



cutting through complexity

City of Toronto

Toronto Transit Commission (TTC)

Capital Program Delivery Review

Final Report

September 2016

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KPMG's role was to outline certain matters that came to our attention during our work and to offer our comments and recommendations for the City's and TTC's consideration. These comments, by their nature, may be critical as they relate mainly to opportunities for change or enhancement and will not address the many strong features of the TTC's current activities and undertakings.

Our procedures will consist solely of inquiry, observation, comparison and analysis of TTC-provided information. We relied on the completeness and accuracy of the information provided. Such work does not constitute an audit. Accordingly, we will express no opinion on financial results, internal control or other information.

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1 Executive Summary

In March 2015, City of Toronto Council directed the City Manager to conduct a review of the project management of TTC major capital projects.

The purpose of this assessment is to:

“review project management practices at the TTC with respect to the delivery of the Capital Program, and provide recommendations to staff that will assist the organization to improve capabilities for managing capital projects and programs. The TTC Capital Program Review seeks to achieve the following goals:

- Improve the organization’s project and program management performance by learning from past experience;
- Support continuous improvement efforts underway at the TTC, including the continued implementation of the TTC Portfolio Management Office (“PfMO”) established in 2014;
- Assess project governance structure and protocols for reporting of project status, to ensure the appropriate level of transparency and accountability to project sponsors and stakeholders; and
- Provide guidance on project delivery options and project management requirements for projects of varying size, scope, and complexity.”

This Review was a joint effort between the City and the TTC. This report is not intended as a critical review of specific decisions made in the execution of any single project. By utilizing a continuous improvement approach, the parties facilitated interviewees providing open and honest perspective which helped pinpoint some of the issues within the scope of this Review.

KPMG’s Approach

Our approach to the review was broadly broken into two phases. The first phase involved a **Current State Assessment** of the maturity of capital project delivery process and governance, identifying best practice strategies that defined a target future state. This assessment was built upon a review of recent capital projects representing the breadth of the TTC’s capital program, a desktop review of TTC project management policies, processes and procedures and stakeholder interviews. In addition, KPMG benchmarked similar organizations to evaluate the maturity of the TTC’s practices.

The second phase involved a **Gap Analysis** study with the provision of a series actionable recommendations. The aim of the recommendations was to achieve both tactical improvements to the delivery of the Capital program where possible, and to close the gap between current practices, those contemplated through ongoing initiatives, and leading practices adopted by peers.

Over the course of the review, KPMG assessed 13 projects, over 100 policies and procedures, and interviewed 68 individuals from the TTC, City and other stakeholders including Infrastructure Ontario and Metrolinx. Interviews were conducted to validate the documented project management activities, gain a better understanding of day-to-day activities and gain an



understanding from management and staff as to what should be done better and how that could be accomplished.

The TTC's 2015-2024 *Capital Budget* is valued at approximately \$13.6 billion for the base budget, the Toronto-York Spadina Subway Extension ("TYSSE"), and the Scarborough Subway Extension ("SSE") programs. This budget includes 35 identified infrastructure-related programs and two subway extensions. There are approximately another 300 projects that form the identified infrastructure-related programs. KPMG developed a risk and complexity assessment tool, which was applied first to the 13 projects identified as part of this review (scaled Level 1 for low to Level 6 for high), and then applied broadly across the remainder of the capital program in order to gain a high-level understanding of the program's characteristics.

Based on the spectrum of projects reviewed, KPMG developed a framework for assessing the risk and complexity of the representative TTC projects. The framework was created by combining the existing TTC principles with industry leading practices in project complexity and risk assessment. Applying this six-level (1 low to 6 high) risk/complexity ranking to the TTC's overall capital program, the budget profile of the program for the 2015-2024 budget cycle is approximately 40% low risk/complexity (Levels 1&2), 30% medium risk/complexity (Levels 3&4), and 30% high risk/complexity (Levels 5&6). This weighting will change on an annual basis but indicates that there is a wide spectrum in the types of projects delivered by Information Technology Services ("ITS"), Operations ("Ops"), and Engineering, Construction & Expansion ("EC&E") as part of the TTC's capital program.

Current State Assessment

As the backbone of our current state assessment, we have leveraged a high-level review of recent and current projects and used our proprietary project management assessment tool as the foundation for the Project Management Maturity Assessment. This tool uses a globally standardized KPMG review framework. The methodology and tool align with the *Project Management Institute's* industry-recognized *Project Management Book of Knowledge*, layering on KPMG-observed leading practices in assessing eight high-level project control elements, which are disaggregated into 31 categories. Each category is scored on a one to four scale representing *Informal*, *Standardized*, *Monitored*, or *Optimized*, and benchmarked against other KPMG reviews of both public and private sector organizations, as defined in Figure 1 below.

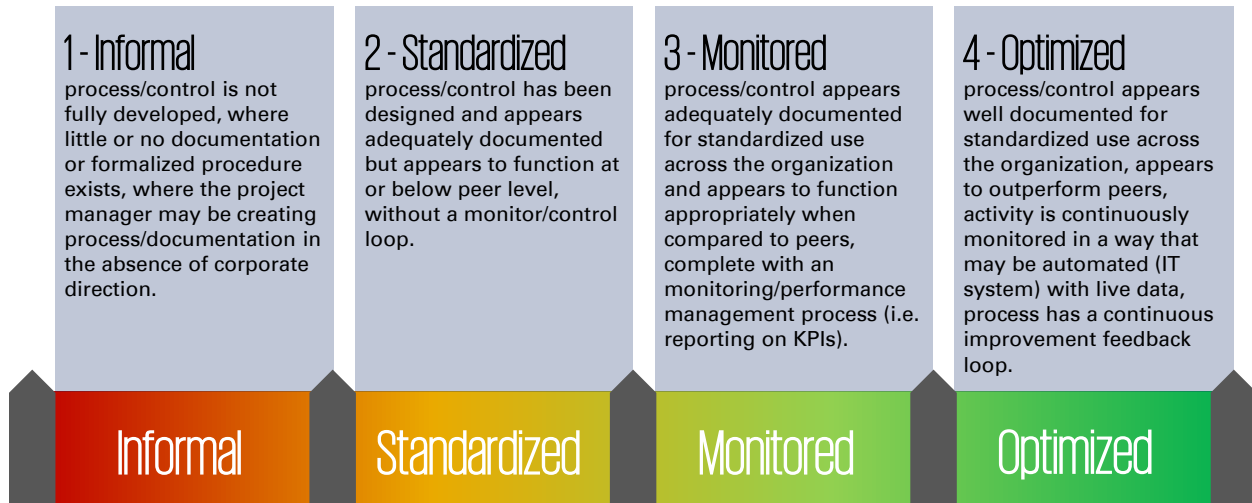


Figure 1 - Project Management Maturity Rating Scale and Definitions

This work has enabled us to evaluate current project management practices, identify gaps, and provide a set of actionable recommendations to staff to increase the success of the TTC capital program by improving portfolio, program, and project management capabilities.

In doing our work, KPMG first we applied our tool to each function (EC&E, ITS, and Ops). We did this not just at the overall function level but along five different categories, as follows:

- Program Strategy, Organization and Administration
- Cost & Financial Management
- Procurement Management
- Project Controls and Risk Management
- Schedule Management

The current state of the Project Management Maturity level for the TTC's capital program delivery as a whole was assessed to be at the mid-range of the *Standardized* level. The *Monitored* level would be a target maturity level of an organization whose goal is to be class-leading (as per the TTC's Corporate Plan), given the risk and complexity profile of the TTC's capital program. The relative ratings of the Operations, ITS, EC&E, TTC Overall, KPMG Benchmark and Target State can all be seen in Figure 2.

During the interviews, KPMG found that throughout the TTC there are dedicated, experienced and qualified individuals who are committed to achieving more successful outcomes of the delivery of capital projects and are openly frustrated with the external perception of the organization. It is clear that there has been a significant change of tone within the organization driven by the current management group that has made capital program delivery staff feel more empowered to drive successful delivery of capital projects than they had previously. It is also evident that there is a lack of consistent and broadly applied project management infrastructure to support project managers in the organization. There are pockets of the organization that perform aspects of capital project management at or above the level of peers, however, there

are others where project managers are forced to rely on their own experience and tools in the absence of corporate standard direction.

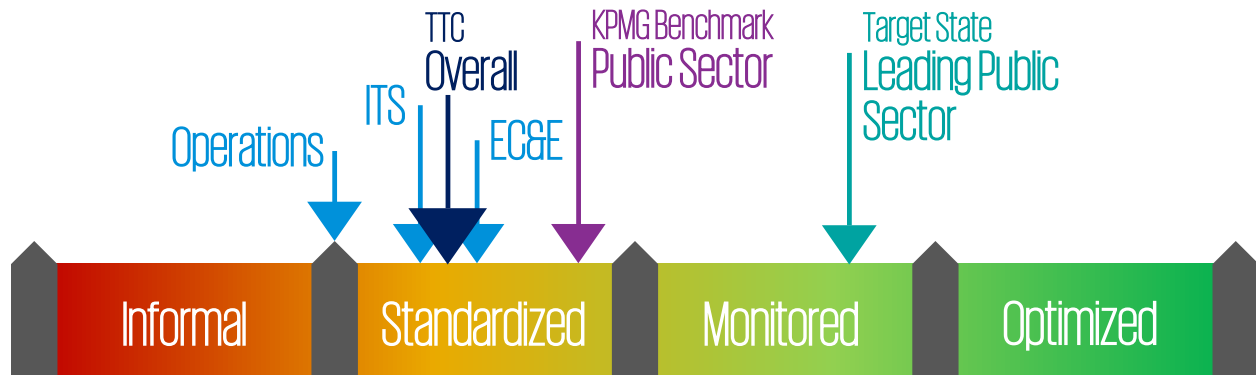


Figure 2 - TTC Summary Project Management Maturity Rating

A common misconception is that projects of lower complexity require a lower maturity (i.e. informal) while those of higher complexity require a higher maturity (i.e. optimized). Instead, leading practice dictates that the organizational project management maturity should be consistent for every project within a capital program, regardless of their complexity. What does change relative to complexity is the level of effort and depth of scrutiny.

Gap Analysis

The TTC is a complex organization with limited resources and a very demanding and diverse capital program to deliver. Our maturity assessment has shown that there are pockets where leading practice is being followed, but also a recognition of shortcomings and a desire across the TTC to improve capital project outcomes. A key challenge in solving these problems and raising performance levels is that change is not within the control of any one individual, department or group.

Although significant progress has been made since the creation of the PfMO at the corporate level within the TTC, there is a general absence of corporate project management support in the form of documented processes, procedures, training, coordination, and performance management. This has a significant impact upon all areas of project control and governance, and represents the primary opportunity for improvement. Within the EC&E and IT groups, the lack of corporate support is compensated for by their respective project management support teams, EC&E Capital Programming and the IT PMO respectively. With little corporate project management support and no formalized group-level project management effort, the Operations group is entirely dependent on its project managers to use their own experience or their knowledge of other groups' experience to delivery their share of the capital program. Although the majority of large construction projects planned by Operations are already handed over to the EC&E group, there are still a large portfolio of operations and maintenance (O&M) capital projects, fleet procurements and some City-delivered projects with no formal project management directions.

During the interviews, KPMG found that throughout the TTC there are dedicated, experienced and qualified individuals who are committed to achieving more successful outcomes of the delivery of capital projects and are openly frustrated with the external perception of the organization. It is clear that there has been a significant change of tone within the organization driven by the current management group that has made capital program delivery staff feel more empowered to drive successful delivery of capital projects than they had previously. It is also evident that there is a lack of consistent and broadly applied project management infrastructure to support project managers in the organization. There are pockets of the organization that perform aspects of capital project management at or above the level of peers, however, there are others where project managers are forced to rely on their own experience and tools in the absence of corporate standard direction.

KPMG has found that although there are multiple opportunities for improvement in the delivery phase of projects (when scrutiny from external stakeholders is often highest), there are equally significant opportunities for improvement at the earliest stages of a project's lifecycle that could greatly improve the probability of success of delivering predictable outcomes. In any project, there are key decisions or communications made during project development that have a lasting impact on project delivery. Current gaps warranting attention exist in governance, processes, controls, and a monitoring feedback loop.

It is unrealistic for most public sector organizations to target an 'optimized' maturity rating, due to the low return on investment of improvements. As a minimum, all organizations with an ongoing capital program should target a **standardized** maturity rating. Any organization should support its project managers with standardized policy, process, procedure, tools and templates to manage their projects and achieve consistent project success. Given, however, the TTC's goal of becoming a class-leading organization as articulated in its Five-Year Plan, the TTC should target functioning at a **monitored** level, with some key processes **optimized** as needed to meet corporate objectives (i.e. risk or contingency management).

Ultimately, the target level of maturity requires a cost-benefit analysis and accompanying management decision to determine the appropriate course for the TTC. It should be noted however, that in KPMG's experience, the benefits of improved project management efficiency and reduced cost overruns far outstrip the investments required in people and technology to improve project management maturity.

Recommendations

Our recommendations stem from lessons learned in the project reviews, the Project Management Maturity Assessment and our experience in capital project leadership. The recommendations that follow therefore, are steps KPMG believes can be taken to elevate the organization's project management maturity to a **monitored** target state. The recommendations also examine some of the broader governance, accountability, planning and data issues that touch on the TTC as well as the City, recognizing that as projects increase in scope and complexity, the City plays a larger and larger role.

The following report includes a total of 41 recommendations for the City and TTC to consider, supported by the following appendices:

- a detailed Project Management Maturity Assessment (Appendix A)
- a Project Risk and Complexity Assessment tool (Appendix B); and
- a Procurement Options Analysis Framework for Major Capital Projects (Appendix C).

The recommendations for improvement have been grouped together into six key themes that largely relate to how and to whom the recommendations can be actioned. The broad themes are as follows:

Governance

Strong governance aligns leadership, mandate, and strategic objectives with corporate goals. Every decision-maker throughout the TTC should understand their role, responsibilities, who's relying on them, and the objectives that should be driving their decisions.

Summary

- **Value driven performance** – Use the organization's corporate vision, mission and strategic objectives as more than just project justification. Make strategic objectives drive decision making throughout both the project lifecycle and within the organization and incorporate it as a core component of portfolio, program, and project performance management. Measure success not just on cost and schedule, but what value is being created by achieving these objectives.
- **Clarity and empowerment** – Ensure that mandates, roles, and responsibilities related to the capital program are clearly documented and understood throughout the organization. This applies to job profiles, project teams, functional groups, oversight boards, committees, TTC management, the TTC Board and the various levels of the City that are involved in a project. Empowerment drives accountability and transparency.
- **Provide tools for success** – Give the governance that exists the ability to succeed in its role by introducing capital projects guidelines for Board members, a corporate project management framework that details the entire project lifecycle, and a Stage Gate approval process that can ensure that all stakeholders' issues are aligned at key decision points.

Recommendations

- 1** Expand the PfMO mandate to include development of the capital program delivery's vision, mission, and strategic objectives, and these should be clearly communicated and enforced throughout the organization.
- 2** Utilize the capital program delivery vision, mission and strategic objectives to guide project decision-making throughout the project lifecycle.
- 3** Develop and document applicable mandates and policies supporting the various entities with capital project oversight responsibilities.

- 4 Empower the existing governance structure with clear mandates, responsibilities, and accountabilities, and ensure these are effectively communicated throughout the organization.
- 5 Provide tools to adequately support each governance entity in the execution of their mandate (from the Board level down to the project team).
- 6 Develop a corporate project management framework that references applicable project management processes, procedures, and tools for use by the project team and other parties throughout the project lifecycle.
- 7 Alter the authority of project leadership to have ultimate accountability for the project, and its team, throughout the project lifecycle. At the same time, ensure that the project team members feel responsible for and are held accountable for project success.
- 8 Develop a new performance management framework for the capital program that measures success relative to the organization's strategic objectives. The framework should assess the real value to project customers and stakeholders gained throughout the project lifecycle.
- 9 Considering the ultimate mandate of the PfMO, develop a growth plan to estimate the investment required to meet the PfMO's stated goals. The plan should include funding source(s) for the work to be undertaken, and in assessing alternatives, strong consideration should be given to a direct charge to the projects.
- 10 Develop a corporate stage gate process to govern gated approval steps to cover the entire project lifecycle. The stage gate process should be aligned with project governance that is appropriate for a project's complexity.

People & Relationships

Success is dependent on the ability to engage and manage people's competencies, as well as internal and external stakeholder relationships.

Summary

- **Structure for success** – Make matrixed project teams 'strong' matrixed teams, giving authority to the projects and enabling a project team mentality to take hold. Enable these teams to be successful by giving central support with a stronger and broader PfMO. The success of a capital program depends on the success of each project.
- **Manage the interfaces** Breakdown internal silos, continue to develop staff-level partnerships with the City, engage with industry and share best practices whenever possible. Complex projects involve multiple internal and external stakeholders that need to be managed.

- **Strengthen engagement** Build on the positive attitude towards the new management direction by clarifying competencies, providing opportunities for training and supporting organizational transformation with sound change management.

Recommendations

- 11** Create clear definitions of individual roles and responsibilities in terms of project roles, as well as functional job descriptions, which are aligned with the corporate project management framework.
- 12** Develop a corporate reporting standard for stakeholder management that addresses both internal and external stakeholders and reporting to them.
- 13** Given the extent to which the PfMO's strategic changes will impact the organization, make supporting the PfMO in its efforts a priority for the new change management function.
- 14** When the TTC management determines the long-term location for the PfMO, it should consider the PfMO's future relationship with the existing ITS PMO and the EC&E Capital Programming team (e.g., merging with one or both).
- 15** Establish minimum project management competencies in the near-term, and develop training requirements to support sponsors, program.

Processes & Procedures

Detailed processes and procedures creates a project management infrastructure that allows project managers and their teams to focus their attention on proactively managing the project.

Summary

- **Build upon strengths** – Use the knowledge, policies, processes and procedures from the high functioning pockets of the organization to create corporate standards that can be adopted in a scalable fashion organization-wide. Leverage certain department level strengths in estimating, scheduling, risk management, master project plans, contract management, and change management.
- **Customize where necessary** – Develop functional group, specific policies, processes and procedures using corporate standards, where before there were none and strengthen those that are inadequate.
- **Develop new competencies** – Develop formal policies, processes and procedures around areas that are currently lacking, such as capital planning, earned value management, commercial management, and stakeholder management.

- **One size does not fit all** – Adapt corporate minimum and functional group standards to be scalable across projects of varying scale and complexity that are applicable to various delivery options.

Recommendations

- 16** Set a capital program management maturity rating target of 'monitored', with optimization reserved for select areas of significant corporate risk.
- 17** Develop corporate standards that leverage the existing efforts of the PfMO, and ITS and EC&E groups.
- 18** Develop corporate standards to fill gaps where it is not possible to leverage the existing efforts of the PfMO, and ITS and EC&E groups.

Risk Management

- 19** Develop the Risk Management function into a broader practice that covers the entire capital program. Incorporate capital program risks into the Enterprise Risk Management system. Increase resources to support first the implementation of the current risk management plan within EC&E, and then more broadly.

Budgeting & Estimating

- 20** Develop a corporate standard for capital project estimating, based on the EC&E process, and suitable for the range of project complexities and delivery models.
- 21** Set budgets based on assumed scope and a risk-adjusted estimate that includes appropriate allowances to deal with unknowns the project teams manage and those driven by external influences that are appropriate for the stage of the project development.
- 22** Develop estimating guidelines that ensure all estimates are holistic, including both internally owned scope and scope affected or improved by other parties, regardless of funding responsibility, and including lifecycle costs when required.
- 23** Stage project approvals to follow key points in the maturing of a project estimate.
- 24** Create processes and procedures around the communication of project estimates as they mature.

Contingency Management

- 25** Develop risk-based contingency for all capital projects from the start, with discrete risks applying to different parts of the project lifecycle. Develop contingency management

policy, process and procedure to govern development, definition and management of a project's contingency.

- 26** Create a separate budget allocation for Management Reserve to capture project scope adjustments that are outside of the scope of the project team.

Procurement Management

- 27** Implement procedures that help ensure that the best delivery model is adopted and appropriately managed, and that will best accommodate the stakeholder, risk and operating environment of the project.
- 28** Consider making the procurement of both services and construction a direct responsibility of the project leadership.
- 29** Expand the strategic role of procurement in the capital program delivery process by highlighting the importance of broad stakeholder engagement.

Commercial Management

- 30** Create a commercial management function within the organization. The adaptation of the process across project classifications may range from dedicated roles on highly complex projects, to project manager or contract administrator competencies on routine projects.

Data & Analysis

Equipping a project team to make the right decisions requires access to a streamlined focused reporting process that accesses the right information at the right time.

Summary

- **Know what you need and when** – Gain an understanding of the information needs of the organization, where that data comes from, how timely it is, how it's collected and distributed and who it's used by and when.
- **Clear Assumptions** – Understand and clearly communicate the assumptions of any data-driven decision-making, particularly during project development. When estimating, be clear on uncertainties and scope from all stakeholders inside and outside of the TTC. When developing contingency, make it risk-based and manage it accordingly.
- **Originating Data** – Base reports on originating data wherever possible. Finding ways of having reports based on originating data, whether generated internally, by external

team members or contracting parties is key to accurate and timely reporting as it minimizes human intervention.

- **Report on what you need** – Measure performance with Key Performance Indicators (“KPIs”) tied to the strategic objectives. For the decisions that must be made today, project managers need forward-looking information, not past.

Recommendations

- 31** Identify all data sources that are critical to the TTC’s capital program decision making in the project management framework.
- 32** Develop a capital program data strategy that identifies capital program data requirements, and aims to collect the data at the source to minimize the needs for reprocessing of data. These requirements should be used to guide the development of an IT strategy to capitalize on the greater use of technology and tools.
- 33** Improve the forward looking information contained within the project reporting and add key performance indicators related to broader project objectives.
- 34** Consider streamlining organizational reporting by leveraging existing project level reporting tools.

Tools & Technology

Integrated tools and technology with appropriately standardized processes and procedures, allows project managers to focus on leading projects instead of acting as administrators.

Summary

- **Develop from within** – Develop tools from within, with active engagement of end users, because it is key to the successful take-up of organizational transformation. Ensure that the PfMO tool development process is transparent and consultative.
- **Start small** – Ensure that simple tools supplementing existing processes are in place before more extensive transformation. Creating smart spreadsheets for risk registers, leveraging existing online form-based reporting, or developing an integrated project management tool spreadsheet that consolidates reporting, risk registers and logs can both improve efficiency in the near-term and prime the organization for change in the long-term.
- **An ecosystem of solutions** – Ensure that medium to long term IT solutions can integrate with or supplant existing systems. Leverage add-on capabilities of existing IT systems like Oracle Primavera (scheduling), Sage (estimating) and SAP (finance & HR) for additional Project Management Information Systems (“PMIS”) capabilities.

Recommendations

- 35** Define and understand the functional requirements and complete a needs assessment and benefit analysis before implementing a technology or tool-based solution to aid in project management.
- 36** Consider implementing an Excel-based integrated project management tool prior to a PMIS solution. This would centralize project information at the project manager and partially automate reporting.
- 37** Complete a risk assessment of the current materials & procurement IT system and determine options for maintenance or replacement that align with corporate system implementations planned in the near future.
- 38** Leverage add-on capabilities of existing scheduling systems to automate and facilitate streamlining of the portfolio level schedule reporting.
- 39** Develop a corporate tool development process for transformative implementation initiatives within the capital program.

Implementation & Monitoring

Effective implementation of the previous five themes is vital. A strong central PfMO is required in order to implement, independently monitor the effectiveness, adoption and improvement of the project policies, processes and controls.

Summary

- **Strengthen the PfMO** – Centralize design, implementation and training of new policies, processes, and procedures supporting revised governance to allow the management of expectations and allaying of uncertainties throughout the organization. The development of this relationship can evolve into monitoring and continuous improvement.

Recommendations

- 40** Develop a PfMO-level policy that defines the process for continuously improving corporate standards.
- 41** Expand the PfMO's mandate to include compliance monitoring of project management policies, processes, and procedures for groups delivering the capital program.

Preliminary Prioritization

Once the City and TTC have validated which improvement opportunities to take forward, it is recognized that they will likely not be in a position to progress on all of these at the same time. It will therefore be necessary to prioritize in order to develop a workable schedule, taking into account the significant time commitment on the part of the work stream members, and their leaders in particular. KPMG's experience indicates the most appropriate method in this instance is to use a matrix of Potential Benefit against Ease of Implementation. A preliminary prioritization matrix using this methodology can be seen below (Figure 3), with the recommendations colour coded by theme / work stream as noted above. This preliminary prioritization will require validation by the City and TTC to help ensure alignment with existing corporate priorities and the PfMO's Maturity Plan.

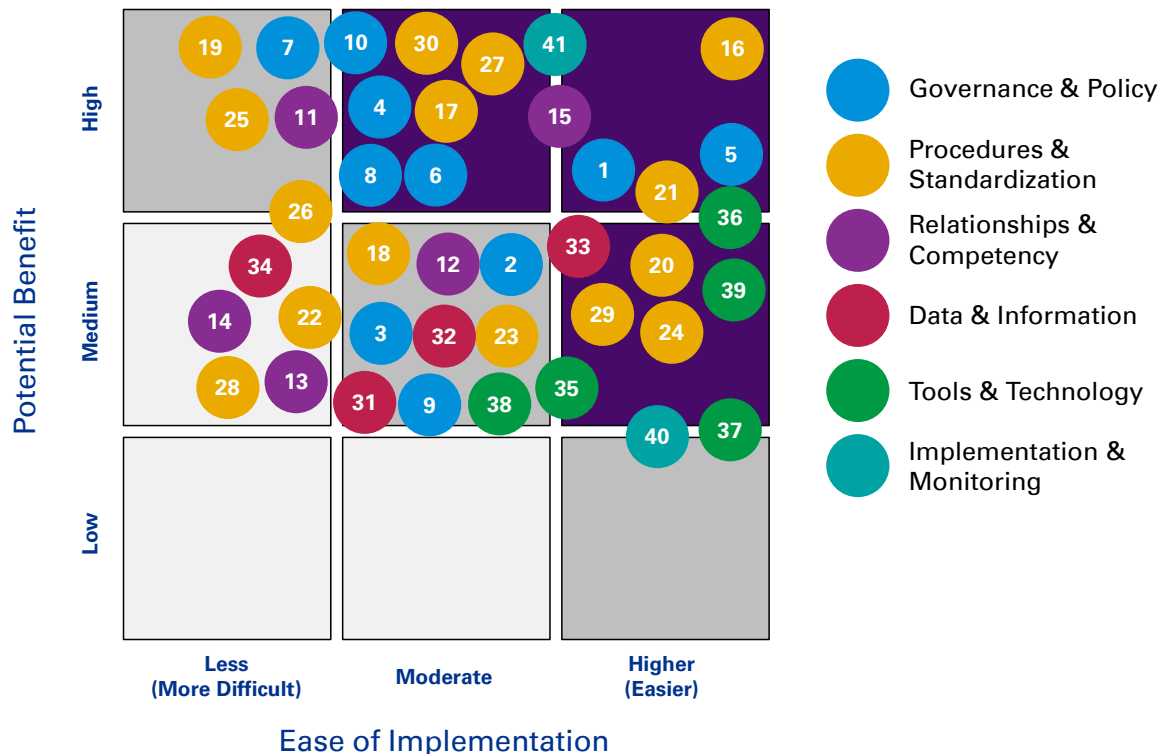


Figure 3 – Preliminary Prioritization Matrix

Additional Deliverables - Tools

In developing the scope of work for this engagement, the City and TTC had identified two areas with a known opportunity for improvement, leading to the inclusion of the development of two project management tools. Appended to this report, and integrated into the recommendations noted above, are a tool for assessing project complexity and risk, and a framework for analyzing alternative procurement options for capital projects. Each of these is described briefly below.

Project Complexity & Risk Assessment

The TTC's extensive capital investments cross a wide range of complexity levels. Projects and programs should be assessed relative to their impact on the organization, i.e., based on the inherent risk and complexity involved. A project risk and complexity tool is required to allow project sponsors, and the organization as a whole, understand the potential impact of projects. A standard enterprise tool provides a common vernacular and approach with respect to how projects are perceived at the outset as well as to they are managed throughout the project lifecycle.

A number of risk and complexity classification systems already exist within the TTC (i.e. Enterprise Risk Ranking, EC&E Risk Management Levels and the ITS Solution Deliver Principles), but they are not aligned or universally applied. These three existing frameworks were used as the foundation for the project complexity and risk assessment framework appended to the report, and were combined with elements from the Project Management Institute and other industry leading practices resulting in a rigorous, qualitative tool for evaluating project complexity and risk. The tool ranks projects from a low of Level 1 to a high of Level 6, a range that aligns with the TTC's corporate Enterprise Risk Management ratings.

The goal of this framework is to assess the capital projects in a qualitative manner against 34 criteria. The purpose of choosing qualitative responses is that it enforces the project sponsor to use an element of judgment. This judgment allows the sponsor flexibility in their responses and recognizes that the relative importance of some risk criteria will change on every project. A qualitative approach helps ensure that the project sponsor will take ownership and responsibility for the outcome, as KPMG has often seen purely quantitative assessment lead to project leadership tailoring their score to meet a particular outcome.

Procurement Options Analysis Framework

Historically, both the TTC and the City have predominantly delivered their capital programs through traditional means, following a Design-Bid-Build procurement model. Although this methodology is well aligned to smaller capital projects, for those with complexity ratings of Levels 4 to Level 6 (from the aforementioned Project Complexity & Risk Assessment tool), there are alternative models that can transfer more risk from the TTC to the contractors, to the benefit of on-budget, on-scope and on-time delivery. Consideration of alternative models will require not only additional competencies for the planning, procurement and delivery of capital projects, but in some cases will require a shift in capital planning strategy. For example, a number of alternative models will require capital projects to be planned and estimated from a lifecycle perspective, meaning the estimating and business case development processes would encompass the capital, operational and maintenance costs for a specific period, such as 30 years.

Selecting the appropriate procurement option for the delivery of a major capital project is therefore crucial. To steer project leadership through the process, this framework provides high-level guidance on the selection of the appropriate procurement option for a major capital project, defined as a project rated Level 4 or higher. This procurement planning stage of the project occurs after Capital Planning, where the need for the project is identified and high level project feasibility

analysis is conducted. Furthermore, this stage precedes the actual procurement and the associated Request for Qualifications (RFQ) and Request for Proposals (RFP). Additionally, multiple concurrent project activities are expected to occur during the procurement options analysis. Continued concept design, preliminary engineering, traffic modelling, public engagement and cost estimating are amongst the activities which will provide essential information for the procurement options analysis.

The appended framework is intended to be used by the TTC Project Team responsible for determining the most suitable procurement option for an identified major capital project. The framework is organized under four successive stages:

- Project Definition – the Who, What, When, Where and Why of the project.
- Initial Screening – the initial test and shortlisting listing of procurement options to determine *how* to deliver the project.
- Packaging Options – a final adjustment to the five “W” of project in consideration of the analysis and feedback received internally and externally.
- Procurement Recommendations – a combined qualitative and quantitative assessment of *how* best to deliver the project and the determination of the preferred procurement option.

2 Introduction

2.1 Context

The Toronto Transit Commission (“TTC”), an agency of the City of Toronto, is responsible for the design, operations and maintenance of subways, streetcars, buses, and Wheel-Trans in Toronto. The TTC is the third largest transit authority in North America having over 1.68 million paid trips on an average business day with passengers using the 151 surface routes (buses and streetcars), four rapid transit routes (subways and RT), and Wheel-Trans, with annual ridership of approximately 540 million riders in 2015.

With some recent late and over-budget major projects, and with a ten-year planned investment of \$9.3 billion, the inevitable questions have been raised – what has been done right and wrong in the past, and how can the TTC be more successful in delivering capital projects going forward. To respond in part to the issues underlying these questions, in 2014 the TTC created the Portfolio Management Office (“PfMO”) with the primary responsibility of introducing new centralized project management strategies, procedures, frameworks, and standards to improve the delivery of capital projects.

Further, in March 2015 the following motion passed at Council:

“That City Council directed the City Manager to issue a Request For Proposal to expedite a review of Toronto Transit Commission Capital program service delivery including:

- Review of project management of Toronto Transit Commission major capital projects in the past five years to determine actual project costs and completion dates relative to original schedules and estimated costs;
- Review of staff reporting mechanisms to the Toronto Transit Commission and City Council related to capital project budget and completion date status; and
- Future organizational options for Transit project management and delivery of major capital projects related to Transit expansion and major state of good repair projects.”

This motion led to the issuance of a Request for Proposals in August for a consultant to review capital project delivery practices at the TTC and to provide recommendations that are intended to assist the TTC to improve the delivery of its capital program. The goals of the TTC Capital Program Review were as follows:

- Improve the organization’s project and program management performance by learning from past experience;
- Support continuous improvement efforts underway at the TTC, including the continued implementation of the TTC PfMO;
- Assess project governance structure and protocols for reporting of project status, to help ensure the appropriate level of transparency and accountability to project sponsors and stakeholders; and

- Provide guidance on project delivery options and project management requirements for projects of varying size, scope, and complexity.

In September 2015, KPMG was selected as the successful consultant.

This Review, although led by the City Manager's Office, is a joint effort between the City and the TTC. Their mutual intention is to take lessons learned from past and ongoing TTC projects, and identify both organizational strengths that can be built upon and weaknesses that require further attention, all in the context of treating this Review as an exercise in continuous improvement.

As such, this report is not intended as a critical review of specific decisions made in the execution of any single project. By utilizing a continuous improvement approach, the parties facilitated interviewees providing open and honest perspective which helped pinpoint some of the issues within the scope of this Review.

2.2 Scope & Structure

The scope of the Review was structured around two phases as follows:

- Phase 1 – Current State Assessment
 - Provide a framework to assess the complexity and risk profile of different types of projects;
 - Determine the required project management capacity/maturity to deliver different types of projects based on international best practices;
 - Assess TTC project management maturity as it relates to industry leading practices; and
 - Undertake a detailed review of specific major capital projects as a component of the organizational project management maturity assessment, including:
 - Review of a representative sample of capital projects;
 - Assess the project management practices and processes utilized in each project;
 - Assess the actual project costs and completion dates relative to the planned budget and baseline schedule;
 - Identify root causes of schedule slippage and budget overages; and
 - Identify any unique organizational and other factors that may influence project budget and schedule.
- Phase 2 – Gap Analysis
 - Identify gaps in the current project management practices based on international best practices and standards;
 - Identify opportunities to improve the organization's project management maturity and capacity;

- Provide a framework for project delivery options for major capital projects; and
- Identify investments required to support implementation.

A Phase 3 is intended to follow the delivery of this report, with the City and TTC reviewing the recommendations, validating prioritization, and developing an implementation plan, with KPMG supporting as required.

The structure of this report addresses the results of phases 1 and 2 together, in order to clearly address the core themes of the findings.

This report is organized as follows:

- [Section 1](#) – The Executive Summary is a brief synopsis of this report that describes the Capital Program Delivery Review’s background, scope, and introduces the key themes that have been identified around improvement opportunities.
- [Section 2](#) – Summary of Recommendation highlights the 41 recommendations that the City and TTC could implement that could help bolster the recommendations that are detailed throughout this report, and particularly in Section 5.
- [Section 3](#) – Introduction provides the context in which the Review has occurred and describes how the scope of work has been executed.
- [Section 4](#) – Current State details at a high-level the findings of both the project reviews and the maturity assessment. The summaries are high-level, further detailed and granular reports on the findings can be found in Appendix A – Project Management Maturity Assessment.
- [Section 5](#) – Gap Analysis and Recommendations illustrates in detail the findings and recommendations of this report. The findings and recommendations have been grouped into six key themes to clearly articulate how class-leading organizations perform in each area, how the TTC compares, and what opportunities there are for improvement.

The project complexity tool and project delivery options framework have been incorporated at a summary level into the same six key themes. More detailed descriptions of the tool and framework can be found in Appendix B – Project Complexity and Risk Assessment and Appendix C – Procurement Options Analysis Framework for Major Capital Projects.

- [Section 6](#) – A proposed prioritization in the short, medium, and long term is presented both in the context of the relative importance of the six key themes, and by each individual recommendation.

3 Current State

This section of the report provides an overview of the current state of the TTC's capital program and project management in accordance with the scope of Phase 1.

From 2015 to 2024, the TTC's capital program will make up 34% of the City of Toronto's tax and rate supported capital budget and plan, or \$10.6 billion of \$31.7 billion.

This budget is comprised of a wide spectrum of projects, both complex and routine. Being an organization structured along functional lines, the TTC's projects in the capital program are delivered primarily by the following three functional groups:

- Information Technology Services ("ITS")¹;
- Engineering, Construction & Expansion ("EC&E"); and
- Operations ("Ops").

The projects are also categorized into four major categories, with their percentage contribution to the total base capital program stated below.

- **State of Good Repair ("SOGR") – 89%** – projects that ensure the safety and reliability of the system. Of the budget, the largest components are vehicles (43%) and structures (29%).
- **Legislated – 7%** – projects that ensure the TTC complies with changes in laws or building codes. Of the budget, the largest components are the accessibility program (67%), streetcar network upgrades (9%) and asbestos abatement (8%).
- **Service Improvements – 2%** - projects that increase the efficiency and functionality of existing assets. Of the budget, the largest components are bus fleet increases (58%) and service driven projects (21%).
- **Growth / Expansion – 2%** - projects that expand the system's capacity in response to increasing ridership. Of the budget, the largest components are the McNicoll Bus Garage (81%) and PRESTO implementation (14%). It should also be noted that this base capital program does not include multi-level government funded expansion projects like the Toronto-York Spadina or Scarborough Subway extensions.

In addition to the \$10.6 billion within the 10-year capital plan, there are approximately another \$2.4 billion of priority projects that remain unfunded, and are therefore considered "below the line". These projects are categorized into **Projects** and **Capacity to Spend Opportunities**. The projects include a bus rebuild program (to extend the current fleet), new subway cars for Line 2, new buses and LRVs for growth, and more fire and accessibility upgrades. The capacity to spend

¹ For ease of presentation, ITS is referred to in this report as a 'functional group', even though it is a department within the Corporate Services group.

opportunities include regular SOGR work on track (surface and subway), bridged and tunnels, paving and upgrading finishes and equipment.

With such a large capital program, it was not feasible for this review to examine the complete breadth and depth of all projects. As a result, as described in the section that follows, a representative selection of projects from across the program were used to assess the current state of the overall program.

3.1 Overview of Methodology for Current State Assessment

The assessment involved a review of the maturity of capital project delivery process and governance in order to identify best practice strategies that defined a target future state. This assessment was built upon three things:

- a review of a selection of recent capital projects representing the breadth of the TTC's capital program;
- a desktop review of TTC project management policies, processes and procedures; and
- stakeholder interviews

In addition, KPMG benchmarked similar organizations to evaluate the maturity of the TTC's practices.

KPMG was tasked with picking a selection of projects that would serve as an appropriate cross-section of projects for the entire capital program. KPMG developed a set of criteria to shorten the list that included the following categories:

- Complexity - High, medium and low
- Projects, programs and procurements
- Delivery group – ITS, EC&E and Ops
- Asset categorization – Expansion, Legislated, State of Good Repair ("SOGR"), Improvement

Table 1: TTC Capital Program Representative Projects and Selection Criteria

Project	Category	Project EFC (M)	Ongoing / Finite	Initial Complexity	Lead	Successful / Challenged	Project, Program or Procurement
Toronto York Spadina Subway Extension ("TYSSE")	Expansion	\$3,184	F	High	ECE	C	Project
Fuel Storage Tank Replacements	Legislated	\$45	F	Low	ECE	S	Program
Subway Station Easier Access Phase 3	Legislated	\$655	F	Medium	ECE	C	Program

Project	Category	Project EFC (M)	Ongoing / Finite	Initial Complexity	Lead	Successful / Challenged	Project, Program or Procurement
Leslie Light Rail Vehicle ("LRV") Barns	SOGR	\$507	F	Medium	ECE	C	Project
Union Station 2 nd Platform	Improvement	\$148	F	High	ECE	S	Project
McNicol Bus Garage	Expansion	\$181	F	Medium	ECE	S	Project
Toronto Rocket ("TR") subway car purchase	SOGR	\$1,172	F	High	Ops	S	Procurement Project
LRV purchase	SOGR	\$1,187	F	High	Ops	C	Procurement Project
Surface Track (streetcars)	SOGR	\$487	O	Medium	Ops	S	Program
On Grade Paving	SOGR	\$83	O	Low	ECE	S	Program
TR Yard accommodation	Expansion	\$985	F	High	ECE	S	Project
Line 1 subway Automatic Train Control (ATC)	SOGR	\$626	F	High	Ops	C	Project
SAP	SOGR	\$63	F	High	IT	S	Project

KPMG conducted interviews with 68 key personnel and stakeholders at the City of Toronto, the TTC and from external organizations, including key personnel for each of the projects identified above. Specifically, the interviewees were the following:

- City of Toronto:
 - 6 - Executive Staff
 - 4 - Management Team
- Toronto Transit Commission:
 - 6 - Executive Staff
 - 21 - Management Team
 - 24 - Project Managers
- External:
 - 2 - Infrastructure Ontario
 - 5 - Consultants and Contractors (project management, oversight committee member, and contractors)

In addition to project-specific documents for the projects listed above, KPMG reviewed the departmental policies, processes and procedures relating to the capital program from the ECE, Ops, ITS and M&P departments.

Following the interviews and document review process, KPMG conducted a project complexity and risk analysis, as well as a project management maturity assessment. Collectively, these analyses provide the platform for recommended improvements.

3.1.1 Complexity and Risk

The TTC's extensive capital investments cross a wide range of complexity levels. To help provide an understanding of project complexity and risk, KPMG developed a framework for assessing the representative TTC projects. The framework was created by combining the existing TTC principles with industry leading practices in project complexity and risk assessment. Part of understanding the current state of the TTC capital delivery is understanding the context in which projects occurs. Project complexity ratings are provided in Tables 2 and 3.

Greater detail can be found in Appendix C – Project Complexity and Risk Assessment.

3.1.2 Projects versus Programs

The current state assessment makes a distinction between "projects" and "programs".

Projects by definition have a discrete scope, budget and timeline. The 9 projects are shown in Table 2 and Figure 4 below. Programs are executed over a long timeframe and have often have scopes that vary from one reporting period to the next. Program budgeting tends to be more fluid and shows more fluctuations than in discrete projects. The 4 programmatic elements are shown in Table 3.

3.2 Estimated Final Cost Analysis

Estimated Final Cost (“EFC”) is a forecast of the final cost of a project or program. As shown in the cash flow report of a TTC project’s Project Status Report (“PSR”), the EFC is a build-up of all the actual costs to-date and the estimated costs to completion. The EFC may be the same as the approved budget for a project, but only if any budget changes have been approved and incorporated into that budget.

The change in EFC is a good indicator of how project and program costs change over their lifecycles. The lifecycle begins when the project is identified and given an early cost estimate. The estimate then evolves to the point where the project is approved with its initial baseline budget. For the purposes of the analysis that follows, this baseline budget signifies the ‘Project Initiation’, where it moves from an estimate to an approved project with a baseline budget that can be moved to tender. The project lifecycle concludes when the project is substantially complete and handed over to Operations. The main reason that we use EFC for our analysis is that it is based on actual and forecast costs, whereas a budget only shows what is approved at a point in time. Ideally, EFC should remain relatively constant over a project’s lifecycle, assuming that appropriate allowances for design development and contingency are included in the very first estimates.

3.2.1 EFC Analysis – Projects

Of the 13 projects assessed, 9 were categorized as “discrete projects” for the purpose of our analysis. Six projects saw an increase in EFC over their lifecycles, and overall EFC increased by over \$2.9B. Of the budget changes that occurred \$1.6B was post project initiation and \$1.3B occurred pre-project initiation, which include scope changes and creep. Project complexity did not appear to be a determining factor in an increased EFC.

Table 2: Project Complexity and EFC

Project Name	Complexity Level	Initial EFC Estimate (Millions)	Project Inception EFC (Millions) ²	Current EFC (Millions)	EFC Change Over Project Lifecycle	Primary Causes of EFC Change
TYSSE	6	\$1,500 ³	\$2,634	\$3,184	\$550	Increase in scope of 2.4km of track and 3 stops into York Region, major project reset for schedule, contractor claims.
McNicol	3	\$160 ⁴	\$181	\$181	\$0	-
Union Station 2nd Platform	5	\$79 ⁵	\$139	\$148	\$9	Additional cost of cancelling the tender and renegotiating.
Leslie Barns	5	\$345 ⁶	\$345	\$507	\$162	Escalation due to delay of contract award, increased scope to enhance landscaping, improve noise mitigation, and replace water main.
SAP	2	\$36 ⁷	\$63	\$63	\$0	-
TR Yard	4	\$658 ⁸	\$639	\$985	\$346	Change in project delivery model to outsource program management, increase in scope to address internal stakeholder requirements.
ATC	5	\$306 ⁹	\$342	\$563	\$221	Increase in scope to include ATC on YYSSE, major project reset to simplify technical requirements and contractual arrangements.
LRLRV Purchase	4	\$1,243 ¹⁰	\$1,286	\$1,187	(\$99)	-
TR Purchase	4	\$755 ¹¹	\$755	\$1,172	\$417	Increase in scope adding 21 trains to replacing H6 cars and adding 12 trains for growth enabled by automatic train control, through exercising of exiting options.
Total:		\$5,082	\$6,384	\$7,990	\$1,606	

¹ All figures as per TTC Capital Budgets unless otherwise noted

³ 2003-2007 Capital Program and 10-Year Capital Forecast

⁴ 2013-2022 TTC Capital Budget

⁵ 2004-2008 Capital Program and 10-Year Capital Forecast

⁶ 2009-2013 TTC Capital Budget

⁷ 2013-2022 TTC Capital Budget

⁸ 2011 Project Status Report

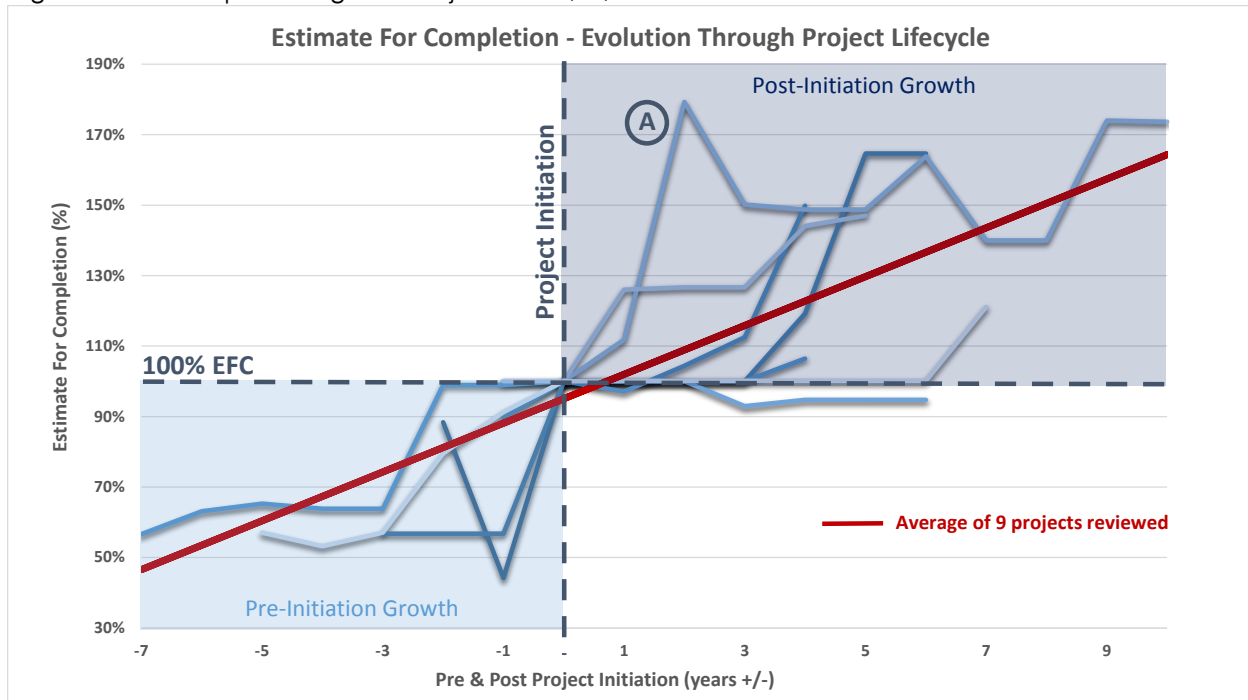
⁹ 2007-2016 Capital Program Analyst Briefing Notes

¹⁰ 2007-2016 Capital Program Analyst Briefing Notes

¹¹ 2005 Subway Fleet Plan

In order to assess how capital project EFC evolved over time, the percent change from year to year for the selected projects was calculated (see Figure 4). The percent change analysis, by definition, does not account for project size, but rather shows the degree of change within each project.

Figure 4: TTC Capital Program Project EFC (%)



The average line in red above demonstrates that the percent change in EFC generally increases over time, with EFC for these projects growing by an average of 6% annually. Some of the significant increases can be explained by scope changes, such as exercising the option on a subway car order (reference 'A' in Figure 4), but others may be caused by scope creep.

It's important to clarify the difference between scope changes and scope creep. Scope changes include external events, errors in defining the initial scope, drawing down contingency or a value-added change that improves the project. Scope creep involves uncontrolled changes in the scope or continuous growth of that scope. When scope definition is poor, a project is more susceptible to creep because the uncertainty allows a broader interpretation of what is 'in' scope. This becomes more problematic when there is a situation with many stakeholders and a general unwillingness or inability to say 'no' to the requests of these stakeholders. Causes of the EFC changes are described further in Section 3.2.4.

According to KPMG's 2015 *Global Construction Survey*, of those surveyed (over one quarter of which were government related), 53% suffered one or more underperforming projects within the last three years, with only 31% of respondents' projects coming within 10% of budget in that same time frame.

Although growth in EFC as compared to budget is common, a 6% per annum growth is high in KPMG's experience. Ideally, the EFC would remain relatively constant over the project's lifecycle. This would only be achievable if the project was wholly scoped in the initial planning phases, and appropriate contingency allocation occurred early, and evolved appropriately as project definition increased. The data above shows that of the nine sample projects, EFC was underestimated by 30% two years prior to project initiation (budget setting), and that EFC at budget setting was 30% underestimated 5 years into the project.

3.2.2 EFC Analysis – Programs

Of the 13 projects assessed, four were categorized as programs. These four programs saw some increases in EFC over a five year span, but generally they do not stem from the same issues noted above relating to projects. The majority of the programs reviewed are, by definition, a collection of discrete projects, but with an uncertain delivery timeline. According to the budgeting process, the EFC reported on an annual basis relates to only a portion of time (typically 10 years) of a program, that can in fact run much longer. In any given year, the budget will include projects just finishing, projects that will be completed within the timeframe, and projects that will start within the timeframe but finish after the budget cycle. Programs can therefore be subject to budget pressures, by delaying or advancing projects within the program to suit available funding.

Table 3: Program Complexity and EFC

Project Name	Complexity Level	Initial EFC ^[year] (Millions)	Current EFC ^[year] (Millions)	Change	Primary Causes of Budget Changes
Storage Tank Replacement	1	\$57 ^[2010]	\$52 ^[2014]	(\$5)	-
Easier Access 3	2	\$355 ^[2011]	\$654 ^[2015]	\$299	Increase in estimates for future stations due to complexity around property, power, utilities, etc. The first two phases were composed of less complex projects.
Surface Track	2	\$312 ^[2012]	\$342 ^[2015]	\$30	Program reprioritization.
On-Grade Paving Rehabilitation	1	\$60 ^[2011]	\$83 ^[2015]	\$23	Program acceleration to eliminate backlog.
Total:		\$784	\$1,131		

3.2.3 Primary Causes of EFC Changes

Based on the project reports and other documentation, trends emerged regarding what was causing the variability in EFC over project lifecycles. The primary impacts on EFC were:

- **Scope Definition and Changes**

The most significant driver of EFC fluctuations was significant change to project scope, which affected the majority of projects reviewed. It is difficult to track a project's EFC if major scope changes occur. There are multiple examples of these kinds of changes. Some major projects had immature scope definition at the time budget was allocated, which can result in scope creep by leaving broader interpretation as to what could be 'in scope'. In several cases elements have been added, such as increased utility work or a greater emphasis on architecture, well into the project lifecycle. In general, these kinds of issues stem from a lack of definition of the complete (of various stakeholders) scope at the estimation and budget stage, inadequate allocation for the further development of scope, and the commercial implications of scope changes later in the project. In one project, a combination of the governance model, a cumbersome change management process and a lack of capacity to deal with changes in a timely manner exacerbated the issues. Although changes appear to be made transparently, historically they haven't been tied to a prioritization of project objectives (i.e. cost versus design excellence) or necessarily with an overall view to the commercial impact on the project.

- **Schedule Slippage**

If project schedules are allowed to slip, there is a resultant impact on the project EFC. The impacts come in many forms, including prolonged equipment costs, prolonged management and overhead expenses, escalation, additional labour required to recover the schedule, and potential penalty costs. Insufficient schedule controls can often have a trickle-down effect on other aspects of the project as well, with commercial implications. To a certain degree, externalities cannot be completely accounted for (i.e. weather, material supply chain issues, labour disruptions), however controls can be put into place that will reduce the incidence of schedule slippage, whether it's through contractual levers or monitoring.

- **Cost Estimate Changes**

Significant EFC increases were seen due to revised cost estimates on some projects. This was due to changes in the assumptions that were made during the early planning or estimating phases. Estimate changes were also common on programs where the lifecycle is long-term and initial budgets are based on a preliminary set of assumptions. An example of this is the Easier Access III program where the budget was based on less complex earlier projects, however, the actual costs of the subsequent Easier Access III program increased due to the difficulties at specific sites for reasons such as access and property easements. According to AACE International (the Association for the Advancement of Cost Engineering) estimating guidelines, cost estimates should mature as a project's definition increases, but typically additional contingency is carried early on in the project to account for this design development. In the cases where cost estimate changes caused significant EFC changes in our sample, the base assumption changes were large enough that this estimate contingency proved insufficient.

- **Budget Decrease Requests**

Occasionally, the City will request budget decreases to temporarily allocate funds to alternate projects, such as on the McNicoll Bus Garage. When these requests are made the project budgets appear to change significantly however the intended scope may never have been changed. Reporting approved funding instead of the true cost of the project distorts annual reporting and makes it difficult for decision makers to have an accurate view of the capital program.

- **Pre-project Initiation Changes**

Many of the projects that were a part of this Review had significant increases to their budgets between initial identification and project initiation. This lack of clarity of this evolution during the planning phases can in part be attributed to the lack of a formal stage gate process and risk adjusted estimate processes. The TTC at times provides project budgets prior to having sufficient detail on the scope of the project, which can lead to increased project budgets as the scope is refined. This is entirely allowable and acceptable, but should only occur as the contingency value decreases, specifically the contingency allocated for scope definition and estimate maturity.

