MEMORANDUM

DATE   June 21, 2012

TO   Boston Region Metropolitan Planning Organization

FROM   Karl H. Quackenbush
CTPS Executive Director

RE   Work Program for: MBTA 2013 National Transit Database: Directly Operated

ACTION REQUIRED

Review and approval

PROPOSED MOTION

That the Boston Region Metropolitan Planning Organization, upon the recommendation of the Massachusetts Bay Transportation Authority, vote to approve the work program for MBTA 2013 National Transit Database: Directly Operated in the form of the draft dated June 21, 2012.

PROJECT IDENTIFICATION

Unified Planning Work Program Classification
Technical Support/Operations Analysis Projects

CTPS Project Number
14333

Client
Massachusetts Bay Transportation Authority
Project Supervisor: Melissa Dullea

CTPS Project Supervisors
Principal: Liz Moore
Manager: Steven Andrews

Funding
Future MBTA contract

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 of nor reduce the quality of other work in the UPWP.

BACKGROUND

For many years, in support of the MBTA's National Transit Database (NTD) submittals to the Federal Transit Administration (FTA), CTPS has produced passenger-miles and boardings estimates for the MBTA's bus and trackless trolley system. In state fiscal year (SFY) 1996, the scope of the analysis expanded to include the heavy rail and light rail transit systems. In SFY 2000, the scope expanded again to include the MBTA commuter rail system.

This year, the MBTA would like to use its automatic passenger counter (APC) data to estimate the unlinked passenger-trips and passenger-miles traveled on its buses (listed in the NTD as motor bus). This would reduce the sample size of, and the costs associated with, ridechecks needed for the motor bus mode. However, the FTA will need to approve the MBTA's use of APC data. If the FTA does not allow the MBTA to use its APC data for this purpose, CTPS will employ the methodology it has used in past years. The present work program describes both the old and new methodologies.

OBJECTIVES

The primary objective of this project is to develop estimates of passenger-miles and boardings for the following MBTA transportation modes: motor bus, trackless trolley, heavy rail, light rail, and commuter rail. CTPS will also verify MBTA estimates of the average passenger trip length for the commuter rail mode. The data that will form the basis of these estimates will be collected in a variety of ways:

• Ridechecks on buses and trackless trolleys, through both the ongoing bus data collection program and supplementary data collection
• Electronic passenger fare-mix counts from automated fare-collection (AFC) faregates at heavy rail and light rail subway stations and fareboxes on motor bus and trackless trolley routes
• Fare-mix counts of passengers on surface light rail, including counts of passengers boarding through rear doors or otherwise failing to interact with the farebox
• Passenger surveys on the heavy rail and light rail systems and on the Silver Line Waterfront to determine origin and destination information
• Commuter rail ridership data provided by the Massachusetts Bay Commuter Railroad Company (MBCR) and CTPS ridership data

WORK DESCRIPTION

Task 1   Develop Sampling Plans

For the heavy rail and light rail systems, as well as the Silver Line Waterfront service, a sampling plan for passenger surveys will be devised to ensure a random selection of

stations across all parts of each system over the entire year for all days of the week and all time periods.

For light rail service at surface stops, onboard observations are necessary because not all passengers interact with fare collection equipment when boarding Green Line and Mattapan High-Speed Line vehicles. Counts of passengers boarding through rear doors and failing to interact with the farebox will be conducted. Two ridecheckers will be necessary: one to count the number of rear boardings and the other to note the number of passengers boarding through the front door who do not interact with the farebox (flash-pass trips, children, and fare evaders). A sampling plan will be devised to ensure that these observations are conducted on surface light rail over the entire year for all days of the week and all time periods.

For the bus system, a sampling plan for ridechecks will be devised to ensure a random selection of trips across all parts of the system over the entire year for all days of the week and time periods. Ridecheckers will also note the number of passengers who board through rear doors or otherwise fail to interact with the farebox. Alternatively, if the FTA allows the MBTA to use APC data to estimate unlinked passenger-trips and passenger-miles, a non-random sample of trips on APC-equipped buses will be selected and ridechecked. These trips will be selected to represent all days of the week and time periods.

For the trackless trolley system, a sampling plan will be developed to conduct full-route ridechecks of each route. These ridechecks involve CTPS staff members riding each scheduled trip for each route over the course of a single quarter in SFY 2013. The specific quarter will be determined based on CTPS staffing availability.

No direct data collection is planned for commuter rail. However, a sampling of some trips may be necessary to verify the figures reported by the contract operator.

