TORONTO TRANSIT COMMISSION

REPORT NO.

MEETING DATE: June 13, 2007

SUBJECT: Business Case Review for a Smartcard System at the TTC

RECOMMENDATION

It is recommended that the Commission:

- Approve the concept of operation for a smartcard system at the TTC, as outlined in this report and described in more detail in the appended report "Business Case Analysis for a Smartcard Fare Collection System";

- Direct City and TTC staff to undertake discussions with representatives of MTO to review the TTC's business requirements and determine how these can be addressed by the Greater Toronto Area Fare System, noting that MTO has stated its willingness to work towards addressing TTC needs;

- Direct City and TTC staff to undertake discussions with representatives of the Provincial Government and Federal Government to determine their position on funding a smartcard system for the TTC;

- Direct staff to report back on the results of these discussions and identify the policy and financial implications of the Provincial and Federal positions; and

- Forward this report to the City of Toronto, Greater Toronto Transportation Authority, Province of Ontario, and the Federal Government for information.

FUNDING

This report has no impact on the TTC's capital or operating budgets.

Funding of $140 million is included under Program 5.2 Integrated Ticketing System – GTA Farecard Project (as outlined on pages 1239-1240) in the approved 2007-2011 Capital Program as approved by City Council on March 7, 2007. Funding of $140 million was included under the Canada Strategic Infrastructure Fund, to be shared by Canada, Ontario and the City of Toronto, pending execution of a Contribution Agreement and completion of a satisfactory business case. Funding for the implementation and operation of up to 10 Greater Toronto Area Fare System (GTAFS) interface readers on turnstiles at five subway stations is to be funded entirely by MTO. The cost for these readers does not form part of the $140 million identified for this project.

BACKGROUND

In November 2000, the Commission approved a staff report entitled "TTC Fare Collection Study". This report concluded that at an estimated cost of at least $140M in capital to implement and an additional $2M per year in operating costs, there was no business case in favour of replacing the TTC's fare collection system with a smartcard system.

During this same period, GO Transit and a number of the other transit properties recognized that, unlike the TTC, they would need to replace their ageing fare collection equipment at some point in the near future. As a result, since 2001, MTO, GO Transit and the 905 transit agencies have been

working on a project to implement a farecard system within the GTA. MTO has signed various agreements with these transit agencies to formalize this partnership for a period of at least ten years.

As part of this process, MTO and the 905 transit agencies have agreed to a common set of rules as to how their smartcard system would operate. These rules formed the basis for a $250M contract that MTO has signed with Accenture for a ten-year period to develop, build, operate and maintain the Greater Toronto Area Fare System (GTAFS). This contract does ***not*** include a possible future TTC smartcard system, and the business rules for the GTAFS do not reflect all of TTC's business needs. The TTC's only current commitment with the Province related to the GTAFS is to allow interface readers to be installed on two turnstiles at each of five subway stations that interface with GO Transit and the 905 transit agencies.

TTC staff had been involved in the GTAFS process as an "observer" between 2001 and 2004, but stated at the outset that because the TTC's fare system was not in need of immediate replacement, they could not justify the costs required to implement a smartcard system. However, from 2004 to the present, the concept of a farecard system has been an important part of various Federal and Provincial funding and legislative announcements:

- In March 2004, the Federal, Provincial and City of Toronto governments made a joint $1.05 billion funding announcement, of which $140 million was targeted for TTC's portion of an "integrated GTA ticketing system". Staff from the Federal and Provincial Governments who are currently negotiating an agreement with the TTC and the City on this funding (i.e. Canadian Strategic Infrastructure Funding), have identified the TTC undertaking a farecard system as a necessary component of the overall agreement.

- In October 2004, the Province of Ontario announced dedicated gas tax funds for public transportation. One of the conditions established by the Province for receiving this funding was TTC's participation in the GTAFS.

- In 2006, the Province passed legislation that created the Greater Toronto Transportation Authority (GTTA). This legislation gives the GTTA authority to manage and implement the GTAFS project.

Subsequent to the CSIF and gas tax funding announcements, the Commission in December 2004 agreed to the TTC's full participation in the GTAFS process. At that time, the Commission established a project team to conduct an independent review of the TTC's requirements for a smartcard system and to prepare a business case that would outline the needs and requirements for such a system at the TTC. The TTC's e-System Committee further directed that the study should address two other questions: (i) the costs to the TTC to own and operate a smartcard system, including running the central system; and (ii) the extent to which the GTAFS business rules are consistent with the business needs and requirements of the TTC.

DISCUSSION

The development of the TTC's business case for a smartcard system included seven major steps:

1. Review of the TTC's current fare system;

2. Identify key principles for a TTC smartcard system;

3. Define TTC's business requirements for a smartcard system;

4. Identify potential benefits, issues and risks;

5. Estimate the capital and operating impacts of a TTC owned and operated smartcard system;

6. Compare TTC business requirements and costs to the Greater Toronto Area Fare System model; and

7. Summary and conclusions.

Each of these steps is summarized below.

