WORK PROGRAM

MBTA SFY 2025 NATIONAL TRANSIT DATABASE: DATA COLLECTION AND ANALYSIS

APRIL 11, 2024

Proposed Motion

The Boston Region Metropolitan Planning Organization (MPO) votes to approve this work program.

Project Identification

Unified Planning Work Program (UPWP) Classification

Agency and Other Client Transportation Planning Studies and Technical Analyses

Project Number 14379

Client

Massachusetts Bay Transportation Authority (MBTA)
Client Supervisor: Joshua Weiland

Project Supervisors

Principal: Rose McCarron
Manager: Bradley Putnam

Funding Source

Future MBTA Contract

Schedule and Budget

Schedule: 18 months from notice to proceed

Budget: $234,184

Schedule and budget details are shown in Exhibits 1 and 2, respectively.

The overhead rate used to calculate the budget is subject to change every July 1st based on the approved projected overhead rate for the state fiscal year (SFY).

Relationship to MPO Work

This study is supported in full with non-MPO funding. Committing MPO staff to this project will not impinge on the quality or timeliness of MPO-funded work.

Background

For decades, the Central Transportation Planning Staff (CTPS) has supported the Massachusetts Bay Transportation Authority's (MBTA) submittals to the National Transit Database (NTD). NTD is the Federal Transit Administration's (FTA) national repository of transit statistics. At first, CTPS produced estimates of passenger-miles traveled and unlinked passenger trips for the MBTA's bus and trackless trolley modes.[1] Over the years, the scope of these analyses expanded to include other modes: Heavy and light rail were added in SFY 1996, commuter rail in SFY 2000, purchased-service bus routes (routes for which the MBTA contracts with a private carrier to provide service) in SFY 2001, and bus-bridge service in SFY 2021.

Directly Operated Bus Data

The MBTA uses its automatic passenger counter (APC) data, verified by on-board passenger counts (also called ridechecks), to estimate the unlinked passenger trips and passenger-miles traveled on its directly operated bus and rapid-bus modes. The MBTA has submitted APC data to NTD since FTA allowed the practice in SFY 2014. As directed by FTA in SFY 2016, CTPS began verifying these data with ridechecks on APC-equipped buses.

Scheduled Purchased-Service Bus Data

In SFY 2019, some of the purchased-service bus routes began to use APC-equipped vehicles.[2] For these routes, the MBTA used APC data to estimate unlinked trips and passenger-miles traveled. As with directly operated buses, CTPS conducted ridechecks on APC-equipped purchased-service buses to verify APC data. CTPS used full-route ridechecks to estimate total passenger-miles traveled and unlinked passenger trips for purchased-service bus routes not equipped with APCs. CTPS will continue to collect these data in SFY 2025.

Bus-Bridge Service Data

In SFY 2021, CTPS began collecting data to estimate unlinked passenger trips and passenger-miles traveled for temporary bus-bridge service, which the MBTA provides when portions of rail service are temporarily suspended for maintenance. This data

[1] In SFY 2022, the MBTA replaced its trackless trolleys with motor buses; so SFY 2022 was the final year in which CTPS collected data on trackless trolleys.

[2] Purchased Service is also referred to as Purchased Transportation.

collection will continue in SFY 2025 for temporary bus-bridge service substituting for both rapid transit and commuter rail.

Heavy and Light Rail Data

Beginning in SFY 2017, the MBTA and CTPS decided to use a rolling three-year average for some of the intermediate factors used to derive passenger-miles traveled and unlinked trips on heavy and light rail. In SFY 2021, the MBTA and CTPS resumed using annual data for those intermediate factors due to disruptions in data collection caused by the COVID-19 pandemic.

Summary

Table 1 summarizes the data that CTPS collects and processes to estimate the average trip length, passenger-miles traveled, and unlinked trips for each mode, and the sources of these data.

