# 5 Road Characteristics

A potential future high-capacity transit line must be designed in the context of existing transportation infrastructure, including roadways and railway rights-of-way. This chapter examines how existing right-of-way characteristics may interact with the proposed high-capacity transit corridors in terms of width; signalized intersections; speed and congestion; and safety considerations. The right-of-way characteristics studied in this chapter include:

- Roadway width and number of travel lanes
- Signalized intersections
- Speed and congestion
- Safety
- Railway rights-of-way uses and existing ownership

# Roadway Characteristics

The characteristics of the existing roadways in the study area are essential to understand, because they will be key determinants of an eventual design for high-capacity transit. This section of the report documents the number of travel lanes and the location of signalized intersections on roadways in the project study area, organized by municipality. These findings provide an understanding of the feasible roadways for high-capacity transit and potential modifications to lane configurations and intersections that may be needed to support high-capacity transit.

## Number of Travel Lanes

Transit priority infrastructure like physically separated protected busways, bus-only lanes, transit stations, and other passenger amenities can be installed on many types of roadways, but wider roadways offer the most space for high-capacity transit infrastructure. This doesn't mean wider roads are the best for high-capacity transit – other factors like land use densities and connectivity to activities are considered – but roadway width is an important consideration. In the absence of available data for the exact width of rights of way in the study area, the project team studied the number of travel lanes of existing roadways.

## Signalized Intersections

Intersections have a major impact on both transit speeds and pedestrian safety. Specifically, transit delay at intersections depends mainly on two factors: (1) how many intersections exist and (2) the intersection characteristics (such as intersection configuration and whether there is a traffic signal or stop sign). For this reason, this chapter examines the existing locations of signalized intersections. Future high-capacity transit could potentially alter existing signals to reduce delay, for example by installing transit signal priority (TSP) and/or queue jumps. For an analysis of where existing and planned TSP is located within the study area, see the Transit Analysis Chapter (Chapter 4) of this report.

## Analysis Considerations and Data Sources

Because the focus of this report is on north-south oriented high-capacity transit corridors, this analysis focuses on north-south corridors that could be suitable for high-capacity transit. In addition, although limited access highways tend to have few intersections and a higher number of travel lanes, they are not typically strong candidates for high-capacity transit because there is limited access for people walking, biking, or rolling in wheelchairs, and because there tend to be few safe opportunities for transit vehicles to make stops. In addition, highways are usually physically separated from the origins and destinations that create demand for high-capacity transit. For this reason, limited access highways are not considered candidates for high-capacity transit corridors.

The project team used publicly available RIGIS data with manual spot checks and adjustments based on the latest available street-level and satellite imagery to document the number of lanes and the locations of signalized intersections. Because this is purely a desktop exercise reliant on available imagery, the results of this analysis will be validated further as needed in future stages of this project.

## Cumberland

Cumberland has four main north-south corridors in the study area with at least two traffic lanes:

- River Road
- Mendon Road/Lonsdale Avenue (includes a section with three lanes and also has an at-grade rail crossing)
- Broad Street
- High Street

Because the northern terminus of the potential high-capacity transit corridors could be in Cumberland, it is also important to identify east-west streets that might suitably connect with the proposed High-Capacity Transit corridor. Candidate streets with at least two lanes include:

- Marshall Avenue
- Ann and Hope Way (noting there is an at-grade railroad crossing)
- John Street
- The two-lane north-south corridors of Mendon Road and Broad Street also intersect in Cumberland

The following areas are places where the roadway narrows and represent potential obstacles for future high-capacity transit:

- Mendon Road at Broad Street
- Lonsdale Avenue at John Street

Cumberland has only eight signalized intersections within the study area, the fewest of any municipality included in the study. These intersections occur along Lonsdale Avenue, High Street, and Broad Street.

