**APPENDIX 1**

# THE MANAGEMENT OF INFORMATION TECHNOLOGY PROJECTS – OPPORTUNITIES FOR IMPROVEMENT

## TORONTO TRANSIT COMMISSION

**October 26, 2007**

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TORONTO Auditor General's Office

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# AUDIT REPORT IN BRIEF

***The TTC is Canada's largest public transit system with an operating budget of over $1 billion and a capital budget approaching $800 million***

The Toronto Transit Commission (TTC) is Canada's largest public transit system with an annual operating budget of over $1 billion and a 2007 capital budget of approximately $757 million. The TTC employs over 10,500 staff, operates approximately 1,500 buses, 250 streetcars, and 700 subway cars. The system provides approximately 445 million passenger trips on an annual basis. In order to manage such a diverse and complex organization, the effective use of information technology is of paramount importance.

***Many Information Technology Systems at the TTC are based on older technology and require updating***

The Toronto Transit Commission is currently operating with a number of information and financial information systems based on older outdated technology. Management's commitment to replace or upgrade these systems means that in the coming years the TTC will need to develop and implement a number of significant information technology projects. Effective use of information technology offers the TTC opportunities to improve performance, reduce costs and enhance the range and responsiveness of service delivery. To ensure that the operations at the TTC are reliable and well run, the TTC must acquire, implement and maintain its information systems effectively.

***Information Technology plays a critical role at the TTC***

The various operational activities, where information technology plays a critical role at the TTC include:

- daily scheduling of operators for buses and subways;
- daily scheduling of bus routes;
- maintenance and warranty management related to vehicles by tracking bus usage, defects and work orders for maintenance and repairs;
- maintenance and repairs of subways and related capital assets and buildings;
- maintenance of a complex financial information system;
- management and administration of human resource, payroll and employee benefits including pension programs and other post retirement benefits.

***Many facets of the TTC rely on information technology – from the daily scheduling of bus routes, cash and token controls, to the tracking of insurance claims***

- maintenance of inventory management systems including procurement, material storage, distribution and payment of invoices;
- management and administration of a significant fuel inventory;
- management and administration of fare passenger revenues, the majority of which is cash;
- management and administration of token and metro pass activities; and
- tracking of insurance claims.

All of these activities are supported by a number of sophisticated and complex technology applications each operated and maintained by different divisions within the TTC. The development, management, maintenance and delivery of these applications through the TTC's Information Technology Services Department represents a significant and important challenge particularly in view of the large financial investment both current and long term in information technology.

***Operating Budget of the TTC's Information Services Department is $19 million; Capital Budget is $18 million***

The 2007 operating budget of the Information Technology Services Department at the TTC is approximately $19 million with an additional capital budget of $18 million. At the end of 2006, information technology services were being delivered by a permanent staff complement of 145. Supplementing permanent staff are consultants hired by the TTC on an as needed basis. The number of consultants varies at any point in time based on requirements.

***In the last five years the TTC has undertaken approximately 40 information technology projects costing over $77 million***

The Information Technology Services Department is responsible for coordinating the evaluation, selection and implementation of information technology projects. In the last five years, the Commission and City Council has approved and the TTC has undertaken approximately 40 information technology projects costing over $77 million. Over this period, the annual capital budget for information technology projects ranged from $15 million to $21 million in 2006. An additional investment of approximately $109 million has been allocated for information technology projects from 2007 to 2015.

If the TTC is to achieve its objectives in a cost effective manner,

information technology systems, particularly their development and implementation must be managed well. In order to better manage information technology systems, management must ensure related costs, benefits and risks are evaluated, scrutinized and monitored regularly.

**Why We Conducted this Audit?**

***Previous City audits have identified issues relating to the management of information technology projects***

One of the most important determinants in selecting audit projects relates to the level of funds expended in the area subject to audit. In the case of the TTC's investment in information technology, the expenditures are significant. In addition, our previous audits on information technology issues at both the City and the Toronto Police Service identified concerns which were important and required immediate and ongoing attention.

***The Auditor General of Canada has identified the development of information technology projects as a complex undertaking carrying significant risks***

In selecting this area for audit, we were also cognizant of the work recently conducted by the Auditor General of Canada in connection with her review of large information technology projects. In her review dated November 2006 she indicated that:

> *"compared with other disciplines, the management of IT projects is relatively new, and organizations are still finding their way with it. Therefore, any organization that invests in IT support must be cautious. Large IT projects are inherently complex, expensive and risky and they usually involve long planning and development times."*

The Auditor General of Canada, in her November 2006 review, also quotes the results from a 2004 research study conducted by the Standish Group (a market research and advisory firm specializing in software and electronic commerce).

***A survey conducted by an independent consulting organization confirms the difficulties associated with the development of large information technology projects***

The Standish Group observed that:

> *"This years results show that 29% of all projects succeeded (delivered on time, on budget, with required features and functions) 53% are challenged (late, over budget and/or with less than required features and functions) and 18% have failed (cancelled prior to completion or delivered and never used)".*

With the above as context, particularly the significant dollar investment in information technology at the TTC as well as the inherent complexity of information technology development and acquisitions, it was determined that information technology operations at the TTC would be an appropriate area for review by the Auditor General's Office. Accordingly, this particular

project was included in the Auditor General's annual audit work plan.

## IN SUMMARY – WHAT DID WE FIND?

***Working relationships between the City and the TTC require improvement***

A recurring theme in a number of audits conducted by the Auditor General's Office at the City, such as the Management of City Information Technology Assets, the Review of Fleet Operations and the Review of Facilities and Real Estate Management is the need for closer cooperation and coordination between the City and its local boards, particularly the TTC and the Toronto Police Service. For instance, during the review of the Enterprise Case and Occurrence Processing System (e-COPS) information technology project at the Toronto Police Service in April 2005, one of the recommendations contained in that report was:

***There are ongoing cost saving opportunities in coordinating information technology activities***

> "The Chief of Police and the City's Deputy City Manager and Chief Financial Officer develop an ongoing protocol and working relationship in order to ensure that:
>
> - technology developments do not occur in isolation from each other;
> - technology developments are in accordance with the long-term objectives of both organizations; and
> - the purchase of any computer hardware and software is coordinated."

