

## **Appendix B – MBTA System Description**

## **MBTA Rail System Description**

### **Overall System Description:**

The Massachusetts Bay Transportation Authority (MBTA), more commonly known as the T, is one of the oldest public transit systems in the United States. It is the largest transit system in Massachusetts and fourth largest Heavy Rail in the country and third largest light rail. The oldest operating rail line, the Green Line, at the MBTA began subway service between Boylston and Park Street Stations in 1897. Currently, the MBTA has approximately 30 miles of double-track light rail service and approximately 39 miles of double-track heavy rail service. While not yet back to 2019 ridership levels, MBTA provided, on average, approximately 375,000 weekday trips (per day) in 2023 on the subway lines.<sup>10</sup>

The MBTA provides subway, bus, commuter rail, ferry, and paratransit service to eastern Massachusetts and parts of Rhode Island.

The Rail Transit System (subway system) includes:

- 30 miles light rail track
- 39 miles heavy rail track
- 81 light rail stations
- 51 heavy rail stations
- 2 light rail lines
- 3 heavy rail lines

### **MBTA Rail Transit System:**

The MBTA rail transit system (or subway) is divided into 2 subsystems: heavy rail and light rail system. Heavy rail includes three rail lines: The Red, Orange, and Blue Lines. Light rail has two rail lines: The Green Line and the Ashmont–Mattapan High Speed Line (designated as an extension of the Red Line but managed as an extension of the light rail system).

Most of the MBTA's subway system runs on the surface and through tunnels. The Green Line and the Orange Line directly connect to the rest of the lines. Park Street station, one of the oldest stations in the system and helps make up the central subway, is the hub where there are direct connections available to the Red, Green and Orange Lines. All four rail lines use standard rail gauge (1435mm or 4'8 ½") but are otherwise incompatible; trains of one line would have to be significantly modified -width, length, dynamic envelope, etc.- to run on another. There are no direct track connections between lines, except between the Red Line and Ashmont-Mattapan High Speed Line, but all except the Blue Line have little-used connections to the national rail network, which in the past have been used for deliveries of railcars and supplies.

Because the various subway lines do not consistently run in any given compass direction, it is customary to refer to line directions as "inbound" or "outbound." Inbound trains travel towards the four downtown transfer stations, and outbound trains travel away from these hub stations.

### **Description of Facilities and Equipment:**

A brief description is provided for all the rail lines, vehicles, maintenance facilities, revenue facilities, training facilities, and administrative facilities below:

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<sup>10</sup> <https://www.mbta.com/performance-metrics/ridership-the-t>

## **Heavy Rail Lines**

**Red Line** – Comprised of two main branches: Ashmont and Braintree. Both the branches originate at Alewife and split into two branches at JFK Station. The Red Line fleet consists of 4 different types of cars:

1. Pullman-Standard (1995-1998), 68 vehicles (22 active)
2. UTDC (1987-1989), 58 vehicles (54 active)
3. Bombardier (1993-1994), 82 vehicles (all active)
4. CRRC (2019-Present), 252 vehicles (14 active)

Currently, only 14 of the new CRRC cars are in service. Once the 252 new CRRC cars are commissioned and accepted in revenue service the older cars will be decommissioned.

These cars are maintained at vehicle maintenance facility, Cabot Yard, located in South Boston. During non-peak and non-revenue hours, vehicles are stored at storage Yards located at terminal stations: Ashmont, Braintree and Alewife.

Red Line vehicles are powered by 600V DC via the third rail system and are equipped with Automatic Train Operation (ATO) and cab signaling. Trains speeds are controlled by cab signals and the door operations are carried out by the operator onboard.

**Orange line** – The Orange Line runs from Forest Hills to Oak Grove and the fleet consists of 2 different types of cars:

1. Hawker Siddeley Canada (1979-1981), 114 vehicles (None in service)
2. CRRC (2018-2023), 100 vehicles so far out of 152 (new)

Older Orange Line vehicles will be decommissioned in phases as the newer 1400 series are commissioned and accepted into revenue service.

These Orange Line vehicles are maintained at vehicle maintenance facility, Wellington Yard, located in Medford. These vehicles may also be stored at Forest Hills and Oak Grove terminal stations during non-peak and non-revenue hours.

Orange Line vehicles are powered by 600V DC via the third rail system and are equipped with Automatic Train Operation (“ATO”) and cab signaling. Trains speeds are controlled by Cab signal, but the door operations are carried out by the operator onboard.

