MEMORANDUM

DATE **June 5, 2014**

TO **Boston Region Metropolitan Planning Organization**

FROM **Karl H. Quackenbush**
CTPS Executive Director

RE **Work Program for: 2015 National Transit Database Data Collection and Analysis**

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 2015 National Transit Database Data Collection and Analysis presented in this memorandum

Project Identification

Unified Planning Work Program Classification

Technical Support/Operations Analysis Projects

CTPS Project Number

To be determined

Clients

Massachusetts Bay Transportation Authority
Project Supervisor: Melissa Dullea

CTPS Project Supervisors

Principal: Annette Demchur
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 any 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. Since SFY 2001, CTPS has also produced passenger-miles and boardings estimates for the MBTA's purchased-service bus routes (that is, routes for which the MBTA contracts with a private carrier to provide the service). Since SFY 2014, at the request of the FTA, the MBTA has reported some of its bus routes as bus rapid transit.

For its directly operated services, this year the MBTA is planning to use its automatic passenger counter (APC) data to estimate the unlinked passenger-trips and passenger-miles traveled on its buses and its bus rapid transit vehicles. This will reduce the sample size of, and the costs associated with, ridechecks needed for the bus and bus rapid transit modes. The MBTA is currently in the process of seeking approval (which it expects to obtain) from the FTA to use APC data for reporting to the NTD. This work scope was produced with the assumption that the MBTA will obtain the necessary approval. If they do not, this work scope will need to be amended to account for the difference in time and cost of collecting data manually.

For purchased services, CTPS began collecting full-route ridecheck data in SFY 2010 rather than collecting data on a random sample of trips. It was determined that the methodology employing full-route ridechecks satisfies the FTA's requirement that the true values for passenger-miles and boardings have a 95 percent probability of falling within 10 percent of the estimates. In addition, this methodology provides ridership and schedule adherence data for each purchased bus route that can be used for other planning purposes. In SFY 2015, CTPS will continue to use full-route ridechecks to estimate total passenger-miles and boardings.

Objectives

The objectives of this project are to develop estimates of passenger-miles and boardings for MBTA directly operated transportation modes, including buses, trackless trolley, heavy rail, light rail, and bus rapid transit. CTPS will also verify MBTA estimates of the average passenger trip length for the commuter rail mode and will develop estimates for contracted MBTA local bus service.

The data that will form the basis of these estimates will be collected in a variety of ways:

- Full-route ridechecks on buses used in contracted MBTA local bus service and trackless trolleys
- MBTA APC data verified and adjusted (if necessary) using ridechecks on the buses and bus rapid transit vehicles on which the APC data is collected
- Fare-mix counts from automated fare-collection (AFC) faregates at stations and from fareboxes on vehicles
- Passenger surveys on the heavy rail and light rail systems to determine origin-destination information
- Inferred origin-destination information based on AFC data
- Commuter rail ridership data from passenger counts conducted by the MBTA or its contractors

Work Description

Task 1 Develop Sampling Plans

For the heavy rail and light rail systems, a sampling plan for passenger surveys will be devised to ensure a random selection of stations 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. It may be necessary to have two ridecheckers: 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 and bus rapid transit systems, a sample of trips on APC-equipped buses will be selected and ridechecked—ridecheckers will also note the number of passengers who board through rear doors or otherwise fail to interact with the farebox. The ridecheck data will be compared against the APC-data to derive adjustment factors for the APC data.

For the trackless trolley system and purchased bus services, sampling plans will be developed to conduct full-route ridechecks of each route. These ridechecks will involve CTPS staff members' riding each scheduled trip for each route once over the course of a single quarter during the state fiscal year. 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 MBTA's current figures.

CTPS will collect as much data as possible through electronic means. CTPS's mobile devices support the following CTPS-developed applications:

- Passenger origin-destination surveys
- Faregate noninteraction counts
- Surface light rail rear-door boarding counts
- Surface light rail front-door farebox noninteraction counts
- Bus and trackless trolley farebox noninteraction counts
- Bus and trackless trolley boardings and alightings by stop
- Inferred heavy and light rail origin-destination data by station

Products of Task 1

- Sampling plans for SFY 2015 passenger surveys
- Surface-light-rail sampling plan for SFY 2015 observations
- Bus and trackless trolley sampling plans for SFY 2015 ridechecks

Task 2 Collect Data

The passenger survey assignments generated by the sampling plans created in Task 1 for bus, bus rapid transit, purchased bus, and trackless trolley will be executed. CTPS will conduct passenger surveys at each of the survey locations. Counts of the numbers of passengers passing through faregates, including counts of those who do not interact with the faregates, at station survey locations that have faregates will also be conducted. Along Green Line and Mattapan Line surface routes, onboard counts of passengers, including those who do not interact with the farebox, will be conducted. CTPS will also conduct full-route ridechecks on trackless trolley and purchased bus trips using mobile devices, will classify how passengers pay for their trips, and, where applicable, will note the number of passengers who do not interact with the farebox.