This recommendation has particular relevance at the TTC and is of significant importance when viewed in the context of this particular review.

While recognizing that both the TTC and the Toronto Police Service are separate legal entities there are, in our view, ongoing cost saving opportunities in developing closer relationships between the City and both of these entities, particularly in the area of information technology.

During late 2006 and early 2007, the City was engaged in a major restructuring of its information technology process. The

intent of the restructuring at the City, known as the "Information Technology Governance and Transformation Project" was to change how the City's information technology services were organized and delivered. The information technology transformation at the City includes:

- new cross – divisional advisory bodies that will provide formal oversight and governance of the City's information technology strategies and infrastructure
- divisional control of development and support of business specific applications while shared information technology services will be centralized; and
- new functions including information technology portfolio management, project and resource management and relationship management.

***The City's recent Information Technology Governance and Transformation Project excluded the Toronto Transit Commission and the Toronto Police Service even though both entities collectively account for 25 per cent of the City's total operating budget***

The basis for the information technology restructuring process at the City was comprehensive, was conducted by a third party consultant, involved significant input from a large number of senior staff throughout the City and included benchmarking research with a number of other organizations. While recognizing the thoroughness of the review, in our view, the exclusion of both of the TTC and the Toronto Police Service from being active participants in this process minimized its effectiveness, particularly, when both of these organizations collectively account for almost 25 per cent of the City's total operating budget.

Our report entitled: "Management of Information Technology Assets" dated January 26, 2006, at the City made specific reference to the Information Technology Governance and Organization Design review and included the following recommendation:

> "The City Manager give consideration to extending the terms of reference of the upcoming Information Technology Governance and Organization Design Review to include the City's Agencies, Boards and Commissions."

The management response to this particular recommendation was as follows:

> "The City Manager will consider extending the scope of this IT Governance and Organization Design Review in the

context of respecting the independent governance of Agencies, Boards and Commissions. We will look to develop a more formal protocol to increase the level of communication and collaboration".

The Information Technology Governance and Organization Design Review was, in our view, conducted with inadequate input from both the TTC and the Police Service. We understand the importance of ensuring that the City's governance process needed to be addressed as a priority, however, the exclusion of both the TTC and the Police Service from this exercise represented a missed opportunity. In our view, it is inherently inefficient for processes not to be put in place where experiences can be shared between the City and its major Local Boards.

The City Manager, however, has indicated that the Organization Design Review was viewed as a two phase approach with the TTC, the Police Service and other major Agencies, Boards and Commissions included in the second phase.

Finally, in response to previous audit reports, which have recommended closer relationships be developed between the information technology functions at the City, the TTC and the Police Service, informal meetings are held by senior information technology management of each of these entities. These meetings are generally held to discuss areas of mutual concern as well as being a forum for the exchange of information. Generally, these meetings do not take place with a predefined agenda, minutes are not prepared and little in the way of ongoing mutual system development has been accomplished.

It is our view that a more formal structured communication and working relationship between the City, the TTC and the Police Service would be beneficial to all three parties and would likely result in cost savings.

***The "SAP First" Protocol and the SAP Competency Centre are areas where greater attention is***

In 2001, the City completed implementation of the basic functionalities for a financial and management information system known as SAP. One of the proposed benefits at that time was the potential use of SAP, not only at the City but also at the City's Agencies, Boards and Commissions. In this context, City

***required***

Council during its various debates relating to Information Technology acquisitions endorsed an "SAP First" protocol as long as SAP was able to provide the required functions at a competitive cost.

While the TTC recognizes the benefits of the "SAP First" protocol there has been little progress in regard to the implementation and sharing of SAP applications with the City. Further, the knowledge gained through the recent establishment at the City of the SAP Competency Centre has not been shared with the TTC. The TTC has not taken advantage of the benefits of the Centre while at the same time the City has not made the resources of the Centre formally available to the TTC.

***SAP has enormous potential on a City-wide basis***

Management has indicated that SAP has enormous potential and the benefits of extending this potential to the TTC are, in our view, significant.

***Lessons Have Not Been Learned From Previous Audit Reports***

Certain of the recommendations contained in this report have been made in previously issued audit reports. Previous audit recommendations contained in audit reports relating to the City, even though they likely have relevance to the TTC, have not always been implemented by the TTC. Certain recommendations contained in previous reports have relevance beyond the entity being audited and as such, it is important that advantage is taken of issues identified elsewhere. Specifically, recommendations made in audit reports relating to the use of long term consultants in the development of information technology projects have particular relevance.

***Other Specific Issues Identified during this Review***

We have summarized the more important issues identified during our review as follows. Details relating to each of the following are contained in the section of the report entitled "Audit Results". In regard to the management of information technology projects at the TTC, there is a need to:

- develop sound, complete and comprehensive business cases for all projects;
- ensure that all cost estimates are evaluated thoroughly;
- develop cost estimates on sub projects within a project as opposed to developing one cost estimate on a major project;
- minimize the use of external consultants in circumstances where the work conducted by consultants could be performed by less expensive internal resources;

- better manage and evaluate consultant contract deliverables;
- ensure that there is an appropriate level of documentation in support of all technology systems;
- more effectively manage costs and time frames;
- update current procedure manuals; and
- set up a process for the final close out of information technology projects.

**Conclusion**

Large information technology projects are becoming increasingly complex and costly. The manner in which new information technology systems are managed and implemented at the TTC can affect the efficiency and effectiveness of basic services. Once implemented, information technology has enhanced the efficiency of the TTC. However, the manner in which the development of such technology projects are managed requires attention.

***Key message contained in the report is the need to coordinate information technology issues at the City***

The key message conveyed in this report relates to the need to coordinate information technology issues with the City. The City's recent restructuring of its information technology management process and the hiring of a Chief Information Officer with overall City responsibilities provides an opportunity for the TTC to develop closer information technology relationships with the City.

This report contains 15 recommendations. The implementation of these recommendations will improve the management of information technology projects at the TTC and provide opportunities for cost savings.