1. Review of TTC's current fare system

The TTC's original 2000 report on fare collection identified the following as key aspects of a good fare collection system:

- Simple, easy-to-use, and easy to understand for customers;
- Quick and efficient, allowing fast fare transactions;

- Flexible, allowing the use of various fare structures, policies, and incentives;
- Usable on neighbouring transit systems;
- Economical and cost-effective to operate;
- Reliable and easy to maintain;
- Secure, with hard to counterfeit media and security of transactions for customers; and
- Data rich, providing information which management may use for various business purposes.

A summary assessment of the TTC's current fare system on these key factors is outlined in Attachment A. Overall, the TTC's fare collection system continues to function relatively well in the areas of simplicity of use, inter-modal transfers, security, efficiency and reliability. There are definite limitations to the current system in terms of transferring between transit systems, the flexibility of the system to implement new fare policies and products and to take advantage of non-fare revenues, and the ability of the system to generate information for management.

However, from a state-of-good repair perspective, the TTC's current fare system is in relatively good condition. The low-tech fareboxes and turnstiles are generally simple to repair and, with few moving parts, are not prone to deterioration. The primary factor that has motivated other transit properties to move to a smartcard system (i.e. the need to replace their current fare collection system), does not currently exist at the TTC.

2. Identifying Key Principles for a TTC Smartcard System

If the TTC is to consider implementing a smartcard system, it is important that a new system build upon the strengths of the current system and address the current weaknesses. However, the objectives of a TTC smartcard system should also go beyond this and achieve the following:

- Provide significant benefits to customers in both the purchase and use of TTC fares;
- Enhance transit operations for the convenience of the customer and benefit of the TTC;

- Provide flexibility for policy makers, while being affordable and not detracting from other transit requirements; and

- Ensure that the short- and long-term interests of TTC customers and City residents are protected.

These objectives were brought together and formulated into a set of "Key Principles for a TTC Smartcard System" that are summarized in Attachment B. These Principles were endorsed by the e-System Committee and were used by TTC staff as the basis for the development of the TTC's business requirements for a smartcard system.

3. Define Business Requirements for a TTC Smartcard System

The business requirements for a TTC smartcard system are detailed in the appended report "Business Case Analysis for a Smartcard Fare Collection System" prepared by Parsons Corporation, working in close consultation with TTC staff. The business requirements describe how a smartcard system would operate at the TTC, including how customers would interact with the system and what business processes are needed to provide support. The requirements are based on a "traditional" approach to a smartcard system: a transit property or governing body issues a smartcard, the card is accepted on readers on transit vehicles and on subway turnstiles, and the financial and ridership transactions are processed through a central system computer. This is the approach that has been used by virtually every major transit smartcard system in the world, and is the approach that the GTAFS is also taking. The traditional model was used as the basis for developing the TTC requirements because of the relatively proven nature of the technology and significantly better data about the costs and operating impacts of these systems.

There are variations on this traditional model that are at various stages of testing (e.g. the transit property accepts payments cards from financial institutions such as a bank or credit card company; cell phones can be used in place of smartcards). However, there is currently limited experience with these recently "emerging" approaches and their long-term viability has yet to be proven. A future TTC smartcard system should, however, have the flexibility to adapt to these payment options should they prove over time to be beneficial for transit customers and transit agencies.

The following presents an overview of some of the key characteristics of a smartcard system at the TTC.

A TTC smartcard system should be based on contactless smartcards and readers (i.e. does not require the smartcard to come into physical contact with the reader). Smartcard readers will be located on all surface vehicles, including Wheel Trans, and all turnstiles within the subway. The smartcard will replace all tickets, tokens and passes, but will support existing fare policies and products. It will also have the flexibility to support new fare policies and products.

Customers will be able to load electronic value onto their smartcards (i.e. e-purse) and the appropriate fare will be deducted when the card is "tapped" to a reader to enter the system. The system will record the transaction and the smartcard can then be used to make all valid transfers on the system. The customer also has the choice of loading weekly or monthly passes onto their smartcard (i.e. e-pass), and the system will replicate the unlimited travel feature that the current TTC passes provide.

A smartcard system provides significant opportunities to enhance the level of customer service, particularly within the subway system. To support this, a key feature of the TTC's smartcard system will be the use of vending machines within the subway that will enable customers to purchase smartcards, add value to their cards, and check the remaining value on their card. Customers will have the ability to use credit, debit or cash in their purchase at all stations.

The automation of smartcard sales and reloads within the subway will provide the opportunity for the TTC to redefine the duties of the Collector. If the Collectors were no longer required to sell and inspect fare media, they could take on a more enhanced customer service function within the subway, assisting customers in a variety of ways, including the use of vending machines, providing information, and addressing other customer needs as they occur.

A smartcard system will also provide improvements to customer convenience for both the purchase of smartcards and the loading/reloading of the e-purse or e-pass. There will be a wide variety of options available to customers, some of which can be easily accessed from the convenience of their homes (see Attachment C). Once purchased, the lifespan of a typical smartcard is three to four years.

