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# perspectives

## Cost Overruns on Infrastructure Projects: Patterns, Causes, and Cures

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The Institute on Municipal Finance and Governance (IMFG) is an academic research hub and non-partisan think tank based in the Munk School of Global Affairs at the University of Toronto.

IMFG focuses on the fiscal health and governance challenges facing large cities and city-regions. Its objective is to spark and inform public debate, and to engage the academic and policy communities around important issues of municipal finance and governance.

The Institute conducts original research on issues facing cities in Canada and around the world; promotes high-level discussion among Canada's government, academic, corporate and community leaders through conferences and roundtables; and supports graduate and post-graduate students to build Canada's cadre of municipal finance and governance experts. It is the only institute in Canada that focuses solely on municipal finance issues in large cities and city-regions.

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## Author

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## Executive Summary

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Cost overruns and schedule delays on infrastructure megaprojects are a common news story in the media, in Canada and around the world. Millions of dollars here, months of delay there. International evidence suggests that the bigger the project, the more likely it will go over budget and miss its deadlines. The outcomes include government budget deficits and a loss of public confidence that the government can meet its commitments.

The three main explanations for cost overruns and delays are technical challenges, over-optimism, and strategic misrepresentations.

Technical challenges include scope changes and change orders, problems coordinating a large cast of contractors and subcontractors, increased labour or material costs, inaccurate forecasting, and poor monitoring of projects. Since most of these factors could be anticipated and controlled, however, one might expect that budgeting and scheduling would improve over time as those who manage megaprojects gain more experience, but this is not the case.

Rather, the all-too-human tendency to underestimate the costs and time required to complete a project means that megaprojects are well-nigh guaranteed to exceed their budgets and schedules. At the same time, promoters of megaprojects may deliberately misrepresent the budget and schedule to ensure approval of projects from which they will gain – financially, professionally, or politically.

International best practices suggest at least five remedies for these problems. First, improved performance monitoring, reporting, and information sharing is a feasible option in a world in which data management is becoming increasingly sophisticated. Second, governments can track and reward the best-performing companies and contractors to ensure more predictable outcomes. Third, staff overseeing megaprojects can be better trained in management skills such as enforcing contracts and resolving disputes. Fourth, governments can draw on more precise forecasting techniques based on data about previous projects. And finally, public-private partnerships can make it easier to control costs and enforce deadlines.

Some governments are already using these approaches. Yet there are barriers to their wider adoption. For one thing, the expense required for skills training, better data collection, and state-of-the-art forecasting technology may hold governments back. For another, many of the parties involved may prefer to obscure the frequency and magnitude of cost overruns to evade accountability for project failures.

This inertia may be shifting, however, as intense media coverage of failures makes politicians and voters more demanding of public servants and government contractors. Time will tell if there is a will to implement these strategies at the municipal level in Ontario.