The projects reviewed in this section and the summary of the primary causes are not intended as a critical review of specific decisions made in the execution of any single project, but rather to illustrate the need for the increased governance, processes, and controls that form the Recommendations portion of this report.

Table 4: Impacts of Budget and Schedule Changes

Project/Program	Budget Increase	Schedule Increase	Factors of Budget Increase		
			Scope Change	Estimate Changes	Schedule Slippage
Easier Access III	X			X	
Leslie Barns	X	X	X		X
McNicoll	X	X		X	
TR1 Yard	X		X		X
TYSSE	X	X	X	X	X
Union 2 nd Platform	X	X			X
Storage Tank					
On-Grade Paving	X	X	X	X	X
ATC	X		X		
LFLRV					
TR Purchase		X	X		X
Surface Track	X				
SAP	X				

3.2.4 Capital Program Characteristics

The TTC's 2015-2024 Capital Budget is valued at approximately \$13.6 billion for the Base, YYSSE, and SSE programs. There are 35 identified infrastructure related programs and two subway extensions. There are approximately another 300 projects that form the identified infrastructure programs. Based on the risk and complexity assessment that was performed on the 13 projects identified as part of this review, KPMG applied similar risk and complexity ratings across the remainder of the capital program in order to gain an approximate understanding of the programs characteristics.

In 2015, the low risk and complexity projects (Levels 1 & 2) account for approximately 20% of the capital budget. The medium risk and complexity projects (Levels 3 & 4) account for

approximately 40% of the capital budget. The high risk and complexity projects account for approximately the remaining 40% of the capital budget. In contrast when the entire 2015-2014 capital budget is considered the budget allocations are approximately 40%, 30%, and 30% respectively. These two views indicate that the mix of projects changes on an annual basis. It also indicates that with respect to risk and complexity there is a broad spectrum of projects delivered as part of the capital budget ranging from low risk routine to high risk one-time complex projects.

Both the Ops and EC&E departments deliver projects across the spectrum of risk and complexity as well as annual budget expenditure. The average budget for the 35 infrastructure related programs is \$28.5 million per year with a broad range of \$0.2 to \$300.0 million. This wide delivery spectrum was a factor to consider when assessing the current state and determining the target future state of the organization's project management maturity.

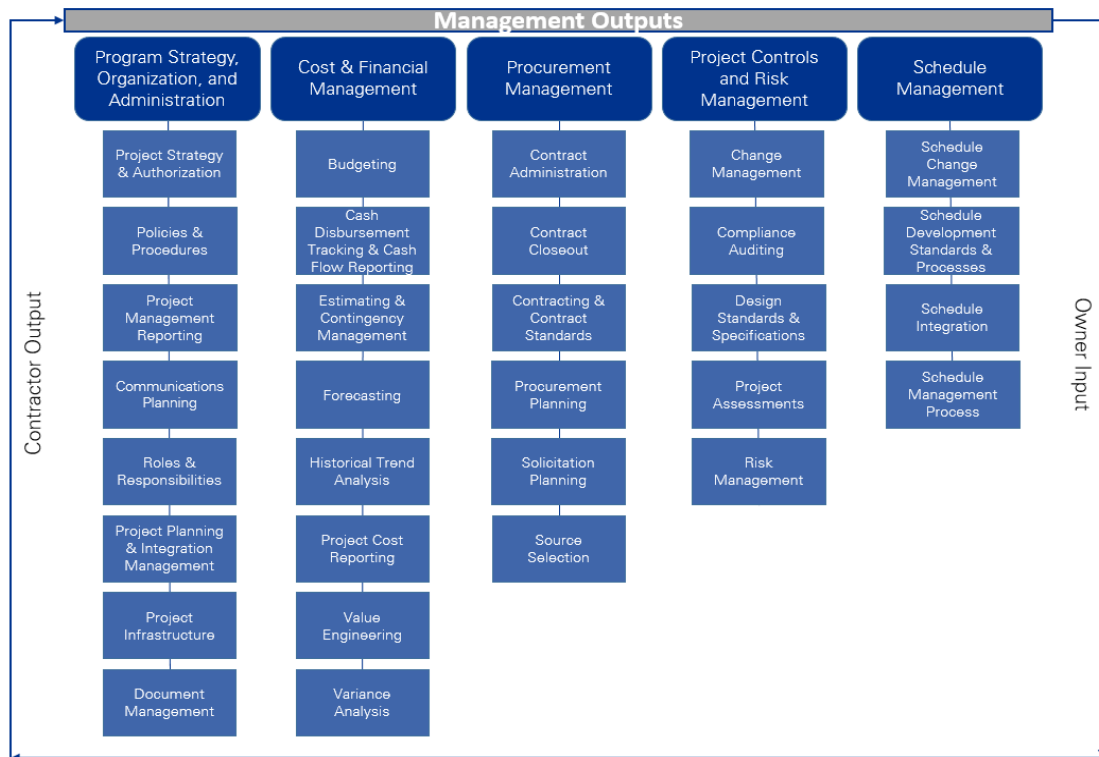
3.3 Project Management Maturity

As mentioned above, the TTC capital program is classified into EC&E, ITS, and Ops. Each of these TTC functional groups has specific processes and procedures that it follows but the processes and procedures of each are different. Specifically, the EC&E and ITS groups have standard processes and procedures governing capital project management, while Ops does not and instead relies upon the project teams to either leverage the standards of other functional groups or develop their own approach. In this context, the practices of each functional group were separately examined and scored as part of the project management maturity analysis.

The project management maturity assessment used a globally standardized KPMG framework aligned with the *Project Management Institute's* ("PMI") *Project Management Book of Knowledge* ("PMBOK"), consisting of the following high-level project control elements:

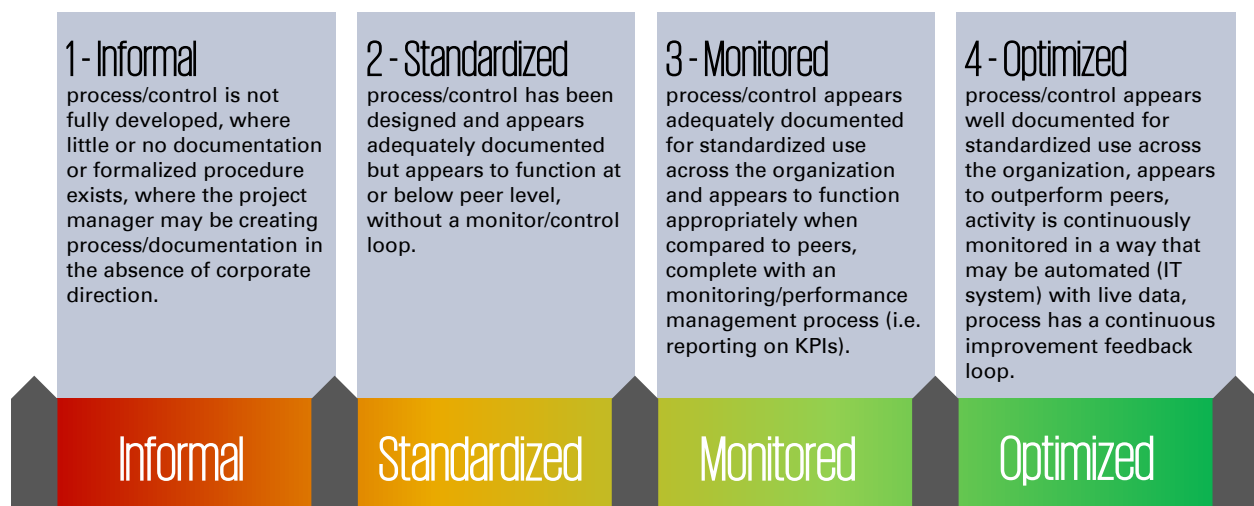
- Program strategy;
- Organization and administration;
- Cost & financial management;
- Procurement management;
- Project controls and risk management; and
- Schedule management.

Figure 5: Five Major Project Control Elements and Sub-Elements



- These high-level elements are disaggregated into 31 categories, which themselves are further disaggregated into 119 sub-categories. These sub-categories were individually scored according to the following scale:

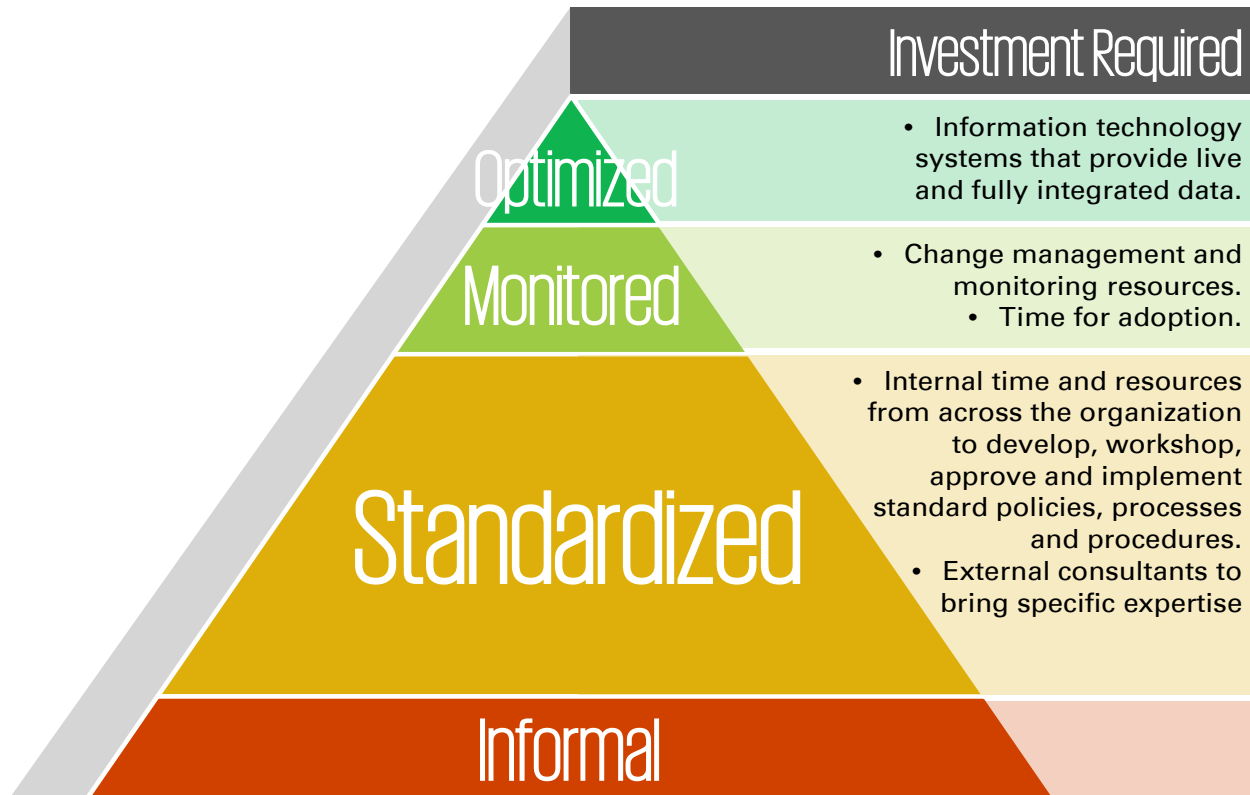
Figure 6: Project Management Maturity Rating Scale



There are two important considerations to the project management maturity assessment and the scale above. The first is that the organization's project management maturity rating should be seen as independent of the complexity of the organization's capital program. A common misconception is that projects of lower complexity require a lower maturity (i.e. informal) while those of higher complexity require a higher maturity (i.e. optimized). Instead, leading practice dictates that the organizational project management maturity should be consistent for every project within a capital program, regardless of their complexity. What does change relative to complexity are the requirements for project control. In an organization such as the TTC, a Project Complexity Tool, like that developed as a part of this Review, can be used to differentiate the reporting requirements for a simple versus complex project. For example, a very simple project may have a one page status report while a complex project may have a report many times as long. The maturity rating is not a measure of the content or thoroughness of these reports, but a measure of the project management system governing them. Continuing this example, if both the simple and complex projects have a standardized reporting format tailored to their complexity, an approval and oversight process that is frequently audited, and a continuous feedback process to improve the standard formats as needed, then both the simple and complex projects would have a 'monitored' maturity for their reporting process.

The second consideration of the maturity assessment and rating scale is the level of effort required for an organization to advance from one rating level to another. Although the maturity is graded across four part scale, the effort within each is not equal. As shown in Figure 7 below, the greatest investment is required to achieve a 'standardized' maturity rating, as there is significant investment required to develop organization-wide standard policies, processes, procedures, tools and templates that require significant consultation with stakeholders. This development also typically requires the assistance of external consultants to aid in areas of expertise that aren't central to the organization.

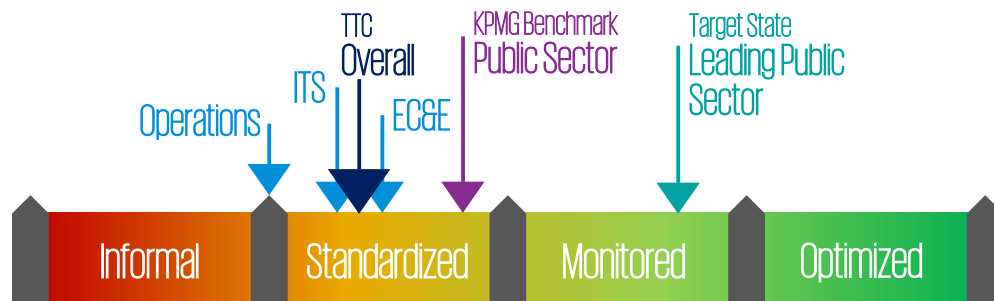
Figure 7: Investment for advancing maturity



Comparatively, the growth from a 'standardized' to a 'monitored' maturity has more to do with the organizational uptake of standardized policy, process, procedure, tools and templates. Investment of resources is typically limited to cultural change management and an implementation team that would evolve into a monitoring function. Lastly, the growth from a 'monitored' to an 'optimized' maturity is heavily dependent on the harmonization of data through integrated IT tools that can give live access to a variety of project data. The investment required to achieve an 'optimized' maturity can therefore be expensive and require alignment of almost all corporate IT systems. For this reason, it is rare that a public sector organization would even consider targeting an overall maturity of 'optimized' due to a low return on investment. Typically only heavily regulated industries such as utilities may achieve an 'optimized' maturity in areas of project management.

3.3.1 Summary Maturity Assessment

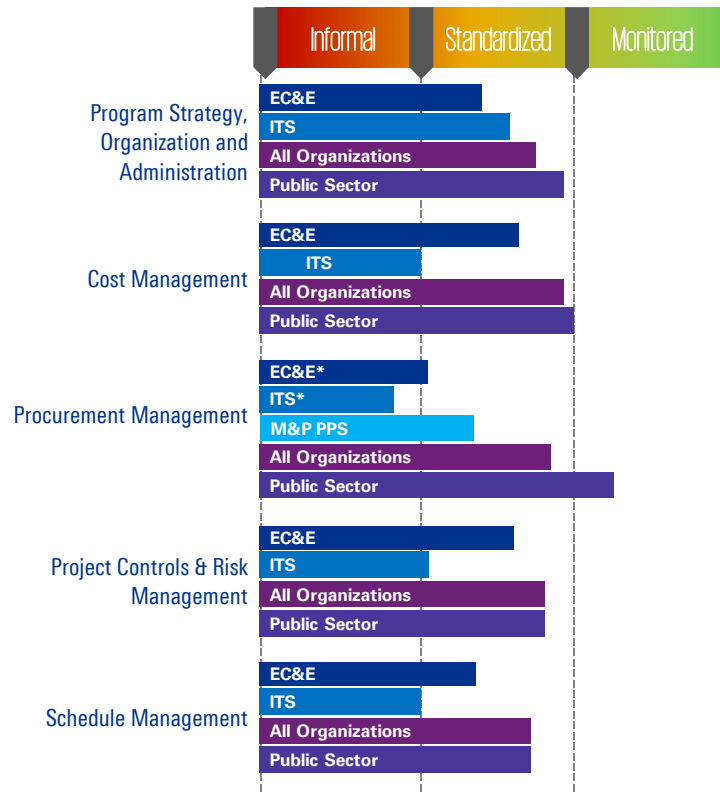
Figure 8: TTC Summary Project Management Maturity Rating



On the basis of our analysis, the TTC is operating near the mid-point of the “standardized” rating, which indicates that the organization’s performance is slightly below the benchmark of comparable public sector and transit organizations, although still within the same “standardized” range.

- The Operations group operates at an ‘Informal’ level, with a reliance on project leadership to develop processes and procedures in the absence of formalized practices.
- The ITS group operates at a lower ‘Standardized’ level, with a formalized PMO and a selection of standardized processes and procedures in some core areas.
- The EC&E group operates at a mid-‘Standardized’ level, with a project support focused Capital Programing group, a number of processes and procedures and some evidence of continuous monitoring.

Figure 9: TTC Detailed Project Management Maturity Rating *EC&E and ITS internal treatment of procurement



The EC&E group functions fairly closely to a blended sample of public and private sector organizations that make up KPMG's benchmark rating. The public sector subset of that sample, shown above, performs slightly better, at a high-'Standardized' level.

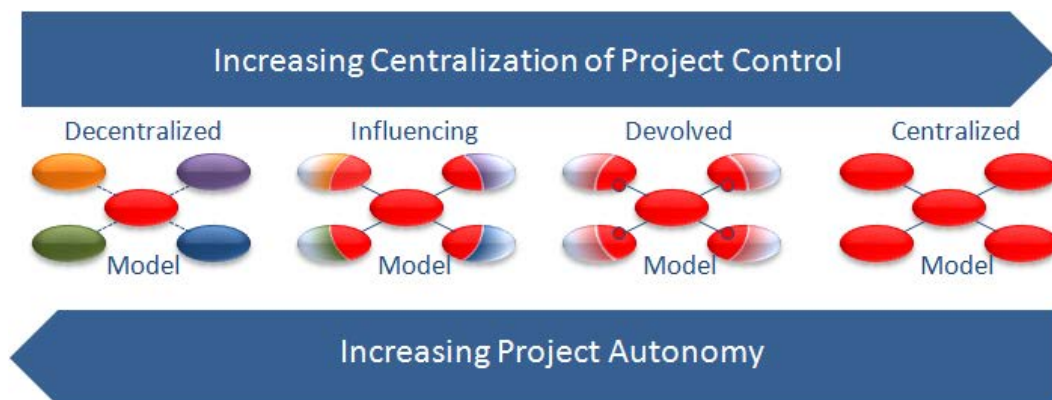
Although the TTC is largely standardized in the core major project delivery groups, the standardization is limited in two ways. First, the TTC's capital program management standardization is, for the most part, tailored to a traditional project delivery method of design-bid-build. Although the TTC has historically delivered all of its capital projects in this manner, recent (e.g. McNicoll Bus Garage and TR Yard) and future projects will be procured with alternative delivery methods. As more delivery methods are contemplated, the maturity of standardization would have to increase to ensure that either corporate standards remain flexible enough or group-level standards are customized enough to apply to new delivery methods. In some instances, this customization may be significant, such as allowing for the incorporation of full lifecycle costs into a capital project estimate.

Second, the TTC's current standardization is not, for the most part, set up to be scalable for projects of differing complexities. Some work has begun to differentiate project management requirements for projects of different complexities within the ITS group, but it has not been implemented on a broader scale. With the implementation of a formalized project complexity

tool, as detailed in Appendix B, the current standards will have to evolve by identifying the differing needs of a project control element for projects of different complexities.

An added element to the discussion revolves around where an organization's structure and governance lies along the project control spectrum, shown below in Figure 10. At one extreme of the project control spectrum lies the fully decentralized model whereby each functional business unit of the organization takes responsibility for delivery of their own capital project requirements, employing project managers and largely using their own processes and procedures. At the other extreme, the centralized model of project control would typically involve a dedicated corporate service department taking direct control of the management of all major capital projects on behalf of internal client business units.

Figure 10 - Spectrum of Project Control



From a portfolio perspective, the TTC operates what can be described as a **decentralized** model of project control, whereby responsibility for how capital projects are delivered is delegated to a number of separate and largely independent groups.

The effect of this decentralization of project control is that the management of each group responsible for delivering capital projects have a great deal of individual discretion in terms of the methodologies that they implement and the oversight arrangements that they employ. The absence of both corporate support for project delivery and a focal point for reporting and performance management is a defining feature of the decentralized model of project control, and one which significantly impacts the maturity of project delivery at the TTC from a portfolio level.

The size and complexity of the TTC is such that within some of the aforementioned groups, primarily EC&E and IT, there is a delegated project control model within each group that is more akin to an **influencing** or **devolved** model, where there is a centralized project management capability that seeks to control performance through the provision of expert support and standardized corporate process and procedure, often combined with a performance management, monitoring and reporting role. In some cases, these group-level offices also assign staff to projects. Within the EC&E and IT groups, these project management support and execution capabilities reside in the Capital Programming and Project Management Office ("PMO") teams respectively.

3.3.2 Target State

As noted previously, it is unrealistic for most public sector organizations to target an ‘optimized’ maturity rating, due to the low return on investment of improvements. As a minimum, all organizations with an ongoing capital program should target a **standardized** maturity rating. Any organization should support its project managers with standardized policy, process, procedure, tools and templates to manage their projects and achieve consistent project success. The entity that delivers the majority of the TTC’s larger individual capital projects, the EC&E group, has already largely achieved standardization across most project control elements. On the other hand, the entity that has some of the highest value procurements (bus fleet, LRVs and subways) and the highest number of projects, the Operations group, has not achieved a standardized rating. The advantage for the TTC is that the standardization work completed to date by the EC&E group, and to a lesser extent the ITS group, can be leveraged to fulfill the needs of Operations.

Although a ‘standardized’ rating is viewed as a minimum standard, to align with the TTC’s goal of becoming a class-leading organization as articulated in its Five-Year Plan, the TTC should target functioning at a **monitored** level, with some key processes **optimized** as needed to meet corporate objectives (i.e. risk or contingency management). Relating this to other organizations, KPMG’s benchmark of public sector clients shows them functioning at the high ‘standardized’ level, while in KPMG’s *2015 Global Construction Survey*, only 64% of those surveyed said their management controls were either ‘monitored’ or ‘optimized’. In many instances, the EC&E group as the most mature group in the organization, is set up to achieve a ‘monitored’ maturity for a number of project control elements, but requires additional resources and performance management measures to fully achieve it.

The ability to achieve a ‘monitored’ state also largely depends on where the responsibility of the monitoring function is placed within the organization. As discussed further in Section 5.4.3, depending on the target corporate project management governance, there are multiple organizational structures that could provide a monitoring function. Those options include a monitoring function that could be centralized within an expanded version of the PfMO, could be centralized under an independent entity like internal audit, or could be decentralized to the groups, to entities like the EC&E group’s Risk & Quality Assurance function, as discussed in Section 5.8.2. It follows then, that a path to a ‘monitored’ state parallels a shift at the portfolio level from a **decentralized** to an **influencing** model, where a centralized entity like a strengthened PfMO provides greater support across the capital program.

Ultimately, the target level of maturity requires a cost-benefit analysis and accompanying management decision to determine the appropriate course for the TTC. It should be noted however, that in KPMG’s experience, the benefits of improved project management efficiency and reduced cost overruns far outstrip the investments required in people and technology to improve project management maturity.

For details on the TTC project management maturity assessment, please see Appendix A.

4 Gap Analysis and Recommendations

4.1 Introduction

The assessment of the current and future state was informed by the project reviews, interviews, and the maturity assessment discussed in Section 4 of this report. Although the Project Maturity Assessment serves as a basis for a significant number of the recommendations that follow, a number are also derived from, and KPMG's experience advising on the delivery of capital programs, both public sector and private sector. Based on the reviews, interviews, and assessments, six themes have been developed to summarize the key findings.

The following section outlines how the TTC would strive to perform as a class-leading organization in each of these six key areas, how that relates to the current state, and what actions may be considered to close the gap between them. Largely, the recommendations focus on strengthening and broadening the reach of some of the centralized project management support and influence that already exists within the organization.

The six areas of focus described below separate the capital program management function into multiple themes that flow easily into areas of work that can be executed together. The structure of the key themes lend themselves to prioritization and each may require multiple stages of development in order to meet the TTC's desired future state of being a class-leading organization.

4.2 Six Key Themes

The key themes are as follows:



4.3 Governance

Introduction

Governance is the set of processes, customs, policies, laws, and institutions affecting the way in which an organization, program or project is directed, administered or controlled. In the context of a project, governance protocols are typically developed and managed from the start of a project

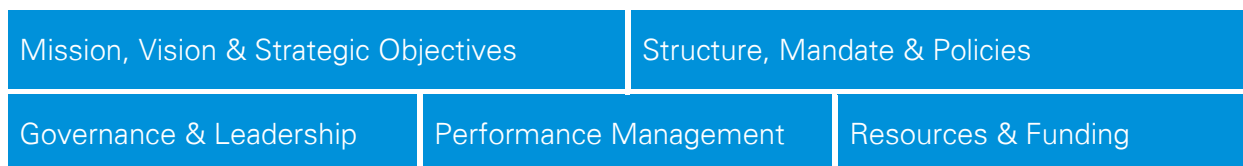
in order to assure consistent, cohesive policies, processes and decisions for a given area of responsibility.

An important part of governance relates to the number of stakeholders involved and the relationships among them. With regards to the TTC capital program, there are typically a large number of stakeholders. Key stakeholders vary depending on the complexity of the project, but generally include:

- TTC project team;
- TTC management;
- TTC Board;
- City Agencies and Corporations, and Council;
- Other levels of Governments where applicable (i.e. Federal, Provincial, Metrolinx);
- Suppliers;
- Customers;
- Contractors; and
- Public.

With this large stakeholder group comes multiple layers of governance that impact projects differently throughout the project's lifecycle. For TTC projects, those layers include the City-TTC relationship, TTC corporately, and the project teams.

Each layer of governance needs to be informed by and aligned with the layer above it, and tailored to the escalation of authority within the organization. This scalability is important to consider for all of the five sub-dimensions discussed below.



4.3.1 Mission, Vision & Strategic Objectives

Current State

Historically, the TTC has not tied the success of its capital program to the goals of the organization. As a result, project success was driven only by the traditional pillars of a successful project – on budget and on time for the full scope. That culture has begun changing at the TTC with the current management group, but the organization is still in the early stages of transformation.

A strategy to improve the TTC's capital program delivery should be built around a future state that aligns with the organization's strategic goals. As a part of the *Five Year Corporate Plan 2013-2017*, the TTC developed a vision, a mission, and seven strategic objectives, as follows:

Vision - A transit system that makes Toronto proud.

Mission - To provide a reliable, efficient and integrated bus, streetcar and subway network that draws its high standards of customer care from our rich traditions of safety, service and courtesy.

Strategic Objectives – Safety, customer, people, assets, growth, financial sustainability, and reputation

Desired Future State

To be class-leading, the TTC should have a broadly communicated, and enforced vision and mission as they pertain to capital program delivery, that tie back to and align to the organization's vision and mission.

Analysis and Recommendation

The PfMO was created to further the strategic portfolio approach to the organization's capital program delivery. Their mandate should be expanded to also include delivery of the capital program delivery's vision and mission. In order to address this mandate, the PfMO should define its strategic objectives and short/medium/long term goals, including priorities, customers, scope of services provided, and customer expectations.

In practice, the PfMO has begun doing some of these things, having identified areas of strategic priority as well as mapping out an implementation strategy for multiple work streams. One of the PfMO's earliest deliverables was the rollout of a business case template. Within the business case template, there is a section that requires project planners to identify impacts and benefits of the project on the seven corporate strategic objectives. The PfMO may wish to now consider expanding this linkage from the *Business Case* template to the seven corporate strategic objectives (and the capital program delivery strategic objectives when available) for risk management, project chartering, change management, performance measurement, and others as appropriate.

Recommendation #1 – Expand the PfMO's mandate to include development of the capital program delivery's vision, mission, and strategic objectives, and these should be clearly communicated and enforced throughout the organization.

Having a broadly communicated and enforced capital program delivery vision, mission and strategic objectives also sets a clear backdrop for all stakeholders when making important strategic decisions about capital projects. Coupled with a staged decision-making process, these objectives underpin the 'go-no go' questions that determine whether a project in its existing form is approved to advance to the next stage. Clear objectives allow all stakeholders, whether they

be TTC staff, executives, City administration, politicians or the public, to probe the value of projects on common grounds, leading to transparent decision making. Maintaining strict alignment to strategic objectives requires discipline from all stakeholders but doing so can greatly improve the reputation of the decision making process.

Recommendation #2 – Utilize the capital program delivery vision, mission and strategic objectives to project decision-making throughout the project lifecycle.

4.3.2 Mandate & Policies

Current State

Good governance is supported by clear roles and responsibilities, both across stakeholders and throughout a project's lifecycle. It is a common misconception that a structure must be fundamentally changed when attempting to transform the performance of an organization. When it comes to capital project management, often the structure is not the problem. The issue may lie with the definition of the roles and responsibilities within the existing structure.

As it pertains to the TTC's capital program, the governance structure of the City and TTC are appropriate for the types and complexities of the projects carried out and is not dissimilar to other transit authorities. The TTC Board's role as an oversight body and representative of City Council is appropriate given the nature of public transit. Governance is enhanced by the City's recent development of the Major Capital Infrastructure Coordination Office and, even more recently, of a City-TTC Executive Transit Committee at the staff level. Within the TTC, the creation of current management of various coordination and oversight entities such as the PfMO, Program Advisory Group, and Project Review Board have been positive organization-wide initiatives that provide an added layer of oversight.

The existence of all of these structural layers of oversight is important, but the structure alone does not guarantee successful project execution. There is currently a lack of definition surrounding the roles and responsibilities throughout the governance structure. This results in ambiguity and blurred lines within the TTC and between the City and the TTC.

Future State

In order to be class-leading, each stakeholder's role and mandate should be formalized and enforced through applicable policy, whether it be at the City, the TTC Board, TTC corporate, or project level. Policy and policy ownership should be documented, understood, maintained, approved, and communicated.

Analysis and Recommendations

Currently, there is little formalized documentation supporting the entities noted above, and there is no documentation knitting all of the entities together.

The rest of this report details a number of possible improvements to processes and procedures. The successful implementation of these possible improvements depends on the establishment of, or reinforcement of existing, strong governance addressing roles and responsibilities for decision making and related accountability.

To do so, the existing organizational structure should be empowered by ensuring that for every decision-making entity, there exists a clear, approved mandate with the delegation of the required authorities, the delineation of its responsibilities, and the means by which its performance is measured. Doing so may include:

- Developing a Terms of Reference for each entity that defines membership, competencies, areas of focus, delegated authority, responsibilities, method of reporting, metrics to measure performance, etc., is flexible enough to accommodate each stage of a project lifecycle and is communicated throughout the organization; and
- Supporting each entity with appropriate tools.

Recommendation #3 – Develop and document applicable mandates and policies supporting the various entities with capital project oversight responsibilities.

Principles of capital project management and project stewardship appear to be well understood at the entities close to the implementation of projects. However, for those entities whose core expertise may not be capital projects, such as the City-TTC Executive Transit Committee, the TTC Board, or the TTC Executive, this level of expertise is not necessarily present. Accordingly, their Terms of Reference may need to be supplemented with a capital projects toolkit which may include:

- High-level training on the concepts of capital project management and stewardship;
- An overview of the relevant capital project entities, their missions, mandates, and strategic objectives;
- A list of considerations for making decisions;
- Techniques for performing due diligence related to capital projects.

These entities may also wish to consider establishing a capital projects subcommittee and ensuring it has the ability to bring in expert advice as needed.

Recommendation #4 – Empower the existing governance structure with clear mandates, responsibilities, and accountabilities, and ensure these are effectively communicated throughout the organization.

Recommendation #5 – Provide tools to adequately support each governance entity in the execution of their mandate.

Key elements of these various Terms of Reference should be knitted together into a project management framework that references applicable project management processes, procedures, and tools that the project team should use throughout the project lifecycle, and defines the roles of all relevant stakeholders in governance at each stage. Users would include the TTC Board, executive, management, and staff; the City's various divisions and agencies; external consultants; contractors; and the Province including Infrastructure Ontario and Metrolinx.

Interfaces among these various users are a significant area of risk on capital projects. To function effectively in this regard, an organization should ensure that the interfaces among functional groups is clear and well managed. Key touch points among these groups at all stages of the project lifecycle should be documented for the purposes of sound quality management of the project, appropriate oversight, seamless handoffs between functional groups, and risk management. These matters should all be documented in the project management framework.

Recommendation #6 – Develop a project management framework that references applicable project management processes, procedures, and tools for use by the project team and other parties throughout the project lifecycle.

In the short term, the TTC could consider creating a project management framework that empowers the governance structure that exists today.

As an example, the UK's At Transport for London ("TfL") developed a project management framework called 'Pathways' in 2012, which consists of the following four main elements:

- Lifecycles – a definition of the lifecycles of projects, programs and portfolios
- Product Matrix – a definition of the deliverables (products) required throughout the lifecycle
- Handbooks – 11 handbooks (i.e., processes and procedures) that cover core aspects of project delivery, as well as a Pathway Manual (user guide)
- Product Management Plan – a questionnaire to align deliverables to a project's characteristics

4.3.3 Leadership & Accountability

Current State

Ensuring structure, mandate and policies are in place is not enough to translate good governance into positive project outcomes. Clear and effective leadership and decision making should take place at appropriate levels throughout the organization, often resulting in the need for greater

delegation. Leadership and senior management roles should be appropriately resourced, and levels of authority should be delineated and formalized, with appropriate escalation processes.

There has been a marked change in culture under current TTC management, with employees feeling greater empowerment to make decisions for themselves that are supported by their supervisors. Historically within the TTC, many capital projects have had unclear authorities for decision-making and/or inadequate resourcing for project leadership, which has led to a lack of timely decisions. This inevitably leads to contract changes and delays to the project schedule.

As noted in chapter 4, the TTC is structured around functional groups, which include:

- Information Technology Services (ITS);
- Engineering, Construction & Expansion (EC&E);
 - Project management
 - Construction management
 - Capital programing (estimating, scheduling, cash flow)
- Operations;
- Materials & Procurement (M&P); and
- Finance.

Analysis

Across many capital projects there has been no constant leader exerting ultimate control over the project throughout its lifecycle. This shortcoming is symptomatic of projects that are set up using a matrixed structure (i.e., project team members are accountable to both their functional lead and the project manager). For example, in the case of EC&E projects, although project managers theoretically retains ownership throughout the project, they do not have a clear authority during the procurement process and during construction, effectively act only as an information flow-through from the construction managers in the field to senior management. This situation is considered to be a 'weak matrix' organizational structure, because one of the two lines of accountability is significantly stronger than the other. As a result, project team members do not have a collective sense of ownership of the project and often do not feel individually accountable for the project's success.

Even at the executive level, there have been instances where no one acts as though he/she has ultimate responsibility for project success. One of the ways in which this issue can be addressed is by identifying at the outset an official project sponsor who is at a high level in the TTC and is ultimately accountable. The PfMO has recently developed a new *Project Charter* as one of its first deliverables which introduces the concept of project sponsorship, but the concept has not yet taken root within the organization.

Desired Future State & Recommendation

For accountability flow down to the project team, the culture must evolve to one where all staff on a project team, whether full or part-time and irrespective of their home functional group, report up to and are accountable to the project's leadership (e.g., from the senior project engineer, to the project manager, to the sponsor). This structure is termed a 'strong matrix' organizational structure. From there, governance aligned with a project's classification determines project leadership's levels of authority and the appropriate escalation process.

Recommendation #7 – Alter the authority of project leadership to have ultimate accountability for the project, and its team, throughout the project lifecycle. At the same time, ensure that the project team members feel responsible for and are held accountable for project success.

4.3.4 Performance Management

Current State

The success of a project is determined by its ability to deliver on the strategic objectives of the organization as they relate to that project. In order to track successful completion of objectives a robust performance management function is required.

As noted earlier, historically performance management on TTC capital projects has been focused on the standard pillars of cost, schedule and scope. Although these three areas drove most of the historical reporting, key performance indicators ("KPIs") were not used to report against targets.

Desired Future State

Class-leading organizations have a performance management framework that clearly defines expectations of project team members throughout the lifecycle of a project, including how to manage a project to the TTC's goals and strategic objectives. The frameworks are proactively managed, consistently monitored, undergo regular updating, and continuous improvement. Performance management frameworks enable proactive risk identification and are integrated with the performance management metrics for reporting and escalation.

Class-leading organizations are shifting away from focusing solely on KPIs that are limited to metrics around cost (cost performance index - CPI), schedule (schedule performance index - SPI) or scope (% changes). They are transitioning to reporting on value to the project's customer or shareholder, value that is defined through the project's objectives. This form of reporting is particularly important in the public sector, where broader objectives of a capital program, such as community building, urban regeneration or providing accessibility, cannot simply be measured in dollars spent and time saved. In the public sector, there are arguably many more stakeholders invested in the successful outcome a transit project, where impacts are felt further afield than just in the immediate vicinity of each transit station.

Analysis and Recommendation

The TTC has been through this change in reporting before, having implemented a significant overhaul of the Operations performance reporting over the last two years. The TTC's corporate objectives have driven a change in the way customer service is measured and therefore delivered. The same can be applied to the capital program.

The first step in altering the performance management framework is to develop measurable metrics applicable to the capital program that derive from the corporate strategic objectives. Once these metrics are engrained in reporting, a strong implementation program followed by a monitoring function will allow the data gathering to build continuous improvement. Implementation and Monitoring are discussed further in Section 5.8 below.

Recommendation #8 – Develop a new performance management framework for the capital program that measures success relative to the organization's strategic objectives. The framework should assess the real value to project customers and stakeholders gained throughout the project lifecycle.

4.3.5 Resources & Funding

Current State

Over the past decades, the TTC has invested funding and resources to build internal competencies in capital program management. They have dedicated resources to the creation of the PfMO and to building competencies within the EC&E Capital Programming team. The TTC has dedicated the time of senior management toward executive committees and review boards for capital projects. However, a recurring issue has been the constraint of money and resources. KPMG understands that in the immediate wake of amalgamation, the City of Toronto had an internal Project Management Office to aid capital project delivery, but the office was later closed due to budget pressures.

Gap

Developing detailed mandates of entities like the PfMO can lay the groundwork for improvement in capital program delivery, but it is not possible to execute on those goals if they are not adequately resourced. As it stands, the PfMO has been unable to deliver on the entirety of its original objectives partially because it has not been staffed to do so.

Desired Future State & Recommendation

Depending on the timelines for delivery of PfMO initiatives to advance the TTC's capital program management capabilities, additional investment will likely be required to improve effectiveness. In order to be class-leading, adequate financial and human resources are required for both the

implementation of current initiatives as well as for the successful pursuit of the TTC's strategic objectives.

Funding for a coordinating entity like the PfMO can come from either the administrative operating budget or a direct charge to projects. The TTC already uses the latter in a number of ways:

- EC&E group - charging a project management fee to all capital projects that funds the departments' functions
- TYSSE project – funding a position within the City from the project to improve response times to the project
- TYSSE, SSE and other large projects – charging program management, controls management and/or construction management directly to the project.

Having a consistent revenue source funding a coordinating entity helps it to remain viable over the long term and to be able to plan its activities with a degree of certainty. When there is not a direct charge to projects, the coordinating entity runs the risk of being subject the uncertainty of annual budget cycle.

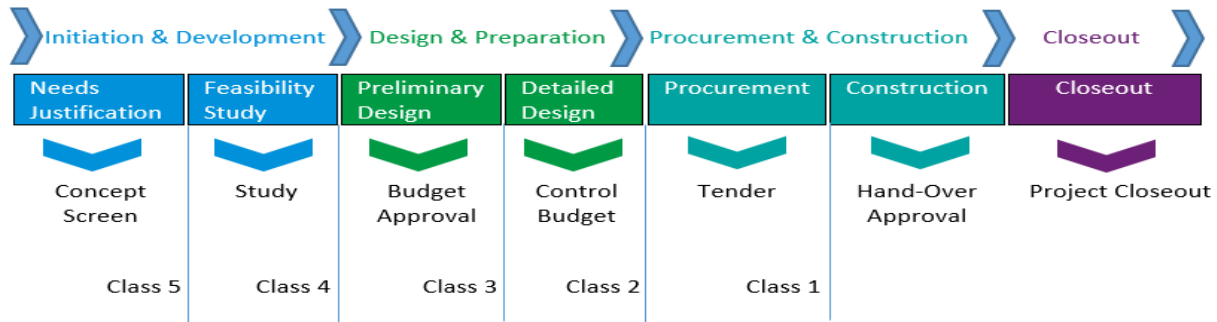
Recommendation #9 – Considering the ultimate mandate of the PfMO, develop a growth plan to estimate the investment required to meet the PfMO's stated goals. The plan should include funding source(s) for the work to be undertaken, and in assessing alternatives, strong consideration should be given to a direct charge to the projects.

4.3.6 Stage Gate Process

Current State

Neither the City nor the TTC have a corporate stage gate process for their capital programs. The TTC's ITS group created a project phase-gate review process in 2014 (and last revised in mid-2015) for all projects over \$500,000. Their process identifies four gates, the requirements to pass each gate, the reviewers involved, the process of the gate review itself and templates for documentation. An example of a stage gating map that could satisfy TTC's capital program as a corporate standard could be as follows:

Figure 11: Stage Gating Map for Capital Program



In the example above, there four groupings of gates - **Initiation & Development**, **Design & Preparation**, **Procurement & Construction**, and **Closeout** - with the first three composed of two sub-gates. All of the gates are tied to go-no-go approval decisions.

Analysis

Leading practice dictates that project governance should begin at the advanced planning phase, and continue through project procurement to construction, commissioning and final closeout phases. To help ensure that good governance is being maintained, typically there would be a hold point at major stages of the project to ask the questions of whether the project is progressing as it should be. These hold points take the form of approval 'gates' that help ensure that all project components (regulatory requirements, stakeholder acceptance, construction, and operations) are aligned and follow a critical path. A stage gate process divides a major capital project into stages, with specific points for executives and boards to make decisions, before continuing to subsequent stages. Each of these stages has different needs, the roles of individual stakeholder groups may shift at each gate, and the project leadership will need to consult differently to meet commercial and technical requirements at each gate.

Desired Future State and Recommendation

With the implementation of the Project Classification Tool, the Stage Gating process must be applicable to projects of all levels of complexity. As noted above, the governance authority of a level 1 project will be significantly different than a level 6. As shown in the sample stage gate map above, the City may have ownership of the first two sub-gates on a level 6 project because they control Project Identification and Project Planning for expansion projects. Alternatively, on a level 3 project, like a station renewal, the TTC will have authority over all gates.

When TTC projects become more complex, the variety of stakeholders involved in major decisions increases significantly. For example, in a Streetcar Way project (e.g., an intersection streetcar grand-union replacement), the project team leadership is actually the City's Department of Transportation. As another example, in a major expansion project like the Scarborough Subway Extension ("SSE"), the project planning process is owned by the City, not the TTC. In these

instances, particularly in the absence of a City stage gate process, it would be prudent if the stage gate process implemented within a City agency like the TTC, follows principles that are City-wide. Doing so would mean that whether or not a project with TTC scope was managed by City staff, TTC staff or even a third party, the governance would dictate the same stage gate process.

Following a clear stage gate process enables transparent review of project performance and compliance against set baselines. This encourages addressing lifecycle issues or risks in a proactive manner, and does so with independent oversight. Using this process with discipline helps ensure that all stakeholders, be it TTC or City staff, the construction market, politicians or the public, have access to information as a project proceeds through its gates, where it is approved to proceed as planned, is terminated, is re-scoped or is assigned additional budget.

Recommendation #10 – Develop a corporate stage gate process to govern gated approval steps to cover the entire project lifecycle. The stage gate process should be aligned with project governance that is appropriate for a project’s complexity.

4.4 Relationships & Competency

Built on a solid foundation of governance, relationships are central to the organization’s ability to engage and manage their personnel’s competencies, engagement in their work, as well as their interactions with internal and external stakeholder. The environment for positive stakeholder relationships is made possible by clear governance. The review of relationship and competency is further broken down into the following sub-categories:

Stakeholder Management	Change Strategies & Management
Organizational Structure	Competency Management & Training

4.4.1 Stakeholder Management

Stakeholder management includes both engagement and communications with internal and external project participants. In all capital project organizations, the project environments include a number of different entities, including:

- the general public;
- other orders of government (e.g. Metrolinx);
- consultants;
- suppliers and vendors;

- contractors;
- employees, and;
- City departments and divisions.

With respect to internal stakeholders, the emphasis is usually on intra-TTC stakeholders who have an interest in the project beyond its delivery. In the TTC's context, there is the added relationship between the TTC, the City and its various departments and other agencies. For this reason, the discussion on internal stakeholders has been broken into two groups along these lines.

In a public sector context, particularly for transit projects, there is added scrutiny from the general public and politicians on capital programs. This means the management of external stakeholders is critically important, as described below.

Current State: Internal – Employees

There was a clear and consistent message in KPMG's interviews that under current management, the work atmosphere has significantly improved at the TTC. Employees are motivated and want to do a good job, they are proud of the organization, and are frustrated by the sometimes negative external perception of the TTC. Part of the change in atmosphere has been the increased empowerment of employees, something that has been delegated from the executive level to middle management and ultimately to the project teams. The other part has come from the addition of new key personnel at different levels of management, who have helped foster the change. Whereas the past culture was described by some as rigidly hierarchical, staff now generally feel they are trusted by their performance managers to make the right project decisions.

Analysis

Despite this significant positive change there remain areas for improvement. The organization remains functionally siloed. At the individual level, there are unclear roles and responsibilities particularly around consultative roles outside of an employee's functional group. Although roles are generally well-defined within the processes and procedures, generally they are not contextualized in a project document, and in some cases there weren't standard job descriptions for functional roles. In the matrixed organizational structure, this can lead to an absence of leadership and the timely resolution of project issues.

Desired Future State

Clarification of individual roles and responsibilities can be accomplished as an extension of the project management framework, by creating clear roles and responsibilities for each functional job description and each project role, and relating them to a project's governance. Typically this alignment is accomplished by the development of tools such as a RACI (Responsible-Accountable-Consulted-Informed) matrix, sometimes also called a responsibility assignment

matrix. This matrix identifies stakeholder involvement in key decisions and interfaces throughout the project's lifecycle. As a further step, it may be desirable to tie performance management to meeting project objectives to these roles and responsibilities.

Recommendation #11 – Create clear definitions of individual roles and responsibilities in terms of project roles, as well as functional job descriptions, which are aligned with the corporate project management framework.

Current State: Internal – TTC & City

Historically there has been little formalized internal City and TTC stakeholder planning on the majority of projects. Where communication guidelines do exist they focus primarily on external stakeholders. By neglecting internal stakeholders there is a lack of understanding of the interfaces between the city and the TTC as well as potential impacts. The ITS group have placed a higher importance on internal stakeholder communication as this aligns closely with their role as an internal service provider. This prominence for stakeholder management can be emulated across the capital program.

Desired Future State

Internal stakeholder identification has been included in both the PfMO's new *Business Case* and *Project Charter* templates, and is a good first step in building a stakeholder management control process. Improvements can be made to the existing identification, with specific emphasis on non-TTC stakeholders that may include other City agencies and departments. Lastly, the implementation of a stage gate process could create a mandated review point where stakeholder management could be a key factor in gate approval.

Current State: External

Due to the high profile atmosphere generally surrounding transit projects, there has been considerable formalized external stakeholder planning on the majority of projects, with standard communication guidelines and tie-ins with the corporate communications function. In some cases, high profile projects have been assigned full-time communications personnel to deal with the project's requirements.

Desired Future State

External stakeholder identification has also been included in both the PfMO's new *Business Case* and *Project Charter* templates. As previously noted, the implementation of the stage gate process could create a mandated review point where stakeholder management will be a key factor in gate approval, particularly in the more transformational or disruptive capital projects.

Reporting

Although stakeholder management is improving through its inclusion in the new business case and project charter templates, there is no provision for reporting on stakeholder management within the new Project Status Report (see project reporting).

Recommendation #12 – Develop a corporate reporting standard for stakeholder management that addresses both internal and external stakeholders and reporting to them.

4.4.2 Change Strategies & Management

Current State

Changes in processes, systems and technology require that jobs be structured and performed differently. To enable and sustain lasting change, appropriate attention to a formal organizational change management process is integral to any significant project an organization undertakes. An organizational change management function was formalized corporately at the TTC in mid-2015, with creation of three permanent new positions - a Change Management Director, a Senior Consultant and a Consultant.

Analysis and Recommendation

The PfMO has been introducing strategic, functional and process-based change. Additionally, the implementation of SAP will bring significant technological change to the broader organization. There is currently no change management role or official responsibility within the PfMO, which may impede the positive objectives of the PfMO. Although a role may not need to reside within the PfMO itself, the support of the change management function is critical to accelerating the successful implementation of project management changes, and to assist in the development of a change strategy for the capital delivery program as the PfMO continues its mandate.

Currently, it is evident that the mandate and function of the PfMO is not clear to employees throughout the organization. This employee impression, from even a few internal stakeholders, can be detrimental to organizational take-up of changes being driven by the PfMO. A clear change strategy and management plan for the PfMO and its transformation projects is critical to ensure some of the following typical change goals are achieved:

- Human and personal side is addressed;
- All levels of the organization are involved;
- Clear case for change is made and advocated from the executive level;

- Culture is addressed head on; and
- Communication is clear and ongoing.

Recommendation #13 – Given the extent to which the PfMO’s strategic changes will impact the organization, make supporting the PfMO in its efforts a priority for the new change management function.

4.4.3 Organizational Structure

Current State

The TTC’s organizational structure for project delivery is similar to many other transit agencies, being functionally driven with a ‘weak matrix’ organizational structure. As discussed earlier, empowerment of the project team can be accomplished within the existing organization if governance is in place for a ‘strong matrix’ reporting, where staff report to and are accountable to both their functional managers and their project leadership. This governance could be facilitated by tweaking the organizational structure.

Analysis

Despite significant improvements in communication, information sharing and collaboration under the current management, as noted previously, the organization remains functionally siloed. Project management is performed differently and independently in EC&E and ITS, and there isn’t a group-specific project management support function for Operations. Materials & Procurement is a separate functional department that takes control of a project through the procurement process and retains the contract administration function into construction. Siloing occurs within the functional groups as well, with Engineering and Construction largely handing off projects to one another through the project lifecycle.

An opportunity to lower the barriers among the groups is to extend the shared services of EC&E’s Capital Programming department to deliver the same services (estimating, cost control, schedule, risk management, and document controls) to other groups, notably Operations and ITS. This could be done within its position in the EC&E group, or combined with the functionality of the PfMO.

The placement of major capital projects within the TTC’s organizational structure should be proportionate to their size and complexity. Large complex projects have an annual budget more than some or functional groups within the organization. As such, their project leadership could be reporting at an authority level comparable to that of equal-sized functional groups. Although not stated in governance documents, this practice takes place to some extent already in the following ways:

- Spadina Subway Extension (SSE) and Yonge Subway/Relief Line projects reporting directly to the Chief Capital Officer (“CCO”, EC&E);

- Automatic Train Control project reporting directly to the Deputy Chief Operating Officer (“COO”, Operations, Subway);
- Toronto-York-Spadina Subway Extension project reporting directly to the CEO (formerly to the CCO).

Future State & Recommendation

As it currently sits, the PfMO is a part of the CEO’s Office, but TTC management recognizes that this may not be the optimal long-term location for this office. We note that there are multiple organizational structures that have been recently adopted by transit agencies and municipalities as ways to improve capital program delivery. Aspects of some of these structures could inform decisions on the future location of the PfMO, some of which are described below.

With respect to Canadian municipalities, in early 2016 both Edmonton and Calgary are realigning their organizational structures to run major projects out of a single office which will be responsible for both the planning and execution of the range of projects being delivered by the cities. Both new offices will have responsibility for transit projects, among others. If Toronto were to follow a similar approach, the PfMO would be transferred from the TTC to this new organization in the City.

With respect to transit agencies, a number of different models have been used. Within Metrolinx, the recently formed Program Management group sits alongside the capital programs of Rapid Express Rail (heavy rail corridors) and Rapid Transit (Light Rail Transit and Bus Rapid Transit) under the Chief Capital Officer. In 2003 New York City’s Metropolitan Transportation Agency (“MTA”) created a separate entity to manage mega projects across the MTA’s various agencies – the MTA Capital Construction Company. At TfL, a Programme Management Office was created in 2012 with a similar mandate as the PfMO. Other organizations, like Boston’s Massachusetts Bay Transportation Authority, follow standardized practices for project management but have not established formal dedicated offices.

Recommendation #14 – When the TTC management determines the long-term location for the PfMO, it should consider the PfMO’s future relationship with the existing ITS PMO and the EC&E Capital Programming team (e.g., merging with one or both).

4.4.4 Competency Management & Training

Current State

As the TTC strives for excellence in competency management, it is important to recognize that based on the interviews with TTC staff, the individual competency of project leaders and management involved in capital program delivery is typically quite high for the roles they are now being asked to carry out. For example, within the EC&E group, there is an informal requirement that all project managers and some Senior Project Engineers be certified as Project Management

Professionals (“PMP”) by the Project Management Institute (“PMI”), a recognized industry accreditation.

Further, the Operations group have recently followed a practice of hiring highly experienced individuals (typically with relevant international experience) to bolster existing resources on significant projects, such as the Automatic Train Control project and the subway vehicle procurement. There is currently a lack of a corporately defined minimum qualifications for project managers, which takes into account the size and complexity of the projects. Project managers can therefore be assigned to projects for which they are not qualified.

Future State

To compete for individuals who are highly qualified to deliver transit capital projects with other transit agencies, consultants or contractors in the Greater Toronto Area, it is important for the TTC to strive for excellence when it comes to competency management both for successful project outcomes and also to attract and keep top talent in its professional ranks. In order to be class-leading, current and required competencies should be well mapped, formalized, integrated with human resources, and monitored effectively. Staff competency matrices should be in place and up to date, and personnel should be proactively engaged to progress their career toward those positions that best match their needs and skills. Lastly, succession planning should be formalized due to the numerous retirements which will be occurring in the next few years and the large capital program backlog.

As a part of its Organizational Maturity Plan, the PfMO has identified project management competency as a current initiative. Their near-term goal includes establishing minimum qualifications for program and project managers. In doing so, the PfMO should consider aligning the minimum qualifications to classification levels within the Project Complexity Tool. The PfMO also has a longer term objective to establish training requirements and toolkits for sponsors, program managers and project managers.

4.5 Processes & Procedures

Good governance is supported by detailed processes and procedures that support the organization’s ability to successfully execute a capital program and to carry out oversight duties appropriately. This section contains a series of comments on processes and procedures, and is organized in the following sub-categories:

Development, Improvement & Alignment	
Risk Management	Budgeting & Estimating
Contingency Management	Procurement Management
Commercial Management	

4.5.1 Development, Improvement & Alignment

Analysis

As a minimum standard, any organization with a significant capital program should have project management processes and procedures in place that have been developed to meet the organization's strategic objectives, user needs, as well as comply with industry best practices. These processes and procedures should be documented, centrally stored, and accessible, practical, proactively managed, and routinely communicated to users and impacted stakeholders. An approach for regular monitoring and continuous improvement should be in place and actively practiced.