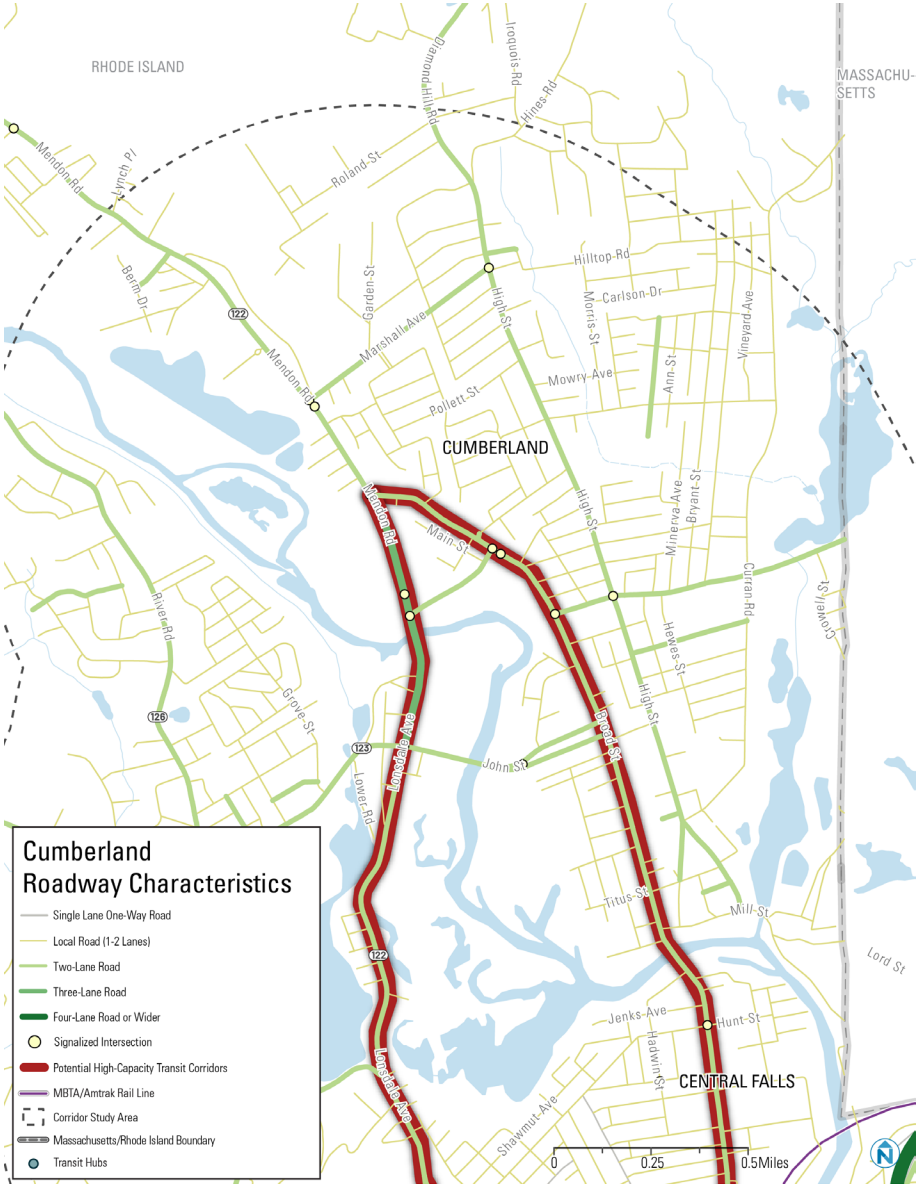


**Figure 5-1 Number of Travel Lanes and Signalized Intersections in Cumberland**

## Central Falls

Central Falls has four main north-south corridors in the study area with at least two traffic lanes:

- Lonsdale Avenue
- Dexter Street
- Broad Street
- Pine Street

There are no notable roadway narrowings in this section of the study area.

Signalized intersections occur most frequently along these north-south arterials, with increasing frequency of signalized intersections approaching the southern border with Pawtucket. While both Lonsdale Avenue and Dexter Street have several signalized intersections, Pine Street is a nearby two-lane road that runs parallel and has no signalized intersections. Traffic volumes are lower on Pine Street than on the other parallel roadways.

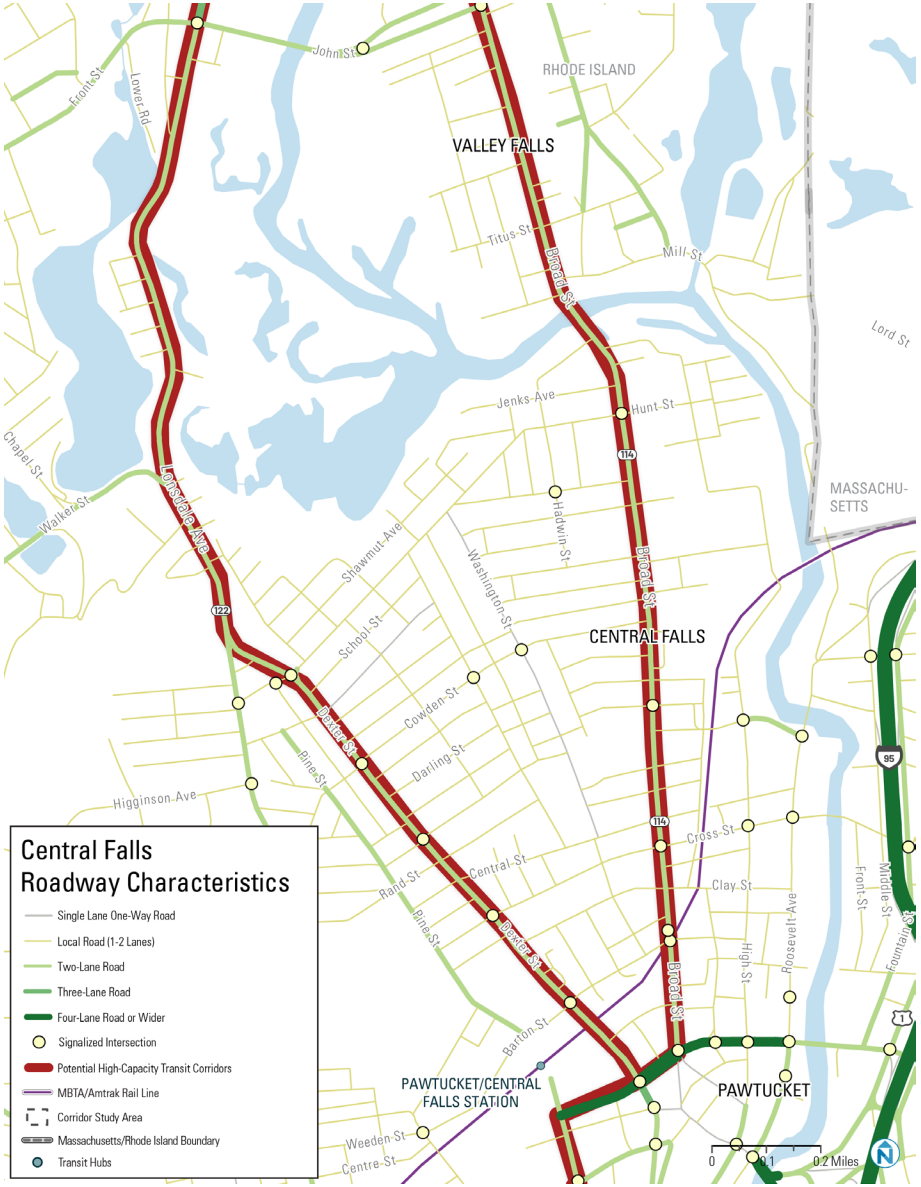


**Figure 5-2 Number of Travel Lanes and Signalized Intersections in Central Falls**

## Pawtucket

Pawtucket has five main north-south corridors with at least two traffic lanes. I-95 also passes through Pawtucket; as a limited access highway, it would not be suitable for high-capacity transit. The following streets in Pawtucket are potential candidates for high-capacity transit:

- Smithfield Avenue
- Lonsdale Avenue/Main Street (includes short sections of three and four lanes)
- Dexter Street/Pawtucket Avenue/George Street
- Broad Street (includes a short four-plus-lane section)

All of these arterials are well suited for high-capacity transit because they continue through Pawtucket into neighboring municipalities in the study area.

Several of the corridors above come together around the Pawtucket/Central Falls Station and are connected by multiple east-west corridors with two or more lanes. Of these potential east-west connecting corridors, Goff Avenue/Exchange Street is particularly notable because it has four lanes and existing transit priority infrastructure. This makes it an especially strong candidate for supporting high-capacity transit.

The following narrowings of the roadway represent potential chokepoints for future high-capacity transit service:

- Lonsdale Avenue at Quincy Avenue
- Pawtucket Avenue at Randall Street

There is a dense network of signalized intersections on two-lane roads in Downtown Pawtucket, especially along the access ramps to I-95, on Main Street, George Street, and Goff Road/Exchange Street

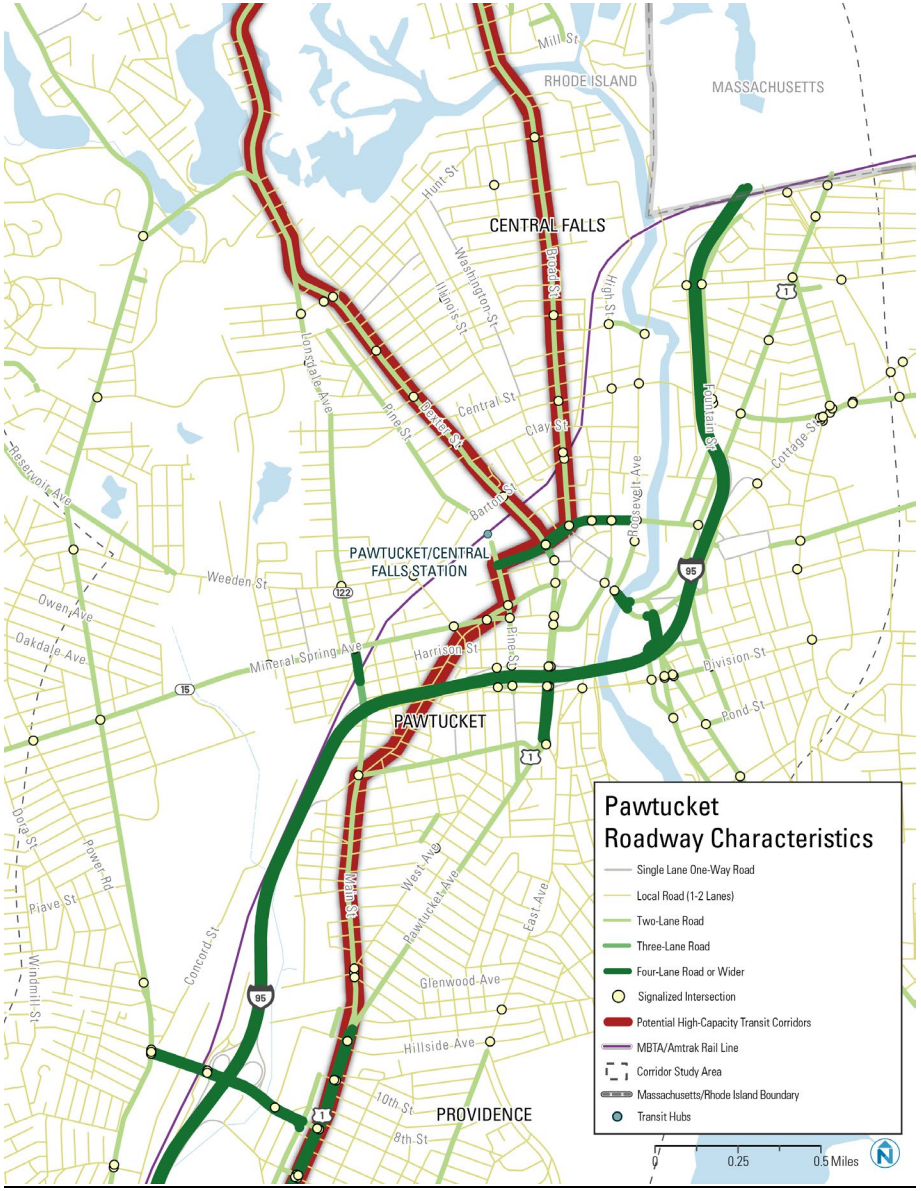


**Figure 5-3 Number of Travel Lanes and Signalized Intersections in Pawtucket**

## Providence

Providence has several north-south corridors with at least two traffic lanes and several limited access highways. The following roadways have at least two traffic lanes and could be candidates for high-capacity transit to access Downtown Providence from the north:

- Douglas Avenue/Route 7
- Charles Street*
- Smithfield Avenue*
- North Main Street/Route 1* (includes a lengthy four-plus-lane segment)
- Hope Street

Charles Street, Smithfield Avenue, and North Main Street/Route 1 are especially well suited for high-capacity transit because they continue through Providence into neighboring Pawtucket to the north.

