Short-Range Planning Practice

Outline

1. Definition & Introduction
2. Measures and Standards
3. Current Practice & Critique

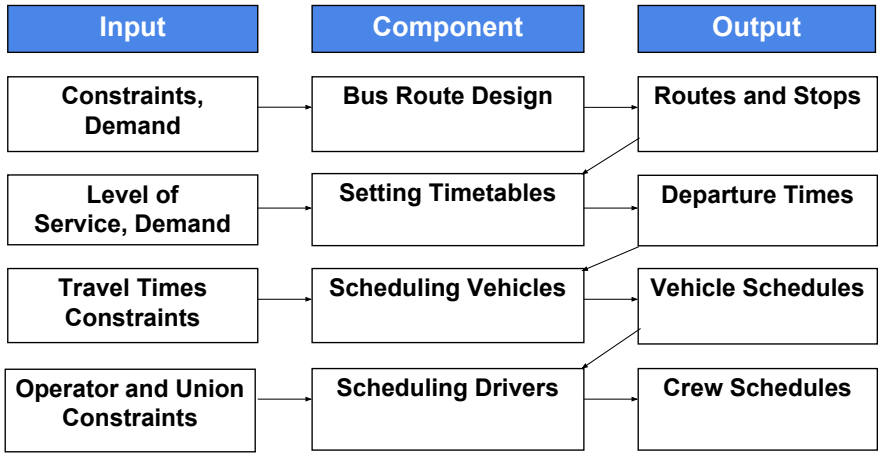
Public Transport Planning

- Long Range (> 3 Years)
  - Major Capital Investment: Infrastructure
  - Major Institutional Changes
- Medium Range (1 - 3 Years)
  - Bus Network Structure
  - Network Size
  - Fleet Size
  - Fare Policy and Technology
- Short Range (< 1 Year)
  - Route Structure
  - Service Frequency
  - Vehicle and Crew Scheduling
- Control (Real Time)
  - Revise Route of Specific Vehicle
  - Revise Schedule of Specific Vehicle

Major Planning Elements

- Data Collection
- Problem/Opportunity Identification
- Design Options/Strategies
- Cost Estimation
- Ridership/Revenue Estimation

Operational Planning Process



Service and Operations Planning Definitions

Service Planning

Defines services as understood by the public

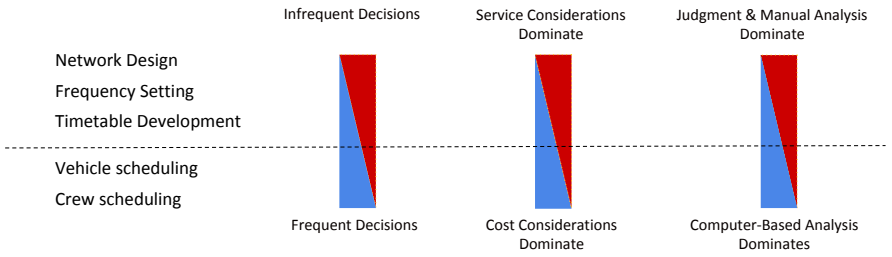
- Network of routes and stops
- Service spans and frequencies
- Timetables

Operations Planning

Defines how operations occur to produce the service

- Vehicle scheduling
- Crew scheduling

Decision Characteristics



Classical Evaluation Structure

GOALS

↓

OBJECTIVES

↓

MEASURES

↓

STANDARDS

Transit Service Guidelines

Purpose

- Communicate to the public and their representatives how decisions are made on changes in the transit network and allocation of resources
- Ensure provision of an acceptable level of service quality to customers on all services
- Provide a consistent and fair basis for:
  - evaluating proposed improvements to existing services
  - considering new services
- Balance improvements to level of service with efficient use of resources

Adapted from TransLink Service Guidelines: Public Summary Report. Greater Vancouver Transportation Authority, 2004

Aspects Covered by Service Guidelines

- Service Design
- Operating Performance
  - Service Quality
  - Economic/Productivity

Factors of Service Quality

Availability	Comfort and Convenience
Frequency	Passenger Load
Service Span	Reliability
Access	Travel Time

Top Drivers of Perceived Service Quality

1. Frequency
2. Waiting Time
3. Reliability
4. Access (closeness to origin and destination)

Source: Transit Capacity and Quality of Service Manual

Service Design: Span of Service

Most agencies have guidelines covering span of service.