Customers will have the option of registering their smartcards with the TTC. Registered smartcard users will have access to the following services:

- Automatic reload: value will be added automatically to the smartcard once the value on the card falls below a predetermined level (e.g. below $5.00);

- Lost card replacement: the customer can report their card lost or stolen, and the system will deactivate this card, and enable the remaining value to be transferred to a new card; and

- Negative balance protection: will allow customers to go into a limited negative balance on their smartcard account to permit them to complete a trip.

Experience at other transit properties has demonstrated that customer support and account management are essential aspects of a smartcard system. From a customer perspective, it is beneficial if these services can be provided through an array of different channels. A TTC smartcard system will have a range of customer services that are provided through four main service channels: a smartcard call centre; three TTC customer service centres that will provide customers with "one-stop shopping"; a smartcard website; and through the mail. Attachment D provides a breakdown of the various services that will be provided at each of these four channels.

Current concession policies will be supported by a smartcard system, and concession smartcards will be visually distinct from adult cards. However, experience at other transit properties has demonstrated that there is an increased risk of fare abuse from the misuse of concession cards if certain controls are not implemented. Transit properties require that the sales and distribution of concession smartcards be done through controlled processes where the eligibility of the individual for a concession card can be verified (e.g. in-person distribution; notarized mail-in application). Once the concession customer acquires their smartcard, however, they will have the flexibility to load value using the full-range of channels available to adult smartcard customers.

The TTC approach to concession cards reflects the lessons learned from other transit properties. For children and students, cards will be distributed through in-school programs, with the option of purchasing at TTC Customer Centres or through the mail with appropriate validation. Seniors will be able to purchase through TTC Customer Centres or by a mail-in application. For Seniors, this will be a one-time activity since their concession classification will not change.

A smartcard system also needs to support the payment of fares by transit customers who do not own a smartcard (i.e. cash users). This will require the use of a limited use smartcard (LUC), a disposable paper card that functions in many ways like a smartcard, but is typically configured to work for only a short period of time. The LUC will be used to replace the transfer, Day Pass, and provides the opportunity to introduce other short-term fare products (e.g. a two- or three-day pass).

For surface vehicles, cash paying customers will put the appropriate cash fare into the farebox as they do today. The operator will provide them with a LUC if they require a transfer. The LUC can then be used to "tap and transfer" between TTC surface vehicles or between surface vehicles and subway stations that require a transfer. Customers wishing to enter the subway without a smartcard

will be required to purchase a LUC from a vending machine that will provide electronic access through the turnstiles. The LUC will also act like an electronic transfer should this be required.

The smartcard system could not function as outlined above without two critical components – the central system and the data transport system. The central system is where the software programs controlling the functionality of the fare collection system operate. This is where the instructions and rules are defined and where transactional data are gathered and processed. The data transport system is the means by which the instructions from the central system are communicated to all the field devices (e.g. readers, vending machines), and the means by which the transactions conducted at these field devices are communicated back to the central system. The central system is also the location where all the data from the system (e.g. financial; customer account; ridership) is maintained.

The functioning and support of the central system and data transport system are critical to the operation of a smartcard system. The TTC will be required to undertake a significant effort to upgrade its current infrastructure to provide the necessary power and communications within the subway system and its surface garages to facilitate the flow of data.

The implementation of a smartcard system is a complex undertaking, for it impacts virtually every business process in a transit agency in one way or another. For this reason, careful planning is essential and there is significant preparation required before the first device is installed. Attachment E outlines a "high-level" schedule for implementation of a smartcard system at the TTC. It is important to note that there is a period of approximately four years in which the concepts outlined in this business case would be taken through at least two stages of more detailed development, design and costing before the system is actually implemented: (i) prior to an RFP being issued for a vendor to deliver the system; and (ii) working with the successful vendor to finalize the system requirements.

The actual roll-out of the system would then occur in stages over a period of up to five years. This systematic and incremental approach to implementation is based on experience from other transit properties, who have advised the TTC that it is important to ensure success at each stage of the implementation before moving to the next stage.

Once the smartcard system has been fully implemented, it is estimated that approximately 1.7 million smartcards will be in circulation for use by TTC customers. This number may actually increase over time, for in areas such as Hong Kong where the smartcard system has been successful and operational for over a decade, there are actually more smartcards in circulation than people living in that region.

It is further expected that approximately half of the TTC's smartcard users will choose to register with the system to take advantage of the benefits provided to registered customers. This means that there will be over 800,000 customer accounts that will need to be managed through a customer service area. Ultimately, it is expected that up to 95% of all rides on the TTC will be taken using a smartcard or LUC; the number of cash users will fall below even today's relatively low levels.

4. Identify Potential Benefits, Issues and Risks

So what are the potential benefits from a smartcard system? First and foremost, there are significant enhancements to customer service and customer convenience. Some of the benefits include:

- An increased convenience and flexibility for the purchase and payment of fares. Customers will be able to purchase fares through a range of methods from the convenience of their home (e.g. web; phone; autoload) to simple-to-use vending machines in the subway. Customers will further have the option of using credit, debit and cash at all locations within the subway.

- An increased range of services available to customers, including customer account services available by web, phone or in-person, and specific services such as the replacement of e-purse or e-pass value for lost or stolen cards.

