Rail Deck Park Cost Study Exclusions Analysis & Report

Canadian Taxpayers Federation

May 26, 2020

Cover Photo: Conceptual Rendering, City of Toronto

Canadian Taxpayers Federation

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About the Canadian Taxpayers Federation

The Canadian Taxpayers Federation is a federally incorporated, not-for-profit citizens' group dedicated to lower taxes, less waste and accountable government.

The CTF was founded in Saskatchewan in 1990 when the Association of Saskatchewan Taxpayers and the Resolution One Association of Alberta joined forces to create a national organization. At the end of 2019, the CTF had 235,000 supporters nationwide.

The CTF maintains a federal office in Ottawa and regional offices in British Columbia, Alberta, Prairie (Saskatchewan and Manitoba), Ontario, Québec and Atlantic Canada. Regional offices conduct research and advocacy activities specific to their provinces in addition to acting as regional organizers of Canada-wide initiatives.

CTF offices field hundreds of media interviews each month, hold press conferences and issue regular news releases, commentaries, online postings and publications to advocate on behalf of CTF supporters. CTF representatives speak at functions, make presentations to government, meet with politicians and organize petition drives, events and campaigns to mobilize citizens to effect public policy change. Each week CTF offices send out Let's Talk Taxes commentaries to more than 800 media outlets and personalities across Canada.

Any Canadian taxpayer committed to the CTF's mission is welcome to join at no cost and receive emailed Action Updates. Financial supporters can additionally receive the CTF's flagship publication *The Taxpayer* magazine, published three times a year.

The CTF is independent of any institutional or partisan affiliations. All CTF staff, board members and representatives are prohibited from donating to or holding a membership in any political party. In 2018-19 the CTF raised $5.1 million on the strength of 30,517 donations. Donations to the CTF are not tax deductible as a charitable contribution.

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About Cyntek Consulting

Cyntek Group is a Toronto-based engineering firm and industrial service provider with over 30 years of experience. Cyntek Group is currently engaged in projects spanning three continents and is made up of engineering professionals working from around the globe

CYNTEK CONSULTING

Executive Summary

Rail Deck Park is a proposed development of 8.15 hectares of new parkland situated above the Union Station Rail Corridor. In October 2017 a study was completed to investigate some of the technical challenges involved with constructing the park and determine a preliminary cost estimate for its construction. The cost estimate contains multiple exclusions which were analyzed to determine a more realistic capital expenditure total. The exclusions analyzed within this report include Project Management Fees, Consultant Fees (other than Design Consultant Fees), Planning Approvals, Permits & Fees, Development Charges, Cost of Financing, Taxes, and a Soft Cost Contingency. All costs displayed in this report are Canadian Dollars reflecting October 2017 (study date) pricing levels unless otherwise stated.

Project Management

The project management fees for the Rail Deck Park project were estimated by developing a project management costing equation that incorporates industry-standard rates for small projects, an exponential factor for decay in project management fees as total installed cost increases, and a factor for the inclusion of project controls. Using the benchmarking methodology, the project management fees for the Rail Deck Park project was estimated at **$38,961,000.00 ± $8,658,000.00**.

Consultant Fees

Consultant Fees make up a large component of the Rail Deck Park soft cost exclusions. The report states that Design Consultant Fees were included, however, the fees are not broken down or elaborated within the *Rail Deck Park Engineering and Costing Study*, therefore several assumptions were made to estimate the remaining consultant fees. The method for estimating the excluded consultant fees has two primary components: front-end loading and design development which was not included in the original study, and detailed design and execution elements that are outside the scope of the consultant team (WSP & McMillan Associates Architects).

The front-end loading component of the excluded consultant fees was estimated using benchmarked costing data for executing front-end development phases. Using the benchmarking methodology, the front-end loading portion of the consultant fees for the Rail Deck Park project was estimated at **$66,600,000.00 ± $16,650,000.00**.

As specified, the *Rail Deck Park Engineering and Costing* Study doesn't breakdown the design elements that are within the scope of the existing Design Consulting Fees, therefore it is difficult to estimate the exact cost of procuring additional consultants. In order to estimate the remaining consultant fees, the Design Consulting Fees included in the report were compared against benchmarked engineering and geotechnical consulting fees published by the Consulting Engineers of Ontario. The remaining consulting fees were assumed to be the difference between the benchmarked consulting fees and those included in the report. Using this methodology, the excluded detailed design and execution portion of the consultant fees for the Rail Deck Park project was estimated at **$21,550,000.00 ± $4,162,500.00**. Combining the two estimates for consulting fees results in an estimated cost of **$88,150,000.00 ± $20,812,500.00**.

Planning Approvals

In budget estimation exercises the Planning Approvals processes can account for 1-3% of the total project expenditure. Similar to project management and consulting fees, this percentage decays as the project size increases. Due to the lack of design information currently available, the cost of Planning Approvals was estimated using a 1% project

cost factor with a 0.5% variance which corresponds to the low end of industry-standard benchmarks.

Using a 1% project cost factor with a 0.5% variance for the Planning & Approvals of the Rail Deck Park project results in an estimated cost of **$16,600,000 ± $8,300.000.00**.

Permits & Fees

The majority of the permits identified within the *Rail Deck Park Engineering & Costing Study* require a substantial amount of design maturity and are therefore difficult to estimate at this time. Without detailed drawings and designs, it is impossible to estimate the type and quantity of each permit necessary for the project. The fees associated with the permits that are straightforward to estimate at this time have a negligible impact on the overall cost and do not reflect the actual expected cost of permitting. As such, the permits and fees have been excluded from this cost estimate. Despite not being able to quantify the cost of permitting, potential obstacles regarding permits and fees in a project of this size have been identified.

Development Charges

Development charges are fees levied against developers of land development projects by the City to help pay for the capital costs of infrastructure that is needed to service new development. It would be illogical for the city to charge development charges on a publicly funded project such as the Rail Deck Park project since the primary purpose of development charges is to fund the development and expansion of facilities and infrastructure including recreational parks. Instead, development charges collected by the City on past and future projects will potentially be used as a funding tool for the Rail Deck Park project. The implications of using development charges as a funding tool for the Rail Deck Park project are evaluated in this report.

Cost of Financing

The costs of financing the Rail Deck Park are the largest portion of the cost exclusions analyzed within this report. The costs of financing grow with the size of the project and for a project with minimal collateral, economic benefit, or yield on the investment, financing costs are directly borne by all taxpayers.

We have estimated carrying costs for debt across a range of interest rates from 2.5% (based on current borrowing rates, 2.8% in November 2019 for a 30-year bond) to 5%, to allow for a prudent analysis of potentially higher borrowing costs in future arising from increased governmental deficits. Using the range of interest rates, over a 30-year period, interest charges would amount to between **$1.05 billion** (at 2.5% interest) and **$2.1 billion** (at 5% interest).

Taxes

Construction activities for the Rail Deck Park are likely to attract HST payments, however, HST payments are also likely subject to Input Tax Credits from the government in whole or in part. We believe that HST inputs will be largely recoverable by the City of Toronto, such that the cost of the taxes will be limited to their carrying cost while awaiting reimbursement.

A number of assumptions were made to estimate the carrying cost, which resulted in a one-time charge estimated to be between **$2.18 million** (at 2.5% interest) and **$4.35 million** (at 5% interest).

Soft Cost Contingency

The soft cost contingency was estimated using a Monte Carlo simulation, which entailed executing 1000 simulations whereby the cost of each line item varies between the “high” and “low” cost estimates according to a normal distribution.

Using the Monte Carlo analysis it was determined that there is a 95% probability that the total capital cost exclusions will be less than ~$2.1-billion. The required soft cost contingency at a 95% confidence level is calculated by subtracting the most likely cost from the cost estimate at 95% confidence as shown below.

Soft Cost Contingency=Soft Cost @ 95% Confidence Interval-Most Likely Soft Cost

Soft Cost Contingency=$2,098,729,838.71-$1,722,026,000.00

Soft Cost Contingency=$376,703,838.71

Summary of Exclusions

The estimated cost of each exclusion analyzed within this report is summarized below in Table 1. Each exclusion is associated with a "low" cost, a "high cost", and a "most likely cost" which highlights the degree of uncertainty and variability in each of the estimates.

