



BOSTON REGION METROPOLITAN PLANNING ORGANIZATION

Richard A. Davey, MassDOT Secretary and CEO and MPO Chairman
Karl H. Quackenbush, Executive Director, MPO Staff

MEMORANDUM

DATE October 4, 2012
TO Boston Region Metropolitan Planning Organization
FROM Karl H. Quackenbush
CTPS Executive Director
RE Work Program for: MBTA Service Standards and Service Delivery Policy Update

Action Required

Review and approval

Proposed Motion

That the Boston Region Metropolitan Planning Organization, upon the recommendation of the Massachusetts Department of Transportation, vote to approve the work program for MBTA Service Standards and Service Delivery Policy Update in the form of the draft dated October 4, 2012.

Project Identification

Unified Planning Work Program Classification

Technical Support/Operations Analysis Projects

CTPS Project Number

11387

Client

Massachusetts Department of Transportation, Office of Transportation Planning
Project Supervisor: Scott Hamwey

CTPS Project Supervisors

Principal: Annette Demchur

Manager: Jonathan Belcher

Funding

MassDOT §5303 Contract #75366

Impact on MPO Work

The MPO staff has sufficient resources to complete this work in a capable and timely manner. By undertaking this work, the MPO staff will neither delay the completion nor reduce the quality of other work in the UPWP.

Background

The Service Delivery Policy (SDP) is the primary tool that the MBTA uses to guide the design and evaluation of transit services to meet the needs of the riding public. To do so, the SDP identifies quantifiable service standards with associated performance metrics and thresholds. The SDP also outlines a planning process that applies the service standards to identify where service improvements are needed and that solicits meaningful public engagement in the development of service change recommendations. The MBTA's current SDP was first formulated in 1996 in response to a study that examined the service standards and service planning methods used by other North American transit systems.¹

In 1996, it was anticipated that the SDP would need to be updated over time, particularly as new technologies enhancing the ability to collect and analyze data become available. Minor updates to the SDP occurred in 2002, 2004, 2006, 2009, and 2010. As the MBTA continues to face significant budget shortfalls and growing debt, it seems prudent to re-evaluate both the service standards and service planning processes found in the SDP in a comprehensive way. By doing so, the MBTA may determine whether service efficiencies could be gained by adding to or changing the standards and/or metrics, adjusting the thresholds associated with the standards, and/or adapting the process through which the standards are applied.

Objectives

The primary objective of this study is to evaluate and update the MBTA's Service Delivery Policy, including the service standards, with their associated metrics and thresholds, and the service evaluation process. To do so, CTPS will update some of the data sources used in service planning and evaluation and develop some new sources, develop cost allocation models to support the evaluation of MBTA service productivity, update the standards used for evaluating service, and develop a methodology for making comparative service evaluations using the new standards. The revised Service Delivery Policy will provide the tools needed for the MBTA to analyze existing services and to determine ways in which they could be restructured to reduce operating costs while maintaining ridership and revenue.

¹ "Final report: Design of Service Quality Measures and Service Evaluation Standards," MacDorman & Associates, Dr. Nigel Wilson, November 27, 1995.

Work Description

The work required to accomplish the project objectives will be carried out in five tasks, programmed to occur over two 12-month periods, as described below. Tasks 1 and 2 are programmed to be performed over 12 months. Task 3 will be commenced, but not concluded, during the course of the Task 1 and 2 work. Tasks 4 and 5 are programmed to be performed during a subsequent 12-month period; task 3 will be resumed and completed during that period.

Task 1 Develop and Update Data Sources

Some of the performance metrics currently in use, or that may be adopted, require accurate ridership information. The MBTA currently has the ability to collect ridership information using automated passenger counters (APC) and automated fare collection (AFC). However, the raw data have limited utility. This task includes several subtasks aimed at developing tools to process, summarize, and analyze the data.

Subtask 1.1 Update Existing Ridership Database and Incorporate APC Data

The current version of the CTPS bus ridership database application was developed in 2004, and the application code is now outdated. Once CTPS moves to Microsoft Office 2010 the current application will cease to function. In this task, CTPS will build a new application using the Microsoft Visual Studio 2010 development platform, which will allow us to continue to make use of the existing database tables and report templates.

The existing database is populated with manually collected ridership data. The update will include changes to the existing table structures to facilitate incorporation of the APC ridership summaries.