Example MBTA Bus

The first trip should arrive no later than, and the last trip should depart no earlier than, the times shown below (for local bus service):

Weekdays 7 a.m. – 6:30 p.m.

For higher density areas only:

Saturdays 8 a.m. – 6:30 p.m.

Sundays 10 a.m. – 6:30 p.m.

TransLink Convenience Objective

Minimum Service Guidelines to ensure that 95% of trips listed can be completed at the times shown

LATEST ARRIVAL TIME OF FIRST TRANSIT TRIP IN MORNING			
SERVICE	**WEEKDAYS**	**SATURDAYS**	**SUNDAYS & HOLIDAYS**
From any point to Downtown Vancouver	7:00 AM	8:00 AM	9:00 AM
From any point to nearest town centre	7:00 AM	8:00 AM	9:00 AM
EARLIEST DEPARTURE TIME OF LAST TRANSIT TRIP IN EVENING			
SERVICE	**WEEKDAYS**	**SATURDAYS**	**SUNDAYS & HOLIDAYS**
From downtown Vancouver to any town centre	Midnight	Midnight	11:00 PM
From town centre to any adjacent town centre	Midnight	Midnight	11:00 PM

Service provided to major regional activity centres should correspond to customary opening and closing times, but can be provided beyond these hours if it is cost-efficient.

Service Design: Route Design

Most agencies with route design guidelines include:

- Population density
- Employment density
- Spacing between routes

Other primary concerns in route design:

- Service to unserved areas
- Direct, non-circuitous routing

Coverage Example

MBTA: The MBTA has a policy objective to provide transit service within walking distance (defined as 1/4 mile) of all residents living in areas with population densities greater than 5,000 people per square mile.

Typical Stop Spacing (by system)

Stops per mile	% of systems
< 4	9
4	21
6-8	51
10-12	13
12	6

TransLink Comprehensiveness Objective

- At least 90% of all residents and employees in urbanized development areas should have a walk of less than 450 metres to a bus stop.
- 98% of all peak period transit trips to/from Downtown Vancouver should require no more than one transfer
- 95% of all peak period transit trips to the nearest town centre should require no more than one transfer
- All transit trips between one town centre and adjacent town centres should require no transfers
- 95% of all peak period transit trips to major regional activity centres and passenger gateways should require no more than two transfers

TransLink Route Design Guidelines

Deviations from the most direct route, must have walking time savings for customers on the added route section greater than the increase in total travel time for through passengers.

Minimum Bus Stop Spacing	
Bus	250 m (but both near & far-side stops permitted at major transfer points)
Express Coach	250 m (in local service area)
B-Line	500-1,500 m average spacing on route
Community Shuttle	Flexible to serve local conditions

Service Design: Schedules

Most agencies have guidelines for scheduling based on

- Maximum (policy) headways
- Maximum passenger crowding

Policy Headway Example (MBTA)

Maximum headway on all local bus routes should be 30 minutes in the peak and 60 minutes at other times. For express service there should be at least 3 trips in each peak period.

Maximum Passenger Crowding Example (MBTA)

On the Green line (light rail) the maximum passengers per car should be no more than 225% of the seats in the peak period. In the off peak the maximum passengers per car should be no more than the seated capacity except in the central subway where it should be no more than 140% of the seated capacity.

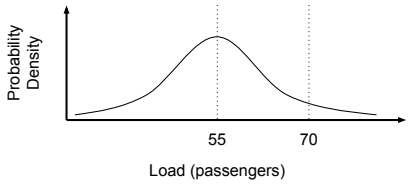
TransLink Frequency Objective

	Weekday peak & mid-day periods	Evenings and weekends
SkyTrain (ALRT)	5-6 minutes	8-10 minutes
B-Line (BRT)	10 minutes	15 minutes except early AM and late PM
West Coast Express	30 minutes	
Bus*	at least every 30 minutes	

* Bus services without timed connections at transit stations, bus loops or major street intersections should provide service every 15 minutes or better in peak and midday periods and every 20 minutes or better in the evening.