As detailed in chapter 4, the functional groups that deliver the capital program differ in the maturity of their processes and procedures as follows:

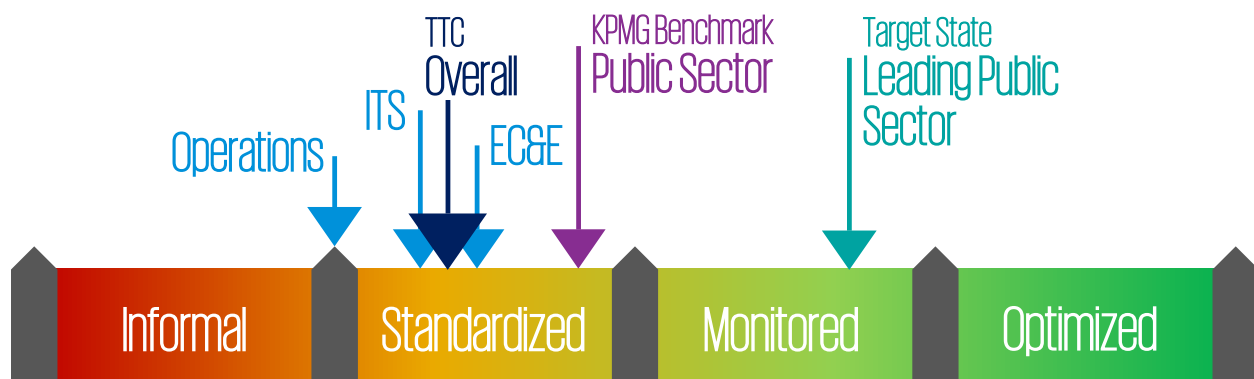


Figure 12: Maturity Level of TTC Functions:

Desired Future State and Recommendation

In order to be a class-leading organization, the TTC should function at a **monitored** level, with some key processes optimized as needed to meet core corporate objectives. Operating at an **optimized** level is typically not a financially viable target for the whole organization because the value of moving from *monitored* to *optimized* cannot be cost justifiable. The decision on a target future state becomes a management level governance decision with a cost-benefit trade-off.

The improvement program put in place should initially focus on corporate priorities and can subsequently address group level priorities. Experience indicates that implementing this program should be carried out as follows:

- Develop corporate standards
 - First by leveraging existing processes and procedures
 - Second by developing new standards to fill gaps
- Develop and/or update group level processes and procedures

Recommendation #16 – Set a corporate capital program management maturity rating target of ‘monitored’, with optimization reserved for select core corporate objectives.

Develop corporate standards - Leverage existing processes and procedures

To develop corporate processes and procedures to govern capital program delivery, the TTC does not have to start from scratch. The PfMO has already started work in this regard, by identifying gaps in the maturity of the TTC’s capital project delivery and by developing templates to strengthen existing corporate processes (e.g., business cases and management reporting). Further, there are a number of mature processes and procedures already in place within the EC&E and ITS groups that can be leveraged to assist in the development of their corporate counterparts. Both groups have created internal offices that develop and maintain these processes and procedures.

The EC&E and ITS processes and procedures that can be leveraged address the following topics:

- Project management manual/framework;
- Project execution planning;
- Estimating;
- Scheduling;
- Contract management;
- Risk management;
- Contract management;
- Quality management (including auditing);
- Change management;
- Phase (stage) gating; and
- Stakeholder management.

The PfMO should collect, assess and adjust the ITS and EC&E processes and procedures to be more broadly applicable to the capital program, by for example, tying them back to the corporate strategic objectives. These processes and procedures should be developed to be broadly applicable to all delivery models and scalable according to project complexity.

Recommendation #17 – Develop corporate standards that leverage the existing efforts of the PfMO, and ITS and EC&E groups.

Develop new processes and procedures to fill gaps

Despite the comprehensiveness of the existing work of the PfMO and ITS and EC&E groups, there will still be gaps. For example, processes and procedures addressing Contingency Management and Commercial Management have not been developed. In order to complete the development of the corporate processes and procedures, these gaps must be filled. This also should be the responsibility of the PfMO, and also tie back to the corporate strategic objectives.

Recommendation #18 – Develop corporate standards to fill gaps where it is not possible to leverage the existing efforts of the PfMO, and ITS and EC&E groups.

Develop and/or update group level processes and procedures

Corporate processes and procedures should be leveraged to develop and/or update their group level counterparts. At the group level it is important to cater to the technical requirements of the diverse functional groups. In some instances, additional group-level processes and procedures may need to be developed either because the corporate processes and procedures are new, or the group did not previously have processes and procedures in that area. Further, where group level processes and procedures already exist, they will need to be updated to reflect the policy decision which underlie the corporate processes and procedures, as well as referencing their corporate counterparts as necessary.

In all cases, the new/updated group level processes and procedures should expand on the corporate processes and procedures by relating them to the characteristics of projects delivered within each function group.

4.5.2 Risk Management

Current State

Implementation of a structured and documented risk management process should be a fundamental cornerstone of basic capital project management practice. Until recently, the TTC had no formal project risk management function. Enterprise Risk Management as a function is currently being developed corporately, but its focus is much more on safety rather than capital

project risks. For project risks, the TYSSE's risk management function has recently evolved into a part of the EC&E Capital Programming team.

Risks are uncertainties that may cause an objective to deviate from its pre-defined plan. Construction projects are often complex, and involve advanced coordination of multiple parties over long periods of time, and therefore are inherently risky endeavours. While a project's risk can never be totally eliminated, risk management by avoiding, transferring, reducing, and mitigating project risks can dramatically reduce the impact risks have on the project relating to scope, schedule, cost, quality, safety, reputation and customer satisfaction.

Risk management incorporates the planning, identification, analysis, and management of project risks and is a vital component of effective project management. As a fledgling team within EC&E Capital Programming team, the risk management function currently exists as a process unto itself. Instead, risk management should be a concept that permeates all project decision making throughout the project's lifecycle. In late 2014, the EC&E Capital Programming Risk Analysis team developed a robust project risk management plan that continues to mature. There is a clear process in place that covers planning, identification, analysis, response and monitoring and control. Process flows, tools and templates have also been created. Perhaps most importantly, the process has been developed to be scalable across levels of complexity.

Analysis and Recommendation

The ability of the plan to be implemented and have an impact on all project decision making is, however, limited by the resources available to do so. As currently structured, the EC&E Capital Programming Risk Analysis has is limited to a Director (who is also responsible for QA) and two risk assessment officers. Without a project risk management system that helps automate consolidation of risk registers across the portfolio of projects underway, there is not enough capacity to both guide the implementation of the process and consolidate the data for reporting and gaining insight into portfolio level project risks. Proper risk management supports the objective of being a class-leader. To do so requires an investment in resources, both people and technology, to implement the project risk management plan across the organization for capital projects, and to tie it into Enterprise Risk Management.

Recommendation #19 – Develop the Risk Management function into a broader practice that covers the entire capital program. Incorporate capital program risks into the Enterprise Risk Management system. Increase resources to support first the implementation of the current risk management plan within EC&E, and then more broadly.

4.5.3 Budgeting & Estimating

Current State

Inaccurate budgeting and estimating was one of the leading causes of project overruns in the 13 projects examined as a part of this review. Early in a project's lifecycle there is inherent uncertainty in the information that makes up the estimate. This uncertainty historically has not been communicated sufficiently to manage stakeholder expectations regarding the intended accuracy of the existing estimate and how the estimate will be refined as the scope and design are advanced.

Although capital project estimating processes do not exist in the ITS or Operations groups, the EC&E group has a robust estimating process in place. For capital projects in groups that do not have a dedicated estimating function (e.g., ITS and Ops), EC&E's specialist resources are sometimes consulted, but only used if requested. EC&E's process clearly defines the steps of estimate preparation, the roles and responsibilities of individuals, and the multi-phase development of estimates from early project scope definition through to construction costing. The EC&E process is leading practice compared to many organizations, as attested by a peer review conducted by the American Public Transit Association (APTA). There are however limitations that prevent it from working successfully consistently.

Analysis and Recommendation - Corporate Standards

The EC&E estimating process is not rigidly followed by all projects within the EC&E group. In some instances, projects are submitted in the annual budget process with estimates developed without input from the estimating function, either because of budget timelines or a lack of available resources. In other instances, project budgets are developed without a scope of the project having been developed which is sufficient to support generating a sound estimate. On certain occasions, these types of immature estimates are used for project approvals (which includes the establishment of the project budget). When fully implemented, the PfMO's new gated *Business Case* process will add requirements for project owners to disclose the assumptions underlying the estimate. However it will not require a rigorous process be used along the lines of the EC&E practices. Without corporatized standards for estimate development, it cannot be assumed that the adequate procedures will be followed.

Recommendation #20 – Develop a corporate standard for capital project estimating, based on the EC&E process, and suitable for the range of project complexities and delivery models.

Analysis and Recommendations - Holistic Scoping

Generally, large complex transit projects evolve into public infrastructure programs fulfilling multiple objectives such as urban renewal, improved access to underserved communities, improvement of the public realm, and upgrading aging utilities. However, the current EC&E estimating process is not designed to address broader project objectives unless they fall within

the scope of the TTC's work. Frequently, the budgets for transit projects are set before the scope of the other infrastructure components (relating to the broader objectives) are substantively defined and costed, and without risk adjustments for to deal with project unknowns. This can result in reputational damage when project costs end up higher than the original (incompletely scoped) estimate that set the stakeholder expectations.

Estimating can also involve lifecycle costs. As discussed earlier, when considering alternative procurement models, a lifecycle approach to estimating is often necessary. For procurement models that include components of operations or maintenance over a time horizon of up to 30 years, the scoping of projects must go beyond initial capital costs to encompass lifecycle costs including operations, ongoing maintenance and periodic capital expenditure (e.g. a replacement roof). Currently, the TTC capital project estimating and business case development processes do not consider initial capital costs alongside lifecycle operations and maintenance costs. In an organization with segregated Operations and EC&E departments, taking a lifecycle approach to project estimating would represent a significant change.

Recommendation #21 – Set budgets based on assumed scope and a risk-adjusted estimate that includes appropriate allowances to deal with unknowns the project teams manage and those driven by external influences that are appropriate for the stage of the project development.

Recommendation #22 – Develop estimating guidelines that ensure all estimates are holistic, including both internally owned scope and scope affected or improved by other parties, regardless of funding responsibility, and including lifecycle costs when required

Analysis and Recommendations - Communications & Stakeholder Management

As previously noted, budget approvals can be often set based on immature estimates or incomplete scope. Doing so can set unrealistic expectations regarding budget for stakeholders that put pressures on project delivery. Leading practice dictates that project announcements and final approvals should be based on a mature estimate and a comprehensive definition of a project. The environment of transit capital project delivery is one in which having mature budget estimates and fully scoped projects is not always possible. At a minimum, the inherent uncertainty of cost estimates should be communicated to stakeholders when a project is being approved.

The EC&E's estimating guidelines generally align with the industry standard AACE (Association for the Advancement of Cost Engineering) estimate classification guidelines that link estimate class to the level of project definition as well as the expected accuracy range, as follows:

Table 5: AACE Cost Estimate Classification Guidelines:

Estimate Class	Level of Project Definition	End Usage	Expected Accuracy Range
Class 5	0% to 2%	Concept Screening	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget Approval	L: -10% to -20% H: +10% to +30%
Class 2	30% to 70%	Control Budget or Tender	L: -5% to -15% H: +5% to +20%
Class 1	50% to 100%	Check Estimate or Tender	L: -3% to -10% H: +3% to +15%

If such a process is followed, project approvals can be staged as the project proceeds from a Class 5 estimate, to a Class 4 estimate, and ultimately to a Class 3 estimate, where the budget is approved (in line with the Stage Gate process (see Recommendation #10). By doing so, the City stakeholders will become familiar with the level of accuracy at various stages, including for example that a Class 4 estimate for a project can have an accuracy range of -15% to +50% (which may be a concept that is currently difficult to effectively communicate to stakeholders).

Recommendation #23 – Stage project approvals to follow key points in the maturing of a project estimate.

Recommendation #24 – Create processes and procedures around the communication of project estimates as they mature.

4.5.4 Contingency Management

Current State

Within the EC&E's estimating guidelines, the contingency is only used to cover uncertainty in the estimating process, and is removed when a 100% Engineer's Estimate is developed. Once a project moves to construction, the contingency allowance is replaced with a Contract Change Allowance ("CCA"), which is defined as work "outside the scope of the construction contract but within the scope of the contract packages". The CCA for a project is determined by applying percentages which have been developed based on TTC experience and are different for different types of projects (rehabilitation, systems work, or greenfield).

According to leading practices, contingency should be set aside to cover the costs of a project owner's exposure to the project risks. For TTC capital projects, neither the terminology nor the concept of contingency follow best practices.

Analysis

Contingency cost allocations for capital project should be an output of the risk management process and should be managed according to how it is funded. Careful consideration must be given to the use of contingency funds, as they can easily be manipulated. They are not intended to be used to fund scope changes that do not stem from an analyzed risk.

When contingency allocations are based on analyzed risks, they should be managed alongside those risks; when a risk is realized the contingency is drawn down, and when a risk is expired, the contingency is returned to the project budget.

Processes used to identify appropriate contingency allocations include:

- Project management expertise on a particular risk or situation and its potential impact on the project.
- Computer simulations of the occurrence of project risks and the potential impact to project costs, such as the Monte Carlo analysis referenced in EC&E's project risk management plan.

Processes used to draw down contingency funds include:

- Reconsideration of contingency funds needed following the expiration of a project risk or achieving a milestone associated with a contingency amount
- Progressive "straight line" drawdowns over the duration of the project.

The use of any contingency funds and changes to any contingency should require approval of appropriate stakeholders.

There are some opportunities for improving the current system. Firstly, there is no way to quantify project-specific risks, and therefore plan for them in the budget. Secondly, with a basis only in percentages based on project type – percentages that appear low compared to industry norms – the management of the CCA is at the sole discretion of the project manager, leaving the possibility that it is perceived as a project 'slush-fund'. The terminology 'Change Allowance' can confuse stakeholders and leave the impression that the allowance can be used to cover scope changes. If allocations are to be left in a budget for scope changes not contemplated in the contract, such allocation is typically called a 'Management Reserve', and that reserve can be allocated at the discretion of the project leadership or a project's steering committee, depending on governance.

Desired Future State & Recommendations

To achieve the TTC's goal of being class-leading, the TTC should leverage the tools developed as a part of the EC&E *Project Risk Management Plan* to develop risk registers for every capital project. These registers can then be used to calculate risk-based contingencies. A contingency and management reserve process must be accompanied by policy and procedure that outlines the development of project contingency management plans and provides for a drawdown reporting function.

Recommendation #25 - Develop risk-based contingency for all capital projects, with discrete risks applying to different parts of the project lifecycle. Develop contingency management policy, process and procedure to govern development and management of a project's contingency.

Recommendation #26 - Create a separate budget allocation for Management Reserve to capture project scope unknowns that are not covered by Contingency.

4.5.5 Procurement Management

Current State

Within the TTC, the Materials & Procurement ("M&P") group, and in particular its Projects department, have ownership of the procurement process for the capital program. Project control is effectively handed over to M&P during the procurement process and M&P retains ownership of contract administration throughout the project lifecycle.

Analysis

Currently, project management processes and procedures within both EC&E and ITS largely omit details around a project manager's role in the procurement process. Experience elsewhere has demonstrated that an empowered project manager should be at the forefront of procurement decision making, to ensure decisions and direction address the project's strategic objectives.

Future State and Recommendations

The planning and execution of the procurement process should heavily involve the project manager. Procurement planning provides an opportunity to document and ensure agreement on a clear and specific project scope, assess qualified and available sources, consider influences that may affect a buying decision, and develop the strategy for the procurement activities to be performed. The goal of procurement planning is to achieve the optimum balance of risk, control and funding for a project, all responsibilities related to the project manager.

The procurement activities themselves, including drafting of tender documents, responding to bidder questions, development and application of evaluation criteria, should also involve the project manager. Development of the tender documents and contract will not only baseline the cost, scope and schedule, but will also lay the groundwork for the project team's management of change, risks, quality, performance and reporting, among others.

The *Procurement Options Analysis Framework*, a tool developed by KPMG as a part of this Review (see Appendix C), involves numerous inputs from multiple stakeholders to determine the right procurement strategy, as well as real expertise and experience. It is important to support with framework with process and procedure to ensure its intended function.

Recommendation #27 - Implement procedures that help ensure that the best delivery model is adopted and appropriately managed, and that will best accommodate the stakeholder, risk and operating environment of the given project.

With the increasing prevalence of alternative delivery models, project procurement will take on an increasingly strategic role which requires the insight of the project manager. Although M&P will continue to have significant input related to market knowledge and detailed knowledge of the process and procedure of the tendering process, but ultimately the project manager, as the authority for a project, should own the procurement method decision.

Recommendation #28 – Consider making the procurement of both services and construction a direct responsibility of the project leadership.

Recommendation #29 – Expand the strategic role of procurement in the capital program delivery process by highlighting the importance of broad stakeholder engagement.

4.5.6 Commercial Management

Current State

With the recent 'project reset' of the Toronto-York-Spadina Subway Extension, the new project management team has established a new role that is unique for City or TTC capital projects – a Commercial Manager. This new role is designed to focus on managing the commercial issues of a project from inception to completion, and it requires an understanding of the economics on both sides of the owner-contractor/vendor relationship. The relationship is important because too often in construction projects, an adversarial mentality can set in between the owner and the contractor, where the contract's commercial terms become a battleground. In class-leading organizations, a project and the owner/contractor relationship is recognized for what it is, a partnership between two organizations with different but generally aligned goals for the completion of the project. A commercial management function can help structure and effectively manage that relationship.

Analysis

Some of the core concepts of commercial management are being discussed within the TTC, but only in the narrow context of developing competencies around proactive claims management. In reality, a claim is only a last resort, when an issues resolution process fails. With a strong commercial management function, many contractual disagreements can either be avoided by detailed commercial planning at the contracting stage, be identified and managed effectively during execution, or be mediated during issue resolution.

Desired Future State & Recommendation

Adding a commercial management function to manage the capital program can occur in a number of ways. One option is to develop the competency within project managers, so long as they are in control of a project throughout its lifecycle. Another potential option is to develop a shared service model where a small team serve as advisors to projects as they navigate the commercial management process. This shared service could include a commercial manager on a project team, or a commercial manager that sits above contract administrators within the M&P group's hierarchy.

Recommendation #30 - Create a commercial management function within the organization. The adaptation of the process across project classifications may range from dedicated roles on highly complex projects, to project manager or contract administrator competencies on routine projects.

4.6 Data & Analysis

The Data and Analysis theme includes the collection and management of information across the TTC's internal departments and groups, as well as with other key stakeholders like the City. A key element of successful project outcomes is making decisions based on information at the project, program and portfolio levels. Timely decision making requires having the right data at the right time to help make the right decision. The review of data and analysis is further broken down into the following sub-categories:

Data Sources & Integration

Reporting Practices & Templates

4.6.1 Data Sources & Integration

Current State

The first step in making the right decision is to have the right data. Key data requirements, data quality, frequency, and storage parameters should be identified. Clear responsibilities surrounding the development of good data including an oversight mechanism, should be defined.

In an organization as complex as the TTC, with a functional organizational structure, there is an inherent difficulty in getting a complete grasp on the sources of and integration of data. This is particularly the case when trying to aggregate data for reporting on the capital program (as opposed to an individual project). The TTC has recently paid specific attention to customer service data to improve service delivery, but has only begun to investigate ways to use capital program data in the same way.

The recent necessary transformational change initiatives depend upon data within the organization but require reprocessing of that data as opposed to collection directly from the data source. Some examples are as follows:

- Project Status Reports (“PSRs”) are unable to leverage the information already entered into the online weekly and monthly reporting forms used by the construction managers.
- PSRs require replication of cash flow data from the Business Analyst cash flow spreadsheet, and of budget information that is first processed by the Finance department.
- PSRs require MS Excel milestone schedules that are replications of the MS Project or Primavera P6 schedules.
- Risk registers are in MS Excel format that require manual consolidation to generate program or portfolio level risk reporting.
- Vendor and Tender information management is in a legacy database whose user interface makes data mining inefficient.

Desired Future State and Recommendations

To be class-leading in this regard, all data sources that are critical to capital project decision making should be identified in the project management framework (see Recommendation #5). In many cases, this data is locally held within different groups or departments and is not readily accessible for broader sharing across the organization.

Recommendation #31 – Identify all data sources that are critical to the TTC’s capital program decision making in the project management framework.

The reprocessing of the data consumes scarce project team resources. These resources can be freed up to concentrate on project management duties through the greater use of technology and tools.

Recommendation #32 – Develop a capital program data strategy that identifies capital program data requirements, and aims to collect the data at the source to minimize the needs for reprocessing of data. These requirements should be used to guide the development of an IT strategy to capitalize on the greater use of technology and tools.

4.6.2 Reporting Practices and Templates

Current State

The purpose of reporting on the capital program as a whole is to facilitate informing stakeholders. In order to be class-leading, an organization requires established communication channels and high quality information.

Historical reporting on TTC capital projects has been focused on the standard pillars of cost, schedule and scope. Key performance indicators (“KPIs”), both on the standard pillars and on measuring on the realization of broader project objectives, were not reported. As a part of the PfMO’s *Organizational Maturity Plan*, project reporting was an early priority and the new PSRs significantly increase the visibility of project status by adding information on:

- Budget;
- Probable final cost (forecast);
- Projected variance;
- High level milestones;
- Percentage of project completion;
- Issues, and;
- Risks.

Analysis and Recommendation

Further refinements are warranted, with a greater emphasis on forward-looking information (e.g., estimated remaining cost to completion, budget remaining, outstanding claims and Earned Value Management statistics) and the addition of KPIs related to broader project objectives.

Recommendation #33 – Improve the forward looking information contained within the project reporting and add key performance indicators related to broader project objectives.

In addition to improving reporting at the capital program level, an opportunity exists to streamline intermediate capital project reporting throughout the organization. For example, the existing online form used for Construction progress reporting may be adaptable to supply PSR data. Such an exercise can inform a reporting needs assessment that can be used as a part of the current pursuit of a Project Management Information System (“PMIS”) solution.

Recommendation #34 – Consider streamlining organizational reporting by leveraging existing project level reporting tools.

4.7 Tools & Technology

This theme relates how integrated systems are leveraged and applied for the planning and delivery of the capital program at the project, program, and portfolio levels. The review of tools and technology is further broken down into the following sub-categories:

Alignment to User Needs	Systems & Capabilities
New Tool Development	

4.7.1 Alignment to User Needs

Current State

Currently, there is an informal understanding of current technological needs among the groups delivering the capital program. The creation of the PfMO has driven the development of tools based on strategic objectives set out in the *Organizational Maturity Plan*. Some tools are in place, but they are often too simple to address the business needs of all stakeholders.

Analysis

It is important that the user technical needs have been assessed and validated within the organization, and are used as the basis for systems and capabilities deployment. These requirements should take into account compatibility, future scalability, resources, cost, and organizational readiness.

Early efforts are underway to define a Project Management Information System (PMIS) solution to aid portfolio reporting. Following the ITS phase gate process, a needs assessment and benefit analysis should be completed as a part of project scoping. It is important that the development of a solution is not solely driven by portfolio reporting requirements, but also from the functional needs of project leadership, functional management and other internal or external stakeholders. It is important to at a minimum define the desired future state of portfolio, program and project governance, and understand its functional requirements before embarking on a technology or tool-based solutions.

Desired Future State and Recommendation

To be a class-leading organization, technical needs within the organization should align with business needs and be integrated with human resources, budgeting, resourcing, oversight, and existing governance processes.

Recommendation #35 – Define and understand the functional requirements and complete a needs assessment and benefit analysis before implementing a technology or tool-based solution to aid in project management.

4.7.2 Systems & Capabilities

Future State

To be a class-leading organization, the systems deployed within the TTC would fully support and empower the achievement of the capital program's strategic objectives, goals and targets. These systems would be up to date, proactively managed, and meet industry standards. They would also be assessed and re-evaluated on a periodic basis. All required technology would be in place to support effective performance, and be scalable to all capital program projects.

As an agency of the City, the TTC has both the ability to align with the broader City's information systems and the freedom to adopt solutions that meet the specific needs of the organization itself. The following section briefly discusses the systems in place, their capabilities, and opportunities for improvement.

Current State - Project Management & Reporting

The TTC does not currently have a system to manage reporting at a portfolio level. Within EC&E Construction team, daily and monthly construction reporting is completed on an online SharePoint form that can create monthly reports for project managers. Reporting above a project manager requires manual Excel-based PSRs that take manual inputs from scheduling, finance, cash flow Excel reports and Excel-based risk registers. These PSRs are then manually consolidated into Excel-based executive dashboards or other ad-hoc reports.

The PfMO is currently investigating a PMIS solution to streamline and centralize some of this reporting. There are some transformative organizational implementations on the horizon, including SAP and an Enterprise Risk Management package, whose integration may dictate particular solutions.

Analysis and Recommendation

Excel-based 'smart' project reporting documents can be developed, prior to investing in a PMIS solution, that effectively act as a sole-source integrated tool for project managers. The Excel file is aligned with the project management framework, the stage gate process and scaled to the project complexity levels, consolidating information that is required throughout the project's lifecycle. Similar integrated reporting documents can also be created at the program level. The advantage of such a tool is that source information from the budgets or cash flow summaries can be used to populate reporting tools, reducing the amount of manual manipulation.

Recommendation #36 – Consider implementing an Excel-based integrated project management tool prior to a PMIS solution. This would centralize project information at the project manager and partially automate reporting.

Current State - Estimating

The estimating function within the EC&E group's Capital Programming department uses Sage Timberline Precision Estimating Extended v.9.8.0, a computerized system that can generate comprehensive estimates for all types of projects using historical TTC data loaded into its database. Although the version in use is from 2011, Sage Estimating (renamed from Timberline) software is considered a leading provider. The system is aligned to the organization's Construction Specifications industry standard numerical classification system that feeds into the project work breakdown structure (WBS). Access to the software is limited to those within the estimating function.

Current State - Materials & Procurement

The systems in place for Materials & Procurement management consist primarily of the following:

- **Company Information System (COMPIS)** - provides a means of storing, viewing, retrieving, and reporting information on companies capable of performing work for the Commission.
- **Tender Document Distribution System (TDDS)** - assists in monitoring and controlling the flow of Tender Documents and document fees.
- **Contract Information System (CONTRIS)** – in scheduling, monitoring and controlling the flow of client department requirements and inventory requirements through the tender, evaluation and award processes.

Analysis and Recommendation

While the suite of software is performing its intended function, the platform itself is very antiquated. The user interface is mainframe-based, meaning all menus must be accessed by

keystrokes and simple coding, not a mouse. This means that all outputs are of a basic format not efficiently transposable into the MS Office suite or other systems for reporting. Access is through IBM's OfficeVision, an application that offers shared document storage and management. The danger with this program is that IBM ceased supporting it in 2003, meaning customization is no longer possible and data security or access could be a risk.

SAP implementation does not include adding functionality for capital project procurement. There are risks that the current systems may necessitate a decision to upgrade. A risk assessment of the current system should be completed and a preliminary analysis of how a replacement solution may have to integrate with other IT systems being implemented in the near future.

Recommendation #37 – Complete a risk assessment of the current materials & procurement IT system and determine options for maintenance or replacement that align with corporate system implementations planned in the near future.

Current State - Scheduling

EC&E's Scheduling team maintains different levels of schedules primarily in Primavera P6. The IT PMO controls group-specific schedule templates, while other project managers across the organization operating smaller projects use MS Project or Excel as needed.

Analysis and Recommendation

At the activity reporting levels of the organization, there may be opportunities to allow multi-user input into schedules. Specialized consultancies have developed web-based tools supported by an administration program, that allow an organization to automate the process of entering activity progress and forecast data for MS Project and Primavera users. Project team members can update the progress of their activities online and the interface program allows scheduling specialists to manage automatic updating of the source schedule files. Microsoft offers similar functionality in its Project Pro for Office 365, as does Primavera with its P6 Enterprise Project Portfolio Management.

Ultimately, there are cost-benefit trade-offs in adding any of these functionalities. Doing so can eliminate some of the process duplication that takes project managers away from focusing on managing their projects.

Recommendation #38 – Leverage add-on capabilities of existing scheduling systems to automate and facilitate streamlining of the portfolio level schedule reporting.

4.7.3 New Tool Development

Current State

The scope of this Review included the development a project complexity tool and a project delivery decision-making framework. As a part of the development of these tools, a consultative approach was taken to development that included workshopping and socializing the initial concepts with a stakeholder group that included representatives of both the TTC and the City. This process should be replicated as the PfMO continues to develop more tools.

As noted previously, the TTC has set up a Program Advisory Group to provide input to all deliverables of the PfMO, and a sub-group to ultimately approve these documents. However, the sentiment of some end-users with the TTC was that they did not feel like they had been adequately consulted and informed of the organizational transformation and development of tools.

Desired Future State & Recommendation

As such, moving forward, it is important that the PfMO, or any group level entity that is implementing new process (ITS PMO or EC&E Capital Programming) follow a clearly communicated and understood consulting and implementation process that allows individual end users to feel engaged, aiding in organizational buy-in. At a high level, the process can be broken into two stages as follows:

- Consulting
 - Assessing the current state
 - Defining needs
 - Developing a future state
 - Planning and tracking progress
- Implementing
 - Executing the plan
 - Monitoring deployment
 - Evaluating the results
 - Rewarding results

The EC&E group's Capital Programming team has a similar but higher level process that can be adapted to service this broader purpose. Leveraging change management resources (see Recommendation #13) can ensure this process is developed properly.

Recommendation #39 – Develop a corporate tool development process for transformative implementation initiatives within the capital program.

4.8 Implementation & Monitoring

Effective implementation and monitoring is required to improve capital program delivery success through the recommendations in the five previous themes.

Implementation

Monitoring

4.8.1 Implementation

Current State

Prior to the creation of the PfMO, the implementation of project management initiatives has been governed by departments at the group level:

- Operations – no project management entity
- EC&E - Capital Programming
- IT - Project Management Office

Desired Future State and Recommendation

Within the EC&E group, there is an effective structure for the creation and revision of department policies, processes and procedures. This should be corporatized by the PfMO as they seek to develop corporate standards.

Recommendation #40 – Develop a PfMO-level policy that defines the process for continuously improving corporate standards.

4.8.2 Monitoring

Current State

Similar to implementation above, prior to the creation of the PfMO, the monitoring of project management initiatives has been largely governed by departments at the group level, with some corporate audit support:

- Operations – no project management monitoring function
- EC&E - Capital Programming – Risk & Quality Assurance (departmental audits)
- IT - Project Management Office (informal audits)
- Internal Audit (process compliance audits)

Analysis and Recommendation

In the past, the Internal Audit group had some involvement in process compliance, however the majority of its efforts have been focused on the TYSSE project, which has limited its ability to support the TTC capital program. The EC&E group's Capital Programming Quality Assurance Audit procedure outlines audit planning, preparation, execution, reporting and close-out. In practice, the majority of audits conducted in the last two years have dealt with construction contract payments, with only a handful dealing with other project management processes.

The governance role assigned to the PfMO will determine their role in monitoring and compliance assurance of corporate and group-level policies, processes and procedures of which there are two main options.

The first is that each group maintains a monitoring function internally, but this would require building competency in two groups, while also overlaying an advisory function from the PfMO.

The second option would be to centralize compliance monitoring, either through the Internal Audit group or the PfMO itself. Deciding between these two process owners depends on the main objective of the monitoring program and how it aligns to the objectives of the groups owning the process. The Internal Audit group as currently composed has few resources available for process compliance auditing within the capital program, and the department's objectives are more aligned to the financial auditing process. If the objective of the monitoring program is to function as a continuous improvement tool, then it aligns well with the PfMO.

Recommendation #41 – Expand the PfMO's mandate to include compliance monitoring of project management policies, processes, and procedures for groups delivering the capital program.

5 Next Steps

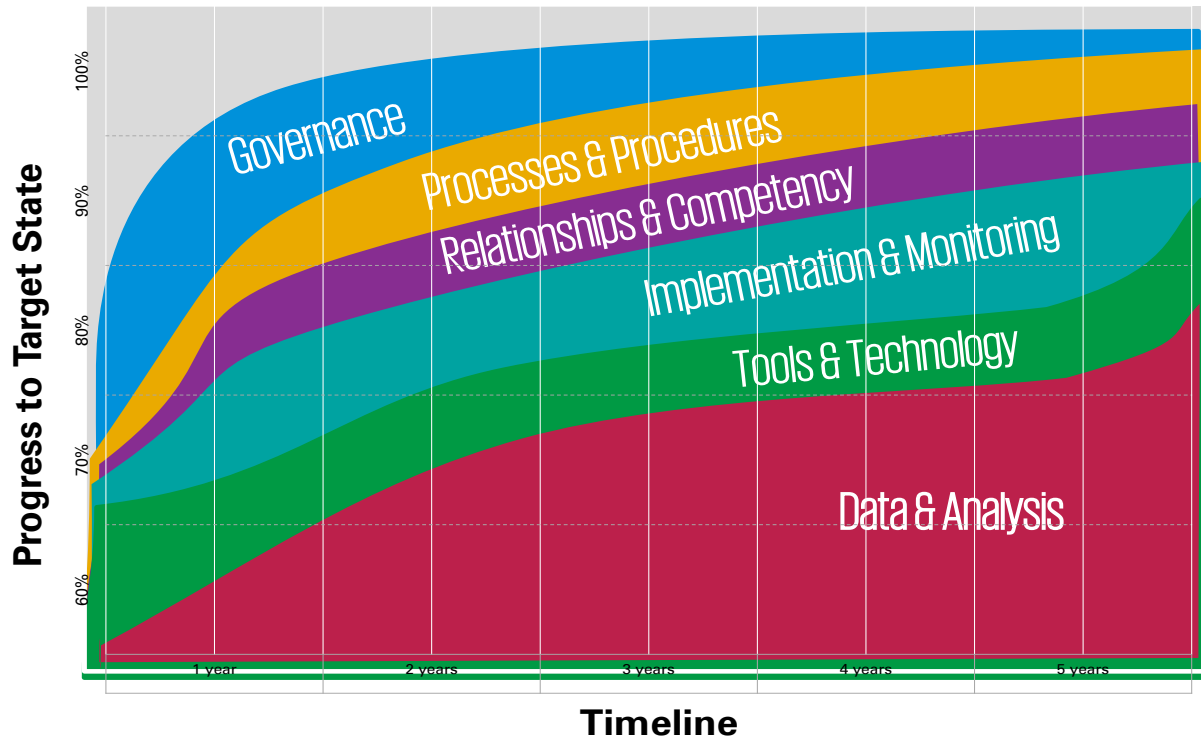
Having identified proposed future state improvements, a plan or roadmap is required to guide the development, implementation and sustainment of those improvements. The implementation program presented in this section of the report acknowledges the challenge of introducing change across a large, complex organization such as the TTC, and will form the basis of that roadmap. Ultimately, any implementation of the recommendations within this report will be decided in Phase 3 of this Review, which is being led by the City and TTC. The ability to implement the recommendations will depend largely on the resources available for execution, whether they be internal staff from the City and TTC, external consultants providing support and guidance, or specific individuals providing subject matter expertise. The following section sets out the next steps required to validate the scope and to develop a roadmap.

5.1 Progression of Themes

Prior to detailing the proposed prioritization of the 41 individual recommendations, they will need to be clustered into a manageable number of groups, or work streams. Each of these work streams would be comprised of improvement opportunities with a similar or related theme, and would be resourced by a small working group.

The grouping shown below (Figure 11) aligns with the themes discussed throughout this report. The representation below illustrates the approximate logic of progress for each theme. The curve of each theme represents the approximately progress curve for that implementation.

Figure 13 - Theme Focus Over Time



The highest level of effort to be considered in the first year should be **Governance**. Clarifying objectives, roles and responsibilities throughout the organization will set a clear backdrop for the rest of the implementation. Both governance documentation and toolkits for decision-making bodies can be clear and concise. Clearly defining roles and responsibilities may be more time consuming to communicate and document. The new business case and project charter templates can be used to link clarified corporate governance with project governance.

The advancement of **Processes & Procedures** must follow the foundation created by the clarification of governance. Much of the effort can be made in parallel to work on governance, but rollout should not occur until the governance has been finalized. Within this theme, focus should first be on developing corporate standards, which can then be combined with new or revised group-specific standards.

Relationships & Competency efforts will generally lag process & procedures. In the near-term however, this area will require extra effort to solidify staff buy-in for efforts that have been ongoing since the PfMO's creation. As noted previously, there are some pockets of the organization that do not yet fully understand the value of an entity like the PfMO, and this should be addressed before standardization efforts increase. With the recent addition of a TTC Change Management function, the first tasks can be to elevate existing efforts and prepare the organization for future changes.

Implementation logically will lag standardization and be integrated with change management. The groundwork for **monitoring** are first used for training, trouble-shooting and garnering continuous feedback. The advancement of monitoring relies to some extent on the resources available, both human and technology. The organization's target should be of a 'monitored' state, but the level of that monitoring will have to be determined on a cost-benefit basis.

Tools & Technology can advance along two streams. For tools that have recently been created, such as the project status reports and risk matrices, they can be revised and more broadly implemented in relatively short order. The development of new internal tools, like an integrated project report, can also be implemented in the shorter term but must lag the standardization of processes that define them. There are medium term needs to acquire PMIS solutions that integrate with existing TTC capital program systems. It is very important however, that governance and process needs drive the procurement of any of these systems, rather than the system being procured and driving the process.

Finally, **Data & Analysis** lags tools & technology as they are outputs from these systems. As new tools are fully implemented, the data will improve in the near term. Long-term, as the possibility arises for integrated data management in a system like SAP, the ability to acquire and analyse data relating to a project will increase significantly.

5.2 Prioritization

Once the City and TTC have validated which improvement opportunities to take forward, it is recognized that they will likely not be in a position to progress on all of these at the same time. It will therefore be necessary to prioritize in order to develop a workable schedule, taking into account the significant time commitment on the part of the work stream members, and their leaders in particular.

There are various ways of prioritizing initiatives within a change program, however KPMG's experience indicates the most appropriate method in this instance is to use a matrix of **Potential Benefit** against **Ease of Implementation**. This method of prioritization helps ensure that due consideration is given to the cost, time and effort required to develop improvements as well as to the likely benefit that would result.

- **Potential benefit** is defined as the anticipated improvement in the project control and governance.
- **Ease of implementation** is defined as the cost, effort and time needed for development and implementation of the solution.

A preliminary prioritization matrix can be seen below (Figure 14), with the recommendations colour coded by theme / work stream. This preliminary prioritization will require validation by the City and TTC to help ensure alignment with existing corporate priorities and the PfMO's Maturity Plan.

Figure 14 – Prioritization Matrix

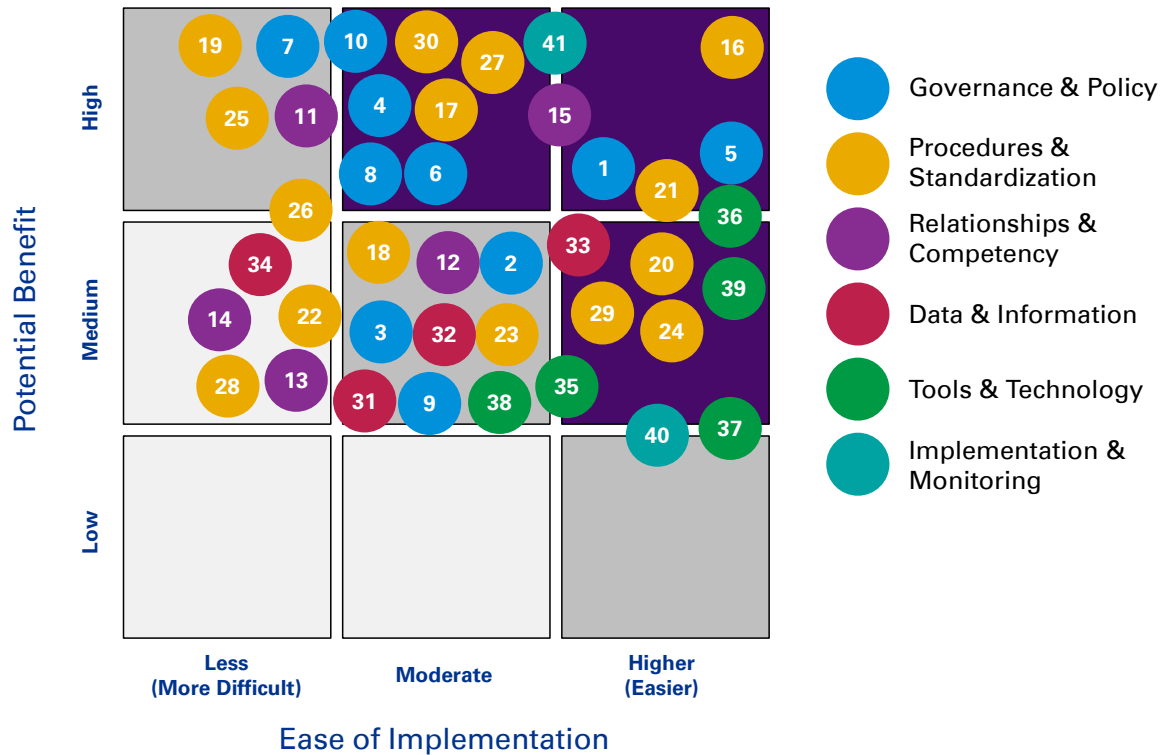


Figure 15 – Prioritization Matrix Legend

- | | | | |
|---|---|---|--|
| 1 PfMO Mandate | 12 Stakeholder Management | 23 Planning/Estimating Sub-Gate Process | 34 Consolidated Reporting |
| 2 Capital Program Strategic Objectives | 13 Change Management Resources | 24 Planning/Estimating Communication Guidelines | 35 Needs Driven PMIS Planning |
| 3 Governance Mandates | 14 Organizational Structure | 25 Risk-based Contingency | 36 Integrated Project Management Tool |
| 4 Empower Oversight Bodies | 15 Minimum Competencies | 26 Management Reserve | 37 Procurement System Risk Assessment |
| 5 Develop Governance Toolkits | 16 Setting a Maturity Target of 'Monitored' | 27 Delivery Options Process | 38 Leveraging System Add-ons |
| 6 Corporate Project Management Framework | 17 Corporate Minimum Standards | 28 Project Manager ownership of Procurement | 39 Tool & Technology Change Management |
| 7 Authority of Project Team | 18 Group Specific Standards | 29 Integrative Procurement Management | 40 Corporatized Standards Change Process |
| 8 Performance Metrics of Strategic Objectives | 19 Portfolio-level Risk Management | 30 Commercial Management | 41 Centralized Project Monitoring |
| 9 Portfolio Management Resources | 20 Corporate Estimating Process & Procedure | 31 Data Source Identification | |
| 10 Stage Gate Process | 21 Risk Adjusted Estimates | 32 Capital Program Data Strategy | |
| 11 Roles & Responsibilities | 22 Holistic Scope Definition | 33 Performance Metrics Reporting | |

The prioritization above has been divided into short-term, medium-term and long-term priorities below. The durations of the phases will be wholly dependent on the available resources and must be validated by the City and TTC. The phasing of these recommendations is a combination of the reasoning described in Section 6.1 and the prioritization as seen in Figure 13 above.

The last consideration that would impact prioritization would be the desire to implement changes as a part of projects that are already underway. It may be helpful to improve or develop governance, processes, and procedures as a part of the development of projects such as the Scarborough Subway Extension or McNicoll Bus Garage. Both of these projects are likely to be structured in ways different from traditionally delivery projects in the past (TYSSE and Eglinton Bus Garage). Therefore, some of the recommendations around governance, project team empowerment and delivery-tailored process and procedure could be developed through the advancement of these projects. The City of Vancouver used a similar process when developing the first pieces of its Project Management Manual, and Metrolinx is using the Program Management consultant on its RER program to help develop its internal Program Management processes and procedures.

Figure 16 – Phased Prioritization

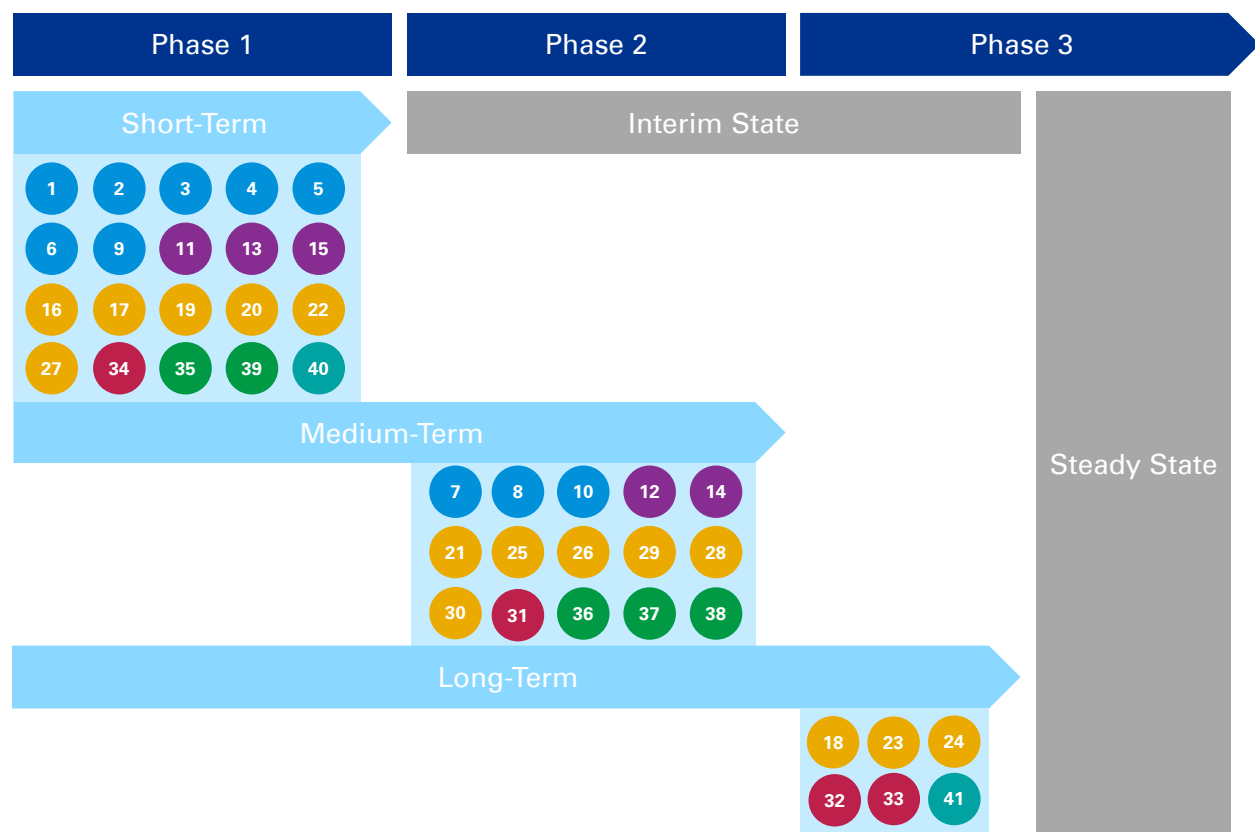


Table 6 – Potential Division of Implementation Responsibilities

Rec. #	Recommendation	Ease of Implementation	Implementation Lead		
			Enterprise	Department	Project
1	PfMO Mandate	Easy	Lead		
2	Capital Program Strategic Objectives	Moderate	Lead	Support	Support
3	Governance Mandates	Moderate	Lead		
4	Empower Oversight Bodies	Moderate	Lead		
5	Develop Governance Toolkits	Easy	Lead		
6	Corporate Project Management Framework	Moderate	Lead		
7	Authority of Project Team	Difficult	Lead	Support	Support
8	Performance Metrics of Strategic Objectives	Moderate	Lead		
9	Portfolio Management Resources	Easy	Lead		
10	Stage Gate Process	Moderate	Lead		
11	Roles & Responsibilities	Difficult	Lead	Support	Support
12	Stakeholder Management	Moderate	Lead	Support	Support
13	Change Management Resource	Difficult	Lead		
14	Organizational Structure	Difficult	Lead		
15	Minimum Competencies	Moderate	Lead	Support	Support
16	Setting a Maturity Target of 'Monitored'	Easy	Lead	Support	
17	Corporate Minimum Standards	Moderate	Lead	Support	
18	Group Specific Standards	Moderate	Lead		
19	Portfolio-level Risk Management	Difficult	Lead	Support	
20	Corporatized Estimating Process & Procedure	Easy	Lead	Support	
21	Risk Adjusted Estimates	Easy	Support	Lead	Support
22	Holistic Scope Definition	Difficult	Lead	Support	Support
23	Planning/Estimating Sub-Gate Process	Moderate	Lead		
24	Planning/Estimating Communication Guidelines	Easy	Lead		
25	Risk-based Contingency	Difficult	Lead	Support	
26	Management Reserve	Difficult		Lead	Support
27	Delivery Options Process	Moderate	Lead	Support	
28	Project Management Ownership of Procurement	Difficult	Lead	Support	Support
29	Expand Strategic Role of Procurement	Easy	Support	Support	Lead
30	Commercial Management	Moderate	Lead	Support	Support
31	Data Source Identification	Moderate	Lead	Support	Support
32	Capital Program Data Strategy	Moderate	Lead	Support	Support
33	Performance Metrics Reporting	Easy	Lead	Support	Support
34	Consolidated Reporting	Difficult	Lead	Support	Support
35	Needs Driven PMIS Planning	Easy	Lead	Support	Support

Rec. #	Recommendation	Ease of Implementation	Implementation Lead		
			Enterprise	Department	Project
36	Integrated Project Management Tool	Easy	Lead	Support	Support
37	Procurement System Risk Assessment	Easy	Lead	Support	
38	Leveraging System Add-ons	Moderate	Lead	Support	
39	Tool & Technology Change Management	Easy	Lead		
40	Corporatized Standards Change Process	Easy	Lead		
41	Centralized Project Monitoring	Moderate	Lead		

Table 6 (and Figure 16) illustrates a preliminary estimate of the ease of implementation of the recommendations, which will have a direct impact on the level of effort required. Similar entities to the PfMO that exist in comparable public sector organizations with annual capital budgets ranging from \$1-2 billion have between 7-15 fulltime staff. The groups that have seven people are responsible for frameworks, tool development, project support, and governance while the larger PfMOs also include project planning responsibilities. The actual number depends wholly on the ultimate mandate of the PfMO, which has the potential to range from a lean coordination body at one end of the spectrum, to a larger entity with an oversight role, to a larger entity that could go so far as having delivery responsibilities.

Using a phased implementation, KPMG estimates that a significant portion of the recommendations could be initiated in the near-term as shown in Figure 14 above. In order to meet this initiation milestone, it is expected that a mix of TTC staff and external consultants would be required for execution. Due to the transformative nature of some of these recommendations, the resourcing of TTC staff is particularly important to ensure organizational buy-in. KPMG has seen some instance where organizations have staffed such a transformation project as they would a real project, ensuring representation from all levels of the organization and that people's time is adequately allocated. Additionally, some of this work may be able to be developed alongside an ongoing project, to examine in real-time where gaps in current processes could be filled (i.e. developing City-TTC governance during the planning of the next major expansion project, or adapting current procurement procedures to a new delivery model like McNicoll's Design-Build). The cost to perform work over the initial phases is estimated to cost between \$1-4M depending on the mix of people and the number that are dedicated as well as the number of recommendations that are implemented.



TTC Capital Program Delivery Review

Appendix A – Project Management Maturity Assessment



**Disclaimer:**

This document has been prepared by KPMG LLP ("KPMG") for **The City of Toronto** ("Client") pursuant to the terms of our engagement agreement with Client dated September 22, 2015 (the "Engagement Agreement"). KPMG neither warrants nor represents that the information contained in this document is accurate, complete, sufficient or appropriate for use by any person or entity other than Client or for any purpose other than set out in the Engagement Agreement. This document may not be relied upon by any person or entity other than Client, and KPMG hereby expressly disclaims any and all responsibility or liability to any person or entity other than Client in connection with their use of this document.

KPMG's role was to outline certain matters that came to our attention during our work and to offer our comments and recommendations for the City's and TTC's consideration. These comments, by their nature, may be critical as they relate mainly to opportunities for change or enhancement and will not address the many strong features of the TTC's current activities and undertakings.

Our procedures will consist solely of inquiry, observation, comparison and analysis of TTC-provided information. We relied on the completeness and accuracy of the information provided. Such work does not constitute an audit. Accordingly, we will express no opinion on financial results, internal control or other information.



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A.1 Introduction

A.1.1 Project Control Model

Each year the TTC invests a significant amount of capital across a wide range of capital projects across the Engineering, Construction & Expansion ("EC&E"), Operations and IT groups. In delivering these often high-risk projects, from a portfolio perspective, the TTC operates what can be described as a 'decentralized' model of project control, whereby responsibility for how capital projects are delivered is delegated to a number of separate and largely independent groups.

The effect of this decentralization of project control is that the management of each group responsible for delivering capital projects have a great deal of individual discretion in terms of the methodologies that they implement and the oversight arrangements that they employ. The absence of both corporate support for project delivery and a focal point for reporting and performance management is a defining feature of the decentralized model of project control, and one that significantly affects the maturity of project delivery at the TTC from a portfolio level.

The size and complexity of the TTC is such that within some of the aforementioned groups, primarily EC&E and IT, there is a delegated project control model within each group more akin to an 'influencing' or 'devolved' model. There is a centralized project management capability that seeks to control performance through the provision of expert support and standardized corporate process and procedure, often combined with a performance management, monitoring and reporting role. Within the EC&E and IT groups, these project management support capabilities reside in the Capital Programming and Project Management Office ("PMO") teams respectively.

Please refer to Appendix A-A – Project Control Models for further discussion on this topic.

A.1.2 Process Control Terminology

KPMG has a project management maturity framework that was used to help assess the TTC's practices across their capital program. The high-level process control categories include the following:

- Program Strategy, Organization and Administration
- Cost & Financial Management
- Procurement Management
- Project Controls and Risk Management
- Schedule Management

These high-level categories are supported and linked to thirty-one (31) sub-categories and one-hundred nineteen (119) low-level process control categories, and scored areas. These scored areas are fundamental to delivering a successful project or program at the TTC. The framework is set out in the figure below.



