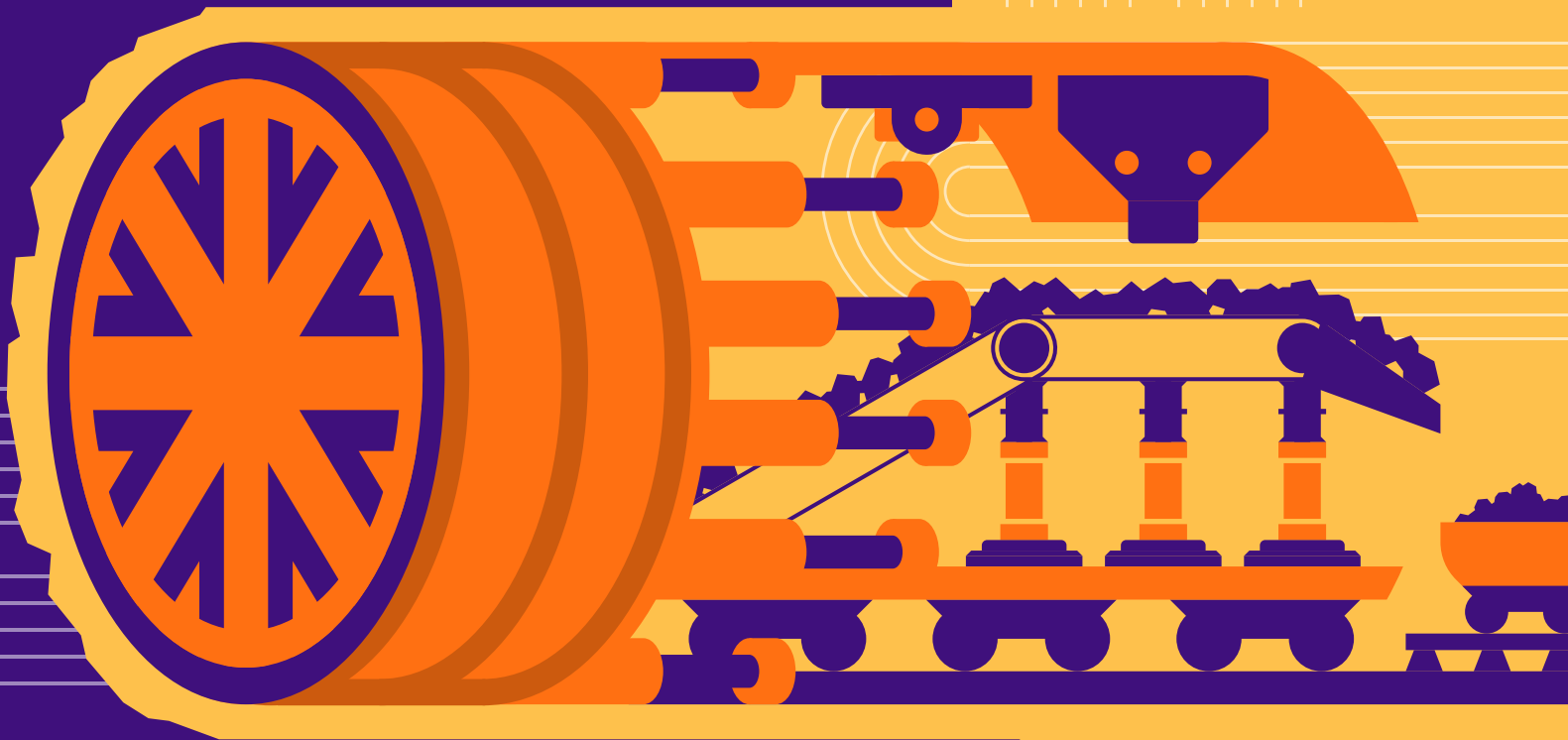


THE PRICE OF PROGRESS

Enabling the Delivery of
Critical Transit Infrastructure

AUGUST 2024





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Foreword: A Critical Moment

Infrastructure is the backbone of our region's economic success. Every year, tens of thousands of new residents choose to make the Toronto region their home. The Greater Toronto Area alone is anticipated to grow by almost 46% over the next two decades, from 7.2 million in 2022 to over 10.5 million by 2046.¹ People continue to flock to the region because of the job opportunities and quality of life that it provides. From housing and roads to transit, our infrastructure isn't keeping up with that growth, and our quality of life and the economic competitiveness of our region is deteriorating. People are unable to take advantage of job opportunities that they cannot get to, and subsequently, employers are struggling to attract and retain top talent. We must expand and maintain our transit networks to ensure the long-term livability of our region and help alleviate congestion.

The lack of a truly integrated transit system across the region also incentivizes driving, further exacerbating our congestion crisis and moving us away from our net-zero goals. These challenges extend beyond the daily commute, impacting trade, global competitiveness, and cost the region over \$11 billion annually in lost productivity and opportunity cost.²

It's no secret that transit planning and implementation has often fallen victim to changing political winds and shifting government priorities – with projects started and abandoned, debates over modes, stations, and alignments, and a lack of

cohesiveness and consistency in decision-making that fails to appreciate the time and effort required to plan, develop and deliver transit projects. In this environment, costs can escalate quickly. This has resulted in a number of missed opportunities and a lack of accessible and reliable transit options in place to efficiently move a booming population.

In recent years, all three levels of government have made commitments to expand the region's transit infrastructure to keep up with this growth. As a result, we are in the midst of the largest transit expansion in North America, with more than \$80 billion of transit projects underway.³ Investments are being made in much-needed subways, light rail transit (LRTs), bus rapid transit (BRT) systems, and other smaller infrastructure projects.

Despite this progress, there are still significant challenges to building transit in our region. Look no further than the oft-maligned Eglinton Crosstown LRT project – now almost 4 years overdue and \$4 billion over budget.⁴ These delays and budget overruns continue to compound commuter issues and erode public support, making delivery even more challenging.

This report explores broader global trends impacting the infrastructure industry and outlines five key areas of strategic focus to enhance the delivery of transit projects now and in the future. We are in a critical moment to reflect and learn, to work together to enable a better and stronger future.



Image credit: Shai Gil

A History of Challenges

Toronto has built-on and expanded its subway system each decade since the first line opened in 1954, albeit far from the pace necessary to keep up with its growth.

Nevertheless, the cost of these expansions provides an insightful baseline for today's builds. From the mid-70's to the mid-90's, the average cost per kilometer of transit infrastructure in Toronto held steady at approximately **\$103M/km***.⁵ Beginning in the 2000's, costs began to accelerate. The Sheppard subway, completed in 2002, marked a sharp turning point, more than doubling the cost per kilometer to **\$234M/km***.⁶ The next subway expansion project, the TTC's six-stop extension of the Line 1 Yonge-University subway into York Region, continued the trend – ultimately costing **\$443M/km*** and delivered several years behind schedule.⁷

In 2019, due in large part to the frustration with transit projects “not getting built in Toronto”,⁸ the provincial government considered uploading the TTC to the province's jurisdiction. Ultimately the province settled on taking on the responsibility and ownership for several major transit expansion projects, which the TTC would continue to operate.

As the province would be able to amortize costs over long periods and fast-track permits to move utilities, the hope was projects would be built more quickly. Indeed, with the passage of the *Building Transit Faster Act* in 2020, the now-provincial transit projects were provided with a legislative framework to expedite their planning, design and construction processes.