Table 1

Exclusion	Low Cost	High Cost	Most Likely Cost
Project Management Fees	$30,303,000.00	$47,619,000.00	$38,961,000.00
Consultant Fees	$67,337,500.00	$108,962,500.00	$88,150,000.00
Planning Approvals	$8,325,000.00	$24,975,000.00	$16,650,000.00
Permits & Fees	N/A	N/A	N/A
Development Charges	N/A	N/A	N/A
Cost of Financing	$1,050,000,000.00	$2,100,000,000.00	$1,575,000,000.00
Taxes	$2,180,0000.00	$4,350,000.00	$3,265,000.00
Total Exclusions	$1,158,145,500.00	$2,285,906,500.00	$1,722,026,000.00
Soft Cost Contingency @ 95% Confidence Level			$376,703,838.71
Total Exclusions Including Contingency @ 95% Confidence Level			**$2,098,729,838.71**

As shown in Table 1, the soft cost exclusions have the potential to exceed the entire project budget. Combining the soft cost exclusions with the original estimate yields an updated estimate of **$3.763-billion** not including the exclusions exempt from this analysis.

Introduction

Rail Deck Park is a proposed project located in downtown Toronto that entails the development of 8.15 hectares of new parkland overtop of the Union Station Rail Corridor. In 2017, an Engineering and Costing Study for Rail Deck Park was undertaken by Build Toronto and consultants WSP Canada Group Limited and McMillan Associates Architects. The study found that the estimated budget for the complete development of Rail Deck Park is estimated to be in the range of $1.665-billion. The *Rail Deck Park Engineering & Costing Study* included multiple cost exclusions including soft costs related to services that could reasonably be delivered by the City, taxes, and fees administered by the City, and escalation. The exclusions listed in the report will have a meaningful impact on the estimated cost, therefore, the budget in its current format does not resemble an accurate picture of the total expected costs.

This analysis was undertaken to investigate a number of the exclusions listed in the *Rail Deck Park Engineering & Costing Study* in an effort to provide a more realistic estimate of the total capital expenditures required to develop the new parkland. Many of the exclusions could not be estimated at this time due to a lack of information. The full list of exclusions is detailed below with the exclusions covered in the scope of this study highlighted in green.

- Soft Cost Exclusions
  - Project Management;
  - Consultant Fees (other than Design Consultant Fees which are included);
  - Planning Approvals;
  - Public Consultation & Information;
  - Legal and Accounting;
  - Permits & Fees;
  - Development Charges;
  - Property Taxes;
  - Municipal Connections and Hydro Charges;
  - Environmental Assessment process;
  - Cost of Financing;
  - Soft Cost Contingency (other than contingency for Design Consultant Fees which are included)
- Taxes (including HST Payable and HST Input Tax Credit)
- Project (Owner's) Contingency & Escalation
  - Work beyond park perimeter (Except as specifically identified in this estimate);
  - Fast-tracking of the work;
  - Upgrades or modifications to existing bridges (Spadina, Bathurst & Blue Jays Way);
  - Work related to mitigating electromagnetic field impacts – i.e., the interaction between the electric field produced by stationary charges (the bridge or park) and the magnetic field that is produced by moving charges (the trains);
  - Delays resulting from approvals/agreements with Metrolinx and/or cancellation(s) of work blocks;
  - Metrolinx documentation review fees; and
  - Remediation of the entire site if required (an allowance for local remediation only is included in the estimate).

Exclusions Analysis

This analysis of the Rail Deck Park Engineering and Costing Study exclusions will be completed by estimating a range of likely values for each of the exclusions highlighted in green above. Due to the incomplete nature of the reference design concept, estimating exact values for each exclusion would be irresponsible and assign unsubstantiated confidence to the cost estimate. Instead, a range of estimates will be presented for each exclusion.

The range of estimates will then be used as part of a Monte Carlo statistical analysis to provide a histogram of potential costs. The Monte Carlo analysis will also be used to estimate the soft cost contingency.

Many of the exclusion estimates will be gathered using industry benchmarked data that inherently contain a range of values. In this instance, the median value will be used and the range will resemble a Gaussian distribution of values. Other exclusion estimates will be estimated as a single value and the range of potential costs will be formulated using the Authority for Advancement of Cost Engineering (AACE) expected accuracy range for a Class 4 Estimate. The AACE cost estimate classification matrix can be found in Table 2.

Table 2

Estimate Class	**Maturity Level of Line Item Definition** Expressed as % of complete definition	**End Usage** Typical purpose of estimate	**Methodology** Typical estimating method	**Expected Accuracy Range** Typical variation in low and high ranges			
				Low (Min)	**Low (Max)**	**High (Min)**	**High (Max)**
Class 5 Estimate	0% to 2%	Concept screening	Capacity factored, parametric models, judgement, or analogy	-20	-50	30	100
Class 4 Estimate	1% to 15%	Study or feasibility	Equipment factored or parametric models	-15	-30	20	50
Class 3 Estimate	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	-10	-20	10	30
Class 2 Estimate	30% to 75%	Control or bid/ tender	Detailed unit cost with forced detailed take-off	-5	-15	5	20
Class 1 Estimate	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	-3	-10	3	15

Project Management

Consulting engineers and project management professionals have three primary methods of remuneration for engineering fees on a project of any scale:

- Time Basis
- Fixed Fee
- Percentage Cost of Construction

Typically in Ontario, project management services are remunerated on a time basis, as corroborated by the Consulting Engineers of Ontario. Although it may be possible to estimate the quantity of project management professionals required for the project along with their garnered market rate, it is impossible to estimate the cost on a time basis without a rough-order-of-magnitude unit of time. Due to the omission of a timeline in the original *Rail Deck Park Engineering and Costing Study*, the cost estimate for project management services must be completed using the percentage cost of construction remuneration method.

Infrastructure projects typically contain three high-level phases, which can be further broken down into sub-phases, however, for the purpose of this analysis, we will assume that there are three distinct phases: conceptual engineering, detailed design, and construction. John Byrne, a Project Management Professional (PMP) with over 20 years of experience in project management authored a paper published by the Project Management Institute (PMI) that investigates the role and cost of project management in each of the aforementioned phases.

Through his extensive experience and research into the topic of project management, Byrne found that the project management office (PMO) or project manager (PM) has varying levels of involvement in each of the three phases. Their involvement is a key component of the conceptual phase and can make up roughly one-third of the total conceptual phase cost, which in itself makes up around 5% of the total installed cost. During the detailed design phase, the PM directs an engineering team according to the project management plan initially conceived during the conceptual phase. The cost of project management during this phase typically amounts to 10% of the detailed design phase, which makes up around 15% of the total installed cost. During the construction phase, it is not uncommon for a dedicated construction manager to take over from the project manager. On large projects, it is common for both project managers and construction managers to be involved in the construction phase of a project. The construction manager oversees on-site operations, such as personnel, materials, and the construction budget, ultimately ensuring that the project is technically sound, while the project manager oversees all phases of a project from start to end and has the ultimate responsibility of ensuring the project is on time and within the allocated project budget. The current cost estimate for the Rail Deck Park includes a construction management fee amounting to **$60,000,000.00** over the entire duration of the project, therefore this analysis will focus solely on the associated project management fees.

According to Means Estimating Handbook, on average, the project management costs during the construction phase of a given project make up between 5-10 percent of the construction phase costs which cover the remaining 80% of the total installed cost.[2] These values are summarized below in Table 3.

Table 3

Phase	Phase % of Total Installed Cost	Project Management % of Phase Cost
Conceptual Phase	5%	33%
Detailed Design	15%	10%
Construction	80%	5-10%
Total Project	**100%**	**7-11%**

Medium and large sized projects may also incorporate a project controls team that is composed of varying specialists in the field of estimating, scheduling, and cost control. The addition of a project controls team typically results in a 33% increase to the total project management costs. Megaprojects, defined as having a total estimated (or installed) cost of greater than $1 Billion, which the Rail Deck

Park belongs to, have historically been plagued by massive cost overruns. Including a dedicated project controls team is critical for mitigating the likelihood and magnitude of capital cost overruns in megaprojects.

The figures illustrated in Table 3, along with the inclusion or exclusion of a dedicated project controls team does not provide the full picture for project management costs as a percentage cost of construction. Additionally, the scale of the project and the industry to which it belongs must be taken into consideration. Traditionally, the larger a project is, the smaller the project management costs as a percentage of the total. This is due to the fact that regardless of the size of any given project, certain project management tasks must be completed, and these activities consume a larger percentage of the project's budget in a small project than they do on larger projects. In large, or megaprojects, as the estimated or total installed costs increase, so does the complexity of scopes, schedules, and budgets. The complexity of these key project management aspects do not, however, increase proportionally.

