APPENDIX 2

TORONTO TRANSIT COMMISSION

SERVICE STANDARDS AND DECISION RULES FOR PLANNING TRANSIT SERVICE

Contents

1 INTRODUCTION

The Toronto Transit Commission (TTC) is responsible for providing public transit in the City of Toronto. The TTC's vision, mission, and core values are:

- vision: a transit system that makes Toronto proud
- mission: to provide a reliable, efficient and integrated bus, streetcar and rapid transit network that draws its high standards of customer care from our rich traditions of safety, service and courtesy
- core values: we value both the quality and quantity of time customers spend on the TTC

The TTC strives towards making public transit the simplest, fastest, and most cost efficient way to move around in Toronto. The service standards lay out a framework for achieving these goals. Service standards are the process by which the TTC plans and evaluates transit services. The TTC has two major objectives in planning transit services:

- to maximize mobility within the City of Toronto by ensuring that public transit is provided in the right places, at the right times, to satisfy the changing travel needs within the community
- to ensure that all transit services operated by the TTC are as efficient and cost-effective as possible and, therefore, affordable to both TTC customers and citizens

In achieving these goals, the TTC must strike a balance between the benefits achieved from providing transit services and the cost to provide these services. The service standards provide a formal mechanism for measuring trade-offs in an objective and equitable way. The service standards are decision rules and guidelines that are:

- grounded in business logic and principles
- transparent, quantifiable, reproducible
- applied consistently, fairly and equally

The service standards provide a systematic and objective means of planning, monitoring, adjusting, and evaluating conventional transit services throughout the City of Toronto. These service standards apply to conventional transit services only and exclude Wheel Trans service.

2 NETWORK DESIGN STANDARDS

2.1 Transit Service Classifications

The TTC operates an integrated multi-modal transit network that provides customers the following services:

- rapid transit
- streetcar
- bus

2.1.1 Rapid Transit

The TTC currently operates four rapid transit lines along dedicated rights-of-way across the City of Toronto. Current rapid transit lines include:

- Line 1 – Yonge-University
- Line 2 – Bloor-Danforth
- Line 3 – Scarborough
- Line 4 – Sheppard

2.1.2 Streetcar

The TTC currently operates 11 streetcar routes predominantly in downtown Toronto. The streetcar routes operate on surface streetcar tracks making frequent stops similar to local bus routes. Some streetcar routes operate either in mixed traffic, or partly or wholly within their own rights-of-way.

2.1.3 Bus

The TTC currently operates over 140 bus routes via three types of services -- local, express and community -- each designed to meet specific customer travel requirements.

Local

The TTC currently operates more than 130 local bus routes in mixed traffic on major arterials, minor arterials, and collector roads across the City of Toronto. Local bus routes are designed as fixed routes with frequent stops and are intended to serve and connect residential, employment and institutional areas with each other. These connections occur either directly or indirectly through a connection to other surface and rapid transit services.

Express

The TTC operates two types of express bus services: Tier 1 and Tier 2 express bus services.

> *Tier 1:* Tier 1 express services are limited stop bus services that are designed to complement the rapid transit network and provide frequent and faster service on high-demand bus corridors with major urban nodes. These routes operate at a minimum frequency of ten minutes or better on weekdays from 6:00 am - 10:00 pm and fifteen minutes or better on weekends from 8:00 am - 7:00 pm.
>
> *Tier 2*: Tier 2 express services are designed to provide frequent and faster service on busy bus corridors generally during the weekday peak periods. These routes operate at a minimum frequency of fifteen minutes or better on weekdays from 6:00 am - 9:00 am and from 3:00 pm – 7:00 pm.

Community

Community bus routes are fully accessible transit services that can be used by anyone, but are designed primarily for seniors and people with disabilities who are paratransit customers who are able to include conventional transit as part of their travel plans.

Community bus services operate on fixed routes, can be flagged down at any point along the route, and are designed to provide easier access to facilities oriented to the target market group, such as seniors' apartments, medical facilities, community centres and shopping centres.

2.2 Key Principles of System Structure and Design

Transit network design must take into account both the needs of the customer and the transit operator, as well as the practical ability to provide the service. From the customer's perspective, the transit network should provide convenient and reliable service when and where they need to go, with good customer communication and service. From a system-wide transit operations perspective, the transit network must be manageable, operable, and sustainable – all within the constraints of a fixed operating budget. The following are key principles that are critical in building an effective and efficient transit network.

2.2.1 Accessibility

The TTC has a strong organizational commitment to accessibility and is making continuous progress towards making all of its vehicles, facilities, and services accessible, consistent with Provincial AODA legislation. The TTC's implementation of accessibility improvements is guided by the 2014-2018 TTC Multi-Year Accessibility Plan, which outlines the TTC's

long-term vision for an accessible transit system. Presently, all TTC bus services are operated using accessible, low-floor buses. The new low-floor accessible streetcars are currently being deployed and all routes will have accessible streetcars by 2019. All subway stations will become accessible by 2025.

2.2.2 Grid Network

Surface (i.e. streetcar, bus) routes will conform or be oriented to the grid system of major arterial roads in the City of Toronto. A basic grid network of surface transit services provides an efficient means of supplying convenient service between the majority of origins and destinations throughout the City, and it provides the maximum number of route combination choices for customers.

2.2.3 Network Connectivity

Connections between surface routes and rapid transit lines will be maximized. This allows for faster service for long distance trips, and is more cost-effective for moving high volumes of customers. An integrated surface and rapid transit network maximizes travel choices, yet necessitates transfers for the majority of TTC customers. Therefore seamless connections between surface routes and rapid transit stations, and between surface routes on-street are essential. Seamless connections will be provided between services regardless of the transit provider.

2.2.4 Route Directness

Surface routes will be planned so that they meet customers' travel needs as well as possible. Routes will be as direct as possible to minimize customer travel time. Diversions off a direct path will only occur where the benefit to customers of the diversion exceeds the inconvenience to all other customers.