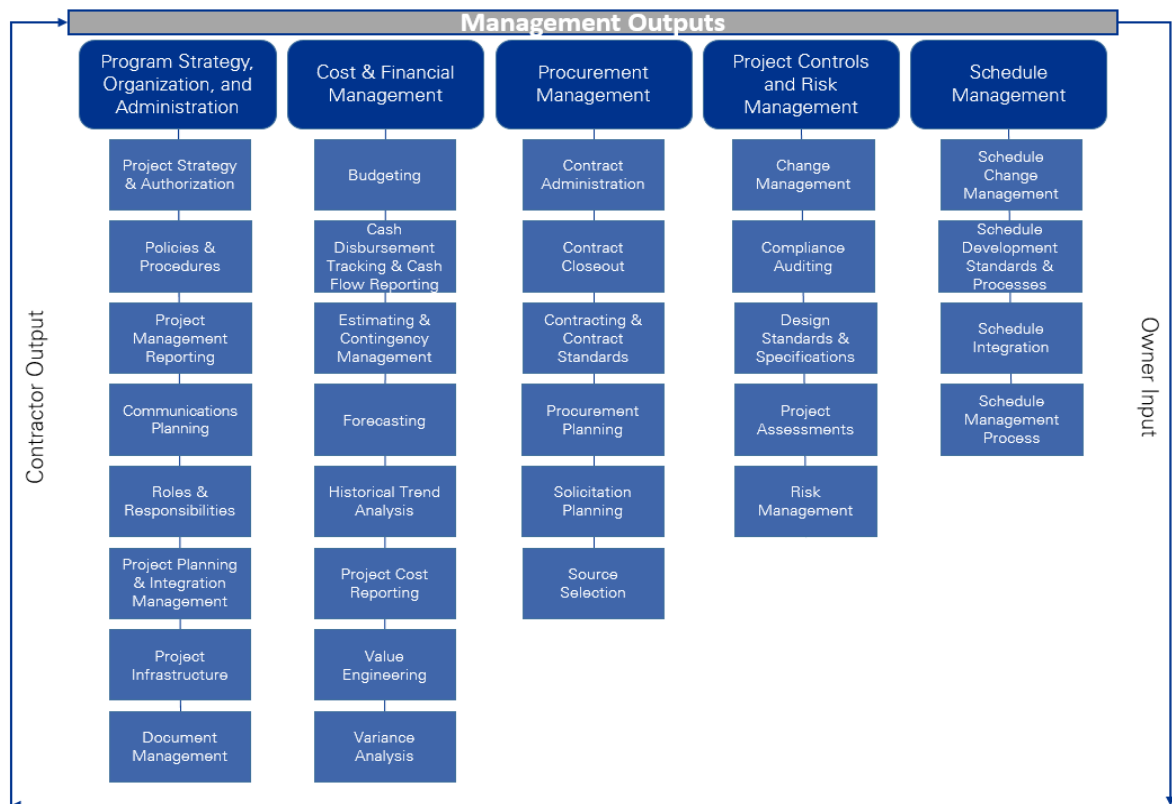
As described in the Approach and Methodology section of this report, KPMG assessed each function EC&E, ITS, and Ops against the one-hundred nineteen process control categories and rated on a one to four scale and ranked as Informal, Standardized, Monitored, Optimized.

The following section is KPMG's current assessment of the level of maturity within the Commission for each function. These controls have been evaluated against KPMG's experience of other comparable organizations with a similar capital spend.

A.1.3 Summary Maturity Assessment

The methodology used for the Maturity Assessment is described in detail in the Executive Report, Section 3.3, including a description of the rating scale and organizational requirements of moving within the scale.

Figure A.1--1: KPMG Major Projects Advisory Framework



The TTC is a complex organization with limited resources and a very demanding and diverse capital program to deliver. We have seen that there are pockets of good practice and some very dedicated and hardworking individuals. We have also seen recognition of shortcomings and a real desire across the TTC to improve capital project outcomes, but that solving these problems and raising performance levels is not within the control of any one individual department or group.



Although significant progress has been made since the creation of the Portfolio Management Office (“PfMO”), there is a general absence of corporate project management support in the form of documented process, procedure, training, coordination, and performance management. This has a profound impact upon all areas of project control and governance, and represents the primary opportunity for improvement. Within the EC&E and IT groups, their respective project management support teams, EC&E Capital Programming and the IT PMO respectively, compensate for the lack of corporate support. With no corporate project management support and no formalized group-level project management effort, the Operations group is entirely dependent on its project managers to use their own experience or their knowledge of other groups’ experience to delivery their share of the capital program. It should be noted that the majority of large construction projects planned by Operations are already handed over to the EC&E group, but that leave a large portfolio of operations and maintenance (O&M) projects, fleet procurements and some City-delivered projects with no formal project management directions.

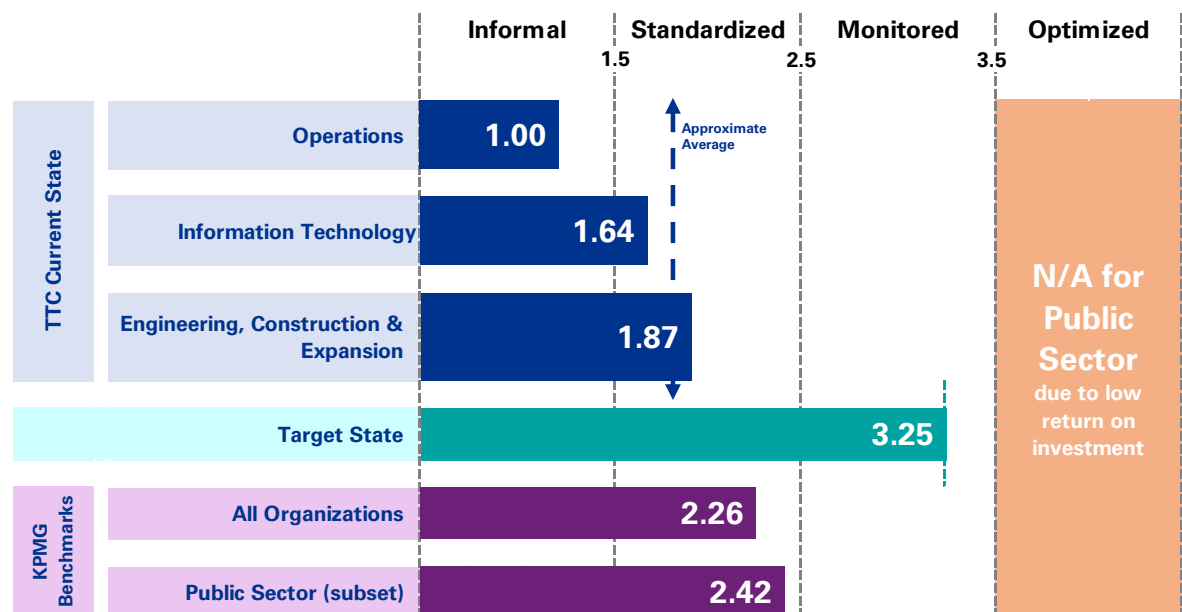
Current Mean
Process Control
Category Rating:

EC&E - 1.87

ITS – 1.64

The current overall state of each TTC function, EC&E, ITS, and Ops, can be seen summarized below.

Figure A.1-2: Summary Maturity Ratings



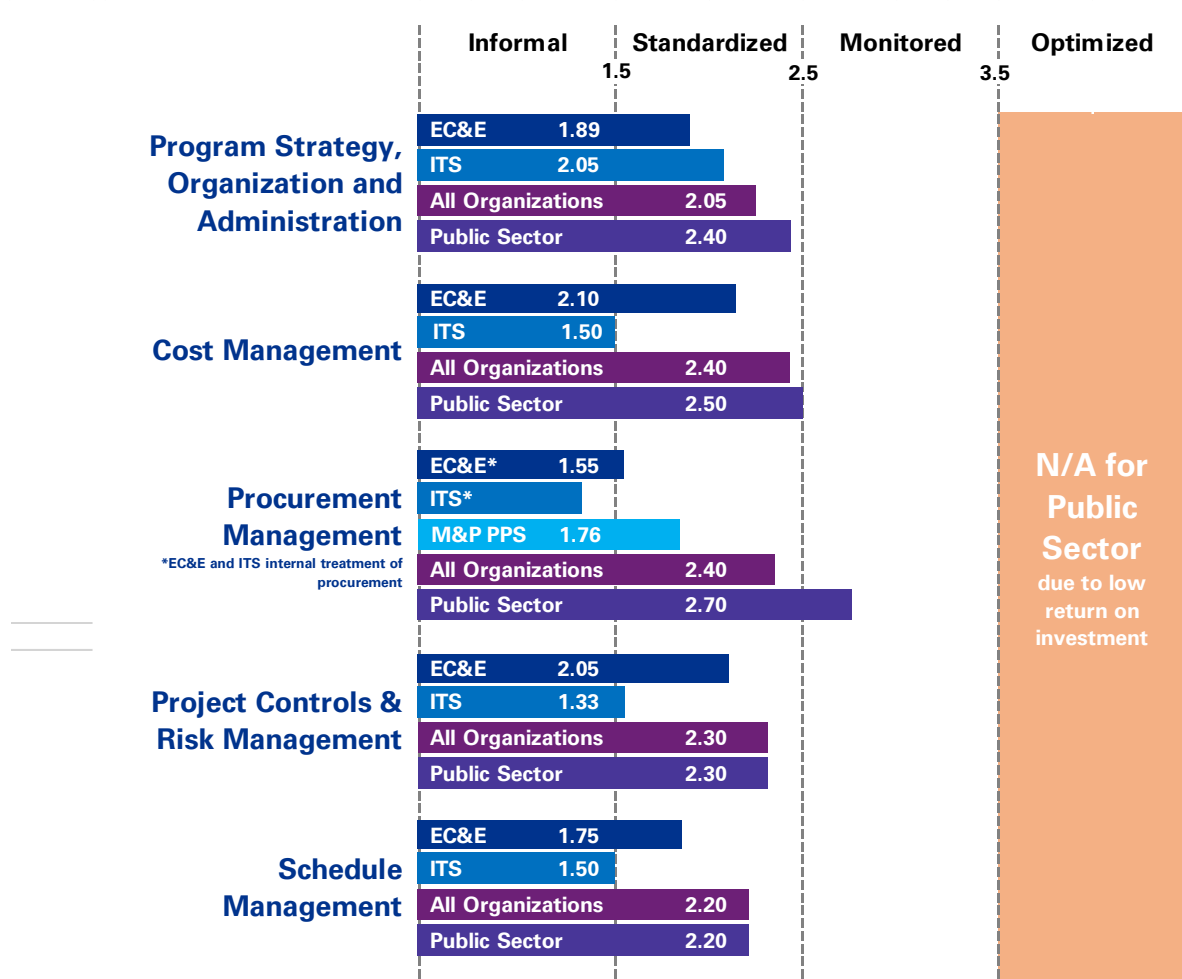
With a mean rating of 1.64 for ITS, 1.87 for EC&E, and 1.00 for Ops. Overall, TTC is operating within the lower half of the Standardized rating, which indicates that the Commission’s performance is approximately in the same band as comparable KPMG benchmarks for public sector and transit organizations.



A.1.4 Detailed Maturity Assessment

The objective of this section is to provide specific detail of each of the high-level process control categories at TTC for EC&E, ITS, and Ops in contrast to the leading practices used at comparable organizations. Following this, a detailed breakdown of the current assessment of each process control category is provided to set up a detailed identification of gaps against leading practices in the Future State Assessment. Each of the thirty-one sub process control categories are addressed in this section, starting with a high-level description about the category. It is then followed by KPMG's rating of the current state of maturity at the City using the scale outlined in the 3.0 Approach & Methodology, and presented with a narrative about the observations of EC&E, ITS, and Ops.

Figure A.1-3: Detailed Maturity Ratings





A.2 Program Strategy, Organization, and Administration

The program strategy, organization and administration encompasses the detailed project plans for the different project management knowledge areas into a coordinated and cohesive layout for execution. The areas of focus include governance, strategy, planning and integration, communications, roles & responsibilities and the policies and procedures that pull all of this together.

A.2.1 Project Strategy & Authorization

Project strategy include the formulation process, approval process, how the strategy is translated into an authorized project, and successful strategy achievement is monitored.

Current Rating	EC&E	IT	Operations
	Standardized	Standardized	Standardized
Target Rating	Monitored		
Delivery strategies are usually considered for most major construction projects but the process is often informal with minimal documentation available within project file record/archive. There is not a defined process for determining a project delivery strategy based on project characteristics. All projects are formally authorized through a formal project authorization document that and department personnel appear familiar with the purpose and details of the project authorization document.			

Detailed Observations:

As a part of the first phase of its Organizational Maturity Plan, the Portfolio Management Office ("PfMO") began establishment of an organization-wide business case development and approval process as a part of the annual budget process. The template was developed in 2014 with rollout occurring through 2015 as a part of the FY2016 budget process. Two templates have been created for projects of different sizes, as well as a process flow that defines the steps and responsible parties within the process. The Business Case includes industry-typical sections including rationale, scope, benefits, cost and ability to deliver. Each Business Case is reviewed by the Executive Project Review Board ("EPRB") as a part of the budget process as a screen before being approved for inclusion in the TTC's budget submission.

This new process and documentation is a significant improvement over the previous annual *Project Summary* and *Project Expenditure Summary* submissions. The *Business Case* document has significantly more detail than the previous *Project Summary* and the review process attempts to ensure proper vetting of projects. The process outlines that Business Cases should be vetted at the Group level, with input from Finance, before submission to the EPRB for final consideration.



The new *Business Case* process can still be considered mid-development, as not all of the supporting documentation, policy and procedure to bolster the process has been created. In some cases, departmental project development procedures have been updated to incorporate the new process, such as within ITS, but for the most part the new process has not been fully integrated into standard documentation across the organization.

The *Business Case* templates do not address project delivery options from the standpoint of procurement methods as historically almost all TTC capital projects have been delivered with a traditional Design-Bid-Build (“DBB”) format.

The PfMO’s Organizational Maturity Plan described the Business Case process as a gated process, but in its current iteration, it is the only corporate project gate. A well-defined ‘Phase Gate’ process does exist within the ITS group.

The ITS group’s ‘Phase Gate’ process (PM-121-01) was developed in 2015 and ensures required documentation has been approved before a project passes the gate. The ITS group’s *Master Project Plan* also addresses ‘Project Strategy’ and ‘Implementation Strategy’. There is no formalized gated process within the EC&E or Operations groups, and neither group has an equivalent document to the *Master Project Plan*.

It should be noted that all projects examined in the course of this Review were developed with the earlier *Project Summary* documents.

Recommendations for Consideration
▪ Use ITS Phase Gate process as a starting point to develop an organization-wide Stage Gating process that can be used for all projects. For Level 5-6 projects, this will need to involve the City as well. ▪ Develop a risk-based project execution decision process as a part of the Stage Gate process and using the Project Complexity Tool ▪ Consider evolving the ‘Project Summary’ document into an annual review of the Project strategy, giving more details relating to success of the project in achieving its goals as stated in the Business Case and Project Charter. ▪ Rationalize the Project Summary and Project Expenditure Summary sheets with the new Project Charter documents and reporting templates. ▪ If an approved Project Charter is the new project authorization document, ensure that existing standards are modified to suit this process.

A.2.2 Project Planning & Integration Management

This area assesses the planning process of a project including the development of a project plan (scoping, organization, business objectives, delivery strategy, schedule, preliminary budgets and schedules) as well as the execution plan and consideration for project integration.



Current Rating	EC&E	IT	Operations
	Standardized	Standardized	Informal
Target Rating	Monitored		
Formal and informal project planning and project integration management is utilized on some major construction projects that includes established project plan development, project plan execution, project integration meetings and limited integration issues documentation.			

Detailed Observations:

Project planning and integration is typically driven by two documents and their component parts – the Project Charter and the Project Execution Plan ('PEP').

A Project Charter is intended as a tool that accomplishes the following:

- Promotes common understanding and acceptance of the reason for undertaking the project and the objectives to be achieved by the project,
- Manages expectations of what the project is to deliver, and
- Provides a basis for objective measurement of the success of the project.

The project charter is often included in the PEP as an executive summary of the plan. The PEP is the core document for the management of the project. It is a statement of policies and procedures defined by the project sponsor, and usually developed by the project manager for the project sponsor's approval. It sets out, in a structured format, the project scope, objectives, and relative priorities and it contextualizes corporate and Group policies and procedures in

Within the TTC, historically the function of the Project Charter has been fulfilled by the *Project Summary*, although it did not clearly communicate the reason for undertaking the project, did not provide a basis for measurement of success, and was not a document that was approved by a project sponsor. In fact, historically the role of sponsor did not formally exist within TTC capital projects.

As with the *Business Case* document, a new corporate *Project Charter* template was created as a part of the first phase of the PfMO's Organizational Maturity Plan. The template is still in development, but builds upon the new *Business Case* documents. At this point, a process flow and accompanying procedure is planned, but has not been completed.

As created, the *Project Charter* template includes many of the items missing from the *Project Summary* and is a comprehensive document. The template does go further however than a typical charter, and includes a number of sections that are more commonly found in a PEP, such as a communications strategy and project-specific change control process.



These two sections are more commonly found in a PEP, like the IT Group's *Master Project Plan* ('MPP') document. According to the IT Group's *Solution Delivery Principles* (v1), a MPP is required for all Level 2-3 projects (according to their project classification). The MPP's content includes management plans for the communications and change control pieces seen in the *Project Charter*, but also covers a detailed project strategy, or plan, that details project-specific management of risk, purchasing, quality assurance, implementation, and training. Neither the Operations nor the EC&E Group has a formal PEP document requirement.

The *Project Charter* dedicates a section to Project Interdependencies (section 7), but there is not an accompanying policy or procedure, either corporately or at the Group level, that creates a framework for managing interdependencies and integration between either other TTC projects or broader City projects.

As the *Project Charter* document is still being implemented, there is not currently a monitoring, control or audit function related to whether it is being used properly or consistently.

Recommendations for Consideration

- Consider either dividing new Project Charter template into two documents, Project Charter and Master Project Plan (to use IT terminology), or making Charter a sub-section of the Project Plan, so that it's intended purpose as a Sponsor document is clear.
- Develop a corporate Stakeholder Management policy that addresses the management of interdependencies, as it has been a recurring issue impacting both time and budget on the projects reviewed.

A.2.3 Policies & Procedures

This area assesses whether there are formal corporate or Group policies and procedures that govern projects in areas of development, approval, accounting, finance, procurement, risk management, and communications to name just a few. It also assesses whether the different policies and procedures are aligned across Groups, aligned with corporate objectives and inter-referenced for the benefit of the project managers.



Current Rating	EC&E	IT	Operations
	Standardized (high)	Standardized (medium)	Informal
Target Rating	Monitored		
Formalized policies and procedures for most core and support project management process areas exist within most Groups. The maturity across Groups differs, ranging from little to no formal policy to detailed standardization with some monitoring functions. Corporately there is little no organization-wide policy. Where there is policy and procedure present, generally there is evidence of some auditing for compliance and ongoing continuous improvement.			

Detailed Observations:

In April 2014, the TTC established a Program Advisory Group, or committee, and presented the PfMO's preliminary analysis of key program management gaps in the organization. Some of the quick wins identified included the establishment of some corporate standards in five areas that are in various states of development: *Business Case*, *Budget Change Request*, *Executive Program Update*, *Project Charter*, and *Project Status Report*.

These documents represent the first organization-wide standardized documents for Capital Project Delivery, and the policies and procedures that govern them are still in development.

EC&E

The majority of the major Capital Program projects are delivered by the EC&E group, whose Group-specific policies and procedures are relatively comprehensive, with a revision history that shows continuous improvement and an annual audit plan that shows some evidence of compliance monitoring. The EC&E Group's plans and procedures library contains 24 documents, with further work instructions including:

- Group-wide work instructions – 9
- Engineering department – 9
- Construction department - 65
- Capital Programming department - 10

Although the documents are generally each very detailed, they only detail the specific process being considered and typically only contemplate EC&E's role after procurement has been completed. The EC&E Group does not have an over-arching project management manual that ties the multitude of policies and procedures together that shows how they interconnect over a project's lifecycle. Without a formalized project plan document, it also is not possible for these policies and procedures, or a project management manual, to be contextualized within a certain project.

EC&E group's project and construction management policies and procedures are specifically tailored to a Design-Bid-Build delivery model because that has historically been



the method of choice for all TTC capital projects. In the last two years, the TTC has embarked on a project reset of the ATC Signalling contract, adopting a modified Construction Management ('CM') model, while the McNichol Bus Garage is being planned as a Design-Build ('DB'). Both projects have experienced trouble using DBB-focused processes and procedures for new and different delivery models. The lack of experience in alternative delivery models extends to the City, where processes around site planning and approvals are also not easily adaptable to the unique procurement characteristics of a model like a DB.

Lastly, without a project classification framework, there is not a differentiation within the EC&E Group's policies and procedures for differing project characteristics, whether that be complexity or size. Without standardized differentiation, there is no method by which to tailor any of the processes to projects of different classification levels. For example, policies and procedures as they exist do not differentiate their application on \$50,000 tank replacement project as opposed to a \$500M LRV barn. For more details on KPMG's proposed project classification tool, see Appendix C.

IT

Much like the EC&E Group, it is evident that the IT Group has spent significant time in the last couple of years improving its policies and procedures, with ownership concentrated within the IT Project Management Office. Almost all reviewed documents have been either revised or introduced within that period. Of the documents that exist within the PMO library on their internal SharePoint site, each document typically includes a template and accompanying guideline, process or procedure.

Additionally, the IT PMO has an over-arching *Project Management Manual* ("PMM") that operates as a set of guidelines for management of a project through its lifecycle. Although most important areas of project management (using PMBOK as a basis) are covered, they are not discussed in detail, and guidelines are limited to inputs, outputs, general responsibilities and recommended guidelines (i.e. best/common practices). The *PMM* does a good job of laying out the entire project lifecycle and identifying the project manager's role throughout each phase from development through closeout, but it does not discuss the implication of IT projects for construction or interfaces and interdependencies.

It should also be noted that for major expansion projects like the Toronto York Spadina Subway Extension ('TYSSE'), the majority of the delivery team is composed of consultants. When these consultants are contracted for roles such as Program Manager, Controls Manager or Construction Manager, they bring with them their own project policies, processes and procedures that must align with TTC standards, but are independent. As the YYSSE was not within the scope of this detailed review, none of these consultant-driven project-specific policies and procedures were reviewed. But even with them in place, it is important that there remains a robust set of corporate policies and procedures that the TTC can use as a minimum standard for the consultants it employs to deliver some of its larger projects.

Recommendations for Consideration	
▪ Corporatize the EC&E policy and procedure change management procedure to apply to all capital program policies in order to make development, consultation and approval process transparent to end users. ▪ Create policy, process and procedure supporting recent templates including the Business Case, Budget Change Request, Project Charter and Project Status Reports. ▪ Create a set of corporate minimum standards for capital program management Policy, Process and Procedure. Leverage existing EC&E and IT documentation and generalize them for broader application. (i.e. Master Project Plan, Project Management Manual, Estimating, Scheduling, Risk Management Plan, Contract Management, Change Management, Quality Management) ▪ Create new corporate minimum standards for functions that do not currently exist (i.e. Capital Planning, Stakeholder Management, Cost Management [Earned Value & Contingency], Commercial Management) ▪ From minimum standards, develop new group-specific standards where they do not exist. (i.e. a full suite for Operations). ▪ Ensure that both minimum and group-specific standards are scalable for different levels of Project Complexity and tailored where necessary to different delivery options. ▪ Formalize policy and procedure training and consider centralizing within PfMO. ▪ Align and corporatize audit guidelines for capital projects and determine sharing of function between PfMO (or other centralized entity) and Internal Audit.	

A.2.4 Project Management Reporting

Activities that are not reported or measured often are not performed. Ongoing monitoring and measuring of stakeholder engagement and satisfaction is a key metric for success of the project.

Current Rating	EC&E	IT	Operations
	Standardized	Informal	Informal
Target Rating	Monitored		
Project reporting is undergoing change at the higher levels within the TTC with an ongoing overhaul of portfolio reporting. Historically, the lack of depth in reporting has resulted in ongoing requests for ad-hoc reporting. At the lower levels of the organization, some reporting has been automated, although the reporting the next level above is not formalized to the same extent.			



Detailed Observations:

Historically, detailed executive level reporting of capital projects was limited to the annual *Project Summary*, being the only location that compared actual costs to planned costs. Within the older *CEO Reports*, only 'Part 5 – Critical Projects' dealt in detail with the capital plan. Additionally, reporting was limited to a couple of paragraphs on six of the largest projects. There was no data reporting on progress of cost or schedule, no commentary on risk and no analysis of KPIs.

PfMO

In August 2015, the PfMO rolled out a new *Project Status Report* template and process to provide standardized status updates on capital projects and programs across the TTC. The new document adds inputs into standardized reporting at multiple levels, contains previously missing insight into budget progress and forecasts, and highlights risks and issues. Below is a listing of some of the focus areas included and absent in the new PSR:

Included	Absent
▪ Budget (no distinction between 'original' and 'current') ▪ Probable (effectively 'Forecast') ▪ projected Variance ▪ milestones, visually by quarter (no dates) ▪ Project Interdependencies ▪ % complete (progress) ▪ Issue / Risk Escalation	▪ Estimate to Complete ▪ Budget Remaining ▪ original Completion Date ▪ Forecast Completion Date ▪ # and \$ of Contractor Claims ▪ # of Project Reworks ▪ % or # Change Orders ▪ Earned Value statistics

The *PSR* is used to feed into a number of new dashboards, representing projects that are classified as 'Assets' or 'Growth' strategic objectives. Dashboards include those for the Executive Committees of Assets & Growth, Finance & Administration and Risk & Governance, as well as the CEO Dashboard. These dashboards effectively communicate the main areas listed as 'Included' in the table above, in a process that did not previously occur.

Although the information contained within the new *PSR*, and subsequently fed into the *Dashboards*, is significantly more detailed and useful than information previously reported to the higher levels of the organization, the consolidation of this information is still a manual process. The PfMO alone is responsible for collecting and consolidating the information, a task that takes up valuable staff resources that could otherwise be progressing more actions identified in the Organizational Maturity Plan. An additional difficulty with the portfolio-driven reporting is that the lower levels of the organization have yet to fully buy into process, not yet understanding its usefulness for streamlining reporting. In some cases, the new *PSR* process now works in parallel to other reporting processes within specific Groups, creating some duplication of effort. This duplication can have a negative impact on employee time as well as lessening confidence due to differing conclusions in different reports.



EC&E

The EC&E Group has very specific work instructions for both Daily Progress Reporting (SWI 77-01) and Monthly Progress Reporting (SWI 80-01) for the Construction department. These reports are generally comprehensive, but do not have all of the details reported in the new *PSR* templates, although some would come from. The EC&E reporting is automated in the sense that it has an online database with web-based data entry. This allows construction reports to be easily accessed by the Project Managers to create higher order reports like the *PSR*. Cash flow information that would feed into these reports comes separately from the Cost Controller within EC&E Capital Programming, while financial data comes from Finance, with a 3-week lag.

EC&E Group processes and procedures have not yet integrated the new *PSR* template, and there are no guidelines for how the *PSR*, or any other reporting, is to be used for the management layers between the Project Manager and the PfMO, including the head of Project Management and the Chief Capital Officer.

IT

The IT Group's *Project Management Manual* has been updated to include reference to the *PSR*, but reporting is not otherwise described in detail, including responsibilities or frequency. The *PSR* is not included in the *Project Deliverables Catalog* and reporting is not a part of the *Project Phase Gate Review Process*.

Recommendations for Consideration

- Investigate the adaptability of the EC&E weekly and monthly form-based reporting tool for broader use for *PSRs*.
- Ensure that relevant group-specific policy, process and procedure is updated to reflect the new *PSR* as the primary management reporting mechanism.
- Develop compliance function for reporting. This process may be automated if an online tool or new PMIS solution is used in the near future.
- Consider adopting Earned Value ("EV") reporting. This may only be possible on projects of a high enough classification that the contractors are mature enough to be capable of EV reporting.
- Study options for the consolidation of reporting. If information typically requested in supplemental reports cannot be incorporated into the new *PSR* templates, then standardized (and if possible online) templates for other types of reports should be created with directions as to their use and approvals.
- Consider expansion of *PSR* reporting to include the following: Estimate-to-Complete, Budget Remaining, original Completion Date, Claims, # Project Reworks, # or % Changes, EV statistics



A.2.5 Stakeholder & Communications Planning

Establishing a strategy for managing stakeholders is the platform to drive the engagement plan and engagement methodology for stakeholder management. Managing stakeholders requires both roles and responsibilities that are clearly defined, and constant attention paid throughout the lifecycle of a project. Communications planning also includes documentation of lessons learned that can facilitate smoother project delivery in the future.

Current Rating	EC&E	IT	Operations
	Standardized	Monitored	Informal
Target Rating	Monitored		
Formal and informal communication plans appear to be developed for all major projects, but they typically include limited documentation and information. Within some Groups, formal communications plans are updated and may include project communication matrices, stakeholder analysis and meeting matrices for the communications plan with some feedback from stakeholders for process improvement.			

Detailed Observations:

City

A critical stakeholder for capital projects is the City, be it City departments or other agencies. The vast majority of TTC capital projects require interfaces with the City, whether the City is a service provider (permit approval), project partner (construction coordination) or supplier (Transportation managing surface track replacement projects). Governance of this relationship is dealt with separately within this report.

After reviews in 2007 and 2008, the City created the Major Capital Infrastructure Coordination Office ("MCIC") to guide the multi-year coordination of infrastructure planning, design and construction on behalf of City divisions, utilities and other organizations. Its key activities include inter-divisional capital coordination, inter-agency coordination and the development of co-ordination tools and techniques. There is not a mirrored entity within the TTC, although arguably this is within the mandate of the PfMO.

On the TYSSE project, a City staff position was funded by the project as a way to streamline City approvals at the staff level. This position would be helpful on an ongoing basis to support all transit projects, be they TTC or Metrolinx delivered.

PfMO

There are no existing corporate policies around capital project stakeholder and communications planning, nor are there specific policies within Operations relating to capital projects. There are currently no standardized distribution list for projects, but lists or matrices are often produced by PMs on a project-by-project basis.



The new *Project Charter* document has a section for Communications (section 12), that includes a listing of stakeholders, their information needs, the format and timing, and the responsibility. It is not possible to gauge whether this section is sufficient to improve stakeholder communications on TTC projects, as implementation is ongoing.

Within the last two year, a Customer and Stakeholder Executive Committee has been created, but the *Dashboard* reporting document reviewed by this group does not address stakeholder issues for projects identified.

Stakeholder management would be a key aspect of a stage gate process, but as previously discuss, this process does not exist corporately, or within the Operations or EC&E Groups.

EC&E

A *Communication Guideline* procedure exists (CDI-07) for the Construction Department that outlines roles and responsibilities of the Project Manager, Senior Project Engineer ("SPE") and Construction Site Manager ("CSM"), and that media and public stakeholder communications must be facilitated by Corporate Communications. This procedure suggests a 'communication strategy' can be developed, but gives only vague guidelines for its content.

Stakeholder objectives are only briefly mentioned in the Project Management procedure (ECP-02) and the EC&E processes and procedures do not have a specific document dealing with stakeholders.

Stakeholder management and communications have been particularly important for the McNicoll bus garage project. In support of their needs, the team created a framework to quantify the changes related to stakeholder feedback/requests. In the absence of policy to develop a strategy for dealing with stakeholders, in this instance the project team had the experience to manage the issue themselves.

ITS

Within the ITS group, there is a greater focus on stakeholder management, principally because ITS functions as a service provider within the organization. It therefore needs to ensure that the customer, in this case TTC employees, are engaged in the development and implementation of the IT Group's projects. It should be noted however that these stakeholders are largely internal, meaning they are somewhat easier to control than external stakeholders on other capital projects are. Within the *PMM*, section 7.1.2 (Identify Stakeholders) outlines the process of identifying stakeholders and documenting their "interests, involvement, and impact on success". The process identifies IT inputs that include the project Definition Document, Feasibility Study and project Charter.

The *PMM* contains the section 'Plan Communications' (section 8.1.14) that defines the process of determining project stakeholder information needs and defining a communication approach. The output of this process is the *Master Project Plan*, of which the Communications Plan is a subsection, although the *PDC* lists the *Communications Plan* as a separate document. The template available on the ITS SharePoint site includes sections on Review/Approval, Internal and External Communications, Key Messages, and



Methodology, which includes matrix of purposes, frequencies, audiences, etc. The *PDC* also identifies reviewers and approvers of the Communications Plan, but does not address broader distribution.

Recommendations for Consideration

- Investigate the adaptability of the EC&E weekly and monthly form-based reporting tool for broader use for PSRs.
- Ensure that relevant group-specific policy, process and procedure is updated to reflect the new PSR as the primary management reporting mechanism.
- Develop compliance function for reporting. This process may be automated if an online tool or new PMIS solution is used in the near future.
- Consider adopting Earned Value (“EV”) reporting. This may only be possible on projects of a high enough classification that the contractors are mature enough to be capable of EV reporting.
- Study options for the consolidation of reporting. If information typically requested in supplemental reports cannot be incorporated into the new PSR templates, then standardized (and if possible online) templates for other types of reports should be created with directions as to their use and approvals.
- Consider expansion of PSR reporting to include the following: Estimate-to-Complete, Budget Remaining, original Completion Date, Claims, # Project Reworks, number or percentage of Changes, EV statistics.
- Develop TTC-City communications guidelines that support a Stage Gated estimating and scoping process, particularly for level 5-6 projects.

A.2.6 Roles & Responsibilities

Much like governance, roles & responsibilities can be described at multiple levels of the organization – at the City / TTC interface, within the TTC at the executive and management levels, and at the project team level. It is critical to have clearly defined roles and responsibilities at each level so that accountability for decisions can be traced up and down the organization.



Current Rating	EC&E	IT	Operations
	Standardized	Standardized	Informal
Target Rating	Monitored		
Project roles and responsibilities are generally clearly defined at the project level including limited project job descriptions and the use of project organizational charts. Corporately, organizational charts and signing authority limits are clearly defined, but the accountability for decision-making is not as clear if it is not explicitly linked to a dollar value. At the City / TTC interface level, roles and responsibilities related to certain decisions are not clearly defined, which cascades uncertainty about decisions downwards through the organization.			

Detailed Observations:

The TTC has a clear organizational chart across all groups. Project organizational charts are incorporated into the TTC organization structure for large projects, but other project organization charts are typically created on an ad-hoc basis. Generally, project documents do not appear to show project organization charts that include project team members across departments. The new Business Case templates include internal and external stakeholders, but do not relate that to accountability through an organizational chart. The new Project Charter includes section for Project Governance Structure (3.1), to which a project organization chart could easily be added.

There are not defined program and/or project roles and responsibilities that are standardized across the organization. Some existing terminology for projects roles is inconsistent between delivering groups. As such, there is not a documented project or program responsibility matrix that outlines individual, departmental and vendor/stakeholder responsibility, accountability, involvement and communication for each project/program activity throughout the project lifecycle, either within specific groups or across the organization. The IT group's *MPP* includes a section on Roles and Responsibilities (12.2) with a matrix limited to role and responsibilities, but without the ACI (accountable, consulted, informed) references. To achieve leading practice, RACI (Responsible, Accountable, Consulted, and Informed) matrices should be used throughout the organization. As a new process, this should likely be implemented from the PfMO, and will interrelate to the new Business Case documents, Project Charters (and/or Master Project Plan) and the PSRs. The RACIs should be aligned with Project Risk Classifications and require identification of relevant internal (City) stakeholders and their roles.

There are documented project signature authority guidelines that are standardized across the organization. Requirements for approved signature authority are a part of the budget process but not enshrined in project documents like the IT group's Master Project Plan. Authority for decision-making is less clear if the decision is not specifically related to a dollar value, something that will be partially addressed by the formalized introduction of project



sponsorship with the Project Charter. The next step would involve formal empowerment of the project teams with delegated decision-making authority.

As more projects are delivered in the level 4 to 6 classification, it may be useful to review organizational Authority Levels. The M&P document citing Authority Levels was last updated in 2012 and includes a scanned page likely updated many years earlier, suggesting values may not be relevant for the current capital program. As noted above, this should occur parallel to the development of Project Risk Classification and be driven by the varying governance requirements of different types of projects.

Without a responsibility matrix, there is not a standardized list of project stakeholders/interfaces for capital program delivery. The Master Project Plan does not address interdependencies, but the new Project Charter has sections on Internal (10.1) and External (10.2) Stakeholders and Interdependencies (7.0). These sections, however, do not contain a guiding list of interfaces. As noted previously, an overall Project Management Framework could give guidance on these interfaces and a Stage Gate process could ensure they have been considered prior to the project passing a gate. Within Phase Gates 1 and 2 of the IT group process, the gate review document specifically addresses the identification and management of interfaces.

Recommendations for Consideration	
▪	Consider using RACI matrices throughout the organization. As a new process, this would likely be implemented from the PfMO, and will interrelate to the new Business Case documents, Project Charters (or Master Project Plan) and the PSRs.
▪	RACI should be aligned with Project Risk Classifications and require identification of relevant internal (City) stakeholders and their roles.
▪	Consider reviewing organizational Authority Levels and assessing their alignment with the levels of the Project Risk Classification.

A.2.7 Project Infrastructure

Making the right decisions requires gathering pertinent data as quickly and efficiently as possible. That information exchange is built upon a reporting systems and tools for project functions like accounting, procurement, change management and scheduling.

Current Rating	EC&E	IT	Operations
	Standardized	Standardized	Standardized
Project reporting systems and tools exist for most primary project functions such as accounting, procurement, change management and scheduling with secure access.			
Target Rating	Monitored		



Detailed Observations:

Maintenance and tracking of changes to performance management baselines, changes to project plan components/elements and the coordination of changes among all project stakeholders has not historically been standard across the organization. The PfMO was created to help facilitate centralized portfolio reporting. The new Project Status Reports are a significant improvement over past reporting, but they will not be integrated with different existing data sources.

To develop a comprehensive project infrastructure, a review of all of the data sources required to support the Project Management Framework would be a prudent first step in determining the needs and timing of data. This could be followed up by a data strategy that would outline a desired future state for capital program data acquisition and reporting, and could identify opportunities to leverage existing ITS options or acquire new technology, like a Project Management Information System ("PMIS").

Project Reporting

The TTC does not currently have a system to manage reporting at a portfolio level. Within a particular sub-group, daily and monthly construction reporting is completed on an online SharePoint form that can create monthly reports for Project Managers. Reporting above a Project Manager requires manual Excel-based Project Status Reports ("PSR") that take manual inputs from scheduling, finance, cash flow Excel reports and Excel-based risk registers. These PSRs are then manually consolidated into Excel-based executive dashboards or other ad-hoc reports.

The PfMO is currently investigating a PMIS solution to streamline and centralize some of this reporting. The difficulty in scoping such a system is that there are some transformative organizational IS implementations on the horizon, including SAP and an Enterprise Risk Management package, whose integration may dictate particular solutions. There are also options in the market that are add-ons to existing TTC systems such as the following: SAP Project System (new), Sage 300 Construction & Real Estate (estimating), or Primavera Contract Management (scheduling).

Excel-based 'smart' project reporting documents can be developed that effectively act as a sole-source integrated tool for project managers. The 'smart' document is aligned with the Project Management Framework, the Stage Gate process and scaled to the project complexity levels, consolidating information that is required throughout the project's lifecycle. Similar integrated reporting documents can also be created at the program level. The advantage of such a tool is that source information from the budgets or cash flow summaries can be used to populate reporting tools, reducing the amount of manual manipulation. An integrated project management tool can even prove useful on smaller routine projects to centralize project information with the implementation of a PMIS solution.



Procurement & Contract Management

The procurement/contract management system in place does not have the ability to provide real time contract commitment data. It does contain secure access/storage of contracts, functionality to report contracts by contract type, region, and vendor. The systems in place for Materials & Procurement consist primarily of the following:

- *Company Information System (COMPIS)* - provides a means of storing, viewing, retrieving, and reporting information on companies capable of performing work for the Commission.
- *Tender Document Distribution System (TDDS)* - assists in monitoring and controlling the flow of Tender Documents and document fees.
- *Contract Information System (CONTRIS)* – assists in scheduling, monitoring and controlling the flow of Client Department requirements and Inventory requirements through the tender, evaluation and award processes.

Although ownership of this tool rests with M&P, the group documents do not communicate its purpose or usefulness to the project manager in the EC&E or ITS group's project management guidelines.

While the suite of software is performing its intended function, the platform itself is very antiquated. The user interface is mainframe-based, meaning all menus must be accessed by keystrokes and simple coding, not a mouse. This means that all outputs are of a basic format not efficiently transposable into the MS Office suite or other systems for reporting. Access is through IBM's OfficeVision, an application that offers shared document storage and management. The danger with this program is that IBM ceased supporting it in 2003, meaning customization is no longer possible and data security or access could be a risk.

The current SAP implementation scope does not include functionality to help in capital project procurement, something that could replace the existing system. A risk assessment of the current system could be completed and a preliminary analysis of how a replacement solution may have to integrate with other IT systems being implemented in the near future.

Primavera Expedition has the ability to provide real time contract commitment data, secure access/storage of contracts, functionality to report contracts by contract type, region, vendor, as well contract abstract summaries, but the capabilities are not communicated in the EC&E procurement guidelines.

Scheduling

EC&E's Scheduling team maintains different levels of schedules primarily using Primavera P6, The IT PMO controls group-specific schedule templates, while other project managers across the organization operating smaller projects use MS Project or Excel as needed.

At the activity reporting levels of the organization, there may be opportunities to allow multi-user input into schedules. Specialized consultancies like PM Alliance have developed web-based tools supported by an administration program, that allow an organization to automate the process of entering activity progress and forecast data for MS Project and Primavera users. Project team members can update the progress of their activities online and the



interface program allows scheduling specialists to manage automatic updating of the source schedule files. Microsoft offers similar functionality in its Project Pro for Office 365, as does Primavera with its P6 Enterprise Project Portfolio Management.

Recommendations for Consideration	
▪ Consider implementation of an Excel-based integrated project management tool, either prior to or in conjunction with a PMIS solution, to centralize project information and partially automate reporting, particularly on less complex routine projects. ▪ Complete a risk assessment of the current Materials & Procurement IT system and determine options for maintenance or replacement that align with corporate system implementations planned in the near future. ▪ Consider opportunities to leverage add-on capabilities of existing scheduling systems to automate and facilitate streamlining of the portfolio-level program and project schedule reporting. ▪ Identify all data sources that are critical to the TTC's capital program decision making in the Project Management Framework. ▪ Develop a capital program data strategy that identifies data requirements, quality and risks, which can be used to guide the development of an IT strategy to support capital program management change initiatives.	

A.2.8 Document Management

Document Management is critical to the success of any capital program. It is imperative that Quality Management ensure a practical Document Management System is in place at project start to ensure data integrity. Due to the large nature of many projects within the capital program, there are often large amounts of documents produced with many revisions. It is critical that these documents are well managed to avoid any legal battles and unnecessary cost increases.

Current Rating	EC&E	IT	Operations
	Standardized	Standardized	Informal
Project files are managed between a centralized SharePoint and decentralized hard copies housed at the regional construction offices. An established project file structure/taxonomy does not exist organization-wide and project documentation has not historically included distribution matrices. Data integrity is reviewed as a part of the audit plan, but audits have primarily focused on contractor payment.			
Target Rating	Monitored		



Detailed Observations:

An in-depth assessment of the TTC's documentation management system was not undertaken as a part of this review. The observations and recommendations that follows are limited to process and procedure around document management within projects.

There does not appear to be a documented project filing structure that is standardized across the organization. Neither the EC&E group's Project Management guideline (ECP-02) nor the IT group's PMM or MPP reference a standardized project filing structure. Although it may not be well referenced, the IT PMO do have process and policy for both *Project Document Control* and *Project Documentation Repository Structure*. These documents can easily be corporatized for broader use.

Project management procedures do not include a requirement to develop meeting lists and/or matrices for identifying project meetings and required attendees, either at an organizational or group level. Within EC&E's Construction group, there are guidelines for both *Contract Progress Meetings* (CDI-15) and *Construction Meetings* (85-02) that specify that contractor meetings be appropriately minuted and sequentially numbered, but this requirement is not reflected in any project plans. The TTC has noted that the influx of large international contractors has created an increasingly litigious construction climate. In this environment, it is important to have easily searchable meeting minutes. Meeting types, frequencies, attendance lists and forms should be created and referenced in all PM procedures (ECP-02 and PMM). Templates could be centrally developed by the PfMO and made common throughout the organization.

There is an established centralized, secure repository for storing and sharing project hard copy and electronic information for IT, but nothing similar is used consistently on construction projects across Operations and EC&E. Various EC&E guidelines reference the Contract Management System Database (CONTRIS) and SharePoint, but most hard copy construction documentation is located at the regional construction offices, while project managers are centralized.

There is a recently established RFI management system in place within the EC&E's Construction group with an RFI report/log (as outlined in SWI-81-01, in place since 2012). The IT group's project management documentation does not appear to refer to RFIs. EC&E's RFI management does not appear to be integrated into the procurement system, with RFIs instead filed at the local Construction Offices. The process includes a detailed flowchart, associated forms and reference to how RFIs integrate into the change process. Ideally, the system would apply across groups (IT and Operations) and be web-based, allowing for remote uploading of information with varying levels of access and functionality. A more functional RFI database/tool would include tracking turnaround time on RFI reviews, status of RFI's and RFI coding (Clarification, omission, recommended change, regulatory, other). In the absence of a database, the RFI log could be a part of the Integrated Project Management tool discussed previously.

There is an established process/system for managing project submittals EC&E's Construction group, including an older department instruction (CDI-08), newer work instructions (42-02 & 75-01), a standardized list, and template forms. The IT group's project management documentation does not appear to refer to Submittals. Although EC&E's the



department instruction dates from at least 2007, the well-defined and detailed work instruction for Submittal Management (75-01) was developed in mid-2015. As noted for RFIs, ideally the system would apply across groups (IT and Operations) and be web-based, allowing for remote uploading of information with varying levels of access and functionality. In the absence of a database, the Submittal log could also be a part of the Integrated Project Management tool discussed previously.

The EC&E group's project management documents do not reference an EC&E established process for granting and maintaining access to project hard copy and electronic information. If a corporate policy exists for such access, it is not referred to in EC&E procedures. The IT group has a more detailed *Project Document Control Procedures* procedure (04117-28-24) that dictates roles and responsibilities, defines the process and links to a deliverables catalog. This clarity of documents, ownership and access could be expanded into a corporate minimum standard, and could be projectized as a part of each project's Master Project Plan.

There is not a corporate process or standard for filing and archiving project documents and communication at project completion. The EC&E group has specific project Closeout procedures (CDI-27) that details responsibilities of the PM, SPE and CSM. The ITS group's PMM speaks generally about close-out, references a report template but also largely relies on M&P guidance for contract closeout. Each of the documents refer to the TTC Records Management Manual, but this document is not discussed in the context of capital projects. If accountability for projects rest with the Project Manager, then a closeout process should be driven by the PM, with a specific deliverable tied to governance (steering committee review) and supporting the final gate of a Stage Gate process.

The majority of the Project, Procurement, Design Engineering, Project Control or Construction Management procedures do not appear to reference project records compliance requirements. The exception appears to be the IT PMO's *Project Document Control Procedure* (04117-28-24), which does discuss document control performance measures. It specifies measuring performance by elapsed days for document reviews, numbers of iterations and percentage of Waiver Requests used. These measurements would be a helpful addition to a corporate minimum standard for capital project document control.



A.3 Cost Management

Cost management is the activity of establishing a cost management plan, monitoring costs against the control budget at the most detailed WBS level, and informing management of variances between the control budget and the estimate-at-completion when such variances exceed certain defined threshold levels. The objective of cost management is to complete the project at or below the authorized amount budgeted.

Typically, a cost management plan captures the approach to cost management of the project. It identifies the cost management procedures outlined in this section, including:

- Budgeting
- Project Cost & Cash Flow Management
- Estimating & Contingency
- Forecasting
- Variance Analysis
- Historical Trend Analysis
- Value Engineering

The Project Manager can monitor compliance to the cost management plan with assistance from an Analyst. Internal audit or other third parties may also monitor compliance with the plan similarly to other policies and procedures. Although ITS mandates a *Master Project Plan* document, the document does not contain a section on cost management. Without an *MPP*, EC&E projects do not typically have a cost management plan. If the *Project Charter* was split into an *MPP* as discussed in section D.2.2 above, the cost management plan could be a part of it.

Recommendations for Consideration

- Include a cost management plan within the Master Project Plan.

A.3.1 Budgeting

The TTC's budgeting process is the corporate process most closely aligned to the City's, being a direct flow through. In a large multi-disciplinary organization like the City, although there may be clear minimum standards for all departments, it is important that the budget objectives are communicated downwards throughout the organization and that individuals providing input to and updates on the budget have a clear understanding of the process and their role.

Current Rating	EC&E	IT	Operations
	Standardized (High)		
Formalized budget development and approval exists with semi-frequent tracking against original baseline budget. Budgeting activities are generally reviewed for compliance and personnel may or may not receive budgeting training.			
Target Rating	Monitored		



Detailed Observations:

All projects undertaken by the TTC, regardless of size, follow the same budgeting process and approvals through the Finance department in line with City guidelines. The budget process is prolonged, with some describing it as a 15-month process for a 9-month budget. The City's Capital Budget Submission Guidelines and Instructions staff report is directed to the TTC Board in May and includes schedule, submission & requirements checklist, as well as dictates any constraints on the development of the budget. In 2010, the City also confirmed the *Budgetary and Financial Management Approval Process and Protocols for the TTC*, outlining council approvals (10-year capital budget & in-year adjustments, variance reporting and surpluses. This attachment could be enshrined in a clearer organization budgeting manual document, one that applies even more broadly than the capital program.

Prior to the creation of the Project Review Board ("PRB"), there was no centralized vetting process of capital projects. Historically, group heads submitted all capital project proposals and Finance determined the ability, or inability, to fund the projects that had been proposed. As a part of the 2016 budget process and coinciding with the PfMO's release of standardized *Business Case* documents, the PRB served as a screening body for all capital projects prior to submission to Finance. As a precursor, the group heads, such as Operations and EC&E, used the *Business Cases* to do an internal screen as well. Given this role, some on the PRB were not entirely clear of their responsibilities in vetting projects. The lack of clarity could be removed by formalizing the governance, responsibilities and accountability of the PRB, with a particular emphasis on their budget role. If resources could permit it and the screening process was built upon a formal capital prioritization model aligned with strategic objectives, the PfMO could theoretically complete a pre-screen process and present its capital prioritization analysis to the PRB for final review and approval.

With the development of the *Business Case* templates and creation of the PRB, the PfMO has successfully taken the first steps to centralizing the capital project budgeting process prior to it being funnelled to TTC Finance. The *Budget Change Request* document is another new template that has yet to be fully implemented. This document includes sections for change scope, impact analysis, stakeholder & interdependency analysis, decisions required, and a contingency plan. Lastly, the new monthly *Project Status Reports* will give a more frequent, standardized reporting on control budget, more so than the quarterly variance updates required by the City. The final step that needs to take place is the finalization of a corporate minimum standard capital project budgeting process and procedure document that include these new templates.

Below the level of the PfMO, there are separate capital budgeting guidelines for both the IT and EC&E groups.

EC&E

Budget development for EC&E is described by department instructions for *Capital Budget Preparation* (EDI-07), which includes roles and responsibilities, but does not include workflows, reference to authority limits, or the City budgeting process or timeline. This procedure also does not link to the estimating process. The responsibilities of budget creation and monitoring are outlined in department instructions for *Capital Project Cost*



Control (EDI-15). The Project Controls Analyst (PCA) is responsible for identifying project variances from the approved Project Budget while the Manager - Budgets & Cost Control (M-B&CC) is responsible for compiling variance reports into Capital Program reports for ECE Management. The ultimate authority of the Project Managers in either of these responsibilities is not clear from the guidelines.

IT

For the IT group, PMM section 6.1 (*Project Conception Process Group*) details how functional department submissions lead to Capital Budget submissions. The guidelines indicate the Project Analyst prepares the 'Capital Project Funding Requirements Summary', built upon the Project Definition and Feasibility Study documents. The PM is responsible for creating the baseline budget, and the Steering Committee will approve or reject the proposed project budget. Within PM-121-01, Budget classes are outlined to correspond to Gates 1 through 4 (classes 5 through 1).

PMM section 6.1 (Project Conception Process Group) details that the Director PM approves the 'Capital Project Funding Requirements Summary', which is then reviewed and approved by the CIO. If the project is approved for inclusion, a PSR and PESD are completed for inclusion in the final TTC capital budget submission to the City. Approval is a requirement of PPGRP Gate 1. PMM section 10.1.6 (Control Costs) details the process of monitoring the project budget. This process is the responsibility of the PM. Monthly *Project Status Reports* are used to document cost and schedule performance against baseline. The PM has a duty to explain variances to the steering committee.

The PMM does not consider scalability of budget control. The Solution Delivery Principles (SDP) cites WO and Levels 1-3 of project scaling, but budget is not referenced.

Ultimately, the documentation within the IT group creates a clearer picture of how the budget process is to unfold within the group, although the terminology and document names are not consistent with those used in EC&E. Budgeting is an example of an area where the combined processes and procedures that exist within IT and EC&E could be generalized for a corporate minimum standard, and then updated to incorporate leading practices from each. The adoption of a broader standard Project Management Framework would be able to more clearly articulate individual roles and responsibilities from development, review, approval and monitoring of the baseline and control budgets.

Recommendations for Consideration

- The budget process is largely dependent on City's process. Changes to the existing internal TTC process, with the introduction of the *Business Plans*, should be rolled out and reviewed in 12-18 months to determine if the improvements have had the desired effect.
- No significant gaps, but authority levels should be reviewed to determine whether they are appropriate, particularly if a risk classification model is implemented.



A.3.2 Project Cost & Cash Flow Reporting

Although timely cost data is important to a project manager, in many instances there are lags in corporate data that make this difficult to achieve. An efficient project cost reporting process eliminates re-processing of data wherever possible, gathering cost data as close to the source as possible. Ideally, a project manager would have real-time access to project cost reports.

Current Rating	EC&E	IT	Operations
	Standardized	Informal	Informal
Generally, formalized and standard reporting of project costs is found that historically includes reporting of some key cost tracking elements. The new <i>PSR</i> templates adds some more elements as well as a format that is easier to use for cost tracking or reconciliation purposes. Data is reprocessed multiple times, with some data lags approaching the monthly reporting cycle. Project managers do not have real-time access to project cost reports and have limited access to historical cost reports in their native format.			
Target Rating	Monitored		

Detailed Observations:

Generally, project procurement document *General Conditions* are vague on requirements for project contractors/consultants to produce project cost reports, with general requirements.