Setting Load Standards: Peak Load

- Peak half-hour
  - avoid such high loads that
    - passengers frequently cannot board the first vehicle to arrive
    - vehicles encounter high dwell times
  - acceptable load of about 70 passengers for a standard 40 ft. bus
    - acceptable average load (at maximum load point) of 55 passengers



- Other times
  - normally expect to provide a seat for all passengers
  - acceptable average load of about 40 passengers for a standard 40 ft. bus

TransLink Comfort Objective: Bus

Maximum Number of Passengers On-Board (standing passengers)*			
Bus Type	**Peak 15 min in AM & PM peak**	**Peak 30 min in AM & PM peak**	**Weekday Mid-day, Evening, Weekends (peak 60 min.)**
12-m high floor trolley coach (38 seats)	60 (22)	55 (17)	45 (7)
12-m low floor bus (38 seats)	55 (17)	50 (12)	45 (7)
12-m highway coach (47 seats)	50 (3)	47 (0)	47 (0)
18-m low floor articulated bus (54 seats)	85 (31)	75 (21)	65 (11)

* These guidelines are for the highest passenger loads averaged for all bus trips on a route within the busiest 15 minutes and 30 minutes in peak periods and over 60 minutes in off-peak periods. Passenger loads on some individual bus trips may exceed the guidelines.

TransLink Comfort Objective

Service	**Level of compliance**	**Maximum customer standing time**
SkyTrain	95%	≤ 20 minutes off-peak periods
Bus	90%	≤ 30 minutes peak periods
	95%	≤ 30 minutes off-peak periods
West Coast Express	90%	≤ 30 minutes peak periods
West Coast Express	≤ 5 standees average over peak 60 minutes	

TTC Loading Standards

Acceptable Maximum-Hour Average Vehicle Loads at Peak Flow Point
(Passengers Per Vehicle)

	Peak Periods	**Off-Peak Periods**	
Vehicle Type	All Routes	High Frequency headway < 10 min	Low Frequency headway > 10 min
40-ft Bus	50-57	35-49	28-39
50-ft Streetcar	74	58	46
75-ft Articulated Streetcar	108	76	61
6-car Subway Train	1100	400-500	--

Service Quality

- Most agencies have formal procedures for monitoring service delivery focusing on on-time performance
  - typically defined as 0 minutes early to 5 minutes late.
  - about two-thirds of agencies report rush hour on-time performance of 90% or above
- Most agencies also keep route level information on
  - Passenger complaints
  - Missed trips
  - Accidents

Service Reliability

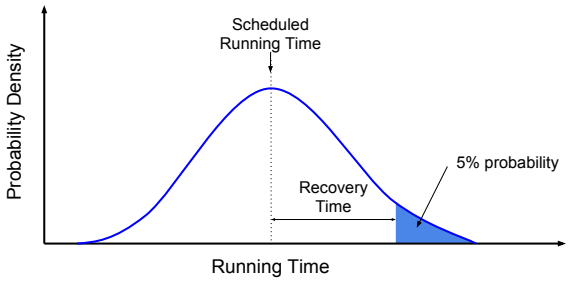
- Walk-up service
  - typically defined as headway < 10 minutes
  - performance measurement based on headways
- Scheduled service
  - typically defined as headway ≥ 10 minutes
  - performance measurement based on punctuality
- A trip is defined as “on time” (or not) at each time point based on performance windows
- Performance is reported in terms of the percentage of observations classified as “on time”

Service Reliability Example: MBTA

- Walk-up service
  - at origin and time points
    - actual headway < 1.5 scheduled headway
  - at destination terminus
    - actual running time between 0.8 and 1.2 of scheduled running time
- Scheduled service
  - at origin terminus
    - actual departure between 0 and 3 minutes after scheduled departure
  - at time points
    - actual departure between 0 and 7 minutes after scheduled departure
  - at destination terminus
    - actual arrival between 3 minutes before and 5 minutes after scheduled arrival
  - at route level, 75% of time points must be “on-time”

Reliability

If you want 95% of departures to be on-time



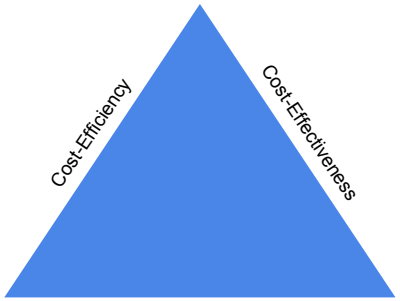
Assuming normally distributed running times, this implies a recovery time of 2 times the standard deviation.