# BACKGROUND

***Organizational Structure of the Information Technology Division at the TTC***

The Information Technology Services Department is managed by the Chief Information Officer who reports to the General Secretary of the TTC. The Information Technology Services Department is responsible for the development and implementation of information systems and related technology services to support programs and operations for the TTC. The Department's primary role is to manage a broad range of system development and "state of good repair" information technology projects.

The Information Technology Services Department is part of the Executive Branch of the TTC management structure and is comprised of five sections as follows:

1. **Technical Services –** responsible for managing the TTC's general business information technology architecture and infrastructure. This includes the selection, implementation and support of the technical and telecommunication infrastructure, operating systems, computer centre operations and purchase and deployment of desktop hardware and software.

2. **Application Services** – responsible for providing maintenance to existing TTC computer based systems, and technical advisory support for the acquisition, design, development and implementation of new and upgraded systems.

3. **Quality Assurance -** promotes standards, methodologies, architectures, best practices and a consistent and efficient approach to delivering information services and technology solutions. This section plays a key role in ensuring systems delivered will meet stated business requirements.

4. **Client Services** - maintains service desks and provides assistance to the information security office.

5. **Project Management** - manages information technology projects. This section is responsible for providing a structured project management framework, for improving accountability, and for reducing schedule and cost overruns for information technology projects.

***Technology Advisory Council serves an important role.***

Supporting the Information Technology Services Department is a Technology Advisory Council. The Technology Advisory Council is comprised of a number of TTC senior management staff who evaluate and prioritize new projects while at the same time considering competing business needs, as well as staff and funding limitations.

Projects endorsed by the Technology Advisory Council are submitted to the TTC Chief General Manager for consideration and approval. Once approved by the Chief General Manager, projects are included in the proposed TTC Capital Budget. Formal and final approval occurs when the Toronto Transit Commission and City Council approve the Capital Budget.

# AUDIT OBJECTIVES, SCOPE AND METHODOLOGY

***Audit objectives***

The objective of our audit was to review TTC practices related to the development, management and implementation of information technology projects in order to identify opportunities for improvement as well as cost savings.

***Audit scope***

Our review focused on the overall general practices and processes followed by the Information Technology Services Department at the TTC to manage information technology projects. The observations and conclusions identified during this review reflect the practices of the Information Technology Services Department from the inception of a number of selected information technology projects through to mid 2007.

***Audit methodology***

Our audit methodology included the following**:**

- review of the TTC's project management practices including key documentation such as the Project Management Manual;
- interviews with key TTC staff;
- interviews with the City's then Executive Directive of Information Technology;
- discussions with the City's Deputy City Manager and Chief Financial Officer;
- review and assessment of the TTC Project Management and Quality Assurance Units' roles and responsibilities related to large information technology projects;
- review of a sample of 15 large information technology projects; and
- review of industry accepted project management and information technology governance frameworks.

***The TTC has adopted best practices in regard to its development of information technology projects***

In developing and managing its Information Technology infrastructure, the TTC has adopted an internationally accepted framework developed by an organization called the Project Management Institute. This framework has been in place at the TTC since 2004. The key processes defined by the Project Management Institute centre around the life cycle of an information technology project from the initiation of a project to the final close out and assessment of the completed project. Specific key project processes defined by the Project Management Institute are provided in Exhibit 1 in this report.

During the course of this review we also considered a number of other information technology best practice guides including "Control Objectives for Information and Related Technology" and The Institute of Internal Auditors "Global Technology Audit Guide".

***This audit was conducted in accordance with generally accepted auditing standards.***

We conducted this audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence that provides a reasonable basis for our findings and conclusions based on our audit objectives.

# AUDIT RESULTS

The following section of our Report contains specific findings from our audit work followed by our recommendations.

***Information Technology development and acquisitions at the City and the TTC requires greater coordination***

The following narrative is an extract from our audit report entitled: "Management of City Information Technology Assets", dated January 26, 2006:

> "The major focus in this report and an area of significant importance is the requirement to clarify the roles, responsibilities and authority of the Corporate Information and Technology Division within the City. In our view, it is important to re-evaluate this role in a wider City context to at least consider what role the Corporate Information and Technology Division should have within the City, as well as at the City's Agencies, Boards and Commissions. While certain of these Agencies, Boards and Commissions, particularly the Toronto Transit Commission and the Toronto Police Services Board, are independent and autonomous, there are advantages and economies to be gained through the closer coordination of information technology functions. The coordination of information technology activities between the City and the Agencies, Boards and Commissions at the moment is informal and generally independent of each other."

***There are advantages to be gained by the closer coordination of information technology activities with the City, the TTC and the Toronto Police Service***

***Information technology staff at the Agencies, Boards and Commissions are in the range of 400 - 500***

The January 26, 2006 report further indicates:

> "Many of the City's Agencies, Boards and Commissions have Information Technology Units of varying size and scope. City management have estimated that Information Technology staffing at the Agencies, Boards and Commissions is in the range of 400 – 500. Certain Agencies, Boards and Commissions use elements of the City's technology infrastructure and have adopted City Information Technology policies while others operate on a more autonomous basis."

The January 26, 2006 report further states that:

> "The Information Technology Governance and Organization Design Review, has its main focus on governance and organization design within the City.

However, in our view, there are cost saving opportunities available if the Review encompasses all Agencies, Boards and Commissions. A collaborative Information Technology function would have significant advantages for the City and its Agencies, Boards and Commissions.

As previously indicated, a governance review, which excludes the Agencies, Boards and Commissions, does not address the potential advantages of larger scale economies. We do appreciate the enormity of such an exercise and understand the desire to address governance issues from a City perspective as a first step."

The recommendation resulting from the above comments was as follows:

"The City Manager give consideration to extending the terms of reference of the upcoming information Technology Governance and Organization Design Review to include the City's Agencies, Boards and Commissions."

The management response to this particular recommendation was as follows:

"The City Manager will consider extending the scope of this IT Governance and Organization Design Review in the context of respecting the independent governance of Agencies, Boards and Commissions. We will look to develop a more formal protocol to increase the level of communication and collaboration".