There are currently no publicly available databases for benchmarking project management fees based on the size of a given project, however, Northwestern University's Facilities Department[3], along with other American universities including Illinois University[4], Oregon State University[5], and Washington University in St. Louis[6] have made their project management fees publicly available. Their published fees highlight the decay in project management fees as a percentage of the total installed cost as the size of projects increase. The rates used by these institutions are included in Table 16, within Appendix B. Using the rates provided by these Universities, the exponential decay of the project management rate based on project size was estimated. The decay in the project management rate was combined with the estimated rates for project management and project controls determined by Byrnes to formulate an equation that can be used to determine the estimated project management fees for a project of any size.

The equation used to calculate the estimated range of project management costs is represented below, where,

Small Proj Fee = 7 to 11 (percent)

Projects Controls = 1 (no project controls) or 1.33 (dedicated project controls)

TIC = Total Installed Cost

$$\text{Project Management Rate} = \left(0.3139 * \left(\frac{\text{Small Proj Fee} * \text{Project Controls}}{5.48} \right) \right) * TIC^{-0.158}$$

Low End – Small Project Fee = 7% w/Control

$$\text{Project Management Rate} = \left(0.3139 * \left(\frac{7*1.3}{5.48} \right) \right) * \$1{,}665{,}000.00^{-0.158}$$

Project Management Rate = 1.82%
Project Management Fee = $30,303,000.00

High End – Small Project Fee = 11% w/Control

$$\text{Project Management Rate} = \left(0.3139 * \left(\frac{11*1.3}{5.48} \right) \right) * \$1{,}665{,}000.00^{-0.158}$$

Project Management Rate = 2.86%
Project Management Fee = $47,610,000.00

Using the benchmarking methodology described above, the project management fee for the Rail Deck Park project was estimated at $38,961,000.00 ± $8,658,000.00.

Consultant Fees

A large component of the Rail Deck Park cost exclusions is consultant fees (other than design consultant fees which are included). The design consultant fees are not broken down or elaborated within the *Rail Deck Park Engineering and Costing Study*, therefore several assumptions must be made in order to estimate the remaining consultant fees. The assumptions will be made by analyzing the current information and costs associated with the project in the context of a traditional project development and cost estimation approach. The methodology used to formulate the assumptions and subsequently estimate the consultant fees is as follows:

1.1 Identify traditional project development and cost estimation approaches for large-scale infrastructure projects.

1.2 Determine where the *Rail Deck Park Engineering and Costing Study* fits into a traditional phased approach to project development and cost estimation.

1.3 Perform a gap analysis to determine components of a traditional project development and cost estimation process that are missing from the *Rail Deck Park Engineering and Costing Study*.

1.4 Estimate the cost of missing components by benchmarking historical data for the missing components against the estimated total installed cost.

2.1 Identify standard rates for engineering and geotechnical consultants during the detailed design and execution phases of infrastructure projects.

2.2 Apply standard rates for engineering and geotechnical consultants to the total installed cost to determine benchmarked engineering and geotechnical consulting fees.

2.3 Compare benchmarked engineering and geotechnical consulting fees with the total design fees included in the cost estimate.

2.4 Calculate the difference between benchmarked engineering and geotechnical consulting fees and the total design fees estimated in the *Rail Deck Park Engineering and Costing Study*.

The method for estimating the excluded consultant fees has two primary components: front-end development and cost estimation elements not included in the original study, and detailed design and execution elements that are outside of the scope of the consultant team which can reasonably be estimated using a benchmarked value for engineering and geotechnical consulting fees.

Background on Project Development Approach & Cost Estimation

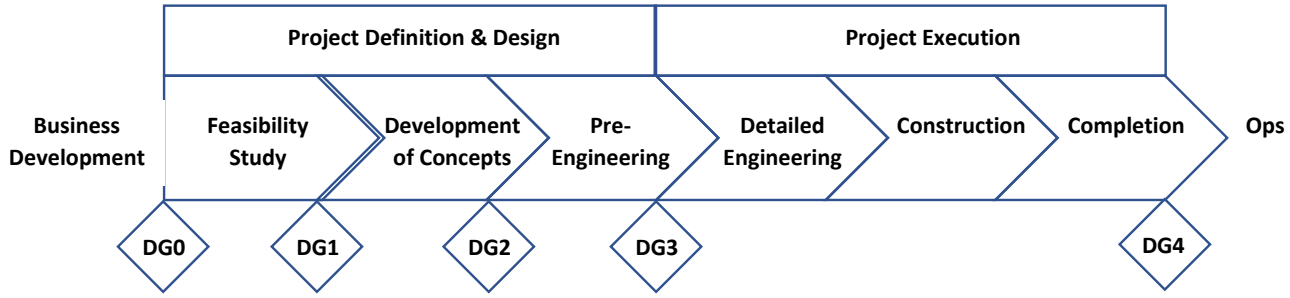
Traditionally, project management has been approached using a "waterfall" methodology whereby the entire project is planned out in detail from initiation to closing. Recently the use of "agile" project management techniques have been introduced and pioneered by the IT and software industries where only a small subset of the project is planned at a given time, and the project stakeholders are continuously engaged to plan subsequent subsets. The agile methodology for project management is useful in IT and software industries because the full requirements of each project are usually not very well understood at initiation. In megaprojects, such as the Rail Deck Park Project, agile methodologies are inadequate because the technical details are usually well-defined and the development timelines can encompass many years. The number of external influences affecting a megaproject is extensive which makes planning them using either a waterfall or agile methodology next to impossible. Due to the inherent complexity involved with megaprojects, their response to any given input is rarely a linear response. The relationship to a given input is better explained using chaos theory due to the numerous interactions between inputs, ultimately resulting in proliferated response to other components of the project. Due to the incompatibility of traditional project management frameworks with the challenges presented by megaprojects, researchers have been posed with the task of developing new project management and development frameworks that address the unique challenge presented by megaprojects.

In a paper published by the Project Management Institute in 2014, Frank Parth, CEO of Project Auditors, conducted a literature review of current research into the topic of planning and controlling megaprojects. Parth's research found that the most critical decisions in determining the success or failure of a given project are made by business decision-makers long before the design and construction phases begin. The importance of the initial decisions in a project development lifecycle has given life to an updated approach to project management and development called the front-end development (FED) or front-end loading (FEL) approach which begins long before the engineering design/EPC phases begin. The front-end development approach is founded on the integration of various phase/decision gates,

where a go/no-go decision on the project is made based on incremental increases in the maturity of the project definition and engineering. There are multiple variations of the front-end development approach, a few of which are presented below.

Figure 1

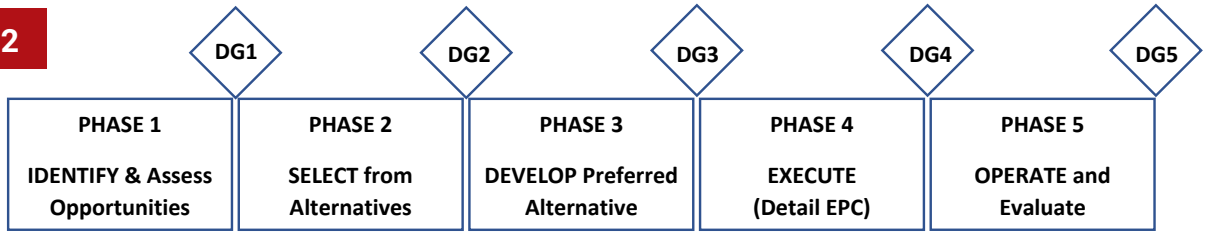
Klakegg, Williams, Walker, Andersen, and Magnussen (2010)



Front-end development process formulated by Klakegg et. al.

Jergeas (2008)

Figure 2



Front-end development process formulated by Jergeas.