Cost and cash flow reporting has historically been contained within the monthly *PSRs*, incorporating past costs (Actual to previous fiscal years), current year costs (Actual to end of the current period [month]), 5-year future costs (budgeted costs) and Estimated Final Cost ("EFC"), which may include years beyond the 5-year look ahead). *PSRs* did not include any graphical representation of cost information, nor did it show any information on months other than the current month, either forward or backward. The lack of period-to-period comparisons makes it difficult to complete any kind of Trend Analysis (discussed in section D.3.6). Having information from the immediately preceding months allows for better analysis of emerging trends, thereby giving project managers better information to affect positive changes to performance.

PSRs are typically delivered one month after a period's data date, meaning data is largely out of date when it arrives in a project manager's hands, leaving little ability to react quickly. This lag is due to a lack of real-time access to costs. Interviews suggest data lags are typically as follows:

- eTimeMachine (internal labour) - +1 week
- Certificate of Payment (COP) submission from contractor - +2 weeks
- General Ledger - +3 weeks
- Cash flows - +4-5 weeks



In August 2015, the PfMO introduced a new *PSR* template containing more and more useful information. Additions include cash flow information for the current year as well as actual burn rate and percentage burn rate for the current year. The new *PSR* now includes an important visualization of budget, probable, actual and variance for the current year, making it easier to comprehend how the project is progressing. Although this new template makes portfolio tracking standardized, it is driven by spreadsheets that requires manual manipulation to create consolidated reports. This is both time and resource consuming for the PfMO and runs the risk of data transposing errors. There are some opportunities for improvement with the existing cost and cash flow reporting that could make it more beneficial to project managers, including altering program reporting.

Neither the past nor the new *PSR* templates are scalable for project size or complexity. Historically, cost and cash flow reporting for programs has been under a single *PSR*, meaning there is no visibility of the performance of individual projects other than text description, if it is included. Consideration should be given to adding, within the *PSR* template, separate cost and cash flow reporting for each project in addition to the program-level reporting. This would create a better program dashboard for project managers, and the ability to select project-specific project cost and cash flow information to include in management reporting.

The *PSRs* do not break down the project cost or cash flows into cost elements, such as management, procurement or construction costs. Having this information at the hands of the project manager provides more information to highlight potential issues with project execution.

Lastly, the new *PSR* template is unable to leverage the information already entered into the online weekly and monthly reporting forms used by the construction managers in the EC&E group. In addition, the reporting requires replication of cash flow data from the Project Control (EC&E), Cost (Ops) or Business (ITS) Analysts' project cash flow spreadsheet, and of budget information that is first processed by the Finance department.

On the majority of projects, the TTC does not use Earned Value Management ("EVM"), except on the largest projects where a consultant is performing the majority of the project controls function. EVM measures the project's planned performance against its earned performance and assists in projecting and estimating unit rates for a particular activity. Earned Value ("EV") is the value of work performed expressed in terms of the approved budget assigned to that work for an activity or WBS component. To get an EV, work must be time-phased, so that the budget (or Planned Value, "PV") is time-phased, allowing you to know how much work was going to cost in a given period based on the defined scope. Previous project reviews have suggested the TTC implement EVM, but a corporate implementation has not occurred. EVM can be difficult for the smallest and least sophisticated contractors on the smaller projects, but EVM should be added for all project over this low threshold, according to project complexity.

Currently, there are slightly different directions around cost and cash flow management and reporting for the EC&E and ITS groups, both of which need to be updated to align with the new *PSRs*.



EC&E

The Project Controls Analyst (“PCA”) is responsible for compiling project-incurred and forecast costs, as defined in *EDI-15 – Capital Cost Control*. According to the 2015 organization chart, there are eight PCAs within the capital programming team under the direction of the Manager – Budgeting & Cost Control (“MBCC”). The MBCC maintains ownership of the project budget/cost/cash flow spreadsheets, with information gathered from the daily and monthly construction reporting forms (online) and data from Finance, but *EDI-15* does not refer to cash flows.

Procedure *ECP-04 – Project Controls & Reporting* only suggest that Project (PSR), Department (DSR) and PSR/DSR (BSR) status reports are required quarterly PSR, which does not align with the intention of the new *PSR* templates. Procedures suggest that there is Chief Capital Officer (“CCO”) level reporting of cash flows, but the documentation suggests it is on an as-required basis. Contractor cash flow reporting requirements are detailed in the document *42-03-001 Division 1 – Scope of Services*, but the document does not contain specific instructions on contractor cash flow reporting review.

The primary tracking tool for EC&E project cash flows is the *Cash Flow Sheet*, which is governed by work instruction *WI-29 – Updating of Cash Flows*. According to *WI-29*, the PCA is responsible for updating and reviewing the cash flow sheets with the PM, usually with a team review meeting. There is however, no guidance on what needs to be reviewed or what types of issues the data could reveal if analyzed properly. The new *PSRs* add information on burn rates, but there is not any description of how that information should be interpreted.

ITS

Neither the PMM nor the MPP refer to consultant/contractor cost reporting. PMM section 10.1.6 (Control Costs) specifies monthly PSRs are used to document cost performance, but does not address accounting or financial reporting. The PMM does not address cash flow management.

Recommendations for Consideration

- Incorporate cost and cash flow reporting in the Project Management Framework, specifically addressing the roles and responsibilities of non-delivery groups (e.g., Finance).
- Add sub-sheets within the PSR to allow for project-specific cost and cash flow tracking of individual projects alongside program reporting.
- Add cost elements to the PSR cost reporting to differentiate owners versus construction costs, particularly on projects with multiple buckets of scope or multiple construction contracts. Cost elements may only be required on projects of a certain complexity rating.
- Add Earned Value Management as a part of cost management on projects of an appropriate complexity. Add EV to the cost reporting, tabular and graphic, in the *PSRs*.



A.3.3 Estimating & Contingency Management

The primary purpose of project estimating is to provide decision makers with the most accurate information possible. This includes information used to make go and no-go decisions during project initiation. Project estimating is not something that occurs only at the begging of a project but instead needs to be revisited persistently throughout the project including during project closeout. Contingency management involves the development of a plan to manage the contingency budget directed towards addressing project risk. The inclusion of project contingency is one possible output of the risk management process and most specifically, the project's risk identification and evaluation processes.

Current Rating	EC&E	IT	Operations
	Standardized (high)	Standardized	Informal
Formalized estimating practices utilized on most major construction projects that includes some rationale for the estimating method. In some groups, process is robust but not universally applied and does not encompass all broader project objective scope.			
In some groups, a formalized contingency development process includes some rationale for the authorization and release of contingency. The basis of contingency is generally not sophisticated enough for the risk associated with the projects.			
Target Rating	Monitored		

Detailed Observations:

Estimating

Although capital project estimating processes do not exist in the ITS or Operations groups, the EC&E group has a robust estimating process in place. For capital projects in groups that do not have a dedicated estimating function (e.g., ITS and Ops), EC&E's specialist resources are sometimes consulted, but only used if requested. EC&E's process clearly defines the steps of estimate preparation, the roles and responsibilities of individuals, and the multi-phase development of estimates from early project scope definition through to construction costing. The EC&E process can be considered leading practice compared to many organizations, as attested by a peer review conducted by the American Public Transit Association (APTA). There are however, limitations that prevent it from working successfully consistently.

EC&E procedure *EDI-14 - Estimating* has clear guidelines for an Order of Magnitude Estimate ("OME"), including its purpose, level of detail and allowances for contingency (related to lack of definition) and escalation. However, not all projects are submitted to the Budget Process with the help of the Estimating function, meaning not all OMEs adhere to the same principles.



EDI-14 also has clear guidelines for evolution of OME through PD (Pre-Development), Conceptual (10%), Control (30%), Definitive (60, 90, 100), and Engineer's Estimate. Estimates reviewed for the 13 projects show consistent commentary on the variance between iterations of the estimates. The estimate evolution does not however, refer to third party estimates or check estimates. These guidelines generally align to with the industry standard AACE (Association for the Advancement of Cost Engineering) estimate classification guidelines that link estimate class to the level of project definition as well as the expected accuracy range, as follows:

Table A.3-1: AACE Cost Estimate Classification Guidelines:

Estimate Class	Level of Project Definition	End Usage	Expected Accuracy Range
Class 5	0% to 2%	Concept Screening	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget Approval	L: -10% to -20% H: +10% to +30%
Class 2	30% to 70%	Control Budget or Tender	L: -5% to -15% H: +5% to +20%
Class 1	50% to 100%	Check Estimate or Tender	L: -3% to -10% H: +3% to +15%

The ITS group's *PMM* guidelines on estimating costs (section 8.1.10) only detail that it is the responsibility of the PM (or their designate) and that it is recorded in the 'Probable/Actual Spreadsheet' until a budget is approved. Using ITS's project ratings, for Level 1-3 projects, inputs to the estimate include the *Business Case*, while for Level 2-3 the *Solution Architecture* is also included. Estimates may also be included in the *Feasibility Study*. The *Solution Delivery Principles* procedure requires a third party review in the Pre-Project phase for all Level 3 projects.

The EC&E estimating process is not rigidly followed by all projects within the EC&E group. In some instances, projects are submitted in the annual budget process with estimates developed without input from the estimating function, because of either budget timelines or a lack of available resources. In other instances, project budgets are developed without a scope of the project having been developed which is sufficient to support generating a sound estimate. On certain occasions, these types of immature estimates are used for project approvals (which includes the establishment of the project budget). When fully implemented, the PfMO's new, gated *Business Case* process will add requirements for project owners to disclose the assumptions underlying the estimate. By developing a corporate standard for capital project estimating based on the EC&E process and suitable for the range of project complexities and delivery models, management can be assured that the adequate estimating procedures were followed when developing the *Business Case*.

The current EC&E estimating process is not designed to address broader project objectives unless they fall within the scope of the TTC's work. Frequently, the budgets for transit



projects are set before the scope of the other infrastructure components (relating to the broader objectives) are substantively defined and costed, and without risk adjustments for to deal with project unknowns. This can result in reputational damage when project costs end up higher than the original (incompletely scoped) estimate that set the stakeholder expectations. To avoid this, leading practice involves setting budgets based on assumed scope and a risk-adjusted estimate that includes appropriate allowances to deal with unknowns the project teams manage and those driven by external influences that are appropriate for the stage of the project development. This would be supported by estimating guidelines that should ensure that estimates from the beginning are holistic and include both internally owned scope as well as third party affected or improved regardless of funding responsibilities.

Lastly, budget approvals can be often set based on immature estimates or incomplete scope. Doing so can set unrealistic expectations regarding budget for stakeholders that put pressures on project delivery. Leading practice dictates that project announcements and final approvals should be based on a mature estimate and a comprehensive definition of a project. The environment of transit capital project delivery is one in which having mature budget estimates and fully scoped projects is not always possible. At a minimum, the inherent uncertainty of cost estimates should be communicated to stakeholders when a project is being approved.

If the EC&E estimate development process is followed (see Figure Table D.3-1 above), project approvals can be staged as the project proceeds from a Class 5 estimate, to a Class 4 estimate, and ultimately to a Class 3 estimate, where the budget is approved (in line with the Stage Gate process). By doing so, the City stakeholders will become familiar with the level of accuracy at various stages, including for example that a Class 4 estimate for a project can have an accuracy range of -15% to +50% (which may be a concept that is currently difficult to effectively communicate to stakeholders).

Recommendations for Consideration

- Develop a corporate standard for capital project estimating, based on the EC&E process, and suitable for the range of project complexities and delivery models. (Recommendation #20)
- Set budgets based on assumed scope and a risk-adjusted estimate that includes appropriate allowances to deal with unknowns the project teams manage and those driven by external influences that are appropriate for the stage of the project development. (Recommendation #21)
- Develop estimating guidelines that should ensure that estimates from the beginning are holistic and include both internally owned scope as well as third party affected or improved regardless of funding responsibilities. (Recommendation #22)
- Stage project approvals to follow key milestones in the maturing of a project estimate. (Recommendation #23)
- Create processes and procedures around the communication of project estimates as they mature. (Recommendation #24)



Contingency

According to leading practices, contingency should be set aside to cover the costs of a project owner's exposure to the project risks. For TTC capital projects, neither the terminology nor the concept of contingency follow leading practices.

Contingency cost allocations for capital project should be an output of the risk management process and should be managed according to how it is funded. Careful consideration must be given to the use of contingency funds, as they can easily be manipulated. They are not intended to fund scope changes that do not stem from an analyzed risk.

When contingency allocations are based on analyzed risks, they should be managed alongside those risks; when a risk is realized the contingency is drawn down, and when a risk is expired, the contingency is returned to the project budget.

Processes used to identify appropriate contingency allocations include:

- Project management expertise on a particular risk or situation and its potential impact on the project.
- Computer simulations of the occurrence of project risks and the potential impact to project costs, such as the Monte Carlo analysis referenced in EC&E's project risk management plan.

Processes used to draw down contingency funds include:

- Reconsideration of contingency funds needed following the expiration of a project risk or achieving a milestone associated with a contingency amount
- Ongoing risk revaluation based on the current project status.
- Progressive "straight line" drawdowns over the duration of the project (although this is the least preferred strategy).

The use of any contingency funds and changes to any contingency should require approval of appropriate stakeholders subject to the project manager's approved delegation of authority.

As described in EC&E's *EDI-14*, the contingency is only used to cover uncertainty in the estimating process, and is removed when a 100% Engineer's Estimate is developed. Once a project moves to construction, the contingency allowance is replaced with a Contract Change Allowance ("CCA"), which is defined as work "outside the scope of the construction contract but within the scope of the contract packages". The CCA for a project is determined by applying percentages which have been developed based on TTC experience and are different for different types of projects (rehabilitation, systems work, or greenfield), ranging from 8% to 22%, as per TTC historical information. In practice however, it is up to the PM what the final CCA percentage is, and can sometimes be driven by shoehorning the project into an 'approved' budget, and adopting a lower-than-recommended CCA to achieve that goal.

There are some opportunities for improving the current system. Firstly, there is no way to quantify project-specific risks, and therefore plan for them in the budget. The TTC should leverage the tools developed as a part of the EC&E Project Risk Management Plan to



develop risk registers for every capital project. These registers can then be used to calculate risk-based contingencies.

Secondly, with a basis only in percentages based on project type – percentages that appear low compared to industry norms - the management of the CCA is at the sole discretion of the project manager, leaving the possibility that it is perceived as a project ‘slush-fund’. A contingency and management reserve process must be accompanied by policy and procedure that outlines the development of project contingency management plans and provides for a drawdown reporting function.

The terminology ‘Change Allowance’ can confuse stakeholders and leave the impression that the allowance can be used to cover scope changes. If allocations are to be left in a budget for scope changes not contemplated in the contract, such allocation is typically called a ‘Management Reserve’, and that reserve can be allocated at the discretion of the project leadership or a project’s steering committee, depending on governance.

Within the ITS group, the PMO’s *PMM* does not discuss contingency.

Recommendations for Consideration	
▪	Develop risk-based contingency for all capital projects, with discrete risks applying to different parts of the project lifecycle. Develop contingency management policy, process and procedure to govern development and management of a project’s contingency. (Recommendation #25)
▪	Create a separate budget allocation for Management Reserve to capture project scope unknowns that are not covered by Contingency. (Recommendation #26)

A.3.4 Forecasting

Particularly when a lag in information delays reporting, organizations can fall into the trap of focusing reporting on historical information rather than doing accurate forecasting. It is important for the project team to maintain a broader perspective on all decisions to ensure that the ramifications are understood on all the work that follows.

Current Rating	EC&E	IT	Operations
	Standardized	Informal	Informal
There is generally formalized project forecasting for most major construction projects that is based on a standard forecasting approach and incorporates forecasting inputs from several primary project contractors (Subcontractors, Contractors, General Contractors, Construction Managers, Consultants, etc.), but most is a flow through process and there is a general lack of confidence in the quality of information from contractors.			
Target Rating	Monitored		



Detailed Observations:

Historically, the *PSRs* did not include forecast cost information other than Estimate for Completion ("EFC"). This gives no indicator as to how costs will increase or drop in the near term, which is very useful information for a Project Manager. The new *PSR* includes Probable costs for every month in the current fiscal year, both in tabular and graphical form, giving the PM a clearer indication on how progress should be changing in the near-term. The addition of the Burn Rate also allows the PM to compare forecast costs in a future period to the historical burn rates to determine if it is indeed feasible. Having this information however, is predicated on having time-phased budget data, both from the contractor and internally. This may not be realistic on the smallest projects within the capital program, but the cut-off for it as a requirement should be included in procedures surrounding the *Project Complexity Tool* and defined in the *Project Management Framework*.

Existing process and procedures for forecasting are slightly different in the EC&E and ITS groups, and are described below.

EC&E:

Contractor forecasting is detailed in '*42-03-001 Division 1 – Scope of Services*', but in practice, interviews indicate that the quality of contractor forecasts are generally not satisfactory. This could be solved by putting a greater emphasis on forecasting requirements (cost and schedule) into the General Conditions and tender documents, making it a component of procurement scoring. The PCA is responsible for compiling forecast costs, as per *EDI-15*, with the Project Team reviewing outstanding liabilities and updating the cost forecasts accordingly. If the forecast amount exceeds the value of the corresponding Budget line item, the PCA brings the issue to the attention of the SPE / PM, and appropriate actions are undertaken either to contain cost within the current Budget or to increase the Budget.

Without standardized quantitative risk reporting, there is not an inherent ability to link outstanding risk to contingency and the impact on the forecast. Typically, this is where unsophisticated forecasting fails – when risks that have not been identified or properly managed have significant impacts on the project, and contingency is not sufficient to address it. Fixing this gap in knowledge will require the adoption of risk-based contingency and a broader emphasis on risk management.

IT:

The ITS group's *PMM* has only briefly discussed cost forecasting, where section 10.1.8 (*Report Performance*) refers to collecting and distributing forecasts. It suggests that the *Probable Actual Spreadsheet* is updated to capture this information.



Recommendations for Consideration
▪ Add clear requirement for time-phased cost reporting and forecasting from contractors, and assess capability during procurement scoring. ▪ Improve the forward-looking information contained within the project reporting and add key performance indicators related to broader project objectives such as Forecast-to-Complete and commitment tracking. (Recommendation #34) ▪ Use risk-based contingency and active risk management to ensure that outstanding risks are properly addressed in cost forecasting.

A.3.5 Variance Analysis

The *Master Project Plan* should detail the performance measurement baseline against which a project's performance is assessed. Any deviation from this baseline is a variance, which should be measured and analyzed on a recurring basis, with particular attention at decision points (Stage Gates) or when exceptional conditions occur.

Current Rating	EC&E	IT	Operations
	Standardized	Standardized	Informal
Formalized analysis of project variances exists for most major construction projects that includes some variance analysis reporting and identification of key issues and drivers.			
Target Rating	Monitored		

Detailed Observations:

Historically, PSRs have generally only represented as a cumulative total for the year and total project. Without breakdowns of reporting into cost elements, variance descriptions were described on an individual basis, with contribution of that variance to the current year and the total project. The new *PSRs* have added a visualization of variance, although in its current form the relative scales of the variance value to the total project value may make it difficult to read both sets of data within one graph. The new area for description of variances is structured only for text, but this section of the report could prove more useful with more structure, specifying the date of the variance, the impact (\$ or time), the description, reference to the risk register, and the root cause. Many organizations will also use a waterfall graph (Figure A.3-1), to show both how variance to the forecast has changed for the period and cumulatively for the project. This form or presentation is an effective dashboard tool for executives that is also useful for trending.

Variance can be completed against the most recent approved baseline (i.e., if the scope has materially changed) or against the original budget, depending on which performance measurement framework is detailed in the *Project Management Framework*. Variance tolerances requiring escalation should be outlined as well. This escalation could be tied in



some way to the TTC Enterprise Risk Ranking Table dimension of 'Financial Sustainability', below.

Table A.3-2: TTC Enterprise Risk Ranking Table – Financial Sustainability

Positive or Negative Impact					
6	5	4	3	2	1
Disastrous	Catastrophic	Major	Moderate	Minor	Minimal
Supreme	Extreme				
>\$100M	>\$50-100M	>\$25-50M	>\$5-25M	\$1-5M	<\$1M

Variance analysis is currently described in the processes and procedures for both EC&E and ITS, as detailed below.

EC&E:

The PCA is responsible for identifying variances from the approved Project Budget and providing the PM with variance analysis, as per *EDI-15*. The MBCC is responsible for compiling project team supplied variance analysis information into periodic Capital Program reports to EC&E Management. The frequency or format of the reporting is not discussed. It would be most efficient as an added use of *PSR* reports, as opposed to as a separate reporting stream.

IT:

The PMM discusses variance in section 10.1.8 (*Report Performance*), but only in the context that performance reports 'may identify variances'.

Recommendations for Consideration
- Include performance requirements for variance analysis within the <i>Project Management Framework</i>. - Increase the detail in the new <i>PSR</i>'s variance section to require dates, root causes, impacted cost elements, etc. - Use waterfall graphs for dashboard representation of variance analysis. This can be used in both project reporting and portfolio reporting. - Develop variance tolerances and escalation requirements as a part of the development of a Performance Management Framework.

A.3.6 Trend Analysis

Trending historical data enables the application of lessons learned to new projects. It is important to have historical data in a format that makes comparison easy means, in which past risks can be identified, more easily quantified and therefore better managed. Ongoing trend analysis also allows for the early identification of issues during execution, allowing for proactive management.



Current Rating	EC&E	IT	Operations
	Informal		
In some areas, formal historical trending of project costs occurs for some major construction projects, that identifies key cost trends taking into some, local, regional and national cost escalation trends. Ongoing trending is informal and not consistent across projects.			
Target Rating	Monitored		

Detailed Observations:

Historical trending requires information that is useful, accessible and accurate. Other than cost trending as a part of EC&E's estimating process (described below), there is little formal discussion of data trending and analysis within the project management guidelines of the Ops, EC&E or ITS groups.

Developing ongoing trending analysis first requires the gathering and reporting of data on a timescale useful to correct negative trends. Historically, the *PSRs* did not provide hindsight or foresight for months other than the one being reported. As noted earlier, the new *PSRs* have a positive addition of visibility to the beginning and end of the current fiscal year. Although this is helpful to see how the project is performing based on its current year budget (which follows how it is approved), it does not give sufficient visibility to previous months at the beginning of the year, or following months at the end of the year. For multi-year projects, the *PSRs* graphical representation of budget, variance, forecast, etc. would be more helpful if it provided a six-month look behind and look ahead, with fiscal year data still being captured for the fiscal year.

As helpful as trending analysis may be in a *PSR*, to be more useful, the analysis needs to be completed on an ongoing basis, as information is available. Other organizations provide project managers with an integrated project management tool, such as a smart Excel spreadsheet, where historical information for the whole project can be maintained on different spreadsheets. These may include cash flows, budgets (original and re-baselines), forecasts, contractor inputs, schedules, the risk register, change logs, issues logs, permits logs. Keeping this data in a centralized location makes comparison of data much more efficient, and allows analysis spreadsheets to be automatically updated as new information becomes available.

Continuous trend analysis can also be helpful for commercial management of a particular contract. Doing so can use a contractors own information from their reports to pinpoint potential issues with their project management of the project. For example, if the contractor provides specific forecast costs for June, July and August, by the time you have the actuals from August, it's possible to see whether their forecasts were improving the closer it got to August. If their forecasts vary wildly, it is possible the contractor does not have a good



handle on their upcoming work. Giving project managers and commercial managers tools such as these, enables them to better monitor the effectiveness of their contractors.

EC&E:

The estimating instruction (*EDI-14*) cites construction escalations trends as an input to estimate escalation allowances. Interviews suggest that the estimating function has the historical information to do trending analysis by category and geography, but doing so does not appear to be a formalized process for doing so. The Capital Programming team's *Phase & Item Price Book Report* was last printed in April 2015 and notes that Timberline escalation rates are updated each July. The *Phase & Item Price Book Report* also has specific costing data on over 30 'Division' categories, with each of those broken down into multiple standard unit, labour or equipment prices where applicable.

There is no specific documentation on ongoing trending and analysis. In the monthly CEO's report, the only KPI reported for the Capital Program are the Actual vs. Budget, reported as YTD, and only as Base, TYSSE and SSE.

IT:

There is no specific documentation on trending.

Recommendations for Consideration

- Add guidelines on ongoing data trending and analysis to the Project Management Framework and Project Management Manual.
- Provide an integrated project management reporting tool (or spreadsheet) that has trend analysis tools built in to allow continuous monitoring of contractors with their own data.
- Formalize the historical trending of information for estimate generation and incorporate into the higher-level corporate standard estimating document.

A.3.7 Value Engineering

Value engineering ("VE") activities occur either informally or formally throughout the stages of project design, planning and estimate refinement, and involves balancing value trade-offs of the project. In practice, VE often occurs at the very end of the project estimating and design/planning process when it is found out the project is over budget, a point in time when it is often very difficult to find recoveries.



Current Rating	EC&E	IT	Operations
	Standardized	Informal	
Formalized value-engineering processes exist in some functional groups for some major construction projects during the design phase, but with limited tracking and reporting of value engineering activities or cost analysis. Informal or non-existent value engineering process is evident in other functional groups.			
Target Rating	Monitored		

Detailed Observations:

Within the TTC, the VE process is discretionary within EC&E project and not formally governed elsewhere. As detailed below, the VE process is defined at a very high level within EC&E's process and procedures, although in some cases it has been performed by third parties on particular projects (e.g., Union Station second platform).

As described in main report, the review of 13 projects revealed cost overruns on most projects. A strong VE process would give project managers an extra option to manage budget pressures. The VE process/approach should focus on optimizing life-cycle costs, saving time, improving quality, solving problems and/or using resources more effectively. The VE process should also seek to optimize the allocation of limited funds without reducing the quality of a project. VE objectives should be to:

- Improve quality
- Minimize total ownership costs
- Reduce construction time
- Make the project easier to construct
- Insure safe operations
- Assure environmental and ecological goals

The VE process separates the components of a project into functions, which in turn leads to identifying solutions that will satisfy these functions. VE project teams should look to optimize a blend of scheduling, performance, constructability, maintainability, environmental awareness, safety, and cost consciousness. This should not be limited to a technical review but encompass a full lifecycle analysis.

VE teams should provide management with as many recommendations as are practical. Project team personnel whose areas are impacted by the proposed recommendations should evaluate the recommendations and management (or their delegate) must decide, based on the available information, whether or not to approve the recommendation. Upon approval, the design team implements the recommendations into the design.

Identifying and accepting VE recommendations can be difficult if there is an overly strict adherence to specifications or a disinclination to test new methods. Interviews with some of the TTC's contractors indicate that in their opinion, there is a historical corporate rigidity that can stifle contractor innovation. Ultimately, this can cost the TTC more money. In



making decisions such as these, the commercial manager function can be helpful, as it ensure that project decisions are made not just with technical specifications in mind, but also commercial and cost implications. As the TTC continues to deliver more projects through alternative delivery methods, there will have to be a shift of specifications from detailed technical ones to those that are driven by outputs. This shift will also facilitate a greater openness to VE opportunities. The

EC&E:

Instructions *CDI-04 - Value Engineering* describe the methodology and objectives of VE at a high level. Responsibility is left to the PM to determine if VE is required. VE review is not mandatory, although guidelines suggest it should be considered based on value (over \$100M), complexity, timeframe and scope. The format of the VE activity is also at the discretion of the PM, including the designation of a VE project lead. Value Engineering has been completed by third parties on specific projects, like Union Station.

All VE is driven and approved at the PM level, presumably so long as any changes are within their delegated authority limits. An individual nominated by the PM monitors progress and reviews implementation of accepted VE initiatives. Results are documented in project files. Although a process for monitoring is specified, it is vague and not incorporated into any of the reporting documents.

IT:

There is no specific documentation on value engineering.

Recommendations for Consideration

- Develop corporate standard for VE.
- Incorporate VE requirements into the Stage Gate process, with particular emphasis during the estimate development sub-gates.
- Incorporate VE tracking into the integrated project management tool.
- Incorporate VE reporting into the PSR for portfolio-level consolidation.



A.4 Procurement Management

Procurement management encompasses all aspects of the procurement of goods and services for a capital construction project, the supply of equipment or the provision of professional services. This process begins with the development and documentation of a contracting strategy to be utilized for the acquisition of goods and services. After establishing contractual relationships with suppliers, the focus of the project manager shifts to the administration and management of these contractual relationships. In addition, commercial and claims management processes are used in attempts to resolve contract claims before such claims turn into disputes, which must be resolved through arbitration or litigation.

The responsibility for procurement management processes should be clearly defined in each organization. Procurement typically has responsibility for managing the overall contracting processes with key inputs from the following departments or functions:

- Functional user groups
- Planning and Engineering
- Legal
- Finance
- Subject Matter Professionals

The procurement management procedures should clearly document and define how, where and by who records relating to procurement and contract administration will be maintained. Typically, procurement documentation is retained in an organized file in a central location and maintained by a contract administrator or the procurement division. The procurement management procedures must also account for the inherent differences between procuring projects, material, equipment and professional services.

Unlike other sections within this maturity assessment, procurement management was assessed both at the delivering functional group level (EC&E, ITS and Ops) and at the corporate functional level (Materials & Procurement - "M&P"). M&P has a dedicated sub-group that deals specifically with capital projects, the Project Procurement Section ("PPS"). The PPS has at least 61 detailed guidelines for procurement management, tailored specifically to a Design-Bid-Build ("DBB") procurement process. For EC&E and ITS, there are varying references to procurement within their project management guidelines, while for Operations there are no guidelines specific to capital projects.

Within EC&E, project control is effectively handed over to M&P PPS during the procurement process and M&P retains ownership of contract administration throughout the project lifecycle. Currently, project management processes and procedures within EC&E (and to a lesser extent ITS) largely omit details around a project manager's role in the procurement process. Experience elsewhere has demonstrated that an empowered project manager should be at the forefront of procurement decision making, to ensure decisions and direction address the project's strategic objectives.

The planning and execution of the procurement process should heavily involve the project manager. Procurement planning provides an opportunity to document and ensure agreement on a clear and specific project scope, assess qualified and available sources,



consider influences that may affect a buying decision, and develop the strategy for the procurement activities to be performed. The goal of procurement planning is to achieve the optimum balance of risk, control and funding for a project, all responsibilities related to the project manager.

The procurement activities themselves, including drafting of tender documents, responding to bidder questions, development and application of evaluation criteria, should also involve the project manager. Development of the tender documents and contract will not only baseline the cost, scope and schedule, but will also lay the groundwork for the project team's management of change, risks, quality, performance and reporting, among others.

The Project Delivery Options Framework (see Appendix D) involves numerous inputs from multiple stakeholders to determine the right procurement strategy, as well as real expertise and experience. It is important to support the framework with process and procedure to ensure its intended function, which is to select a procurement delivery option as an output *of* the process, not an input *to* the process.

Every project delivery model contemplated in the Project Delivery Options Framework can be effective based on the risks and project environment. Because of the increased sophistication in the construction industry, there is more appetite for these alternative models. Those shifting market conditions mean that project procurement will take on an increasingly strategic role that requires the insight of the project manager. Although M&P will continue to have significant input related to market knowledge and detailed knowledge of the process and procedure of the tendering process, but ultimately the project manager, as the authority for a project, should own the procurement method decision.

Recommendations for Consideration

- Implement procedures that help ensure that the best delivery model is adopted and appropriately managed, and that will best accommodate the stakeholder, risk and operating environment of the project. (Recommendation #27)
- Consider making the procurement of both services and construction a direct responsibility of the project leadership. (Recommendation #28)
- Expand the strategic role of procurement in the capital program delivery process by highlighting the importance of broad stakeholder engagement. (Recommendation #29)

A.4.1 Procurement Planning

Procurement planning provides an opportunity to document a clear and specific scope, assess qualified and available sources, consider influences that may affect a buying decision, and develop the strategy for the procurement activities to be performed. The goal of procurement planning is to achieve the optimum balance of risk, control and funding for a project.



Current Rating	M&P PPS	EC&E	IT	Operations
	Standardized	Informal	Standardized	Informal
Formalized procurement planning is evident on most major construction projects that includes planning for most major contracts and supplier agreements. Process does not appear to be formally reported beyond the PPS project team, but includes identification of some contract activities, milestones and ownership of major procurement activities. Delivering functional groups have some (ITS) or little (EC&E) reference to the project manager's roles and responsibilities during the process.				
Target Rating	Monitored			

The procurement planning process typically begins with a planning workshop to determine the appropriate procurement strategy, identify issues that require action and resolution for contract execution and establish key milestones, assign responsibilities and get buy-in on the strategy from key stakeholders. The *Project Delivery Framework* detailed in Appendix D lays out this process and describes the roles of key stakeholders.

Planning meetings should be tailored to the specific procurement requirements and include representatives from the following departments:

- M&P PPS – responsible for leading and coordinating the planning and execution of the supply chain activities and ensuring that the necessary procurement practices are utilized.
- Legal – responsible for ensuring that contract development obligations are met and that known or anticipated risks have been adequately addressed.
- Finance – responsible for the commercial aspects of the solicitation, including the financial and payment terms.
- Project Management team – responsible for project management aspects of the procurement, including cost and schedule considerations.
- Functional Groups – the end user of the structure, facility, or services being procured.
- Subject Matter Experts (as needed) – depending on the procurement, specialists input could include Tax, Engineering, Construction, Regulatory, Risk, Insurance, etc.

Key stakeholders should identify and discuss the issues that influence the procurement strategy such as:

- Project scope
- Availability of qualified suppliers (skills, geography, experience)
- Availability of resources
- Use of agents



- Unique products or services
- Project schedules
- Conflicting contract provisions
- Potential impacts on other company projects and activities (e.g., self-competition)
- Regulatory environment

The planning workshop or meetings should result in a planning agreement or documented procurement plan that documents key stakeholders, the agreed upon procurement strategy, issues or scope agreed upon for inclusion in the contract, issues that remain unresolved, action items, documentation requirements, and a procurement schedule. Typically, this procurement plan would form a section of the Master Project Plan.

Additional issues to be addressed during procurement planning include development of the following:

- Clearly defined scope of work
- Price and quality expectations
- The required minimum number of bids or proposals required to award the contract
- The process for assessing potential bidders (This plan should assess, at a minimum, financial strength, specialization, reputation and, independence issues)
- Lists of specific materials or service requirements and alternatives for these materials or services (make or buy decisions)
- Clearly defined spending limits or delegation of authorities to approve contracts or contract changes

M&P PPS

The TTC Procurement Policy, published online, does not reference a procurement plan.

M&P PPS *Guideline 3.2 - Procurement Checklist* outlines the process for the Project Coordinator ("PC") to assign a Senior Contract Administrator ("PCS") and for checking completeness of Procurement Requisition (Form 1) or Purchase Authorization (Form 2), but does not detail how a procurement is planned. In the absence of a procurement plan, there is no accompanying review and approval process nor an implementation plan or monitoring function. The division of responsibilities between the SCA and the PM in the procurement planning process should be very clear, and where other decision makers, such as a project steering committee, have a say in the process. A clear Project Management Framework and a Stage Gate process would create the backdrop to clarify responsibilities, accountability and authority at this point in the process.

EC&E

Procedure *ECP-05 - Contract Procurement and Management* does not deal with procurement planning. The procedure was last revised in June 2008 and do not detail



responsibilities prior to contract award. The development of the McNicoll bus garage has created difficulties for project leadership, as they have come to realize that existing procurement processes and procedures are tailored to the traditional DBB model. This means that internal procurement expertise for other models does not exist, and it becomes difficult to adapt existing process to alternative forms of procurement.

Ops

Although the Ops group does not have specific guidelines around procurement planning for capital projects, they have informally dealt with the issue, particularly on the ATC project. When new project leadership was recruited with overseas experience, a new commercial strategy was implemented with a reorganization and renegotiation of existing contracts resulting in a modified Construction Management ("CM") model. The methodology used to reach this decision would be very similar to the well-defined process used by the ITS group as described below.

ITS

The ITS group has the clearest direct on the PM's role in the procurement process. PMM section 8.1.6 - *Plan Procurement* places ownership of the procurement planning process with the PM, with assistance from the M&P group. The PM formulates the plan, following applicable M&P processes, which is then to be recorded in the *MPP*.

MPP section 9.2 - *Purchasing Strategy* outlines the method of purchase, the process and provides a description of the planned purchases, assumptions, selection criteria, contractual considerations, timing, receiving, storage, etc. It also notes that criteria and assumptions for selecting a vendor must be documented.

Being a part of the *MPP*, the procurement strategy is approved as per the *MPP*'s approval, including a review by the directors, Chief Enterprise Architect ("CEA"), Steering Committee and PMODCL, and approved by the PM and Director of Project Management.

PMM section 8.1.6 - *Plan Procurement* does not discuss updating or monitoring of the procurement plan. In addition, *MPP* section 9.2 - *Purchasing Strategy* does not give guidance to include details of updating or monitoring.

With some modification, the ITS procurement planning process can be corporatized and used as a model for all capital projects. Their process follows leading practice where the project manager is the ultimate owner of the procurement decision, with a heavy reliance on the M&P PPS team. The output of a procurement plan and its inclusion in an *MPP* can be replicated elsewhere, with the whole process defined in a Project Management Framework and accompanying PMM.

Recommendations for Consideration
- Develop procurement planning policy, process and procedure around the <i>Project Delivery Options Framework</i>. - Leverage process and procedures from ITS around procurement planning, including the creation of a Procurement Plan within the <i>MPP</i> and the inclusion of Procurement Planning in the <i>PMM</i>.

A.4.2 Solicitation Management

Solicitation management encompasses the process of notifying prospective or qualified bidders on the TTC's decision to receive bids on the capital project. Solicitation consists of the activities necessary to execute the procurement strategy, encompasses the sourcing, tender, selection of suppliers and the related processes, procedures, and controls necessary to enter into a contract.

Current Rating	M&P PPS	EC&E	IT	Operations
	Standardized	Informal		
Within M&P, there is formalized solicitation planning for most major construction contracts that includes some vendor pre-qualification and some planning of solicitation, source selection and contract execution activities, milestones and ownership of solicitation documents (RFP SOW, Contract Template, RFP Template, etc.) Within delivering functional groups, there is informal or non-existent solicitation guidance for major construction agreements.				
Target Rating	Monitored			

Detailed Observations:

The TTC's *Procurement Policy* is posted on their website, and although it is high level, it does detail the bid selection process. Section 8.0 - *Bid / Proposal Information* notes that all formal Bids are publically opened and all formal Proposals are opened by the Commission Services Office. The same website also outlines the typical Bid Irregularities and TTC's response to each.



M&P PPS

Procurement Policy section *4.0 - Procurement Process*) identifies that solicitation occurs by RFI, RFQ, RFB, RFP and/or Formal Requests, with some exclusions, but does not include definitions of each or criteria for use.

The M&P PPS has multiple guidelines around the solicitation cycle and the tools to be used, but the responsibilities are generally process as opposed to strategically driven.

Solicitation begins with the identification of potential bidders, but M&P PPS guidelines do not appear to cover the process to formally identify, review and approve potential project vendors/bidders from a database of prequalified vendors. Guidelines for using the contract information system refer to a "Restricted Bidders List (<200k)" as a type of procurement, and *Guideline 3.4 - Document Pickup and Bidders List* refers to a list of bidders with restrictions, available on the M&P intranet, but there is not more detailed information on the pre-qualification of bidders. Typically, there should be documentation around bidder list maintenance, prequalification and restriction.

For the TTC's standard procurements, *Guideline 5.1* outlines the *Procurement Cycle*, specifying the timelines for 7 phases of procurement (document review, sign-off/printing, tender period, evaluation period, purchase approval, award, issue) for 16 different types of procurement (T1-14, T20-21). Although the timelines are differentiated for different procurements, the definitions or breakdowns of each phase are not included. Some of the durations seem excessive based on their phase descriptions (e.g., 20 business days of effort for 'Sign-off/Printing' of \$20k-150k construction tender documents). With a historical emphasis on DBB contracts, the procurement cycles do not differentiate by delivery type, with a 'construction/engineered equipment' timelines being one broad categorization with five contract value sub-categorizations. In the near term, the McNicoll DB can be used to inform and update the existing documentation, with the longer-term addition of details for other procurement models contemplated in the *Project Delivery Options Framework*.

With respect to roles and responsibilities during solicitation, *Guideline 5.5 - Authorization for Expenditures* deals with approval levels for given contract award values, but does not outline approval of tender documents. Ideally, the SCA and PM should be authorizing documents, with project team Subject Matter Experts consulted as required. The guidelines do not appear to address procurement document (RFQ, RFP, etc.) issuance, including invitation & distribution.

M&P - Technology

As noted above, some project cycle phases appear to be lengthy compared to their phase description. In general, the solicitation process can be executed more efficiently when technology enables fast sharing and approval of documentation. *Guideline 2.1-2.3* describes the functionality and purpose of the Information Systems that support M&P solicitation management:

- Contract Information System (CONTRIS) – in scheduling, monitoring and controlling the flow of client department requirements and inventory requirements through the tender, evaluation and award processes.



- Company Information System (COMPIS) - provides a means of storing, viewing, retrieving, and reporting information on companies capable of performing work for the Commission.
- Tender Document Distribution System (TDDS) - assists in monitoring and controlling the flow of Tender Documents and document fees.

While the suite of software is performing its intended function, the platform itself is very antiquated. The user interface is mainframe-based, meaning all menus must be accessed by keystrokes and simple coding, not a mouse. This means that all outputs are of a basic format not efficiently transposable into the MS Office suite or other systems for reporting. Access is through IBM's OfficeVision, an application that offers shared document storage and management. The danger with this program is that IBM ceased supporting it in 2003, meaning customization is no longer possible and data security or access could be a risk.

Currently, SAP implementation does not include adding functionality for capital project procurement. There are risks that the current systems may necessitate a decision to upgrade. A risk assessment of the current system could be completed and a preliminary analysis of how a replacement solution may have to integrate with other IT systems being implemented in the near future.

EC&E

EC&E does not specify a vendor pre-qualification or disqualification process, but the interim process *ECE-P05 - Contractor Performance Reviews* dictates a minimum of one mandatory Contractor Performance Review ("CPR") within one year of contract award. The process dictates that if a contractor is found to be non-satisfactory, and does not adhere to its agreed-upon Action Plan, then "TTC may, in its sole discretion, restrict the Contractor from being awarded any further contracts for a period of time."

The prequalification process should be clear both internally and externally. Recently, a contractor with inadequate references was hired for station reconstruction work because the qualification process was not clear in the solicitation documents. Having a clear pre-qualification and disqualification process could eliminate issues like this from recurring in the future, fed by lessons learned from CPRs.

EC&E's procurement guidelines only deal with process from contract award onwards. Neither the project manager's nor the broader EC&E role is defined for any of the following aspects of solicitation: solicitation documents development, review and approval; bidder management; bidding process monitoring; and bidders' questions and/or interviews.

ITS

As noted earlier, ITS does require the creation of a procurement plan as a part of the MPP. Within that procurement plan, section 9.2 - *Purchasing Strategy* recommends including details of the solicitation process in the plan, but does not expand on what is pertinent information.



Although the PMM notes that M&P process and procedure must guide IT procurement, it does not address how the following areas would apply to IT projects nor where the responsibility would rest: bidder prequalification, tracking, and disqualification; bidder management; bidding process monitoring; and bidders questions and/or interviews.

ITS's procurement guidelines do however go further than those of EC&E in that they note the PM's responsibility is defined as owner of the procurement strategy, and that details of the solicitation process should be a part of the procurement plan (i.e., the MPP) that is approved by ITS management.

Recommendations for Consideration	
▪	Clarify guidelines to formally identify, review and approve potential project vendors/bidders from a database of prequalified vendors, ensuring involvement of all relevant stakeholders.
▪	Complete a review of the solicitation process to confirm the timelines
▪	Complete a risk assessment of the current M&P IT system and determine options for maintenance or replacement that align with corporate system implementations planned in the near future. (Recommendation #37)
▪	Expand responsibilities of the project manager to include the solicitation process (planning, document development, vendor selection, etc.)

A.4.3 Source Selection

The primary objective of source selection is to select a bidder that can deliver on the project objectives and do so at the needed level of quality. The project team can be confident in their selection if they have detailed expectations of what is required that both they and the bidders fully understand.

Current Rating	M&P PPS	EC&E	IT	Operations
	Standardized	Informal		
Formalized source selection on most major construction contracts as well source selection training for some project personnel. Sealed bidding procedures appear to be followed for most competitive situations and are sometimes audited for compliance. For non-competitive situations, source selection matrices or other evaluation approaches are sometimes developed and utilized by project team members with scoring often facilitated by someone from the project management team.				
Within some delivering functional groups, there is informal or non-existent source selection guidance outside of M&P PPS process and procedure.				
Target Rating	Monitored			



Detailed Observations:

M&P PPS

Guidelines for bid evaluation are structured around a transparent process to give supporting evidence to project managers. They are process driven, as required of a public organization and a fair procurement process. Guideline 3.14 - *Preliminary Bid Evaluation* outlines the preliminary steps taken once a bid/proposal has closed. The guideline does not however address the following:

- bid/opening security until opening (including) requirements for safeguarding bid/proposal information such as identity & # of bids until after the bids/proposals are opened
- a process for addressing mistakenly opened bids
- roles/responsibilities for bid/proposal openings and a requirement for at least 1 witness
- a procedure for handling bids/proposals received after Opening such as not Opening them and returning them to the associated Bidder(s) as non-responsive.

Neither the Procurement Policy nor the PPS guidelines address oral presentations. Guidelines could include the circumstances in which orals should be used, who should be asked to attend, how they should be managed, what content may be presented and how they should be used to support scoring.

Guideline 3.22 - *Proposal Evaluation Criteria and Weighting for Qualitative Information* (subsection 3, Evaluation Process) clearly outlines the evaluation process based on performance scoring and price. Although the procedure is comprehensive, neither the Procurement Policy nor the guidelines appear to address monitoring of the source selection activities, whether that's by an internal independent entity (i.e. internal audit) or a third party fairness monitor.

EC&E

Source selection is only detailed in EC&E procedure *ECP-05 – Contract Procurement and Management*, stating "tenders, quotations or proposals submitted to the Branch are evaluated by M&P, the Project Team and any other appropriate Branch staff." The procedure only discusses that "evaluation criteria include meeting the commercial requirements of the tender, proposal or quotation, technical requirements of the tender, proposal or quotation and the consideration of any alternative, which may be submitted."

EC&E guidelines do not discuss EC&E's role in oral presentations, questions to ask during these orals or interviews, or their role in bid analysis. The Project Management Framework should refer to relevant M&P guidelines, such as 3.22 noted above, and the Procurement Plan within the Master Project Plan should detail any specific requirements or conditions on particular project that should be addressed during the source selection process.



Questions around bid rating criteria, particularly around rating of quality of references, were raised because of the Easier Access III program. A lack of clear rating criteria for reference projects in the RFP made it difficult for the TTC to disqualify and under-qualified low bidder on a particular project.

ITS

Neither ITS PMM nor the MPP discuss bid normalization guidelines, ITS's role in bid analysis, or the development and application of source selection guidelines. As with EC&E, these areas should be detailed in both the Project Management Framework, MPP as well as ITS specific group procurement guidelines.

Recommendations for Consideration	
▪	Expand responsibilities of the project manager captured within the Project Management Framework to include the source selection process, including planning, oral presentations / interviews, scoring.
▪	Include project-specific source selection plan and responsibilities within the Procurement Plan of the Master Project Plan.

A.4.4 Contract Negotiation

Negotiation of the contract is an important building block of the TTC's relationship with its contractor or consultant. The relationship is important because too often in construction projects, an adversarial mentality can set in between the owner and the contractor, where the contract's commercial terms become a battleground. In class-leading organizations, a project and the owner/contractor relationship is recognized for what it is, a partnership between two organizations, and negotiations will colour that partnership. Negotiation planning can include contract information, project information, a situation analysis, project scope/schedule/budget, a proposal/bid analysis, negotiation fact breakdown, negotiation plan/tactics and approved negotiation positions. To ensure that final contract negotiations are as fair and uncontentious as possible, many of these leading organizations will shift commercial term negotiations into the bidding process itself.

Current Rating	M&P PPS	EC&E	IT	Operations
	Standardized	Informal		
Formalized negotiation guidelines have recently been introduced, but negotiation plans are developed only for some major construction contracts. Training related to new guidelines is has not been fully implemented. Within some delivering functional groups, there is informal or non-existent contract negotiation guidance for project leaders outside of M&P PPS process and procedure.				
Target Rating	Monitored			



Detailed Observations:

M&P PPS

Formal M&P PPS negotiations guidelines appear to have been introduced with Guideline 3.38 – *Negotiation Guidelines* in November 2015. The guideline outlines specifically circumstances under which negotiations are permissible prior to contract award and what the process is for different procurement formats. These distinctions between formats however, typically relate only to different forms of DBB, as opposed to alternative forms of project delivery. The guidelines do not discuss negotiation monitoring, nor do they discuss the role of project managers from functional groups. Lastly, there is no reference to whether or not letters of intent are entered prior to negotiations.

An improved guideline would include roles and responsibilities of the M&P PPS and project leadership in the development and execution of negotiation plans, with reference to the PMF and MPP. If a commercial management capacity is developed within the TTC, either as an independent entity or a competency of the project manager, the commercial management function should have a key role in contract negotiation.

EC&E, ITS

Neither the EC&E procurement guidelines nor the ITS PMM discuss the project manager's role in contract negotiations. There is no requirement for negotiation plans for individual projects, and therefore no plan review and approval. A negotiation plan should be a part of the Procurement Plan within the MPP, with the project manager's role in contract negotiations described in the Project Management Framework.

Recommendations for Consideration

- Expand responsibilities of the project manager captured within the Project Management Framework to include contract negotiation planning and execution.
- Include project-specific contract negotiation plan and responsibilities within the Procurement Plan of the Master Project Plan.
- Ensure that if developed, the commercial management function is a key player in contract negotiation planning and execution.
- Update M&P PPS negotiation guideline to include responsibilities of project managers and to accommodate differing negotiation requirements of different contract vehicles of alternative delivery models (as defined in the Project Delivery Options Framework).



A.4.5 Contracting & Contract Standards

The contract is a project manager's primary tool for managing their project to ensure success. The contract and its application is the foundation of the partnership that is to be developed with the contractor, its commercial terms and conditions are the levers with which the project manager can steer project success, and the accurate definition of its technical specifications sets the expectations on the work to be completed.

Current Rating	M&P PPS	EC&E	IT	Operations
	Standardized	Informal		
Standard contract templates developed by Owner for all most major contract forms utilized by the TTC, including consulting services. Master agreements are executed with some major consultant (but not construction) vendors. Contract templates are periodically updated by project management and legal. Executed contracts are sometimes reviewed for compliance. The ability of delivering functional groups to direct reviews of or changes to contract standards are not defined within each group’s procurement and contracting guidelines.				
Target Rating	Monitored			

Detailed Observations:

M&P PPS

Standard contract templates exist, but are under control of the M&P group. M&P also published the TTC's *General Conditions* ("GC") on the TTC Procurement website. Interviews suggest there is a Contract Documents Committee, that includes representatives from M&P and legal that periodically reviews GCs and incorporates contractor community feedback where appropriate, but the terms of reference of this committee are not clear, nor are their details as to how issues are raised to this committee by user groups. Terms of reference should be developed for the committee and referred to as a part of an M&P process for contract document continuous improvement that includes frequency of contract document reviews, stakeholder engagement (both internal and external), approval process and communications guidelines for the changes.

Interviews with contractors suggest that the TTC's stance on contracting can be rigid compared to their other clients. The Contract Documents Committee can be responsible for overseeing an engagement program to identify opportunities for improvement. The TTC recently posted job opportunities for construction contract legal experience, which will be a beneficial addition to this effort. The role of this group will be particularly important as the TTC pursues projects using new contracts required by alternative delivery models. The TTC can consult with public procurement agencies such as Infrastructure Ontario to leverage their experience in this regard.



Master Agreements exist primarily for supplemental EC&E staffing (i.e. long-term consultants) rather than for construction contracts. There does not appear to be a strategy to develop master agreements for construction, which may be helpful for particular types of work.

EC&E, ITS

Neither the EC&E contract administration guidelines nor the ITS PMM discusses the project team's role in review or modification of standard contract documents. Neither group's guidelines refer to the committee above or mechanisms for modifying contract templates (i.e. through a lessons learned process).

The individual functional group procurement guidelines do not discuss different types of standard contracts, or the advantages and disadvantages of each when applied to the types of projects delivered by that group.

The Project Management Framework should discuss the types of TTC-standard contracts available for different types of procurement models, the advantages and disadvantages of each, and a process for decision-making. The procurement plan within the MPP should include the contract strategy, with support for the chosen form of contract.

Recommendations for Consideration

- Include in the Project Management Framework a continuous improvement process for standard contract documents.
- Formalize the Contract Review Committee with terms of reference that are referred to as a part of the above process.
- Include project-specific contract form selection as a part of the contracting strategy within the Procurement Plan of the Master Project Plan.
- Ensure that if developed, the commercial management function is a key player in contract standard development and review.
- Develop strategy for development of new contract standards needed to accommodate differing requirements of new contract vehicles of alternative delivery models (as defined in the Project Delivery Options Framework).

A.4.6 Contract Administration

Contract administration involves the activities necessary to maintain the contractual relationship. Administration activities include the control and maintenance of the commercial and compliance aspects of the contractual relationship such as communication and reporting protocols, document management, contract audits, and resolution of back charges, claims, and disputes.

The contract administration process helps to ensure that the contractors and suppliers performance meet the contractual requirements. Contract administration includes the application of project management processes to administer the contract relationship and



help ensure compliance with key contract terms and conditions. This process monitors and documents how a contractor or supplier is performing based on the contract terms. Financial management of the vendor to ensure payment terms are linked with contract performance should be monitored within contract administration.

Current Rating	M&P PPS	EC&E	IT	Operations
	Standardized		Informal	
Formal contract administration exists that includes documentation and tracking of major construction agreements and standardized contract filing and archiving. Contract management file structure provides access to contract information. Contract administration practices are sometimes reviewed for compliance and some personnel receive contract administration training.				
There is not currently a corporate or group level commercial management competency.				
Target Rating	Monitored			

Detailed Observations:

M&P PPS

Some corporate standards relating to contract management are referred to in the publically available Procurement Policy on the TTC Procurement website. This includes a standard contract change process (section 6.0). The rest of corporate capital project contract administration guidelines are focussed within the M&P PPS documentation.

Although officially the responsibility of contract management may remain with the project manager, for the majority of construction projects the M&P Senior Contract Administrator ("SCA") effectively acts as the owner of contract management. In leading organizations, the project manager should be as familiar with the contract as the contract administrators. Within the EC&E group, the Construction Managers add a layer in between the contract administration and project managers. Within ITS and some of the larger Operations procurements, project managers appear somewhat more closely involved in contract management.

M&P PPS's contract administration function is well defined within its department guidelines, with guidelines including kick-off meetings, correspondence, reporting, performance reviews, work plan releases, payments, progress review meetings, accruals, emergency plans and changes. The guidelines also have defined expectations for role expectations, including Senior Contract Administrators, Project Coordinators, Procurement Support Assistants and Contract Clerks. Role profiles like these are not found within the policies and procedures of the delivering functional groups.