- The opportunity for enhanced customer assistance in the subway, by possibly redefining the role of the Collector and giving that position the flexibility to assist customers in a variety of ways throughout the subway station.

- A reduction in line-ups to purchase fare media in subways. Customers will have more choices both within and outside the subway system.

- A reduction in line-ups to pay fares within the subway. Customers will be able to make fare payments or use a LUC transfer at any subway station turnstile, rather than being limited to entering the subway only via the Collector's booth.

- A potential improvement to the convenience of transferring between TTC and other GTA transit properties.

A smartcard system will also increase the flexibility for decision-makers regarding fare policy and pricing. It will be much easier to change the price of existing fare options and products, even for a short period of time. Further, with flexibility built into the system, it should be possible to add new fare options and products without a number of the obstacles that currently exist.

A key benefit for the TTC is in the area of employee safety and security. A smartcard system will reduce the amount of cash that needs to be collected and transported within the system, as up to 75% of smartcard transactions are expected to be done electronically through credit and debit. Further, the delivery of fare media to points within the system will be significantly reduced. While a limited number of smartcards will still need to be delivered to vending machines, these cards are not yet loaded with any "transit value" so the risk to employees is less than today.

There is also the expectation that a smartcard system can reduce the number of assaults on operators by removing the operator from the fare validation process on surface vehicles. The smartcard system, not the operator, will determine whether the card presented by a customer is valid and has sufficient funds to pay a fare. This "automation" of the fare payment process is believed to make the exchange with the customer less "personal" and potentially lead to fewer confrontations.

One of the shortfalls of the current system is the need to manually generate ridership and revenue information. There is no doubt that a smartcard system can lead to improvements in the amount, accuracy, and timeliness of data that is available to staff to better understand how customers are interacting with the system.

A further shortfall of the current fare system is its inability to link to other payment or card schemes, and potentially expand to other applications such as parking, retail, and selected City services. A smartcard provides the flexibility to consider these options and potentially generate non-fare revenues. However, these options should only be considered after the transit application has proven successful. Within the transit industry, there are still few examples where the use of the transit smartcard has been significantly expanded to other applications. Hong Kong is one of the more successful, and currently about 25% of its transactions are for non-transit purposes.

While a smartcard system has a number of potential benefits, there are also issues and risks that will need to be considered before a final decision is made to implement such a system. These include:

- A smartcard system will be such a significant investment and change for the TTC, that once the system is implemented it will be difficult and costly to "turn back";

- The technology of smartcards and AFC continues to evolve and there is a risk that the technology and/or the "traditional" approach to smartcards will become outdated by the time the system is fully implemented;

- Currently, there is little consensus on the standardization of AFC technology. While there are efforts to establish international standards, the TTC needs to ensure it does not get tied to a proprietary technology;

- It is imperative that the security and privacy of data stored within the central system be protected, and the appropriate processes must be in place to ensure the ongoing protection of this information; and

- The TTC will need to stay current with the rules that regulate stored value payment cards and the acceptance of credit and debit payments.

5. Estimate Financial Impacts of a TTC Owned and Operated Smartcard System

The e-System Committee had directed staff to identify the costs to the TTC to own and operate a smartcard system, reflecting the same premise that formed the basis for the TTC's 2000 AFC study. However, the process to estimate the capital and operating costs for the current business case that is presented here was done in a far more detailed and comprehensive manner than the process used in the TTC's 2000 study. In 2000, many smartcard systems were in the early stages of implementation and data on the experience and costs at these transit properties was limited.

An overview of the processes used to develop the capital and operating costs is included as Attachment F. Two key points from this overview should be noted here:

- The capital costs were developed using two separate but related processes to identify a likely range of capital costs; and

- Cost estimates at this stage of a project (i.e. feasibility) are typically +/- 25%.

A. Capital Costs (all financial data in $2006M)

The total capital cost of a TTC smartcard system is estimated at $250M to $260M (see Attachment G). Two key categories of expenses account for over 50% of the total cost of the project:

- There will be approximately 7000 field devices (e.g. smartcard readers; vending machines; point-of-sale devices; driver control units) required to implement the system, and the cost estimates reflect the purchase, testing and installation of these devices; and

- There are significant infrastructure modifications required in subway stations and surface garages to install the power and communication network that is necessary to support the smartcard system and the field devices.

The estimated capital cost also includes $20M for the purchase of smartcards and LUC that will be required during the implementation period of the system. The total capital cost of the system could be offset by up to $10M if customers were charged a $5.00 fee to purchase their smartcard. This is typical in other transit agencies and deters the wastage of cards.

How does the current capital TTC estimate compare to other automatic fare collection (AFC) systems? As noted in the TTC's 2000 study, the capital cost of implementing AFC systems can vary considerably, depending on the size and complexity of the transit system, and whether it already had some form of AFC system in place which would have required the previous installation of power and communication capability. Attachment H summarizes the reported AFC capital investments for four major multi-modal transit systems. In order to provide some perspective on these costs relative to the size and ridership volumes of the system, these costs have been normalized relative to the total daily volumes of the system.