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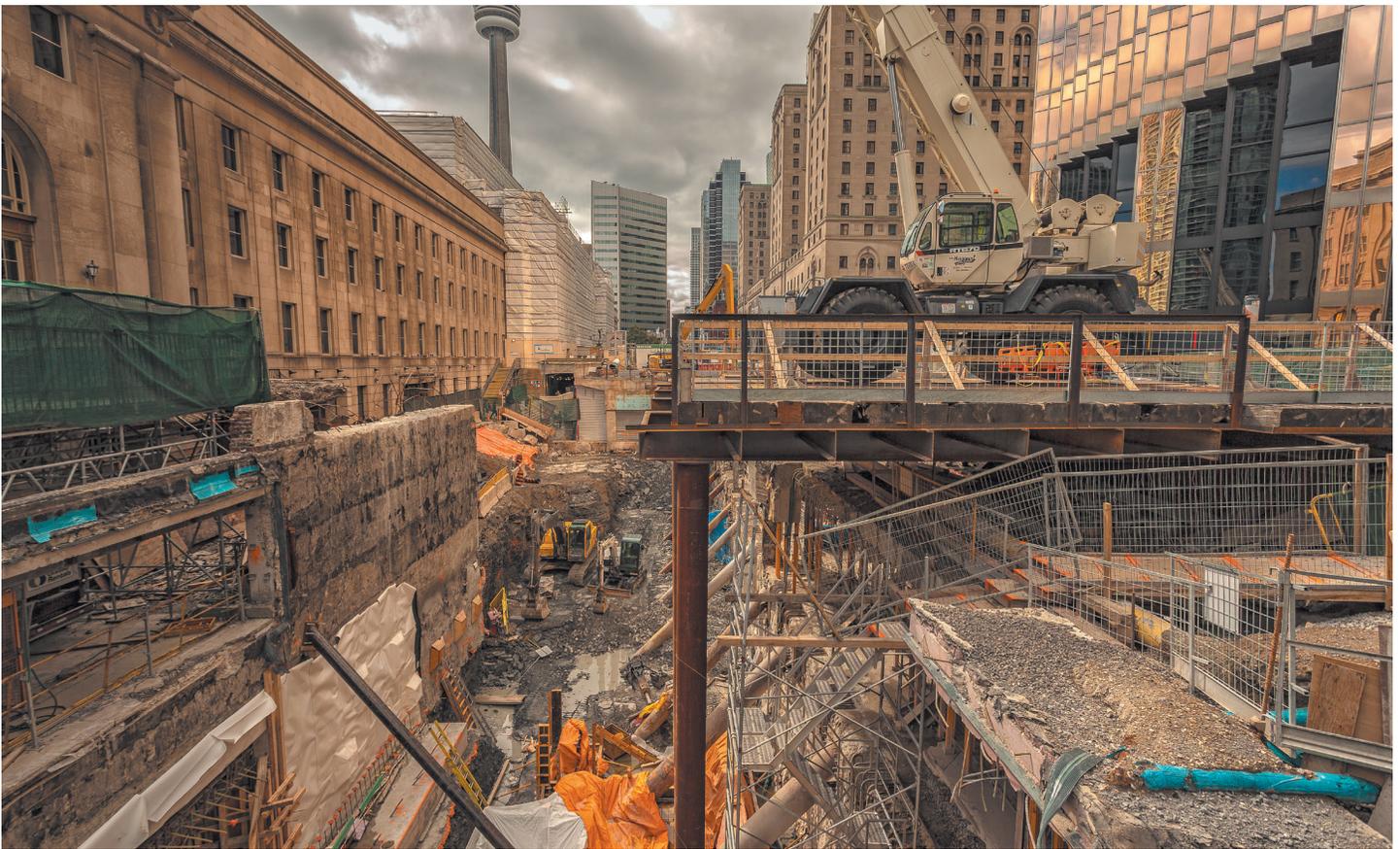


Photo: Ben Roffelsen

# Cost Overruns on Infrastructure Projects: Patterns, Causes, and Cures

## Introduction

Municipalities across Ontario are in the midst of an infrastructure building boom. After decades of underinvestment, billions of dollars are now being spent to rehabilitate existing assets and construct new transportation, water, waste, public housing, civic, and recreation facilities.

The City of Toronto, for instance, plans to allocate \$31.7 billion to social and physical infrastructure between 2015 and 2024. In York Region, the ten-year Capital Plan is forecast to be \$6.6 billion; it is \$2.4 billion in Mississauga, and \$1.85 billion in Hamilton. Mid-sized cities also have significant multi-year capital plans, with infrastructure spending over the next decade budgeted at \$1.75 billion in London and \$438

million in Waterloo. These investments in the physical assets of cities are essential to the vitality of Ontario municipalities, as infrastructure provides the foundation upon which economic growth, environmental sustainability, and social equity and inclusion are achieved.

For the largest and highest-profile infrastructure projects, common challenges are construction cost overruns and schedule delays. “Spadina subway extension \$400M over budget” the *Toronto Star* stated in 2015.<sup>2</sup> “Mayor apologizes for cost overruns in construction of city hall,” reported the *Guelph Mercury* in 2014.<sup>3</sup> “City on hook for Union Station cost overruns” announced the *Toronto Sun* in 2015.<sup>4</sup>

Over the years, the media has tallied millions of dollars in rising costs and years in schedule delays on municipal infrastructure projects such as the construction of the Spadina Subway extension, the redevelopment of Union Station, the purchase of new TTC streetcars, the revitalization of Nathan Phillips Square, the upgrading of Queen’s Quay Boulevard, the construction of Lansdowne Park Stadium in Ottawa, and the building of new city halls in Vaughan and Guelph. The media tend to report each one as an isolated case, with its own unique set of reasons that led to spiralling construction costs or lengthy schedule delays. Yet studies from around the world suggest that cost overruns and construction delays are

an endemic feature of infrastructure project delivery, with a common set of causes and potential cures.