2.2.5 Duplication of Service

In most cases, only one local route will operate on each major arterial roadway or on closely spaced parallel roadways (less than 800m) to make the best use of available resources. When parallel routes operate closer together, they split the potential demand for service. In areas and time periods of low demand, this can result in many routes competing for the same passengers and no route attracting enough demand to warrant higher frequency service. It may be necessary in some cases; however, to duplicate service along major arterials where a) routes merge to feed a rapid transit station, b) routes are designed and function as branch services, or c) to achieve other system design objectives.

2.3 Coverage and Access

An important aspect of providing the City of Toronto with adequate access to transit services is the proximity or accessibility of transit service to population and employment areas. The coverage and access standard addresses the accessibility of transit by targeting a maximum walking distance that a customer will have to travel to reach a transit station or stop.

The TTC provides public transit services 24-hours a day, seven days a week. Coverage and access to transit service varies by operating day and depends on customer demand (see **Section 3.0**).

2.3.1 Base Network – "All-Day, Every-Day"

The TTC provides base (subway, streetcar and bus service) coverage and access to transit services in the City of Toronto during regular daytime and evening hours, aligned generally with the operating hours of the rapid transit network approximately from:

- 6:00 am to 1:00 am, on weekdays and Saturdays and holidays; and
- 8:00 am to 1:00 am on Sundays.

The base network, also known as the All-Day, Every-Day network, will be provided with regular rapid transit, streetcar and bus routes. The base network of transit services is designed so that 90% of the population and employment is within a 400 metre (5 minute) walk of transit service seven days a week.

2.3.2 Overnight Network – "Blue Night"

The TTC's overnight network of bus and streetcar service, known as the Blue Night Network, will be provided between approximately 1:30 am and 5:30 am from Monday to Saturday, and between approximately 1:30 am and 8:00 am on Sunday and holidays, after the regular daytime and evening services have ended.

The overnight network is designed so 95% of the population and employment is within a 1,250 metre walk (15 minutes) of transit service. Consequently, overnight services may be provided on different routes than the base network in order to meet these requirements. Where possible, however, overnight routes will follow daytime routing and be identified in a manner consistent with the daytime route. The overnight network is an important part of the TTC's commitment to maximizing the mobility of people in the City of Toronto and meeting all of their diverse travel needs.

2.3.3 Coverage and Access Standard

The TTC will provide, at minimum, coverage and access to transit service as presented in **Table 1**.

Table 1: Coverage and Access Standard

Operating Day	% of Population and Employment	Within Walk Distance	Within Walk Time
Base Network - "All-Day, Every-Day" Weekdays* - (6:00 am to 1:00 am) Saturdays** - (6:00 am to 1:00 am) Sundays** - (8:00 am to 1:00 am)	90%	400 metres	5 minutes
Overnight Network - "Blue Night" Every Day (1:30 am to 6:00 am)	95%	1,250 metres	15 minutes

* Proximity standard measured against service during AM peak operating period.

** Proximity standard measured against service during afternoon operating periods.

The TTC will strive to meet coverage and access standards from a city-wide, network level perspective, recognizing that the provision of transit service in some areas is conditional on density, land use and street network design to support viable transit operations.

2.4 Surface Stop Spacing

Surface stops should be designed in accordance with the TTC's Technical Criteria for the Placement of Transit Stops. When the locations of stops are being planned for a route, it is necessary to strike a balance between the competing objectives of passenger convenience, operating efficiency, safety and community impacts. In general, increasing the number of stops on a route results in shorter walking distances for passengers but it also slows down service. To achieve a proper balance, the TTC will place bus stops in accordance with the standard presented in **Table 2.**

Table 2: Surface Route Stop Spacing Guidelines

Service Classification	Stop Spacing Range
Streetcar	300 - 400 metres
Bus – Local	300 - 400 metres
Bus – Express (Tier 1)	650 – 1,000 metres
Bus – Express (Tier 2, Limited Stop)	650 – 1,000 metres
Bus – Express (Tier 2, Local/Express)	>650m for express portion; 300 – 400m for local potion
Bus – Community	flag stop

2.5 Early / Late Connections

An integrated surface and rapid transit network maximizes travel choices, yet necessitates transfers for the majority of TTC customers. At the beginning of the regular service day and at the end of the core service hours, the TTC will schedule surface routes to connect to first/last rapid transit services. In some cases, service on surface routes may be provided earlier/later if the demand warrants it.

3 QUALITY OF SERVICE STANDARDS

The TTC's existing and potential customers place a high value on frequent, reliable and comfortable transit service. The following guidelines set out specific criteria for the quality of service that customers can expect. Quality of service standards outline span of service (operating hours), service levels (frequency of service), vehicle crowding, and service reliability.

3.1 Span of Service & Service Levels

The TTC provides transit service 24-hours a day, seven days a week. The span of service (operating hours) and service levels (frequency of service) determine the availability and convenience of transit service for customers. The span of service and service levels vary for each transit service classification: rapid transit, streetcar, bus.

Table 3 presents the minimum span of service and service levels for each transit service classification. In many cases, however, routes need to operate more frequently than the minimum frequencies in order to accommodate higher ridership levels. In these cases, vehicle crowding standards (see **Section 3.2** below) match service to the number of riders using a particular transit service at a given time.

The minimum frequency levels may not be met for no longer than one year if required during temporary service changes for construction related traffic delays.

3.1.1 Frequent Network – "Ten Minute Network"

The TTC's frequent network, known as the Ten Minute Network, is a network of rapid transit, streetcar and bus services that operate every ten minutes or better from approximately 6:00 am to 1:30 am from Monday to Saturday and from approximately 8:00 am to 1:30 am on Sundays.