Attachment H demonstrates that the current TTC estimate of $260M equates to an investment of $115/weekday boarding. This is less than New York, Chicago and Boston which include expenditures for infrastructure changes to power and communications like TTC requires, but higher than Washington and London which were upgrading from a magnetic AFC system and did not have extensive power and communications requirements. Overall, the updated TTC capital estimate does not appear to be inconsistent with the experience elsewhere.

B. Operating Costs (all financial data in $2006M)

A TTC smartcard system is projected to result in a net increase of workforce of 49 positions, and a net increase in operating costs of $11M to $12M annually (see Attachment I). These estimates reflect a number of "pluses and minuses" from the TTC's current operating budget, but the key factors are summarized below.

Cost increases include:

- Price of paper limited use smartcards;
- Credit and debit fees payable to financial institutions for customer purchases of fare media and value;
- Maintenance staff required to maintain and service 7000 field devices;
- Customer service staff to manage over 800,000 customer accounts;
- Special Constable staff required for higher levels of fare enforcement; and
- IT staff for system management, expenditures for software licenses, application and database support, and costs to ensure system business continuity and disaster recovery.

Cost reductions include:

- Eliminate costs for production of tickets, tokens and passes;
- Reduced costs for activities related to the distribution of fare media and revenue collection; and
- Reduced costs for activities related to staffing of additional subway booths during busy Metropass sales period and "crash gate" fareboxes at busy points in the subway system.

It is important to note that the cost of LUC and the fees for credit/debit transactions will account for approximately $12M in additional operating costs between these two factors alone. The costs for all other factors essentially offset one another from an operating impact perspective.

There are additional issues that should be taken into consideration when considering the overall annual operating impact of a smartcard system:

- The ongoing sale of smartcards at $5.00 per card could reduce the operating impact by between $1M to $2M annually;

- It will be difficult for a smartcard system to fully automate the TTC's current transfer rules, resulting in a potential revenue loss of up to $4M annually. More detailed reviews will need to be done to see if the current system can be replicated more completely to minimize these potential revenue losses; and

- It is unclear what the overall impact on fare evasion will be. There will be definite improvements in the areas of transfer abuse, card passback, and counterfeit fare media. However, TTC staff are concerned with the increased risk that a smartcard system may present due to the potential misuse of concession smartcards at unattended turnstiles within the subway system.

These factors have not been included in the $11M to $12M estimate.

C. Other Financial Considerations

The following factors have not been included in the capital and operating estimates but will need to be considered in the overall assessment of a smartcard system:

- Transition costs: The operating costs presented reflect the impact after full system roll-out has been completed. There are additional one-time activities that will need to occur during the implementation phase and may only be required for a condensed period of time (e.g. 6 to 24 months). These types of activities include driver training, customer services required to complete the initial distribution and registration of smartcard customers, and the exchange of old fare media. Depending on how the roll-out is conducted, the net impact of these costs may or may not push the annual operating impacts during the implementation period beyond the $11M to $12M currently estimated.

- System replacement costs: As with any computer system, at some point in the future the hardware and software will need to be replaced. The timing will vary, but typically hardware and software may need to be updated or replaced every five to seven years. However, the typical life of

fare collection equipment ranges from 15 to 20 years. It is important to recognize though, that once a smartcard system is installed, these are costs that cannot be avoided.

- Fareboxes: The current cost estimates assume that smartcard readers are retrofitted to the TTC's existing "gravity" fareboxes. However, there may be good business reasons why the TTC would consider replacing these fareboxes with integrated units that validate cash payments and include a smartcard reader. TTC will be undertaking a more detailed review of the pro's and con's of these automated fareboxes, and they may become a further requirement for a TTC smartcard system.

D. Summary of Estimated Financial Impacts of a TTC Owned/Operated Smartcard System

The following chart summarizes the estimated costs for the TTC to own and implement a smartcard system:

	Estimated Cost Impact ($2006M)	**Other Impacts ($2006M)**
Capital	$250M to $260M	• possible $10M in revenues due to smartcard sales during implementation period
Operating	+$11M to +12M annually	• possible $1M to $2M in revenues due to annual smartcard sales • up to $4M in lost revenues, if current transfer rules cannot be fully implemented • uncertain impacts related to fare evasion
Other costs to consider: transition costs; future system replacement costs		

6. Compare TTC business requirements and costs to Greater Toronto Area Fare System

TTC staff have reviewed the business rules that govern the design and operation of the GTAFS. Based on this review, there are areas within the GTAFS framework that do not currently meet all of TTC's business needs and requirements. Preliminary discussions have been held with MTO representatives to review the results of the business case analysis. MTO staff have reiterated their willingness to work with TTC to see how the TTC business requirements for a smartcard system can be addressed within the GTAFS framework.

Some of the areas that the TTC has identified as a business need which are not fully supported by the current GTAFS specifications include:

- Current TTC fare products, such as fully automated direction based transfers, commuter parking, Family Pass, and the administration of MDP;
- Flexibility to introduce a range of new fare policies and products (e.g. passes that will start at time of first use, rather than based on a calendar month);
- Ensuring that the fare system call centre can provide services to customers such as balance queries, the loading passes onto a smartcard, and changing customer account information;
- Ensuring that customer centre staff can provide on-the-spot services, including the full processing of smartcard registration, and customer account changes; and
- Allowing for the loading of passes onto smartcards through the website.