Poorly executed public works can burden governments with hundreds of millions of dollars in unexpected expenses, put the financial viability of projects at risk, and exacerbate construction-related disruptions for residents and businesses. Persistent project delivery problems also jeopardize public confidence in the ability of government to deliver complex but critically important infrastructure projects. As public trust is eroded, it can become harder to build support for the next generation of critical municipal infrastructure investments.

In this context, it is not surprising that municipal politicians such as Toronto Mayor John Tory are “furious that this happens over and over again.”<sup>5</sup> And city staff managing large public works projects are coming under increasing scrutiny when projects experience significant overruns and delays. Since 2012, two project managers have been fired at the Toronto Transit Commission and two more at the Niagara Falls Parks and Recreation Department in response to cost overruns on high-profile projects, raising the personal stakes of poor project management considerably.<sup>6</sup>

Local governments need to develop effective strategies to plan and deliver major infrastructure projects. This paper identifies approaches that municipalities can use to improve the accuracy and efficiency of their infrastructure project delivery. First, extensive international academic literature is reviewed to show how pervasive cost overruns and construction delays are on large infrastructure projects. Second, the causes of poor project delivery are identified. Third, strategies are proposed to minimize cost overruns and delays on large infrastructure projects.

### How Accurate Are Cost Estimates?

Procurement problems on large infrastructure projects are a global epidemic. They affect projects conducted by national, provincial, and local government, and by private-sector organizations; they are a feature of a wide diversity of infrastructure project types; and they have been stubbornly persistent throughout history. Cost escalations and schedule slippage can occur during preliminary project planning as the initial concept is priced and the design refined; from the time that the project is approved until a final contract is signed; during the actual construction period until substantial completion is reached; and after completion if deficiencies must be fixed.

The common definition of an overrun in most studies is a change in cost or schedule relative to the final estimate provided when the approval or “go decision” was made until construction is completed and the facility is operational. This definition means that a project is not necessarily considered on time and on budget just because it was built within the contracted price and schedule. Rather a project is considered on time and on budget only if it is built to *the final estimate at the time when the project was approved*, which is typically before a construction contract is signed.

International research shows that most infrastructure megaprojects experience cost escalations, but the overruns depend on project type and size. In the transportation sector, Bent Flyvbjerg, Nils Bruzelius, and Werner Rothengatter conducted the largest and most robust study of cost overruns on a sample of 258 major roads, tunnels, bridges, urban transit, and interurban rail projects in 20 countries on five continents. Each megaproject cost \$100 million or more,

and most were the biggest, highest-profile, and most complex transportation projects conducted in the jurisdiction at the time.

The study concluded that nine out of ten megaprojects experienced a cost overrun, and the average cost escalation was 28 percent. Rail projects in the sample experienced

the largest cost escalations with the average overrun being 45 percent. Fixed-link bridges and tunnels on average had a cost overrun of 34 percent, and the average cost overrun on surface roads was 20 percent. This pattern of cost escalation was common across all countries in the study and was unchanged over the 70 years for which data was available.<sup>7</sup> The finding that transportation megaprojects routinely experience large cost overruns is consistent with the results of the other studies of transportation megaprojects.<sup>8</sup>

Cost overruns are also a persistent problem on megaprojects in other sectors. Large information and technology projects that cost hundreds of millions or even billions of dollars, such as new enterprise software, management support systems, or digital customer record-keeping, are notorious for cost escalations. A 2011 study published by Flyvbjerg and Alexander Budzier in the *Harvard Business Review* found that out of a sample of 1,471 IT megaprojects in the United States and Europe, the average cost overrun was 27 percent. And fully one in six IT projects had a cost overrun of 200 percent, which added hundreds of millions of dollars to the initial budget.<sup>9</sup> There was no

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difference in performance between Europe and the United States, or between projects undertaken by public- or private-sector organizations – they each experienced cost overruns equally. In Canada, the development of the PRESTO transit fare card by Metrolinx and of electronic health records by eHealth Ontario experienced significant cost escalations.