Even though there was an acknowledgement by management of the importance of including both the TTC and the Police Service in this process, the Information Technology Governance and Organization Design Review was completed with inadequate input from both the TTC and the Police Service.

The City Manager, however, has indicated that the Organization Design Review was reviewed as a two phase approach with the TTC, the Police Service and other major Agencies, Boards and Commissions included in the second phase.

***There is a need to develop closer relationships***

The TTC and the City need to develop closer relationships both at the Executive as well as the Senior Management levels in the area of information technology. These relationships should

***between the TTC and the City***

include, for example:

- the joint development of information technology systems
- the acquisition of information systems
- the sharing of software and software licenses
- the possible sharing of staff resources
- the sharing of project management best practices.

In terms of information technology development, the concept of "re-inventing the wheel" should be minimized.

**Recommendation:**

**1. The Chief General Manager of the TTC and the City Manager be required to develop a formal working protocol on all issues relating to Information Technology. Such a protocol to include ongoing communication and collaboration, the sharing of information technology systems and software licenses, the development of new systems, the acquisition of new systems and the sharing of resources including staff and consulting services.**

***The "SAP First" Protocol and the SAP Competency Centre are both important issues which need to be addressed***

In 2001, the City acquired a financial and management information system known as SAP. One of the proposed benefits at that time was the potential use of SAP, not only at the City but also at the City's Agencies, Boards and Commissions. In this context, City Council during its various deliberations relating to Information Technology acquisitions endorsed an "SAP First" protocol as long as SAP was able to provide the required functions.

Maximizing the use of SAP throughout the City as well as its Agencies, Boards and Commissions will likely reduce the total cost of ownership of information systems (e.g. eliminating the need to develop and maintain interfaces between SAP and other systems) while improving the overall quality and timeliness of information used in decision-making. Further, increasing the use of SAP throughout the City will also maximize the City's return on its investment in SAP.

***The advantages of the SAP Competency Centre should be extended to the TTC***

Supporting the "SAP First" protocol at the City has been the establishment of an SAP Competency Centre. The competency Centre is generally viewed as a City Centre only and as a result its availability to the City's Agencies, Boards and Commissions is limited. The major function of the Centre is to provide direct support to City business units in regard to SAP. In general

terms, the Centre:

- plans for SAP related initiatives;
- provides system administration, application support and technical development;
- provides system design and development services;
- manages the implementation of SAP enhancements and new functionality; and
- coordinates training for new SAP functions.

While the TTC recognizes the benefits of the "SAP First" protocol there has been an inadequate level of communication or coordination at both the City level and the TTC in regard to both the "SAP First" protocol and the SAP Competency Centre. The TTC has not taken advantage of the benefits of the Centre while at the same time the City has not formally made the resources of the Centre available to the TTC.

**Recommendation:**

**2. The Chief General Manager of the TTC, during any preliminary deliberations relating to Information Technology development and acquisitions, consult on a priority basis with the Deputy City Manager and Chief Financial Officer at the City in order to determine whether or not there are opportunities to take advantage of available SAP applications. Further, the City and the TTC ensure that the benefits and advantages accruing to the City as a result of the establishment of the SAP Competency Centre are shared with the TTC.**

***Previous audit reports have identified similar issues to those contained in this report***

In general terms, many of the issues contained in this report parallel those identified and reported on in previous audit reports issued by the Auditor General relating to information technology. These reports include the "Management of Information Technology Assets" at the City of Toronto dated January 26 2006 and the "Review of the Enterprise Case and Occurrence processing System (eCops) Project – Toronto Police Service" issued in April 2005. Further, a report dating as far back as June 2001 entitled "Selection and Hiring of Professional Consulting Services Review" contain recommendations which continue to have relevance, particularly in terms of minimizing costs to the TTC. Finally, concerns raised by the Auditor General of Canada in a report entitled: "Large Information Technology Projects" issued in November 2006 contain concerns which are similar to those identified during this

***Lessons Have Not Been Learned from Previous Audit Reports***

review.

***Recommendations in one Audit should, where appropriate, be applied City-wide***

One of the basic characteristics of all the work conducted by the City Auditor General's office is a requirement that when audit reports are issued either at the City or at one of the City's Agencies, Boards and Commissions is the expectation that lessons learned from one audit be applied by management to other entities throughout the City. In our view, this has not happened to any great extent at the TTC. It is evident that certain of the recommendations from this review are similar to those previously made as a result of audit work conducted elsewhere throughout the City.

**Recommendation:**

**3. The Chief General Manager of the TTC develop a formal process for the review and follow-up of recommendations made by the Auditor General. Such a process to take into consideration the review of audit reports relating to City Divisions and its Agencies, Boards and Commissions. Further, the Chief General Manager of the TTC review all audit reports previously issued by the Auditor General pertaining to information technology issues in order to ensure that all appropriate recommendations which may have relevance to the TTC are implemented.**

***There are a number of other issues identified during the course of this review***

The balance of this report relates to specific issues identified during the course of the audit. The issues are outlined in the following categories and essentially follow the normal life cycle of an information technology project from initiation of the project to final completion and close out:

- initiation;
- planning;
- executing;
- monitoring and reporting, and
- closing.

# A. INITIATION OF INFORMATION TECHNOLOGY PROJECTS

***The existing policies at the TTC for project initiation are consistent with best practices. However, in certain cases they are not being followed***

The approved policy in regard to the initiation of information technology projects at the TTC is for the most part consistent with best practices.

Project initiation begins with user departments submitting requests for specific information technology projects to the Information Technology Services Department. The policy requires that staff analysts conduct a general overall concept review of each request. The results of this review are submitted to the Technology Advisory Council for further analysis and evaluation. The Technology Advisory Council sets the strategic direction for the TTC's investment in information technology over each five-year budget period and evaluates and prioritizes all information technology projects based on proposals submitted.

In accordance with TTC policy, a two-step project approval process is required. The policy requires that projects receive endorsement from the Technology Advisory Council based on an initial review prepared by information technology staff. Once the Technology Advisory Council endorsement is given, a more thorough feasibility study which includes a detailed analysis of project costs, timelines and benefits is required. Policy requires the Chief Information Officer to present the feasibility study to senior management, including the Chief General Manager for further review and evaluation. Approved projects at this point are presented to the Toronto Transit Commission and City Council for final budgetary approval.