Construction Industry Institute Best Practices

Figure 3

Project Development and Delivery Life Span Model

	Business Planning	Front End Loading			Implementation			Close-Out	Operations
PHASE	Front-End Planning	Concept		Development	Execution			Close-Out	
		FEL 1	FEL 2	FEL 3	FEL 4				
STAGE	Define Need / Identify Alternatives	Develop Alternatives	Select Single Solution	Develop Solution	Finalise Solution	Implement	Commission Transition Handover	Close Project	
ENGINEERING	Stakeholder Requirements (URS)	Concept Design	Basic Design	Detail Design	Contracting and Procurement	Manufacturing, Erection and Installation	Commission, Transition and Hand-Over	As-Built Packs	Asset Management
OUTPUT	Need Statement / Business Case	Establish Core Project Team	Select Preferred Alternatives	Definitive Scope	Finalise Solution Detail	Site Development, Solution, Execution and Delivery	Operational Readiness	As-Built Data Packs	Benefits Realisation
PURPOSE	Business opportunity and economic study / Option Study, Alternatives identified, Two or more alternatives selected for development	Conceptual Study, Qualification of need / opportunity and development of the concept	Pre-Feasibility Study, Development and evaluation of options. Selection of optimal scope	Feasibility Study, Perform detailed scoping and front-end engineering design (FEED)	Execution, OEM Contracting, Finalise FEED and project implementation organisation	Site Development, Engineering and Construction	Commissioning, transitioning and hand-over to operations	Close-out and hand-over of all as-built data packs. Finalise and close project accounting	Manage on-going operations to realise benefits and sustainable value delivery
ESTIMATE MATURITY	Class 5 0% to 2%	Class 4 1% to 15%	Class 3 10% to 40%	Class 2 30% to 75%	Class 1 65% to 100%				
ACCURACY RANGE	L -20% to -50% H +30% to +100%	L -15% to -30% H +20% to +50%	L -10% to -20% H +10% to +30%	L -5% to -15% H +5% to +20%	L -3% to -10% H +3% to +15%				
COST EXPENDITURE	0.5%	1% to 2%	3% to 5%	6% to 9%	10% to 14%	15% to 94%	95% to 98%	99% to 100%	
GATES		◆	◆	◆	◆		◆	◆	

Best practices for front-end development formulated by the Construction Industry Institute.

Front-End Development Consulting Fees

Using the aforementioned analysis of the proposed megaproject development and cost estimation timelines, it is evident that the current *Rail Deck Park Engineering and Costing Study* doesn't follow a front-end development approach to project development. Given the complexity of the Rail Deck Park Project, reliance on numerous project stakeholders, and the various high impact/high probability risks highlighted in the *Rail Deck Park Engineering and Costing Study*, the omission of critical project phases and decision gates could lead to a catastrophic capital cost overrun.

The current cost estimate is based on an analysis of the reference design concept, which is advanced to between 1% and 5% design development. Based on AACE's cost estimate classification system, 1-5% design development is at the low-end of a Class 4 cost estimate. The design includes multiple variables regarding the structural design (foundation options, girder options), construction methodology (top-down vs. bottom-up), and phasing. Using the Construction Industry Institute's (CII) best practices for front end planning as a baseline, the identification of multiple design alternatives implies that the estimate more accurately resembles a Class 5 estimate. According to the CII best practices, a Class 4 cost estimate should involve the establishment of the core project team with each of the design alternatives developed to a point where decisions regarding each alternative can be made.

An analysis of the *Rail Deck Park Engineering and Costing Study* shows that the project doesn't include front-end loading phases, and excludes any costs that would be associated with these phases. The current cost estimate covers Phase 0 (early works) and each of the four construction phases (Phases 1-4). The early works include any preparatory work in and around the rail corridor and yard required to reroute utilities, relocate signals and electrical distribution, establish staging areas, and generally prepare the Rail Deck Park project site and surroundings for heavy civil and structural works. This work could be described as construction, therefore, the current study doesn't explicitly allocate costs for a Detailed Engineering phase either. Additionally, as specified in the previous section, the cost estimates include *Construction Management Fees* from Phase 0 through to Phase 4 which confirms that any front-end loading phases that would traditionally be executed on a project of this scale have been excluded from the *Rail Deck Park Engineering and Costing Study*.

The current cost estimates do include *Design Fees (Including Contingency)* however. It is assumed that the design fees currently included in the *Rail Deck Park Engineering and Costing Study* encompass the fees that would traditionally be associated with the Detailed Engineering phase. The front-end loading portion of the consulting fees will be estimated as a range based on the following two cases:

- The *Rail Deck Park Engineering and Costing Study* is accurate in assigning a Class 4 label to the current estimate and thus FEL 2 is missing and required; or
- The *Rail Deck Park Engineering and Costing Study* more accurately resembles a Class 5 estimate and thus FEL 1 and FEL 2 are missing and required.

The Construction Industry Institute has compiled benchmarked data for the estimated cost expenditure as a percentage of total project cost for each of the project development phases. According to the CII, front-end loading phase 1 (FEL 1), typically costs 2% of the total installed project cost, while front-end loading phase 2 (FEL 2), typically costs 3% of the total installed project cost.[7][8] Each of the costs associated with these two scenarios are calculated below.

Front-End Loading Phase 1 Complete

*FEL Consultant Fees=(FEL2 % of Total)*Total Installed Cost*

FEL Consultant Fees=0.03*$1,665,000,000.00

FEL Consultant Fees=$49,950,000.00

Front-End Loading Phase 1 Incomplete

*FEL Consultant Fees=(FEL1 % of Total+FEL2 % of Total)*Total Installed Cost*

FEL Consultant Fees=(0.02+0.03)*$1,665,000,000.00

FEL Consultant Fees=$83,250,000.00

Using the benchmarking methodology described above, the front-end loading portion of the consultant fees for the Rail Deck Park project was estimated at **$66,600,000.00 ± $16,650,000.00**.

Detailed Design and Execution Consulting Fees

The cost exclusions within the *Rail Deck Park Engineering and Costing Study* state that consultant fees have been excluded from the cost estimate other than Design Consultant Fees which are included. Without knowing what exactly is included within the scope of the existing Design Consultant Fees it is difficult to estimate what additional consultant fees may have been excluded. A feasible method for determining the extent of the excluded consultant fees is to compare benchmarked engineering and geotechnical consulting fees against the Design Consultant Fees already included in the cost estimate.

The Consulting Engineers of Ontario (CEO) publishes a fee guideline every year to be used as a resource and reference document for engineering firms and clients alike. Within their 2020 guidelines, CEO provides typical fee ranges as a percentage of construction cost for transportation & infrastructure projects. Similar to the project management fees, the typical consulting fee as a percentage of construction cost decays as the size of the project increases. For projects with a total cost of construction greater than $10,000,000.00, the typical fee ranges as a percentage of construction cost for transportation and infrastructure projects is **6.75% - 7.25%**. The formula for determining the excluded consulting fees is as follows:

Excluded Consulting Fees=Typical Consulting Fees-Design Consulting Fees

Typical Consulting Fees=Total Installed Cost(Consulting Fee % of Total)*

Upper Limit of Range

Typical Consulting Fees=$1,665,000,000.00*0.0725

Typical Consulting Fees=$120,712,500.00

Excluded Consulting Fees=$120,712,500.00-$95,000,000.00

Excluded Consulting Fees=$25,712,500.00

Lower Limit of Range

Typical Consulting Fees=$1,665,000,000.00*0.0675

Typical Consulting Fees=$112,387,500.00

Excluded Consulting Fees=$112,387,500.00-$95,000,000.00

Excluded Consulting Fees=$17,387,500.00

Using the benchmarking methodology described above, the excluded detailed design and execution portion of the consultant fees for the Rail Deck Park project was estimated at **$21,550,000.00 ± $4,162,500.00**.

Combining the two estimates for consulting fees results in an estimated cost of **$88,150,000.00 ± $20,812,500.00**.

Planning Approvals

The Planning Approvals process requires extensive coordination and communication between numerous stakeholders. The location and GFA of the Rail Deck Park project amplify this process and makes accurate cost estimates exceptionally difficult to project. In budget estimation exercises the Planning Appovals processes can account for 1-3% of the total project expenditure. Similar to project management and consulting fees, this percentage decays as the project size increases. Due to the lack of design information currently available, we used a 1% project cost factor with a 0.5% variance when determining an estimate for Planning Approvals.

Despite the lack of design information currently available, some figures such as park acreage have been defined. The following example is a standard City of Toronto Site Plan Control application cost based on the planned park acreage.

Community Planning Application(s) (City of Toronto)

Table 4

Name	Base ($)	Additional	Total
Site Plan Control	$22,224.60	$7.37 per m²	$665,743.52

Amendments incur base fee charge again. The above calculation assumes a project GFA of 21.7 acres.[11]

Table 4 provides an example of what more accurate cost estimates will look like as the project matures, and highlights cost oversights of the current 1.665 billion estimate.