The current business rules of the GTAFS will need to be revised to address these requirements of the TTC. Approval for these types of changes will require the support of the other partners in the GTAFS; these are not decisions that MTO can make independent of the other transit agencies.

The reason for this is that the GTAFS business model is designed to operate as a partnership between the participating transit systems and MTO. An Executive Committee made up of staff members typically at the Chief General Manager level, has been established to address budget and policy decisions related to the GTAFS. All participants in the GTAFS have one vote, including MTO. The intent is to work towards consensus on issues, but certain issues can be passed with a 60% majority. There is allowance for a dispute resolution process that would forward these issues to the political representatives from the transit agencies and MTO.

It is intended that the GTTA will eventually take responsibility for the operation of the GTAFS, and have the legal ownership of the smartcard and the central system. MTO staff have indicated that the GTTA will control the licensing rights for the smartcard application and for any decisions related to adding non-transit applications to the smartcard (e.g. city services; retail). The timing for the GTTA assuming these responsibilities is currently unknown, as is the specific manner in which the governance and decision-making process will ultimately work between the GTAFS and GTTA.

From a financial perspective, it is currently unclear what the overall capital and operating impacts are if the TTC were to join the GTAFS. There are elements within the GTAFS business rules that could potentially reduce some of TTC's costs, while other business rules may offset some of these savings. These will need to be clarified by MTO. There are also some other cost-related questions that will need to be reviewed with MTO to better understand the potential financial impacts of the TTC joining the GTAFS, including:

- The funding of the GTAFS central system beyond the current MTO commitment of 2016;
- The responsibility for paying for changes to the GTAFS required to meet TTC business needs; and
- The structure of GTAFS fees and commissions and how they will impact the TTC.

There are also broader financial issues related to the funding of a smartcard system at the TTC that need to be reviewed with the Federal, Provincial and City governments. The key areas for discussion are:

- Under the CSIF agreement, the Federal, Provincial and City governments agreed to fund 1/3 of $140M for the costs of a TTC smartcard system. What level of funding will be available from these governments now that the costs have been updated and are expected to be significantly higher?
- How will decisions about funding from CSIF and the Provincial gas tax be linked to decisions about whether the TTC implements a smartcard system and whether the TTC joins the GTAFS?

Overall, there are issues related to governance, system ownership, decision-making, and financing that will need to be resolved between the City, TTC, Province and the Federal Government before a decision can be made on the TTC becoming part of the GTAFS. It will be necessary to review the

TTC's business requirements with these parties to determine how these needs will be addressed, and what the net financial impacts (including funding) are to the TTC.

CONCLUSIONS

The TTC has conducted a business case analysis that outlines the needs and requirements for a smartcard system at the TTC. The information from this business case was intended to assist the Commission in determining a future direction for smartcards at the TTC.

The business case demonstrates that a smartcard system will have definite benefits for customers (convenience), decision-makers (flexibility in policy and pricing), and employees (safety and security). The analysis estimates that the cost for a TTC owned and operated smartcard system is between $250M to $260M in capital, and $11M to $12M in additional operating expenses annually. The business case analysis further shows that while the current TTC fare system does have limitations, it is simple to understand and operate, and is relatively cost efficient and reliable. From a state-of-good repair perspective, the current fare system does not need to be replaced.

It is unclear at this time what the impact would be if the TTC were to join the GTAFS. The TTC has identified some areas in the GTAFS that are currently not consistent with the identified business needs of the TTC. There are also issues related to the governance, system ownership, decision-making and financing of the GTAFS that need to be resolved. These issues and overall questions related to the affordability of a smartcard system, whether the TTC should implement such a system, and whether the TTC should join the GTAFS, can only be answered by initiating discussions with the Federal and Provincial governments to determine their position on the issues that TTC has identified. The Province has reiterated its willingness to discuss these issues. Once these positions are understood and the overall impact on the City and TTC is clear, the Commission and City will be in a better position to determine the future direction for a smartcard system at the TTC.

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Attachment A: Assessment of Current TTC Fare System

Attachment B: Key Principles for a TTC Smartcard System

Attachment C: TTC Smartcard System – Listing of Various Methods Available to Customers to Purchase Smartcards and Load/Reload Value

Attachment D: TTC Smartcard System – Customer Service Functions by Service Channel

Attachment E: TTC Smartcard System – High Level Implementation Schedule

Attachment F: Overview of Process Used to Develop Capital and Operating Cost Estimates

Attachment G: TTC Smartcard System – Summary of Capital Cost Estimates

Attachment H: Comparison of Capital Costs to Implement a Smartcard System

Attachment I: TTC Smartcard System – Estimate of Net Operating Expense Impacts

Appended Report: Business Case Analysis for a Smartcard Fare Collection System

Attachment A:

Assessment of Current TTC Fare System

The following updates the assessment of the TTC's fare system on the key factors identified in Section 1 of the Discussion in the main body of this report.