There are also several north-south corridors with at least two traffic lanes that could be candidates for high-capacity transit to access Downtown Providence from the south:

- Cranston Street (includes a three-lane segment)
- Reservoir Avenue/Route 2 (includes three- and four-plus-lane segments)
- Broad Street
- Eddy Street
- Allens Avenue/Route 1A (includes a four-plus-lane segment)

Each of these roadways to the south of Downtown Providence connect to those to the north via a dense network of streets with two or more lanes in Downtown. Downtown also has the highest density of signalized intersections in the entire study area. Because of these conditions, there may be several candidate alignments through Downtown Providence, and one-way service may be considered. There also exists the opportunity for a new transit-only guideway that connects Gaspee Street to Exchange Street located just to the west of Providence Station.

Outside of Downtown, signalized intersections occur most frequently on wider roadways in Providence, with the notable exceptions of I-95 and I-195. There are also several roadway narrowings, most notably along Branch Avenue, North Main Street/Route 1, Cranston Street, Reservoir Avenue, and Allens Avenue/Route 1A.

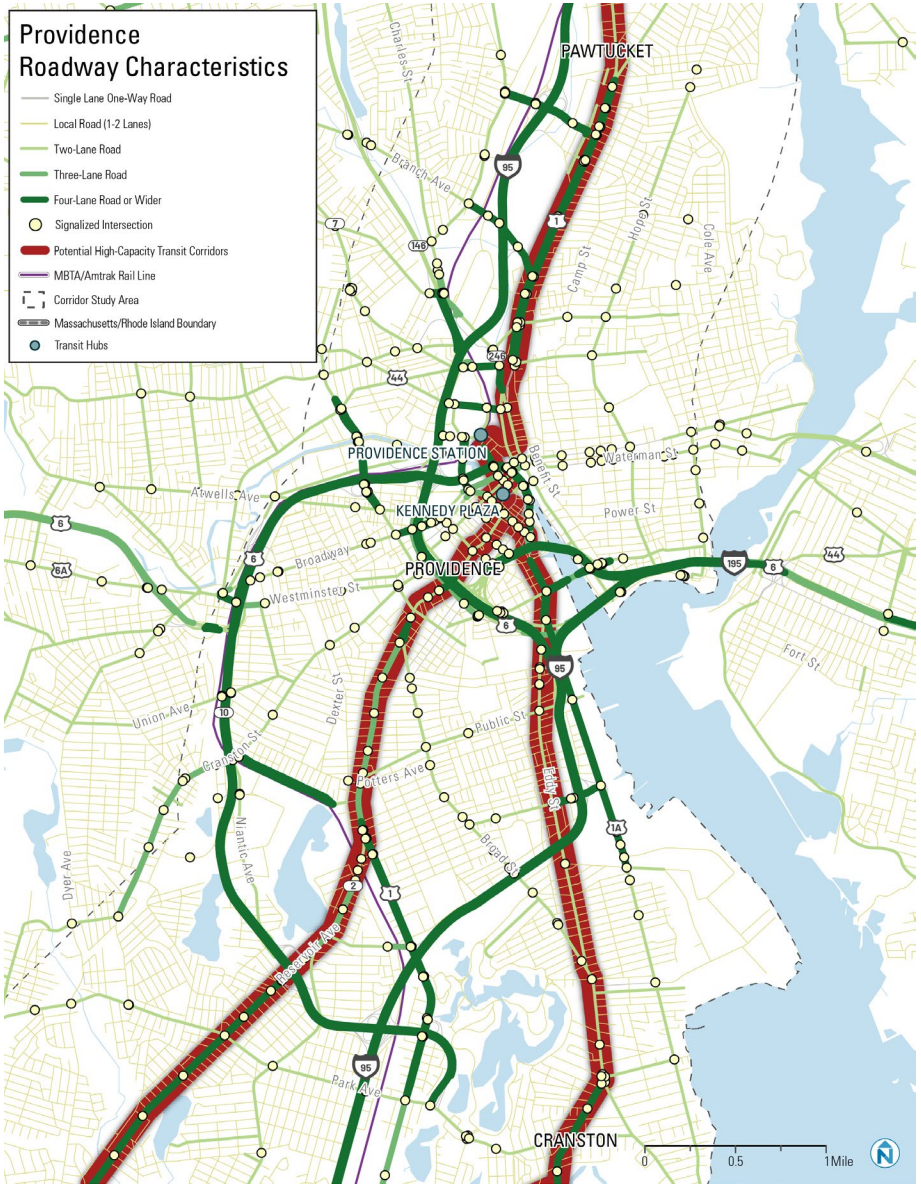


**Figure 5-4 Number of Travel Lanes and Signalized Intersections in Providence**

## Cranston

Cranston has six main north-south corridors with at least two traffic lanes and several limited access highways. The following local streets are especially well suited for high-capacity transit because they continue through Cranston into neighboring municipalities to the north and south.