## A.1. Non-Compliance With the Two-Step Approval Process has Resulted in Inaccurate Cost and Timeline Estimates

***Policies are not being followed***

Our audit included a review of 15 specific information technology projects as outlined in Exhibit 2 to this report. Certain of these projects have been completed, while others are still in progress.

In 11 of the 15 projects reviewed, the two-step approval process was not followed. In each case, projects were approved and included in the TTC Capital Budget based on initial and preliminary cost and time estimates without the preparation of detailed feasibility studies. Minutes of the Technology Advisory Council indicate that approvals are rarely made based on

comprehensive detailed feasibility studies.

***Detailed guidelines are required to ensure compliance with policy***

There are no guidelines or criteria to ensure the consistent application of the two-step approval process for all large information technology projects. The current process is informal, inconsistent and subjective.

Written guidelines or criteria should include parameters such as the need to develop and provide preliminary cost estimates, project size and complexity considerations, risk factors and timelines for making decisions. Adopting a more consistent and structured approach to project initiation including the determination as to whether detailed feasibility studies are required, will strengthen project budget development and improve project accountability.

**Recommendation:**

**4. The Chief General Manager develop detailed guidelines or criteria relating to the two-step approval process for the development of large information technology projects. The Chief General Manager ensure that business cases for all proposed information technology projects are prepared in accordance with the two-step TTC approval policy.**

## A.2. Preparation of a Sound and Comprehensive Business Case is Essential in Making the Right Business Decision

***Sound and comprehensive business cases are required to support all new information technology projects***

An essential component to successful information technology project development is a sound and comprehensive business case. The preparation of a business case is an elementary and important process in the evaluation of information technology projects particularly when there may be more than one alternative to the solution proposed. The preparation of a comprehensive business case is particularly important in prioritizing various information technology projects. A poorly prepared business case may result in a particular project receiving a higher priority than necessary, and as a result may lead to "bumping" more important projects to a lower status.

***What should a sound business case include?***

A proper business case should include:

- an analysis of alternative solutions, complete with properly supported costs and anticipated benefits;
- personnel requirements both in-house and contracted;
- clear performance expectations upon completion of the

project;

- an analysis of risks;
- the establishment of time frames; and
- measurable objectives.

***Business cases are not being prepared consistently***

Our review of the 15 projects included in Exhibit 2 to this report indicated that a detailed business case had only been completed for two specific projects. A limited analysis had been conducted for one other project. In the majority of cases, significant increases in cost, over and above those initially estimated, were incurred for these projects. Although other factors may have contributed to the increase in costs, initial estimates were clearly understated, overly optimistic or the scope of the project was changed significantly beyond its initial intent.

**Recommendation:**

**5. The Chief Information Officer at the TTC, in consultation with the Chief Information Officer at the City, develop guidelines, including specific templates for the development of comprehensive business cases for all information technology projects. Information Technology projects not be considered or initiated unless detailed business cases have been prepared, evaluated in detail and approved by senior management. Approval for all such business cases should be in writing.**

## A.3. Reported Cost and Benefit Estimates Need to Be More Rigorously Evaluated

***Evaluation of costs and benefits need to be independently evaluated***

An independent evaluation of specific information technology project cost and benefit estimates should be a standard practice. For example, in the case of projects where external consultants are required, the TTC uses a standard wage rate to arrive at cost estimates. During 2006, the standard annual wage rate used to estimate project costs for individual consultants from 2002 to 2005 was $180,000 per year. In a review of monthly rates paid to consultants as of June 2006, a more appropriate annual wage rate would have been in the range of $138,000 per year. Based on these calculations, it appears as of the projected cost estimates for certain projects were overstated by somewhere in the range of $2 million.

An overstatement of cost estimates provides a “cushion” for certain projects and may lead to an increase in the scope of a particular project. It also has the potential to lead to the

mismanagement of projects particularly if excess funds are available for the project.

**Recommendation:**

**6. The Chief Information Officer review detailed cost estimates for information technology projects for accuracy and reasonableness prior to submission to the Technology Advisory Council. Such a review be clearly documented and approved.**

## B. PLANNING INFORMATION TECHNOLOGY PROJECTS

### B.1. Cost Estimates Should Be at the Sub-Project Level

***Best practice indicates that information technology projects are more likely to be successful if broken down into smaller more manageable components***

According to best practices, large information technology projects are more likely to succeed if they are broken down into smaller, more manageable components. For example, the Standish Group in its review of best practices found that most successful projects take no longer than six months to complete and cost no more than $750,000. Further, the Standish Group Report states that projects costing $750,000 or less had a 55 per cent success rate compared to eight per cent for projects ranging from $6 million to $10 million.

One of the information technology projects included in our review relates to the state of good repair of the TTC's communications system. This is a multi year project with a revised budget of $98 million. Operationally, the project was subdivided into six sub-projects. However, from a financial management perspective, estimated costs have not been allocated on a sub-project basis. Costs for this project continue to be managed at the overall project level.

***Control of costs are easier if projects are smaller***

Financial control and evaluation of information technology projects can only be effective by comparing actual results against budgeted cost estimates. This comparison is much more difficult unless cost estimates are broken down on a sub-project and more easily manageable basis. Managing costs at the overall project level rather than at the sub-project level increases the risk that problems such as over expenditures within an individual sub-project may go undetected.

**Recommendation:**

**7. The Chief Information Officer, in approving information technology projects, develop and establish separate budgets for sub-projects within each large information technology project. Such a process will ensure that costs are more easily managed and controlled.**

# C. EXECUTING AN INFORMATION TECHNOLOGY PROJECT

## C.1. Significant Cost Savings Can Likely Be Realized By Hiring Employees to Replace Positions Currently Held By Long-Term Consultants

***The use of external consultants should be reviewed and where appropriate replaced by TTC staff***

On a regular basis, the TTC engages consultants to supplement internal staff resources or to acquire skills or expertise not available within the TTC. From 2001 to 2005, the TTC hired over 150 consultants at an approximate total cost of $29 million or an average of almost $6 million per year. In 2006, the TTC spent $9.5 million or over half the amount budgeted for information technology projects, on external consultants. Although the number of consultants engaged by the TTC varies, the average number engaged at any point in time exceeds 50.