- ***Customer convenience:*** As was noted in the TTC's 2000 report, the TTC's pay-on-entry, flat-fare systems is quick, simple, and easy to understand. TTC customers have expressed little dissatisfaction with the current system, as market research has consistently indicated that fare-related issues (e.g. price; media) are significantly less important to customers than good quality, fast and reliable service. However, the fare system related feedback that does come from customers indicates that the system could be enhanced by providing more convenient means to purchase fares (e.g. credit; debit; Internet).

- ***Ease of transferring:*** There is little that has changed here since 2000. The TTC's free-transfer system continues to allow easy transferring between buses, streetcars, and subways that is in contrast to many other transit properties around the world. However, it can be inconvenient for customers transferring from a surface vehicle to the subway in situations where a freebody transfer does not exist (e.g. Queen streetcar to Queen Street Subway Station). And as was determine in the 2000 study, the current system is still inconvenient for customers to transfer between the TTC and neighbouring GTA transit properties.

- ***Security:*** The TTC's fare evasion rate is estimated to be approximately one percent, which places it significantly below other transit properties who have seen smartcard systems as a means to reduce their fare evasion rates. Since 2000, the counterfeiting of TTC fare media has become more of a concern, although the introduction of a new token is expected to significantly reduce the overall potential for this.

- ***Economical:*** The TTC's fare system continues to be efficient in terms of its cost of operation. The TTC spends eight percent of its fare revenues on the collection and processing of fares and fare revenues. This is significantly lower than other properties who report fare collection costs of more than ten percent of fare revenues.

- ***Flexibility:*** The TTC's fare media and collection system continue to be relatively inflexible, and new fare options and products are typically difficult to implement.

- ***Reliability:*** The TTC's fare collection system continues to be reliable, as its "gravity" fareboxes and subway turnstiles continue to operate effectively despite their age.

- ***Management information and data:*** There is no data generated directly by the fare collection system for use by management. Information concerning ridership and revenues are generated by manual processes, such as the counting of fare media collected.

- ***Non-fare revenues:*** There continues to be few opportunities to generate non-fare revenues from the current fare collection system.

Attachment B:

Key Principles for a TTC Smartcard System

A TTC smartcard system should:

1. Meet the needs of TTC customers while improving convenience for customers using the system and enhancing the overall quality of service.

2. Support existing fare policies and products and provide the flexibility for new fare policies and products.

3. Be affordable for the City, TTC and its customers for both the implementation and operation of the smartcard system.

4. Provide opportunities to expand the use of the transit smartcard to other applications for the benefit of transit customers and City residents, and provide the potential for new revenue sources for the City.

5. Ensure that the City and TTC have authority over transit-related decisions that impact TTC customers and City residents.

Attachment C:

TTC Smartcard System - Listing of Various Methods Available to Customers to Purchase Smartcards and Load/Reload Value

	Purchase Smartcard	Load/Reload Value to Smartcard
Vending Machine (subway)	√	√
Internet	√	√
Telephone/IVR	√	√
Mail	√	**n/a**
TTC Customer Centre	√	√
Third Party Ticket Agent	√	√

Schools and Institutions	√	**n/a**
Autoload	**n/a**	√ *

* Available for customers with registered smartcards only.

Attachment D: TTC Smartcard System - Customer Service Functions by Service Channel

Customer Action	Call Centre		Customer Centre	Web Services	Mail
	Interactive Voice Response System	Operator Assisted			
General smartcard inquiries	√	√	√	√	√
Buy a smartcard	n/a	√	√	√	√
Register a smartcard	n/a	√	√	√	√
Card balance and transaction history	√	n/a	√	√	n/a
Replace lost, stolen, damaged smartcard	n/a	√	√	√	n/a
Process changes to account	n/a	√	√	√	√
Reload e-purse or e-pass	√	n/a	√	√	n/a
	n/a	√	√	√	√

Receive/resolve smartcard related complaints					
Photo identification services	n/a	n/a	√	n/a	n/a

n/a = not available

Attachment E: TTC Smartcard System – High Level Implementation Schedule

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Approve Project										
Develop Detailed Business Requirements										
Issue Request for Information										
Develop specifications,										

issue Request for Proposal, sign vendor contract										
Detailed design with vendor										
Pilot, system roll-out										

Attachment F:

Overview of Process Used to Develop Capital and Operating Cost Estimates

A key objective with the costing exercise was to base the estimates, as much as possible, on the data available from other transit properties. For the capital cost estimates, Three Point Consulting was contracted to identify the components of a typical smartcard system and provide the unit costs for these components. They conducted a review of transit agencies that had performed transit smartcard system procurements relevant to the TTC within the past five years. They also supplemented this agency data with information from industry contacts, published sources, and data directly from suppliers. These results were then reviewed and validated by a second consulting group, Parsons Corporation, who were hired by the TTC to assist in the development of the TTC's overall business case.

The unit costs for smartcard capital items were then put through two separate but related processes to develop two estimates for the overall capital costs for a TTC smartcard system – one was done by Parsons Corporation, and the other done by TTC staff who are responsible for capital estimates. The intent was to compare the two estimates and identify a likely range of capital costs.