For the bus mode and bus rapid transit mode, CTPS staff will ridecheck a sample of APC-equipped vehicles. The MBTA will provide CTPS with APC-derived passenger-miles and passenger counts for the trips that CTPS ridechecks. This parallel ridechecked sample will be used to adjust and verify the MBTA's APC data. CTPS will obtain from the MBTA the number of bus and bus rapid transit trips operated by route, time of day, and APC-equipped status, and the unlinked passenger-miles and passenger-miles traveled for APC-equipped buses. If certain inconsistencies with the APC data are not rectified on the MBTA's Silver Line Waterfront bus rapid transit service, additional work beyond the work outlined in this work scope may be required.

Ridechecks, passenger surveys, and passenger counts will be performed by CTPS personnel, using mobile devices where practicable. 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 a different database, where they will similarly be checked for completeness and accuracy.

The MBTA will provide CTPS with detailed AFC data for all of the MBTA's modes for which data exist.

CTPS will need to transition its ridecheck program to the operating system used on its mobile devices.

Products of Task 2

- Passenger survey results in electronic form
- Passenger count data for surface light rail, bus, bus rapid transit, and trackless trolley in electronic form
- AFC data on total boardings for all modes
- Ridecheck data in electronic form
- APC data on ridechecked bus and bus rapid transit trips
- APC data for 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
- Detailed AFC data by transaction
- Updated version of the ridecheck program

Task 3 Clean, Code, and Enter Passenger Count and Ridecheck Data

CTPS will clean the passenger survey data as necessary after uploading them into a spreadsheet program, which will allow for the processing of origin-destination data. The passenger count and farebox-noninteraction data for the surface light rail system, bus mode, bus rapid transit mode, and trackless trolley mode will also be entered into a spreadsheet for processing. Ridecheck data will also be cleaned.

Products of Task 3

- Passenger survey data in electronic form
- Surface light rail, bus, bus rapid transit, and trackless trolley passenger count and farebox-noninteraction data in electronic form
- Cleaned ridecheck data in electronic form

Task 4 Estimate Passenger-Miles and Boardings

Subtask 4.1 Estimate Passenger-Miles and Boardings for Directly Operated Services

Information on the total numbers 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 findings of the origin-destination passenger surveys conducted in Task 2 and the processed AFC data. 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 the total of 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 the total number of passengers on surface light rail; the results will then be increased to account for transfers made to other heavy rail or light rail lines, resulting in estimates of the total of unlinked light rail and heavy rail riders attributable to light rail surface boardings.

The origin-destination data generated by the passenger surveys, and the processed AFC data, will be converted into estimates of the average passenger-miles per passenger for both the heavy rail and light rail systems. Multiplying the average passenger-miles per passenger by the total number of passengers will yield estimates of the total number of passenger-miles for each mode.

CTPS will compare the trip-based ridecheck data to the APC data. An adjustment factor will be created that will correct for errors in the APC data. Systemwide APC data will be used to estimate passenger-miles traveled on buses and bus rapid transit vehicles. On some of the bus rapid transit routes, the APC data may be used to estimate unlinked passenger trips as well. 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.

For the commuter rail system, ridership counts will provide the basis for the estimate of passenger boardings. Counts by station, in conjunction with data indicating the percentage of alightings of inbound trains prior to North Station and South Station, will provide the basis for the estimate of the average passenger trip length. CTPS will not conduct these counts but will rather rely on data obtained by the MBTA or its contractors.

Subtask 4.2 Estimate Passenger-Miles and Boardings for Purchased Bus Services

Estimates of passenger-miles and boardings will be produced using revenue data from the MBTA and output from the CTPS bus ridership information database. Estimates of the average farebox deposit will be generated, along with the average passenger trip length based on ridecheck observations. By dividing the average farebox deposit into the total revenue, an estimate of the total boardings may be made. Multiplying this total by the average trip length yields total passenger-miles.