Table 1
Data and Sources for Unlinked Passenger Trips and Average Trip Length Calculations

	Unlinked Passenger Trips						Average Trip Length					
Mode	**MB**	**RB**	**MB**	**HR**	**LR**	**CR**	**MB**	**RB**	**MB**	**HR**	**LR**	**CR**
Service type	DO	DO	PT	DO	DO	PT	DO	DO	PT	DO	DO	PT
CTPS Data												
Ridecheck data for APC verification	X	X	X				X	X	X			
Full-route ridecheck*			X						X			
Noninteraction survey				X	X							
Fare-mix survey			X									
Transit trip survey				X	X					X	X	
MBTA Data												
APC data	X	X	X				X	X	X			
AFC boardings				X	X							
Revenue reports			X									
ODX data (potential)				X	X					X	X	
Passenger counts (Keolis or CTPS)												X
mTicket data												X

Note: ODX data, if used, would replace transit trip survey data to estimate transfer factors and average trip lengths.

* Full-route ridechecks will only be conducted for regularly scheduled purchased-transportation bus routes that do not have APCs. Spot checks will be conducted for temporary bus-bridge service substituting for both rapid transit and commuter rail. These bus-bridge services will include both directly operated and purchased transportation.

AFC = Automated Fare Collection. APC = Automatic Passenger Counter. CR = Commuter Rail. CTPS = Central Transportation Planning Staff. DO = Directly Operated. HR = Heavy Rail. LR = Light Rail. MB = Motorbus. MBTA = Massachusetts Bay Transportation Authority. mTicket = Mobile Ticketing. ODX = Origin-Destination-Transfer Model. PT = Purchased Transportation. RB = Rapid Bus.

Objectives

The objectives of this project are as follows:

- Develop estimates of passenger-miles traveled and unlinked trips for the MBTA's directly operated heavy rail and light rail modes
- Develop estimates of passenger-miles traveled and unlinked trips for the following bus modes:
    - regularly scheduled purchased-service bus routes
    - temporary directly operated and purchased-service bus-bridge service substituting for rapid transit
    - temporary directly operated and purchased-service bus-bridge service substituting for commuter rail
- Develop an estimate of the average trip length per passenger for commuter rail service
- Develop an estimate of commuter rail passenger-miles traveled in each urbanized area served by the MBTA

CTPS will use the following methods to collect the data on which these estimates will be based:

1. Ridechecks on a sample of APC-equipped buses on the directly operated bus, rapid bus, and the purchased-service bus modes
2. Full-route ridechecks, including observations of fares paid, on the purchased-service bus mode for the routes without APC-equipped buses
3. Transit trip surveys on heavy rail, Green Line, Mattapan Line, and rapid-bus modes to determine origins, destinations, transfer rates, and average trip lengths
4. Faregate noninteraction, farebox noninteraction, and rear-door entry surveys from stations or Green Line vehicles equipped with automated fare collection (AFC) technology (noninteraction surveys count passengers who pass by faregates or fareboxes, including those who do not use fare media)
5. Inferred origin-destination information from AFC data, if available from the MBTA or its partners, to determine origin-destination information (transfer rates and average trip lengths)
6. Commuter rail ridership data obtained from passenger counts conducted by the MBTA or its contractors, or from the MBTA's mobile-ticketing vendor
7. Counts of temporary bus-bridge passengers during sample periods when portions of rapid transit or commuter rail service are temporarily suspended and replaced with bus service

If the MBTA's data sources change, CTPS will consult with the MBTA about making corresponding changes to the methods listed above.

Work Description

Task 1 Develop Sampling Plans

For the directly operated bus and rapid-bus modes, CTPS will work with MBTA staff to develop a sampling plan for conducting ridechecks. Every three years the MBTA submits its APC recertification to FTA. SFY 2025 is a recertification year, so CTPS will collect data for 60 trips each on rapid-bus routes and motor bus routes.

For the purchased-service bus mode, CTPS will develop a sampling plan for conducting ridechecks to verify the accuracy of the APC data in consultation with MBTA staff. SFY 2025 being a recertification year, CTPS will collect data for 60 trips on APC-equipped purchased service buses. CTPS will also develop a sampling plan for conducting full-route ridechecks on the non-APC equipped routes, including fare-mix surveys. CTPS will perform the ridechecks over the course of a single quarter during SFY 2025. CTPS's staffing availability will determine the selection of quarters.