*2023 dollars

**AVG. COST PER KM OF
TRANSIT INFRASTRUCTURE
IN TORONTO (2023 DOLLARS)**

MID-70'S - MID-90'S

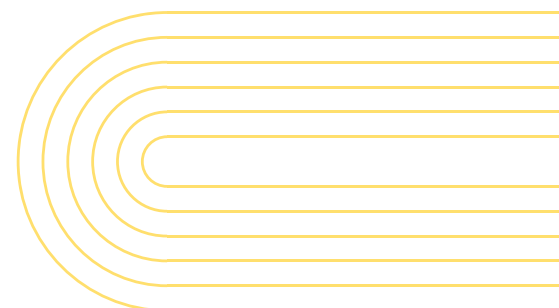
\$103M/km

2002 | SHEPPARD SUBWAY

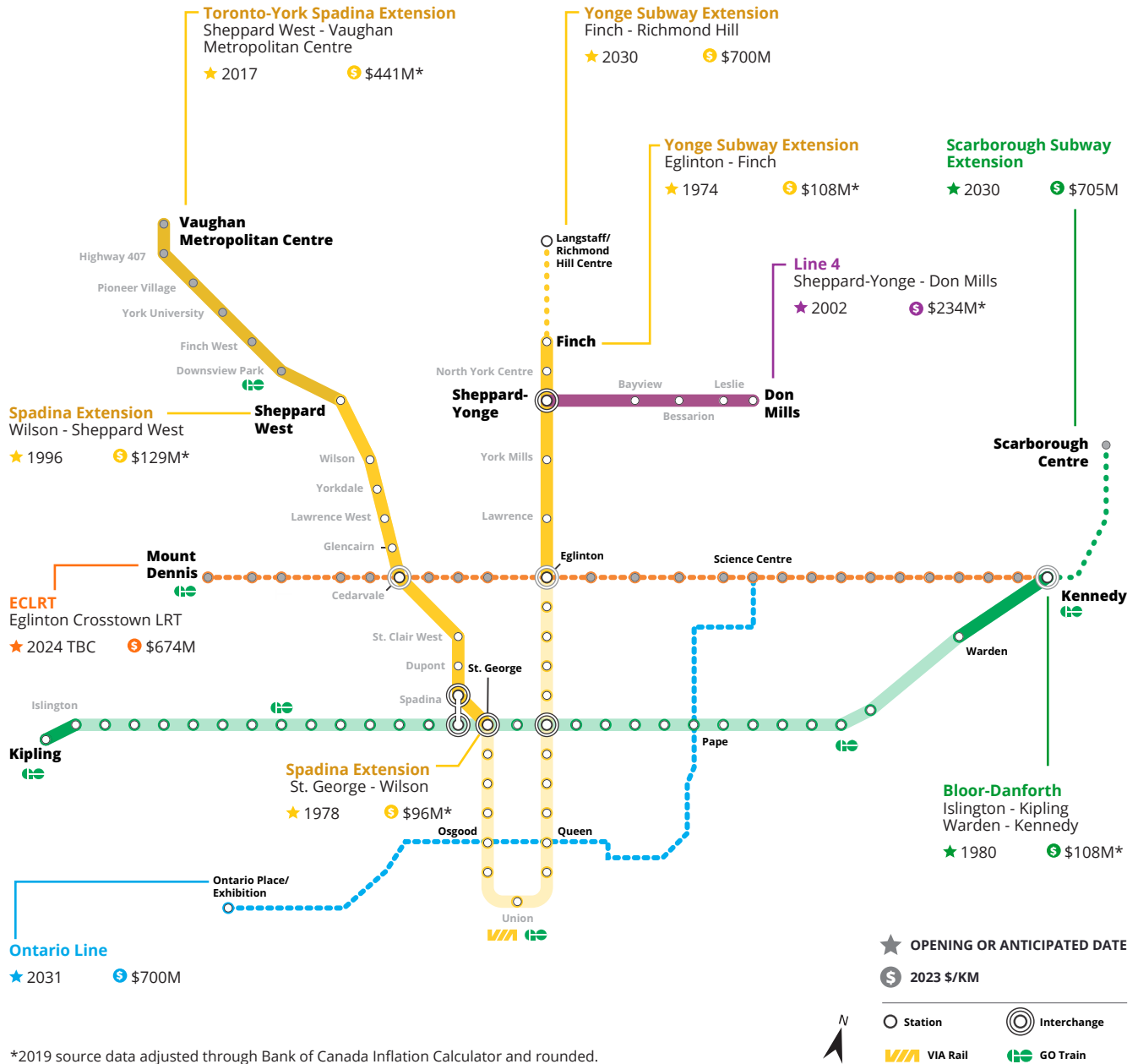
\$234M/km

**2017 | LINE 1 SPADINA SUBWAY
EXTENSION**

\$443M/km



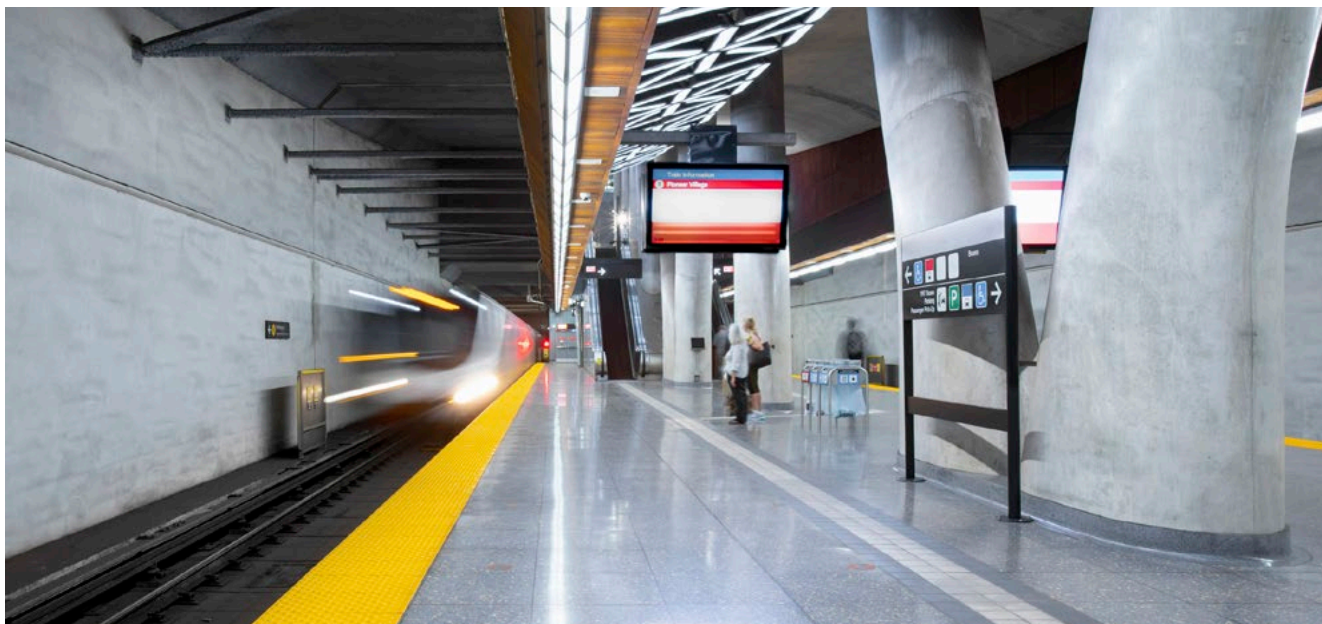
A HISTORY OF CHALLENGES



After amending the *Metrolinx Act* to focus on regional transit delivery and service excellence, Metrolinx expanded its regional transportation area to the Greater Golden Horseshoe (GGH). Now, in partnership with Infrastructure Ontario (IO), Metrolinx leads the subway expansion program in Toronto and numerous regional rapid transit projects across Toronto, Mississauga, Brampton, and Hamilton.

Metrolinx (and its predecessor organization, the stand-alone GO Transit) has decades of experience

in building and operating regional rail transit, including building the new UP Express line in 2015. IO, established in 2005, is dedicated to the renewal of province's public assets (hospitals, courthouses, roads, bridges, water systems), using a public-private-partnership delivery model which has "garnered international attention and made Ontario a global leader in infrastructure development".⁹ However, coming together to build transit projects within the boundaries of City of Toronto was a new endeavor.



Agency expertise alone has been insufficient to control rising transit project costs:

- The **Ontario Line**, unlike traditional subway projects, utilizes existing rail corridors, reducing construction costs and minimizing the distance passengers need to travel between platforms and streets. Despite these innovative measures, its initial \$10.9 billion price tag has surged to an estimated \$17-19 billion.¹⁰ Although this includes capital costs and 30 years of operating the line. Supply chain shortages and high inflation have been major contributors to the surge in pricing. The initial project completion date of “before 2029” has also been pushed back to 2031.¹¹ Even taking the initial price tag at face value, capital costs were projected to add up to almost **\$700M/km**.
- Still on schedule to open by 2030, the **Scarborough Subway Extension**, a political football, would also cost **\$600M/km** for its 3-stop route based on the government’s initial capital cost estimate.
- The **Yonge North Subway Extension**, even if completed at the \$5.6 billion cost as announced in the 2019 provincial budget, would amount to **\$700M/km**, and is still scheduled to open in 2030.
- The **Eglinton Crosstown LRT**, initially announced as a \$5.3 billion capital project in 2010¹², rose to an estimate of \$11.8 billion in 2018. This includes design, construction, financing and 30-year maintenance, and is now somewhere around \$12.8 billion, or **\$674M/km**.¹³ Infamously, its opening date has been moved several times with previous targets announced as 2020 and 2021. At time of writing, no confirmed opening date has been announced.