In the energy sector, a 2013 study by Flyvbjerg and Atif Ansar found that of 245 large hydro dam projects in 65 countries, the cost escalated on average by 90 percent between the final approved budget and the completed project. There was no improvement in budget accuracy over the 70 years of data that the study covered.<sup>10</sup>

In the case of major global sporting events, Flyvbjerg and Allison Stewart found in a 2012 report that for every Olympic Games between 1962 and 2012, final costs were higher than anticipated at the time that the bid was submitted. The average cost overrun in real terms was 179 percent for Olympic Games host cities, higher than for other types of megaprojects.<sup>11</sup>

Studies of smaller, more routine construction and maintenance projects in the transportation sector show that cost estimates for this type of work tend to be more accurate. As three recent studies in the transportation sector found, only about half of all small road projects experienced a cost overrun, and the average escalation ranged from 4 percent to 9.5 percent.<sup>12</sup> A 2006 study of cost overruns on Canadian transportation projects conducted by Joseph Berechman and Qing Wu examined 163 routine highway, bridge, and tunnel projects on Vancouver Island, and found that eight out of ten had cost overruns. The average cost overrun was 5.5 percent, while a considerable share of the projects had far larger cost escalations.<sup>13</sup>

It appears that while overruns still occur, cost estimates tend to be more accurate for smaller, simpler projects that can be completed over a shorter period than for megaprojects, and for projects that involve fewer sub-contractors. These routine projects are also less likely to get caught up in politicized decision-making processes that can surround a high-profile megaproject.

### Why Do Cost Overruns Persist?

Explanations for cost overruns can be grouped into three categories: technical challenges, over-optimism, and strategic misrepresentations.

### Technical Challenges

Technical challenges with project management and delivery take a variety of forms:

- *Scope changes and change orders:* the specifications of the project are changed following the “go decision,” leading to escalating costs. Scope changes include major alterations to a facility such as the addition of new stations on a transit line, the inclusion of additional tunnels where a road was planned on the surface, or additional space in a building. Politicians often initiate these significant changes to ensure that their constituents benefit from a project, or that the harm to adjacent communities is mitigated. Change orders may take the form of contractor-initiated variations to the approved facility design to correct errors and make the facility buildable, or minor variations to change finishing materials or facility layouts to meet the evolving desires of the client. On large, complex infrastructure projects, hundreds of change-order requests may be instigated by the various stakeholders, all of which have to be negotiated and approved between the client and the contractor.

This can be a time-consuming, costly, and sometimes contentious process.

- *Handover problems:* large construction projects involve cooperation between the government client and a general contractor, and between the general construction contractor and multiple subcontractors. Disputes between these parties about the work quality of other partners and responsibility for errors made on a project can lead to schedule delays and rising project costs.
- *Incomplete studies prior to project approval:* project approval and construction on large infrastructure projects often proceed before all technical feasibility and engineering studies are completed, leading to escalating costs as more details about the project are confirmed. This problem occurs because governments often expedite approvals to get urgent projects started quickly, or to make project announcements to meet program funding deadlines or election timelines.
- *Inflation in labour and material costs:* infrastructure projects often rely on key construction materials and workers in specialized building trades, the cost of which can escalate over the course of the project. This tends to

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occur when projects are built during periods of strong economic growth and tight employment markets, which creates scarcity and drives price increases.

- **Inaccurate forecasting:** since large infrastructure projects are complex and take place in a context of uncertainty, accurately forecasting final project costs can be difficult. Forecasting problems include the use of inappropriate methods or inaccurate underlying assumptions because of poor-quality or incomplete data, and unforeseen, dramatic shifts in external conditions.
- **Project delays:** strikes, challenges in sourcing materials or skilled workers, or disputes among different contractors on a job can upset a tight project delivery schedule. Utility companies' requirements to relocate sewer, water, electric, or telecommunications infrastructure is another common cause of delays; meanwhile, the builder often must pay work crews and sub-trades for additional time.
- **Unforeseen events:** a very cold winter or unusually heavy rains can delay a project and increase costs. Construction accidents also lead to delays and additional costs. And uncovering unexpected pollutants or asbestos, undocumented utilities, or archaeological artifacts on a worksite may lead to further work and higher costs.
- **Poor project reporting and performance monitoring:** governments may not have the decision-support systems in place to track contractor performance as the job progresses or to select contractors who have a strong record of delivering quality projects on budget and on schedule.

It is perhaps to be expected that technical reasons for cost overruns are most often cited by stakeholders involved in the delivery of a project, as this explanation minimizes their level of responsibility for the problem. However, technical problems with project delivery are not the sole explanation for the persistence of cost overruns, for two key reasons.