For the heavy rail, light rail, and rapid-bus service, CTPS will develop a passenger survey sampling plan for conducting surveys at a random selection of stations over the course of an entire year. The sampling plan will ensure that the results represent all days of the week and all service periods. CTPS will also conduct noninteraction surveys at the stations that have faregates.

Because not all passengers interact with fare-collection equipment when boarding vehicles at Green Line surface stops, CTPS will conduct counts of passengers who do not interact with the farebox. CTPS will develop a sampling plan that will ensure that these observations are conducted on Green Line surface stops over the entire year for all days of the week and all service periods.

For the commuter rail mode, CTPS may obtain and analyze four potential data sources: conductor audits, data from the MBTA's mobile-ticketing vendor, Keolis Commuter Services' passenger counts, and CTPS's passenger counts collected as a part of a separate project. No direct data collection is planned for commuter rail.

For the ferry mode, CTPS may choose a small selection of trips on which to count boarding or alighting passengers. The MBTA will use CTPS's counts to verify passenger count data received from the ferry operator.

For temporary bus-bridge service, CTPS will develop a sampling plan for counting passengers who board or alight buses that are providing substitute service for segments of rapid transit or commuter rail lines that have been temporarily suspended.

Products of Task 1

- Sampling plan for SFY 2025 directly operated bus and rapid-bus ridechecks

- Sampling plan for SFY 2025 purchased-service bus ridechecks and fare-mix surveys
- Sampling plan for SFY 2025 passenger surveys
- Sampling plan for SFY 2025 faregate noninteraction counts and surface Green Line observations
- Sampling plan for SFY 2025 temporary bus-bridge counts

Task 2 Collect Data

CTPS will complete the ridecheck assignments generated by the sampling plans created in Task 1 for the directly operated bus mode, the rapid-bus mode, and the purchased-service bus mode. CTPS will classify how passengers on purchased-service buses that are not equipped with APC pay for their trips. For heavy rail and light rail, CTPS will conduct passenger surveys at each of the survey locations. Staff will conduct counts of the number of passengers passing through faregates, including those who do not interact with the faregates, at survey locations in stations that have faregates. Along Green Line surface routes, CTPS will conduct onboard counts of passengers, including those who do not interact with the farebox. For temporary bus bridges, CTPS will count bus boardings or alightings at locations where the MBTA is substituting bus service for regular rapid transit or commuter rail service.

The MBTA will provide CTPS with detailed AFC data for the heavy and light rail modes; monthly and annual fare revenue reports for the purchased-service bus routes; and APC data for the purposes of verifying directly operated bus, rapid-bus, and APC-equipped purchased-service bus unlinked passenger trips and average trip length. If the MBTA concludes that data from the MBTA's origin-destination-transfer model (ODX) is sufficient for NTD reporting purposes, the MBTA will provide CTPS with relevant ODX output in addition to AFC data.

Products of Task 2

- Ridecheck data for a selection of trips on the directly operated bus mode, the rapid-bus mode, and the purchased-service bus mode with APC-equipped buses for verifying APC data
- Full-route ridecheck data for the purchased-service bus mode without APC-equipped buses
- Transit trip survey results
- Noninteraction data for faregates at stations and for fareboxes on Green Line surface stops
- Potential ODX transfer factors and average passenger trip length for heavy rail, light rail, and gated portions of the rapid-bus mode
- Counts of temporary bus-bridge boardings or alightings

Task 3 Process Ridecheck, Passenger Survey, and Passenger Count Data

CTPS will process the ridecheck, passenger survey, and passenger count data, including data on passenger noninteraction with faregates and fareboxes. Completed assignments will be checked for accuracy and completeness, and incomplete assignments will be redone. The number and types of remaining assignments will be monitored throughout the fiscal year to ensure that all types of assignments are completed in a timely manner.

The data collected on ridechecks will be uploaded to CTPS's bus ridership database, and these data will be checked for completeness and accuracy. Passenger survey results and passenger count data will be uploaded to a different database, and these data will be checked for completeness and accuracy.