Table 3: Minimum Span of Service, and Service Levels

Operating Period	Minimum Service Levels (minutes)					
	Rapid Transit*	Streetcar	Bus - Local	Bus - Express (Tier 1)	Bus - Express (Tier 2)	Bus - Community
Weekdays						
Morning Peak 6:00 am - 9:00 am	6	30	30	10	15	
Midday 9:00 am - 3:00 pm	6	30	30	15		60
Afternoon Peak 3:00 pm - 7:00 pm	6	30	30	10	15	60
Early Evening 7:00 pm - 10:00 pm	6	30	30	15		
Late Evening 10:00 am - 1:00 am	6	30	30			
Overnight 1:30 am - 5:30 am		30	30			
Saturdays						
Early Morning 6:00 am – 8:00 am	6	30	30			
Morning 8:00 am – 12:00 pm	6	30	30	15		
Afternoon 12:00 pm – 7:00 pm	6	30	30	15		
Early Evening 7:00 pm – 10:00 pm	6	30	30			
Late Evening 10:00 pm – 1:00 am	6	30	30			
Overnight 1:30 am - 5:30 am		30	30			
Sundays/holidays						
Early Morning 6:00 am – 8:00 am		30	30			
Morning 8:00 am – 12:00 pm	6	30	30	15		
Afternoon 12:00 pm – 7:00 pm	6	30	30	15		
Early Evening 7:00 pm – 10:00 pm	6	30	30			
Late Evening 10:00 pm – 1:00 am	6	30	30			
Overnight 1:30 am - 5:30 am		30	30			

Note: Service is subject to ridership meeting minimum performance standards. For local bus routes, the standard applies to all branches of the route.

*New rapid transit lines may have a frequency of up to 10 minutes in the first few years of operation until ridership matures.

3.2 Vehicle Crowding

Average vehicle crowding sets a standard of comfort for passengers while on board transit vehicles. The standard determines the appropriate level of service based on the maximum load point, or the greatest number of customers riding at one time, in the busiest direction, along a route during the busiest 60 minutes of each period of service. The number of customers at other locations along the route, and in the reverse direction, is lower (often much lower) than the maximum load point.

Vehicle crowding standards are applied as an average. For example, the off-peak crowding standard for vehicles calls for a seated load, with no standees. This standard does not guarantee that no customers will stand; it does ensure that, on average, vehicles will carry a seated load of customers during the busiest 60 minutes during off-peak periods of service. **Table 4** provides a summary of the TTC's vehicle crowding standards.

Table 4: Vehicle Crowding Standards

Transit Service Classification / Vehicle Type	Peak periods	Off-peak periods**
Bus (local, express)		
Orion VII 12-metre low-floor bus (38 seats)	53	38
Orion VII 12-metre low-floor bus (36 seats)	51	36
New Flyer D40LF 12-metre low-floor bus	50	35
Nova LFS 12-metre low-floor bus*	51	35
Nova LFS artic 18-metre low-floor bus*	77	46
Bus (community)		
To be determined	seated load	seated load
Streetcar		
Standard 15-metre streetcar (CLRV)	74	42
Articulated 23-metre streetcar (ALRV)	108	61
Articulated 30-metre low-floor streetcar*	130	70
Rapid transit		
Train (6 cars, TR-series)	1100	540
Train (6 cars, T-series)	1000	500
Train (4 cars, S-series)	220	130
Train (4 cars, TR-series)	740	370

Note: *Standards for new vehicles are subject to confirmation after in-service experience.
**The off-peak crowding standard for bus is a seated load up to a minimum of 35

With respect to rapid transit, it is important to note that the distribution of customers on trains is almost never even; some cars will be more crowded than others.

3.3 Service Reliability

Convenience, comfort, predictability and dependability are the main features customers expect of a transit system. A person using any transportation mode has an expectation that the service will be reliable. Services that cannot meet their published schedules or provide a consistent headway lose the loyalty of their customers. A consistent and reliable service reduces the variability of wait times for customers and improves comfort as customers are evenly distributed between vehicles.

The TTC is focused on continuously improving the on-time performance and reliability of transit services to provide customers with a predictable and consistent travel experience. The TTC uses the following standards to measure service reliability.

3.3.1 Surface Transit

3.3.1.1 On-Time Performance

The on-time performance of a route is affected by many variables including: traffic congestion, traffic incidents, construction related delays, weather etc. On-time performance standards vary by frequency of service and provide the tools for evaluating the on-time performance of individual TTC routes. Passengers using high-frequency services are generally more interested in regular, even headways than in strict adherence to published timetables, whereas passengers on less frequent services expect arrivals/departures to occur as published.

On-Time Departure

To be considered on-time, a vehicle must leave its origin timepoint between 1 minute early and 5 minutes late. TTC's goal is to have 90% of all trips depart on-time.

On-Time Arrival

To be considered on-time, a vehicle must arrive at its terminal timepoint between 1 minute early and 5 minutes late. TTC's goal is to have 60% of all trips arrive on-time.

Headway Performance

Service frequency > 10 minutes

Service is considered to be on time if it is no more than one minute early and no more than five minutes late. TTC's goal is to have 60% of all trips meet the on-time performance standard.

Service frequency > = 5 minutes and < = 10 minutes

For services that operate between five and ten minutes, passengers do not rely on printed schedules, but expect vehicles to arrive at prescribed headways. Therefore, on-time performance for frequent service is measured by how well actual headways correlate to scheduled headway intervals. Trips are monitored at a location based on arrival time, without regard to whether the trip that arrived was scheduled for that time slot. The vehicle is considered on-time when the headway deviation is less than 50% of the scheduled headway. For example a service that operates every 6 minutes is deemed on-time if the headway deviation falls between 3 minutes and 9 minutes. TTC's goal is to have 60% of all trips operated within +-50% of the scheduled headway over the entire service day.

Service frequency < 5 minutes

For services that operate better than five minutes, the vehicle is considered on-time when the headway deviation is less than 75% of the scheduled headway. For example a service that operates every 3 minutes is deemed on-time if the headway deviation falls between 0.75 minutes and 5.25 minutes. TTC's goal is to have 60% of all trips operated within +-75% of the scheduled headway over the entire service day.