TRANSIT PROJECT COSTS

ONTARIO LINE

\$700M/km

Anticipated Completion: 2031

SCARBOROUGH SUBWAY EXTENSION

\$600M/km

Anticipated Completion: 2030

YONGE NORTH SUBWAY EXTENSION

\$700M/km

Anticipated Completion: 2030

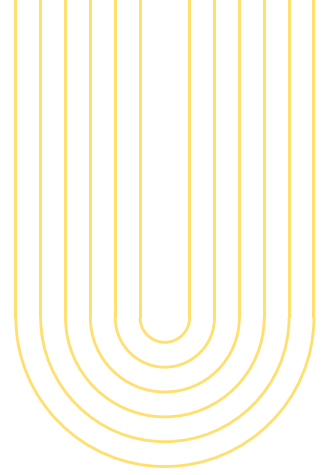
EGLINTON CROSSTOWN LRT

\$674M/km

Anticipated Completion: TBD

Not Alone

The Toronto region isn't alone in struggling with the delivery of projects on time and on budget. Other jurisdictions have faced similar hurdles, exacerbated by the COVID-19 pandemic and related labour and supply chain issues.



Matthew Boonstra, CC BY-SA 4.0 Wikimedia/140233898



Youngjin, CC BY-SA 3.0 Wikimedia/82200571



Andrew Latreille / Arch Daily



Systra / Railway Technology

Edmonton's Valley Line

At \$1.8 billion, the city's largest-ever capital project, has faced multiple setbacks since its projected opening date of 2020. Construction delays, cracks found in the concrete piers supporting elevated portions of the track, and the replacement of signaling cables along the entire 13-kilometer route have put into serious question how the city builds large projects.¹⁴ The project opened in November of 2023.

Ottawa's O-Train Confederation Line

The city's most significant transportation infrastructure initiative since the construction of the Rideau Canal has faced numerous challenges. An unexpected sinkhole, construction delays, and an adversarial relationship between the City and the construction consortium delayed the opening date. Since coming into operation in 2019, the line has continued to experience a series of incidents prompting a provincially-mandated public inquiry.

Metro Vancouver's Evergreen Extension

Albeit only half a year or so behind schedule, Metro Vancouver's Evergreen Extension involved tunnelling through challenging geological conditions. This led to tunnel boring being stalled for five months at one point and litigation between project proponents.

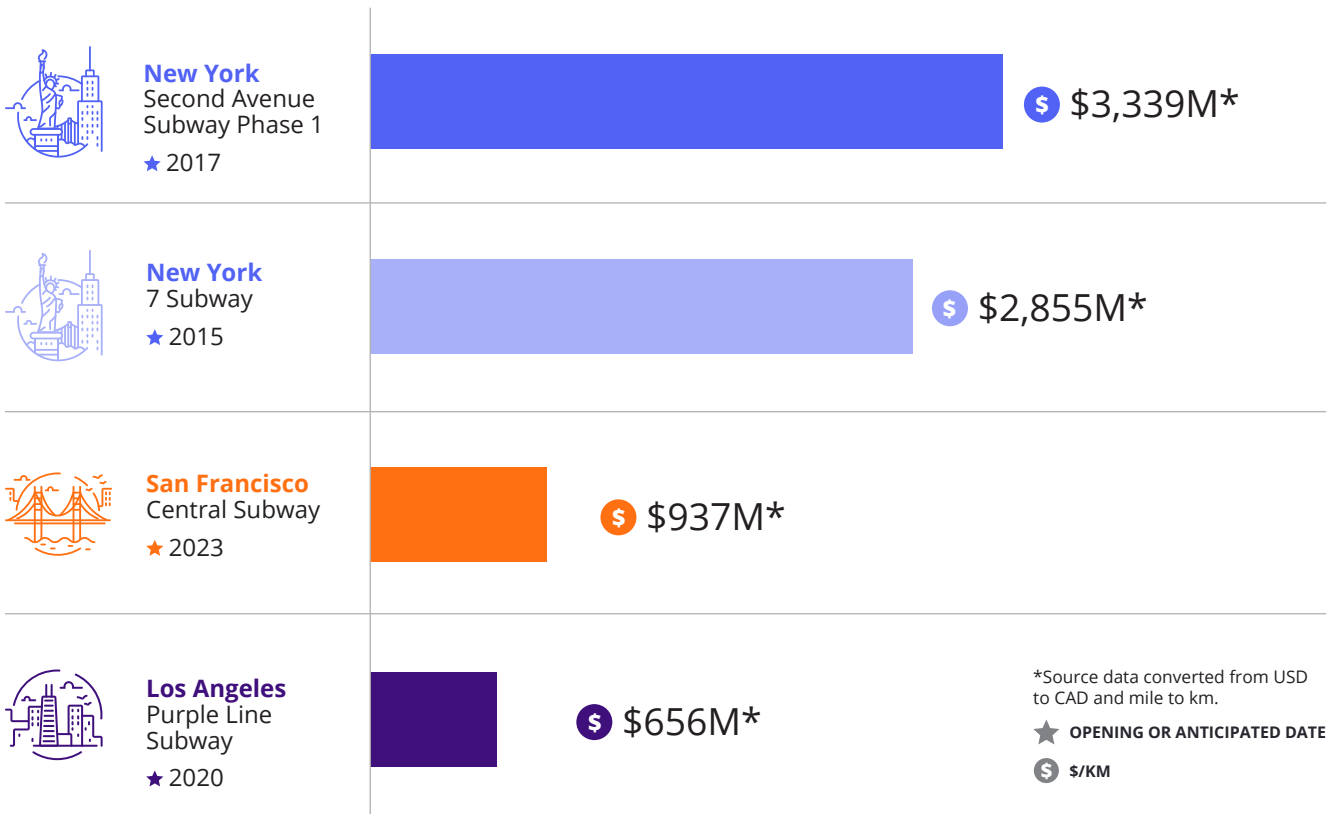
Montreal Metro's Blue Line

The 5.8-kilometer extension of the Montreal Metro's blue line, approved and initially funded in 2018, was expected to begin construction in 2020 at a cost of \$3.9 billion. Another announcement in 2022 pegged the project at \$6.4 billion, and the delivery date pushed back from 2029 to 2030.

The Quebec City Tramway

The 19.3 km LRT tramway project has experienced challenges getting off the ground. Construction was slated to begin in 2024 and finish in 2029. In 2023, when the provincial government announced it would pull its funding commitment, the project hung in limbo as further studies were undertaken until recently.

A HISTORY OF CHALLENGES



Where does this place us globally?

In a seminal study by the Eno Centre for Transportation, researchers reviewed hundreds of transit projects to pinpoint the cost drivers of U.S. transit projects in recent years. We should take little comfort that we are in the same peer group as Los Angeles and San Francisco with recent costs ranging between \$600-\$800M/km and with New York fairing even worse at costs **exceeding \$2 billion/km**.¹⁵ In comparison, the recent Grand Paris Express project, comprised of both new lines and extensions, is being built at a cost of **\$300M/km**.^{16,17}

We should take little comfort that we are in the same peer group as Los Angeles and San Francisco - jurisdictions with high project costs.



The Way Forward

There is no silver bullet for delivering projects effectively. Most commonly, project deficiencies fall into one of the following categories: scope, budget, structure, and schedule.

All of the above resonate in the context of the Toronto region and must be applied through a local lens. While it's hard to pinpoint any one deciding factor in improving our outcomes, we must focus on creating a competitive and supportive ecosystem around transit infrastructure – one that is transparent, predictable, and focused on a defined set of core objectives. Doing so is essential to lowering and better managing project costs in the future.

The time for incorporating best practices is now. Being more structured, transparent and committed to learning lessons from past mistakes is key to gaining back public trust that's been eroded by cost over-runs and delays, and is necessary to generate momentum for transit investment.

The Toronto Region Board of Trade proposes **five key recommendations to reduce infrastructure costs and accelerate delivery:**

1. Embrace advanced technology in infrastructure construction
2. Adopt lower-cost, modular design and construction methods
3. Develop a long-term transit and implementation plan — and stick to it
4. Ensure governance, decision-making structures, and clear roles are established before projects start
5. Collectively build support for the vision and benefits of transit projects



RECOMMENDATION #1

Embrace advanced technology in infrastructure construction

Over the past four years, a confluence of supply chain disruptions, workforce shortages, escalating demand, declining productivity, and geopolitical influences has significantly driven up the costs of both materials and labor. This ‘perfect storm’ has had a pronounced impact on the economic landscape of transit infrastructure projects, necessitating a reevaluation of budgetary frameworks and a focus on better managing these inputs.