Furthermore it is reasonable to assume the RDP project Planning & Approvals process will run both longer and at a higer cost than the average municipal project. This is not only due to the size of the project and its budget, but the extensive list of stakeholders and the impact on their respective services. The City of Toronto defines a list of *External Agencies, Boards and Commissions* a planning application may be circulated to. To better understand the extent of the RDP approval process our team has identified pertinent organizations as they relate to the project below. Each party is entitled but not limited to determining the project: length of estimated impact, impact mitigation strategies, scheduling, and compensation.

External Agencies, Boards and Commissions

Table 5

Organization	Impact
Bell Canada	Telecom, data infrastructure along rail corridor
Canadian National Railway	Rail assets and schedule impacts
Canadian Pacific Railway	Rail assets and schedule impacts
Enbridge Gas Distribution	Natural gas infrastructure
Metrolinx	Rail assets, co-ordination, schedule impacts
Hydro One Networks Inc.	Power, data and delivery infrastructures
Ministry of Transportation	Rail assets, roadway closures
Rogers	Telecom, data infrastructure along rail corridor
Telus	Telecom, data infrastructure along rail corridor
Toronto & Region Conservation Authority	Environmental Impact Assessment, recommendations
Toronto Hydro	Power, data and delivery infrastructures
Toronto Police Services Board	Anticipated coverage amendments
Toronto Public Library	Fort-York TPL Impact Assessment
Toronto Transit Commission	Scheduled services Impact Assessment

Table 6

Line Item	Cost Factor (%)	Variance (%)	Principal ($)	Total Range ($)
Planning Approvals	1	0.5	1.665B	$8.3M – $24.9M

Permits & Fees

Due to the limited design and project information, it is unreasonable to put forth an estimate on applicable permits and fees. Without detailed drawings and designs, it is impossible to estimate the required permits for any utility service or related project. Furthermore, determining the costs of city building permits and other relevant Municipal, Provincial and Federal fees is difficult since we do not have insight into the City of Toronto's process for approving and paying their own fees and permits. Despite not being able to quantify the cost, we have found some potential obstacles regarding permits and fees in a project of this size.

TRCA

The Toronto and Region Conservation Authority (TRCA) is tasked with safeguarding the health and well-being of watershed communities through protection and restoration of the natural environment. Their jurisdiction includes all of downtown Toronto, including the proposed build site for this project. Any construction project in an area managed by TRCA will require approval of permits from the TRCA. They will assess whether the proposed project will affect the control of flooding, erosion, dynamic beaches, pollution or the conservation of land. Due to the nature of the Rail Deck Park project, it is prudent to expect many TRCA processes and approvals will be required throughout the construction process. Several of these permits and costs are outlined below[12].

- $5775 – Municipal Development Projects Permit from Toronto and Region Conservation Authority (TRCA)
- $2100 - Minor Ancillary (per component, Ancillary structures, Resurfacing, Individual Site Landscaping (TRCA)
- $9950 - Standard topsoil stripping/temporary stormwater management - SWM Ponds and associated outfalls - Standard Road Crossings - Major Grading/ Earth Works (TRCA)
- $25,000 - $75,000 - Complex Fill Project (TRCA)
- $1000 - Major or Complex Permit Application with Letter of Undertaking in addition to all other permit fees. (TRCA)

- $1000 - Major or Complex Projects - Additional Technical Review in addition to all other permit fees. (TRCA)

Electrical

Without access to detailed electrical plans for the proposed project, it is impossible to provide an accurate estimate of electrical permit costs. However, the required electrical permits and inspections will be assessed by the Electrical Safety Authority (ESA). For a project of this size, there will likely be multiple inspections, permits, and plans required by the ESA. A general cost estimate for the electrical permits and inspections would be a minimum of $15,000 - $20,000[13]. This number can vary quite significantly depending on the number of lights, structures, and other electrical components in the proposed plan.

Metrolinx

Due to the location of the proposed project, collaboration and planning with Metrolinx will be required. Metrolinx controls the train corridor over which this project is proposed to be built. They will require multiple permits, inspections, and scheduling coordination to minimize the impact this construction will have on train schedules. Costs associated with the required permits and fees are not readily available, as it appears to vary on a case by case basis. It is also expected that any disruptions to their regular train schedule and loss of revenue will need to be reimbursed by the projects funding.[14]

Development Charges

Development charges are defined as fees imposed on land development and redevelopment projects that are used to help pay for the capital costs of infrastructure that is needed to service new development. Development charges are a key municipal funding tool. In 2018 the City of Toronto collected over $750 million in development charges. Approximately 26% of development charges are allocated towards funding the development of parks and community infrastructure.[15]

It would be illogical for the city to charge development charges on a publicly funded project such as the Rail Deck Park project since the primary purpose of development charges is to fund the development and expansion of facilities and infrastructure including recreational parks. Essentially, in charging themselves development charges, the city would simply be "moving money from the left hand to the right hand".

Development charges will be used as one of the many funding tools being considered to support the financing of the Rail Deck Park, and as such will have no direct impact on the capital cost of the Rail Deck Park project. The development of the Rail Deck Park project would, however, affect how development charges are levied against future developers in the downtown core. All municipalities in the Province of Ontario must follow the Development Charges Act which outlines rules municipalities must follow for setting a development charge rate. A major component of the Development Charges Act is the inclusion of deductions and adjustments which dictate the maximum calculated development charges rates that can be imposed.[16] In a report issued by the Deputy City Manager regarding the results of Rail Deck Park Feasibility Analysis, it was found that in order for the City to be able to effectively utilize development charges for the Rail Deck Park project, City Council has requested the Province of Ontario amend the Development Charges Act and to make necessary regulation to exempt the Rail Deck Park project from the following development charge adjustments and deductions:[17]

- The use of the service level cap;
- The statutory 10 percent reduction in the rate;
- Any Federal/Provincial contributions towards the cost of the project be deemed for the benefit of existing development, for the calculation of applicable Development Charge rates for the project.

Although the Rail Deck Park capital cost will not include development charges, the project will have an effect on the development charges levied by the city for future residential and non-residential developments. The exemptions listed above allow the City to manipulate their traditional method for determining Development Charges for the benefit of the project, but at the cost of future developers. For instance, developers may be charged a higher rate of development charges in the future to help pay for the park. Ultimately, these costs will be integrated into developers' fees and

will eventually be passed on to the end-user resulting in higher real-estate costs and renting fees which will further accentuate the cities current housing affordability problem.

Costs of Sales Taxes and Financing

Creating a project cost estimate is not complete without analysis of sales taxes (HST and HST Input Tax Credits) as well as the cost of financing. While the costs of sales taxes can potentially be recouped, the costs of financing grow with the size of the project. Indeed, for a project with little forecast direct economic benefit or yield on the investment, financing costs are directly borne by all taxpayers.

We have estimated carrying costs for debt across a range of interest rates from 2.5% (based on current borrowing rates, 2.8% in November 2019 for a 30-year bond) to 5%, to allow for a prudent analysis of potentially higher borrowing costs in future.

Taxes (including HST Payable and HST Input Tax Credits)

Construction activities for the Rail Deck Park are likely to attract HST payments. However, HST payments are also likely subject to Input Tax Credits from the government in whole or in part. The HST payment and Input Tax Credit regime for municipalities is complex and can be reviewed at: https://www.canada.ca/en/revenue-agency/services/forms-publications/publications/rc4049/gst-hst-information-municipalities.html#P182_11227. We believe that HST inputs will be largely recoverable by the City of Toronto, such that that cost of the taxes will be limited to their carrying cost while awaiting reimbursement.

In order to estimate the order of magnitude of HST taxes carrying costs, we have made the following assumptions:

- HST taxes are 100% recoverable
- Taxes are recovered after one year
- Phases 0 and 1 are financed equally over five years
- Annual construction costs are drawn down equally throughout the year

With the above assumptions, we calculate Phase 0 and 1 construction costs at $174 million per year for five years[a]. Thus, applicable HST amounts to $22.62 million, using the prevailing 13% rate for HST. Given we assume funds are drawn down equally throughout the year, we estimate carrying costs at between $2.18 and $4.35 million, the range driven by the interest rate assumption. This charge would be one-time in nature in Year One. The range of potential carrying costs is illustrated in Table 7.

Table 7

Borrowing Costs to Finance Taxes Payable at Various Interest Rates				
Interest Rate	2.5%	3.0%	4.0%	5.0%
Carrying Costs (in millions)	$2.18	$2.61	$3.48	$4.35

Cost of Financing

The Rail Deck Park Engineering and Costing study was prepared in late 2017 with estimated capital costs of $1.665 billion. As noted elsewhere in this report, there are a number of cost exclusions in this estimate, notably the costs to finance construction of the park. Finance charges are important and can be reliably estimated across a number of interest rate scenarios.