***A comparison of costs of consultants and staff indicate that from 2001 to 2006 cost savings of over $500,000 could have been realized***

A comparison of fees paid to consultants to the salary levels for internal staff conducting similar work indicated that the cost for external consulting resources is significantly higher. For example, three individuals hired as consultants in August 2001, December 2001 and August 2002 continue to be engaged by the TTC in 2006. While consulting services would likely be required at certain points during this time frame, if the TTC had hired these individuals as temporary or permanent staff, cost savings of over $500,000 would have been realized.

***Replacing consultants with TTC staff could result in significant cost savings of somewhere in the range of $364,000***

In addition, certain consultants have been hired as business and test analysts. A general and less technical skill set is required for these positions and the skills are readily transferable from one project to another. In our view, these are suitable positions for staffing on a temporary or permanent basis. We reviewed the annual cost of 14 analyst positions currently filled by consultants and concluded that the use of temporary or permanent staff would reduce annual costs at the TTC by approximately $364,000. Finally, with such a dependence on consultants, the TTC is at risk of losing valuable project knowledge and

experience when the consultant leaves the TTC.

**Recommendation:**

**8. The Chief Information Officer identify areas where the Information Technology Services Department has skill shortages or insufficient staff resulting in repetitive and extensive long-term use of consultants:**

**(a) present the appropriate business cases justifying meeting long-term operational demands by increasing staffing levels, such increases to be financed by the transfer of funds from consulting budgets to salaries and wages budgets;**

**(b) where possible, ensure sufficient TTC staff are trained in skills required frequently and on a long-term basis, thus reducing the TTC reliance on contractors to perform such duties; and**

**(c) ensure that the continuous operation of critical management information systems is not dependant upon a single individual or small groups of consultants.**

## C.2. Management of Consultant Deliverables Needs Improvement

***Consultant deliverables need to be more clearly articulated***

The ability to have ready access to qualified consultants is often necessary to meet various project schedules or to acquire the necessary skill sets. To meet these requirements, the TTC has negotiated an Information Technology Services Global Assistance Contract. This is an arrangement with eight information technology placement firms who are in a position to provide qualified consultants when needed to assist in the development of information technology projects.

Under the Information Technology Services Global Assistance Contract the TTC contacts placement firms for its resource requirements. The placement firms providing the TTC with a list of potential candidates and the TTC issues a purchase order to the firm with the successful candidate or consultant. The purchase order outlines the work or services provided by each consultant.

***Purchase orders relating to consulting services require elaboration***

In many instances, purchase orders issued for consulting services contain general non-specific information on the services required from the consultant. In these circumstances, it is difficult to determine if deliverables at the end of a project have been met. In one instance, the deliverable was a feasibility study that was never completed. In another instance, there was no evidence to support work products listed on the purchase order were in fact completed. The absence of clearly defined work products make it difficult to determine if deliverables have been met and whether or not the TTC is receiving value for money.

Current practice requires project managers to approve time sheets submitted by the consultant. Prior to paying the consultant, reported hours are reconciled to invoices. However, the invoices do not include any details pertaining to a description of the work completed in the billing period. The lack of clearly defined deliverables and absence of reconciling payments to such deliverables increases the risk that full value is not received from consultants.

**Recommendation:**

**9. The Chief Information Officer ensure that measurable deliverables, standards, acceptance and payment criteria are included in all consultant contracts. Invoices not be paid unless they contain an adequate level of information to support such payment. Standard consultant contracts in place at the City be used as a guideline in developing contracts at the TTC.**

## C.3. Administration and Retention of Project Documentation Needs Improvement

The Project Management section of the Information Technology Services Department is responsible for ensuring appropriate project documentation is prepared and stored in a central library. To monitor this activity, an automated Document Library System is used and the Quality Assurance Section is required to conduct quarterly follow up on outstanding items.

Our review of information contained in the Document Library System indicated that almost 500 individual documents scheduled for completion prior to 2006 had not been signed off as received and stored in the central library. These documents included feasibility studies, business requirements, and three

project charters that have been open for three or more years.

***Guidelines need to be established for documentation retention requirements***

Where there are specific guidelines for the maintenance of documents regardless of project size, management has not specified minimum documentation requirements. As a result, the level of documentation varies from project to project.

The administration and retention of project documentation is important for effective project management. Documentation plays an important part in maintaining an historical context between project estimates and actual results. As well, documentation is important in ensuring a management trail of key control documents such as approved decisions and sign-off on completed work products.

**Recommendation:**

**10. The Chief Information Officer, in consultation with the City's Chief Information Officer, establish minimum documentation standards required in support of information technology projects.**

## D. MONITORING AND REPORTING ON INFORMATION TECHNOLOGY PROJECTS

Project monitoring is required at three levels:

- day to day monitoring at the individual project level;
- regularly scheduled intervals to review project work products, performance, budget status; and
- high-level strategic review to determine whether projects will achieve the projected benefits.

### D.1. Accountability Over Information Technology Project Costs, Scheduling and Benefits Needs Improvement

Each project has an assigned Steering Committee responsible for making day-to-day project decisions and guiding the project from initiation to final close out.

The mandate of the Technology Advisory Council is at a relatively high level and strategic in nature and for the most part focuses on the prioritization and initial review of information technology projects. There is little high level review of the progress of individual information technology projects on an ongoing basis. Cost overruns and project delays are identified at

the senior management level only after the event.

***The role of the Technology Advisory Council requires evaluation and clarification***

There is a need for a more thorough senior management oversight role through the Technology Advisory Council in a review of a range of technology related issues such as:

- project status related to planned versus estimated costs;
- project status in terms of the timing of certain projects;
- achievement of expected benefits; and
- continued relevance of original assumptions on which projects were approved.