MATERIAL INPUT

- In most transit construction projects, the key cost drivers are architectural services, steel, and concrete. In Canada, the price of steel rose almost 200% in 2022, and is currently 50% higher than 2020 prices.¹⁸ Fuel prices followed a similar arc, including diesel and biofuel which increased markedly following Russia’s invasion of Ukraine in February 2022.

LABOUR INPUT

- Wage inflation and labour shortages were already being felt in the transportation construction sector before the onset of the pandemic. Following 2020, wages for occupation groups required for transit projects increased much faster than their historic trends.¹⁹
- Over half of the sector’s labour input is comprised of technical and general trades, while another quarter is made up of helpers and laborers, middle management, and technicians. Despite an initial dip following the onset of the pandemic, wages for four of the five occupations rose sharply between August 2021 and August 2023. A building boom across multiple sectors, and an increase in the number of retiring trade workers, and limited pipelines for new trades have led to a scarcity of skilled workers needed to execute infrastructure projects.²⁰
- Wage growth in the construction sector noted above also shows the share of construction employment in the total labour market has not risen in a way that is consistent with the sector’s growth.²¹ With resulting labour shortages, there are risks that projects teams are understaffed and overworked. Meanwhile, the construction industry is relying increasingly on new, untrained labour, causing productivity growth to lag the national average by approximately 50%.²²



NEW TECHNOLOGIES AND SKILLS

Innovations such as the use of digital twins – virtual replicas of physical objects or processes created by combining real-world data with digital simulations – are becoming an indispensable tool for infrastructure planning and design (as well as the actual operating and maintenance of systems).

With a 3D map, contractors and technicians can better plan work through a more complete understanding of their environment. For example, it can lead to efficiencies such as knowing how much space is available to stage equipment or taking detailed measurements in advance of work beginning.²³ Vancouver's Canada Line recently commissioned a digital twin of its existing infrastructure, which will guide predictive maintenance and planning. The REM in Montreal was delivered using *Building Information Modelling* to ensure that different projects teams could work closely together on one shared platform.²⁴

It is encouraging to see the recent provincial budget investment into exploring this new technology to modernize the delivery of public infrastructure.²⁵

The adoption of new technology by a well-trained labour force is the other critical component of enhancing sectoral production. As noted earlier, an increasing trend in the retirement of trade workers, and a diversification of knowledge required, will necessitate a renewed focus on digital skills development in the construction labour force.

It is encouraging to see the recent provincial budget investment into exploring this new technology to modernize the delivery of public infrastructure.

RECOMMENDATION #2

Adopt lower-cost, modular design and construction methods

If staying on budget is a core priority we must act accordingly, eschewing grand station designs and putting political capital behind the difficult trade-offs required in accommodating local priorities like route or technology preferences.

Madrid Case Study

With a population of 3.2 million, Madrid boasts the 10th longest rapid transit system in the world, with a length of almost 300 kilometers and 302 stations. What makes this statistic remarkable is that over a third of those kilometers and quarter of those stations were built over several successive four-year spurts, between 1995 and 2007. That timeframe is no coincidence – it was government direction (and commitment to multi-year financing and construction plans) supported by efficient processes.²⁸

Consider that Madrid and Toronto are similar in geographic size, and Madrid’s population is smaller than Toronto’s – its 70 kilometer expansion compared to Toronto’s 8 kilometer during the same time period, draws a telling contrast.

Deemed one of the largest and fastest subway expansions in history, the Madrid Metro approach focused on speed and delivery:

- Concurrent (albeit shallow) tunnelling on multiple lines and modular station design allowed for replication and learning from station to station. Stations were “treated like Lego”²⁹, with all sharing the same design elements.
- Tried and tested approaches to construction, design and even rolling stock were given preference over new and emerging technologies.
- Contracts awarded based 50% on a technical score, 30% on cost, and 20% on speed.

As a result, it is considered one of the lowest cost cities in the world to build subways.³⁰ Take for example its 2007-2011 expansion – *Metro Tram*. With 20 new stations and 10 kilometers long, it cost approximately \$94M/km (in 2023 dollars).³¹

Consider that Madrid and Toronto are similar in geographic size, and Madrid’s population is smaller than Toronto’s – its 70km expansion compared to Toronto’s 8km during the same time period, draws a telling contrast.

| The Madrid Miracle ²⁶ | GTA Subway Projects ²⁷ |
|----------------------------------|------------------------------------|
| LENGTH | |
| 150 km | 40.6km |
| STATIONS | |
| 120 | 30 |
| COST/KM | |
| \$126M/km (2023 dollars) | \$657M/km (2019 budget numbers) |
| PROJECT DURATION | |
| 12 years (1995-2007) | ~12 years (2019-2031) |



The speed with which the subways were built had broader benefits than mere completion. Decades of study has shown that speed is important to the success of megaprojects. Extended timelines come with increased risk and uncertainty.³² With the opportunity to repeat designs, quick iteration also contributes to driving down costs.

Make it modular

Modular construction offers the opportunity to prefabricate key components, such as stations, platforms, or even entire transit structures, in a controlled off-site environment which can lead to significant cost savings through economies of scale. Once manufactured, these modular units can be transported to the construction site and assembled, reducing on-site construction timelines and minimizing disruptions to transit operations.

In addition to Madrid, we have seen modular construction deployed on transit projects in Canada:

- Three stations along the Canada Line in Vancouver, opened more than three months ahead of schedule thanks in large part to prefabricated components that were manufactured off site while foundational civil work was done in parallel on site. The builder was then able to ship the components to site and erect the majority of the station structure in record time.³³

- Each train station in Montréal's Réseau express métropolitain was designed to be built as a configuration of shared modular components, allowing for a customized look that still fits into a unified brand esthetic of the entire REM network.³⁴

Metrolinx also had recent success with using prefabricated construction – including new bridge decks on the Finch West LRT Project. Metrolinx crews replaced a bridge on Highway 400 using self-propelled modular transporters – large trailer platforms – which moved two old and heavy bridges out and lifted new ones into place.³⁵

However, procurement approaches have to be flexible enough to allow for modular manufacturers to be included. Their factory systems limit dimensions and finishes that can be produced and therefore, if a request for proposals includes a highly prescribed set of specifications, these will inherently favour more traditional construction methods.³⁶

Metrolinx has recently indicated it is looking to hear from the industry on what can be done to incentive more modular construction,³⁷ a positive development which should be encouraged and accelerated.