3.3.1.2 Missed Trips

Any vehicle leaving more than 20 minutes late from an end is considered a 'missed trip'. TTC's goal is to minimize the number of missed trips on each route.

3.3.1.3 Short Turns

A short turn is when a vehicle is turned back and taken out of service before reaching the terminus of a route. While some short turns are necessary, TTC's goal is to minimize short turns due to schedule and operator issues.

3.3.2 Rapid Transit

3.3.2.1 On-Time Performance

As with frequent bus service, passengers on rapid transit do not rely on printed schedules, but expect trains to arrive at prescribed headways. Two different measures are used to evaluate on-time performance: headway performance and average trip time on each line.

Headway performance

Service frequency < = 6 minutes

For services that operate better than six minutes, the vehicle is considered on-time when the headway deviation is less than 100% of the scheduled headway. For example a service that operates every 3 minutes is deemed on-time if the headway deviation falls between 0 minutes and 6 minutes. TTC's goal is to have 95% of all trips operated within +-100% of the scheduled headway over the entire service day.

Average Trip Time

The TTC's goal is to have 85% of trips operated within 5 minutes of scheduled total trip time by time period or +10% of scheduled trip time. The average trip time is measured as the train departs the terminal to when the train arrives at the terminal.

3.3.2.2 Capacity Delivered

Capacity delivered is measured as the number of trains that pass the peak point during the peak hour divided by the scheduled number of trains during the peak hour.

The TTC's capacity delivered target is to deliver 90% of the scheduled trains per hour.

If the above performance standards are not met on a regular basis for a specific route, TTC will consider a range of options including, adjusting the published schedule, adjusting route timing, providing additional training for drivers or modifying or adding transit priority measures.

4 PERFORMANCE TARGETS

Performance targets are used to set desired and achievable goals for transit services. The following section provides guidance on overall performance of the system in terms of the effectiveness and efficiency of the service provided. This includes specific criteria for measuring service productivity and economic performance. The goals are set in an effort to encourage continuous incremental improvement over time to achieve the desired targets.

4.1 Service Productivity

4.1.1 Surface Transit Service Productivity

Service productivity is a measurement of the effectiveness of the application of the TTC's resources. The performance measurement must take into account that each service classification has different performance expectations and ridership potential, and, even within the same service classification, performance will vary. Therefore, the following performance targets have been established for every service classification for each operating period:

- Class average target, based on the average boardings per revenue hour that all routes within each service classification should achieve in each operating period.
- Route minimum performance target, on the basis of average boardings per revenue vehicle hour, for each of the individual routes within the classification. Routes consistently not meeting the prescribed minimum thresholds would be subject to compulsory review to recommend a change to improve or remove the service. Individual route performance will be assessed annually, as a minimum.

Table 5 presents the service productivity performance targets for surface transit services. Rapid transit productivity numbers are large and vary by line. It is impractical to apply a common standard to all rapid transit lines; therefore, the productivity of each line will be assessed on an individual basis.

Table 5: Surface Transit Service Productivity Targets – Average boardings per revenue service hour

Operating Period	Streetcar		Bus – Local		Bus – Express (Tier 1)		Bus – Express (Tier 2)**		Bus – Community	
	Class Avg.	Route Min.	Class Avg.	Route Min.	Class Avg.	Route Min.	Class Avg.	Route Min.	Class Avg.	Route Min.
Peak Periods*	95	50	75	20	65	40	50	40	8	6
Off-Peak Periods	85	35	55	10	55	30	N/A	N/A	8	6

* Monday to Friday: 6:00 am - 9:00 am, 3:00 pm - 7:00 pm

**Excludes Downtown Premium Express Routes

4.2 Economic Performance

The TTC requires a municipal subsidy to deliver public transit service within the City of Toronto. Therefore, a primary objective of planning transit services is to ensure that all transit services operated by the TTC are as efficient and cost-effective as possible and, for that reason, affordable to both TTC customers and citizens.

4.2.1 Net Cost per Passenger

In planning transit services it is important to have a measure that can compare the economic productivity of any given route in relation to other routes within a service classification or to the service classification average. Economic performance will be assessed based on the net cost per passenger. This is an allocation of costs, revenue and ridership to individual routes to provide a relative measure of economic performance on a route by route basis. It is defined as the amount of subsidy the TTC requires per boarding passengers, over and above fare revenue collected, to operate a given route. It is calculated by dividing the cost of operating the route by the number of passengers and subtracting the average fare per boarding. This ratio reflects the benefits of a given service (measured in customers) against the public cost of operating the service.

$$\text{Net cost per passenger} = \frac{\text{Route Operating Cost}}{\text{Route Boardings}} - \text{Average Fare per Boarding}$$

The net cost per passenger measure will be reviewed annually, during the Annual Performance Review and during the Route Enhancement Plan process (see **Section 6.1** and **6.2**). Routes that perform within the bottom 10% of the service classification would be subject to compulsory review to recommend a change to either improve or remove the service. Individual route performance will be assessed annually.

4.2.2 Change in Ridership per Net Dollar

The TTC also measures return on investment through the change in ridership per net dollar metric. The goal of this measure is to ensure that service changes achieve better ridership results than would be achieved through fare changes. To do this, the metric compares service changes to fare changes because both result in a) changes to ridership and b) changes to subsidy. Service increases and fare reductions result in increases in ridership and subsidy. Service reductions and fare increases result in reductions in ridership and subsidy.

The TTC can estimate the change in ridership based on increases and decreases to fares. As seen in **Table 6**, a 10% reduction in fare will gain 12 new customers per $100 spent in lost revenue (or $100 in additional subsidy). An increase in fare will lose 12 customers per $100 saved in new revenue (or $100 in less subsidy). All service changes (outside changes required for passenger comfort and schedule adherence) must do better than the threshold set by fare changes. Service increases must gain 12 or more new customers per $100 spent and service reductions must lose less than 12 customers per $100 saved to be worthwhile. This metric is not intended to replace the cost recovery targets set through the budget process but is intended to ensure service changes yield the best value for money results. For more information please see **Appendix 1**.