First, if cost overruns on megaprojects were truly unexpected, over a large sample of projects they would follow a normal distribution: half the projects would experience cost overruns and half would be completed under budget. But this is not the case. Evidence

suggests that the distribution is highly skewed and the costs of infrastructure megaprojects are systematically underestimated.

Second, government-led infrastructure projects are delivered by professional project managers who can learn from past experience. If cost overruns were merely caused by technical problems with project delivery, then the size and frequency of cost overruns would decline over time as forecasting and project delivery methods improved. However, data from thousands of projects show that cost overruns are a consistent feature of large infrastructure project delivery, suggesting that other factors are at play.

Bent Flyvbjerg, Professor of Business at Oxford University and the leading expert on megaproject management, provocatively argues that the real causes of

cost overruns can be categorized into two groups: "fools" and "liars."

"Fools are the reckless optimists who see the future with rose-tinted glasses. These forecasting fools ignore hard facts and uncertainty, betting the family

silver on gambles with a very low probability of success. Liars deliberately mislead the public for private gain, fiscal or political, by painting overly positive prospects of an investment, just to get it going."<sup>14</sup>

### ***Optimism Biases***

For decades, researchers studying human behaviour have found that people are prone to "planning fallacies" or optimism biases, whereby they underestimate the time and cost to complete a task. As Daniel Lovallo and Nobel-prize-winning economist Daniel Kahneman explain in a 2003 *Harvard Business Review* article, "Most people are highly optimistic most of the time." Research shows that people tend to display overconfidence in their own abilities, talents, and skills. They are quick to take personal credit for positive outcomes, while attributing failures to unexpected external events like inflation or poor weather. They typically exaggerate the degree of control they exercise over the unfolding of events, and they often downplay the role of luck or chance in achieving a successful outcome.<sup>15</sup>

The tendency of individuals to accentuate the positive is amplified by forces within organizations. Organizations have limited resources to pursue new initiatives, and there is

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often strong internal competition amongst various options. This creates a powerful incentive for individuals drafting new plans and proposals to emphasize the positives to give their preferred project the best chance of being implemented. Early forecasts and project plans then tend to become anchors around which future technical and cost estimates are made, magnifying bouts of over-optimism. These tendencies are compounded in situations in which the results of a plan will not be known for many years, staff turnover is quick, and there are few personal consequences for underestimating project costs. Faced with the prospect of making an optimistic forecast in the short-term to get a project started or an accurate long-term forecast, the favourable short-term forecast usually prevails.

Taken together, the innate human condition of being over-optimistic about the outcome of future events, combined with subtle organizational pressures to accentuate the positive, leads to forecasts in which costs are chronically underestimated. However, as Flyvbjerg argues, a more cynical explanation for cost overruns points to willful misrepresentation on the part of project planners and promoters.

### ***Strategic Misrepresentation***

Infrastructure projects create winners who stand to gain financially or in terms of prestige from the delivery of a large public works project. These include politicians, bureaucrats, consultants, lawyers, construction contractors, property owners, and community residents, depending on the project. But there are few direct consequences for these participants when budget expectations are not met.

When project construction is entirely financed by government, the costs of overruns and schedule delays deemed the responsibility of government are borne by taxpayers rather than those who planned, approved, and promoted the project. Until recently, few government employees were ever fired over projects that experienced cost overruns.

This means strong incentives for proponents to strategically misrepresent initial budgets to get a project approved, funded, and started, knowing that once work begins, few projects are ever halted. Studies by Don Pickrell<sup>16</sup> and by Alan Altshuler and David Luberoff<sup>17</sup> have found that municipal government officials applying for senior-level

government funding have an incentive to underestimate the costs of their pet projects to make them more attractive to provincial or federal governments. Politicians and project promoters have an incentive to underestimate the costs of their preferred infrastructure plans to make them palatable to voters. And contractors competitively bidding for projects may strategically underestimate costs, knowing that once they win the job, they can drive up the price through change orders.