CTPS will continue to collect as much data as possible through electronic means. CTPS's palmtop computers support the following CTPS-developed applications:

- Light rail, heavy rail, and Silver Line Waterfront passenger surveys
- Faregate noninteraction count
- Surface light rail rear door boarding count
- Surface light rail front door farebox noninteraction count
- Bus and trackless trolley farebox noninteraction count

Products of Task 1
- Heavy rail and light rail sampling plan for SFY 2013 passenger surveys
- Surface-light-rail sampling plan for SFY 2013 observations
- Bus and trackless trolley sampling plan for SFY 2013 ridechecks

Task 2 Collect Data

The heavy rail, light rail, Silver Line Waterfront, bus, and trackless trolley assignments generated by the sampling plan created in Task 1 will be executed. CTPS will conduct passenger surveys at each of the heavy rail, light rail, and Silver Line Waterfront survey locations. Counts of the number of passengers passing through faregates, and

specifically those who do not interact with the faregate, at station survey locations will also be conducted. Along Green Line and Mattapan High-Speed Line surface routes, onboard observations of passengers, and specifically those who do not interact with the farebox, will be conducted. CTPS will also conduct ridechecks on trackless trolley trips using palmtop computers, and will note the number of passengers who do not interact with the farebox.

One of two possible methodologies will be used to collect data on buses. One method will require CTPS staff to ridecheck a non-random set of APC-equipped buses. The MBTA will provide CTPS with APC-derived passenger-miles and passenger counts for the trips that CTPS ridechecks. The other method will use CTPS staff to ridecheck a larger, random sample of trips. The former method will require the FTA to approve the MBTA's use of APC data. If FTA approval is not granted, the latter method will be used.

The number of motor bus trips operated by route, time of day, and APC-equipped status and the unlinked passenger-miles and passenger-miles traveled for APC-equipped buses will be obtained from the MBTA.

All ridechecks, passenger surveys, and passenger counts will be performed by CTPS personnel, using palmtop computers. The data collected on ridechecks will be uploaded directly to the CTPS bus ridership information database, where they will be checked for completeness and accuracy. Passenger survey results and passenger count data will be uploaded directly to the CTPS non-palm database, where they will similarly be checked for completeness and accuracy.

AFC data will be requested from the MBTA for total heavy rail and light rail subway station boardings, as well as for total surface light rail, motor bus, and trackless trolley boardings. In addition, AFC data will be requested for total farebox deposits for each sampled bus and trackless trolley trip.

Products of Task 2
- Completed passenger survey assignments for heavy rail, light rail, and Silver Line Waterfront stations in electronic form
- Completed passenger count assignments for surface light rail, motor bus, and trackless trolley in electronic form
- AFC data on total boardings for light and heavy rail stations and surface light rail, motor bus, and trackless trolley routes
- AFC revenue data for motor bus and trackless trolley fareboxes for ridechecked trips
- Ridecheck data in electronic form

If APC data are used:

- APC data on non-random ridechecked motor bus trips
- APC data on unlinked passenger-trips and passenger-miles traveled by time of day and route
- Information regarding the number of trips operated by route, time of day, and APC-equipped status.

Task 3   Clean, Code, and Keypunch Survey, Passenger Count, and Ridecheck Data

CTPS will clean the heavy rail and light rail passenger survey data as necessary after downloading them into a spreadsheet program. The program will allow for the processing of the origin-destination data, as well as any other data included on the form. The farebox noninteraction passenger count data for surface light rail, motor bus, and trackless trolley will also be entered into a spreadsheet for processing. Ridecheck data will also be cleaned.

Products of Task 3
- Heavy rail and light rail passenger survey data in electronic form
- Surface light rail, motor bus, and trackless trolley passenger count data in electronic form
- Cleaned ridecheck data in electronic form

Task 4   Estimate Passenger-Miles and Boardings

Information on the total number of passengers boarding at subway stations on the heavy rail and light rail systems will be obtained from the MBTA through AFC faregate passenger counts. Factors that account for the number of transfers between each mode will then be estimated based on the origin-destination passenger surveys conducted in Task 2. Additionally, a faregate noninteraction factor will be developed from the observations at station survey locations. These factors will be applied to the AFC faregate counts to estimate total unlinked heavy rail and light rail riders attributable to subway boardings.

For light rail surface stops, counts of passengers boarding through rear doors and failing to interact with the farebox will be used to develop a farebox noninteraction factor. This factor will be applied to the AFC farebox counts of total passengers on surface light rail, which will then be increased to account for transfers made to other heavy rail or light rail lines, resulting in an estimate of total unlinked light rail and heavy rail riders attributable to light rail surface boardings.

Meanwhile, the origin-destination data generated by the passenger surveys will be converted into estimates of the average passenger-miles per passenger for both the heavy rail and light rail systems. This conversion will make use of procedures developed a number of years ago for the Systemwide Rapid Transit Survey. Multiplying the average passenger-miles per passenger by the total number of passengers will yield estimates of total passenger-miles for each mode.

If the first method of collecting motor bus data is used—conducting non-random ridechecks on APC-equipped buses—CTPS will verify that the ridecheck data are equivalent to the APC data. Systemwide APC data will be used to estimate unlinked passenger-trips and passenger-miles. Information on the number of trips operated by APC-equipped vehicles and non-APC-equipped vehicles will be obtained from the MBTA to assist in this process.

If the second method of collecting motor bus data is used—conducting random ridechecks—a farebox noninteraction factor developed as part of the ridecheck sample will be applied to the AFC farebox count of total motor bus and trackless trolley

passengers to estimate total boardings. Total passenger-miles will be estimated, as in previous years, using the ridecheck sample of trips to develop an average trip distance: this distance multiplied by total boardings results in total passenger-miles.