Table 6: Change in Ridership per Net Dollar Spent, TTC 2015 example

2015 Inputs Annual Fare Paying Customers: 535M Annual Fare Revenue $1,108M Revenue Per Passenger: $2.07 Assumed Fare Elasticity: -0.20
For a 10% Fare Increase: Annual Passengers Lost: (535M x –0.20 x .1) = 10.7M New Annual Fare Revenue: ((535M – 10.7M) x $2.07 x 1.1) = $1,194M Net increase in Revenue: ($1,194M - $1,108M) = $86M
Passengers Lost per Dollar of Adjusted Subsidy (10.7M/$86M) = 0.12

Community Bus

Community bus services are designed to act as an intermediary between conventional and paratransit service, as a result they will be measured against a lower performance standard. For community bus to be cost effective the cost per passenger trip must be less than the Wheel-Trans taxi cost per passenger trip. Therefore, a minimum number of Wheel-Trans door-to-door trips must be diverted to each viable community bus route such that each route serves no less than the average number of trips performed by a door-to-door vehicle per service hour.

5 Service Change & Warrant Guidelines

The following section specifies the procedure for changing service levels, routing alignments and when new services are warranted.

5.1 Service Change Guidelines

Changes to TTC services are made regularly and frequently, to meet the changing transit requirements in the City. Minor changes developed through the continuous monitoring of services are introduced every Board Period.

Changes which are more substantial, either affecting the travel options of current TTC customers, or requiring additional resources for operation, undergo a more rigorous review. Included in this category are requests and proposals for new routes or route extensions, additional periods of service on the present routes (e.g., new weekend service), and major changes to the structure of routes in a community. These major changes require TTC Board approval. **Table 7** provides a summary of minor and major service changes.

Table 7: Summary of Minor and Major Service Changes

Magnitude	Types of Service Changes	Resource Implications
Minor	• Service level changes to match capacity with demand • Span of service changes within 90 minutes or less, such as earlier or later trips • Routing changes resulting in service being removed from a road (or portion of a road) where there are multiple transit services on the road • Schedule changes to improve service reliability • Recurring seasonal route changes that have been previously approved by the Board	Changes that can be implemented with existing equipment and within the adopted budget
Major	• Routing changes resulting in service being proposed on a road (or portion of a road) where there was no previous transit service • Routing changes resulting in service being removed from a road (or portion of a road) where it is the only transit option available • Addition/removal of a period of service	Changes that will have a significant effect on resources, and may potentially have a significant effect on customers

5.1.1 Comparison of Effects on Customers

Major service changes including routing changes, the provision of new service and the addition or removal of service must result in an overall benefit for customers. The net benefit is measured by estimating the net change in weighted travel time for customers.

Each of the four components of a trip -- walking to the stop, waiting for the bus or streetcar to arrive, riding in the vehicle and transferring from one vehicle to another -- is weighted differently, according to how each is perceived by customers and how it affects customers' travel decisions (see **Appendix 2** for more details).

The weights that are applied to each component of a trip were developed from research based on several surveys of travel behaviour. With the use of these weights, it is possible to predict customers' travel patterns.

Trip component weight:

- Each minute of in-vehicle travelling time 1.0
- Each minute of waiting time 1.5
- Each minute of walking time 2.0
- Each transfer 10.0

To make recommendations on proposed service changes, the change in weighted travel time is calculated for each group of customers who are affected by a change, both those for whom the change will improve their service and those for whom the change will cause an inconvenience.

Proposals which have an overall benefit for customers are those with a net reduction in weighted travel time. These beneficial proposals will also, over time, attract increased numbers of customers to the TTC's transit services.

5.1.2 Service Level Change

Service level changes will be made based on the following conditions.

Service level increases will be considered on a route when the vehicle crowding thresholds identified in **Section 3.2** are consistently greater than 95% for a period of six months. Corrective actions to maintain the standard can include adding trips to the schedule in the form of a frequency improvement over the whole operating period; addition of individual bus or streetcar trips; and/or restructuring the service to distribute demand among several routes or branches, if applicable.

Service level reductions will be considered on a route when vehicle crowding targets identified in **Section 3.2** are consistently below 80% for a period of six months. A service

reduction will be considered as long as the resulting vehicle crowding target does not exceed 95%. Service reductions should not result in a headway widening greater than 25%[1].

An additional period of operation or an additional first/last trip will be considered on a route if estimated ridership projections demonstrate that the minimum boardings per revenue vehicle hour thresholds identified in **Section 4.1** can be met.

5.1.3 Public and Stakeholder Consultation

The TTC strives to engage customers and stakeholders in an inclusive and consistent manner to receive feedback on major changes to transit routes and services in Toronto. The following engagement principles will inform all engagement activities related to service changes:

1. **Accessible:** utilization of multiple channels to engage all customers
2. **Meaningful:** discussions with customers and stakeholders will have purpose and will be used constructively to guide decision making
3. **Accountable:** engagement materials and summaries will be available to document engagement activities

Staff will develop engagements plans to suit the scale of work to be undertaken. Depending on the type of study system-wide engagement, area-level engagement or route-specific engagement may be required. Tools and approaches such as social media outlets, online surveys, origin-destination surveys, public information centres, charrettes and meet the planners events are just some examples of the kind of engagement that may be applied.

[1] Service reductions will not be made on a route that belongs to the 10 minute network if the change results in a headway greater than 10 minutes.

5.2 Express Bus Service Warrant

5.2.1 Tier 2 Express Service

Tier 2 express bus services will be considered when all of the following conditions are met during the defined minimum span of service operating the minimum service frequency.