Product of Task 4

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

Task 5 Document Results

The results of Task 4 and the methodology of the study will be documented in a series of three technical memoranda. The technical memoranda will include statistical analyses of the results.

Product of Task 5

- Technical memoranda describing the data collection and analysis processes, summarizing the results, and presenting a statistical analysis of the results

Task 6 Assist with the 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

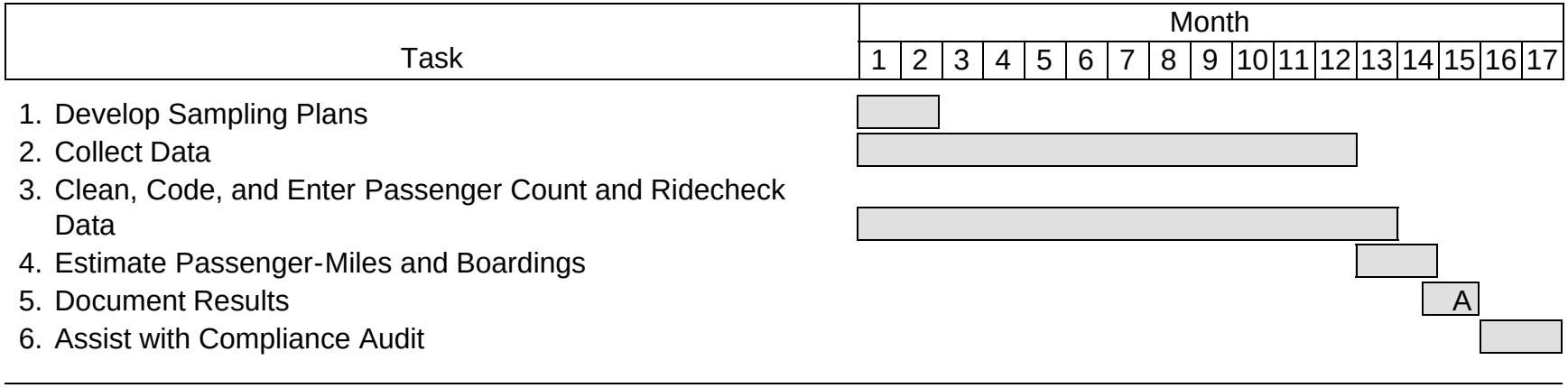
It is estimated that this project will be completed in November 2015 (or 17 months after the notice to proceed is received). The proposed schedule, by task, is shown in Exhibit 1.

Estimated Cost

The total cost of this project is estimated to be $129,426. This includes the cost of 89.3 person-weeks of staff time, overhead at the rate of 97.42 percent, and travel. A detailed breakdown of estimated costs for this option is presented in Exhibit 2.

KQ/SPA/spa

Exhibit 1
ESTIMATED SCHEDULE
2015 National Transit Database Data Collection and Analysis



Products/Milestones

A: Technical memorandum

Exhibit 2
ESTIMATED COST
2015 National Transit Database Data Collection and Analysis

Direct Salary and Overhead	**$128,926**

Task	Person-Weeks							Direct Salary	Overhead (97.42%)	Total Cost
	M-1	P-5	P-3	SP-3	SP-1	Temp	Total			
1. Develop Sampling Plans	0.1	0.6	1.0	2.1	1.5	0.5	5.8	$5,211	$5,076	$10,287
2. Collect Data	1.5	1.8	3.5	10.6	18.8	37.4	73.6	$49,374	$48,101	$97,475
3. Clean, Code, and Enter Passenger Count and Ridecheck Data	0.0	0.0	0.8	0.0	0.8	1.0	2.6	$1,888	$1,840	$3,728
4. Estimate Passenger-Miles and Boardings	0.0	0.0	2.8	0.0	0.0	0.0	2.8	$2,970	$2,894	$5,864
5. Document Results	1.5	0.2	2.4	0.0	0.0	0.0	4.1	$5,437	$5,297	$10,735
6. Assist with Compliance Audit	0.0	0.0	0.4	0.0	0.0	0.0	0.4	$424	$413	$838
Total	3.1	2.6	10.9	12.7	21.1	38.9	89.3	$65,305	$63,620	$128,926

Other Direct Costs	**$500**
Travel	$500

TOTAL COST	**$129,426**

Funding

Future MBTA Contract