The development of the operating costs was done during an extensive process by TTC staff working closely with Parsons Corporation. Based on experience elsewhere, the potential changes to current business processes that would result from a smartcard system were identified. The workforce and non-labour impacts of these changes were developed in consultation with TTC staff within Departments that would be impacted by a smartcard system. From these discussions, the cost impacts of a smartcard system were estimated.

A detailed process was also undertaken to develop demand estimates on a number of key factors that would impact both the capital and operating requirements for a TTC smartcard system. A number of factors were forecast in the demand estimates including:

- Number of smartcards and limited use smartcards required;
- The number of sales and reloads for each sales and reload channel;
- Total demand for customer account services such as inquiries, account changes, card replacement, registration;

- Proportion of sales and reloads done by credit and debit;
- Equipment failure rates and the impact on maintenance requirements; and
- Overall system transactions.

While every effort was made to base the TTC cost estimates on experience elsewhere, it is evident that there is no such thing as a "standard" smartcard system. There are unique elements to every transit agency that sometimes make a direct "apples to apples" comparison between agencies difficult. Keeping this in mind, it should also be recognized that there are a number of unknowns that can impact the actual costs of a project of this scope and nature, particularly when there is a significant information technology component as there is with a smartcard system. Cost estimates at this stage of a project (i.e. feasibility) are typically +/- 25%.

Attachment G: TTC Smartcard System – Summary of Capital Cost Estimates

As outlined in Attachment F, the capital cost estimates were developed using two separate but related processes to iden costs. The results of the two processes are summarized below. Please note that there are differences between the proc smartcard system items, activities and services were grouped together and categorized. Therefore, a comparison of ind two processes does not necessarily reflect an "apples to apples" comparison. Variations between the cost estimates als underlying assumptions on individual factors.

Estimate A: Parsons Corporation		
Item/Activity	**Key Factors**	**$2006M**
Primary Contract with Vendor - Equipment & Systems	• smartcards; limited use cards • field equipment • equipment (non-field) • central system & system architecture • change order & contingency	$100.2
Services & Other Items in Primary Contract	• testing, installation of equipment • maintenance contract • warranty; insurance; vendor project mgt; training; etc	$42.7

Estimate B: TT	
Item/Activity	**Key F**
Fare Media	• smartcards;
Field Equipment	• readers; ven point-of-sale dev • Test, install
Other AFC Equipment & Vendor Maintenance	• equipment (spares • maintenance
Central System & System Architecture	• hardware • software
Services & Other Items in Vendor Contract	• warranty; in project mgt; train

Modifications	• power/communications in stations, garages • TTC project mgt. • customer services equipment • change order & contingency	$91.3
Program Planning & Implementation	• TTC project team • consultants • IT support • customer information materials	$28.3
GST Rebate		($13.6)
	TOTAL	***$248.9***

Facility Infrastructure Modifications	• power/comm stations, garages • TTC Engine mgt.
Change Orders & Contingency	• construction • equipment
TTC Smartcard Project Mgt.	• TTC project • consultants • IT support
Customer/Call Centres & Customer Information	• customer inf materials • workstations devices
GST Rebate	

Attachment H:

Comparison of Capital Costs to Implement a Smartcard System

City	Total Weekday Passenger Boardings	Reported AFC Capital Investment (Cdn$)	AFC Investment Per Weekday Boarding
A. Manual Fare System Replaced by Magnetic System			
New York	7 million/day	$1 billion	$145/boarding
Chicago	1.3 million/day	$210 million	$160/boarding
Boston	1.2 million/day	$210 million	$170/boarding
Toronto	2.3 million/day	$260 million (est.)	$115/boarding
B. Smartcards Added and Magnetic System Upgrade			
Washington	1 million/day	$70 million	$70/boarding
London	6 million/day	$600 million	$100/boarding

Attachment I: TTC Smartcard System – Estimate of Net Operating Expense Impacts

(Note: Estimates reflect impact after system roll-out has been completed;

estimates do not reflect impact during implementation period)

Area/Activity	Key Factors	Change From Current ($2006M)
Fare Media	• added cost for smartcards, limited use cards • eliminate costs for production of tickets, tokens and passes	$1.6
Revenue Collection and Processing	• reduced costs for activities related to distribution of fare media and revenue collection	($2.0)
Equipment Maintenance	• increased resources required to maintain and service approximately 7000 field devices	$2.8
Subway Transportation	• reduced costs for activities related to staffing for additional subway booths during Metropass sales • reduced costs for activities related to staffing for "crash gates"	($4.5)
Customer Services	• additional call centre and customer centre resources required to manage and provide services for approximately 1.7 million smartcard customers, including over 800,000 registered accounts	$3.3
Fare Enforcement	• additional resources required for higher levels of fare enforcement	$1.0
Financial Services	• added costs for credit and debit fees payable to	$4.7

	financial institutions for customer purchases of fare media and value • reduction in commissions paid to ticket agents due to alternative sales channels available	
IT Services	• additional resources required to support added systems • added costs for software licences, application and database support, and to ensure system business continuity and disaster recovery	$4.6
	NET IMPACT FROM CURRENT	***$11.5***