- Minimum Span of Service
  - weekdays: morning & afternoon peak
- Service Frequency
  - 15 min or better
  - 15 min or better (outside minimum span of service)
- Demand
  - existing local bus service on the corridor is every six minutes or better during peak periods
  - demand on the corridor for both local and express services must be at least 75% of the total corridor capacity except on weekend mornings
- Speed and Travel Time Improvement
  - the express service travel time must be approximately 20% less than the existing TTC alternative for each of the operating periods being considered; and the one-way distance between the start and end of the local route must be greater than 10km, or;
  - express service can be implemented on routes with a one-way distance of less than 10km, if the average customer trip length is 60% or more of the local route's one-way distance
- Economic
  - the new service must attract a minimum number of new customers for every dollar spent

If a corridor meets the service warrants, multiple route structures and stopping patterns can be applied depending on the corridor demand profile including:

- Limited stop
  - major intersections and nodes serving 50% in total of the transit corridor ridership at minimum; and
  - average stop spacing should be within 650 to 1,000 metres

- Local/express stop
  - while operating as an express, stops will be located only at major intersections and nodes that attract 10% of the total corridor's boardings at minimum
  - limited stop – every 650+ at minimum

New express bus stops can be added to an existing service provided that the resulting service change does not violate any of the preceding demand, speed, and economic standards and the service change is a net benefit to customers. Additional consideration should be given to stops that provide transfer opportunities to other routes for customers.

5.2.2 Tier 1 Express Service

Tier 1 express bus service will be considered when all of the conditions for Tier 2 express bus services are met in addition to the following conditions:

- Minimum Span of Service
  - Weekdays: morning & afternoon peak, midday, early evening (approximately 6:00 am to 10:00 pm)
  - Weekends: morning & afternoon (approximately 8:00 am to 7:00 pm)

- Service Frequency
  - 10 min or better (during peak periods)
  - 15 min or better (outside of peak periods)

- Economic
  - the new service must attract a minimum number of new customers for every dollar spent

- Strategic
  - the corridor has been identified as a future rapid transit corridor or fills gaps in the rapid transit network as defined in Metrolinx's Regional Transit Plan and the City's official plan; or
  - the express service is able to support a minimum of 10,000 weekday customer-trips

If a corridor meets the Tier 1 service standards, a limited stop service will be established if it does not already exist. The Tier 1 services would stop at major intersections and nodes.

New express bus stops can be added to the existing service provided that the resulting service change does not violate any of the preceding demand, speed and economic standards and the service change is a net benefit to customers.

5.2.3 Local Bus Service Guidelines

When Tier 1 and Tier 2 express bus services are introduced on a corridor, the following guidelines should be considered for changes to the frequency of overlapping local bus service.

- If the existing local bus service is every ten minutes or better, the local service headway should not be widened more than 50%;
- If the existing local bus service is ten minutes or greater, the local service headway should not be widened more than 25%; and
- If the existing local bus service is part of the Ten Minute Network, headways should not be widened to violate the frequent network policy.

5.3 Community Bus Service Warrant

Community bus routes act as an intermediary between conventional and paratransit (Wheel-Trans) service. New or modified routes should be designed to capture some of the door-to-door trips that would otherwise be taken by conditionally eligible Wheel-Trans customers.

A community bus route should be considered for operation if the following conditions are met:

- Areas of the City where the population density of seniors over the age of 65 is above average; (measured using Statistics Canada Census Tracts);
- Wheel-Trans is making 25-30 short-distance trips (< 7km) daily in a concentrated area of the City to common destinations, and these trips could be accommodated on conventional services.

Access distance to the route for targeted customers (as outlined above) should not exceed a walk distance of 175 metres. This figure is in line with the average walking speed for seniors, 1 meter per second, and an average route access time of two and a half to three minutes. Service to larger destinations and designated seniors' apartments should directly enter the driveway and serve the front door when possible. In general, routes should be implemented in areas where they do not largely overlap conventional services.

A community bus route should serve:

- A major shopping facility with a grocery store, bank and pharmacy.
- Hospital or major medical centre
- Community centre
- Library
- Other points of interest or cultural centres

Community bus route ridership is closely linked to demographic patterns and the availability of a niche set of trip generators. Therefore, frequent monitoring of demographic changes and the opening and closing of new shopping, health and community centres is required to ensure that routes continue to serve their intended customers and meet minimum performance standards.

6 Service Evaluation

The TTC regularly evaluates the performance of its services. The following sections outline the various ways in which service is evaluated to ensure that available resources are being used in the most effective manner.

6.1 Annual Performance Review

The Annual Performance Review provides a process with which to measure and evaluate system performance on a year-to-year basis. Under this program existing services are evaluated against the Performance Targets found in **Section 4** and measured against the Quality of Service Standards identified in **Section 3**.

The Annual Performance Review will include:

- a description of the performance of existing services;
- a general review of the effectiveness of the previous year's major service changes; and
- recommendations for major service reviews;

6.2 Annual Route Enhancement Plan

The Annual Route Enhancement Plan provides a process with which major service changes are evaluated. The plan also consists of a comparative evaluation of all proposed service changes in order to determine which proposals represent the best allocation of available resources.

During this process routes recommended for assessment from the annual performance review, in addition to feedback from customers and TTC staff, will be evaluated. Based on this analysis, TTC staff will propose major service changes. Minor service changes may also be identified at this time; however, they may be implemented as soon as possible, rather than waiting for the Annual Route Enhancement Plan. Major service changes considered in the Route Enhancement Plan can also be proposed through all of the same avenues as those considered in the various on-going service evaluation processes.

Major service changes which meet the performance standards and whose economic performance is expected to meet the minimum value for the customer change per dollar of net cost change are referred to the comparative evaluation process. The comparative evaluation process provides an objective and systematic procedure to rank these service changes with respect to their passenger and community benefits, compared to the cost of providing the services. This ranking provides an indication of how best to allocate limited TTC resources to obtain the most benefits from among the service changes proposed.

The proposed service increases are ranked using the number of customers gained per dollar spent: those that garner the most new passengers at the lowest incremental cost are ranked highest priority for implementation. The proposed service reductions are ranked using the customers lost per dollar saved: those that save the most money with the lowest loss of passengers are ranked highest priority for implementation.