- Cranston Street (includes a three-lane segment)
- Oaklawn Avenue
- Reservoir Avenue/Route 2 (includes three- and four-plus-lane segments)
- Elmwood Avenue/Route 1 (includes three- and four-plus-lane segments)
- Eddy Street/Warwick Avenue (includes a four-plus-lane segment)
- Narragansett Boulevard/Route 1A (includes a four-plus-lane segment)

The following narrowings of the roadway represent potential chokepoints for future high-capacity transit:

- Cranston Street at Howard Street
- Cranston Street at Niantic Avenue
- Reservoir Avenue at Rounds Avenue
- Reservoir Avenue at Elmwood Avenue
- Broad Street at Montgomery Avenue
- Allens Avenue at Ernest Street
- Pontiac Avenue at Sockanosset Cross Road
- Pontiac Avenue at Howard Avenue

Signalized intersections are most heavily concentrated along Reservoir Avenue, US Route 1, Warwick Avenue, and Eddy Street.

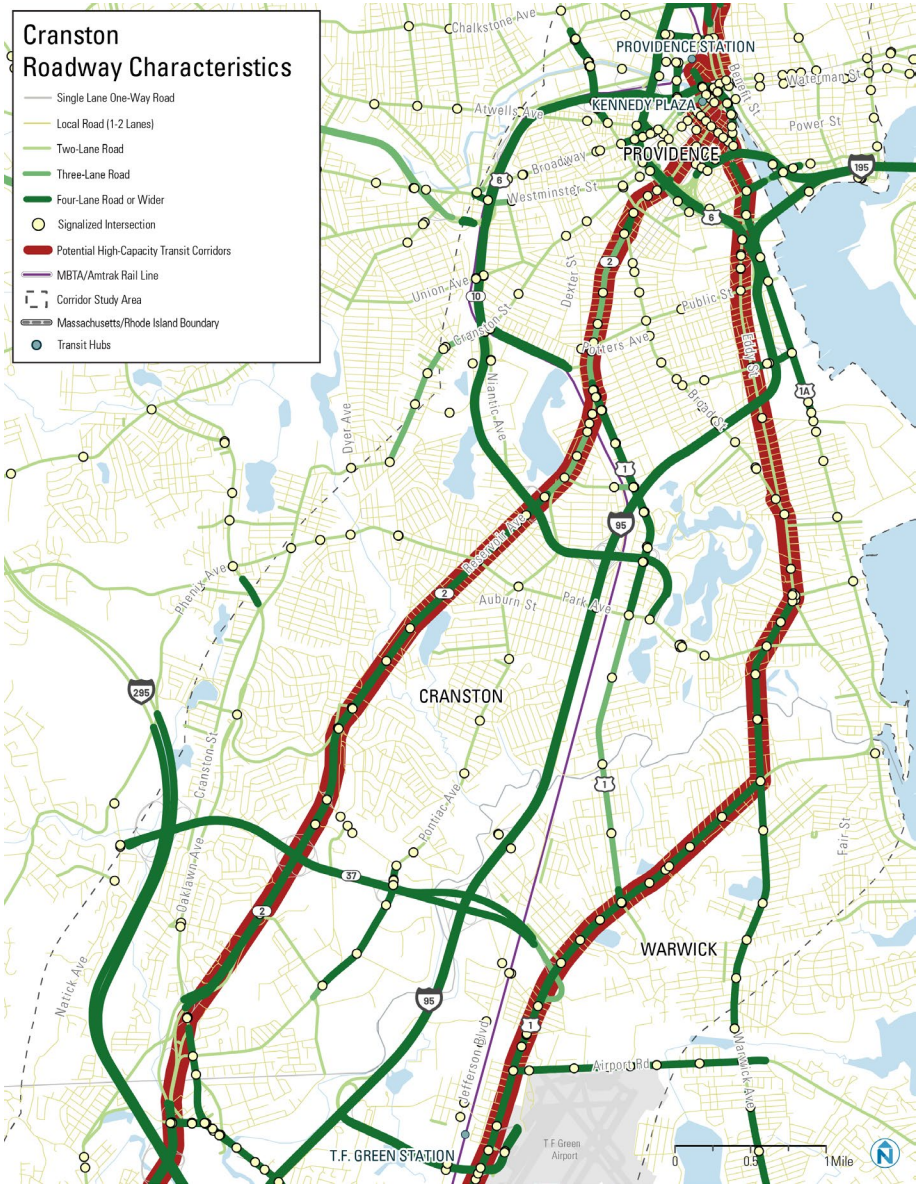


**Figure 5-5 Number of Travel Lanes and Signalized Intersections in Cranston**

## Warwick

Warwick has five main north-south corridors with at least two traffic lanes and two limited access highways. The following local streets are especially well suited for high-capacity transit because they continue through Warwick into neighboring municipalities to the north and south.

- Reservoir Avenue/Bald Hill Road/Route 2 (four-plus lanes)
- Pontiac Avenue (includes a four-plus-lane segment)
- Elmwood Avenue/Route 1
- Post Road/Route 1/Route 1A (four-plus lanes)
- Warwick Avenue/Route 1A (includes a four-plus-lane segment)

Because the southern terminus of the potential high-capacity transit corridors could potentially be in Warwick, it is also important to identify east-west streets that might be suitable connect the two potential high-capacity transit corridors. Candidate streets with at least two lanes include:

- Airport Road (four-plus lanes)
- Greenwich Avenue (includes three- and four-plus-lane segments)
- East Avenue/Main Avenue (four-plus lanes)
- Toll Gate Road
- Centerville Road

The following narrowings of the roadway represent potential chokepoints for a future high-capacity transit corridor:

- Warwick Avenue at Norwood Avenue
- Warwick Avenue at Sandy Lane
- Main Avenue at Greenwich Avenue
- Main Avenue at Trinity Street
- Greenwich Avenue at Greenwood Avenue

Signalized intersections are distributed relatively evenly across each of the corridors of two or more lanes in width. Notably, Greenwich Avenue has a particularly high density of signalized intersections.