Simpler construction and optimizing tunnelling

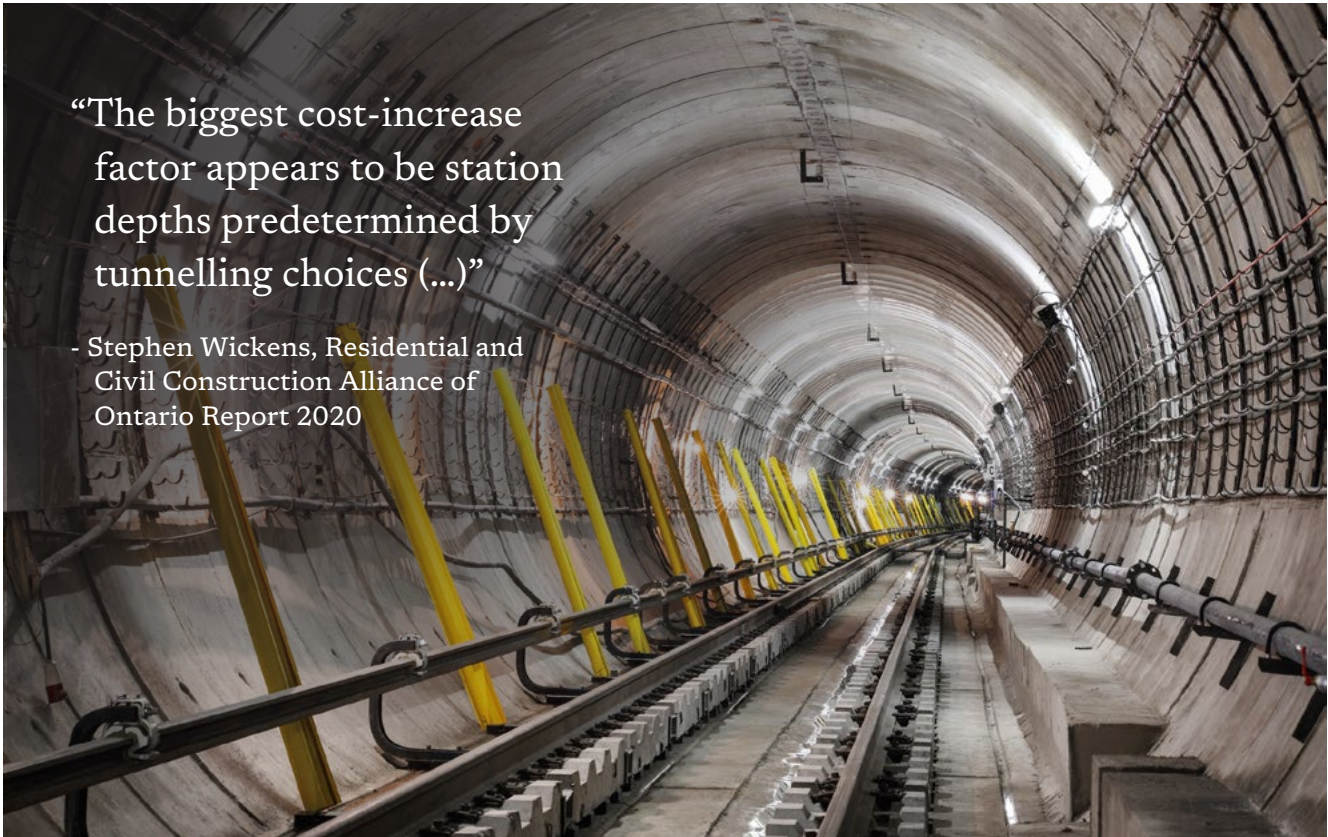
Madrid's metro famously deployed tunnelling and dozens of boring machines – resulting in lower capital costs as compared to other European or North American equivalents – and did so at speed.

In a report summarizing their own study tour of Madrid's experience in 2008, Metrolinx officials wrote:³⁸

“Madrid was found to be roughly equivalent to other European capitals and major North American metropolises, in terms of standard of living, civil engineering practices, transparent public procurement and public finance. (However...) lower capital costs reflected themselves both in lower “hard” costs of capital construction and in lower “soft” costs of pre-engineering, public tendering, contracting, process delays, and in resolving environmental, financing and legal issues.

How was this performance achieved? The answer appeared to be a combination of favourable factors, some of which were natural advantages (e.g., soil conditions) but many due to sound, efficient decision-making and following a comprehensive, priority-based strategy. By setting out very ambitious multi-year financing and construction plans, major technological investments in tunnel-building were amortized early and over large projects. This appeared to have allowed major capital equipment (such as expensive tunnel boring machinery) to be used more economically over time and over other projects. At the time of the Study Tour's visit, Madrid had an estimated 41 boring machines in operation, including some 30 that were used at one point in subway construction.”





“The biggest cost-increase factor appears to be station depths predetermined by tunnelling choices (...)”

- Stephen Wickens, Residential and Civil Construction Alliance of Ontario Report 2020

Tunnelling is being used on the Eglinton Crosstown LRT, the Eglinton Crosstown West Extension, the Scarborough Subway Extension, the Yonge North Subway Extension, and the Ontario Line.

Stephen Wickens, in his 2020 report for the Residential and Civil Construction Alliance of Ontario, attributed much of the cost escalation seen in recent decades to a shift away from simpler construction techniques and designs.

In particular, he notes that the “biggest cost-increase factor appears to be station depths predetermined by tunnelling choices (...) Twentieth-century stations were much less expensive, largely because the TTC preferred to use shallow cut-and-cover tunnels, open trenches and above-grade alignments, methods that are messier, but usually faster and much less costly.”³⁹

Metrolinx notes that “cut and cover is typically reserved for building relatively shallow tunnels where there is more open space at the surface, and most often in areas where tunnels transition into stations”

and is utilizing this approach for a tunnel being constructed behind Corktown Commons where Ontario Line is brought to grade, for example.⁴⁰

Construction techniques and their impacts on communities are hotly debated. Advocacy groups publicly called for the use of a cut and cover approach on parts of the Yonge North Subway Extension, pointing to cost savings.⁴¹ Conversely, Metrolinx’s decision to utilize a cut-and-cover approach in Moss Park (resulting in impacts to dozens of mature trees) was met by strong local objections from the community and elected officials in 2023.⁴²

While cut and cover techniques may not be appropriate in the built-up areas that the current transit expansion is happening in, it should remain an option where there is a clear value-for-money imperative and clearly weighed alongside necessary supports for communities and businesses needed due to the disruption. Based on local experience, it’s fair to say that even tunneled projects can be disruptive to communities if not delivered on time.



RECOMMENDATION #3

Develop a long-term transit and implementation plan — and stick to it

Urban rail projects are inherently complex. The construction of the physical infrastructure (tunnels, bridges, etc.) has been studied and improved upon over many decades. Integrating elements such as track infrastructure, signaling systems, rolling stock (trains), power supply systems, communication networks, and passenger information systems, is an area of continued focus especially as new technologies continue to come online.

As we see in the Istanbul and Italian case studies below, the delivery of infrastructure projects improves with a steady market and long-term predictable investments. Furthermore, the capacity

of government agencies must grow alongside that of the private sector to best realize its benefits.

As Metrolinx updates its next Regional Transit Plan (RTP) to 2051, the province should provide a clear prioritization framework that allows the sector and stakeholders to plan proactively. The other benefit of a long-term plan is that it is conducive to building and retaining institutional capacity.

The region should aim for a steady and robust ecosystem that retains lessons learned and expertise, getting better along the way.



Istanbul's competitive edge

Istanbul, spurred by a boom in urbanization around the turn of the century, evolved from initiating its first metro line in 1989 to supervising almost 20 projects with a combined length of more than 300 kilometers in 2019 – a metric which earned the recognition as the world's foremost city in terms of the total length of urban heavy rail construction.⁴³

A consistent stream of rail projects, supported by the political class, resulted in a robust rail construction ecosystem, underpinned by growing industry expertise and healthy competition. Receiving six or more bids for a metro construction tender encompassing over 10 kilometers of tunnels is a common occurrence.

The results: In Istanbul's rapid rail projects, the average length per contract is approximately 16 kilometers, with a weighted average cost of about \$126M/km. On average, 1 kilometer of subway in Istanbul is constructed in about 7 months.⁴⁴

How has Istanbul achieved this feat? One key ingredient has been the optimization of procurement processes over time. Learning from its earlier projects, the Istanbul Metropolitan Municipality (IMM) steadily developed its expertise to better manage rail construction projects⁴⁵:

- Investing time in the design phase, collaborating with experienced design consultants before proceeding to the construction tender stage, utilizing a “final design for application” approach with 60% design completed;
- Bundling contracts into as few packages as possible while including specific itemized costs in the tender;
- Allowing contract increases of up to 20% of total value, based on changes, with any higher amount triggering cabinet approval, which parties work to avoid in order to prevent delays.



In Istanbul's rapid rail projects, the average length per contract is approximately 16 kilometers, with a weighted average cost of about \$126M/km.

Transit projects in Italy have been delivered using a range of delivery schemes, but Italian legislators who studied project delivery found that a key determinant of success is the level of oversight public agencies have over fundamental tasks such as early planning, design, as well as construction management.



Italy's institutionalized transparency

Italy provides another instructive case study. While the country has a history of national railway construction dating to the mid-19th century, mass transit infrastructure beyond Rome and Milan began to proliferate only in the 1980s.

Marred by corruption scandals in the 1990s, steps were taken to curb costs and improve procurement practices. This included:

- Adopting official reference unit-price lists to determine the benchmark cost of procurement and the bid ceiling, itemized unit-price contracts,
- Revamping the bidding process to incorporate technical scores rather than assessing exclusively on costs.