Other evaluation criteria are also used in the comparative evaluation, as appropriate, to determine the rank of service change proposals. For example, higher priority would be given to a proposed change that improved a route's performance on one or more of the service standards. After the rankings are completed, the savings from the major service reductions are compared to the cost of major service enhancements to help select the proposed service changes. The goal is to maximize ridership and service performance in a cost-effective manner. The final Route Enhancement Plan will include:

- recommendations for major service changes; and
- a discussion of service changes that were considered and/or evaluated, but are not recommended at the time.

The TTC will conduct a comprehensive network review every 5-10 years. This review includes a review of the entire network structure and performance.

6.3 Ridership Monitoring and Service Adjustments

TTC staff is continuously adjusting transit service levels and hours of operation to match changing customer needs. Ridership counts, customer communications and observations from operating staff are reviewed and analyzed. When passenger counts show that services are overcrowded, the service is made more frequent, to increase the passenger-carrying capacity. Service increases are guided by the vehicle crowding standards. Adjustments can also be made to the start and finish times of service, running time and to the scheduled trip times. Minor routing changes using weighted passenger minutes (see **Section 5.1.1**) can also be made. These changes are made ten times throughout the year, subject to the availability of operating resources in the budget.

6.4 Review of Customer Feedback

TTC staff is constantly reviewing suggestions and complaints from customers. This source of input provides additional information for adjusting service with respect to the intervals between vehicles, the start and finish times and other service details.

6.5 Route Management

Each operating division is constantly measuring and monitoring service reliability and operations. The results are based on the real-life, day-to-day observations of operating staff and the input they receive from customers and are used to improve TTC service.

6.6 Post-Implementation Reviews

Every new service that the TTC introduces is initially operated for a trial period of at least twelve months, during which the service is promoted, and a consistent ridership level becomes established. Monitoring will be performed at regular intervals to ensure that the new service is trending towards the appropriate standard. A formal evaluation will be conducted after twelve months, the performance of the route is reviewed, and a recommendation is made regarding its future. Service changes are reviewed to ensure that the original objective of better service for customers has been met. New routes, extensions, and additional periods of service, which have been introduced at an additional cost, undergo a financial review to check that the service meets the TTC's financial standard. The review also considers comments that have been received from customers and the experience that has been gained in operating the service.

A service change which has met its performance objectives is recommended to be made a regular part of the TTC system. If a service change has been unsuccessful in some way, then a recommendation is made to either make further changes or to remove the service.

The compulsory post-implementation review of every trial of a service change ensures that the success or failure of every service change is assessed consistently and fairly and that there is full accountability to the Commission on matters which affect the service that is provided to customers.

Appendix 1 - Technical Background Paper – Change in Ridership per Net Dollar

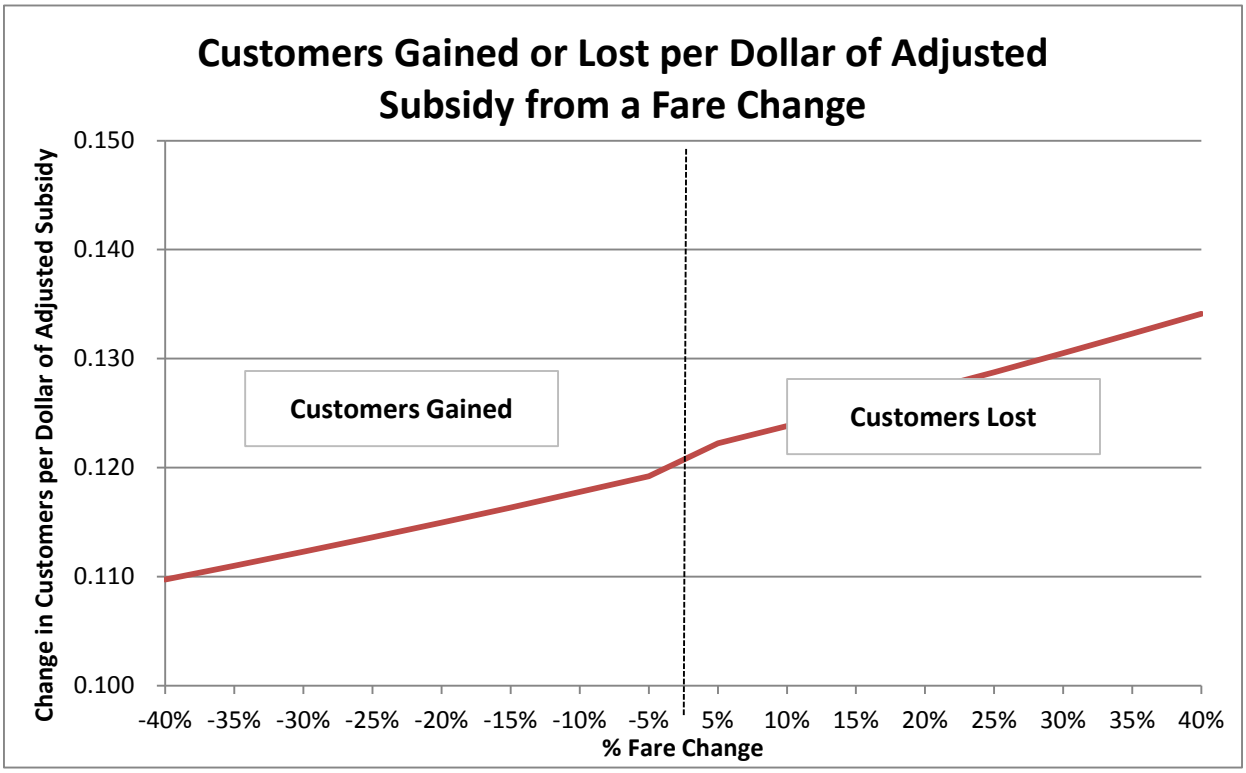
The TTC measures return on investment through the change in ridership per net dollar metric. The goal of this measure is to ensure that service changes achieve better ridership results than would be achieved through fare changes.