One downside of the matrixed responsibility of contract administration is that the contract administration team is not well integrated into the project teams. On construction projects, the construction managers are located at site offices, with the project manager and M&P



teams centralized, and each seem to operate in a somewhat disconnected manner from one another. Internally, the contract administration team is seen as a process-driven entity operating outside the project as a support function, but one with a strong policing function. Interviews with contractors reveal the same observations, noting that often the contract administration can be rigid and burdensome to the point of contractors adding a 'TTC cost' to their bids anticipating the extra effort required. The rigid interpretation of the contract also has contributed to strained relationships with contractors, as highlighted in KPMG's contractor interviews and the Bechtel review of the TYSSE project.

The commercial management function discussed earlier is designed to focus on managing the commercial issues of a project from inception to completion, and it requires an understanding of the economics on both sides of the owner-contractor/vendor relationship. The relationship is important because too often in construction projects, an adversarial mentality can set in between the owner and the contractor, where the contract's commercial terms become a battleground. In class-leading organizations, a project and the owner/contractor relationship is recognized for what it is, a partnership between two organizations with different but generally aligned goals for the completion of the project. A commercial management function can help structure and effectively manage that relationship.

Some of the core concepts of commercial management are being discussed within the TTC, but only in the narrow context of developing competencies around proactive claims management. In reality, a claim is only a last resort, when an issues resolution process fails. With a strong commercial management function, many contractual disagreements can either be avoided by detailed commercial planning at the contracting stage, be identified and managed effectively during execution, or be mediated during issue resolution.

M&P PPS Guideline 2.1 describes the functionality and purpose of the Contract Information System (CONTRIS), an internally developed system that appears to be of significant age and of much lower functionality than most systems on the market. The system however, appears to only deal with the contract and related document during the initial contract process, not as a tool for contract administration. A more modern contract management software could be used support contract administration throughout the project lifecycle. Selecting a software package complimentary to existing TTC IT systems could also integration with other aspects of project management, including the following: Oracle Primavera Contract Manager (Primavera P6 currently used for scheduling); Sage Contract Management (currently using Sage Timberline Estimating); and SAP Project System Module (planned implementation of SAP for HR and Finance).

Requirements for maintaining and issuing formal project contract correspondence such as notices, amendments, letters of clarification, etc. are defined in M&P PPS 5.13 - *Contract Management System Reports Attachment* and 5.18 - *Issuance of Standard Reports*, noting 25 different reports including some of the following:

- Activity Reports
- Outstanding Contract Changes
- Overdue Payments
- Invoices Processed and received



- Contract Change/Claims Summary
- WARs issued and received
- WPRs issued and received
- RFQs
- staff assignments

Each report has defined frequency, time of run, users and parameters. However, 'Users' is by name, not title, and the listing appears to have been last updated in July 2012. This document should be updated to align with positions, and could be incorporate into a broader project management framework. Specification of names alongside, if continued, should only be done within a Master Project Plan for a specific project. M&P PPS *Guideline 1.2 (Typing, Signing and Distribution of Correspondence)* addresses hard copy signing and distribution, but not records maintenance or location.

Neither the Procurement Policy nor M&P PPS guidelines appear to address security or access to procurement documents.

EC&E

A contract review and approval process does not exist within the EC&E group, nor do existing procedures discuss EC&E's (or the PM's) role in the M&P's contract review and approval process.

EC&E procedure ECP-05 does not refer to the Contract Management System Database (CONTRIS), although *SWI-73-01 (Contract Change & Change Directive Management)* does refers to changes being logged in the Contract Management System Database.

Requirements for maintaining and issuing formal project contract correspondence such as notices, amendments, letters of clarification, etc. are not defined within EC&E Project Management or Contract Procurement & Management processes and procedures.

Documented security and access requirements, both to ensure confidentiality of contract information and to monitor contract system access, are not defined within EC&E Project Management or Contract Procurement & Management processes and procedures.

As noted above, the Project Management Framework should include the contract administration process and the roles and responsibilities of all functional groups (EC&E, ITS and Ops) within the process. The PMF can generalize the detailed guidelines within M&P PPS, but must define the role of the project manager and the broader project team. The PMF can feed into more detailed functional group procedures that define each group's contract administration role within a capital project. These responsibilities should be further defined within the contract administration section of the Master Project Plan.

Recommendations for Consideration

- Create a commercial management function within the organization. The adaptation of the process across project classifications may range from dedicated roles on highly complex projects, to project manager or contract administrator competencies on routine projects. (Recommendation #23)

Recommendations for Consideration

- Include in the Project Management Framework a section on contract administration.
- Update M&P PPS Contract Administration guidelines to reflect roles of project manager and functional group members of the project team.
- Include project-specific contract administration as a part of the contracting strategy within the Procurement Plan of the Master Project Plan.
- Ensure that if developed, the commercial management function is a key player in contract administration.
- Develop strategy for development of new contract administration standards needed to accommodate differing requirements of new contract vehicles of alternative delivery models (as defined in the Project Delivery Options Framework).
- Complete a risk assessment of the current materials & procurement IT system and determine options for maintenance or replacement that align with corporate system implementations planned in the near future. (Recommendation #34)

A.4.7 Contract Closeout

A leading contract closeout process includes a checklist for major closeout activities and handoffs of contractually required information and documentation such as As-Builts, Equipment Data Sheets, O&M Manuals, Warranties, and Certificates of Occupancy. This process also provides for a stage gate hold point to ensure that lessons learned have been captured. A well-controlled contract closeout process means all contract statuses are maintained within a contract management system with status reporting available real time to any stakeholders.

Current Rating	M&P PPS	EC&E	IT	Operations
	Informal	Standardized		Informal
Formal contract closeout procedures are developed and utilized on some major construction projects. Contract closeout status is sometimes maintained by project management and may be available upon request.				
Target Rating	Monitored			



Detailed Observations

M&P PPS

Neither contract closeout nor a contract closeout checklist are specifically dealt with in the M&P PPS Guidelines. Although a significant number of the deliverables related to closeout would typically be managed by the project manager, the interdependent roles of the project team and M&P should be described in M&P PPS guidelines, as well as the Project Management Framework.

EC&E

Procedure *ECP-05 - Project Management* refers to *Project Close-Out* (section 2.5), which references more specific requirements in procedure CDI-28 (Project Close-Out). This document was replaced with CDI-27 (discussed below) in December 2014, meaning document references should be updated.

The EC&E *Project Risk Management Plan* (Rev.1), which is currently in draft, has a section placeholder for lessons learned (3.1.6.3) under Risk Monitoring and Control, but the section has yet to be written. The lessons learned should play a critical role in defining risks for the next project.

EC&E work instruction *CDI-27 - Contract / Project Closeout* identifies the "actions necessary for the completion of a project including its aggregate design and construction contract(s)". Requirements are standardized for EC&E, but discussed in broad terms, with in-determinant language such as "should include" and "not limited to". *CDI-27* does include a broad list for the 'Contract Completion Package', but this includes vague requirements such as "Other contractual documents". Section 3.2 discusses project documentation, but does not include a checklist. *CDI-27* does not include a requirement to monitor contract closeout status for compliance with requirements and checklist.

CDI-27 section 2.0 (Responsibilities) dictates that the PM "is responsible for verifying all phases of the contract(s) are complete, issuing the project close-out report, and communicating project completion to identified project stakeholders", but does not reference a monitoring or approval process.

CDI-27 can be generalized into a corporate standard for contract and project closeout, which in turn can be adapted to the needs of other functional groups through function-specific procedures. Additional areas not addressed within CDI-27 that can be included in an update and in a corporate standard include the following: more rigid requirements for the project closeout report, a definition of a monitoring process, and integration into the stage gate process.

ITS

The *Project Phase-Gate Review Process* stipulates the creation of a *Project Closeout Report* ("PCR"). The PCR is a detailed document for capturing lessons learned, with focus on



realization of business goals, achievement of schedule, scope and cost, and with a specific section on Lessons Learned.

Recommendations for Consideration

- Include in the Project Management Framework a section on project / contract closeout.
- Update M&P PPS Contract Administration guidelines to include the closeout process.
- Include project-specific contract closeout requirements as a part of the contracting strategy within the Procurement Plan of the Master Project Plan.
- Ensure that if developed, the commercial management function is a key player in contract closeout, particularly with respect to lessons learned.
- Align new corporate contract/project closeout standards to the differing requirements of new contract vehicles of alternative delivery models (as defined in the Project Delivery Options Framework).



A.5 Project Controls and Risk Management

A.5.1 Change Management

Change management involves managing changes to a contract or project, which may involve changes to scope requirements, schedule duration, cost, or means and methods. These changes could be driven by an event, alteration in regulation, risk or safety requisite, change in stakeholder requirements, etc. Change management must be tied into the budgeting and forecasting processes, and be built on a culture of proactive risk management.

Current Rating	EC&E	IT	Operations
	Monitored	Standardized	Informal
On the majority of projects, formalized change management process is secure and utilizes a change management tool (project information, contract information, change reference, description of change, justification of change, source of change, impact & pricing, approvals,) standardized change order categories, formal review and approval and routine reporting of changes. The process is sometimes audited for compliance.			
Target Rating	Monitored		

Change control processes are the formal mechanisms through which a project's boundaries can be changed. The project manager should manage the process carefully to prevent unnecessary "scope creep" from occurring, and should cultivate continuous support for decisions from the project sponsor, steering committee, and all other members of the project team. Frequent and/or pivotal changes to project boundaries can create significant levels of risk for a project.

Without a structured change control process, project boundaries are difficult to maintain on long or complex projects as the need for change increases as the business undergoes routine change over time.

The key objectives of the change control procedures include:

- Control of change throughout all projects
- Transparency throughout the change process
- Implementation of cost justified and authorized changes only
- Reporting on product and project changes; corrective action taken and lessons learned
- Establish roles and responsibilities for the change management process
- Understanding and acceptance by management of the impact of proposed changes
- Authorization of proposed changes at the management level



- Communication to all relevant stakeholders as well as relevant sub-project leaders and sub-contractors

Detailed Observations:

PfMO and M&P

Within M&P's Project Procurement Section, there are detailed contract change procedures. Guideline 4.9 – *Contract Change Process Guidelines* lists the following categories for change: error/omission, changed requirements, scope change, site conditions, claim, and other.

Guideline 4.9 defines the procedures and departmental roles/responsibilities for processing changes for EC&E Branch construction and supply & install contracts (which assumes TTC's representative is the Construction Site Manager – "CSM"). The guideline also includes information in EC&E *SWI 73-01* and *SWI-083* (described below), but with more clearly defined roles and responsibilities, but does not refer to the EC&E *SWI*s or vice versa. These documents refer to a joint process, so according to leading practice they should cross-reference one another.

According to guideline 4.9, the Senior Contract Administrator ("SCA") is responsible for performing an analysis of the contractor's quotation(s) for a given change. Evaluation guidelines exist for lump sum, unit rate, and impact costs. There is also a documented change order authorization process and a requirement to formally approve change orders for all project changes based on established signature authority matrix/guidelines, which are appended to the guideline.

The PfMO is also in the process of rolling out a *Budget Change Request* document template to be used for in-year additional funding request for budgeted projects. This document includes discussion of impact analysis (for scope, cost and schedule), stakeholder impacts, project interdependencies, decisions required and contingency planning. Policy and process surrounding this document do not yet exist, but should form a portion of the Project Management Framework and be referenced in corporate and group-specific change management procedures.

EC&E

The EC&E group has detailed change management policy, process and procedure that, when combined with similar standards within M&P and the PfMO BCR, can form a robust corporate change standard to be adapted in other functional groups.

Change process work instruction (*SWI 73-01*) was revised in August 2015 and applies to Contract Changes ("CCs") and Change Directives ("CDs"). *SWI 73-01* has documented minimum change order requirements (3.1.3), which are included in the form *73-01-001 - Contract Change Order Summary ("CCOS")*. The *CCOS* includes an internal summary (CC&CD), an external report for contractor, and a summary sheet. The document is



controlled as well, with an accompanying sign-off (form 73-01-002), created in November 2015 as a one-page form for construction changes.

SWI-083 - Request for Change, defines how the Construction office manages a Request for Change (RFC) from the General Contractor. Within the CC/CD Management work flow, there is a documented requirement to receive a quote for change and validate the quote. Within the workflow, the PM is only involved if the value of the change exceeds the CSM's authority (>\$100k). The CCOS includes costs (quoted, CD, CC) as well as claimed and approved time extensions.

SWI-73-01 also includes an approval process (section 3.4) that generally aligns with M&P Guideline 4.9, but it is less detailed and does not include reference to the authority matrix.

CONTRIS is the M&P contract management tool that provides change order tracking and reporting. *SWI-73-01* notes that change initiation begins in the Contract Management System Database. Change Order & Claims Summary reports can be created for different contracts or higher roll ups. The tracking/reporting tool has the following functionality:

- Ability to tracking project changes based on the change reason (coded numbers).
- Ability to track Change orders throughout the Change order review and approval process
- Ability to report Changes based on submitted/ pending, approved, completed, etc.

ITS

The *PMM* references '*Change Management Procedure PS-004-11 2009-04-13*'. *PMM* section 10.1.2 (*Perform Integrated Change Control*) notes that management of the process is the responsibility of the PM. The Project Deliverable Catalog ("PDC") notes that change related 'Artefacts' include the Project Change Request (PCR) form and PCR log. The owners, authors, reviewers and approvers of the PCR and PCR Log are also noted in the PDC, but it does not indicate how changes should be incorporated into project reporting, nor does it discuss monitoring of change process. ITS's change process is standardized, but could easily include more detailed instructions from the EC&E and M&P processes.

Recommendations for Consideration

- Create harmonized corporate standards for Change Management, underpinning the new *BCR* and leveraging existing EC&E and M&P guidelines.
- Incorporate change management reporting and tracking into an integrated project management tool (i.e. 'smart' spreadsheet).
- Add change management key performance indicator (e.g., time to approval) to project reporting.
- Ensure that if developed, the commercial management function is a key player in the change management process.



A.5.2 Risk Management

Risk management incorporates the planning, identification, analysis, and management of project risks. Through risk management, the project changes from being in control of the manager to the manager being in control of the project. By helping reduce the impact of unplanned incidents and maximizing the occurrence of planned events through identification of potential risks before significant negative consequences occur, the project owner is in the position to realize numerous benefits relating to scope, schedule, cost, quality, safety and customer satisfaction.

Organizations with leading risk management functions commit to addressing risk management throughout the project lifecycle, as something that permeates all decision-making from project development through operations.

Current Rating	EC&E	IT	Operations
	Standardized (low)	Informal	
Within EC&E, formalized risk management planning is starting to occur for most major construction projects. Tasks include defined risk mapping (high, med & low for both probability and impact), but the risk management process not yet mature enough to be audited for compliance. Within ITS and much of Operations, risk management is informal, without risk management plans for the majority of projects. Some of the largest projects have risk management plans, but they are derived from the experience of the senior project team as opposed to by corporate standards.			
Target Rating	Optimized		

Implementation of a structured and documented risk management process should be a fundamental cornerstone of basic capital project management practice. Until recently, the TTC had no formal project risk management function. Enterprise Risk Management as a function is currently being developed corporately, but its focus is much more on safety rather than capital project risks. Because of its importance to all decision making, the TTC may consider risk management as an area to aim for an 'Optimized' level of control, allowing for live updating and reporting of risk across the organization.

Detailed Observations:

EC&E

The TYSSE's risk management function has recently evolved into a part of the EC&E Capital Programming team. As a fledgling group within EC&E Capital Programming team, the risk management function currently exists as a process unto itself. As noted above, instead, risk management should be a concept that permeates all project decision-making



throughout the project's lifecycle. In late 2014, the EC&E Capital Programming Risk Analysis team developed a robust project risk management plan that continues to mature. There is a clear process in place that covers planning, identification, analysis, response and monitoring and control. Process flows, tools and templates have also been created. Perhaps most importantly, the process has been developed to be scalable across levels of complexity.

The *Project Risk Management Plan* ("PRMP") was released in February 2014 (Rev.0) and outlined the process for planning, identification, qualitative and quantitative analysis, response and monitoring & control. The PRMP was substantially revised in October 2015 (Rev. 1) with the updating of one and addition of seven more appendices, including a process flow. The PRMP guidance document does not direct PMs to develop an individual Risk Management Plan for their projects, but instead refers to standard the appendix 'Risk Management Approach by Project Type', which identifies a continuum of management according to 5 risk levels.

Within the new *Project Charter*, the Risk section (11. *Project Risks*) is meant to highlight major risks and their treatment, but it does not speak to a risk management plan for the project. As the risk management process matures, a formal risk management plan can become a critical component of the Master Project Plan.

Risk register templates have been created for small (<\$5M), medium (\$5M-\$25M) and large (>\$25M) projects, with links to the SharePoint site included within the PRMP. The PRMP notes that the Register is the responsibility of the PM and SPE and that it must be stored in a specific SharePoint directory. New projects must use the new format Register, while existing projects will be assessed to determine if changeover is necessary. All Risk Registers are reviewed by Risk team. In the future, it may be possible to include the risk register as one sheet within an integrated project management tool (a consolidated 'smart' spreadsheet).

The PRMP documents risk analysis guidelines/procedures. The process outlines qualitative risk probability and impact rating (initial and current), and includes rankings (3 colours and 8 factors). It also outlines quantitative rating, when it is required and how Monte Carlo analysis is to be used. The small Capital Programming Risk team is supposed to be involved in risk workshops.

The PRMP stipulates a process for Risk Response (3.1.5), focusing on Strategy (3.1.5.1), Plan (3.1.5.2), Responsibility (3.1.5.3) and Action Due Dates (3.1.5.4). Response planning appropriately follows SMART methodology (Specific, Measurable, Attainable, Relevant, and Timely). Risk ownership is to be identified in the planning process and if risks are accepted, then their responsibility rests with the PM and SPE. The PRMP also has a section placeholder for lessons learned (3.1.6.3) under Risk Monitoring and Control, but the section has yet to be written. The Lessons Learned process within Project & Contract Closeout, as discussed previously, will play a critical role in defining risks for the next project.

Risk registers are centralized within SharePoint for review by EC&E risk team. Although all registers are of a standard format, they are Excel-based and there is no ability to aggregate their data for EC&E consolidated risk reporting. At this point, there is not a link between Enterprise Risk Management and Project Risk Management. Software purchased for ERM



did not take into consideration the relationship with Project Risk Management. Risk registers have been recently rolled out within the EC&E group, so Risk team involvement has been limited to on-the-job training and feedback rather than compliance and auditing.

The ability of the risk management plan to be implemented and have an impact on all project decision making is limited by the resources available to do so. As currently structured, the EC&E Capital Programming Risk Analysis has is limited to a Director (who is also responsible for QA) and two risk assessment officers. Without a project risk management system that helps automate consolidation of risk registers across the portfolio of projects underway, there is not enough capacity to both guide the implementation of the process and consolidate the data for reporting and gaining insight into portfolio level project risks. Proper risk management supports the objective of being a class-leader. To do so requires an investment in resources, both people and technology, to implement the project risk management plan across the organization for capital projects, and to tie it into Enterprise Risk Management. The EC&E Risk Management process is very strong and can easily be adapted and expanded to apply to all capital projects across the TTC's functional groups.

ITS

The ITS's *PPM* section 10.1.9 (Monitor and Control Risks) speaks very generally about risk management and a risk register. It does not however discuss risk planning or the creation of the register. Neither the *Solution Delivery Principles* ("SDP") nor the *Project Deliverables Catalogue* ("PDC") mention a risk register. The PDC's revision history suggests that a risk register was listed in a previous version, but removed in 2013. The guidelines note that the 'Risk Plan' is used to mitigate risks, but there is no reference to that document elsewhere in the PMM or within the PDC.

Recommendations for Consideration

- Develop the Risk Management function into a broader practice that covers the entire capital program. (Recommendation #19)
- Incorporate capital program risks into the Enterprise Risk Management system. (Recommendation #19)
- Increase resources to support the implementation of the current risk management plan within EC&E, and then more broadly across the organization. (Recommendation #19)
- Develop risk-based contingency for all capital projects, with discrete risks applying to different parts of the project lifecycle. Develop contingency management policy, process and procedure to govern development and management of a project's contingency. (Recommendation #20)



A.5.3 Design Standards & Specifications

Design standards form the backbone for any capital project process, as they provide the road map for how a project will be executed from a technical standpoint. In a leading organization, design standards across the company or function group in order to allow consistent delivery of projects from a technical perspective. Specifications meanwhile are an extension of those standards as tailored to the unique needs of the project delivery method.

Current Rating	EC&E	IT	Operations
	Standardized	N/A	Informal
Formalized design standards and specifications are utilized on most major construction projects that are updated regularly and made available to project personnel. Most project personnel are familiar with standards and specifications and sometimes perform reviews of contractor submittals for compliance with established standards and specifications.			
Target Rating	Monitored		

For the purposes of this Review, only EC&E and Operations were reviewed. Although the Operations group has multiple technical specifications, and indeed there are many referenced in the major Operations projects reviewed, there is no formal Operations capital project process or policy that informs how to manage these specifications. It should be noted that KPMG does not perform technical engineering and design services for construction projects. However, as part of our role providing governance and oversight services we are routinely requested to assess, evaluate and review the process and controls for engineering and design for construction projects.

Detailed Observations:

EC&E

Within EC&E, there is a standardized design management process. According to *ECP-06 - Design Engineering*, design engineering standards are detailed in the following:

- CADD Standards and Procedures Manual (2010 Ed.) - 95 page document, including sections for Consultants
- Design Manual – An online database with three volumes. Standards include general, civil, structural, stations, mechanical, systems, etc. (<http://standards.int.ttc.ca/DesignManual/default.asp>)
- Standard and Directive Drawings - online database with 8 'Directive' and 17 'Standard' drawing subcategories (<http://standards.int.ttc.ca/stdirdwg/default.asp>)
- Master Specifications - online database has 479 files listed as 'Master Specifications'.



The design review process is referred to in *ECP-06* and detailed in *ECE-P02 - Design Reviews and Bid Release*. *ECE-P02* notes that design reviews must include a Scope Review and a Constructability Review at a minimum, and scheduling is the responsibility of the PM. Process includes scope review, acceptance, design variance (if necessary), interim design review, construction review, sign-off for bid release and release for bid.

The detailed process references 18 checklist documents. Stakeholder responsibility for design reviews is also laid out, including: mandatory reviewer, signoff, and review acknowledgement. There are specific sign-off processes for the Plant Maintenance Department (PMD) at 30%, 100%, during construction and handover.

ECP-06 does not specifically address compliance or monitoring, except that the objective of the Design Reviews is to ensure compliance with TTC Design Standards. The process could be strengthened with the addition of a compliance and monitoring process and can be added as a major component of the Stage Gate Process.

Recommendations for Consideration	
▪ Add a compliance and monitoring process to the Engineering Design process. ▪ Adapt the Engineering Design process to apply to all other capital projects within Operations. ▪ Include a gate (or multiple sub-gates, depending on project complexity) for the Engineering Design Process as a part of the Project Stage Gate Process.	

A.5.4 Project Assessments

Project Assessments provide an opportunity for an organization to complete and independent review of a project's health throughout its lifecycle. Assessments are a way to gauge the success of project control at intermediate points between control gates of the Stage Gate Process. Performed either by an independent internal team or a third party, assessments can allow mid-project course corrections that can improve project outcomes and generate valuable lessons learned.

Current Rating	EC&E	IT	Operations
	Informal		
The TTC rarely if ever performs self-assessments on major construction projects and does not track and report project issues in order to avoid future issues recurring.			
Target Rating	Monitored		



Detailed Observations:

Within the EC&E group, there is not a formal self-assessment process or methodology. Internal audit notes that although they have completed process reviews in the past, they have more recently focused on contract compliance. The Engineering & Construction function had a peer review of their organization completed by the American Public Transportation Association (APTA) in 2007.

Within the ITS group, the *PMM* does not discuss project self-assessment or any role of Internal Audit in performing project reviews.

Without a self-assessment process, there is no related tracking, reporting, training, or lessons learned.

Formalized project assessments are becoming more common in capital project organizations, primarily as an expansion of Internal Audit compliance reviews that seek to be a more proactive tool to help project teams ensure the continued success or improve on the performance of their project. Project assessments typically will combine some form of contract auditing with a project management review for a given project. Depending on the duration of a project, project assessments can be scheduled periodically, with the project team also being assessed on how well they actioned and closed recommendations from prior assessments. These assessments can be included in the Master Project Plan as a part of oversight. In essence, these reviews are like a miniaturized version of this Review, one based on a pre-determined process and grading that allows for comparison of the relative health of projects within the TTC's capital program.

The ownership of a project assessment process could rest with either the PfMO or Internal Audit. The key for project assessments is that they are internally independent, and therefore not carried out by the delivering department. If the PfMO's mandate is to provide policy, process and procedure and act as a coordinating and advisory body for functional project teams, then the PfMO could also assume a monitoring role. If the PfMO takes on an execution role for capital projects, perhaps larger ones, then a monitoring role for those projects would need to rest with an independent group like Internal Audit.

Recommendations for Consideration

- Develop a standardized project assessment framework that focuses on both contract compliance and project management and controls monitoring.
- Include a requirement for project assessments in the Project Management Framework, with frequency and depth dependent on the project complexity.
- Include project assessments in the Master Project Plan.

A.5.5 Compliance Auditing

Compliance auditing provides assurance to the organization and project team that a capital project is being managed according to project management guidelines or by the terms of the contract. Compliance auditing can often focus purely on commercial terms of contracts,



but it is also important to ensure that process and procedure, either internal to the TTC or internal to a mature contractor, are being appropriately followed.

Current Rating	EC&E	IT	Operations
	Standardized	Informal	
The TTC performs compliance audits for some major capital contracts and sometimes conducts external contract compliance audits to identify and incorporate industry-leading practices. Issues identified during contract compliance audits are reviewed and decisions are made whether to seek credits/compensation. Contract compliance methodology is not standardized and personnel performing contract compliance audits receive limited training on changes to methodology and common issues encountered.			
Target Rating	Monitored		

Detailed Observations:

EC&E

ECE-P04 - Quality Assurance Audits describes creating a compliance audit plan for the EC&E group for processes and procedures, but does not deal with project audit plans. The *PRMP* notes that the Director Risk Analysis & Quality Assurance is responsible for establishing auditing standards for risk analysis, but they are not yet complete. *ECP-02 - Project Management* and *ECP-04 - Project Controls and Reporting* do not discuss project audits. *ECE-P04* refers to a QA Audit Plan (ECF-0303-001). Interim process *ECE-P05 - Contractor Performance Review* was revised in Sept. 2015, and includes requirement a minimum of one review within one year of contract award or within six-months of award if the Contractor is new to the TTC.

ECE-P04 describes creating a compliance audit plan for the EC&E group for processes and procedures on an annual basis. The workflow describes planning, execution, reporting and Corrective Action Plans (CAPs) and Requests (CAPs). *ECE-P04* also describes in detail audit preparation, execution, reporting, auctioning and closeout.

There is no formal process involving Internal Audit or a Third Party to audit contract compliance. Recently, if project audits have been conducted by the Internal Audit Department, they have been directed by management, carried out through that department, and focused primarily on contract compliance (invoicing and payments).

CDI-27 - Contract - Project Close Out dictates that a *Project Closeout Report* (section 3.3) must be created within two months of project completion. The department instruction does not discuss auditing of the process, or auditing related to the contract.



Overall, the process for auditing compliance with EC&E process and procedure is standardized, but a lack of resources prevents it from being carried out frequently enough to be helpful. The audits that were completed and reviewed were thorough and showed evidence of follow through. The Quality Assurance function could potentially benefit from being separated from the Risk Analysis function. Having a shared Director whose apparent primary responsibility is the development of the important Risk Management function could create some issues around prioritization. One option is to move both of these functions, separately, under a centralized entity such as the PfMO.

ITS

The ITS group's *PMM* does not discuss a project audit plan, nor is an Audit Plan included in the PDC's list of artefacts. *PMM* does not discuss a project auditing in relation to project controls and risk management, nor does it discuss third party or contract audits. The only reference to auditing relates to Quality auditing.

Internal audit suggests that their project auditing is primarily focused on contract compliance, but an audit had not been completed on the IT project sampled (SAP project is only in the development stage). The *PMM* also does not discuss a project closeout audit.

Recommendations for Consideration

- Develop a project audit plan as a component of the Master Project Plan, relating to project contracts or specific process areas.
- Adapt the EC&E Quality Assurance Audit process for broader use, applying first to new corporatized standards and then to more detailed functional group standards.
- Replicate the EC&E Quality Assurance Audit process for other function groups.
- Consider separation of the EC&E Risk Analysis and Quality Assurance functions.
- Consider the application of the Quality Assurance function within the EC&E Capital Programming group to the broader capital program.

A.5.6 Quality Management

Quality Management can be defined as the set of processes, policies and procedures to help ensure the management and product (goods and services) of a project adhere to a set of quality standards.

Current Rating	EC&E	IT	Operations
	N/A	Standardized	Informal
Within ITS, formalized quality control and quality assurance policies and procedures exist with formal quality management plans developed and maintained for many major projects. Quality assurance and quality control & inspection processes are in place to ensure projects meet the needs for which they were undertaken.			
Target Rating	Monitored		

Quality Management integrates the various internal control processes within the organization as well as within a specific project, and intends to provide a planned process approach for project execution. Quality Management should address the sequence and interaction of quality processes; the criteria and methods to help ensure effective operation and control of the processes; availability of information necessary to support the effective operation and monitoring of these processes; methods of measurement, monitoring and analysis needed, in order to implement those actions that will achieve planned results and continual improvement.

For this Review, the Quality Management of capital construction projects was not reviewed in detail, as they are largely dependent on the Engineering Department and their internal processes. Quality Management was reviewed in context of the ITS group.

Detailed Observations:

Most TTC capital construction projects are delivered using a traditional Design-Bid-Build delivery model, with design managed separately from construction, meaning it is the responsibility of the designers to manage project quality. Within EC&E projects, it is the Engineering group's responsibility to ensure the project is delivered with the appropriate quality, but *ECP-06 Design Engineering* does not reference quality management. As alternative forms of project delivery are increasingly used, the requirements for quality management will change dramatically as specifications change from detailed design standards to output specifications.

ITS

The ITS group's *PMM* section 8.1.12 (Plan Quality) outlines the creation of the 'Quality Assurance Plan'. Responsibility rests with the PM and the assistance of a project team member resource drawn from the QA department. The 'Quality Assurance Plan' document is not listed in the *PDC* or as a requirement in the Solution Delivery Principles 'minimum artefact requirements'. There is a Manager - Testing & Quality that oversees all projects from the ITS Quality Assurance department. The *PDC* includes multiple quality 'Artefact' documents as a part of the test phase, including Test Plan, Record of Test Results, Validation Form, Requirements Traceability Matrix, and Deficiency Form.



PMM section 9.1.2 (Perform Quality Assurance) outlines the quality auditing process. Specified inputs include the performance test plan, quality test plan, performance testing guidelines and the ITS Performance Metric Trends Maintenance document. The first four of those items are not referenced in the PDC 'Artefacts' section but may be a part of the Project Master Plan. Specified outputs include a Quality Assurance Investigation Report, which is not listed in the PDC 'Artefacts' section. Responsibility lies with the PM.

PMM section 10.1.7 (Perform Quality Control) outlines the quality monitoring process. Specified inputs include the quality testing guidelines, Test Plan, Record of Test Result, Quality Assurance Plan (QAP) and Issues Log. PDC 'Artefacts' section includes only the Test Plan and Test results. Specified outputs include a Quality Assurance Investigation Report, which is not listed in the PDC 'Artefacts' section. Responsibility lies with the PM.

The project management framework should include quality management as it applies to capital projects, with a quality management plan a component of the Master Project Plan. Quality requirements should be a part of monthly report as needed, and performance should be tied to the Stage Gate Process. The role and responsibility of the project manager should be clearly defined in the quality management process, with clear supporting responsibilities of functional technical experts.

Recommendations for Consideration

- Leverage the ITS quality management process for a corporate standard as a part of the Project Management Framework.
- Replicate the ITS quality management process for the EC&E and Operations group capital program.
- Integrate quality management into the Stage Gate Process.

A.6 Schedule Management

A.6.1 Schedule Development Standards & Processes

In an organization with multiple projects within the capital program, it is important that all schedules be developed with a common set of development standards and following a defined process, allowing easy comparison and consolidation for portfolio reporting. Varying project complexities require schedules of varying sophistication, but the principles of development should be the same throughout.



Current Rating	EC&E	IT	Operations
	Standardized		Informal
Formalized schedule development standards and processes (critical path methodology, templates, scheduling taxonomy/hierarchy) with formal milestone and detailed schedules utilized on most major construction projects with some project personnel receiving schedule development training.			
Target Rating	Monitored		

Detailed Observations:

EC&E

Although the schedule development methodology is not recorded, it appears to be formalized in practice within the EC&E Capital Programming's Scheduling team. EC&E department instruction *EDI-17* discusses multiple schedules: Master Project Schedule ("MPS"), Project Schedules, Contract Schedules (Design, Pre-Construction, Construction) and references the schedule format standards. Schedules follow AACE numeric levels (0-4-x):

- Level 1 is for Program-level scheduling
- Level 2 is done within the TTC for visibility of different departments
- Level 3 is used for coordination with other City agencies
- Level 4 is project specific.

Schedule databases are isolated to maintain integrity. All schedulers have access to a Projects level database and can create or import and schedule. The MPS level database is locked to schedulers to preserve master control. The TTC's *Master Specification - Section 01 32 17* deals with CPM Schedule and provides detailed requirements for contractor/consultant schedules. Contracts require the following schedules dependent on value:

- <\$5M - Microsoft Project
- >\$5M - Primavera P6

Instruction *WI-20 - Scheduling Hierarchy* details the three levels of schedules, what they include, their templates and how they evolve through the project. *WI-22 - Adding Level 1 and/or Level 2 Schedule to the Master Project Schedule* details how to add preliminary schedules into the P6 MPR.

WI-25 - Master Project Schedule Coding details how schedulers are to code and organize information within the MPS to allow, "the relevant data extracted for reporting and analysis". Six schedule templates (P6) have been implemented, based on three types of execution each in design and construction. Schedule specification was recently updated, including



requiring the qualifications of the contractor's scheduler, as smaller contractors often have not had the capability to provide adequate schedules.

According to *EDI-17*, the Project Scheduler prepares and reviews detail pre-construction schedule prior to tendering. The Program Scheduler assists Project Schedulers in reviewing contractors' schedules submitted for approval during construction. Following project budget approval, the Project Schedule becomes the Baseline Schedule.

Although schedule development appears well defined within the EC&E Capital Programming Scheduling function, the expertise is not universally used. Limited resources mean that many smaller projects are managed by either MS Project or spreadsheet-based schedules by the individual project managers without the oversight or guidance of the scheduling expertise.

Documentation of the schedule development process and the addition of a monitoring function could ensure consistent application of project scheduling techniques, particularly on smaller projects, across the capital program.

ITS

The ITS group's *PMM* section 8.1.9 (Develop Schedule) sets some high level guidelines for schedule development. The process is the responsibility of the PM and is usually self-performed. The process does not refer to required software or level of detail. The SDP requires a schedule to be created for all levels of project complexity. The PDC lists the Director-PM as the owner of the Schedule Template, and that the author is the BA or PM/PL. The *2015 TTC Org Chart* shows two Project Cost/Schedule Analysts positions within the 'Planning Resources & Admin' group, but with one vacancy, the *PMM* does not refer to the Schedule Analyst role.

PMM section 8.1.9 (Develop Schedule) sets some high level guidelines for schedule development, but does not cite best practices, tools, or software. Within the appendix, the schedule is noted to be in Primavera P6, but this is not discussed within the *PMM* itself.

PMM section 8.1.9 (Develop Schedule) dictates that the schedule is to be reviewed and approved by the steering committee. The PPGRP requires an approved baseline schedule in order to complete Gate 2, with a milestone schedule required for Gate 1.

Overall, although the ITS scheduling guidelines lack some of the structure of those within the EC&E group, they provide more detail on schedule development and the roles and responsibilities of functional team members in the development and approval of schedules. They also tie the schedule creation to the Phase Gate process. These additional details can be added to the EC&E scheduling guidelines as a part of a corporate standard for scheduling.



Recommendations for Consideration

- Formalize documentation of the EC&E schedule development process and use as a basis for developing corporate standards.
- Align schedule development, WBS levels and software, with project complexity according to the Project Complexity Tool.
- Develop scheduling standards for smaller projects with a monitoring function to ensure compliance.

A.6.2 Schedule Change Management

Schedule Change Management concerns the planning, scheduling, and approval of schedule changes resulting from the change control process. The primary objectives of managing schedule changes are to:

- Identify direct and indirect changes to the schedule based on scope changes
- Perform a schedule impact and cost estimate for the identified change
- Track and communicate schedule and cost impacts to the project team

Current Rating	EC&E	IT	Operations
	Informal		
Formalized change management standards and processes utilized on many ITS projects (schedule change meetings, review methodology) with some review and approval and ad-hoc reporting of key schedule changes. Informal or non-existent change management standards and processes utilized on major construction projects Some project personnel receive regular training on schedule change management.			
Target Rating	Monitored		

Detailed Observations:

EC&E

Formalized procedures do not appear to exist for schedule change management. *Master Specification ("MS") 01 32 27* (CPM Schedule) dictates that request for extensions of time must include a Time Impact Analysis (9), or a change in sequencing must include a Recovery Schedule (8).

Instruction *SWI 73-01 - Contract Change and Change Directive Management* does not address schedule directly, with schedule only discussed in relation to cost impacts of delays. *MS 01 32 27* does not address schedule change review and approval.



ITS

The ITS group's *PMM* section 8.1.9 (Develop Schedule) notes that major revisions to the schedule that affect overall cost or milestones must be approved through the "TTC Project Change Management Process", although an IT-specific 'Project Change Request Process' document exists. The *PMM* does not give any context to how that process applies to IT specifically.

Although management of change is discussed within the *PMM*, there is not a defined methodology to assess schedule impacts of project changes. PCR Process workflow indicates the PMO is responsible for verifying PCR document compliance, but that the steering committee is responsible for recommendations. There is no further detail on a process for assessing schedule impact. The PCR form has a space for "Time" impact and a general comments section. PCR Process indicates changes must be reviewed and approved by the steering committee.

The project change management process should be detailed as a part of a corporatized capital project change management process. This process should address the following:

- Process for objectively evaluating project status and communicating it to upper management
- Process for receiving, reviewing and reporting on recovery schedules
- Process to ensure impacts of changes are properly evaluated
- Methodology for continuous evaluation of schedule impacts of active risks
- Process for capturing and reporting the costs of schedule impacts
- Requirements for milestone change justification and escalation

Recommendations for Consideration

- Ensure that schedule change is specifically addressed in existing change management guidelines.
- Develop schedule change process as a part of the change management process within the project management framework.
- Include the schedule change process in the change management plan section of the Master Project Plan.

A.6.3 Schedule Management Process

Successful schedule management ensures that the project schedule is an accurate reflection of the interdependencies of the project and is an adequate tool to determine the effort required to complete the stated scope of work.



Current Rating	EC&E	IT	Operations
	Standardized	Informal	Informal
Formalized schedule management on many major EC&E projects with established schedule reporting (baseline, milestone, detailed, Look Ahead), ad-hoc distribution of project schedules to project stakeholders, limited schedule review meetings and limited access to project schedules.			
Informal schedule management procedures exist on major ITS and Operations projects.			
Target Rating	Monitored		

Detailed Observations:

The new PfMO *PSR* template includes an 'Executive Level Program Schedule' that highlights major milestone status as red, yellow or green, but does not contain any schedule KPIs. The schedule reporting in this document is in a Gantt chart format that replicates only the milestone schedule, requiring the reprocessing of schedule data rather than porting data from the source, whether that is MS Project or Primavera P6.

At the activity reporting levels of the organization, there may be opportunities to allow multi-user input into schedules. Specialized consultancies have developed web-based tools supported by an administration program, that allow an organization to automate the process of entering activity progress and forecast data for MS Project and Primavera users. Project team members can update the progress of their activities online and the interface program allows scheduling specialists to manage automatic updating of the source schedule files. Microsoft offers similar functionality in its Project Pro for Office 365, as does Primavera with its P6 Enterprise Project Portfolio Management.

Ultimately, there are cost-benefit trade-offs in adding any of these functionalities. Doing so can eliminate some of the process duplication that takes project managers away from focusing on managing their projects.

EC&E

Instruction *SWI-80-01 - Monthly Progress Reporting* does not refer to project schedule updates. *EPI-17* indicates only that Project "schedules are updated periodically against the baseline", and that "significant variations from the baseline are noted on the Project Summary Report each period to represent current status." Status and deviations to the agreed Design schedule are reported each period by the Designer to the Project Team. Interviews indicate the MPS is updated monthly and published on SharePoint, but there does not appear to be a documented requirement to formally track and report project schedule milestones and distribute project monthly schedule updates (baseline and detail) on a monthly basis. The process of updating and reporting on the project schedule should



be clearly defined. The monthly dates for submission and approval of the schedule should be included in the Schedule Management section of the Master Project Plan.

MS 01 32 27 dictates that a contractor's Baseline Schedule should be updated on a monthly basis (7.1), with additional specifications on how to revise the baseline (10), and a requirement to include a tabular EV report at the WBS level with SPI and CPI (7.11.3).

An interim process *ECE-P06* (Schedule - Contractor's - Management and Application of LDs) was created in August 2014, for the management and application of Liquidated Damages pertaining to schedule. This interim process puts specific guidelines around how Construction Site Managers should deal with contractor delays that do not have an accompanying request for extension of time. The process is very rigid and although it may provide a disincentive for contractors to claim delays, it reinforces the fraught commercial relationships that contractors cited as problematic with the TTC. Ideally, a commercial management function should work closely with schedule management to avoid surprise delays.

The TTC can be proactive in this regard by reviewing contractor schedules and testing their integrity. Interviews suggest that the TTC's scheduling team has both the software capability and internal competency to complete this kind of analyses, but that the resources are too scarce to complete it on a regular basis. Using the Project Complexity Tool as a reference, the TTC can consider requiring project schedule integrity tests for contractor schedules on projects above a certain threshold. Depending on how the contracts are structured, it may be possible to make integrity audits a requirement of the contractor, removing the need for the TTC team to conduct a full assessment themselves.

ITS

The ITS group's *PMM* section 10.5 (Control Schedule) indicates only "the project schedule will be adjusted to reflect the progress against the baseline". It does not comment on instances where it is necessary to update the baseline. Neither the *PMM* nor the *MPP* refer to schedule performance management or schedule reporting. The EC&E schedule management principles can largely be adapted as the ITS process.

Recommendations for Consideration

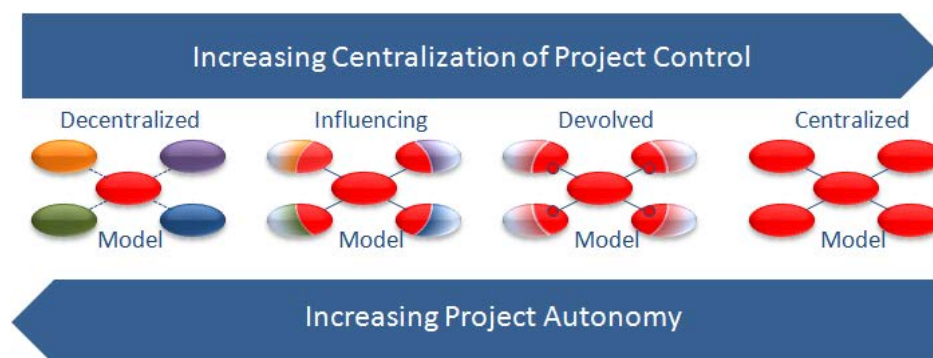
- Leverage add-on capabilities of existing scheduling systems to automate and facilitate streamlining of the portfolio level schedule reporting. (Recommendation #35)
- Develop corporate schedule management procedures, clearly defining schedule updates and reporting.
- Detail the monthly dates submission and approval process of the Schedule Management Plan within the Master Project Plan.
- Develop formal schedule integrity requirements for contractor schedules and develop an independent testing requirement (by the TTC or using a third party) for projects of a certain complexity.

A.7 Project Control Models

The Spectrum of Capital Project Control

When we look at how high capital spend organizations are structured to deliver capital construction projects, it is helpful to consider a continuous spectrum of project control ranging from a fully decentralized to a centralized model (see Fig. A7-1). Through our engagement with City and TTC staff, it is clear that the organization currently operates a largely decentralized model of project control. The objective of this appendix is to present a discussion of the various models of capital project control and how the TTC might benefit from an increased degree of centralization, and what this might look like in practice in terms of a corporate project management support function.

Figure A7-1 – Spectrum of Project Control



Decentralized Model

At one extreme of the project control spectrum lies the fully decentralized model whereby each functional business unit of the organization takes responsibility for delivery of their own capital project requirements, employing project managers and largely using their own processes and procedures. This model is typical of organizations with highly diverse and specialized capital projects that require close integration of capital and operational functions.

Influencing Model

Moving across the spectrum, the influencing model is characterized by the existence of a corporate project management capability that seeks to control performance through the provision of expert support and standardized corporate process and procedure, often combined with a performance management, monitoring and reporting role. This model is well suited to organizations with a diverse portfolio of capital projects and is a common model among municipal governments.



Devolved Model

Moving further towards centralization, the devolved model is where a central pool of project managers is deployed among the client business units, integrating closely with their operational colleagues while implementing a common project management methodology and operating under the oversight of a corporate project management function. This model permits a degree of autonomy within an otherwise very structured project delivery environment and is typically used by organizations with less diverse capital project needs.

Centralized Model

At the other extreme, the centralized model of project control would typically involve a dedicated corporate service department taking direct control of the management of all major capital projects on behalf of internal client business units. We see this model employed by organizations with a strong operational focus that have a program of well-defined capital projects of low complexity and variety.



TTC Capital Program Delivery Review

Appendix B – Project Complexity and Risk Assessment



**Disclaimer:**

This document has been prepared by KPMG LLP ("KPMG") for **The City of Toronto** ("Client") pursuant to the terms of our engagement agreement with Client dated September 22, 2015 (the "Engagement Agreement"). KPMG neither warrants nor represents that the information contained in this document is accurate, complete, sufficient or appropriate for use by any person or entity other than Client or for any purpose other than set out in the Engagement Agreement. This document may not be relied upon by any person or entity other than Client, and KPMG hereby expressly disclaims any and all responsibility or liability to any person or entity other than Client in connection with their use of this document.

KPMG's role was to outline certain matters that came to our attention during our work and to offer our comments and recommendations for the City's and TTC's consideration. These comments, by their nature, may be critical as they relate mainly to opportunities for change or enhancement and will not address the many strong features of the TTC's current activities and undertakings.

Our procedures will consist solely of inquiry, observation, comparison and analysis of TTC-provided information. We relied on the completeness and accuracy of the information provided. Such work does not constitute an audit. Accordingly, we will express no opinion on financial results, internal control or other information.





B. Project Complexity and Risk Assessment

B.1 Introduction and Background

The TTC's extensive capital investments cross a wide range of complexity levels. Projects and programs should be assessed relative to their impact on the organization, i.e., based on the inherent risk and complexity involved.

A project risk and complexity tool is required to allow project sponsors, and the organization as a whole, understand the potential impact of projects. A standard enterprise tool provides a common vernacular and approach with respect to how projects are perceived at the outset as well as to they are managed throughout the project lifecycle.

Projects of greater complexity have an increased potential to impact the reputation of the organization. These projects are not necessarily the ones with the largest capital budgets, though they are frequently related. Complex projects also tend to have greater interfaces with externalities such as the public, other city departments, and multiple levels of government due to funding requirements.

The project classification framework is designed to assist project sponsors in classifying projects into one of the six identified categories.

The category of project will determine the competencies of project management, the appropriate controls, and governance arrangements that should be adopted to help ensure the project is delivered successfully.

The TTC currently has three frameworks:

- Enterprise Risk Ranking;
- EC&E Risk Management Levels; and
- ITS Solution Delivery Principles.

Collectively, these frameworks classify project risk for various purposes throughout the organization. These frameworks capture some of the required assessment areas to categorize a project in terms of risks and complexity, however, are also missing some of the essential areas required for an assessment that fully captures the required breadth.

As a part of EC&E's Project Risk Management Plan a system has been developed for classifying projects with respect to risks. The purpose of classifying the projects is to provide a recommended approach to manage project risks.

There are five levels of classification from low to high risk as they apply to the potential severity of the impact to organization:

- Level 1;
- Level 2;
- Level 3;
- Level 4; and
- Level 5.

The Information Technology Services department created a solutions delivery principles matrix which scales projects. The matrix outlines the standardized minimum project elements that are



required at stages throughout the project lifecycle, from pre to post-project. Larger more complex projects require an increased level of documentation. The ITS scale used is as follows:

- Work Order;
- Level 1;
- Level 2; and
- Level 3.

B.2 Project Complexity and Risk Framework

B.2.1 Framework Development

The three existing TTC frameworks were used as the foundation for the project complexity and risk assessment framework. These were combined with elements from the Project Management Institute and other industry leading practices resulting in a rigorous, qualitative tool for evaluating project complexity and risk.

The goal of this framework is to assess the capital projects in a qualitative manner against 34 criteria. The criteria fall into thirteen categories consisting of the TTC's seven corporate strategic objectives as well as the six additional categories included based on industry leading practices.

Figure 1: Complexity and Risk Framework Criteria Categories

TTC Corporate Strategic Objectives	Additional Categories
Safety	Corporate
Customer	Budget
People	Externalities
Assets	Procurement
Growth	Project Team
Financial Sustainability	Schedule
Reputation	

B.2.2 Use of the Framework

The framework is intended to provide a qualitative supplement to the institutional knowledge of the TTC and exist as a living document. No single tool should be viewed as a replacement for in-depth knowledge. Each project will present unique challenges, and this framework should be adapted to suit the purposes of project management practitioners.

The purpose of choosing qualitative responses is that it provides the project sponsor with an element of judgement. This judgement allows the sponsor flexibility in their responses and



recognizes that the relative importance of some risk criteria will change on every project. A qualitative approach helps ensure that the project sponsor will take ownership and responsibility for the outcome. This is in contrast to a quantitative approach where the numbers guide the assessment of project complexity. Quantitative selection has been shown in previous reviews to be too prescriptive, and reduces the sponsor's ability to use judgement as to the nature of the risk.

B.2.3 Framework Scoring

The framework scores each criteria by assigning a value of 1-6 from low to high complexity/risk. Once all of the questions have been answered the score is determined by adding the value for each of the questions.

Figure 2 is the assessment framework matrix that practitioners would use in scoring projects, and Figure 3 provides further guidance on the application of each criteria.



Figure 2: Complexity and Risk Framework

Category	Criteria	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Score (1-6)
Corporate	Overall effect of this project on the organization	Minimal	Low	Medium	High	Very High	Significant	
	Potential for legal risk due to liabilities, regulatory requirements, property acquisition/easement, claims, etc.	Minimal	Low	Medium	High	Very High	Significant	
	Internal support for the project	Significant	Very High	High	Medium	Low	Minimal	
Budget	Estimated total project cost	Less than \$5 million	\$5-20 million	\$20-125 million	\$125-250 million	\$250-500 million	Greater than \$500 million	
Externalities	Number of sponsors, funding agencies, or stakeholder groups that are involved	Minimal	Low	Medium	High	Very High	Significant	
	Stakeholder commitment	Significant	Very High	High	Medium	Low	Minimal	
	Level of public involvement	Minimal	Low	Medium	High	Very High	Significant	
	Level of dependency of other projects/operations on this project?	Minimal	Low	Medium	High	Very High	Significant	

	Level of dependency of this project dependent upon other projects/operations?	Minimal	Low	Medium	High	Very High	Significant	
	Influence of public perception on the project	Minimal	Low	Medium	High	Very High	Significant	
Procurement	Separate contracts that will be procured as part of this project (contract interfaces).	Minimal	Low	Medium	High	Very High	Significant	
Project Team	How many people (TTC, design consultants, and contractors) are required to complete this project at its peak activity	Less than 10	10-25	26-50	51-100	101-250	Greater than 250	
Schedule	From project initiation to project close-out, what is the expected duration of the project	Less than 12 months	12-24 months	24-36 months	36-48 months	48-60 months	Greater than 60 months	
	The susceptibility of the schedule to delay	Minimal	Low	Medium	High	Very High	Significant	
	Number of external approvals required	Minimal	Low	Medium	High	Very High	Significant	
	Rate the disparity in the location of the project participants	Minimal	Low	Medium	High	Very High	Significant	
Scope	In past 10 years, how many times has this type of project been undertaken at the TTC	Routine	Annual	Every 2yrs	Every 5yrs	Every 10yrs	+10yrs	
	In past 10 years, how many times has this type of project been undertaken outside of the TTC	Routine	Annual	Every 2yrs	Every 5yrs	Every 10yrs	+10yrs	

	Rate the support for the proposed project methodology	Significant	Very High	High	Medium	Low	Minimal	
	Rate the clarity of the project's requirements	Significant	Very High	High	Medium	Low	Minimal	
	Rate the project in terms of the number of tasks, elements, or deliverables in the work breakdown structure compared to "an average project"	Minimal	Low	Medium	High	Very High	Significant	
	Rate the capability of the TTC to deliver the project.	Significant	Very High	High	Medium	Low	Minimal	
Safety*	Risks & opportunities regarding safety, health and security of customers, employees and the public	Minimal	Minor	Moderate	Major	Catastrophic	Disastrous	
	Risks & opportunities regarding the environment	Minimal	Minor	Moderate	Major	Catastrophic	Disastrous	
Customer*	Risks & opportunities to on-time service delivery	Minimal	Minor	Moderate	Major	Catastrophic	Disastrous	
	Risks & opportunities to customer service performance measures	Minimal	Minor	Moderate	Major	Catastrophic	Disastrous	
People*	Employee engagement, performance and culture	Minimal	Minor	Moderate	Major	Catastrophic	Disastrous	
Assets*	Risks & opportunities to the security of the asset & information	Minimal	Minor	Moderate	Major	Catastrophic	Disastrous	



Growth*	Rate the project regarding its ability to expand the system to meet future demand	Minimal	Minor	Moderate	Major	Catastrophic	Disastrous	
Financial Sustainability*	Funding, revenue or expenditures	Minimal	Minor	Moderate	Major	Catastrophic	Disastrous	
Reputation*	Risks & opportunities to customer confidence	Minimal	Minor	Moderate	Major	Catastrophic	Disastrous	
	Risks & opportunities to stakeholder and media management	Minimal	Minor	Moderate	Major	Catastrophic	Disastrous	
	Risks & opportunities to financial penalties	Minimal	Minor	Moderate	Major	Catastrophic	Disastrous	
	Risks & opportunities to regulatory compliance	Minimal	Minor	Moderate	Major	Catastrophic	Disastrous	
				Total				

* denotes criteria that are TTC strategic objectives from the enterprise risk ranking table.