The City of Toronto created a policy document regarding the funding of capital works, which can be reviewed at: https://www.toronto.ca/wp-content/uploads/2019/07/9827-Capital-Works-Policy.pdf. The policy document allows the city some limited flexibility for financing capital projects. The document states that "Debt with a term of 30 years is usually issued for infrastructure such as rapid transit, municipal buildings, Waterfront revitalization and certain transportation assets such as bridges that have a useful life of 30 years or greater."

In addition, the City acknowledges "A debenture term to 30 years increases the affordability of the debt and reduces the impact on the operating fund since the annual principal repayment is amortized over a longer term. This process also

[a] Gross construction costs are taken from Figure 17: Cost Estimate Summary by Phase of the Rail Deck Park Engineering and Costing Study. See Appendix A.

allows the cost of the asset to match the benefits for future taxpayers who will be using the assets and by not unduly burdening current taxpayers with paying for the entire asset during the early years of its operation."

We have thus estimated finance charges based on recently issued City of Toronto 30-year bonds. This term will match the useful life of the asset and spread the costs out amongst taxpayers who will enjoy the assets over that useful life.

We have reviewed the construction finance costs of Rail Deck Park and make the following assumptions:

- Phases 0 through 4 occur over 10 years
- Capital costs are $1.665 billion, as presented in the costing study
- Funds are drawn down equally over the estimated duration of each phase
- The project funds are drawn from proceeds of 30-year City of Toronto bonds

According to the City of Toronto's website, the City issued a $350 million 30-year bond in November 2019 at an interest rate of 2.8% (CUSIP 891288DU3). Using the 2.8% rate as a starting point, a range of interest rates and financing charges over the first ten years of the project are presented below in Table 8. By Year 10, interest charges are likely to cost a minimum of $40 million per year, and will have amounted to a minimum $250 million in aggregate over the first 10 years. Over a 30-year period, interest charges would amount to between $1.05 billion (at 2.5% interest) and $2.1 billion (at 5% interest).

Sinking Fund

The City policy document states that issuing "debt requires an annual payment to be made to a sinking fund controlled by the Sinking Fund Committee so that these contributions, when invested at an actuarial interest rate[b], will provide for the repayment of the debt at maturity." Rail Deck Park debt would require an annual sinking fund payment of between $35.0 million and $48 million dollars of the day (depending on Sinking Fund investment returns) in order to retire the debt after 30 years.

We acknowledge that the City will be able to stagger its debt issue to the match the demand for funds and otherwise optimize its borrowing practices. Our analysis in this document is intended to present order of magnitude financing costs in a simplified manner. Even with an optimized program, the absolute size of the borrowing and estimated costs to finance Rail Deck Park are clear and incremental to the city budget.

Table 8

Potential Capital Deployment Schedule (All figures in millions of Canadian Dollars)

		Project Year									
Phase and Capital Estimates		1	2	3	4	5	6	7	8	9	10
Phase 0 & 1	$872	$174	$174	$174	$174	$174	-	-	-	-	-
Phase 2	$211	-	-	-	$70	$70	$70	-	-	-	-
Phase 3	$287	-	-	-	-	-	$96	$96	$96	-	-
Phase 4	$295	-	-	-	-	-	-	-	$98	$98	$98
Cumulative Amount Borrowed		**$174**	**$349**	**$523**	**$768**	**$1,013**	**$1,179**	**$1,274**	**$1,468**	**$1,567**	**$1,665**

Table 8 continued next page

[b] We assume a 1% to 3% return on Sinking Fund investments for our estimate of annual debt retirement payments.

Estimated Borrowing Cost Per Year (in millions of Canadian Dollars)										
	Project Year									
Interest Rate Assumption	1	2	3	4	5	6	7	8	9	10
2.5%	$4.4	$8.7	$13.1	$19.2	$25.3	$29.5	$31.9	$36.7	$39.2	$41.6
3.0%	$5.2	$10.5	$15.7	$23.0	$30.4	$35.4	$38.2	$44.1	$47.0	$50.0
4.0%	$7.0	$14.0	$20.9	$30.7	$40.5	$47.1	$51.0	$58.7	$62.7	$66.6
5.0%	$8.7	$17.4	$26.2	$38.4	$50.6	$58.9	$63.7	$73.4	$78.3	$83.3
Estimated Cumilative Borrowing Cost (in millions of Canadian Dollars)										
	Project Year									
Interest Rate Assumption	1	2	3	4	5	6	7	8	9	10
2.5%	$4.4	$13.1	$26.2	$45.4	$70.1	$100.1	$132.0	$168.7	$207.9	$249.5
3.0%	$5.2	$15.7	$31.4	$54.4	$84.8	$120.2	$158.4	$202.5	$249.5	$299.4
4.0%	$7.0	$20.9	$41.9	$72.6	$113.1	$160.2	$211.2	$269.9	$332.6	$399.2
5.0%	$8.7	$26.2	$52.3	$90.7	$141.4	$200.3	$264.0	$337.4	$415.8	$499.0

Summary

Costs of taxes and financing the Rail Deck Park Project are significant and would place additional financial demands on the City budget. Making some simplifying assumptions, we estimate the costs of up to $4.35 million to finance HST outlays for Year One before Input Tax Credits can be recouped. Estimates for financing the project range from $1.05 billion to $2.1 billion over a 30-year amortization of the project costs on a gross basis.

Total Cost of Exclusions

The estimated cost of each exclusion analyzed within this report is summarized below in Table 9. Each exclusion is associated with a "low" cost, a "high cost", and a "most likely cost" which highlights the degree of uncertainty and variability in each of the estimates.

Table 9

Exclusion	Low Cost	High Cost	Most Likely Cost
Project Management Fees	$30,303,000.00	$47,619,000.00	$38,961,000.00
Consultant Fees	$67,337,500.00	$108,962,500.00	$88,150,000.00
Planning Approvals	$8,325,000.00	$24,975,000.00	$16,650,000.00
Permits & Fees	N/A	N/A	N/A
Development Charges	N/A	N/A	N/A
Cost of Financing	$1,050,000,000.00	$2,100,000,000.00	$1,575,000,000.00
Taxes	$2,180,0000.00	$4,350,000.00	$3,265,000.00
Total Exclusions	**$1,158,145,500.00**	**$2,285,906,500.00**	**$1,722,026,000.00**

Soft Cost Contingency

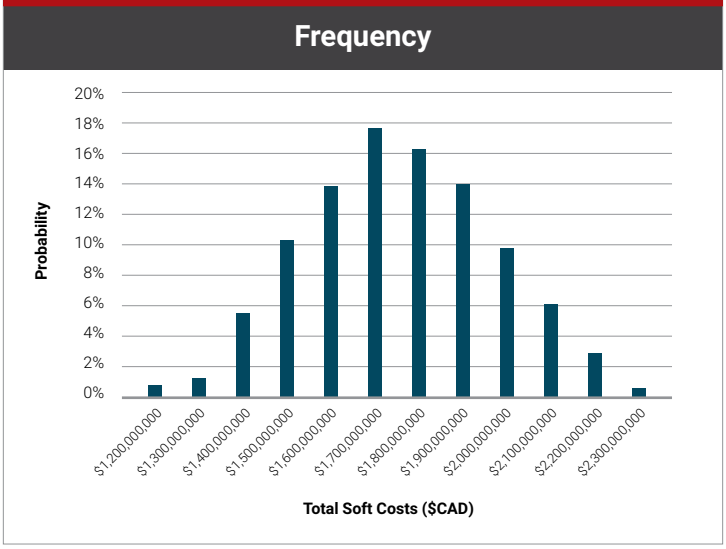
To estimate the soft cost contingency, a Monte Carlo analysis was conducted by assigning a confidence level to each of the items shown in Table 9 based on the maturity level of their definition (amount of engineering or associated work conducted). To conduct a Monte Carlo Analysis, several simulations (>1000) are executed where each line item randomly varies between a 'high' cost and a 'low' cost which are dictated by the confidence level of each respective line item. The Authority for the Advancement of Cost Engineering (AACE) has published a cost estimate classification matrix that can be used to predict the expected accuracy range of a given line item based on the amount of work conducted.

The cost estimate classification matrix illustrates the asymmetrical nature of cost estimates. Inherently estimators have a propensity to underestimate line item costs when their maturity level is low, therefore the high (H) accuracy range typically has a larger variance than the low (L) accuracy range.