Scholarly articles with titles such as “When planners lie with numbers” by Martin Wachs,<sup>18</sup> “The lying game” by Bent Flyvbjerg,<sup>19</sup> and “Deception in Dallas: Strategic misrepresentation in rail transit promotion and evaluation”

by John Kain,<sup>20</sup> have documented how cost escalations result from a systemic pattern of wilful misinformation on the part of project proponents seeking to maximize their individual benefits from an investment initiative. As Flyvbjerg writes, the projects that get built are not “necessarily the

best ones, but those projects for which proponents best succeed in conjuring a fantasy world of underestimated costs, overestimated revenues, undervalued environmental impacts, and overvalued regional development benefits.”<sup>21</sup>

### **Cures for Cost Overruns**

As has been demonstrated, cost overruns on large-scale infrastructure projects are a persistent problem with a diversity of complex technical, psychological, and political economic causes. In response, measures are required that together address the varied causes of escalating project costs: strategies to improve the technical management and oversight of megaproject procurement; innovative cost estimation techniques to mitigate the effects of genuine optimism biases; and new project delivery approaches that create incentive structures that reward accurate forecasting and construction management while de-legitimizing the strategic misrepresentations that are sometimes used to get projects started. Below are five promising approaches, drawn from international best practices, to reduce construction cost overruns.

#### **1. *Enhance Performance Monitoring, Reporting, and Information Sharing***

The world is in the midst of a big data and analytics revolution. From professional sports to product marketing,

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sophisticated new methods are being developed to improve performance by collecting and statistically analyzing massive amounts of data. Yet infrastructure megaproject delivery remains a sector that has been largely untouched by this trend.<sup>22</sup> International research on infrastructure project cost overruns has identified a lack of systematic tracking across government departments of how project cost and schedule estimates at the time of project approval compare with the outcome.<sup>23</sup> As a result, limited institutional learning from past experience is taking place and information is not being harnessed in real time to improve decision-making.

Cities should therefore require that data on procurement performance be collected for all infrastructure projects over a minimum cost threshold. Data collection should be coordinated through a central department and conducted through a single software application. Project managers in departments (and agencies) across the city should be required to input the schedule and cost details of each project into the software program when it is initially approved; at the time the contract is signed; and at substantial completion. Other data about each project would also be collected: the type, size, and location of the project; the firms and project managers involved; the project delivery model (i.e., traditional procurement, public-private partnership, joint venture, etc.); major changes to scope; the causes of any cost escalations or schedule delays; measures of construction quality and safety on the job site; and any long-term construction defects.

Such evaluation systems are by no means a novel concept in Ontario municipalities, especially as they pertain to measuring vendor performance. Many municipalities include formal contractor performance evaluations as part of their tendering policies. In 2013 for instance, the City of Toronto mandated that the general contractor on any city construction job be evaluated using a common Contractor Performance Evaluation Form.<sup>24</sup>

Here, the focus of the evaluation is expanded to include a broader range of factors. Inputting data as the project is ongoing would reduce the costs associated with retrieving this information after the fact, and make it possible to account for changes in budgets over time that can make it difficult to accurately interpret a project's success.

Over time, this performance tracking system would develop a very large dataset that could be statistically

analyzed to show trends in the dynamics of infrastructure delivery costs, quality, and cost overruns. Analysis would show whether certain types of projects are more prone to overruns, how firms and departments compare in terms of cost containment, and how the cost of building different types of facilities are changing over time. In time, cities could develop predictive models that estimate the likelihood of cost escalations under various conditions. The system could also identify the early warning signs of any strategic or corrupt project pricing behaviour, if project costs vary widely from the observed norm for that type of infrastructure.

## 2. *Reward Good Performance*

Long-term, sustained improvements in performance are greatest when incentives reward individuals or firms that rank at the top of their league table, while penalizing those that fail to meet performance expectations.

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One approach that has gained international interest is the implementation of formal prequalification systems, which give firms with a good track record an improved chance of obtaining future contracts. Although such systems have been used to drive up the quality of

infrastructure procurement, in Canada they are commonly designed so that as long as a firm meets the minimum standard required, it is eligible to bid for a government construction job.

In Hong Kong and Singapore, by comparison, firms found to be consistently high-performing in terms of quality construction and budget certainty on previous jobs are assigned extra points when their bids are evaluated. This means that high-performing firms can beat out low-performing firms even if their bids are scored slightly worse or cost a little more. Such prequalification systems give all firms an incentive to deliver projects on time and on budget and meet their quality targets on each job.<sup>25</sup>

The ranking of each firm is based on results from numerous previous projects, since cost overruns on any single project can be caused by factors that may or may not be within the control of the contractor. The strength and legitimacy of the prequalification system is predicated on the development of a data collection regime that is rigorous in capturing both the size and causes of cost overruns as well as construction quality.