Transit projects in Italy have been delivered using a range of delivery schemes, but Italian legislators who studied project delivery found that a key determinant of success is the level of oversight public agencies have over fundamental tasks such as early planning, design, as well as construction management. Contracting authorities equipped with ample in-house capabilities, such as Milan's Metropolitana Milanese and Turin's InfraTO, can both execute traditional Design-Bid-Build approaches and effectively navigate diverse public-private partnership structures.⁴⁶

Accompanied by greater competition through a European-wide procurement market, these changes have led to a more transparent and efficient market. Based on the average of its post-war performance, Italy would be considered a "medium-to-low-cost country for metro rail construction, with an average cost of \$159M/km".⁴⁷

Procurement approaches match institutional capacity

One of the ways the infrastructure industry is looking to reduce risks, and thereby cost, is by moving to a new model of procurement in the Toronto region: the alliance project development model, an evolution of the public private partnership (P3) models practiced and in fact championed, in Ontario. Via contractual agreement, the key to the alliance model is to force more collaborative behaviour, by laying out the sharing among the parties, rather than the division between them, of the risks and responsibilities connected to the execution of the project. This incentive mechanism is often referred to as “pain share/gain share”. In fact, Toronto’s Union Station Enhancement Project is the first major project in Canada to be procured as an alliance contract.⁴⁸

Innovations in procurement models are an important part of the learning curve in the Toronto region. The current transit expansion program was jump-started by a sudden spurt of government investment and political will, and led by new governance/delivery arrangements, so some growing pains could be expected.

At the outset of the current transit infrastructure program, Metrolinx was criticized by the Ontario Auditor General for relying too heavily on outside consultants – with the agency having since grown its capacity by bringing much-needed specialization in-house.⁴⁹

Between Metrolinx, IO, and its municipal partners, we ought to turn our attention to retaining such institutional capacity and knowledge, for the current wave of transit projects, but also those in the pipeline, awaiting the funding go-ahead.

When municipalities within the Greater Golden Horseshoe, or indeed elsewhere in the province, undertake higher-order transit projects that are not deemed provincial projects, how will they benefit from the expertise earned in the Toronto region? Doing something for the first time does not lead to efficiencies.



Alberta and Quebec are both currently considering new agencies to deliver transit projects. The Alberta government recently unveiled a new passenger rail master plan, a strategy which is also expected to introduce an Alberta-led, “Metrolinx-like” crown corporation.⁵⁰ The Quebec government has also introduced legislation to establish the province’s new transportation infrastructure agency, Mobilité Infra Québec (MIQ). MIQ’s main mission would be to conduct opportunity analyses for complex transportation projects and plan or carry out such projects when mandated by the provincial government.

In 2017, the United Kingdom’s Department of Transport established Crossrail International (CI) made up of specialist advisors who held senior executive, management and technical roles on the Crossrail project. As an arms-length, specialist advisory practice, CI provides strategic advice to clients, globally.



TTC Line 5 Eglinton - Bombardier Flexity Freedom

RECOMMENDATION #4

Ensure governance, decision-making structures, and clear roles are established before projects start

The major transit infrastructure projects currently being built in the GTA are being led by Metrolinx and Infrastructure Ontario, both agencies of the provincial government - while being funded by multiple levels of government. Meanwhile, the projects will be operated at a municipal level – in Toronto’s case, by the TTC. As noted earlier, the province took on leadership of these projects in 2018/19, whereas previous higher order transit projects within Toronto were built at the municipal level.

Alignment between the leading entities cannot rely on cultural norms or relationships alone. Formalized governance structures that include decision makers must be considered at the outset of the project and reviewed for each major project phase.

Whether a lack of trust and collaborative will, or a lack of structured governance agreements between all necessary parties – the Eglinton Crosstown LRT has been besieged by finger pointing on all sides over delays.

The Elizabeth line, which is now transforming travel in London, could be an insightful comparison of a project that went “off track” and was brought back through a diligent focus on oversight and governance.

Alignment between the leading entities cannot rely on cultural norms or relationships alone. Formalized governance structures that include decision makers must be considered at the outset of the project and reviewed for each major project phase.



Elizabeth Line section of Bond Street underground station in London, UK.

Crossrail Governance Structure

Crossrail, the project to deliver the Elizabeth line broke ground in 2009. The project involved the construction of a new high-capacity east-west underground railway line that spanned throughout London, England and beyond, encompassing over 140 km and 10 major new stations. At the time, this was the largest construction project in Europe and the most significant addition to London’s transport network in a generation.⁵¹

The project was led by Crossrail Ltd, a wholly owned subsidiary of the local government organization, Transport for London (TfL), and jointly sponsored by the TfL and the UK Department for Transport (DfT) (the “sponsors”). The interests of the sponsors were brought together through a comprehensive and detailed sponsors agreement and supported by a Project Representative who provided independent advice to them on project progress, risks, changes in scope, and other project management priorities.

During the first 5 years of the project, the programme proceeded well. An independent Public Accounts Committee report at the time noted “the joint sponsors of the Crossrail programme, the Department for Transport and Transport for London, are working well with the delivery organization, Crossrail Limited, to deliver

the programme, which at present is broadly on schedule and being delivered within budget.”⁵² This same report however cautioned that “construction is not yet complete, and considerable risks remain in delivering the programme by 2019, particularly managing the transition from building the railway to operating it, and delivering the Crossrail trains.

When it was announced in 2018 that the Crossrail programme could not be delivered to the original timescale and budget, it came as a “significant shock and surprise to those on the outside of the program,”⁵³ and led to a breakdown in trust between the governing parties.

What had gone wrong? Major civil works and tunnelling had been successfully completed but systems integration became the defining challenge on Crossrail, the complexity of which was not sufficiently recognized at the outset by the previous Crossrail team.⁵⁴ An independent review was commissioned and found that the governance structures did not “sufficiently address the evolving needs of the project from the changing balance between construction, systems, integration and operational readiness activities.”⁵⁵ The review recommended a new governance structure, focused on increased levels of oversight and transparency.

Specifically, the main changes included:⁵⁶

- Changes to the composition of the Crossrail Ltd Board to increase its effectiveness and set out priorities and expectations with the Chair and Deputy Chair for the remainder of the project.
- Strengthening the executive team by appointing a new Chief Executive and Chief Financial Officer. Further project changes included appointing an experienced Programme Director, Technical Director and Project Controls Director.
- Strengthening the Project Representative by bringing in new skills and capabilities, setting out expectations, and agreeing to a revised approach for more proactive and inclusive challenges of Crossrail Ltd, and reporting to sponsors.

In addition, in order to rebuild trust, the Crossrail leadership team and Board recommitted to openness and transparency, implementing tactics like⁵⁷:

- Frequent briefings of sponsors and stakeholders;
- Publication of board minutes and Project Representative (P Rep) reports;
- Face-to-face briefing of sponsors at the end of all board meetings; and
- Above all, exhibiting open and transparent behaviour: a willingness to share the bad news as well as the good, and to be open about the risks and uncertainties facing the program.

Finally opening in May of 2022, the Elizabeth line has delivered incredible benefits, increasing central London's rail capacity by 10 per cent and bringing an additional 1.5 million people within 45 minutes of central London.⁵⁸

The project has also contributed to global industry knowledge: the Crossrail Learning Legacy website houses dozens of good practice documents, micro-reports, case studies, technical papers and research summaries, which aggregate and disseminate best practices, lessons learned, and innovation aimed at raising the bar in industry.



SPONSORSHIP MODEL OF OVERSIGHT

When bestowed with a mandate to deliver these new priority projects, Metrolinx took steps to implement a best practice project management approach designed to ensure that planned project benefits are delivered as outcomes. Taking inspiration from the UK – and specifically the Crossrail project - Metrolinx introduced a “Sponsor Office” in 2017.⁵⁹ Similarly, the City of Toronto established a new Transit Expansion Office in 2018, to provide oversight through the project lifecycle.⁶⁰



RECOMMENDATION #5

Collectively build support for the vision and benefits of transit projects

Major capital projects are generally accompanied by public engagement strategies as well as well-placed advertising around the projects themselves. We have seen an increased focus on communications around the benefits of the GTA transit projects, which is needed. However, a clear tactical opportunity to make project benefits more tangible for the general public remains outstanding.

Demonstrating an integrated network

In Toronto, projects that are under construction are not typically shown on the conventional subway map. While future benefits are now well displayed on the site of construction, steps could be taken to integrate projects that are under construction with existing transit (e.g., TTC) maps and thus build an earlier and better picture of the regional benefits. With the recent addition of Ontario's One Fare Program, allowing transit riders to only pay once when connecting to and from the TTC and GO Transit, Brampton Transit, Durham Region Transit, MiWay and York Region Transit, now is the best time to demonstrate the interconnected network of current and upcoming transit options, and promote the regional benefits of these major infrastructure projects.⁶¹

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Conclusion

As major transit infrastructure projects in the Toronto region remain in peak construction over the next decade, there are opportunities to incorporate best practices laid out in the Board's 5 recommendations into current projects.