**Blue Line** – The Blue Line runs from Bowdoin to Wonderland and the fleet consists of:

1. #5 East Boston Siemens (2007-2009), 94 vehicles (all active)

This fleet is maintained exclusively at Orient Heights Yard, located in East Boston. In addition to Orient Heights Yard, these vehicles may be stored at Wonderland terminal station during non-peak and non-revenue hours.

Blue line Siemens cars are the only vehicles in the country equipped with both catenary power and third rail power collection systems. The Blue Line uses third rail 600V DC power from Bowdoin to Airport Station (underground) and Overhead Catenary System (“OCS”) 600V DC power from Airport to Wonderland Station (above ground).

The Blue Line utilizes an Absolute Block System (“ABS”) and operates on a wayside signal system. A trip stops system automatically stops the train (to fail safe) in case of a signal violation.

### **Light Rail Lines**

**Green Line** – The Green Line consists of four active branches:

- A Branch, which ran southeast from Watertown station to Packard’s Corner station was retired in 1969.<sup>11</sup>
- B Branch runs east from Boston College Station to Kenmore station
- C Branch runs northeast from Cleveland Circle Station to Kenmore Station
- D Branch runs from Union Square to Riverside station
- E Branch runs northwest from Heath Street Station to Medford/Tufts Station

Branch B and C have exclusive ROW shared on the street and has grade crossings without safety protections, whereas Branch E shares ROW with vehicular traffic and operates on the street. Branch D has exclusive and dedicated ROW.

The GLX extension from Lechmere opened in December 2022 and added another 4.3 miles of track and 7 new stations (including Lechmere) on two routes running parallel to commuter rail Lowell route while crossing the Fitchburg route near the Innerbelt carhouse.

Green line fleet consists of:

1. Type 7 LRV – Kinki Sharyo (1986-1988), refurbished, 100 vehicles, (79 active.)
2. Type 7 LRV-Kinki Sharyo (1997), refurbished, 20 vehicles, (15 active)
3. Type 8 LRV – Ansaldo Breda (1998-2007), 95 vehicles, (81 active)
4. Type 9 LRV – CAF USA (2018-2020), 24 new vehicles, (24 active)
5. Type 10 LRV – Planning for type 10 vehicles to replace type 7 and 8, possibly 9, started in 2014. Contract for 102 new vehicles awarded to CAF USA in late 2022. The vehicles will be assembled in the Elmira, New York assembly plant.<sup>12</sup>

These vehicles are maintained at vehicle maintenance facilities, Riverside and Reservoir Yard and Innerbelt carhouse. In addition to Riverside and Reservoir Yard, during non-peak and non-revenue hours cars are stored at Boston College terminal station.

Green Line vehicles are powered by Overhead Catenary System (“OCS”) 600V DC system. The Green Line generally utilizes a fixed block system in the tunnel and operates on a wayside signal system while the surface running portion generally relies on operations rules to maintain train separation. The Green

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<sup>11</sup> Belcher, Jonathan. “Changes to Transit Service in the MBTA District 1964-2023 with Thanks ...” <http://roster.transithistory.org/MBTARouteHistory.pdf>, August 27, 2023.  
<http://roster.transithistory.org/MBTARouteHistory.pdf>.

<sup>12</sup> “The MBTA Vehicle Inventory Page.” <http://roster.transithistory.org/>, December 28, 2023.  
<http://roster.transithistory.org/MBTARouteHistory.pdf>.

Line Train Protection (“GLTP”) Project is currently underway to add protection to make the system fail safe in case of signal violation by an operator or encroachment of another vehicle.

### **Operations Control Center (“OCC”)**

The OCC located at 45 High Street is the centralized control location from where all supervisory controls and orders are executed. OCC controls the movement of trains, Right-of-Way (“ROW”) access and remote operations/control of most of the field devices, i.e., switches, signals, heaters, etc. The supervisory control system (“SCADA”) facilitates more consistent and timely revenue service and reduces the number of required field personnel. As of this audit, the OCC is preparing for a large expansion.