For the commuter rail system, ridership counts supplied by MBCR will provide the basis for the estimate of passenger boardings. Counts by station, in conjunction with data indicating the percentage of alightings prior to North Station and South Station (from the 2000 Commuter Rail Peak Load Counts report), will provide the basis for the estimate of average passenger trip length.

Product of Task 4
Estimates of passenger-miles and boardings for all MBTA modes discussed above

Task 5   Document Results

The results of Tasks 4 and 5 will be documented in technical memorandums. The memorandum regarding Task 4 will include a statistical analysis confirming that the true values for passenger-miles and boardings have a 95 percent probability of falling within 10 percent of the estimates, as required by the FTA. The memorandum regarding Task 5 will document the results of the APC comparison.

Product of Task 5
Technical memorandums describing the data collection and analysis processes, summarizing results, and presenting a statistical analysis of the results

Task 6   Assist with Compliance Audit

The FTA requires an independent auditor to review and verify the MBTA's directly operated bus and rail passenger-miles and boardings estimates. As the agency responsible for these estimates, CTPS will provide any materials and assistance necessary for the audit.

ESTIMATED SCHEDULE

It is estimated that this project will be completed approximately 17 months after the notice to proceed is received. The proposed schedule, by task, is shown in Exhibit 1.

ESTIMATED COST

The total cost of this project if the APC data are not used is estimated to be $95,906. This includes the cost of 73.9 person-weeks of staff time, overhead at the rate of 94.57 percent and travel. A detailed breakdown of estimated costs for this option is presented in Exhibit 2. If the FTA approves use of the APC data, the total cost of the project is estimated to be $81,800. This includes the cost of 61.0 person-weeks of staff time. A detailed breakdown of estimated costs for this option is presented in Exhibit 3.

KHQ/SPA/spa

Exhibit 1
ESTIMATED SCHEDULE
MBTA 2013 National Transit Database: Directly Operated

Task	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Develop Sampling Plans	███	███															
2. Collect Data	███	███	███	███	███	███	███	███	███	███	███	███					
3. Clean, Code, and Keypunch Data	███	███	███	███	███	███	███	███	███	███	███	███	███				
4. Estimate Passenger-Miles and Boardings													███	███			
5. Document Results														███	A		
6. Assist with Compliance Audit																███	███

Products/Milestones
A: Technical memorandum

Exhibit 2
ESTIMATED COST
MBTA 2013 National Transit Database: Directly Operated

Direct Salary and Overhead										$95,176

Task	Person-Weeks							Direct Salary	Overhead (@ 94.57%)	Total Cost
	M-1	P-4	P-3	SP-3	SP-1	Temp	Total			
1. Develop Sampling Plans	0.1	0.0	1.0	2.1	0.0	0.5	3.7	$3,085	$2,917	$6,002
2. Collect Data	0.1	0.0	0.2	7.0	25.5	23.5	56.3	$33,026	$31,232	$64,258
3. Clean, Code, and Keypunch Data	0.0	0.0	2.9	3.8	0.0	2.2	8.9	$7,024	$6,643	$13,666
4. Estimate Passenger-Miles and Boardings	0.0	0.0	2.8	0.0	0.0	0.0	2.8	$2,863	$2,708	$5,571
5. Document Results	1.0	0.2	0.8	0.0	0.0	0.0	2.0	$2,714	$2,566	$5,280
6. Assist with Compliance Audit	0.0	0.0	0.2	0.0	0.0	0.0	0.2	$205	$193	$398
Total	1.2	0.2	7.9	12.9	25.5	26.2	73.9	$48,916	$46,260	$95,176

Other Direct Costs		$730
Travel		$730

TOTAL COST	$95,906

Funding
Future MBTA Contract

Exhibit 3
ESTIMATED COST
MBTA 2013 National Transit Database: Directly Operated

Direct Salary and Overhead										$81,070

Task	Person-Weeks							Direct Salary	Overhead (@ 94.57%)	Total Cost
	M-1	P-4	P-3	SP-3	SP-1	Temp	Total			
1. Develop Sampling Plans	0.1	0.0	1.0	2.1	0.0	0.5	3.7	$3,085	$2,917	$6,002
2. Collect Data	0.1	0.0	0.2	5.5	19.0	18.0	42.8	$25,162	$23,796	$48,958
3. Clean, Code, and Keypunch Data	0.0	0.0	3.1	3.8	0.0	2.2	9.1	$7,228	$6,836	$14,064
4. Estimate Passenger-Miles and Boardings	0.0	0.0	3.2	0.0	0.0	0.0	3.2	$3,272	$3,095	$6,367
5. Document Results	1.0	0.2	0.8	0.0	0.0	0.0	2.0	$2,714	$2,566	$5,280
6. Assist with Compliance Audit	0.0	0.0	0.2	0.0	0.0	0.0	0.2	$205	$193	$398
Total	1.2	0.2	8.5	11.4	19.0	20.7	61.0	$41,666	$39,404	$81,070

Other Direct Costs		$730
Travel		$730

TOTAL COST	$81,800

Funding
   Future MBTA Contract