We call upon Metrolinx and the Ontario Government to take stock of ongoing lessons learned during their delivery and document them in a clear, transparent manner to allow for ongoing accountability and improvement – as project construction continues and the next wave of priorities are planned in the upcoming 2051 Regional Transit Plan (RTP) Update.

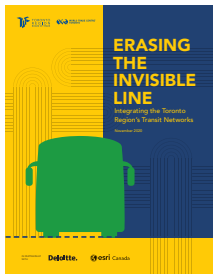
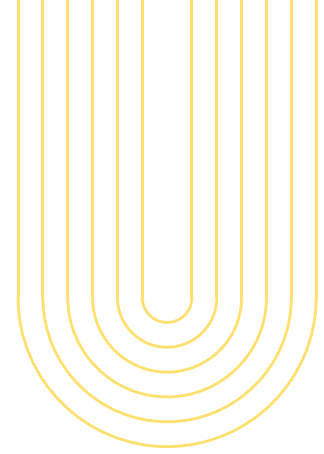
The region won't stand still. With a booming population and travel patterns increasingly crossing municipal boundaries, regionally integrated transit infrastructure is more important than ever. Already, a queue of would-be projects in Toronto alone crowd transit planners' wish lists – such as the Waterfront East LRT, or the Eglinton Crosstown LRT West Extension going all the way to Pearson Airport, to name a few.

We need to start planning for the next wave of transit projects and be ready to deliver them successfully. This planning should cultivate a healthy ecosystem, one that has the access to talent and labour, raw materials, specialized skills, and maintains a culture of continuous improvement across the entire delivery spectrum. Our region deserves an integrated regional transit system that is built quickly and on budget, fostering public trust and driving regional growth.

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A Regional Transit Strategy

The Toronto Region Board of Trade has been presenting a comprehensive strategy for building an integrated, globally competitive transit system across the Toronto region. This is the fourth in a series of reports which provides actionable recommendations to address our mobility challenges.



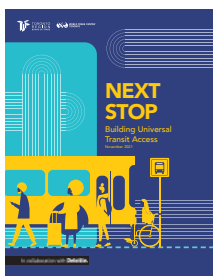
ERASING THE INVISIBLE LINE: INTEGRATING THE TORONTO REGION'S TRANSIT NETWORKS

This report presents an approach to achieve service integration while respecting municipal autonomy to address the fragmented regional transit system, which hinders access to employment and disproportionality impacts equity-seeking communities. A 'Transit Federation' or co-operative body modelled on the German Verkehrsverbund, is proposed to incorporate municipal agencies, GO transit, and other new mobility operators.



GETTING ON THE RIGHT TRACK: CONNECTING COMMUNITIES WITH REGIONAL RAIL

As the province moves ahead with GO expansion, this report lays out a comprehensive plan for how regional rail can be adjusted to function as the backbone of regional transit. Its guiding principles are two-way, all-day service; high frequency; seamless integration with local transit; a focus on equity; and integration with regional planning.



NEXT STOP: BUILDING UNIVERSAL TRANSIT ACCESS

This report identified four guiding principles - improved accessibility, infrastructure, integration, innovation and multimodality - for building a universally accessible and globally competitive local mobility system, supported by an examination of success stories and challenges in this region and elsewhere. Making these key recommendations core tenets of regional transportation policy would build the foundation needed to help residents choose not to own a vehicle or to leave their car at home.



THE PRICE OF PROGRESS: ENABLING THE DELIVERY OF CRITICAL TRANSIT INFRASTRUCTURE

We are in the midst of the largest expansion of transit infrastructure in our region's history, catching up to immense population growth and decades of underinvestment. With some projects already over budget and delayed, it's critical that we apply best practices and learnings to improve delivery and value. This report explores global infrastructure best practices and lays out five key recommendations to improve the delivery of transit projects now, and into the future.

Endnotes

- 1 Ontario Ministry of Finance, population projections. [https://www.ontario.ca/page/ontario-population-projections#:~:text=The%20Greater%20Toronto%20Area%20\(%20GTA,over%2010.5%20million%20by%202046](https://www.ontario.ca/page/ontario-population-projections#:~:text=The%20Greater%20Toronto%20Area%20(%20GTA,over%2010.5%20million%20by%202046). The “GTA” is defined as including Toronto, Durham, Halton, Peel and York Regions
- 2 Dachis, B. (2013, July). Cars, Congestion and Costs: A New Approach to Evaluation Government Infrastructure Investment (Vol. 385, p. 1). C.D. Howe Institute. The Region being referred to is the Greater Toronto and Hamilton Area
- 3 Money, S., & Lytwyn, D. (2024, February 16). Exciting progress on North America’s largest transit expansion. Metrolinx. <https://www.metrolinx.com/en/discover/exciting-progress-on-north-americas-largest-transit-expansion>
- 4 Lorinc, J. (2023, November 21). Why private-public infrastructure projects haven’t always lived up to the hype. The Globe and Mail. <https://www.theglobeandmail.com/business/rob-magazine/article-private-public-infrastructure-eglington-crosstown/#:~:text=The%20Crosstown%2C%20which%20is%20being,own%20members%20and%20the%20province>.
- 5 Wickens, S. (2020, April). Station to Station: Why Subway-building Costs Have Soared in the Toronto Region. Residential and Civil Construction Alliance of Ontario, pg. 8. Average of 1974-1996 adjusted for 2023 year dollars via Bank of Canada inflation calculator. Included the extensions on the Yonge, Spadina and Bloor-Danforth lines
- 6 Ibid.
- 7 Ibid.
- 8 Chubb, C. (2019, May 1). Ontario government to introduce legislation for TTC subway upload Thursday. CityNews Toronto. <https://toronto.citynews.ca/2019/04/30/province-to-reveal-plan-for-ttc-subway-upload/>
- 9 Infrastructure Ontario. Our public-private partnerships (P3) model. <https://www.infrastructureontario.ca/en/what-we-do/major-projects/our-p3-model/#:~:text=Ontario's%20P3%20model%20is%20a,P3%20approach%20for%20project%20delivery>.
- 10 Callan, I., & D’Mello, C. (2023, March 28). Officials Bury rising costs of Ontario line, cite concern about “further public discussion.” Global News. <https://globalnews.ca/news/9563105/ontario-line-rising-costs-freedom-of-information/>
- 11 CBC/Radio Canada. (2024, January 25). Metrolinx needs to communicate better about Ontario line construction, councillors say | CBC news. CBCnews. <https://www.cbc.ca/news/canada/toronto/metrolinx-ontario-line-construction-community-support-1.7094058#:~:text=effectively%2C%20she%20added.-,The%20Ontario%20line%2C%20a%2015.6%20kilometre%20subway%20route%20with%2015,to%20be%20completed%20by%202031>.
- 12 Ontario newsroom. (2017, Aug. 9). <https://news.ontario.ca/en/release/45826/ontario-reaches-major-milestone-on-eglington-crosstown-lrt-construction>
- 13 CBC/Radio Canada. (2022, December 8). There’s no “credible plan” to complete the Toronto’s crosstown LRT, confidential documents say | CBC news. CBCnews. <https://www.cbc.ca/news/canada/toronto/confidential-documents-eglington-crosstown-lrt-1.6675131>
- 14 Smith, M. (2022, Aug.10). Long delayed \$1.8-billion valley line LRT stymied yet again. Edmonton Journal. <https://edmontonjournal.com/news/local-news/long-delayed-1-8-billion-valley-line-lrt-stymied-yet-again>
- 15 Miettinen, D. (2022, March 28). Why does transit infrastructure cost so much in the U.S.?. Marketplace. <https://www.marketplace.org/2022/03/28/why-does-transit-infrastructure-cost-so-much-in-the-u-s/>
- 16 Gibson, T. (2024, March 20). Why Paris is Doubling Its Metro. The B1M. <https://www.theb1m.com/video/grand-paris-express>
- 17 ENO Centre for Transportation (2022, April), Transit Cost Database <https://docs.google.com/spreadsheets/d/1vswm6N0KWt3HS6o2OpOnTUr0JcUzKkjy/edit?usp=sharing&ouid=116025220132372710387&rtpof=true&sd=true>
- 18 Sorensen, J. (2023, September 26). Daily Commercial News. Construction steel prices in 2023-24 expected to remain high. <https://canada.constructconnect.com/dcn/news/resource/2023/09/construction-steel-prices-in-2023-24-expected-to-remain-high>
- 19 Statistics Canada; Calculations by Deloitte.
- 20 CIBC Capital Markets. (2023, June 20). Canada’s construction labour shortage - CIBC economics. <https://economics.cibccm.com/cds?id=c3793f6c-c629-49eb-9fe6-6a0598c6fd2b&flag=E>
- 21 Ibid
- 22 Ibid
- 23 Digital Twinning “the living information backbone of the Canada Line.” Journal Of Commerce. (2023, July 4). <https://canada.constructconnect.com/joc/news/infrastructure/2023/07/digital-twinning-the-living-information-backbone-of-the-canada-line>
- 24 Future of Infrastructure Group. (2021, March). Reducing Risk in Transit Projects: Driving More On-time and On-budget Delivery in Canada. Pg.19
- 25 2024 Ontario Budget: Building A better Ontario. <https://budget.ontario.ca/2024/index.html>, pg.65