Figure 3: Complexity and Risk Framework Criteria Guidance

Category	Criteria	Criteria Guidance
Corporate	Overall effect of this project on the organization	Complexity and risk may increase if the project impacts significant portions of the organization. A score of 6 indicates that the project significantly impacts the TTC and the quality/quantity of services that are offered. A score of 1 indicates that there is little impact to the TTC corporately and the quality/quantity of services offered are not likely to be affected.
	Potential for legal risk due to liabilities, regulatory requirements, property acquisition/easement, claims, etc.	Complexity and risk may increase if the project has the potential to cause legal risks. A score of 6 indicates that the project significantly impacts the legal risks to the TTC and the quality/quantity of services that are offered. A score of 1 indicates that there is little impact to the TTC corporately and the quality/quantity of services offered are not likely to be affected.
	Internal support for the project	The level of the project complexity and risk may be related to the support a project receives internally. A score of 6 indicates that, while the project may have received funding, there is little to no support in completing the project. A score of 1 indicates that the project has full internal support.
Budget	Estimated total project cost	The size of the budget for a project may indicate the level of complexity or risk. Level 6 indicates a generational project valued at over \$500M while a Level 1 indicates a routine project with a value of less than \$5M.
Externalities	Number of sponsors, funding agencies, or stakeholder groups that are involved	The number of stakeholder groups involved may impact the level of complexity or risk to a project. Each stakeholder may bring unique requirements to the project. A Level 6 response indicates that there are many stakeholders involved whereas a Level 1 indicates that there are only a few.
	Stakeholder commitment	The level of project complexity and risk may be related to the support a project receives from its external stakeholders. A score of 6 indicates that the project has received little or no commitment from all of the project stakeholders for completing the project. A score of 1 indicates that the project has full stakeholder support.
	Level of public involvement	The level of the project complexity and risk may be related to the level of public involvement in a project. Increased public involvement can increase the complexity. A score of 6 indicates that there is significant level of public involvement in the project. A score of 1 indicates that the project will have limited impact on the public, and therefore the public involvement is limited.

	Are other projects/operations dependent on this project?	Projects rarely exist in a vacuum and are likely to have varying degrees of impact on other projects or operations. The greater the number of interfaces between these projects or operations, the greater the risk and complexity involved. A score of 1 indicates minimal impact on existing projects and operations, a 6 indicates a significant potential impact.
	Is this project dependent upon other projects/operations?	Projects rarely exist in a vacuum and are likely to be impacted by other projects or operations. The greater the number of interfaces between these projects or operations, the greater the risk and complexity involved. A score of 1 indicates minimal impact by existing projects and operations, a 6 indicates a significant potential impact.
	Influence of public perception on the project	The level of the project complexity and risk may be related to the public perception of a project. Increased public involvement can lead to a project becoming politicized, which can increase the complexity. A score of 6 indicates that there is significant level of public involvement in the project. A score of 1 indicates that the project will not impact the public and therefore the public is not involved.
Procurement	Separate contracts that will be procured as part of this project (contract interfaces).	The level of the project complexity and risk may be impacted by the number of contract interfaces involvement on a project. Project interfaces created by multiple contracts can increase the number of project stakeholders, risks and complexity of the project. A score of 6 indicates a significant number of contracts involved; a score of 1 indicates minimal additional contracts.
Project Team	How many people (TTC, design consultants, and contractors) are required to complete this project at its peak activity?	The number of project team members can impact the risks and complexity on a project. This is especially true if there are multiple organizations involved. Greater numbers of team members can increase the project risk and complexity. A score of 6 indicates that there is significant number of project staff and craft (250). A score of 1 indicates that the project has limited staffing requirements (<10).
Schedule	From project initiation to project close-out, what is the expected duration of the project?	The duration of a project can impact the complexity and risks. The number of decisions and interfaces that occur over an extended period can increase the level of complexity and risk. A score of 6 indicates a project that extends beyond 60 months, a score of 1 indicates a project duration of less than one year.
	The susceptibility of the schedule to delay	Numerous factors can impact project baselines. Delays can be caused by the contractor, supplier(s), owner, external partner, etc. Highly complex and risk Level 6 projects are easily susceptible to schedule delays, regardless of who is responsible of the delay. Level 1 projects are secure in their timelines and are not likely to incur any schedule delays.
	Number of external approvals required	External approvals can potentially increase the complexity and risk of a project as the project team is not in control of the outcome. There is the potential for an outside party approver to impose additional requirements on the project that was not anticipated. Approvals can also create schedule delays depending

		on the time for the approving party to respond. A Level 6 project has a significant number of external approvals required whereas a Level 1 project requires a minimal number or none.
	Rate the disparity in the location of the project participants	Project communications can become an interface problem if the project participants are spread over a large area, particularly in the case of multiple time zones. A Level 6 project has participants who are located in multiple locations throughout the city, province, country, or internationally. A Level 1 project has participants who are all located at the project site.
Scope	In past 10 years, how many times has this type of project been undertaken at the TTC?	Projects can increase in complexity and risk when being completed for the first time. A Level 6 project has not been completed at the TTC in the past 10 years whereas a Level 1 project is routine.
	In past 10 years, how many times has this type of project been undertaken outside of the TTC?	Projects can increase in complexity and risk when being completed for the first time. A Level 6 project has not been completed outside the TTC in the past 10 years whereas a Level 1 project is routine.
	Rate the support for the proposed project methodology	Projects can be delivered using different methods. The TTC has traditionally used the DBB technique. Projects can increase in complexity and risk based on the capacity of the project delivery team and the organization. A score of 6 indicates a project team who are unfamiliar with the delivery method, and are not supported by organizational knowledge, tools, and processes. A score of 1 indicates that the project delivery method is well understood and uses well-defined processes and procedures.
	Rate the clarity of the project's requirements	The scope requirements of a project should be well defined. Projects that have ambiguous scope requirements can have increased levels of risk and complexity. A Level 6 project has low scope definition and is not fully understood. A Level 1 project is well defined and understood.
	Rate the project in terms of the number of tasks, elements, or deliverables in the work breakdown structure	The number of WBS items on the project schedule can be indicator of the complexity of a project. A Level 6 project has a lengthy WBS whereas a Level 1 project has a limited WBS.
	Rate the capability of the TTC to deliver the project.	Does the organization have the capability to deliver the project? Project managers should have experience in delivering similar types of projects, and be readily available. For Level 6 projects, the TTC does not have project management with the required skillset to deliver the project. A Level 1 project has management who are significantly experienced in the delivery of similar projects.
Safety*	Risks regarding safety, health and security of customers, employees and the public	Project complexity may be increased due to the potential severity of risks regarding safety. Level 6 projects have the potential for multiple fatalities. Level 1 projects have the potential for injury to one person, which requires minimal intervention.



	Risks regarding the environment	Project complexity may be increased due to the potential severity of risks regarding the environment. Level 6 projects have the potential for major environmental damage over a widespread area. Level 1 projects have the potential for minor environmental damage in a limited area within TTC property.
Customer*	Risks to on-time service delivery	Project complexity may be increased due to the potential severity of risks to on-time service delivery. Level 6 projects have the potential to close the whole network for multiple peak periods. Level 1 projects have the potential to cause minor customer and network impacts.
	Risks to customer service performance measures	Project complexity may be increased due to the potential severity of risks regarding customer performance measures. Level 6 projects can cause a reduction in customer satisfaction by more than 20%. Level 1 projects can cause a reduction in customer satisfaction by up to 3%.
People*	Employee engagement, performance and culture	Project complexity may be increased due to the potential severity of risks regarding people, i.e. employee engagement as well as performance and culture. Level 6 projects can cause large-scale industrial action and a reduction in overall employee engagement score by more than 20%. Level 1 projects can have temporary localized employee dis-engagement and a reduction in overall employee engagement score by up to 3%.
Assets*	Risks to the security of the asset & information	Project complexity may be increased due to the potential severity of risks regarding the security of assets and information. Level 6 projects can have major asset damage, loss, or deterioration by more than 20%; and/or a significant compromise of information. Level 1 projects can have major asset damage, loss or deterioration by up to 3%; and/or the compromise of information otherwise available in the public domain.
Growth*	Rate the project regarding its ability to expand the system to meet future demand.	Project complexity may be increased due to the potential severity of risks regarding the expansion of the system to meet future demand. Level 6 projects could fail to meet >20% of future capacity demands. Level 1 projects could fail to meet up to 3% of future capacity demands.
Financial Sustainability*	Funding, revenue or expenditures	Project complexity may be increased due to the potential financial severity of risks. Level 6 projects could require risk expenditures of >\$100M. Level 1 projects could require risk expenditures of <\$1M.
Reputation*	Risks to customer confidence	Project complexity may be increased due to the potential severity of risks regarding the TTC's reputation with respect to customer confidence. Level 6 projects could cause sustained and organized community reaction. Level 1 projects could cause minor individual stakeholder concerns.
	Risks to stakeholder and media management	Project complexity may be increased due to the potential severity of risks regarding stakeholder and media management. Level 6 project risks could cause sustained national media reporting. Level 1 project risks could cause minimal, adverse local media reports.



	Risks of financial penalties	Project complexity may be increased due to the potential severity of risks regarding the company's reputation with respect to financial penalties. Level 6 projects have the potential to incur legal financial penalties that cause a large number of executives to leave the TTC. Level 1 projects could incur penalties of less than \$50K.
	Risks to regulatory compliance	Project complexity may be increased due to the potential severity of risks regarding the TTC's reputation with respect to regulatory compliance. Level 6 projects could involve criminal prosecution. Level 1 projects settlements do not require the courts.

* denotes criteria that are TTC strategic objectives from the enterprise risk ranking table.

B.3 Project Complex and Risk Assessment Results and Implications

Once a project has been scored, it can be ranked based on the overall totals. The overall scores have been calibrated and tested to ensure that the levels of complexity and risk apply in real-world scenarios however; the tool should be modified to fit the requirements of the TTC.

Depending on the level of project risk and complexity, certain guidelines can be put in place to assist in assuring that appropriate levels of oversight are in place. Figure 4 shows the appropriate degree of project manager experience based on the ranking, and provides suggestions as to who might be able to provide desired levels of project leadership.

Figure 4: Project Management Experience Classification Matrix

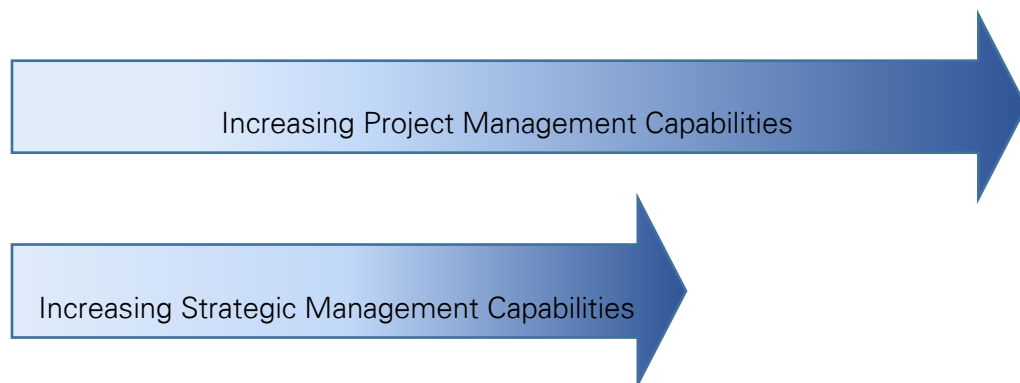
Project Complexity & Risk Classification Matrix			
Score Levels		Project Management Experience	Suggested PM Level Required
Level 1	< 72	Low	Project Engineer
Level 2	73-90	Limited	Senior Project Engineer
Level 3	91-108	Intermediate	Project Manager
Level 4	109-126	Senior	Senior Project Manager
Level 5	145-162	Head	Department Head/Director
Level 6	> 162	Executive	Executive Director

B.3.1 Overview of the six project classifications

Table 5 presents a summary of the six levels of project risk and complexity classification, their typical characteristics, and further details on project management competency requirements.

Table 5: Complexity and Risk Project Classifications and Characteristics

Levels Low to High Risk and Complexity	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Typical Characteristics	Small in size and scope, low risk and low complexity. Minimal risk to the corporate strategic objectives.	Limited in size and scope, small level of risk and complexity. Minor risk to corporate strategic objectives.	Medium size and scope, medium level of risk and complexity. Moderate risk to corporate strategic objectives.	Large in size and scope, high level of risk and complexity. Major risk to corporate strategic objectives.	Very large in size and scope, very high level of risk and complexity. Catastrophic risk to corporate strategic objectives.	Extreme in size and scope, immense level of risk and complexity. Disastrous risk to corporate strategic objectives.
Project Management Competencies	Project engineer or construction manager required. Limited project management competencies required.	Senior project engineer and construction manager required. Moderate project management competencies required.	Project manager required. Significant project management competencies required. Foundational strategic management competency required	Senior project manager required. Extensive project management competencies required. Substantial strategic management competency required	Project director required. Extensive project and program management competencies required. Significant strategic management competency required	Executive project director required. Extensive project and program management competencies required. Executive level strategic management competency required





It is recommended that the same governance structure be used for each of the project level classifications. However, due to the varying levels of risk and complexity the governance and reporting requirements should be scalable. The project management competencies also vary as the project risks and complexities increase. The required project management capabilities increase as project complexity increases from Levels 1 through 3. Examples of these capabilities include project controls (budget, cost, and reporting), technical comprehension of design/project requirements, commercial management, contract management, and contract administration. As the complexity increases through Levels 4-6, the required project management capabilities evolve from being project centric to focusing on the entire project environment. Strategic management capabilities are required. The project manager must now have the ability to understand the environment of the project and take into account the externalities such as the various internal and external stakeholders as well as the numerous interfaces on the project. For complex projects, there are generally fewer legacy projects to model after, which contributes to the uncertainty of approvals, costs, schedules, and stakeholder requirements.

Due to the minimal risks and low complexity apparent in the Level 1 classification, the project can be managed by a project engineer or site construction manager. These projects are short in length, with a budget generally less than \$5M. There are few interfaces with government, internal stakeholders, external stakeholders, or the public.

Level 2 projects can be managed by a senior project engineer and construction manager. These projects are generally less than two years in length and have a budget of between \$5-20M. There are some interactions with other stakeholders but minor risk to the corporate strategic objectives.

Level 3 projects can be managed by a project manager. These projects are generally between two and three in years in length, with budgets in the range of \$125M. There is an increased potential for interactions with a greater number of stakeholders. Greater attention has to be paid to externalities. Scope no longer is limited by the needs of the TTC. There is a moderate risk to the corporate strategic objectives.

Level 4 projects can be managed by a senior project manager. These projects are generally less than 4 years in length with a budget of up to \$250M. There are high levels of interactions with stakeholders both internal and external to the TTC. It is important to ensure that the scope of the project takes into account the requirements of these stakeholders. There is a major risk to the corporate strategic objectives.

Level 5 projects can be managed by a project director, potentially someone who has experience as a department head. These projects are generally less than 5 years in length with a budget of up to \$500M. There are very high levels of interactions with stakeholders both internal and external to the TTC. Project teams are supplemented with consultants. The successful completion of the project is contingent upon proper management of the interfaces with other projects as well as stakeholders. There is a potential catastrophic risk to corporate strategic objectives.

Level 6 projects can be managed by an executive project director who has experience leading an organization. Due to their size and complexity, these leaders require senior level competencies. These projects are generally greater than 5 years in length with a budget of over \$500M and are typically generational in frequency. There are very high levels of interactions with stakeholders both internal and external to the TTC. The project team often consists of a large number of



consultants. These projects in many cases have attributes of programs due to their size and complexity. The successful completion of the project is contingent upon proper management of the interfaces with other projects as well as stakeholders. There is potential for disastrous risk to the corporate strategic objectives.

Figure 6: Complexity and Risk Level of Selected TTC Projects

Complexity and Risk Level							
Group	Project	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
EC&E	Easier Access III		X				
	Leslie Barns					X	
	McNicoll Bus Garage			X			
	TR1 Rail Yard				X		
	TYSSE						X
	Union 2nd Platform					X	
	Storage Tank Replacement	X					
	On-Grade Paving Rehabilitation Program	X					
OPS	YUS ATC					X	
	LFLRV Purchase				X		
	TR1 Purchase				X		
	Surface Track		X				
IT	SAP Implementation		X				

Using the proposed framework, KPMG evaluated each of the representative projects to identify their level of complexity and risk.



TTC Capital Program Delivery Review

Appendix C – Procurement Options Analysis Framework for Major Capital Projects



**Disclaimer:**

This document has been prepared by KPMG LLP ("KPMG") for **The City of Toronto** ("Client") pursuant to the terms of our engagement agreement with Client dated September 22, 2015 (the "Engagement Agreement"). KPMG neither warrants nor represents that the information contained in this document is accurate, complete, sufficient or appropriate for use by any person or entity other than Client or for any purpose other than set out in the Engagement Agreement. This document may not be relied upon by any person or entity other than Client, and KPMG hereby expressly disclaims any and all responsibility or liability to any person or entity other than Client in connection with their use of this document.

KPMG's role was to outline certain matters that came to our attention during our work and to offer our comments and recommendations for the City's and TTC's consideration. These comments, by their nature, may be critical as they relate mainly to opportunities for change or enhancement and will not address the many strong features of the TTC's current activities and undertakings.

Our procedures will consist solely of inquiry, observation, comparison and analysis of TTC-provided information. We relied on the completeness and accuracy of the information provided. Such work does not constitute an audit. Accordingly, we will express no opinion on financial results, internal control or other information.



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C.1 Introduction

Major capital projects have a significant impact on the Toronto Transit Commission's (TTC's) ability to deliver on its mandate. Selecting the appropriate procurement option for the delivery of a major capital project is therefore crucial. Procurement is the process for acquiring goods and/or services. This process includes defining the requirement, sourcing, preparing and distributing a Request, evaluating the Bids/Proposals, obtaining the appropriate authorization for award value in accordance with the Authorization for Expenditure and Other Commitments Policy and issuing a Contract.

Overview of the framework

This framework provides high level guidance on the selection of the appropriate procurement option for a major capital project, defined as a project rated Level 4 or higher. This stage of the project occurs after Capital Planning, where the need for the project is identified and high-level project feasibility analysis is conducted. Furthermore, this stage precedes the actual procurement and the associated Request for Qualifications (RFQ) and Request for Proposals (RFP).

Concurrent Project Activities

Multiple concurrent project activities are expected to occur during the procurement options analysis. Continued concept design, preliminary engineering, traffic modelling, public engagement and cost estimating are amongst the activities that will provide essential information for the procurement options analysis.

Organization of the Framework

This framework is organized under four successive stages:

- Project Definition – the five “W” of the project: Who, What, When, Where and Why
- Initial Screening – the initial test and shortlisting listing of procurement options to determine *how* to deliver the project
- Packaging Options – a final adjustment to the five “W” of project in consideration of the analysis and feedback received internally and externally
- Procurement Recommendations – a combined qualitative and quantitative assessment of *how* best to deliver the project and the determination of the preferred procurement option

Application

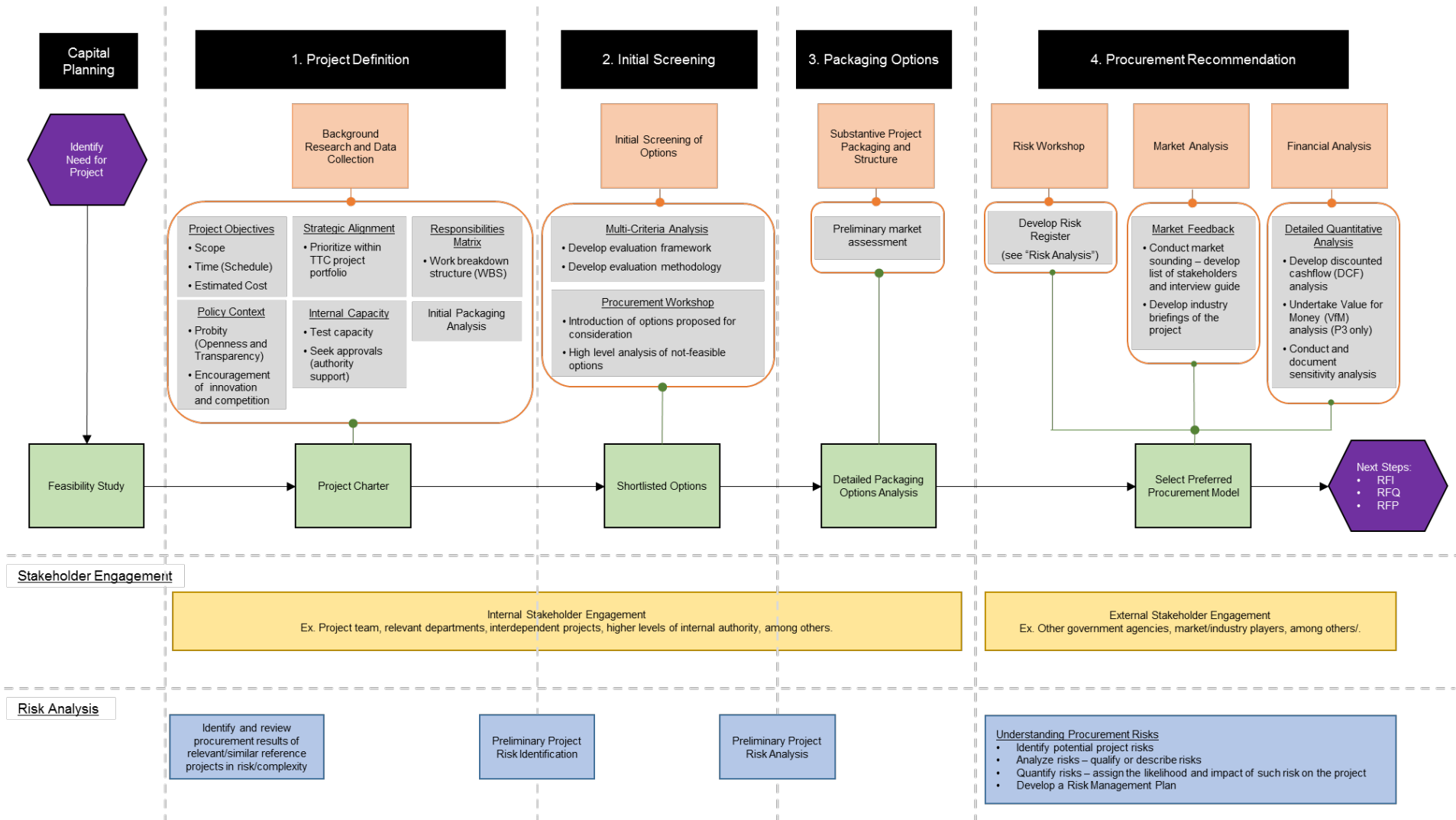
This framework is intended to be used by the TTC Project Team responsible for determining the most suitable procurement option for an identified major capital project. It is assumed that the project team has working knowledge of project management principles and is familiar with the mandate and operations of the TTC.



Visual Guide to the Procurement Options Analysis Framework

The following figure provides a high-level outline of the procurement options analysis framework and the major steps within each stage.

Figure 1: 4-Stage Procurement Process



C.2 Procurement Process

C.2.1 Stage 1. Project definition

Properly defining a project is fundamental to its success. Once a project is identified during the Capital Planning process for further consideration, it should undergo a Project Risk & Complexity Assessment. For projects assessed to be high risk and complexity, such as those rated Level 4 or above, the following outlines information requirements for establishing the five “W”, the “who, what, when, where, and why” within a procurement context.

Background

A summary of work completed to-date, including the project history and findings from previous analysis. Such types of analyses may also include a Feasibility Analysis.

Furthermore, the Background should provide general information, including:

- Project Timeline (to-date)
- List of planned and completed studies
- Geographical and site-specific information
- Asset information: location, age, history and condition (if applicable)

At this stage...

... the Project delivery option should already be identified at a high level. That is to say, what needs to be build (i.e. dedicated bus lane vs. light rail transit) should be defined, while how it will be procured will now be considered.

Properly outlining the background of project, at the very least, addresses the question “**Where** will this project be?”

Project Objectives

A summary of key issues addressing the questions:

- 1) What is the challenge, opportunity or need that this project is intended to address?
- 2) What are the primary barriers to achieving this goal?

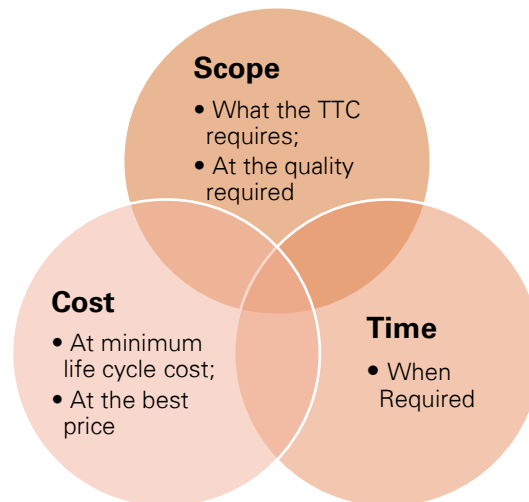
Policy Context

All projects considered should be within TTC’s Mandate and delivered according the Policies governing the Commission’s practices. The TTC serves the people of Toronto by ensuring that the transit system is reliable, safe, and prepared for future needs. Be it a system construction, maintenance & operations initiative, or a facilities and services expansion, a major capital project must show a direct link to supporting TTC’s Mandate.

In addition to the fares paid by users, the TTC is entrusted with public funds. Capital project expenditure decisions must therefore be made with the utmost probity. Fairness, openness and transparency must underpin the procurement of every major capital project.

Each procurement should also be structured to balance the three project management constraints of Time, Cost and Scope, as shown in Figure 2 below. By balancing these constraints, the TTC can be assured that it is receiving best value. Of particular importance below is that leading practices would suggest costs be at minimum, lifecycle driven. Although this long-term view is not necessary for all alternative procurement models, it is good practice to do it wherever possible. In an organization with segregated Operations and EC&E departments, taking a lifecycle approach to project estimating would represent a significant change.

Figure 2: Project Management Constraints



The TTC is subject to several policies and procedures that guide its procurements. Where applicable, the following policies should be adhered to:

- Authorization for Expenditures and Other Commitments Policy
- Authorization for Sales Policy
- Conflict of Interest Policy
- Delegation of Management Authority Policy
- Engagement of Outside Counsel Policy
- Green Procurement Policy
- Lobbying Registry Policy
- Materials and Procurement Department's Users' Guide
- Petty Cash Policy
- Product Endorsement Policy
- Purchasing Card Program Procedures
- Signing Officers for the Execution of Documents Under Corporate Seal Policy
- Ministry of Transportation, Transit Policy Branch – Canadian Content for Transit Vehicle Procurement Policy



As the scope of projects undertaken by TTC will vary, other relevant policies within the TTC should also be reviewed for adherence, as it pertains to each project.

Strategic Alignment

Torontonians and the numerous visitors to the City rely on the variety of transit services provided by the TTC, as such, there will be competing priorities for the available capital funding. A major capital project must demonstrate an alignment to the short, medium and long-term plans of the TTC.

By considering the urgency of the project in the context of other project priorities, it provides an answer to the question “**When** should this project be undertaken?”

With the objectives, policies and strategic alignments defined, a catalogue of project drivers may be summarized to answer the questions of “**Why** undertake this project?”

Initial Packaging Analysis

How a project is packaged affects the scope, timing and costs. Identifying suitable elements to include in a procurement is crucial to project success. For instance, bundling the demolition of an existing facility with the construction of the replacement may save time, but the added size and complexity could limit the number of bidders. The potential decrease in competition may then result in higher overall project costs (or fewer competitive quotes responding to the procurement).

What is...

... Project Packaging? This is simply the catalogue of projects requirements that are within scope of a particular procurement.

In order to undertake the preliminary analysis, an initial project packaging must be defined. This packaging structure will continue to be refined throughout the procurement options analysis as more information and feedback from stakeholders is received. At this initial stage, the packaging should focus on identifying the high-level project components that are within scope. More details on packaging analysis are presented in **Stage 3**.

Defining the initial project packaging addresses the question “**What** does this project entail?”

Preliminary Project Risk Identification

At this early stage, the preliminary project risk analysis focuses on the identification of macro, organizational and project-specific risks at a high level. A list of these risks should be developed and, where possible, the qualitative description of their impact, likelihood and timing should be included.

What is...

... a Risk? It is an uncertain event or condition that, if it occurs, will have a negative effect on one or more project objectives.

Internal Capacity Test

With the project drivers and risks identified, an internal capacity test should be undertaken to match the project team capabilities against the project requirements, as outlined by the Work



Breakdown Structure (WBS).¹ This is also an important opportunity to identify additional resources, or stakeholders, who can help bridge the capabilities gap of the project team.

Stakeholder Engagement - Internal

Major capital projects are significant not just for their size, scope and time requirements, but also because of the considerable number of stakeholders involved. Effective stakeholder engagement is fundamental to the project's success. A stakeholder communication and engagement strategy should be developed and include:

- A list of all relevant stakeholders who have an involvement in the Project;
- A description of their stake; and
- Communication and engagement protocols for each stakeholder.

During the project definition stage, the majority of the stakeholder categories identified will likely be internal. Once they are identified, they should be engaged in order to support the project planning and procurement options analysis. As the project progresses, the number of external stakeholders, such as user groups and suppliers, will increase and should be engaged appropriately. Nevertheless, this preliminary stakeholder engagement addresses the question “**Who** is involved in this project?”

Responsibilities Assignment Matrix

With the project team resources and stakeholders identified, a responsibilities assignment matrix should be populated with tasks listed against individuals and their assigned roles and responsibilities. These roles and responsibilities may include persons:

- **Responsible:** those assigned to perform the task;
- **Accountable:** the authority to make decisions and ultimately answerable for related setbacks;
- **Consulted:** those providing opinions, most often expert advice, with whom there is two-way communication; and
- **Informed:** those to be kept abreast of the progress, with whom there is one-way communication.

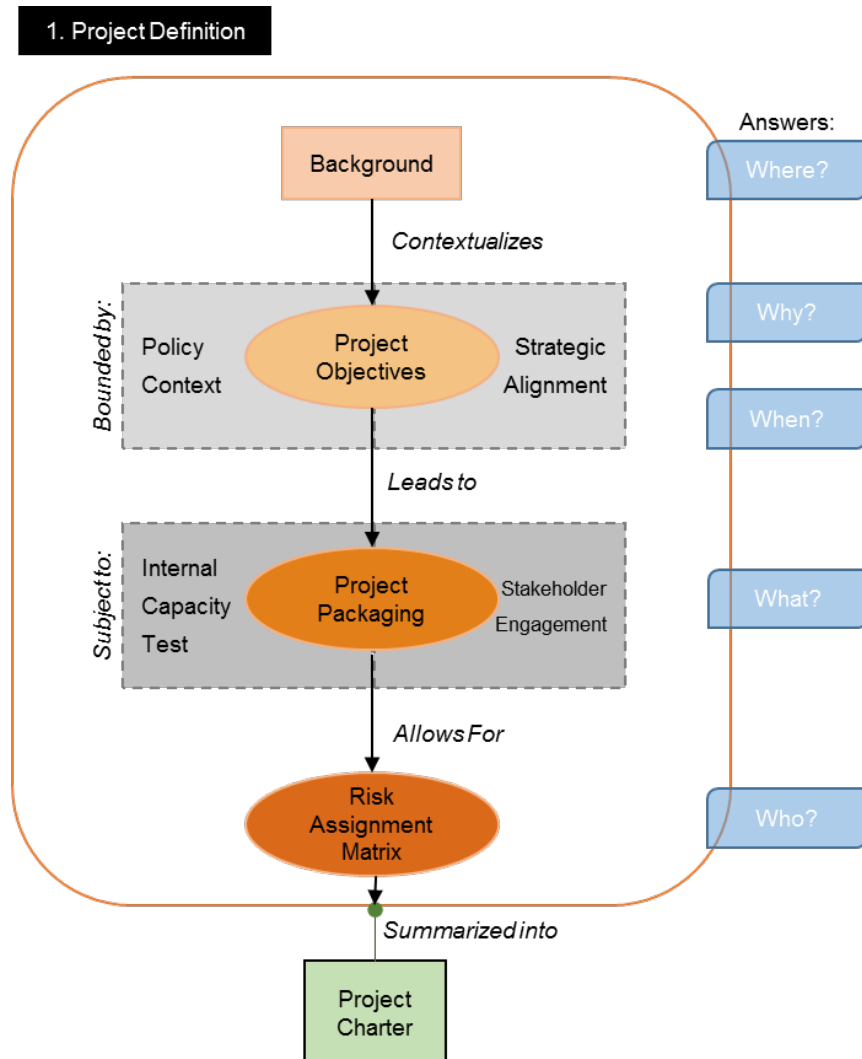
Deliverable: Project Charter

A Project Charter concisely summarizes the information gathered during the Project Definition stage (Stage 1). This will ensure that all parties fully understand the project and their respective responsibilities. The “Who, What, When, Where and Why” of the project should be briefly addressed, with particular attention to:

¹ “Work Breakdown Structure (WBS). A hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish the project objectives and create the required deliverables.” (Project Management Body of Knowledge, Fifth Edition)

- Project Drivers and Key Performance Indicators (KPI)
- Authorization and sources of funding
- Roles & Responsibilities

The project's ultimate goals, outcomes and objectives should be succinctly described in a one or



two sentence **Statement of Requirements**. With the five "W" addressed, the remainder of the Procurement Options Analysis Framework focuses on the "How." "**How** should the TTC procure this major capital project?"

The Project Charter should then be reviewed for completeness and overall alignment to TTC's Mandate with its stakeholders. If the Project Charter is approved by the project authority, it may proceed to Stage 2 (Initial Screening) of the Procurement Process.

Figure 3: Alternative Visual Summary of Stage 1: Project Definition



C.2.2 Stage 2. Initial Screening

A number of procurement options are available to the TTC for the delivery of major capital projects. Procurement models differ based on the level of external involvement in the delivery of each major project component:

Design; **B**uild; **F**inance; **O**perate; and **M**aintain (or **R**ehabilitation)

Theoretically, there are 32 different models based on the combination of components listed above. Practically, there are far fewer models commonly used in the market. A detailed analysis of a procurement model is a time consuming affair. An initial screening of the procurement options against the project requirements from the Project Definition stage may, therefore, eliminate clearly unsuitable procurement models and allow TTC to focus its efforts for subsequent stages and tasks of the procurement process.

Procurement Workshop

An introductory procurement workshop is often used to facilitate the initial screening. Workshop participants typically consist of representatives from relevant internal (TTC) resources (staff). The objective of the procurement workshop is primarily: establishing a common understanding of the procurement models, and confirming the procurement objectives among the stakeholders. This is differentiated from Task 2.3 (Initial Screening), whereby procurement options are evaluated against a specified list of criteria.

Identifying Participants

Project-level internal resources accountable for the decisions regarding the model selection, bidder selection, and management of the resulting contract(s) should be included in the procurement workshop.

Confirm Procurement Objectives

Both project and procurement objectives will be used to inform the procurement approach and used to justify the degree of success of the project at closeout. The *project objectives* are to be used in order to guide and measure performance throughout the life of the project, whereas the *procurement objectives* guide and measure performance up to contract award.



Figure 4 describes a non-exhaustive list of examples for potential procurement objectives.

Figure 4: Examples of Procurement Objectives

Procurement Objectives	Criteria
Support the project objectives	Procurement approach supports the achievement of the project objectives
Achieve best value for tax payer	- Maximizes performance - Ensures cost-effective construction and operating costs - Minimizes negative impact on other assets - Ensures a robust competition by maximizing market interest and structuring the procurement approach with respect to market capacity - Procurement process is fair, open and transparent
Meet project schedule	Ensures the project is delivered as per the project schedule
Meet project budget	Ensures project is delivered within overall budget
Optimally manage project risks	- Achieves optimal risk allocation - Successfully manages project integration risks - Integrates safety into all aspects of design, construction, and operations

Introduction to Procurement Models

Establishing a common understanding of the available procurement models amongst the participants will facilitate the initial screening. A variety of procurement models exist, each with varied risk allocation profiles that are suitable for different types of projects (typically depending on scope and complexity). The lists below summarize a number of procurement models typically considered for capital projects that TTC may undertake.

Procurement models commonly used in the market for major capital projects include:

- Design-Bid-Build (DBB);
- Design-Build (DB) / Engineering, Procurement & Construction (EPC);
- Design-Build-Finance (DBF);
- Design-Build-Finance-Maintain (DBFM); and
- Design-Build-Finance-Operate-Maintain (DBFOM).

Modifications to the project components result in the following models, which may also be considered:



- Construction Management (CM);
- Engineering, Procurement & Construction Management (EPCM);
- Construction Management at Risk (CM@R);
- Alliance Contract/Early Contractor Involvement; and
- Design-Build-Finance-Rehabilitate (DBFR).

Models where the successful bidder/proponent assumes the majority of the project risks (for a pre-determined period of time) include:

- Full Concession; and
- Private Ownership

A description of these procurement models is available in section D.4.1.

Multi-Criteria Analysis

Multi-criteria analysis (MCA) is a tool that can support the decision making process. Within this framework, procurement options considered are evaluated for alignment and ability to achieve project and procurement objectives. The objectives are specified with corresponding attributes or indicators of alignment – which are used as the common basis of qualitative comparison among different procurement options.

The actual measurement of these indicators is qualitative, rather than in monetary terms which will be addressed during the procurement recommendations stage. An effective MCA is typically highly tailored (both in evaluation criteria and methodology) to the unique requirements each capital project.

The MCA can begin at this stage, and then be updated throughout the project as the new information and stakeholder feedback is received.

Evaluation Framework

The Evaluation Framework provides the general structure and direction, which should guide the development and application of project-specific evaluation methodologies. From this framework, project-specific evaluation methodologies are developed to evaluate the available procurement options against the developed qualitative criteria.

Evaluation Criteria should be selected if they have significant effect(s) on project success. It is common that such criteria are difficult to quantify at this stage of analysis. For example, Potential to Maximize Market Interest is often an important MCA consideration. A procurement option that will not garner any market interest will likely be eliminated from further consideration.

Procurement options should be **scored according to their perceived likelihood of meeting the evaluation criteria**. Since the scoring should be undertaken collectively by the relevant internal resources, establishing an agreed upon scoring guide will allow facilitate the evaluation and allow the each procurement option to be compared efficiently.



Sample Evaluation Methodology

A unique MCA evaluation methodology should be developed for every major capital project under consideration. The evaluation methodology should be based on the evaluation framework established above. While the following example provides an overview of the MCA process, an evaluation methodology should not be limited by the information presented herein.

Criteria Scoring Guide

These scoring guides may be used to assess each procurement options ability to meet the evaluation criteria.

Figure 5: Sample scoring guides

Binary Scoring	Description
Pass [P]	Procurement option is effective in satisfying the mandatory requirement.
Fail [F]	Procurement option is not effective in satisfying the mandatory requirement.

Multi-level Scoring	Description
✓✓✓	Procurement option is effective in satisfying all of the requirements of the criterion
✓✓	Procurement option is effective in satisfying most of the requirements of the
✓	Procurement option satisfies or partially satisfies some of the requirements of the
0	Procurement option is ineffective in satisfying the requirements of the criterion
n/a	Not applicable

Binary scoring is effective for evaluating mandatory criteria that are straightforward to pass or fail. Multi-level scoring may be used where procurement options offer more granular differences in their ability to satisfy the evaluation criteria. Alternative multi-level scoring guides could include fewer or more possible scores (e.g. 0 to 5 ✓).

Evaluation Criteria

This abbreviated list of pass/fail evaluation criteria provides an example of factors that may be of critical importance to the success of a project at this stage of analysis. An expanded example with multi-level scoring is presented in section D.4.2.

Figure 6: Sample evaluation criteria

Evaluation criterion	Description	Pass/Fail
Supports the delivery of project components	The procurement model could include and deliver all of the required project components.	[P/F]
Meets regulatory & legislative requirements	The procurement model meets the applicable legislation and resulting regulations. For instance, transferring the power of land appropriation for transit corridor development to a private proponent, and private ownership of the real property under an urban rail link, are often prohibited or heavily regulated. There may also be limitations on the amount of debt the TTC may assume, which will greatly restrict the range of viable procurement options.	[P/F]
Adheres to TTC Policies	The procurement model will be compliant with the applicable TTC Policies. For example, safety critical products require testing and validation by the TTC. If they are required from the Bidders, the procurement model must allow for sufficient time for testing on TTC property to verify that system safety is achievable.	[P/F]

While there may be a potential inclination to include as many evaluation criteria as possible, a large number of evaluation criteria may ultimately defocus the discussion. While a definitive number of evaluation criteria is difficult to articulate (as it varies depending on complexity and scope of the project), it is suggested that only the qualitative criteria with a significant (or crucial) impact on the project's success be included.

At the conclusion of Task 2.2, three key items must be defined before proceeding to Task 2.3:

- All procurement options under consideration are defined to a comparable level of detail;
- Evaluation criteria reflect the most important project and procurement objectives; and
- A consistent scoring methodology is developed such that it is applicable uniformly in evaluating all procurement options against all evaluation criteria.

Initial Screening

The initial screening of the procurement options against the MCA criteria should be collectively conducted by the appropriate internal resources. This may be undertaken during an initial screening workshop, where the discussion should focus on the respective benefits, risks and mitigation options for each procurement model. At the conclusion of the exercise, there should be an initial shortlist of procurement options developed based on the rankings.

Conducting the Multi-Criteria Analysis

Below is an example of a condensed and truncated MCA table, which highlights the information and consideration, required for each procurement model that is evaluated.

Figure 7: Sample scoring table

	Procurement Options Considered		
Evaluation	DBB	DBFOM	Full Concession
Market interest & appetite	Due to market conditions, many firms are seeking opportunities to bid on designing and/or building major transportation projects.	Canada has observed increasing domestic and international interest in its full-lifecycle major transportation projects.	While a few similar procurements have been completed, other projects provincially & nationally have seen a limited number of bidders willing to assume the ridership risk for major transportation projects.
Score	✓✓✓	✓✓✓	✓
Innovation & incentive	<i>[description of reasoning for scoring]</i>	<i>[description]</i>	<i>[description]</i>
Score	✓✓	✓✓✓	✓✓✓
TTC Capacity	<i>[description]</i>	<i>[description]</i>	<i>[description]</i>
	✓✓✓	✓✓	✓✓
Risk management	<i>[description]</i>	<i>[description]</i>	<i>[description]</i>
	✓✓	✓✓✓	✓✓
Total Score	10✓	11✓	8✓
Ranking	2nd	1st	3rd

Initial Shortlist of Procurement Options

The initial shortlist should include the procurement options that merit additional analysis and consideration. Typically, the shortlist consists of up to two procurement options, based on their rankings. Under extraordinary circumstances the shortlist may consist of additional options, but that is should be avoided due to the time and resources required for the detailed analysis.



C.2.3 Stage 3. Packaging Options

Before the procurement options analysis proceeds to the Procurement Recommendations stage (Stage 4), the project packaging should be finalized based on the feedback received internally and externally from the market.

Questions to consider and answer include:

- **Technical** - Does the packaging allow the contractor and the TTC to respond appropriately to technical challenges?
- **Market Capacity** - Are at least three competitive bids likely to be received from qualified proponents?
- **Construction Risk** - Does the packaging avoid creating unnecessary risks to the TTC?
 - Interface - Does the packaging avoid creating critical interfaces that could affect safety, schedule, cost and/or quality?
 - Site Logistics - Does the packaging allow contractors to efficiently utilize resources?
 - Materials - Does the packaging avoid creating interfaces in critical material supply chains and material disposal routes?
- **Schedule** - Can the project meet the scheduled in-service date if procured under this packaging?
 - Design - Can the design work required to tender this packaging be completed in time?
 - Construction - Does the packaging avoid creating critical interfaces that would reduce the ability of contractors to achieve the schedule?
- **Management** - Does the packaging minimize the number & criticality of interfaces that the TTC has to manage?
- **Operations and Maintenance** - Does the packaging maximize the life-cycle optimization for the asset, considering capital investment, revenue generation and operations and maintenance?

Project Preliminary Risk Analysis

The project risks discussed during the initial screening should be catalogued. The analysis should describe each risks' cause and effect. This will facilitate the development of the Risk Register during the procurement recommendations stage.

Market Analysis

Feedback from the bidding community will be essential in managing project risks. From prevailing market conditions to their views on bundling project components, potential bid participants' collective feedback may better inform the procurement structuring, thereby



increasing the overall attractiveness and competitiveness of the procurement contemplated by the TTC.

Market Sounding

One approach to analyzing market appetite at this stage is to conduct a Market Sounding exercise. A formal market sounding may consist of the following:

- Define Objectives – What does the TTC want to know?
- Identify Potential Participants – Whom should the TTC hear from?
- Select a Market Sounding Approach – Should participants be consulted in person, by survey, video/tele-conference, or by another medium?
- Develop a market sounding package – this could be provided to the participants or used by the interviewer. It should contain background information on the project, options considered, project goals & constraints, interview questions, in addition to confirming how the information received will be used and the confidentiality of Responses.

The breadth and depth of information that a market sounding is expected to yield will largely depend and vary based on the capital project's scope (typically in terms of capital value) and complexity. The results of a market sounding exercise should provide information to TTC both to validate market assumptions (of risk tolerance, for example), and improve the competitiveness of a procurement.

Final Project Structure for Procurement Option Recommendation

Once internal and external feedback are received, the project's packaging should be adjusted for the last time, and finalized for subsequent analysis to focus on the procurement options during the Procurement Recommendations stage.

C.2.4 Stage 4. Procurement recommendations

The procurement option recommendation should be based on both the qualitative and quantitative considerations of a project. The following framework outlines, at a high level, the approach towards analyzing risks and quantifying impacts.

Procurement Risk Analysis Framework

Prudent risk management is fundamental to the success of any major capital project. It consists of five main activities:

- **Risk Identification:** Identify the risks that threaten or enhance the achievement of priorities and expected results in the immediate or distant future; risk identification also includes Market Analysis and Scenario Analysis.
- **Risk Assessment:** Assess the probability (likelihood) and impact of the risk occurring and rank risks according to importance.



- **Risk Response:** Find cost-effective options to prevent or reduce the probability or impact of the risk.
- **Monitoring:** Monitor the functioning and effectiveness of risk responses and any changes to the risk profile.
- **Documentation:** Document efforts to demonstrate that a rigorous risk management process has been followed and to share lessons learned.

While the selection of a procurement model may sometimes be premised on transferring the maximum amount of risk to the proponent, *prudent risk management* involves the allocation of risk to the party best able to manage it. The project risk analysis framework described herein provides guidance on how to achieve this objective by undertaking these five main activities.

Develop the Risk Register

A risk register is a commonly utilized tool that facilitates the development, monitoring and documentation of a risk management plan, by facilitating a systematic process in identifying risks. This allows the TTC to begin develop risk mitigation strategies before construction begins. This tool also facilitates the constant monitoring of risks throughout the entire procurement process. The first step of developing a risk register is risk identification.

Identify Risks

Risks are present in every aspect and throughout every phase of a major capital project. Significant risk categories that may have material impact on the project's success should be identified and described.

The following is a sample of questions and risk categories to consider at this stage:

- **Legal:** What are the legal risks, in the form of existing and expected changes in law, which affect this project?
- **Governance:** What risks are created by the proposed governance structure?
- **Capacity:** Are there risks associated with our capacity, in the form of human resource or funding, to implement this project?
- **Environmental/Hazards:** What potential hazards resulting from the implementation of the project may impact the environment or any of the stakeholders?

Risk Assessment

Once all significant risk categories are identified, their **impact** and **likelihood** of occurrence should be assessed.

The impact of a realized risk is typically influenced by three major factors:

- **Effect:** to what extent the project's success is negatively affected if the risk were to occur. For example, this could be in the form of higher construction costs or lower ridership and revenue.

- **Timing:** when and at which phase of the project lifecycle a risk occurs also alters its impact. For example, a construction project delay during the development of a new rail link, has significantly different effect than that of a delay during the operations/rehabilitation phase.
- **Severity of Impact:** the severity of the same risk may be drastically different depending on the unique project characteristics. For example, in the context of government approvals, failing to adequately meet a documentation policy may delay a project by a few weeks, however, not satisfying environmental and heritage requirements may delay a project by years if not force a project cancellation altogether.

The likelihood of a risk occurring is often estimated based on experience and the expectation for future conditions. To facilitate the analysis, “likelihood” is commonly described by one of three scenarios: low, medium or high probability. The “low” probability scenario is often assumed to be equivalent to the fifth percentile of the probability distribution (of being realized), and the “high” probability scenario is considered to be the 95th percentile. The intent of this approach is to minimize the impact that extreme outliers may have on the overall assessment.

The product of the likelihood and impact results in a risk ranking.² The following matrix is an example.

Figure 8: Risk Classification

Likelihood		Descriptor	Impact	Descriptor
3		Likely	3	Major
2		Possible	2	Significant
1		Unlikely	1	Minor
Risk Ranking				
Likelihood	3	Medium	High	Extremely High
	2	Low	Medium	High
	1	Extremely Low	Low	Medium
		1	2	3
		Impact		

Risk Response

When the risks are identified and assessed, a risk response plan should be developed. The implementation of these risk responses is intended to not only decrease the likelihood of a risk occurrence, but to also decrease the impact of all risks, where feasible.

Approaches to dealing with project risk include:

² In the sense of expected value: (Likelihood) x (Impact) = Risk Ranking



- Avoid
- Transfer
- Mitigate
- Accept

Risk Allocation

Project success and cost savings are realized through the strategic allocation of risk between the TTC and the proponent. The Risk Allocation process should identify the party best able to manage each risk within a procurement.

The following is a sample risk allocation table, which may be different for every project.

Figure 9: Sample Risk Allocation Table

Risk	DBB Procurement			DBFOM Procurement		
	TTC	Proponent	Shared	TTC	Proponent	Shared
Financing	x				x	
Design			x		x	
Construction			x		x	
Regulatory	x			x		



Risk Register

A risk register provides an avenue to document and monitor the risks analyzed. The table below is a sample risk register template.

Figure 10: Sample Risk Register Template

Identification			Assessment						Treatment	
#	Risk Category	Description	Likelihood	Impact	Ranking	Initial Allocation Under		Quantified	Risk Manager	Mitigation Strategy
						DBB	DBFOM			
[risk ID number]	[Risk Name]	[cause, consequence(s)]	[3,2 or 1]	[3,2 or 1]	[EH, H, M, L, EL]	[Retained, Transferred or Shared]	[R, T, S]	[Yes, No]	[Individual assigned to monitor and manage risk]	[risk response]
[...]	[...]	[...]	[...]	[...]	[...]	[...]	[...]	[...]	[...]	[...]

Risk Workshop

A risk workshop with the Project Team (as defined by the Project Charter) and the respective Risk Managers (as defined throughout the procurement structuring process, or as specified in the Risk Management Plan) may greatly enhance the population of the Risk Register. Risk workshops are typically facilitated with each Risk Manager identifying and describing the risk categories. Other participants may also be invited, to the extent that the Project Team feels suitable, to provide their views based on and drawing from their experiences. The goal in developing a Risk Register (and in undertaking a risk assessment) is to rank all major risk categories and develop a robust mitigation strategy for each identified risk.

Risk Management Plan

The Risk Register, in combination with the background and market information from project definition and initial screening stages, form the basis of the Risk Management Plan.



Market Analysis

With the qualitative risk analysis complete, the market may be engaged again to provide information on matters that may have changed or arisen since the first market sounding. This external stakeholder engagement may take the form of an industry briefing.

Industry Briefings

Industry briefings involve collecting project specific information during the planning phase to facilitate preliminary dialogue with industry. This step helps ensure a competitive procurement prior to inviting tenders. There is a range of issues that may be discussed at this point based on project specifics (subject to probity). Some include:

- Scope of the project;
- Procurement approach;
- Project timelines;
- Project specific issues and requirements; and
- Market interest and capability.

Important differences between the Industry Briefings and the Market Sounding is level of information that may be available to share and the level of detail sought in the responses. The level of information shared within Industry Briefings will vary by project and should be developed and tailored as part of the larger communication strategy of the project and procurement.

Detailed Quantitative Analysis

A detailed quantitative analysis is required to determine which procurement option is most likely to deliver the best value of the project to the TTC and at the lowest project life cycle cost. The following framework provides high-level guidance; however, consideration should be given to adapting the applied methodology to the unique project characteristics and nature of procurement options under consideration.

Capital and O&M Expenditure Estimate

At this stage of the analysis, the project cost estimates should be at least of the “Class C” level. This is commonly characterized as the Schematic Design (33% design) with level of precision at the -15% to +20% range and preparation effort expected to be between 1.5% and 5% of project development costs. The cost estimates should be unique to procurement option considered, which acknowledges the short term to long-term cost trade-offs differences amongst the various models. Cost estimates will ultimately vary depending on the procurement model selected. The capital, and operations and maintenance (O&M) cost estimates should be at comparable levels of refinement.

It is understood that the cost estimation will continue to be refined, eventually reaching the substantive level, either Class A or B depending on the procurement option selected, before the procurement stage.



Discounted Cash Flow Analysis

Discounted Cash Flow (DCF) analysis is a commonly used financial analysis tool to determine the expected returns of a project, by considering all streams of cash inflows and outflows throughout the entire lifecycle of a project. Discounting of cash flows is applied in order to reflect the “Time Value of Money” concept, which implies that a dollar received today is greater than the value of a dollar received in the future.³

Cash streams to consider include, but should not be limited to the following:

- Outflows
 - Capital Costs (CapEx)
 - Operations & Maintenance Costs (OpEx)
 - Lifecycle Costs (e.g. Rehabilitation)
 - Financing Costs
 - Inflation
 - Owner’s Cost (including procurement preparation)
- Inflows
 - Revenue
 - Other Offsetting Revenues (such as leases, advertisements, naming rights)

A DCF analysis should be conducted for each of the shortlisted procurement options.

Discount Rate

The discount rate is the interest rate used to discount the cash flows; it is used to calculate the “present value” of a project.⁴ A variety of options exists to determine the discount rate, including the following examples:

- Borrowing rate of TTC, City of Toronto or Government of Ontario;
- The government’s social discount rate,
- An expected project internal rate of return (IRR), as determined by TTC; or
- Weighted-average cost of capital (WACC)

³ To check this concept ask yourself if you were owed a monetary debt by a generic 3rd party at 0% interest, would you prefer to be repaid today or 10, 20, perhaps 100 years from now? Also consider the inflationary nature of the dollar, which has historically lost its purchasing power over time due to inflation.

⁴ Consider the example where one is faced with the choice of receiving a repayment of \$100 today or one year from now. If the interest rate that this individual faces is 5%, receiving \$100 one year from now is only worth $\$100/(1+5\%)$ or about \$95.24 today. To confirm, assume the individual deposits \$95.24 today at 5% annual interest. 1 year from now this individual will receive the principal of \$95.24 back along with an additional 5% as interest. Since 5% of \$95.24 is \$4.76, one year from now the individual will have $\$95.24 + \$4.76 = \$100$. Therefore, it is better to receive the repayment today rather than in the future, as long as the real discount rate is positive.