### 3. *Enhance the management capabilities of staff*

Weak project management by city staff has been identified as a common source of cost overruns. There is a growing need for city government staff with specialized skills to manage the complex relationship between the public and private sectors.

Necessary skills for the contemporary government project manager include the ability to write effective requests for proposals that clearly articulate the client's demands; to manage competitive tender processes designed to select firms based on best value rather than lowest bid; to draft enforceable contracts that clearly transfer the risk if budget expectations are not met or change orders are requested by the contractor; to oversee change orders initiated by government; and to use conflict resolution approaches when tensions between partners arise. In addition, sufficient resources must be available to support the function of contract drafting, management, and monitoring, such as effective training programs.

In the United Kingdom, for instance, the Cabinet Office of the national government responded to a history of weak government megaproject procurements by creating the Major Projects Leadership Academy. The Saïd Business School at Oxford University and Deloitte consultancy provide the training, and the program offers instruction on best practices for effective project delivery. Senior government staff members in departments that oversee major infrastructure projects in the United Kingdom are required to have completed the Leadership Academy program.<sup>26</sup>

### 4. *Apply State-of-the-Art Forecasting Techniques*

Numerous innovative techniques have been designed to deliver more accurate *ex-ante* project cost estimates. Benchmarking a project under review against a representative reference class of recently completed projects has been proposed to assess probable project costs and overrun magnitude more realistically than developing forecasts based on internal agency predictions of costs.<sup>27</sup>

In line with such an approach, the British government has provided guidance on applying “optimism uplifts” to transportation project cost estimates, which are based on empirical measures of cost overruns on past projects in the sector.<sup>28</sup> This method of reference class forecasting is enabled by data collected through the implementation of a

rigorous performance monitoring system. In a 2015 study, James Odeck and his colleagues found that cost overruns were reduced on large transportation projects in Norway by instituting a quality assurance program whereby initial cost estimates were reviewed by external advisors before final approval was granted.<sup>29</sup>

While few oppose the application of state-of-the-art forecasting and risk assessment techniques, their application is constrained by limitations on budgets, time, and staff expertise. One way to lessen the burden of applying state-of-the-art forecasting techniques is to standardize parts of the process. For instance, enhanced data collection on cost overruns can be used to develop dynamic registries of reference classes and project benchmarks as comparators in the assessment of future projects. And a common set of instructions, procedures, and assumptions for estimating the costs of different types of projects can be developed, as in Britain, so that all proposals are subjected to a similar analysis, and thus more easily audited for accuracy.

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**There is a growing need for city government staff with specialized skills to manage the complex relationship between the public and private sectors.**

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### 5. *Make Selective Use of Public-Private Partnerships*

Public-private partnerships (PPPs) have become increasingly popular in Canada as a procurement model. To date, provincial governments have been

the primary users of PPPs. PPPs have two main features designed to incentivize on-time and on-budget project delivery. First, they bundle multiple aspects of project delivery, such as facility design, construction, operations, and maintenance into a single contract. This creates a level of integration within the consortium of designers, builders, and operators of the facility right from the planning stages of the project. There is a direct line of responsibility within the consortium for any design flaws or challenges during handovers between subcontractors on the job.

Second, PPPs function as pay-for-performance contracts in which the private-sector concessionaire finances all or a portion of the initial construction costs of the project. The private-sector partner is repaid its initial investment in the project by government or through user fees over the entire life of a long-term operating concession that can last between 25 and 50 years, provided that service quality standards in the contract are met.

Having a significant amount of private capital at stake during the construction of a project provides an incentive for the contractor to meet performance objectives and gives

greater leverage to the government client to enforce the terms of the contract. Recent provincial government PPPs in Ontario have delivered a high level of cost certainty. A study commissioned by Infrastructure Ontario found that of 30 projects delivered since 2007 by the provincial government agency, 29 were completed below budget and 22 were opened on time.<sup>30</sup>

Yet the value and suitability of PPPs for municipalities has limitations, and this model of procurement should be applied with care. Due to the high costs of structuring and executing a PPP deal, PPPs make sense only for projects with a capital value of more than \$50 million. This excludes many smaller municipal projects. Many municipal infrastructure projects are also closely integrated within an existing network of service and thus there is no effective means of introducing private operations – for instance, on one portion of an extended rapid transit line. Additionally, although PPPs may provide cost certainty to government, private financing of infrastructure over a long-term concession period comes at significantly higher cost than direct public borrowing. The private consortium also charges a premium to assume the risk of cost overruns. Together, these costs can add 10 to 20 percent to the upfront price of delivering a comparable infrastructure project through a traditional government procurement model.<sup>31</sup>