Each line item was assigned an estimate class and corresponding accuracy range from the AACE classification matrix which is illustrated on page 9 in Table 2.

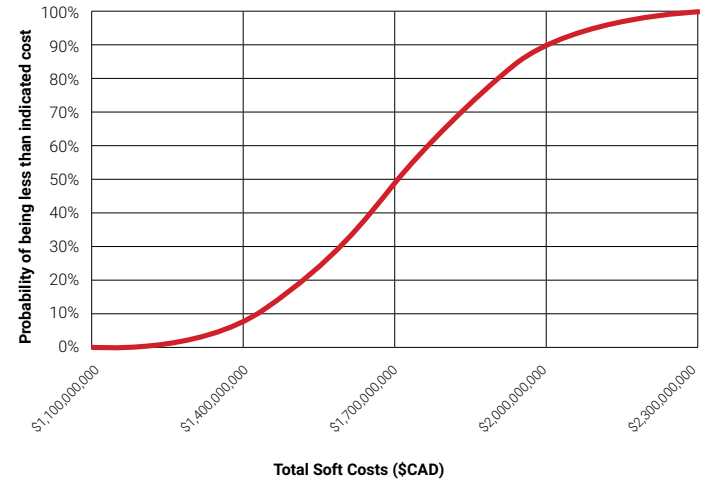
Over 1000 simulations, each line item was randomly varied between the low cost and the high cost, and a histogram showing the distribution of results was generated, as shown below in Figure 4.

Figure 4



The cumulative probabilities were used to develop an S-curve which illustrates the probability that the capital cost exclusions are less than the indicated cost. The S-curve is used to determine the soft cost contingency for a given confidence level.

Figure 5



For example, using the S-curve shown in Figure 5, there is a 95% probability that the total capital cost exclusions will be less than **$2,098,729,838.71**, therefore the required soft cost contingency at a 95% confidence level is the difference between this cost and the sum of the most likely costs shown in Table 9.

Soft Cost Contingency=Soft Cost @ 95% Confidence Interval-Most Likely Soft Cost

Soft Cost Contingency=$2,098,729,838.71-$1,722,026,000.00

Soft Cost Contingency=$376,703,838.71

The soft cost contingency is equivalent to 21.8% of the total (most likely) soft cost which is primarily due to the uncertainty regarding interest rates discussed in the Costs of Sales Taxes and Financing section. The value may seem high, however, it is corroborated by MMM Group, a subsidiary of WSP, who prepared a report for Infrastructure Ontario which states that preliminary design plans usually apply contingency allowances of 20% to major soft cost items when arriving at a capital cost for a given infrastructure project.[18]

Combining the cost exclusions analyzed within this report (along with their respective contingencies) with the original project cost uncovers a completely different picture of the Rail Deck Park Project. As displayed in Table 9, the soft cost exclusions have the potential to exceed the entire project budget. Combining the soft cost exclusions with the original estimate yields an updated estimate of **$3.763-billion** at a 95% confidence level. It should be noted that this updated cost estimate doesn't include the exclusions exempt from this analysis.

Additional Factors

There are multiple exclusions listed in the Rail Deck Park Engineering and Costing Study that have not been investigated in this analysis due to a lack of available information. Additionally, there are additional factors, both internal and external, that will have an impact on the project cost and execution that should be taken into consideration and addressed before the project proceeds. These factors include but are not limited to the impact of identified (and unidentified) risks, the propensity of megaprojects to experience capital cost overruns, other infrastructure developments in the downtown core, and the effect of the Covid-19 pandemic on government budgets.

Evaluation of Project Risks Matrix

The *Rail Deck Park Engineering and Costing Study* includes a project risks matrix highlighting the type of risks involved with the delivery of the Rail Deck Park project along with their respective probabilities, consequences, and manageability. In total, there are 20 risks identified in the project risk matrix, each of which poses a combination of financial, schedule, technical, operational, or public risks. An analysis of the project risks matrix shows that the majority of the project risks belong to multiple risk categories (financial, schedule, etc.), resulting in 48 domain-specific risks from the original 20 risks identified. This is highlighted in Table 10, shown below.

Table 10

Risk Type	
Financial	11
Schedule	13
Technical	13
Operational	7
Public	4
Total	**48**

The majority of risks are assigned either a high or medium probability and consequence, and will not be managed easily by the project team. This is unsurprising given that the project is located in a high density, high traffic urban area situated above one of the busiest rail corridors in North America. Many of the risks identified in the risk matrix pertain to the high degree of coordination required with Metrolinx to provide access, promote safety, and limit disruptions within the rail corridor. The distribution of risks based on their probability, consequence, and manageability is summarized in Table 11, shown below.

Table 11

	Probability	Consequence	Manageability
High/Difficult	12	11	9
Medium	5	9	10
Low/Easy	3	0	1
Total Risks	**20**	**20**	**20**

The estimated project cost should be composed of three primary components: base cost, uncertainty (contingency), and risk reserves. The base cost represents the cost of executing the project plan assuming that the project materializes as planned; uncertainty (contingency) costs are estimated by assigning a confidence level to the cost estimate and determining the potential variability at a given confidence level (AACE Cost Classification); and risk reserves are determined by referencing the risk register, where the probability of occurrence and consequence of each potential risk event is indexed.[19] Risk-based cost estimation methods are complex analyses that use the inferred and probabilistic relationships between cost, schedule, and events related to the project. Without more detailed information about the project schedule, and how the cost estimate was compiled, it

is impossible to know whether the current estimate includes risk reserves, and if not, to assign a risk reserve for the Rail Deck Park project. Despite the inability to put a quantitative value to the project risks, they are relevant to this analysis and should be taken into consideration when determining whether the project should proceed.

Capital Cost Overruns in Infrastructure Megaprojects

Estimating project costs on any given project can be a challenging endeavor. The difficulty to accurately predict project costs is accentuated when dealing with megaprojects – those that cost $1 billion or more – due to overoptimism and overcomplexity. Bent Flyvbjerg, an expert in project management at Oxford's business school, estimated that rail projects with a projected CAPEX of over $1 billion go over budget by an average of 44.7 percent.[20] The likelihood of CAPEX overruns in other megaproject domains is similar, with bridges and tunnels incurring an average 35% cost overrun, and roads incurring an average cost overrun of 20%.[21] Flyvbjerg's study concluded that on average, nine out of ten megaprojects experience capital cost overruns.

Cost escalations and schedule creep can occur during any phase of a project and are primarily attributed to technical challenges, over-optimism, and strategic misrepresentations. In a report published by The Institute on Municipal Finance and Governance (IMFG), in conjunction with the Munk School of Global Affairs at the University of Toronto, Matti Siemiatycki investigates why cost overruns persist in megaprojects. Siemiatycki found that explanations for cost overruns can be grouped into the three categories highlighted above, which can further be broken down as follows[22]:

- Technical Challenges
  - Scope changes and change orders
  - Handover problems
  - Incomplete studies prior to project approval
  - Inflation in labour and material costs
  - Inaccurate forecasting
  - Project delays
  - Unforeseen events
  - Poor project reporting and performance monitoring
- Optimism Biases
  - Planning fallacies
  - The tendency of organizations to accentuate the positive aspects of projects due to internal competition amongst potential options
  - The innate human condition of being over-optimistic about the outcome of future events
- Strategic Misrepresentations
  - Asymmetric gains financially or in terms of prestige for politicians, bureaucrats, consultants, lawyers, and contractors when a successful project is delivered versus the losses when budget expectations are not met
  - 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
  - A systemic pattern of wilful misinformation on the part of project proponents seeking to maximize their individual benefits from an investment initiative.