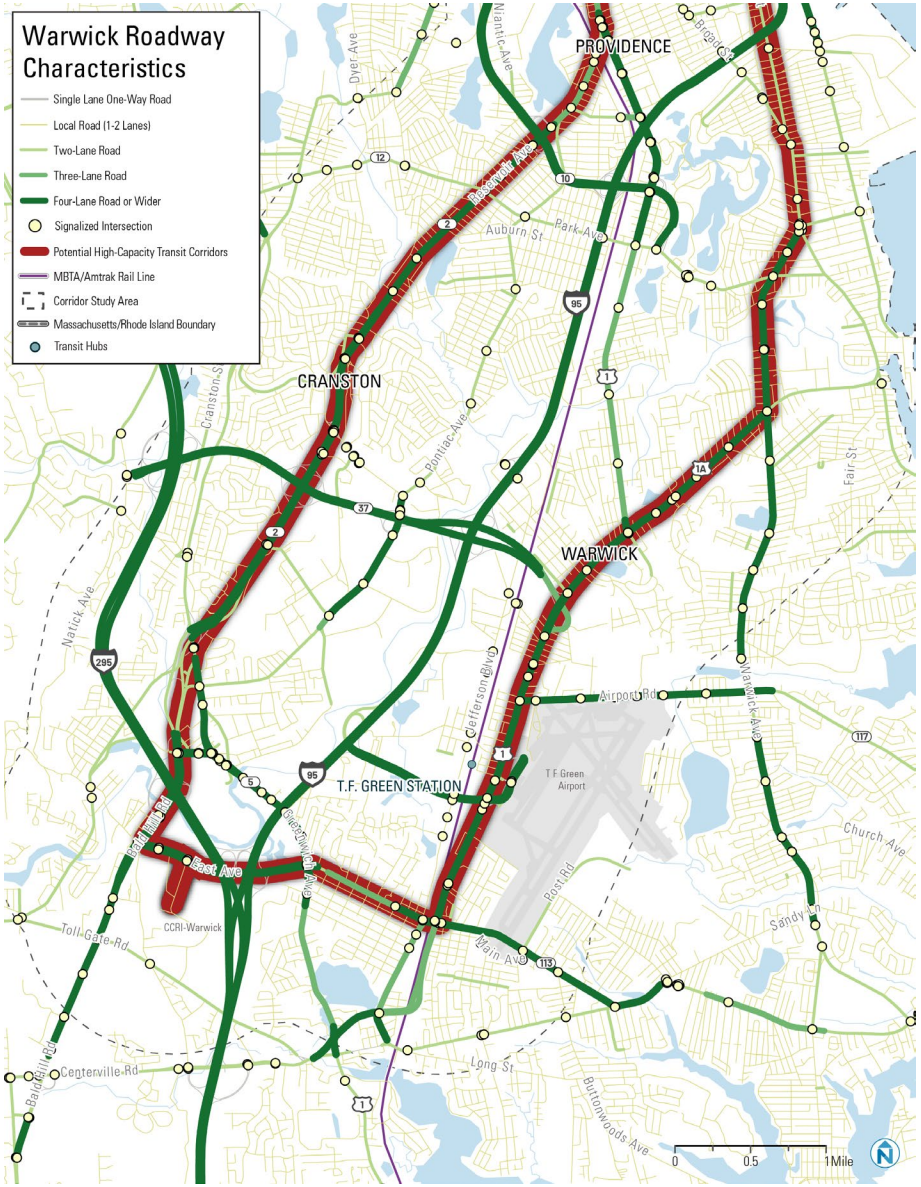


**Figure 5-6 Number of Travel Lanes and Signalized Intersections in Warwick**

# Speed and Congestion

Transit speeds are important because riders want to reach their destination quickly. General roadway characteristics such as stop signs, traffic signals, mid-block crossings, traffic congestion, double parking, and circuitous streets are key determinants to transit speeds.

To evaluate transit speeds, the project team mapped morning peak RIPTA bus speeds throughout the study area (see Figure 5-7). This analysis relies on RIPTA's AVL data processed by Swiftly to identify the areas where, due to lower existing bus speeds, new and additional transit priority infrastructure could be needed to support potential high-capacity transit service.

## Existing Transit Speed

Transit speeds are slowest (less than 15 miles per hour) in Downtown Providence, Downtown Pawtucket, near highway on/off ramps, and around major destinations in Warwick and Cranston. Outside of these areas, buses commonly operate above 20 miles per hour. However, many factors can make buses slow and unpredictable:

- Providence and Pawtucket's narrow streets are difficult to navigate and are often blocked by delivery trucks and double-parked cars.
- Traffic congestion slows down buses and is unpredictable, especially in Providence and Pawtucket. Traffic can be better or worse depending on the day and hour.
- Bus stops that are blocked by illegal parking or double-parked cars.
- Some routes are long, increasing opportunities for delays.
- Some routes have circuitous alignments. Bus routes that travel on smaller streets and make numerous turns result in trips that are longer and harder to keep on time.

To the extent that corridors in these areas are considered for rapid transit alignments in this study, they are likely candidates for more intensive speed and reliability improvement measures, such as bus lanes or transit signal priority.