Product of Task 3

Processed ridecheck, passenger survey, and passenger count data

Task 4 Estimate Passenger-Miles Traveled and Unlinked Trips

For the MBTA's directly operated bus and rapid-bus modes, CTPS will select some APC-equipped buses on which to conduct passenger counts for use in APC data verification. The MBTA will use these CTPS-produced results to verify the APC data it uses to estimate passenger-miles traveled and unlinked passenger trips.

CTPS will obtain AFC faregate passenger counts from the MBTA, which will provide information about the total number of passengers boarding at gated stations on the heavy and light rail systems, and on rapid buses. CTPS will then estimate the factors that account for the number of transfers between modes based on the origin-destination passenger surveys conducted in Task 2. In addition, CTPS will develop a faregate noninteraction factor from the observations at station survey locations and will apply the factor to the AFC faregate counts to estimate the total number of unlinked heavy rail and light rail trips.

For Green Line surface stops, CTPS will use counts of boarding passengers who do not interact with the farebox to develop a farebox noninteraction factor. CTPS will apply this factor to the AFC farebox counts of the total number of passengers at Green Line surface stops. CTPS will then apply additional factors to account for transfers between Green Line branches, to heavy rail lines, or to the Mattapan Line, which will generate estimates of the total of unlinked light rail and heavy rail riders attributable to light rail surface boardings. These transfer factors will be derived from the origin-destination passenger surveys.

For the heavy rail and light rail modes, CTPS will convert the origin-destination data generated by the passenger surveys and the processed AFC data into estimates of the average passenger-miles traveled per transit mode. The average passenger-

miles traveled per passenger will be multiplied by the total number of passengers to yield estimates of the total number of passenger-miles traveled for each mode.

If the MBTA decides to use ODX as the basis of reporting to the NTD, CTPS will adjust the methodology as needed to incorporate the ODX outputs.

For the commuter rail mode, CTPS will use one or more of the sources of ridership counts described in Task 1 as the basis for estimating unlinked passenger trips. In recent years, because conductor audit data were not available, CTPS obtained anonymized origin-destination data from the MBTA's mobile-ticketing vendor. That dataset was sufficient for estimating the average passenger-miles traveled per trip. In addition, CTPS will examine Keolis's passenger counts; this dataset should also be sufficient for calculating the average passenger-miles traveled per trip. However, CTPS does not produce estimates of unlinked passenger trips or total passenger-miles traveled for commuter rail, and CTPS does not expect to conduct any direct observations of the commuter rail mode.

CTPS will also use commuter rail mobile ticketing data to estimate passenger-miles traveled on commuter rail in each of the urbanized areas the MBTA serves. Urbanized areas are defined by the US Census Bureau using data from the 2020 US Census.

For temporary bus-bridge service substituting for rapid transit, CTPS will obtain AFC faregate passenger counts from the MBTA for comparable periods with regular rail service and use counts of temporary bus-bridge boardings or alightings to develop a bus-bridge scaling factor. CTPS will use AFC counts and the scaling factor to estimate annual and monthly unlinked passenger trips and passenger-miles traveled on temporary bus-bridge service substituting for rapid transit. For temporary bus-bridge service substituting for commuter rail, CTPS will take a similar approach while using conductor counts instead of AFC faregate passenger counts.

For the purchased-service bus mode, CTPS will produce annual and monthly estimates of passenger-miles traveled and unlinked trips using revenue data from the MBTA for routes that are not equipped with APCs and output from CTPS's database of bus ridership. CTPS will generate estimates of the average farebox deposit and will then estimate the average trip length per passenger based on ridecheck observations.

The total unlinked trips will be estimated by dividing the average farebox deposit by the total revenue. The total passenger-miles traveled will be calculated by multiplying the total unlinked trips by the average trip length per passenger. The MBTA will use APC data to produce estimates of passenger-miles traveled and unlinked trips on APC-equipped routes. CTPS will combine the results from APC-

equipped routes and routes without APCs into a single set of values for the purchased-service bus mode.