In practice, PPPs are like purchasing an insurance policy against the likelihood of a cost overrun. The government pays a significant premium up front to ensure cost certainty and protect against a far larger cost exposure if the budget increases as the project progresses. Purchasing this type of insurance through a PPP delivers value only for the largest, most complex, and riskiest municipal infrastructure projects, for which major cost overruns are a likely occurrence. The implementation of performance monitoring systems that systematically track patterns of cost overruns across a large number of municipal projects would provide empirical evidence to identify projects that are appropriate candidates for PPPs.

While PPPs are suitable only for certain large municipal public works projects, the lessons learned from this approach can be applied to local infrastructure projects. In particular, bundling facility design and construction into a single contract can be used on smaller infrastructure projects to create synergies and accountabilities between the designer and builder. As studies by Jan Whittington in 2012<sup>32</sup> and Ralph Ellis and his colleagues in 2007<sup>33</sup> conclude, design-build contracts can lower the size of cost overruns on routine infrastructure projects by minimizing the number of change orders and claims against the government client. Also, including some short-term, private construction financing in traditional procurement contracts to be repaid by government

once construction is substantially complete can incentivize contractors to meet their performance expectations, without incurring the full cost of long-term, private financing as is typical in PPPs.

### Conclusion

Cost overruns have plagued government infrastructure projects for decades. As demonstrated above, if rising construction costs were merely the result of technical challenges associated with delivering large, complex projects, then it is likely that the problem would have been solved by now. In practice, there are deep psychological and political economic factors that also contribute to the persistence of this phenomenon.

However, a suite of policy prescriptions can together minimize cost overruns by shifting the incentive structures of project delivery in three important ways. First, the power of big data can be applied to make the patterns, triggers, and culprits of project overruns more transparent, and thus enable learning from past experience. Second, contracts and procurement models can be designed to motivate all stakeholders to deliver on their obligations or face appropriate consequences. Alternative project delivery arrangements that bundle facility design, construction, and short-term project finance are appropriate to incentivize successful delivery of select projects. PPP concessions that involve long-term private finance, facility operations, and maintenance have the potential to significantly impact the cost and effective provision of municipal services, and require careful study to ensure that public value is realized. Third, regardless of the procurement model used, the delivery of public works projects must be carried out by skilled procurement management personnel who apply the most advanced cost forecasting methods, have the expertise to negotiate fair contracts, and are appropriately empowered to enforce the terms of the agreement.

The outstanding question arising from this analysis is whether any of the main stakeholders involved in municipal infrastructure delivery – politicians, city staff, and firms – have an interest in moving beyond tough talk about cost overruns to implement strategies that actually address this problem. Historically, the answer to this question has been no. None of the stakeholders involved in delivering municipal infrastructure projects has been willing to upset the status quo and implement a comprehensive program aimed at reducing cost overruns in public procurement. On the contrary, all parties prefer to obscure the frequency and magnitude of cost overruns, avoid identifying which city departments and firms perform worse than others, and evade accountability for project failures. Moreover, expanding data collection, providing staff training, and improving forecasting methods

are costly – a deterrent to action during periods of tight municipal budgets.

However, the costs to governments of unexpected overruns are staggeringly large, easily costing tens if not hundreds of millions of dollars a year. In purely economic terms, this justifies the expense of remedial measures. More broadly, political economic incentives may be shifting towards the implementation of more effective strategies to clamp down on the causes of cost overruns. Politicians are becoming increasingly sensitive to the problem of cost overruns, amidst intense media scrutiny of each high-profile failure. City staff may be more receptive to implementing strategies to stop cost overruns if, justified by the facts of the case or not, there is a growing trend of municipal project managers bearing the ultimate responsibility and losing their jobs due to poorly executed infrastructure projects. And as politicians and city staff become more motivated to eliminate cost overruns, firms that have a good track record may recognize a commercial benefit in being identified for delivering projects on time and on budget, and support policies that reward high-performing companies.

Effective strategies do exist and are being implemented to measure and incentivize effective management of large public infrastructure projects elsewhere in the world. Is there a will to implement these strategies at the municipal level in Ontario?

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