### **Non-revenue Vehicles**

For use in responding to emergencies, performing maintenance work, keeping the system safe for passengers, and engaging in major construction work, the MBTA operates a large fleet of vehicles and work equipment not used to transport passengers. Non-revenue vehicles and equipment support the entire range of Authority operations, including maintenance service calls, safety-critical situations, field supervision, revenue collection, repair projects, and system upgrade efforts, all of which occur throughout the MBTA’s service district. The Authority owns a fleet of over 1,000 nonrevenue vehicles. These vehicles are of many different types, including rail-mounted cars, rubber-tired cars, trucks, sedans, SUVs, police cruisers, snowplows, track geometry cars, brush cutters, and spreaders. Included in the maintenance-of-way category are crane, bucket, cable, platform, and snow-fighting trucks.

### **MBTA Transit Police Department (“TPD”)**

The MBTA’s Transit Police Department (“TPD”) was formed in 1968. This department has primary jurisdiction over MBTA property and vehicles in each of the 177 cities and towns within the MBTA, and currently has 266 officers and 10 civilian employees. The majority of the MBTA Police Department’s efforts are focused on patrol in Boston and surrounding communities. The department patrols and protects the 5 subway lines to include the Silver Line, 13 commuter rail lines, 6 passenger ferry routes, 181 bus routes and The Ride paratransit system in Massachusetts communities.

### **Power Distribution**

Even though MBTA procures power from commercial utility companies for its needs, the MBTA transforms and distributes electricity over its own to power a network that consists of 10 power substations, 67 unit substations, 48 traction power substations, 3 switching stations, 800 miles of cable, 1,200 circuit breakers, 1,000 switch boxes, 3,325 manholes, 54 passenger station low-voltage switchgears, 2 emergency backup generators, and 2 supervisory control systems to monitor and control all of the power facilities. For the rapid transit and trackless trolley services, the MBTA distributes electricity to power various systems, including signals; communications; station lighting, escalators, and elevators; maintenance and layover facilities; tunnel lighting and ventilation fans; fire alarms; and fare collection. In addition, the MBTA distributes electricity to the overhead catenary system that powers the Green Line, part of the Blue Line, and the Silver Line Waterfront. The third rail system that powers the Red Line, Orange Line, and part of the Blue Line also receives electricity through the MBTA’s power network.

Somewhat unique to the MBTA and transit in general is the ability to generate power through twin Hawker-Sidley jet turbines located at the South Boston Switching Station (“SBSS”) capable of producing 68-Megawatts of power, to supply either the system or the national electric grid as demand dictates.

## **Major Administrative Facilities**

- 10 Park Plaza (State Transportation Building), Boston
- 45 High Street, Boston
- 185 Kneeland Street, Boston
- MBTA Transit Police: 240 Southamptn Street, Boston
- Senior & Transportation Access Pass (TAP) / Disability Office: Charlie Card Store, Downtown Crossing Station concourse (near Arch Street exit), Boston (Temporarily relocated to 10 Park Plaza)
- Customer Service Window: Charlie Card Store, Downtown Crossing Station concourse, Boston (Temporarily relocated to 10 Park Plaza)
- Revenue Operations:
  - 32 Alford Street, Charlestown
- E&M Facilities:
  - 21 Arlington Avenue, Boston MA 02129
- Power Department facility
  - 21 Arlington Avenue, Boston 02129
- Training Facilities:
  - Heavy Rail training school – Cabot Yard
  - Light Rail training school – Riverside Yard
  - Emergency Training Center (“ETC”) – South Boston
  - Signals Training School – Cabot Yard
  - South Boston Switching Station – 696 E 1<sup>st</sup> St, Boston, MA
  - Everett Shops – 80 Broadway, Everett, MA
  - UTC – Charlestown, MA

**T** Massachusetts Bay Transportation Authority  
Rapid Transit/Key Bus Routes Map



**Legend**

- RL RED LINE
- OL MATTAPAN LINE
- OL ORANGE LINE
- BL BLUE LINE
- GL SILVER LINE and branches
- GL GREEN LINE and branches
- GL Terminates at Park St.
- GL Terminates at Park St. (N. Station during off-peak)
- GL Terminates at South St.
- PR COMMUTER RAIL
- PR KEY BUS ROUTE
- PR FERRY
- BL Accessible station
- BL Rapid Transit transfer station
- BL Commuter Rail transfer station
- BL Free Logan Airport shuttle bus
- BL Amtrak service
- BL Customer Communications & Travel Info
- BL MBTA Transit Police: 911
- BL Elevator/escalator/lift updates: 800-392-6100

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Not to scale

**Figure 1: Map of Massachusetts Bay Transit Authority System**