Delays in completing project milestones as scheduled and extensions to project completion dates appear to occur on a regular basis. In this context, we reviewed Project Status Reports for the nine projects listed in Exhibit 2 with a status of "on-going". Details from our review are itemized as follows:

**Information Technology Projects**
**Comparison of Final Costs and Estimated Completion Dates with Costs and Completion Dates Originally Contemplated**

| Project Name | Original Budget ($ million) | Revised Budget ($ million) | Actual Costs as of 12/31/2006 ($ million) | Start Date | Original Completion Date | Revised Completion Date |
|---|---|---|---|---|---|---|
| Fare Media Management | **1.5** | **4.0** | **3.3** | 2001 | 2006 | 2009 |
| Financial Suite | **6.0** | **9.4** | **1.0** | 2003 | 2008 | post 2015 |
| Payroll and Human Resource Information Systems | **7.5** | **4.2** | **1.0** | 2003 | 2008 | 2011 |
| Information Technology Security Business Plan | **1.5** | **6.5** | **2.1** | 2004 | 2007 | 2007 |
| Common Vehicle Work Order | **3.9** | **4.5** | **9.8** | 1997 | 1999 | 2007 |
| Divisional Operations Support System | **1.3** | **7.4** | **6.0** | 2000 | 2002 | 2007 |
| Purchasing Module Replacement | **2.1** | **5.2** | **3.0** | 2003 | 2005 | 2006 |
| Wheel Trans Information System Replacement | **1.5** | **2.6** | **1.0** | 2003 | 2005 | 2007 |
| Communication Information System | **17.1** | **98.0** | **3.2** | 2001 | unidentified | post 2015 |

This particular table is intended to identify the extent of project cost overruns as well as the significant delays in completing certain projects.

***Certain projects are over budget and significantly delayed***

It is clear from the above that the costs for the majority of these projects are significantly in excess of the original proposed budget. In addition, certain of these projects have been significantly delayed. Project delays for the most part often result in significant additional costs. In addition, delays also impact the implementation of the efficiencies which the technology is intended to address. When significant delays or cost overruns are anticipated, procedures should be in place requiring ongoing reporting to the Technology Advisory Council through to the Chief General Manager and the Toronto Transit Commission.

**Recommendation:**

**11. The Chief General Manager review the role and mandate of the Technology Advisory Council, particularly in relation to monitoring of the ongoing progress of major technology projects. The Technology Advisory Council be required to review the progress of information technology projects in terms of costs and completion dates.**

## D.2. Actual Project Cost and Time Estimates are Not Compared to Original Cost and Time Estimates

The TTC's Project Control Framework provides for a number of monitoring processes including the preparation of an ongoing Project Status Report. The Project Status Report includes a brief description of the project, project highlights, cash flow and significant milestones completed. These reports are a part of the monthly Chief General Manager's Report provided to the Toronto Transit Commission.

***Final costs of projects require comparison with original budgets***

Our review of a sample of Project Status Reports indicated that reports compare actual cost and completion dates with only the most recent estimated final cost and amended project completion dates. Original baseline budgets and subsequent amendments are not reported. As a result, comparisons of original budget estimates with current or actual costs are not possible.

This reporting method invariably results in providing a far more favourable picture of actual versus estimated cost and time comparisons. Without meaningful status reports, it is difficult to assess management performance related to the development of large-scale information technology projects.

**Recommendations:**

**12. The Chief Information Officer review the Project Management Framework to ensure Project Status Reports provide a comparison of actual costs with original estimated costs and timelines.**

**13. The Technology Advisory Council periodically report to the General Manager on major information technology projects and related information technology priorities. The reporting process for each project should at a minimum include:**

- **a detailed description of each large information technology project;**
- **progress to date;**
- **budget and milestones, including historical budget information;**
- **return on investment; and**
- **related performance measures.**

**Consideration be given to initiating a similar reporting process to the Commission.**

## D.3. Review and Update Project Management Manual

***The Project Management Manual requires updating***

The Project Management Manual should be updated. The most recent update occurred in 2002 and inconsistencies exist between current staff practice and those required as outlined in the Project Management Manual.

We also compared the TTC's Information Technology project management practices with those of the Project Management Institute. The Commission's Project Management Manual includes most of the Institutes best practices but in some instances is limited in terms of detail and specific guidelines. For example:

- procedures related to project scope verification require further development;
- procedures related to completing one phase of a project and moving to another do not address sign-off documentation required nor when documentation should be produced; and
- project completion process does not detail when and how a project should be closed.

An up-to-date comprehensive Project Management Manual ensures project development consistency and provides assistance in training, managing and evaluating staff performance.

**Recommendation:**

**14. The Chief Information Officer review and update the Project Management Manual to ensure existing project management processes, procedures and templates are relevant and applicable to the TTC's information technology environment. Periodic updates should be undertaken to ensure procedures are complete, current and consistent with industry best practices. Consultations be held with the Chief Information Officer at the City in connection with the review and update of the Project Management Manual.**

# E. CLOSING INFORMATION TECHNOLOGY PROJECTS

## E.1. Opportunities Exist to Improve on Future Projects By Evaluating Recently Completed Projects

The final phase of a projects life cycle is a process known as "close-out". The first step of the "close-out" is the user's acceptance of the system. This is an important step as the user determines when the project is completed. The acceptance should be formal with an appropriate level of sign offs.

***Lessons learned from recently completed information technology projects should be applied to all new projects***

A generally accepted best practice in managing projects is to conduct an evaluation of the overall results of the project shortly after the project is completed. The objective for such a review is to improve the management of future projects by reviewing what went right and what went wrong. The Project Management Manual calls for an overall assessment of a project at its completion but does not specify the format of the process or the required documentation.

We reviewed the six projects listed in Exhibit 2 with a "closed" status to determine whether the TTC reviews recently completed projects in order to apply lessons learned to future projects. No formal assessment took place for five of the six projects. The "Close-out Report" required as a standard practice in the Project Management Manual was also not completed. The potential risk in not conducting such reviews is that lessons learned will not be identified and any inefficiencies or problems experienced will likely be repeated in the future. It is also important that

successes as well as problems on projects are identified. In the same way that problem identification can lead to improvements, successes should also be identified so they can be repeated.