The project management community continually struggles to find methods for improving the performance of megaprojects, however, despite all the negative performance, there are an increasing number of them being proposed with increasingly more complexity, and increasingly ambitious project budgets and timelines. Inserting a line item for cost overruns within the cost estimate would be unnatural, however it should be considered when deciding whether to approve the Rail Deck Park project. Merrow, one of the world's leading megaproject analysts, sums up the historical results of megaprojects succinctly by stating that many megaprojects *"end up being disappointing to their sponsors; a few number turn out to be destroyers of shareholder wealth; and a few are horrendous with respect to anything and everything involved – the investing companies, the local population, and the environment."*[23]

Other Infrastructure Projects in Downtown Toronto

On February 19th, 2020, Toronto City Council approved an updated 10-year capital plan which budgets $43.5-billion for the City's "most critical needs" for transportation, the environment, real estate, and emergency service facilities. The updated 2020 10-year capital plan allocates $2.23-billion for Parks, Forestry & Recreation. An analysis of the Parks, Forestry and Recreation 10-year Capital Plan shows that of the $2.23-billion budget, there are currently no current and future year cash flows committed to the development of the Rail Deck Park project.[24] The capital budget invests a total of $13.2-billion in transit and another $2.2-billion in the Gardiner rehabilitation plan which together account for 35% of the city's total 10-year capital plan.[25] The omission of any capital allocated towards the Rail Deck Park project signals that the parks biggest proponents, Mayor John Tory, and Joe Cressy, city councilor representing the Trinity – Spadina ward, may be losing support amongst their peers for advancing the development of the project.[26]

Another project under consideration in Toronto's downtown core is the Union Park development proposal put forth by Oxford Properties, the real estate investment arm of OMERS, one of Canada's largest pension funds. The Union Park proposal includes 4.3 million-square-foot of mixed-use space and similarly to the Rail Deck Park project, involves building a decking structure overtop of the Union Station Rail Corridor to support a two-acre urban park. The project would contain four towers with heights of 44, 48, 54, and 58 storeys respectively. The development is projected to cost $3.5-billion.

At the current juncture, Union Park appears to have more momentum than Rail Deck Park, and Oxford's concept will likely break ground before Rail Deck Park. If both projects were to proceed concurrently, it would cause an unprecedented disruption to Toronto's downtown core, and in particular to the Union Station Rail Corridor and the Go Train network.

Covid-19 Effect

This analysis of the exclusions from the Rail Deck Park cost estimate cannot be completed without mentioning COVID-19. The pandemic has put an unprecedented amount of stress on government budgets resulting in growing deficits at the Federal, Provincial, and Municipal levels. Although the development of new projects can be a catalyst in sparking economic growth, the federal government may wish to embark on small projects that can be approved quickly and create immediate jobs. This sentiment is echoed by Canada's Federal Infrastructure Minister, Catherine McKenna, who in a recent interview with the Globe and Mail stated the importance of initiating *"shovel ready"* projects such as recreation-center repairs.[27] Initiating a single megaproject that is funded by the City of Toronto, and thus provides limited development charges for other infrastructure initiatives would be counter-intuitive at this current juncture.

Appendices

Appendix A – Original Cost Estimate Summary

Figure 6: Cost Estimate Summary by Phase

	PHASE 0 & 1	PHASE 2	PHASE 3	PHASE 4	TOTAL
area (SM)	37,972	10,600	17,199	15,738	81,509
Early Works Packages	**155,000,000**	**7,000,000**	**9,000,000**	**9,000,000**	**180,000,000**
Deck Construction	255,000,000	73,000,000	99,000,000	103,000,000	530,000,000
Park Construction (On Top of Deck)	39,000,000	13,000,000	16,000,000	14,000,000	82,000,000
sub-total	**294,000,000**	**86,000,000**	**115,000,000**	**117,000,000**	**612,000,000**
General Requirements	42,000,000	12,000,000	16,000,000	17,000,000	87,000,000
Construction Management Fee	29,000,000	8,000,000	11,000,000	12,000,000	60,000,000
Work Restrictions	146,000,000	42,000,000	57,000,000	59,000,000	304,000,000
sub-total	**511,000,000**	**148,000,000**	**199,000,000**	**205,000,000**	**1,063,000,000**
Design and Pricing Contingency Construction (C/O) Contingency Other Allowances	156,000,000	44,000,000	63,000,000	64,000,000	327,000,000
HST - Excluded	0	0	0	0	0
Total Construction Cost (Excluding EW)	**667,000,000**	**192,000,000**	**262,000,000**	**269,000,000**	**1,390,000,000**
Total Construction Cost (Including EW)	**822,000,000**	**199,000,000**	**271,000,000**	**278,000,000**	**1,570,000,000**
Total Design Fees (Including Contingency)	**50,000,000**	**12,000,000**	**16,000,000**	**17,000,000**	**95,000,000**
Total Construction Costs + Design Fees	**872,000,000**	**211,000,000**	**287,000,000**	**295,000,000**	**1,665,000,000**
Cumulative Total (Excluding Escalation)	**872,000,000**	**1,083,000,000**	**1,370,000,000**	**1,665,000,000**	

Appendix B – Project Management Data

Project Management Data - Publicly Available Project Management Fee Data

Table 12

Northwestern University		
Minimum	Maximum	Management Fee
$ -	$500,000.00	5.00%
$500,001.00	$1,000,000.00	4.50%
$1,000,001.00	$5,000,000.00	4.00%
$5,000,001.00	$10,000,000.00	3.50%
$10,000,001.00	$25,000,000.00	3.00%
$25,000,001.00	$50,000,000.00	2.50%
$50,000,001.00	$75,000,000.00	2.00%
$75,000,001.00	$100,000,000.00	1.75%
$100,000,001.00	$150,000,000.00	1.50%
$150,000,001.00	$200,000,000.00	1.25%
Over $200,000,000.00		**1.00%**

Table 13

Illinois University		
Minimum	Maximum	Management Fee
$ -	$999,999.00	3.5%
$1,000,000.00	$10,000,000.00	3.5% on first 1M, 0.6% on balance
$10,000,001.00	$30,000,000.00	3.5% on first 1M, 0.6% up to 10M, 0.55% on balance
Over $30,000,000.00		**3.5% on first 1M, 0.6% up to 10M, 0.55% up to 30M, 0.45% on balance**

Table 14

Oregon State		
Minimum	Maximum	Management Fee
$ -	$99,999.00	7.5%
$100,000.00	$59,999,999.00	((1.49% x Project Cost)+6010)/Project Cost
Over $60,000,000.00		**1.5%**

Table 15

Washington University in St. Louis		
Minimum	Maximum	Management Fee
$ -	$100,000.00	8.00%
$100,001.00	$300,000.00	6.25%
$300,001.00	$2,000,000.00	5.00%
$2,000,001.00	$5,000,000.00	4.00%
$5,000,001.00	$8,000,000.00	3.50%
$8,000,001.00	$10,000,000.00	2.90%
$10,000,001.00	$15,000,000.00	2.75%
$75,000,001.00	$100,000,000.00	1.75%
$100,000,001.00	$150,000,000.00	1.50%
$150,000,001.00	$200,000,000.00	1.25%
Over $15,000,000.00		**2.50%**

Table 16

Project Size	Northwestern	Illinois	Oregon State	Washington Uni St. Louis	Average	Byrnes	
	Percentage	Percentage	Percentage	Percentage	Percentage	W/Controls (%)	W/O Controls (%)
$62,500.00	5.00%	3.500%	7.50%	8.00%	6.00%	9.11%	14.31%
$125,000.00	5.00%	3.500%	6.30%	6.25%	5.26%	8.16%	12.82%
$250,000.00	5.00%	3.500%	3.89%	6.25%	4.66%	7.31%	11.49%
$500,000.00	5.00%	3.500%	2.69%	5.00%	4.05%	6.56%	10.30%
$1,000,000.00	4.50%	3.500%	2.09%	5.00%	3.77%	5.88%	9.23%
$2,000,000.00	4.00%	2.050%	1.79%	5.00%	3.21%	5.27%	8.28%
$4,000,000.00	4.00%	1.325%	1.64%	4.00%	2.74%	4.72%	7.42%
$8,000,000.00	3.50%	0.963%	1.57%	3.50%	2.38%	4.23%	6.65%
$16,000,000.00	3.00%	0.763%	1.53%	2.50%	1.95%	3.79%	5.96%
$32,000,000.00	2.50%	0.650%	1.51%	2.50%	1.79%	3.40%	5.34%
$64,000,000.00	2.00%	0.550%	1.50%	2.50%	1.64%	3.05%	4.79%
$128,000,000.00	1.50%	0.500%	1.50%	2.50%	1.50%	2.73%	4.29%
$256,000,000.00	1.00%	0.475%	1.50%	2.50%	1.37%	2.45%	3.84%
$512,000,000.00	1.00%	0.463%	1.50%	2.50%	1.37%	2.19%	3.45%
$1,024,000,000.00	1.00%	0.456%	1.50%	2.50%	1.36%	1.97%	3.09%
$1,665,000,000.00	1.00%	0.454%	1.50%	2.50%	1.36%	1.82%	2.86%
$2,048,000,000.00	1.00%	0.453%	1.50%	2.50%	1.36%	1.76%	2.77%

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