ENDNOTES

26 Wickens, S (2020), pg. 42

27 GTA Subway Projects (based on 2019 ON Budget)

| | Length | Stations | Total Project Cost | Cost/Km | Projected End |
|-----------------------------------|---------------|-----------|--------------------|------------------|------------------|
| Ontario Line | 15.6km | 15 | \$10.9 B | \$698M/km | 2029 |
| Yonge North subway Extension | 8 km | 5 | \$5.6B | \$700M/km | 2029/30 |
| Scarborough Subway Extension | 7.8km | 3 | \$5.5B | \$705M/km | 2029/30 |
| Eglinton Crosstown West Extension | 9.2km | 7 | \$4.7B | \$510m/km | 2030-31 |
| Totals | 40.6km | 30 | \$26.7B | \$657M/km | ~12 years |

Sources:

Ontario <https://www.ontario.ca/page/ontario-priority-transit-projects-greater-golden-horseshoe-region>

Project cost and projected completion dates as of 2019 Ontario Budget <https://budget.ontario.ca/2019/chapter-1b.html#c1-9>

28 Wickens, S (2020), pg. 42

29 Flyvbjerg, B. and Gardner, D., pg. 170

30 Goldwyn, E., A. Levy, E. Ensari and M.Chitti (2023, July 31) Transit Costs Projects: Understanding Transit Infrastructure Costs in American Cities. Marron Institute of Urban Management. https://transitcosts.com/wp-content/uploads/TCP_Final_Report.pdf, pg. 68

31 Fenn, M.W. (2008, Jan. 25) UK/Madrid Study Tour. Management Report to Metrolinx. https://www.toronto.ca/legdocs/mmis/2012/cc/bgrd/CC20_1_app3_5.pdf, pg.8

32 Flyvbjerg, B. (2021, Dec.) Make Megaprojects More Modular. Harvard Business. <https://hbr.org/2021/11/make-megaprojects-more-modular>

33 Drake, A. (2024, January 12). 3 ways prefabrication can keep public transit projects moving. Perkins&Will. <https://perkinswill.com/insights/3-ways-prefabrication-can-keep-public-transit-projects-moving/>

34 Nithya, C. (2018, April 17). Modular design chosen for Montréal's new transit network. Construction Canada. <https://www.constructioncanada.net/modular-design-chosen-for-montreals-new-transit-network/>

35 Aerial flight gives perspective to massive Finch LRT Project. Metrolinx. (2020, Oct.7). <https://www.metrolinx.com/en/discover/aerial-flight-gives-perspective-to-massive-finch-lrt-project>

36 Dragicevic, N., & Riaz, K. (2024, Jan.). Seizing the Modular Construction Opportunity. CSA Public Policy Centre. Pg.10

37 Gismondi, A. (2023, Feb. 14) Daily Commercial news. Collaborative Models are the 'right place to be' for industry: Verster. <https://canada.constructconnect.com/dcn/news/infrastructure/2023/02/collaborative-models-are-the-right-place-to-be-for-industry-verster>

38 Fenn, M.W. (2008, Jan. 25) UK/Madrid Study Tour. Management Report to Metrolinx. https://www.toronto.ca/legdocs/mmis/2012/cc/bgrd/CC20_1_app3_5.pdf, pg.8

39 Wickens, S., pg. 9

40 Metrolinx. (2024, January 25). Corktown Construction Liaison Committee. https://assets.metrolinx.com/image/upload/v1706829926/Images/Metrolinx/Jan_25_2023_CLC_Presentation-updated_version.pdf

41 Cut-and-cover option for Yonge North Subway Extension. Transport Action Ontario. (2021, June 25). <https://ontario.transportaction.ca/cut-and-cover-option-for-yonge-north-subway-extension/>

42 Wong-Tam, K. (2023, February 4). Statement: Metrolinx Cuts Down Trees Without Consultation. https://www.kristynwongtam.ca/statement_metrolinx_cuts_down_trees_without_consultation

43 Goldwyn, E., et al., (2023, July 31), pg. 71

44 Ibid, pg. 77

45 Ibid., pg. 159

46 Ibid., pg. 287

47 Ibid., pg. 173

48 Daily Commercial News. (2022, Feb. 4) Union Statement enhancement project procured as alliance contract. <https://canada.constructconnect.com/dcn/news/projects/2022/02/union-station-enhancement-project-procured-as-alliance-contract>

49 Auditor General of Ontario (2022, Nov. 23) 2022 Value-for-Money Follow Up Report: Metrolinx Operations and Governance: Follow-Up Report, pg. 10 https://www.auditor.on.ca/en/content/annualreports/arreports/en22/1-06metrolinxgov_en22.pdf

ENDNOTES

- 50 Alberta government announces “master plan” for railway development. Calgary. (2024, April 29). <https://calgary.ctvnews.ca/alberta-government-announces-master-plan-for-railway-development-1.6865747>
- 51 Tucker, W., The execution strategy for delivering London’s Elizabeth line. (2017), Civil Engineering, V.10, Issue CE5. <https://learninglegacy.crossrail.co.uk/wp-content/uploads/2017/04/The-execution-strategy-for-delivering-Londons-Elizabeth-line.pdf>
- 52 KPMG (2019, Jan. 23) Independent review of Crossrail - Governance. <https://content.tfl.gov.uk/governance-redacted.pdf>, pg. 4
- 53 Crossrail Learning Legacy. Crossrail project 2019-2023 - Completing the Elizabeth line. <https://www.apm.org.uk/v2/media/10vnyi1q/crossrail-project-2019-to-2023-completing-the-elizabeth-line-apm-journal.pdf>
- 54 Parker, R. (2022, May 25). Lessons from Crossrail. Deloitte United Kingdom. Deloitte. <https://www2.deloitte.com/uk/en/pages/public-sector/articles/lessons-from-crossrail.html>
- 55 Bain, R. and R. Zavitz (2023, April 05). Governance arrangements to complete the Crossrail project. Crossrail Learning Legacy. <https://learninglegacy.crossrail.co.uk/wp-content/uploads/2023/03/Governance-arrangements-to-complete-the-Crossrail-project.pdf>
- 56 Mayor of London (2019, Feb. 25). Questions to the Mayor, London Assembly: KPMG Crossrail governance review. <https://www.london.gov.uk/who-we-are/what-london-assembly-does/questions-mayor/find-an-answer/kpmg-crossrail-governance-review>
- 57 <https://www.apm.org.uk/v2/media/10vnyi1q/crossrail-project-2019-to-2023-completing-the-elizabeth-line-apm-journal.pdf>, pg. 14
- 58 Mayor of London, Department of Transport, Transport for London. Elizabeth line: evidence value Benefits Framework. <https://content.tfl.gov.uk/tfl-elizabeth-line-benefits-framework.pdf>
- 59 Transcom, C. (2023, April 5). Major projects sponsorship: A must for complex rail and transit projects - cpcs - advisors to infrastructure leaders. <https://cpcs.ca/project-sponsorship-for-major-rail-and-transit-projects/>
- 60 Canadian Consulting Engineer (2018, Nov. 8) City of Toronto announces new Transit Expansion Office. <https://www.canadianconsultingengineer.com/transportation/city-of-toronto-announces-new-transit-expansion-office/1003408295/>
- 61 Ontario newsroom. (2024, Feb. 5). Ontario Launching “One Fare” to Save Transit Riders \$1,600. <https://news.ontario.ca/en/release/1004151/ontario-launching-one-fare-to-save-transit-riders-1600>

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