The "close-out" process should also include an evaluation of each consultant used on projects. Such an evaluation is important in the selection of consultants for future projects. These evaluations should also be shared with the City. Likewise evaluations conducted by the City should be shared with the TTC.

**Recommendation:**

**15. The Chief Information Officer ensure that, subsequent to the completion of all information technology projects, final "close-out" reports are submitted to the Chief General Manager through the Technology Advisory Council. Such reports to include a comparison of original cost estimates, benefits and timelines to actual results. Further, the Chief Information Officer, upon completion of a project, ensure that consultants' performance is documented and made available to all appropriate staff including those at the City.**

# CONCLUSION

This review has identified a number of important issues relative to how the TTC develops, implements and manages its information technology projects. The key message in this report relates to the need to coordinate information technology development with the City, particularly, in regard to the use of the SAP information management system.

Other issues in this report centre around the need for an appropriate level of project management, discipline and oversight. A structured project management methodology is important to ensure that projects are prioritized and implemented on budget and on schedule. Based on our review of a limited number of information technology projects, it is evident that significant improvements in the management of information technology projects are required. Significant funds are expended on a wide range of information technology projects and, as such, ongoing scrutiny is required to ensure that these funds are spent effectively.

It is anticipated that addressing the recommendations in this report will further improve the controls and processes in place to manage TTC information technology projects.

**EXHIBIT 1**

## KEY PROJECT PROCESSES DEFINED BY THE PROJECT MANAGEMENT INSTITUTE

| PHASE | DESCRIPTION |
|---|---|
| **Initiation** | The initiation phase consists of processes required to obtain formal authorization to start a new project or project phase. |
| **Planning** | The planning phase consists of processes followed to develop and maintain a project plan and related activities. |
| **Executing** | The executing phase consists of processes used to carry out work defined in the project plan. |
| **Monitoring and Control** | Monitoring and control processes include activities to identify potential and actual problems and manage them. The objective of this phase is to produce the required services and products on time, within budget and to the required level of quality. |
| **Closing** | The closing phase includes processes to close a project and the hand-over to others. An assessment of the project to better manage future projects is part of this phase as well. |

**EXHIBIT 2**

## TTC INFORMATION TECHNOLOGY PROJECTS REVIEWED

| Project Name | Description | Budget | Actual costs as of 12/31/2006 | Project Schedule | Status |
|---|---|---|---|---|---|
| **Pension Fund General Ledger Upgrade** | **Upgrade the existing version of the Pension Fund General Ledger system** | **Initial - $150,000 Revised - $117,000** | **$118,000** | **2004 – 2006** | **Closed** |
| **Facilities Management System Extension** | **Improve the TTC's facility maintenance record keeping, maintenance work assignments and cost tracking.** | **Initial - $3.2 M Revised - $4.8 M** | **$4.7 M** | **2005 - 2006** | **Closed** |
| **Facilities Maintenance** | **Enhance functionality of current system to meet departmental operational requirements.** | **Initial - $650,000 Revised - $840,000** | **$844,000** | **2004 - 2005** | **Closed** |
| **Communication and Information System** | **Identify and replace critical voice and data network components of the Communication and Information System.** | **Initial - $2.7 M Revised - $1.4 M** | **$1.4 M** | **2001 - 2004** | **Closed** |
| **Corporate Security** | **Implement a local area network for Corporate Security personnel including a direct data link to the Toronto Police Service.** | **Initial - $290,000 Revised - $461,000** | **$464,000** | **2001 - 2004** | **Closed** |
| **Scheduling Computer Upgrade** | **Upgrade the current System.** | **Original - $350,000 Revised - $983,000** | **$983,000** | **2000 - 2004** | **Closed** |
| **Fare Media Management** | **A single integrated system with enhanced capabilities designed to maintain, track and report on all Fare Media movement.** | **Original - $1.5 M Revised - $4.0 M** | **$3.3 M** | **2001 - 2006** | **Ongoing** |
| **Financial Suite** | **A multi-year program replacing the outdated Payroll and Human Resource systems.** | **Original - $6.0 M Revised - $9.4 M** | **$982,000** | **2003 – Post 2015** | **Ongoing** |
| **Payroll and Human Resource Information Systems** | **A multi-year program replacing the TTC's Payroll and Human Resource systems.** | **Original - $7.5 M Revised - $14.2 M** | **$969,000** | **2003 - 2011** | **Ongoing** |
| **Information Technology** | **A comprehensive upgrade of the TTC's information** | **Initial - $1.5 M** | **$2.1 M** | **2004 - 2007** | **Ongoing** |

| Project Name | Description | Budget | Actual costs as of 12/31/2006 | Project Schedule | Status |
|---|---|---|---|---|---|
| **Security Business Plan** | **technology security framework** | **Revised - $6.5 M** | | | |
| **Common Vehicle Work Order** | **A fully integrated work order/inventory system to support maintenance of the TTC's vehicle fleet.** | **Initial - $3.9 M Revised - $14.5 M** | **$9.8 M** | **2001 - 2007** | **Ongoing** |
| **Divisional Operations Support System** | **Implementation of a system designed to automate and standardize the administrative functions of the operating divisions.** | **Initial - $1.3 M Revised - $7.4 M** | **$6.0 M** | **2001 - 2007** | **Ongoing** |
| **Purchasing Module Replacement** | **A system integrated with others within the TTC and has business-to-business links with vendor applications.** | **Initial - $2.1 M Revised - $5.2 M** | **$3.0 M** | **2003 - 2006** | **Ongoing** |
| **Wheel Trans Information System Replacement** | **Analysis to address issues related to the lifecycle of the existing system as well as upgrading the existing system.** | **Initial - $1.5 M Revised - $2.6 M** | **$964,000** | **2003 - 2007** | **Ongoing** |
| **Communication Information System** | **Multi-year state of good repair program for the Communications and Information Systems supporting data and voice communications between surface vehicles and revenue systems.** | **Initial - $17.1 M Revised - $98 M** | **$3.2 M** | **2001 – Post 2015** | **Ongoing** |

[1] Project discontinued and rolled into the CIS Futures/CIS State of Good Repairs project