Subtask 1.2 Develop AFC Database

CTPS has demonstrated the use of AFC data to estimate passenger trip paths and how this data can help to summarize passenger trip patterns in terms of transfers, passenger line volumes, and average trip lengths. In order to use these data, however, data from the AFC system need to be regularly collected and summarized appropriately. In this task, CTPS will develop a system for regularly downloading, analyzing, and summarizing AFC data.

Subtask 1.3 Development of Origin-Destination Model Using AFC Data

The MBTA CharlieCard Trip Paths Pilot Study conducted by CTPS created a set of computer programs to generate station-to-station trip tables for the MBTA rail rapid transit system. These used daily station entry reports from the MBTA's AFC system as input. The trip tables generated by the existing programs do not separate passengers by mode of access to or egress from the rapid transit system. However, with additional programming it would be feasible to produce tables for subgroups such as station-to-station travel by

passengers transferring to or from MBTA buses, commuter rail trains, or commuter boats.

This task would: create the additional programming needed to more fully automate the steps used in converting the data from the AFC records from the format in which they are obtained from the MBTA into the input format required by the CTPS programs; complete work that was begun to create hourly trip tables; generate transfer tables; and produce written documentation of the expanded program, including its input requirements and instructions for how to use it to generate the various summary tables.

Products of Task 1

APC database, AFC database, and expanded origin-destination model with written documentation.

Task 2 Develop and Calibrate Cost Allocation Model

During development of the MBTA's biennial Service Plan, potential major changes are assessed through a comparative evaluation to determine which represent the best allocation of available resources. As a part of the 1996 Service Delivery Policy, the MBTA developed the net cost per passenger standard to measure the cost-effectiveness of bus routes. The net cost per passenger for any given route is calculated by subtracting the service revenue from the total operating cost of the route and dividing by the number of boarding customers. This is the driving standard used by the MBTA to compare the productivity of bus routes when evaluating service.

Because one of the main factors considered in evaluating service is the net cost per passenger, it is important to have an accurate determination of the operating cost per unit of service. For bus service, the MBTA uses a fully allocated cost model in the comparative evaluation of net cost per passenger and a variable cost model for the estimation of incremental cost impacts of service changes. These models have not been revised since 1996; in addition, the MBTA does not have a cost-allocation model for the other modes it operates (expenses vary significantly by mode of operation). In this task, the existing bus cost allocation model will be reviewed and revised as appropriate, and new models will be developed for trackless trolley, light rail, heavy rail, commuter ferry, and commuter rail.

Subtask 2.1 Review Existing Model

CTPS will review the existing bus cost allocation model to establish a baseline for developing the new bus cost allocation model. This review will be used to identify the modifications that should be incorporated in the new model as well as to determine a methodology for developing cost allocation models for the other modes of transit that the MBTA operates.

Subtask 2.2 Assemble Financial Data

A fully allocated cost model requires a complete accounting of the cost of all labor, capital, and material resources used in the delivery of transit service. This task will focus on assembling one year of cost data from the MBTA, by mode when relevant. These data will be collected at the most disaggregate level possible, to maximize accuracy of allocation.

Subtask 2.3 Assemble Operating Data by Mode

The MBTA's current cost allocation model uses three cost drivers – factors that closely approximate the way costs are consumed over time – as variables for allocating expenses: vehicle hours, vehicle miles, and peak vehicles. In this task, operating data for the allocation variables will be assembled for the same time period as the financial data. These data will be utilized at various levels of aggregation to evaluate routes, route segments, time periods, etc.

Subtask 2.4 Calibrate the Cost Allocation Model for Each Mode (Bus, Trackless Trolley, Light Rail, Heavy Rail, Commuter Ferry, and Commuter Rail)

Development of a basic cost allocation model for each mode consists of three tasks for each:

1. Assign expense categories from subtask 2.2 to the allocation variables identified in subtask 2.3 (vehicle hours, vehicle miles, and peak vehicles) that they are most clearly associated with. For example, fuel costs will be allocated to vehicle miles, since the number of miles operated reflects the rate of fuel consumption. This assignment of expenses to allocation variables will be used to develop the costs associated with each allocation variable.
2. Calculate the average unit cost for each allocation variable by totaling the costs assigned to each allocation variable and dividing that total by the aggregate value of the allocation variable.
3. Use the resulting values to define the coefficients of the cost allocation model.