TransLink Reliability Objective

Service	Level of Compliance	Deviation from Scheduled Times
SkyTrain	98%	≤ 2 minutes delay in trips
SeaBus	98%	arrival/departure ≤ 3 minutes late
West Coast Express	98%	arrival ≤ 5 minutes late
Bus	90%	depart terminus ≤ 2 minutes late, but not early
	85%	depart mid-route timepoints ≤ 3 minutes late, but not early
	90%	arrive at terminus ≤ 3 minutes late

Inputs, Outputs, and Consumption

Service Inputs
Labor
Capital
Fuel



Service Outputs
Vehicle Hours
Vehicle Miles
Capacity Miles
Service Reliability

Service Consumption
Passengers
Passenger Miles
Operating Revenue
Operating Safety

Alternative Benefit Measures

	Advantages	Disadvantages
Revenue	relevance to financial concern	discounts value of reduced fare trips
	related to willingness to pay	favors higher income passengers
Passengers	reflects number of people who benefit	doesn't reflect trip length
	values each passenger equally	reflects unlinked trips not linked trips
Passenger Miles	weights longer trips more	hardest to measure
	most reflective of some benefits	favors higher income passengers

Alternative Cost Measures

	Advantages	Disadvantages
Net Cost	usually most directly constrained	hardest to estimate
Cost	may also be directly constrained	hard to estimate
Vehicle Miles	easy to measure	directly reflects only 30% of bus costs
		penalizes fast services
Vehicle Hours	easy to measure	doesn't reflect cost differences between peak and off-peak services
	related to >50% of bus costs	

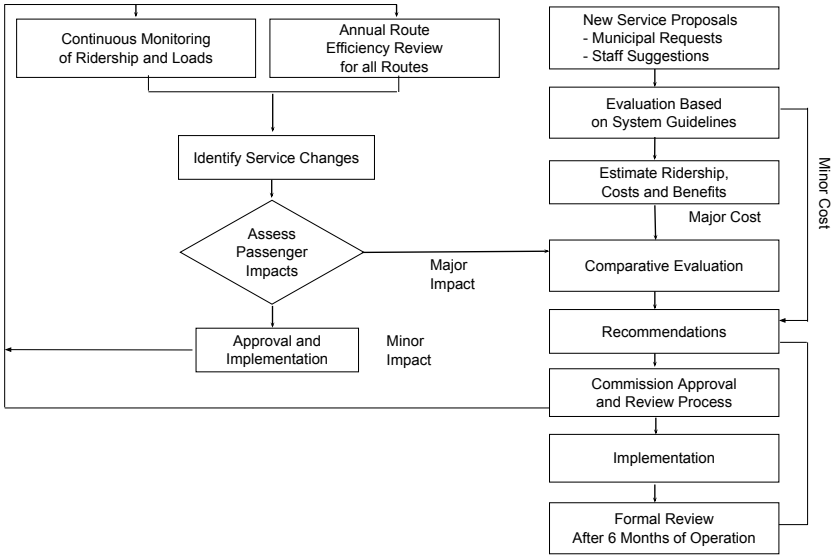
Cost-Effectiveness Standard Example: MBTA