Guidance should be sought from the finance department regarding the appropriate discount rate to be used for the DCF analysis of a major capital project.

Net Present Value

Net present value (NPV) is the discounted value of an investment's cash inflows less the discounted value of its cash outflows. A positive NPV demonstrates net positive returns, therefore only options with positive NPV should be considered. The greater the positive NPV, the better the value proposition.

DCF Example

The following is a sample template for a DCF analysis, outlining its basic components.

Project Name						
Discount Rate						
		Year	1	2	3	4 5 [...]
<u>Outflow</u>	<u>Subtotal</u>					
Cost Category 1						
Cost Category 2						
Cost Category 3						
[...]						
<u>Annual Subtotal</u>						
<u>Discount Annual Subtotal</u>						
<u>Inflow</u>	<u>Subtotal</u>					
Revenue Category 1						
Revenue Category 2						
Revenue Category 3						
[...]						
<u>Annual Subtotal</u>						
<u>Discount Annual Subtotal</u>						
<u>Net Cashflow</u>						
<u>NPV</u>						



Risk Quantification and Risk-Adjusted DCF

Risks may have a significant impact on the financial viability of a procurement option. Risks may be quantified using the expected value method, where the product of the likelihood of risk occurrence (denoted as a %) and the impact (denoted as a \$ figure) generate a risk value (in dollars). These risk values may be added to the DCF to generate a “Risk-Adjusted DCF,” resulting in risk-adjusted NPV calculations that reflect the risk profile of a procurement option.

Procurement Option Selection

The procurement option selected depends on the weighting of importance of the qualitative and quantitative criteria. Often, the procurement option that satisfies the qualitative criteria (from Stage 2, Task 2.3) and demonstrates the highest positive risk-adjusted NPV (from Stage 4, Task 4.3) is considered most likely to provide best value and lowest project life cycle cost to the TTC. The options that represents the highest qualitative and quantitative weighted score should be selected as the preferred procurement option.

Sensitivity Analysis

A sensitivity analysis generally seeks to understand the robustness of assumptions made during Detailed Quantitative Analysis, and the impact of changes to such assumptions on the project’s calculated NPV and risk-adjusted NPV. Cost and revenue estimates may be altered to gauge the potential impact on the project NPV. Commonly considered scenarios include construction cost estimate increases, ridership decreases, positive and negative interest rate adjustments. These scenarios are usually applied as percentage changes to the base cost or revenue estimates.

Value for Money Analysis – P3 Only

For analysis considering public private partnership (P3) models such as DBFOM, a value-for-money (VFM) analysis is recommended. VFM analysis involves the development of public sector comparators and shadow bids with the use of Monte Carlo simulations for risk quantification. While guidance documents are available from public agencies, it is recommended that the project team retain the services of an experienced professional advisory team to assist in the undertaking of a VFM.

C.3 Next Steps

Once the preferred procurement option is selected, the project may proceed to the procurement stage. It may include the following activities.

C.3.1 Request for Information

An optional activity, Request for Information (RFI) provides an opportunity for the TTC to seek additional input from prospective bidders most often regarding the procurement process.



C.3.2 Request for Qualifications

Typically representing the first solicitation stage of the procurement, the Request for Qualifications (RFQ), sometimes referred to as the Request for Expression of Interest (REOI), is used to short-list qualified proponents by assessing their qualifications, including project team, financial resources and track record on similar projects.

This solicitation may not be required for projects of smaller capital value, or those which are expected to generate a more concentrated group of proponents.

C.3.3 Request for Proposal

Once suitable bidders are shortlisted, the procurement progresses to the Request for Proposal (RFP). The shortlisted bidders are provided with a set of detailed RFP documents, which outline the specific technical and financial performance criteria of the project. The bidders are asked to provide their best approach and offer based on the RFP requirements. The bidder who meets the technical and financial criteria with the highest overall weighted score is selected as the successful proponent.



C.4 Supplemental Information

C.4.1 Detailed description of procurement models

Construction Management (CM)

Construction Management (CM) is a contracting strategy in which an owner delegates the day-to-day management and administration of design and construction contracts to a Construction Management team. While the Construction Management contractor carries out project management responsibilities on the owner's behalf, overall accountability for project outcomes is retained by the project owner.

The Construction Management contractor generally advises the design team, procures the construction and manages the project delivery. As the owner's agent, the Construction Management contractor is authorized to enter into legal relationships with third parties on the owner's behalf.

There are many possible variants of a CM contract depending on the particular issues involved in the project. Some typical features and considerations relating to schedule, cost, and quality in a CM contract are summarized below.

Schedule

If brought on at the early stages of design, the Construction Management contractor can assist in understanding the complexities in construction and schedule development, which can facilitate for an earlier start to construction within which the CM contractor is ramped up more quickly to undertake the project.

The Construction Management contractor's signing authority, as determined by the project owner, allows the turnaround time on changes and contracts to be minimized and for momentum to be maintained at the construction site. However, schedule delays due to the design (for example due to late or inadequate design) are the responsibility of the owner.

Construction cost overruns resulting from delays due to construction (such as poor coordination of site activities) are the responsibility of the construction contractor, as they are typically paid a fixed price for construction. As progress or milestone payments are typically made to the construction contractor during construction, the construction contractor may not be incentivized to achieve timely completion to the extent that it would under a procurement model that does not compensate the contractor until construction is complete (e.g. DBF).

Cost

The project owner retains responsibility for the design and construction phases of the project and therefore retains understanding/transparency to the costs.



The project owner's control is reduced during the construction phase as the contract signing authority is released to the Construction Management contractor.

The Construction Management contractor can reduce the number of change orders by advising the project owner throughout the design phase and identifying potential design shortfalls and constructability issues prior to construction. The Construction Management contractor will typically possess expertise to implement efficient change management processes, which can minimize the overhead and markup associated with change orders during construction.

Quality

The involvement of a Construction Management contractor generally improves the design quality, as the Construction Management contractor will review the design from a constructability perspective and will generally have better constructability expertise than the owner.

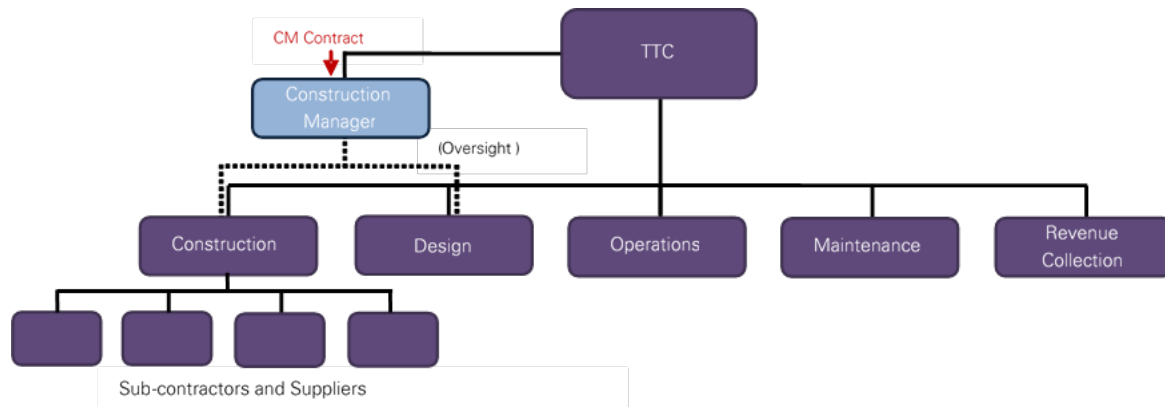
The Construction Management contractor's compensation is generally tied to effort expended on a time-based system, which allows for objectivity and transparency in the trade-off between construction costs and quality (since the Construction Management contractor is not financially motivated to reduce costs at the expense of quality).

However, the Construction Management contractor is not financially motivated to ensure quality, and therefore is difficult to financially motivate a Construction Management contractor to provide more than a minimally acceptable performance.

In summary

There can be benefits to contracting out the construction management role to a specialized construction management firm that has the necessary expertise and resources to manage the project on the owner's behalf, particularly for owners with limited in-house construction management resources. The advantages of a CM approach are most likely to be realized (and hence the additional cost of hiring a Construction Management Contractor most likely to be justified) on relatively complex projects involving numerous counterparties, e.g. multiple material and equipment suppliers and construction trades, and for projects the owner lacks the in-house expertise to oversee the design and construction. However, the owner retains ultimate responsibility for design and construction scope, schedule and quality gaps.

Figure 1: Typical Responsibilities under a Construction Management Model



Engineering, Procurement, Construction Management (EPCM)

In an Engineering, Procurement, Construction Management (EPCM) approach, a single company (the EPCM contractor) is contracted to provide the following professional services: engineering (design), procurement, and construction management services (the management and administration of construction contracts).

The EPCM contractor may take design responsibility and will manage procurement and construction but does not usually undertake any construction work. The construction works are contracted directly between the various trade contractors and the owner, with the EPCM contractor assisting the project owner in the negotiation and development of the contractual relationships between the owner and its contractor(s).

Thus, whilst the EPCM contractor will advise the owner, and supervise safe construction to specification on the owner's behalf, the overall accountability for project outcomes is retained by the project owner. EPCM payment options can vary, but cost-plus fee is common.

There are many variants possible on an EPCM contract and the characteristics and issues associated with it depend upon the unique characteristics of the project. Some typical considerations and issues relating to schedule, cost, and quality of an EPCM contract are summarized below.

Schedule

Schedule delays due to the design (for example due to late or inadequate design) are the responsibility of the EPCM contractor. Construction cost overruns resulting from delays due to construction (such as poor coordination of site activities) are the responsibility of the construction contractor that the EPCM contractor is overseeing, as they are typically paid a fixed price for construction. However, progress or milestone payments are typically made to the construction contractor during construction, therefore the construction contractor may not be incentivized to achieve timely completion to the extent that it would under a procurement model that does not compensate the contractor until construction is complete (e.g. DBF).

Cost

Although the EPCM contractor provides advice to the owner relating to supply contracts and supplier selection, the project owner has direct contracts with the suppliers. As a result, the project owner retains the majority of the cost risk under an EPCM arrangement.

Quality

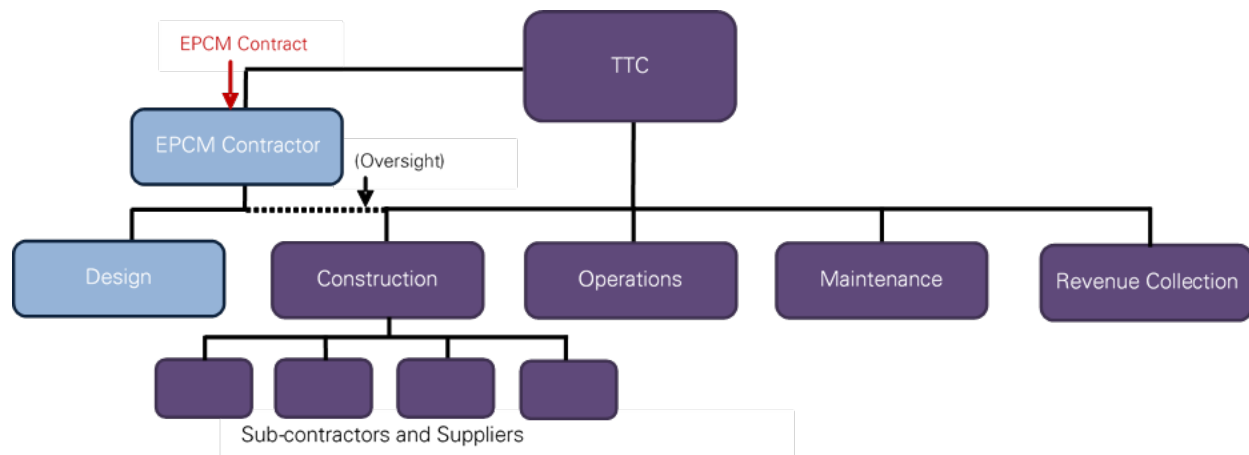
The EPCM model allows for transparency in construction quality as the EPCM contractor is not at risk if the quality is not met. The owner is ultimately responsible for monitoring quality, however, given the segregation of the Construction Manager and the construction contractor the quality control function can be delegated to the Construction Manager.

The term of the EPCM contract is coincident with the completion of construction. The short-term nature of the contract does not motivate the EPCM contractor to balance any potential design or construction cost savings against the asset's long-term performance.

In summary

The EPCM approach will not provide cost or schedule certainty and is usually only employed where a project is comprised of many specialist and often-proprietary engineering elements that cannot be coordinated without supplier engagement. EPCM should be considered when fixed price procurement is not a value of risk transfer option due to project complexity and lack of scope definition.

Figure 2: Typical Responsibilities under an EPCM Contract



Design-Bid-Build (DBB)

Design-Bid-Build (DBB) is a traditional procurement model in which the owner awards two distinct and sequential contracts for design and construction:



- The first contract is a consultant appointment of a design team to develop the owner's brief into a full detailed design and to assist the owner in putting the construction of the project out to tender;
- The second contract is with a construction contractor to build that design.

The characteristics of a DBB model and the issues associated with it depend upon the unique characteristics of the project and contract formed. Some typical considerations and issues relating to schedule, cost and quality of a DBB project are summarized below.

Schedule

The sequential nature of the DBB model, in that the construction contractor is only hired once the design is complete, has two schedule implications:

- The overall process is generally longer than that for other procurement models; and
- The construction period may also be longer than under other procurement models, as there is no opportunity for the construction contractor and designer to collaborate and incorporate constructability considerations into the design.

Schedule delays due to the design (for example due to late or inadequate design) are the responsibility of the owner.

Construction cost overruns resulting from delays due to construction (such as poor coordination of site activities) are the responsibility of the construction contractor, as they are typically paid a fixed price for construction. However, progress or milestone payments are typically made to the construction contractor during construction, therefore the construction contractor may not be incentivized to achieve timely completion to the extent that it would under a procurement model that does not compensate the contractor until construction is complete (e.g. DBF).

Cost

The project owner retains the majority of the project risks under a DBB model and has to manage the interface between the designer, who may claim defective construction, and the builder, who may claim faulty design.

The construction budget is not determined until the design is complete and the construction contract is awarded.

Since the construction is based on the tendered design, any design shortfall or constructability issue may be costly for the project owner to resolve.

There is often little incentive for the designer to pursue creative design and/or construction solutions that could increase efficiencies during the operations phase.



Quality

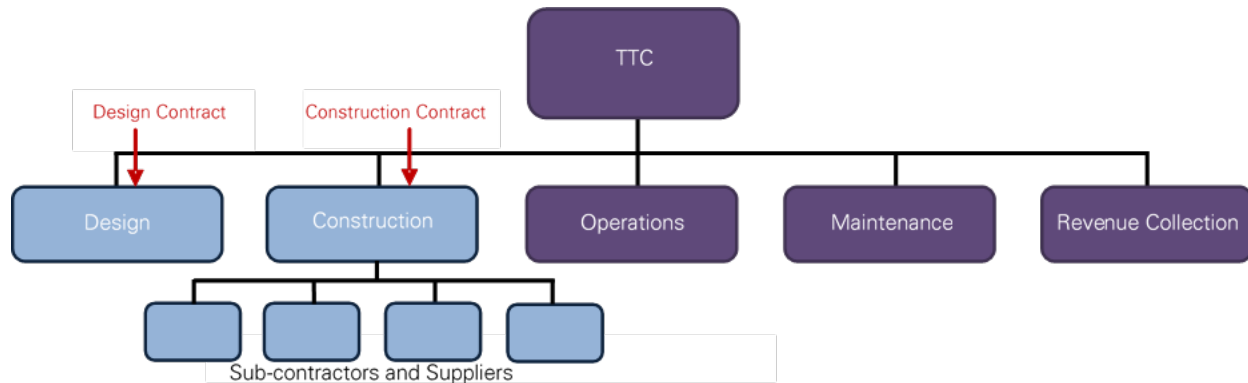
The project owner retains a significant degree of control over the project by managing both the design and construction contracts. As a consequence of retaining this control (and approving the final design), the project owner remains liable for any performance shortfall in the design.

Once construction is complete, the asset is handed to the project owner to maintain and operate, which relieves the design and construction contractors of any obligation for the asset's long-term operational performance. The construction contractor therefore has no motivation to improve the life-cycle performance of the asset.

In summary

The DBB model is the most commonly used procurement method. Project owners, contractors and suppliers are familiar with the model and the evaluation process is simple – the lowest bidder is usually the winner. However, for a complex and/or high-risk project, the project owner's retention of the majority of the project risks can be a significant disadvantage, as the risk and cost of design errors or omissions will typically increase with the complexity of the project. In addition, it limits private sector innovation, as the design and construction teams are not afforded the opportunity to work together and the short-term nature of the contract forces a short-term view of the asset.

Figure 2: Typical Responsibilities under a Design-Bid-Build Model



Construction Management at Risk (CM@R)

With Construction Management at Risk (CM@R), the Construction Manager at Risk (CM@R contractor) is engaged by the owner to provide consultancy services during the pre-construction stage (constructability and value engineering reviews, tender administration, etc.) and is later contracted to deliver the construction of the project under a cost-plus-fee arrangement to an agreed Guaranteed Maximum Price (GMP). The GMP is negotiated before the design is fully complete, and the remaining design is then managed by the CM@R contractor within the GMP.

The CM@R contractor is responsible for any construction cost overruns above the GMP. As a result, once the GMP is negotiated, the role of the CM@R contractor essentially shifts from that of an agent to that of a supplier.

Thus, similar to the CM model, the CM@R contractor typically advises the design team, procures the construction and manages the delivery. As the owner's agent, the CM@R contractor is authorized to enter into legal relationships with third parties on the owner's behalf. However, in contrast to the CM model, once the GMP is negotiated the project owner transfers cost risk over the construction components of the project.

There are many possible variants of a CM@R contract depending on the particular issues involved in the project. Some typical features and considerations relating to schedule, cost, and quality in a CM@R contract are summarized below.

Schedule

If brought on at the early stages of design, the CM@R contractor can assist the owner in understanding the complexities in construction and schedule development.

The CM@R approach can allow for an early start to construction and accordingly a fast track process.



Schedule delays due to the design (for example due to late or inadequate design) are the responsibility of the owner.

Construction cost overruns resulting from delays due to construction (such as poor coordination of site activities) are shared between the owner and the CM@R contractor, with the owner's risk capped at the GMP. However, progress or milestone payments are typically made to the CM@R contractor during construction, therefore the CM@R contractor may not be incentivized to achieve timely completion to the extent that it would under a procurement model that does not compensate the contractor until construction is complete (e.g. DBF).

Cost

Cost certainty is achieved in the design phase, once the GMP is negotiated.

The negotiation of the amounts that should be allowed in the GMP for contingency and undefined scope is difficult due to the CM@R contractor wanting to justify as large a maximum as possible, in order to limit their exposure. The owner may obtain a third-party estimate to challenge the GMP, but the construction is essentially sole-sourced to the CM@R contractor without the competitive tension of a tender process influencing the proposed GMP.

The GMP is typically supported by a combination of market proposals and estimated material take-offs from the scope. Typically, the CM@R contractor will be entitled to a share of any amount left in the GMP at the end of construction, which can motivate the contractor to continue to look for cost-reduction opportunities after the GMP has been negotiated.

The nature of a CM@R agreement is such that the contractor is responsible for completing the project within budget; however, the owner retains responsibility for monitoring the costs, schedule and quality of the construction as it progresses to ensure that the costs assigned to the GMP are fair.

Quality

Depending on the terms of the CM@R agreement, the CM@R contractor will be financially responsible for the remediation of any deficiencies, provided that the deficiency noted is within the control of the contractor.

Once construction is complete, the asset is handed to the project owner to maintain and operate, which relieves the CM@R contractor of any obligation for the asset's long-term operational performance.

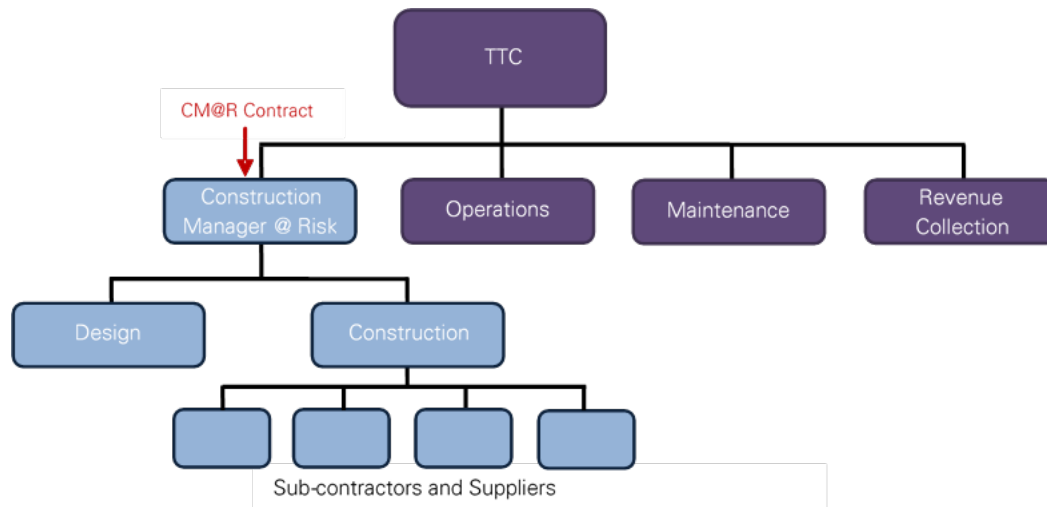
In summary

The advantages of a CM@R approach are similar to those of a CM approach, with the added advantages of cost certainty earlier in the project (at the point at which the GMP is negotiated), and construction cost risk transfer (once the GMP is negotiated). As a result of the risk transfer involved, the GMP is likely to include a risk premium. The advantages of a CM@R approach are



most likely to be realized, and any risk premium justified, on a relatively complex project involving numerous counterparties.

Figure 3: Typical Responsibilities under a Construction Management at Risk Model, Post-Negotiation of the GMP



Alliance Contract

An alliance contract is formed by the project owner, designer, construction contractor and suppliers to deliver a specific project. Under this strategy, all parties share the responsibility for all aspects of the project, including design, construction and construction management. Compensation under an alliance contract is directly tied to cost, schedule and profitability milestones of the overall project.

The fundamental difference between alliance contracts and traditional contracts is the underlying principle: a non-adversarial approach between the contracting parties. This is achieved through establishment of alliance principles, good faith commitments, existence of an alliance board, and adoption of no-dispute provisions. The collaboration requires a time commitment on the owner's part, but efficiencies and win-win situations are maximized.

The characteristics of an alliance model and the issues associated with it depend upon the unique characteristics of the project. Some typical considerations and issues relating to schedule, cost, and quality of an alliance contract are summarized below.

Schedule

The increased complexity of the contract(s) between entities increases the time required to plan and deliver the procurement structure and details.

Given the uncertainty of delivery dates, alliance contracting is not generally suited to projects with an inflexible completion deadline.

The higher degree of risk sharing characteristic of alliance contracts may be desirable when schedule risks are difficult to quantify, as they allow the owner to incentivize the contractor to



manage schedule risks without incurring a significant risk premium, which would typically be included were the owner to attempt to transfer all schedule risk to the contractor.

Schedule risks are shared under alliance contracts, which exposes the project owner to 'uncapped risk'.

Cost

Reduced threat of disputes compared to traditional adversarial contracting approaches.

Earlier involvement of all parties at preliminary design may provide greater visibility into project costs.

The higher degree of risk sharing characteristic of alliance contracts may be desirable when cost risks are difficult to quantify. The sharing allows the owner to incentivize the contractor to manage cost risks without incurring a significant risk premium that would typically be included were the owner to attempt to transfer all cost risk to the contractor, e.g. by using a fixed price contract under another procurement model.

Cost risks are shared under alliance contracts which exposes the project owner to 'uncapped risk'. To mitigate this risk, some alliance contracts may have "right of first refusal" provisions that allow the construction contract to be subject to a market tender should the owner need a market benchmark for the construction costs estimated by the alliance partner.

Quality

Less constrained design process may be more innovative and co-operative.

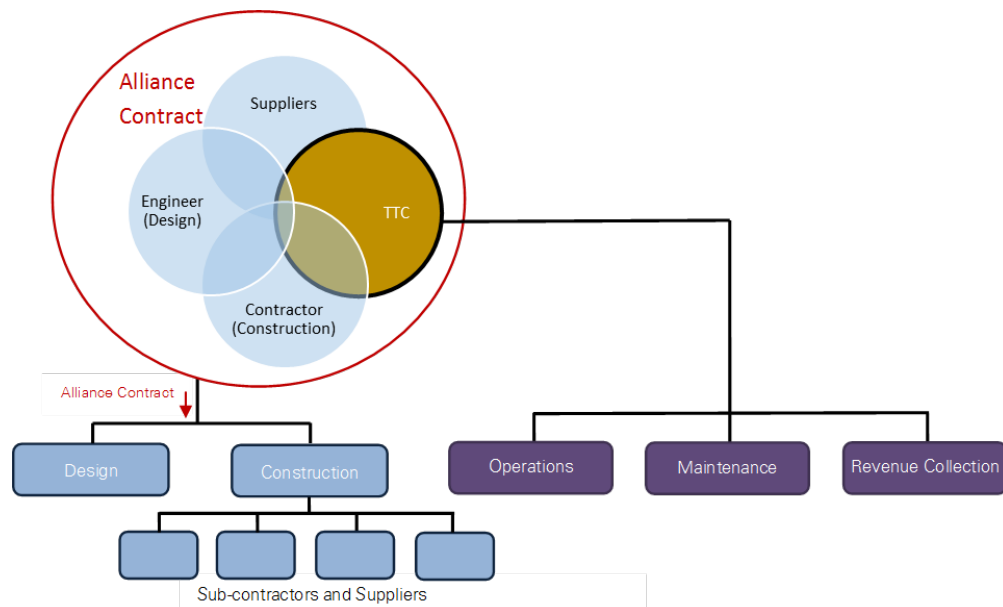
Non-adversarial approach that focuses on project outcomes and open communication is often productive for projects with very high risk and complexity.

Depending upon the term of the alliance contract and the payment structure to the alliance partners, the project owner shares the risk of deficiencies during the construction phase and may retain the risk of deficiencies during operations.

In summary

In alliance contracts, parties seek to align their commercial interests, and as a result, efficiencies and win-win situations are maximized. Alliance contracts are collaborative ventures that require commitment from all parties, including a significant time commitment from the project owner. In particular, alliance contracting requires a commitment to establishing the necessary governance processes and the ability to allocate the internal resources required to participate in a relationship contract and accept a risk-sharing arrangement. This commitment is most likely to yield a return on longer-term and more complex projects.

Figure 4: Typical Responsibilities under an Alliance Contract



Design-Build (DB)

The Design-Build (DB) model awards the design and construction under a single contract. Consortia, joint ventures or subcontract agreements may be established between two or more companies to pool the resources and expertise necessary to deliver a DB project.

The tender of the DB is not based upon a detailed design but rather the project requirements as defined in the form of a performance specification which states what the project needs to achieve in terms of functional requirements, rather than how to achieve it.

The characteristics of a DB model and the issues associated with it depend upon the unique characteristics of the project and contract formed. The General Contractor is typically the lead in this arrangement as the majority of the cost, schedule and quality risk relate to the construction. Some typical considerations and issues relating to schedule, cost, and quality of a DB project are summarized below.

Schedule

The DB contract is awarded at an earlier stage of design than the construction contract under a DBB approach (typically during the preliminary design stage rather than during the detailed design stage). This has several schedule implications:

- The DB model enables a fast-track process as construction can begin before the design is complete.
- As the construction contractor in a DB consortium typically controls the designer there is a focused effort to limit 'non-owner caused' change orders and incorporate



constructability considerations in the design, both of which increase the potential for the construction period to be reduced.

Schedule delays due to the design (for example due to late or inadequate design) are the responsibility of the DB consortium. Construction cost overruns resulting from delays due to construction (such as poor coordination of site activities) are the responsibility of the DB consortium, as they are typically paid a fixed price for design and construction. However, progress or milestone payments are typically made to the DB consortium during construction, therefore the construction contractor may not be incentivized to achieve timely completion to the extent that it would under a procurement model that does not compensate the contractor until construction is complete (e.g. DBF).

Cost

Competing contractors are motivated at the bid stage to leverage their technical and commercial expertise to innovate and find the most efficient, value of risk transfer design solution.

The construction cost risk is transferred to the DB consortium, as they will typically have provided a fixed price to design and construct the project.

It is typically more difficult and costly to implement a change order under a DB than a DBB because of the way the contract is structured.

There is often little incentive for the DB consortium to pursue creative design and/or construction solutions that could increase efficiencies during the operations phase.

Quality

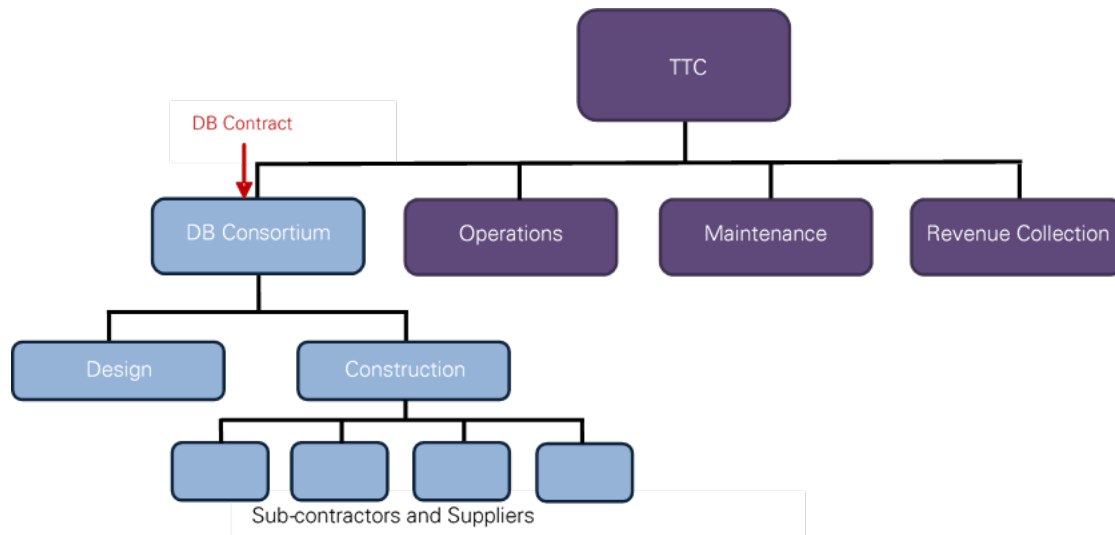
The DB consortium is responsible for building an asset to the performance specification, and therefore is liable for any design shortfalls.

The DB consortium is financially motivated to under-design and reduce construction costs, as they have no responsibility for the asset's long-term operational performance. The performance specification is therefore critical in ensuring that the DB consortium produces an asset with the level of quality the owner requires.

In Summary

The principal advantage of the DB approach is the elimination of the need for the project owner to manage the interface between the design and construction of a project, and the transfer of the risk associated with this interface to the DB consortium. The advantages of the DB approach are most likely to be realized on projects which offer significant scope for innovation, and for which the advantage of transferring design risk is greater. The key to the success of the DB approach lies in the quality of the performance specification, and ensuring this captures all of the owner's requirements without prescribing the means to achieve them.

Figure 5: Typical Responsibilities under a Design-Build Model



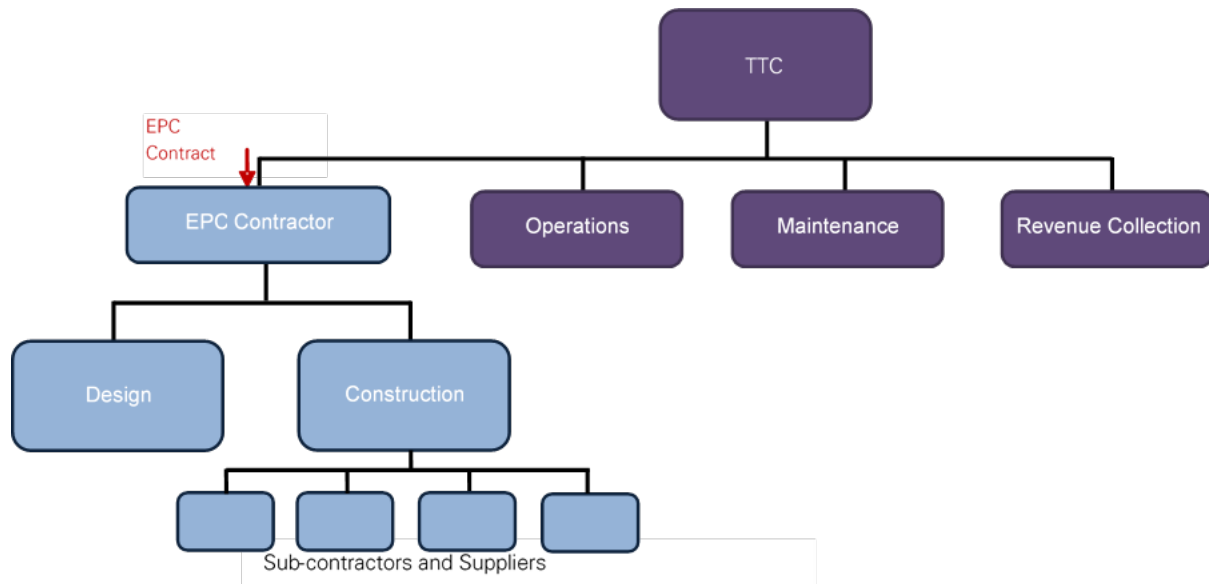
Engineering, Procurement and Construction (EPC)

In an Engineering, Procurement and Construction (EPC) approach, the project owner hires a contractor (the EPC contractor) to undertake the engineering (design), procurement of necessary materials, and construction.

EPC arrangements are generally structured as fixed-price contracts, whereby the contractor will be paid an agreed amount to deliver a commissioned asset to the project owner at the end of the construction phase. The project owner defines the scope, specifications, quality and completion date. The EPC contractor will then select suppliers, often with limited input from the project owner. The EPC contractor enters direct contracts with construction contractors and as a result, carries cost, quality, and schedule risk.

The EPC model is similar to the DB model, as can be seen by comparing Figures 7 and 8. For the purposes of this analysis, the EPC model is considered a variant of the DB model and is not considered sufficiently distinct to warrant separate evaluation.

Figure 1. Typical Responsibilities under an EPC Contract



Design-Build-Finance (DBF)

Similar to a Design-Build (DB) model, a Design-Build-Finance (DBF) approach awards the design and construction under a single contract. Consortia, joint ventures or subcontract agreements may be established between two or more companies to pool the resources and expertise necessary to deliver a DBF project.

The distinguishing feature between the DB and DBF procurement models relates to who retains the financing risk. Under a DB model, the project owner is responsible for financing the entire project, while under a DBF model responsibility for construction financing and the associated financing risks are transferred to the DBF contractor/consortium. In addition, the DBF consortium will be motivated to complete the project on time, as the owner will withhold all or a significant proportion of payment until project completion. Any incremental interest costs and financial penalties associated with schedule delays will be borne by the DBF consortium.

The characteristics of a DBF model and the issues associated with it depend upon the unique characteristics of the project. Some typical considerations and issues relating to schedule, cost, and quality of a DBF project are summarized below.

Schedule

Schedule delays due to the design and construction cost overruns resulting from delays due to construction are the responsibility of the consortium.



Since the DBF consortium is typically not compensated until construction is complete, this type of financing arrangement is advantageous to minimize completion risk and provide greater schedule certainty for the project owner.

Similar to the DB approach, the DBF approach creates opportunities for the designer and construction contractor to collaborate, reducing the risk of schedule overruns.

Cost

The DBF approach allocates financial risks including interest rate fluctuation to the DBF consortium, and provides another form of security. The private sector is only compensated after construction is complete, through one lump-sum payment.

The higher cost of private sector borrowing compared to public sector borrowing could result in a higher final cost to the project owner than if the project owner were to fund the project directly.

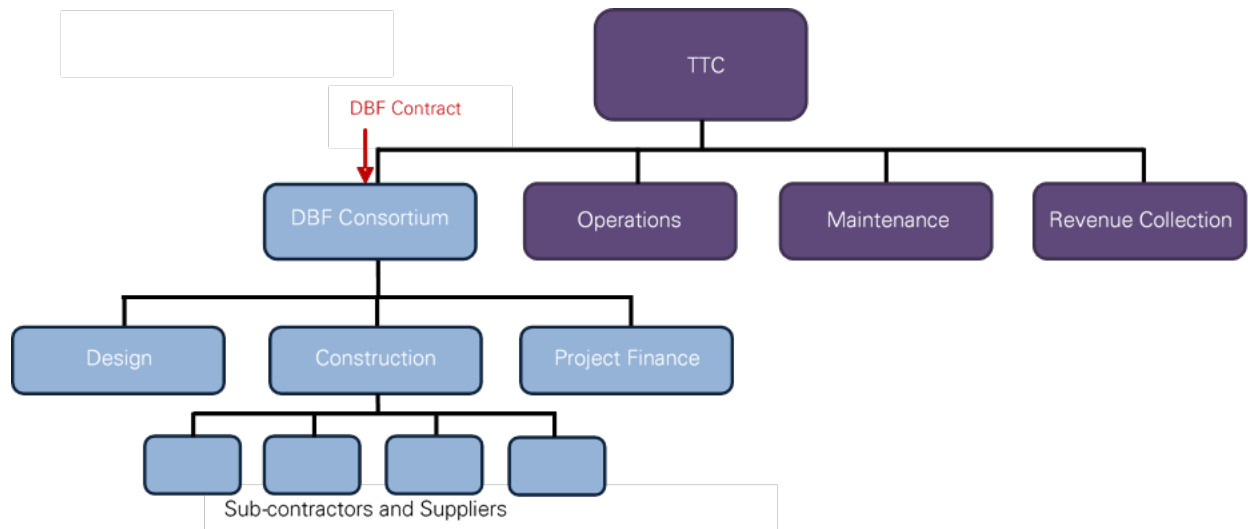
Quality

The responsibility for operations, maintenance, and any expansions after construction is complete are retained by the project owner under the DBF arrangement. As a result, it is still difficult to incentivize the private sector to pursue creative design and/or construction solutions that could increase efficiencies during the operations phase.

In summary

The advantages of the DBF approach are most likely to be realized on a project with greater risks, for which the higher cost of private sector borrowing may be justified by the value of transferring the financing risk and/or the greater schedule certainty and extra security associated with the private sector provision of finance.

Figure 6: Typical Responsibilities under a Design-Build-Finance Contract



Design-Build-Finance-Rehabilitate (DBFR), Design-Build-Finance-Maintain (DBFM) and Design-Build-Finance-Operate-Maintain (DBFOM)

The Design-Build-Finance-Rehabilitate (DBFR), Design-Build-Finance-Maintain (DBFM) and Design-Build-Finance-Operate-Maintain (DBFOM) approaches are all similar to the Design-Build-Finance (DBF) approach, with the additional responsibility for the specified services also included in the contract.

Under these approaches, the project owner awards a single contract to a private sector consortium to design, build, finance and either rehabilitate (DBFR), maintain (DBFM), or operate and maintain (DBFOM) the asset for a fixed period of time on the owner's behalf. At the end of the term, the asset is 'handed back' to the project owner at a specified standard.

The consortium is entitled to compensation under the DBFR/DBFM/DBFOM agreement through performance-based availability payments, which are essentially service payments linked to the performance of the asset that begin to be paid only once construction is complete and the asset is operational.

Thus, in addition to transferring the design, construction and financing risks, these approaches also allocate the risks associated with the asset's rehabilitation, maintenance, or operations and maintenance (depending upon the agreement), to the private sector consortium.

The characteristics of a DBFR/DBFM/DBFOM model and the issues associated with it depend upon the unique characteristics of the project. Some typical considerations and issues relating to schedule, cost, and quality of a DBFR/DBFM/DBFOM project are summarized below.



Schedule

Schedule delays due to the design and construction cost overruns resulting from delays due to construction are the responsibility of the consortium.

Since the consortium is typically not compensated until construction is complete, this type of financing arrangement is advantageous to minimize completion risk and provide greater schedule certainty for the project owner.

The procurement process is likely to be longer compared to a straight construction tender as the bids will take longer to prepare and assess and the contract will take longer to negotiate, but the overall timeline to asset completion may be faster as design and construction can be undertaken concurrently.

Cost

The cost of the project to the owner is spread over the term of the agreement. This allows the owner to more closely match their outlays on the project to benefits received, and provides the owner with financial security that the consortium will fulfil its contractual obligations.

The DBFR/DBFM/DBFOM approaches provide the project owner with cost certainty for the term of the agreement, for the services specified. The longer the term, the greater the cost risk that is transferred to the consortium and, typically, the greater the risk premium that the consortium will include in the availability payments they negotiate.

To submit a competitive proposal and to maximize financial returns over the term of the contract, the consortium will work together to seek efficiencies in design, construction, financing and whichever additional services are included in the agreement (e.g. rehabilitation, maintenance and/or operations) to lower the overall cost of the asset. In doing so, the consortium analyzes the trade-offs between upfront costs and long-term life cycle costs in the design phase and absorbs the related risks over the long-term.

Without taking into account the potential risk transfer under this contract, the higher cost of private sector borrowing compared to public sector borrowing could result in a higher final cost to the project owner than if the project owner were to fund the project directly.

Quality

The project owner has less direct control over the asset once it is operational, compared to procurement models that do not include the provision of any post-construction services. It is therefore critical that the terms of the agreement allow the project owner to hold the consortium accountable for high standards of service throughout the term of the agreement. This is usually achieved by carefully designed availability and bonus/penalty payment structures.

It is generally more difficult and expensive for the owner to make changes to the project than under the procurement models already discussed.



As quality is a contractual commitment, the long-term quality of the asset is generally more consistent under this arrangement than under a model where the owner has discretion each year over whether to expend funds on maintenance and rehabilitation.

In summary

The DBFR, DBFM and DBFOM approaches can provide many advantages in terms of cost certainty, risk transfer and life-cycle cost efficiencies. These advantages are most likely to be realized and the impact of the higher cost of private borrowing justified when:

- material expenditures are associated with the provision of the services to be included in the agreement; and/or
- the project is complex enough that the consortium can realize life-cycle cost efficiencies by virtue of considering the cost of the specified post-construction services during the design and construction of the asset; and
- the risks of the asset over the long-term can be relatively well understood and quantified.

Figure 7: Typical Responsibilities under a Design-Build-Finance-Rehabilitate (DBFR) Contract

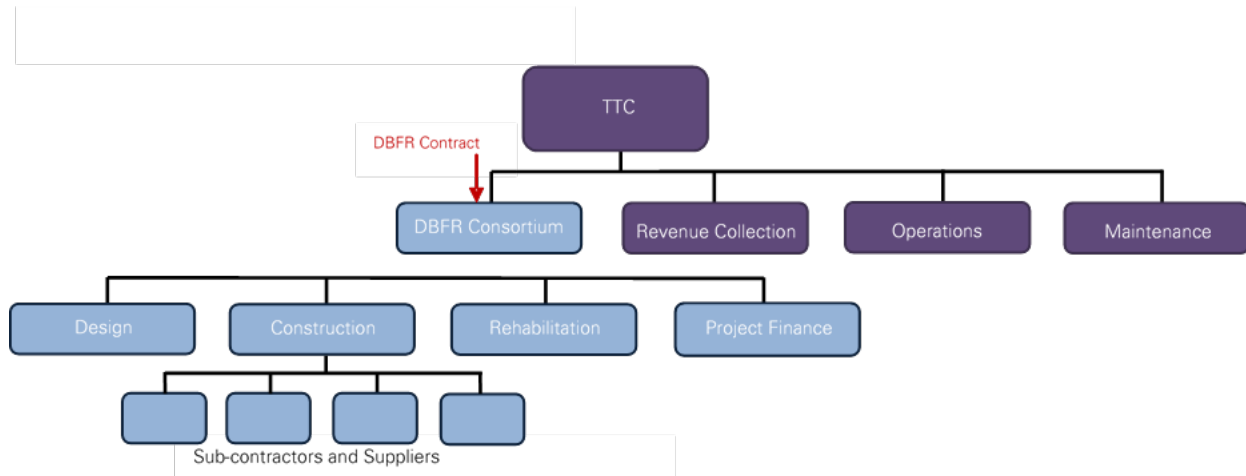


Figure 8: Typical Responsibilities under a Design-Build-Finance-Maintain (DBFM) Contract

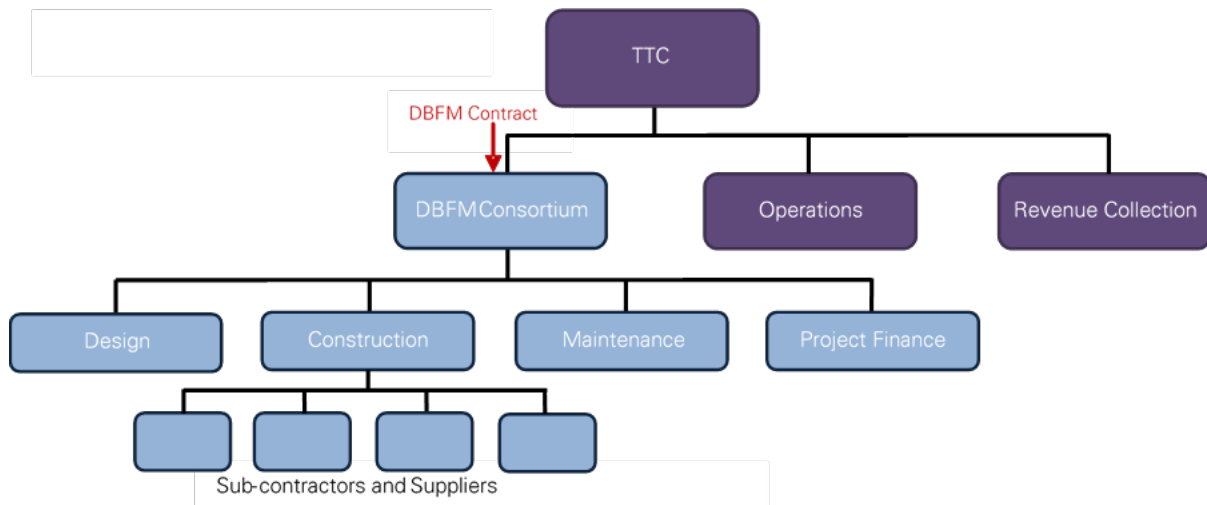
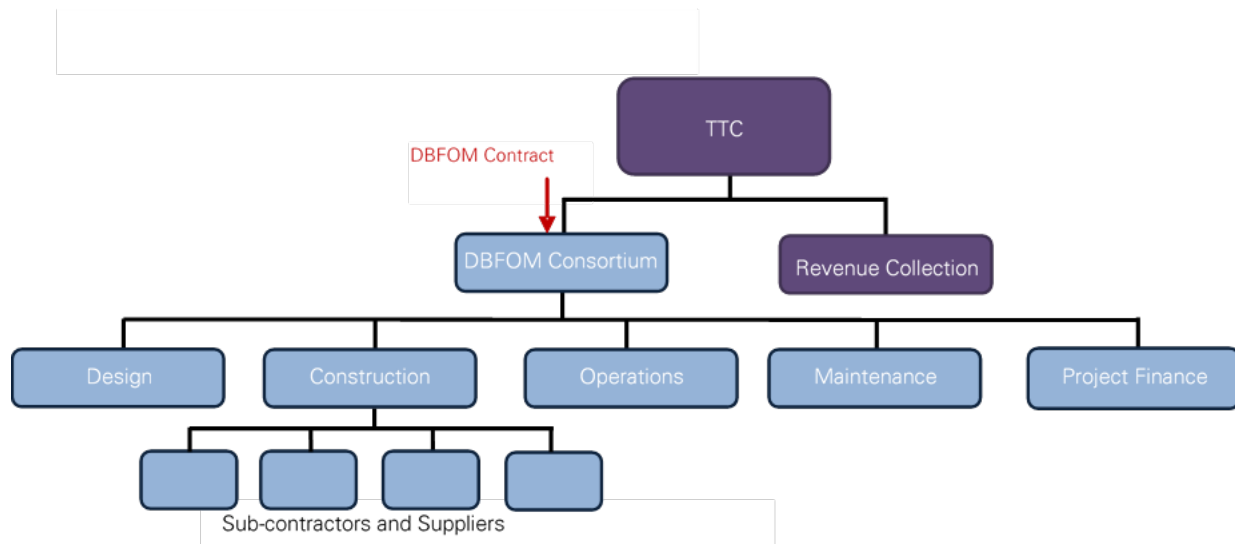


Figure 9: Typical Responsibilities under a Design-Build-Finance-Operate-Maintain (DBFOM) Contract



Full Concession

The Full Concession model is the procurement method with the highest degree of private sector involvement (with the exception of the IPP approach, which is outlined at the start of this appendix). The Full Concession model is similar to a DBFOM approach, with the additional transfer of revenue risk to the private sector consortium. The Full Concession model is therefore only applicable to projects that will generate user fee revenues.

In a Full Concession agreement, the private sector consortium constructs an asset and is responsible for collecting tolls or fees directly from asset users for a pre-defined period of time. The concession grants the consortium a right to collect user fees, but the consortium never takes physical ownership of the asset. The revenues collected from tolls or fees are intended to compensate the private sector for capital, operating, maintenance, life-cycle and financing costs expended and provide a reasonable rate of return. Accordingly, the private sector consortium is incentivized with the opportunity to turn a profit from collecting user fees after it recaptures design, construction, operating, maintenance and financing costs.

Since the consortium's profits are maximized by usage and efficiency, it could be argued that the Full Concession approach promotes optimal use of public infrastructure assets. It should be noted that although the private sector consortium manages and collects user fees, rate regulation is generally still controlled by the project owner to protect the public interest.

The characteristics of a Full Concession model and the issues associated with it depend upon the unique characteristics of the project. Some typical considerations and issues relating to schedule, cost, and quality of a Full Concession approach are summarized below.



Schedule

Schedule delays due to the design and construction cost overruns resulting from delays due to construction are the responsibility of the consortium.

With the transfer of revenue risk, any delays in the in-service date can result in significant opportunity costs for the Full Concession consortium. As a result, the Full Concession model maximizes the consortium's incentive to deliver the project on schedule.

The procurement process is likely to be longer compared to a straight construction tender as the bids will take longer to prepare and assess and the contract will take longer to negotiate, but the overall timeline to asset completion may be faster as design and construction can be undertaken concurrently.

Cost

Under a Full Concession agreement, the consortium must generate user fee revenues to cover capital costs and turn a profit. Accordingly, unlike the other models discussed, the Full Concession model transfers all cost risk to the consortium for the term of the agreement: the project owner has cost certainty over the entire asset for the term of the agreement.

The longer the term the greater the cost risk that is transferred to the consortium and, typically, the greater the risk premium that the consortium will include in their bid for the concession (i.e. the lower the bid the consortium will submit for 'leasing' the asset).

To submit a competitive proposal and to maximize financial returns over the term of the contract, the consortium will work together to seek efficiencies in design, construction, financing, maintenance and operations, to lower the life-cycle cost of the asset. In doing so, the consortium analyzes the trade-offs between upfront costs and long-term life cycle costs in the design phase and absorbs the related risks over the long-term.

Without taking into account the potential risk transfer under this contract, the higher cost of private sector borrowing compared to public sector borrowing could result in a higher final cost to the project owner than if the project owner were to fund the project directly.

The transfer of revenue risk to the private sector is a significant risk transfer that the consortium will expect to be compensated for through a higher required rate of return.

Quality

The project owner has less direct control over the asset once it is operational, compared to procurement models that do not include the provision of any post-construction services. It is therefore critical that the terms of the agreement allow the project owner to hold the consortium accountable for high standards of service throughout the term of the agreement. This is usually achieved by a carefully designed liquidated damages regime backed by appropriate performance security.



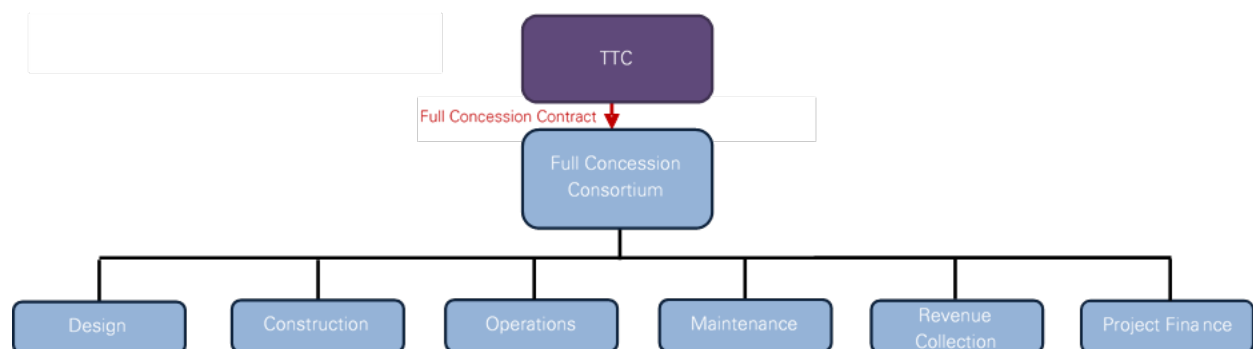
It is generally more difficult and expensive for the owner to make changes to the project than under the procurement models already discussed.

In summary

The Full Concession model is only applicable to projects that are projected to generate sufficient user fees to cover a significant amount, if not all of the project costs. The model can provide many advantages in terms of cost certainty, risk transfer and life-cycle cost efficiencies. These advantages are most likely to be realized, and the risk premium required to entice the private sector to accept revenue risk justified, when:

- Material expenditures are associated with the long-term operation of the asset; and/or
- The project is complex enough that the consortium can realize life-cycle cost efficiencies by virtue of considering the long-term performance of the asset during its design and construction; and
- The risks of the asset over the long-term can be relatively well understood and quantified.

Figure 10: Typical Responsibilities under a Full Concession Contract



C.4.2 Expanded Sample Evaluation Criteria

Evaluation criterion	Description	Relative priority
Risk management	The extent to which the procurement model allocates risk to the party best suited to manage it.	High
Time	The extent to which the procurement model is able to deliver the project within the TTC's time constraints and provides time certainty.	High
Price & budget certainty	The extent to which the procurement model supports cost certainty and competitive pricing for capital and whole-of-life costs.	High
Innovation & incentive	The extent to which the procurement model incentivizes the bidder/proponent to innovate to meet the required performance outputs and other requirements (in a way that is beneficial to the project).	Medium
Flexibility & control	The extent to which the procurement model enables the TTC to retain flexibility to change specifications and operations over time.	Medium
Market interest & appetite	The extent to which the procurement model assists in maximizing market interest amongst the appropriate market participants with the relevant skills, expertise and capacity.	Medium
TTC Capacity	The extent to which the TTC has the capacity to undertake the procurement and the management of the resulting contract and services	Low