The fully allocated model for each mode will be converted to a variable cost model that will only use vehicle hours and vehicle miles (costs associated with peak vehicles are fixed costs, so would not be included in the variable model) for use in estimating the incremental costs of service changes. Because the cost of providing service is higher in the peak periods than in the off-peak, the basic models will be developed for different time periods (peak vs. off-peak).

Subtask 2.5 Document Cost Allocation Model for Each Mode (Bus, Trackless Trolley, Light Rail, Heavy Rail, Commuter Ferry, and Commuter Rail)

CTPS will prepare documentation of the cost allocation models that will include the inputs and methodology used.

Products of Task 2

A cost allocation model for each mode (bus, trackless trolley, light rail, heavy rail, commuter ferry, and commuter rail), with accompanying documentation

Task 3 Establish Service Delivery and Service Standards Technical Advisory Committee

Implementation of the 1996 Service Delivery Policy (SDP) was guided by a Service Standards Technical Advisory Committee (SSTAC) that advised the MBTA on the types of activities needed to fully develop and implement the recommendations of the study on which the SDP was based. When the 1996 SDP was first used, in 1998, it became clear that some of the service standards needed to be revised to provide meaningful information for evaluating services. The SSTAC was re-established in 2002 and was instrumental in developing the changes made to the SDP in 2002, 2004, and 2006.

In this task, CTPS will establish a similar group of experts and interested parties to advise the MBTA on revisions to the SDP and service standards. It is anticipated that this group will meet up to eight times. The initial meeting(s) will help ensure that all relevant issues have been identified, and additional meetings will be held as needed to discuss potential changes to the SDP and service standards.

Products of Task 3

The formation of a technical advisory committee, associated meetings, and notes on comments and concerns raised at the meetings.

Task 4 Update and Refine Service Standards

The MBTA Service Delivery Policy establishes the following service objectives, which define the key performance characteristics of quality transit services:

- Accessibility (services should be geographically available throughout the community and should operate at convenient times and frequencies)
- Reliability (services should be operated as scheduled)
- Safety (services should be provided in a safe manner)
- Comfort (services should offer a pleasant and comfortable riding environment)

- Cost Effectiveness (services should be tailored to target markets in a financially sound and cost-effective manner)

To measure progress toward meeting these objectives, the SDP identifies quantifiable service standards and the metrics that are used to measure them. The MBTA's existing service standards, as described in its SDP, are:

- Coverage (how far a customer has to walk to reach a transit service)
- Span of Service (the hours in which transit operates, measured using the times at which a service begins and ends service)
- Frequency of Service (how often transit operates)
- Schedule Adherence (how actual service times compare to schedule times, generally measured either by comparing arrival/departure times to the published timetables or by measuring how well headways adhere to scheduled headways)
- Vehicle Load (the number of passengers per vehicle, generally measured using the average of the vehicle loads over a given time period)
- Net Cost per Passenger ($\frac{\text{Operating Costs} - \text{Service Revenue}}{\text{Boarding Customers}}$)

While the MBTA's existing service standards provide a comprehensive evaluation of service structure, provision, and efficiency, the MBTA currently faces a number of challenges that suggest that the existing standards and the services that they govern may need to change. Modifications to the existing standards, as well as the adoption of some potential new types of standards, may result in performance measures that are better tailored to the current fiscal environment. In addition, the enhanced capabilities for collecting and analyzing data developed in task 2 may suggest the need for refinement of the standards. This task will include a critical review of the MBTA's service standards, with an eye toward updating the standards utilized so that they reflect the fiscal restraints facing the MBTA, as well as more accurately reflect the customer experience.

Subtask 4.1 Assess Existing Standards and Determine Utility of Additional Standards

Working with the Service Delivery and Service Standards Technical Advisory Committee, the service standards used at the MBTA will be assessed and additional metrics that could potentially be used to evaluate service will be identified. This task will draw from the findings of the CTPS Core Efficiencies Study, which reviews service standards used at the MBTA and peer transit agencies and identifies potential new service standards that reflect the changing ways in which MBTA service is perceived and utilized. The standards recommended in that study will be considered along with any additional

standards proposed by the Technical Advisory Committee and any standards that utilize the databases developed in task 2.

Subtask 4.2 Analyze Existing Thresholds and Potential Additional Thresholds

The databases and analytical tools developed in task 1 will be used in conjunction with the standards proposed in subtask 4.1 to assess, and revise if appropriate, the thresholds for the existing standards and to facilitate determination of thresholds for any new standards.