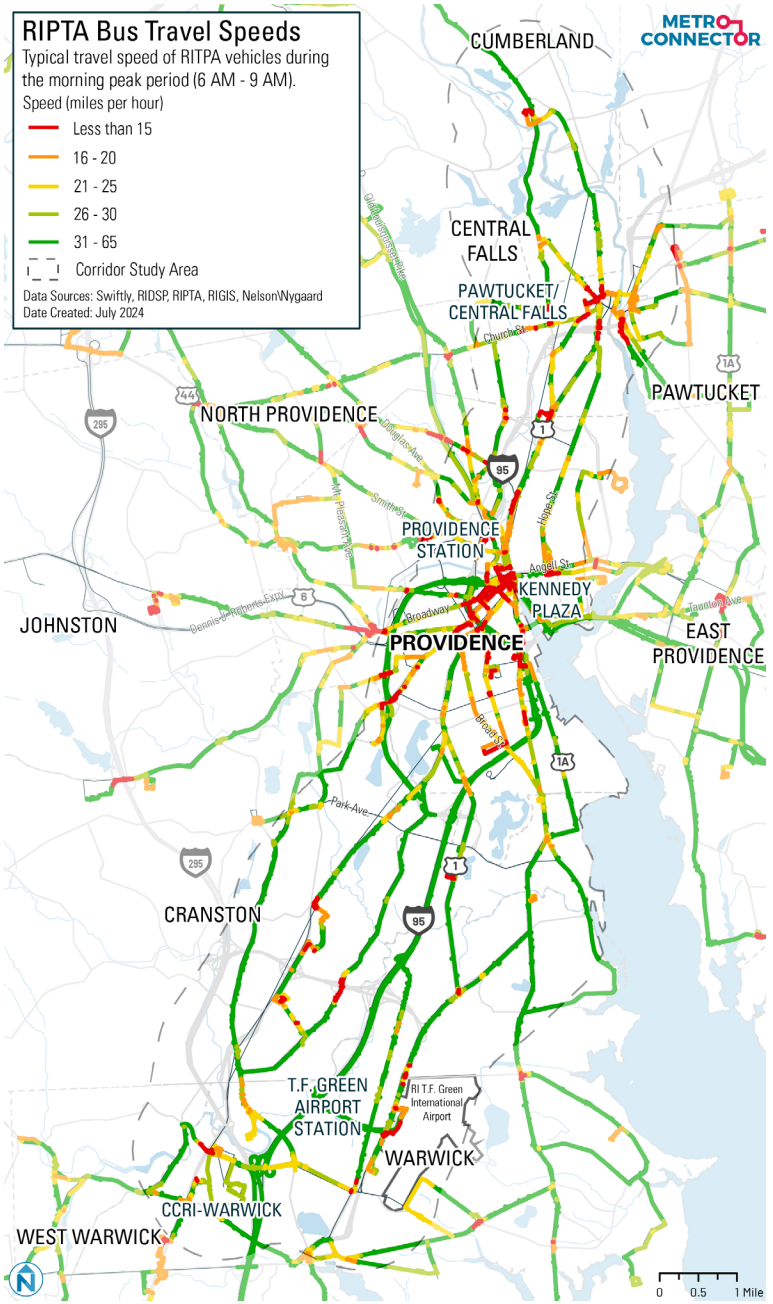


**Figure 5-7 Map of Bus Speeds**

# Safety

Future high-capacity transit corridors will likely include the construction of new roadway and pedestrian infrastructure such as dedicated transit guideways, wider sidewalks, new street crossings, and new and reconfigured signals. This infrastructure facilitates the movement of transit vehicles and can also improve the safety of existing roadways by slowing automobile speeds and providing additional infrastructure for pedestrians and transit users. Furthermore, a safe roadway environment can ensure better access to potential high-capacity transit service, particularly for people walking, biking, and rolling in wheelchairs.

To evaluate roadway safety conditions, the project team used the last five years of available RIDOT data to identify hotspots of crashes causing injury throughout the study area (see Figure 5-8). The weighting scale in Table 5-1 was used to highlight the higher severity of more serious crashes. The "Crash Severity" type is pulled directly from the Federal Highway Administration's (FHWA's) KABCO[11] value in the dataset, with weights assigned by testing various alternatives. Crashes with no apparent injury were assigned a weight of zero so that only crashes involving injuries and fatalities appear on the map.

**Table 5-1 Weights Used in Crash Density Analysis**

| Crash Severity | Analysis Weight |
|---|---|
| **Fatal** | 15 |
| **Incapacitating (Suspected Serious Injury)** | 5 |
| **Non-Incapacitating (Suspected Minor Injury)** | 2 |
| **Complains of Pain (Possible Injury)** | 1 |
| **No Apparent Injury** | 0 |

Most crash hotspots within the study area occur on high-speed roads like interstates and state highways, with a higher crash density occurring on all types of roads in Providence and Central Falls. The following areas have the highest density of injurious crashes within the study area:

- Bald Hill Road at Toll Gate Road, at East Avenue, and at West Natick Road, Warwick
- Centerville Road at Greenwich Avenue, Warwick
- Reservoir Avenue at Park Avenue and at Legion Way, Cranston
- Broad Street at Norwood Avenue, Cranston
- Elmwood Avenue at Roger Williams Avenue, Providence
- Elmwood Avenue at Reservoir Avenue and Potters Avenue, Providence
- Broad Street at Elmwood Avenue, Providence
- North Main Street at Branch Avenue, Providence
- Smithfield Avenue at Silver Spring Street, Providence
- Dexter Street at Goff Avenue, Pawtucket
- Mineral Spring Avenue at Smithfield Avenue, Pawtucket
- Lonsdale Avenue at Weeden Street, Pawtucket
- Broad Street at Cross Street, Central Falls
- Broad Street at John Street, Cumberland