- **Measure** Net Cost/Passenger
- **Standard** $NCP_i < 3\ NCP_{sys}$

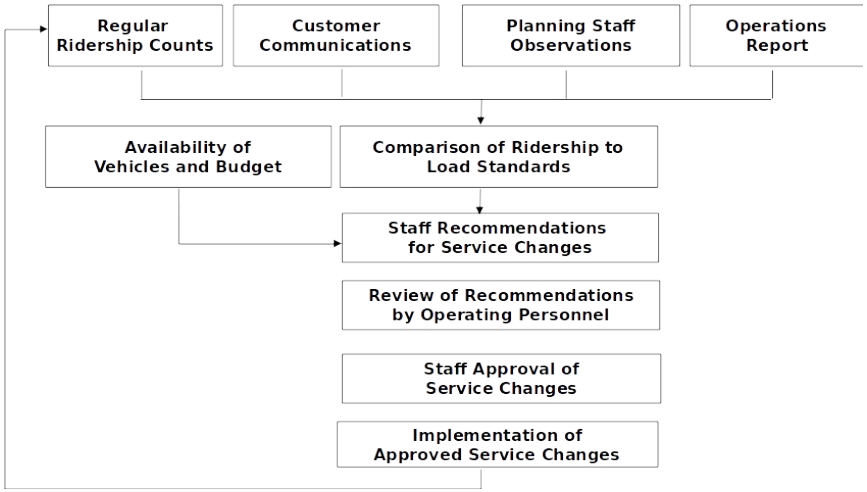
Issues in Setting Up a Short-Range Transit Planning Process

- Role of budget constraints in the process
  - before budget is set
  - after budget is set
- Role of standards and constraints vs investing resources to obtain best ridership results
- Consideration of new service options vs protection of existing services
- Allocation of analysis/planning effort to "problem" routes vs other routes
- What form of standards/guidelines to use
- Focus on individual routes not route as component of system

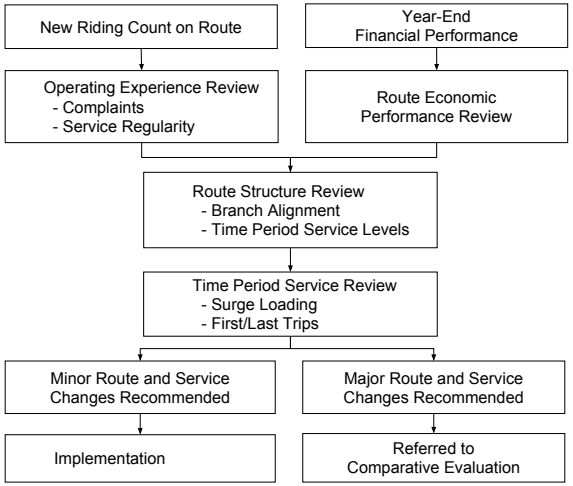
TTC Service Standards Process: Overview



TTC Service Standards Process: Ridership Monitoring and Service Adjustment



TTC Service Standards Process: Route Efficiency Review Program



TTC New Services Criteria

1. Must serve people beyond 300 meters from current TTC service
2. Must maximize interconnections with rapid transit
3. Must result in a net benefit for customers
   - net benefit is measured by change in weighted travel time, which is the sum of
     - 1.0 in-vehicle travel time
     - 1.5 waiting time
     - 2.0 walking time
     - 10.0 number of transfers

TTC Financial Standards and Comparisons

- Service change proposals are evaluated according to customers gained (lost) per dollar spent (saved)
  - new service proposals
  - possible service reductions
  - fare changes
- The financial unit is the net cost (cost − revenue) associated with the change.
- Currently, the threshold for new service is 0.23 new customers per dollar spent.
- Services with performance of less than 0.23 customers per dollar spent are examined for possible cost reduction annually.

Service Change Process

- Major service changes are evaluated twice per year
  - ranking against other proposals
  - productivity for existing services
- Board provided with
  - recommended service changes
  - ranked list of all other proposals evaluated
  - system average performance
- Experimental services are designated and evaluated after six months operation

TransLink Service Optimization Program

Guiding Principles

- Maintain basic service for transit dependent customers
- Maintain services that are strategic for network connectivity
- Minimize service reductions in areas with no transit alternatives
- Support growing markets where productivity is improving
- Re-invest in services to generate higher revenue ridership and/or address overcrowding
- Re-invest in services that support TransLink's long-term goals and objectives

A Critique of Current Practice

- Focus is on poorly-performing routes.
- Data limitations, both type and quality.
- Measures not always closely tied to objectives.
- Focus on individual route performance rather than network contribution.

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