Products of Task 4

- Estimates of passenger-miles traveled and unlinked trips, including a summary by service day of week, for heavy rail, light rail, and buses
- Estimates of average passenger trip lengths on commuter rail

Task 5 Document Results

CTPS will document the results of Task 4 and the methodology of the study in four technical memoranda: one each for the purchased-service bus mode, directly operated services, commuter rail mode, and temporary bus-bridge service. The technical memoranda will describe the data-collection and analysis processes and present a summary of the results. In addition, CTPS will document the results of Task 4 in a summary table presenting the data for the MBTA's directly operated modes by the service day of week. The MBTA has requested that CTPS transmit a draft copy of the memoranda and table by October 1, 2025, and a final version by October 15, 2025.

Products of Task 5

Four technical memoranda, one table, and other underlying data as requested

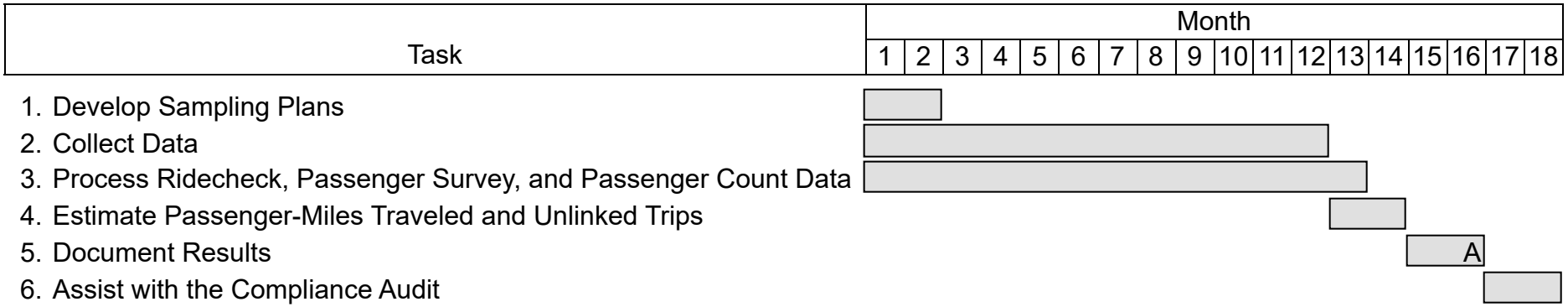
Task 6 Assist with the Compliance Audit

The FTA requires that an independent auditor review and verify the MBTA's estimates of passenger-miles traveled and unlinked trips. As the agency responsible for these estimates, CTPS will provide materials and assistance necessary for the audit.

Products of Task 6

Materials and assistance necessary to the independent auditor

Exhibit 1
ESTIMATED SCHEDULE
MBTA SFY 2025 National Transit Database: Data Collection and Analysis



Products/Milestones

A: Four technical memoranda and one table

Exhibit 2
ESTIMATED COST
MBTA SFY 2025 National Transit Database: Data Collection and Analysis

Direct Salary and Overhead	**$233,884**

Task	Person-Weeks by Pay Grade							Direct Salary	Overhead (120.3%)	Total Cost
	G-9	G-8	G-7	G-6	G-2	G-1	Total			
1. Develop Sampling Plans	0.0	0.0	0.0	1.0	0.0	0.0	1.0	$1,562	$1,879	$3,440
2. Collect Data	0.0	4.0	0.0	0.0	12.0	48.0	64.0	$60,774	$73,112	$133,886
3. Process Ridecheck, Passenger Survey, and Passenger Count Data	0.0	0.0	0.0	13.0	0.0	0.0	13.0	$20,300	$24,421	$44,721
4. Estimate Passenger-Miles Traveled and Unlinked Trips	0.0	0.0	2.0	8.0	0.0	0.0	10.0	$15,425	$18,556	$33,981
5. Document Results	0.3	0.4	1.0	2.0	0.0	0.0	3.7	$6,544	$7,872	$14,416
6. Assist with the Compliance Audit	0.0	0.0	0.0	1.0	0.0	0.0	1.0	$1,562	$1,879	$3,440
Total	0.3	4.4	3.0	25.0	12.0	48.0	92.7	$106,166	$127,718	$233,884

Other Direct Costs	**$300**
Travel	$300

TOTAL COST	**$234,184**

Funding
Future MBTA Contract

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