The metric compares services changes to fare changes because both result in a) changes to ridership and b) changes to subsidy. Service increases and fare reductions result in increases in ridership and subsidy. Service reductions and fare increases result in reductions in ridership and subsidy.

As seen in the table below, ridership effects from service and fare changes balance at 0.12 customers gained or lost per dollar spent or saved. The graph below illustrates that the value of 0.12 remains basically unchanged for almost any reasonable percent change in average fare.

The table and graph show that a reduction in fare will gain 12 new customers per $100 spent. An increase in fare will lose 12 customers per $100 saved. All service changes (outside changes required for passenger comfort and schedule adherence) must do better than this threshold. Service increases must gain 12 or more new customers per $100 spent and service reductions must lose less than 12 customers per $100 saved to be worthwhile. This metric is not intended to replace the cost recovery targets set through the budget process but is intended to ensure service changes yield the best results.

Customers Gained or Lost per Dollar of Subsidy Adjustment from a Fare Change **2015 Inputs** Annual Fare Paying Customers: 535M Annual Fare Revenue $1,108M Revenue Per Passenger: $2.07 Assumed Fare Elasticity: -0.20
For a 10% Fare Increase / Decrease: Annual Passengers Gained / Lost: (535M x –0.20 x .1) = 10.7M New Annual Fare Revenue: ((535M – 10.7M) x $2.07 x 1.1) = $1,194M New Change in Fare Revenue (or Adjusted Subsidy): ($1,194M - $1,108M) = $86M
Passengers Gained or Lost per Dollar of Adjusted Subsidy (10.7M/$86M) = 0.12



The standard is applied this way: If additional subsidy is available, new services will not be introduced if the number of customers gained per dollar spent is below 0.12, as the additional funds would be better spent to defer or decrease the average fare in order to grow ridership. Services which are on trial will be eliminated if the number of customers gained per dollar spent was below 0.12. Other services which are already being operated will be modified to reduce their costs or to increase fare revenue if the number of customers gained per dollar spent is below 0.12. If no suitable changes can be found for routes on which the number of customers gained per dollar spent is under 0.12, and if service reductions are required, either because of declining ridership or reductions in funding, then these services would be recommended for removal.

If service cuts were to be required because of reductions in funding, or because of declines in ridership, the services with the poorest financial performance would be the ones selected to be removed. This would ensure that the service cuts would result in the least possible decline in ridership and thus the least possible loss of fare revenue.

This systematic approach of measuring financial performance, matching supply and demand and determining the effects on customers ensures that, if services must be reduced to re-allocate resources or to meet budgetary requirements, the reductions will be made where the removal of service would have the least detrimental effect on customers' travel needs and the TTC's financial situation.

Appendix 2 – Technical Background Paper – Comparison of Effect on Customers (Weighted Travel Time)

Components of a transit trip

There are four main components of a transit trip: walking to a stop, waiting for the vehicle to arrive, riding in the vehicle and transferring from one vehicle to another. Customers may perceive that certain components are more onerous, or are a greater inconvenience than others. Research indicates that in-vehicle travel time (IVTT) is the least onerous or most satisfying part of making a trip; when a customer is travelling on the vehicle or is "on his or her way", there is clear progress towards the destination. However, other parts of making a trip, such as waiting for a vehicle or transferring between vehicles, may be perceived to be less satisfying because, instead of producing a sensation of progress towards one's destination, these activities may be considered to be "delays" or "obstacles" to actual travel.

For example, customers who have waited two-to-three minutes for a bus may claim that they would rather spend ten additional minutes of in-vehicle travel time to arrive at, say, a subway station than to transfer from one route to another in order to arrive at a closer connecting subway station. In each of these instances, the perceived inconvenience of waiting or transferring is greater than what the customer actually experiences. The customer is, therefore, placing greater "weight" or importance on the inconvenience of waiting for, or transferring between, transit vehicles than they place on the actual in-vehicle travel time component of the trip. It is therefore reasonable for such weights or customers' perceptions of importance to be reflected in the evaluation and decision-making processes regarding proposed changes to transit service. Service standards incorporate weights for various components of transit trip-making.

Use of weights in the application of service standards

Transit planners estimate weighted travel times when they are investigating service changes. These service changes can be in any of the following forms:

- change in routing
- change in speed (eg. TSP measures)
- change in hours of operation

The above service changes could result in any of the four transit trip components being affected. For example, a change in routing could cause customers to have a longer/shorter walk and/or a longer/shorter in-vehicle travel time.

The weights that are applied to each component of a trip were developed from research based on surveys of travel behaviour. With the use of these weights, it is possible to predict customers' travel patterns.

Weighting factors used in TTC's service standards have been derived from the calibration of our transit assignment model MADITUC using detailed transit travel information from participants in the Transportation Tomorrow Survey. A re-calibration of our model in early 2016 has shown that our weights have not changed much from our previous calibration exercise. Thus the following weights are applied by transit planners when investigating service changes.

Trip component	**Weight**
Each minute of in-vehicle travelling time	1.0
Each minute of waiting time	1.5
Each minute of walking time	2.0
Each transfer	10.0

These weights imply, then, that one minute of walking time is equivalent to two minutes of in-vehicle travelling time, that one minute of waiting time is equivalent to 1.5 minutes of in-vehicle travel time, and that one transfer is equivalent to 10 minutes of in-vehicle travel time. Using the transfer weight as an example, customers have been observed to ride up to 10 minutes longer in a bus to avoid making a transfer.

To make recommendations on proposed service changes, the change in weighted travel time is calculated for each group of customers who are affected by a change, both those for whom the change will improve their service and those for whom the change will cause an inconvenience. The change in time of each component is multiplied by the number of customers affected by the change and by the weight of the component. The numbers for all the groups are then added, to arrive at a change in weighted travel time.

Proposals which have an overall benefit for customers are those with a net reduction in weighted travel time. These beneficial proposals will also, over time, attract increased numbers of customers to the TTC's transit services.