Subtask 4.3 Recommend Standards and Thresholds

Working with the Technical Advisory Committee, CTPS will make recommendations for an appropriate mix of service standards and related thresholds, taking into consideration the interplay between standards.

Products of Task 4

A technical memorandum documenting the recommended standards and thresholds

Task 5 Review Service Planning Process and Develop Methodology for Evaluating Service Using the Metrics Developed in Task 4

Major service changes (for example, cutting all or part of a route, extending an existing route, adding a new route, restructuring a route, or changing the span of service) are generally only proposed in the context of the service planning process for the MBTA's biennial Service Plan. Through this process, bus routes are evaluated against all of the service standards; however, the standard of net cost per passenger is the primary screening tool for identifying routes that may be candidates for elimination and for evaluating the effectiveness of all proposed service changes. Net cost is also the mechanism for prioritizing proposed major service changes for implementation through the Service Plan.

In addition to being proposed in the context of the Service Plan, major service changes are also sometimes proposed as a way to reduce operating costs when the MBTA faces a large budget shortfall. The net cost per passenger standard was the main tool used to determine the bus service reductions that were implemented in conjunction with the state fiscal year 2013 MBTA fare increase.

Although the net cost per passenger standard will continue to be an important measure of economic performance, a more nuanced approach to comparing route performance and prioritizing service changes is not only needed due to the continuing budget constraints, but is also now possible due to the quantity of data that are available through technologies such as APC, AFC, and automatic vehicle location (AVL). In this task, staff will develop a new service evaluation process that will incorporate the standards and thresholds developed in task 4

and will reflect the reality of long-term level funding. This new evaluation methodology will become the basis for developing the MBTA's biennial Service Plan and any other processes through which major service changes are proposed.

Product of Task 5

A technical memorandum documenting the methodology for evaluating service using the metrics developed in task 4

Estimated Schedule

It is estimated that this project will be completed two years after the notice to proceed is received. The proposed schedule, by task, is shown in Exhibit 1. The second, separately funded part of this project (consisting of Tasks 4 and 5 and the completion of Task 3) will not necessarily begin immediately upon the conclusion of the first part.

Estimated Cost

The total cost of the first 12 months of this project is estimated to be \$181,887. This includes the cost of 61.2 person-weeks of staff time and overhead at the rate of 96.58 percent. A detailed breakdown of estimated costs for the first 12 months of this project is presented in Exhibit 2. The second 12 months of this project will be funded under a different contract. An estimated cost for the second 12 months, including a detailed breakdown, will be submitted for review and approval at a later date.

KQ/AD/ad

Exhibit 1
ESTIMATED SCHEDULE
MBTA Service Standards and Service Delivery Policy Update

Task	Month																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1. Develop and Update Data Sources	A																							
2. Develop and Calibrate Cost Allocation Model	B																							
3. Establish Service Delivery and Service Standards Technical Advisory Committee							C																	
4. Update and Refine Service Standards												C												
5. Review Service Planning Process and Develop Methodology for Evaluating Service Using the Metrics Developed in Task 4												D												

Products/Milestones

- A: Databases, model, and documentation
- B: Cost allocation models and documentation
- C: Technical memorandum
- D: Technical memorandum

Exhibit 2

ESTIMATED COST

MBTA Service Standards and Service Delivery Policy Update, YEAR 1*

Direct Salary and Overhead									\$181,887
Task	Person-Weeks					Direct Salary	Overhead (96.58%)	Total Cost	
	M-1	P-5	P-4	P-3	Total				
1. Develop and Update Data Sources	7.5	19.7	1.0	6.5	34.7	\$53,828	\$51,987	\$105,815	
2. Develop and Calibrate Cost Allocation Model	5.5	11.0	1.0	8.5	26.0	\$37,939	\$36,641	\$74,580	
3. Establish Service Delivery and Service Standards Technical Advisory Committee	0.2	0.1	0.2	0.0	0.5	\$759	\$733	\$1,492	
Total	13.2	30.8	2.2	15.0	61.2	\$92,526	\$89,361	\$181,887	
Other Direct Costs									\$0
TOTAL COST									\$181,887

Funding

MassDOT §5303 Contract #75366

*Year 2 funding will be determined at a later date.