[11] KABCO Injury Classification Scale and Definitions, https://highways.dot.gov/media/20141

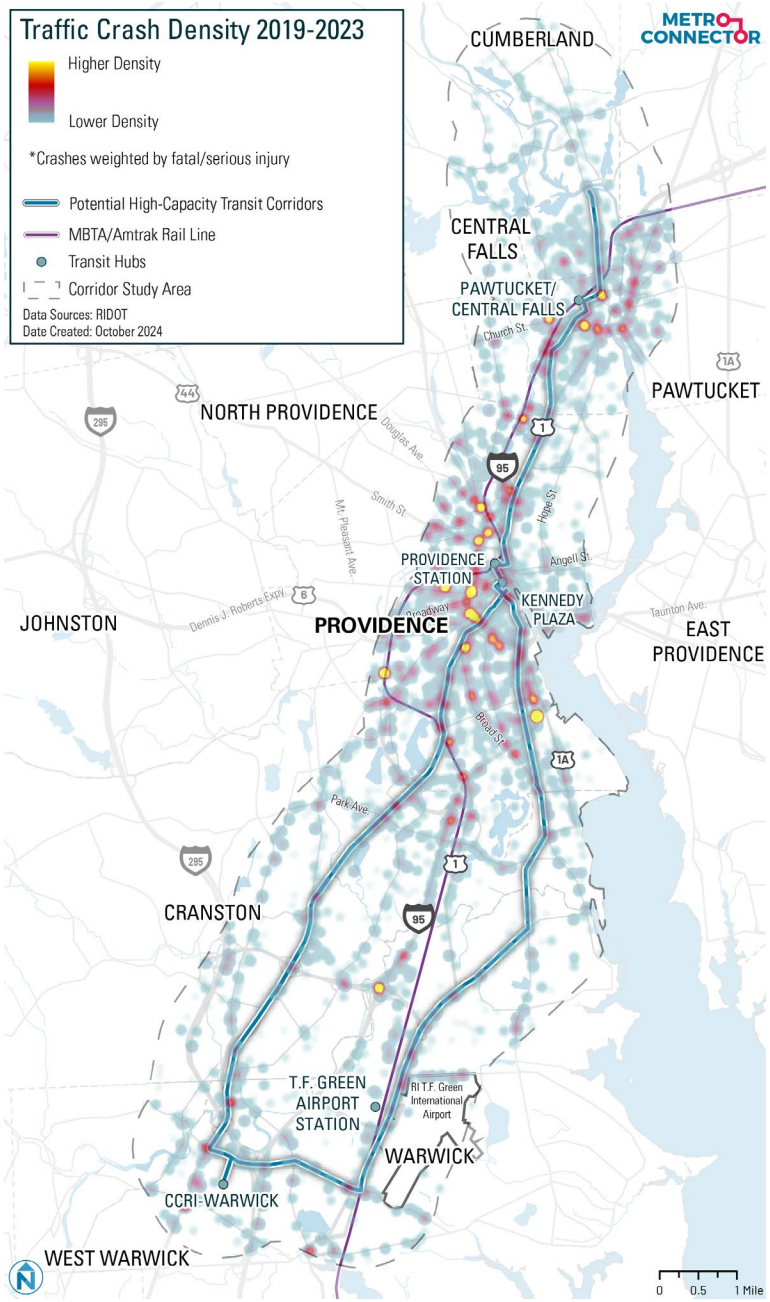


**Figure 5-8 Crash Density Within The Study Area Weighted by Injury Severity**

# Railway Characteristics

## Current Use of Existing Railroad Rights-of-Way

Existing railroad rights of way in the study area vary by use, including a mix of passenger, freight, commercial, converted bike path, inactive, and undeveloped rights of way (see Figure 5-9). High-capacity transit can potentially use existing railroad rights-of-way, although the ownership, existing use, width, and existing crossings and access to the rights-of-way can affect the feasibility of these corridors. The existing railroad rights-of-way in the study area have the following uses:

**Freight/Passenger:**

A key active freight and passenger rail line that runs north-south through the study area is the Amtrak Northeast Corridor (NEC) served by Amtrak and MBTA Commuter Rail, as well as Freight Rail Improvement Project (FRIP) Freight/Passenger Track. This corridor roughly parallels I-95 in the study area, except directly south of downtown Providence, where the line runs on the western border of Federal Hill and the West End and I-95 runs on the eastern border of Lower South Providence.

**Commercial:**

Commercial rail corridors are present in several places near the edges of the study area:

- Running through Cumberland is the Providence and Worcester Main Line running roughly parallel to Broad Street in the study area.
- Moshassuck Valley Industrial Track runs just over a mile spur off the NEC into Central Falls.
- The Harbor Junction Industrial Track runs parallel to the NEC and runs north and east into the Providence Port.
- The Warwick Industrial Track runs parallel to the NEC and travels east into Warwick.

**Bike Path**

The Washington Secondary Track has been converted to a bike path running primarily north-south through Cranston and into Warwick.

**Undeveloped**

Undeveloped rights-of-way include:

- The Pontiac Secondary Branch in Cranston.
- The Wrentham Industrial Track in the northeast section of the study area in Cumberland.
- The East Providence Secondary Track runs east from Providence into East Providence and is inactive and underground in the study area.

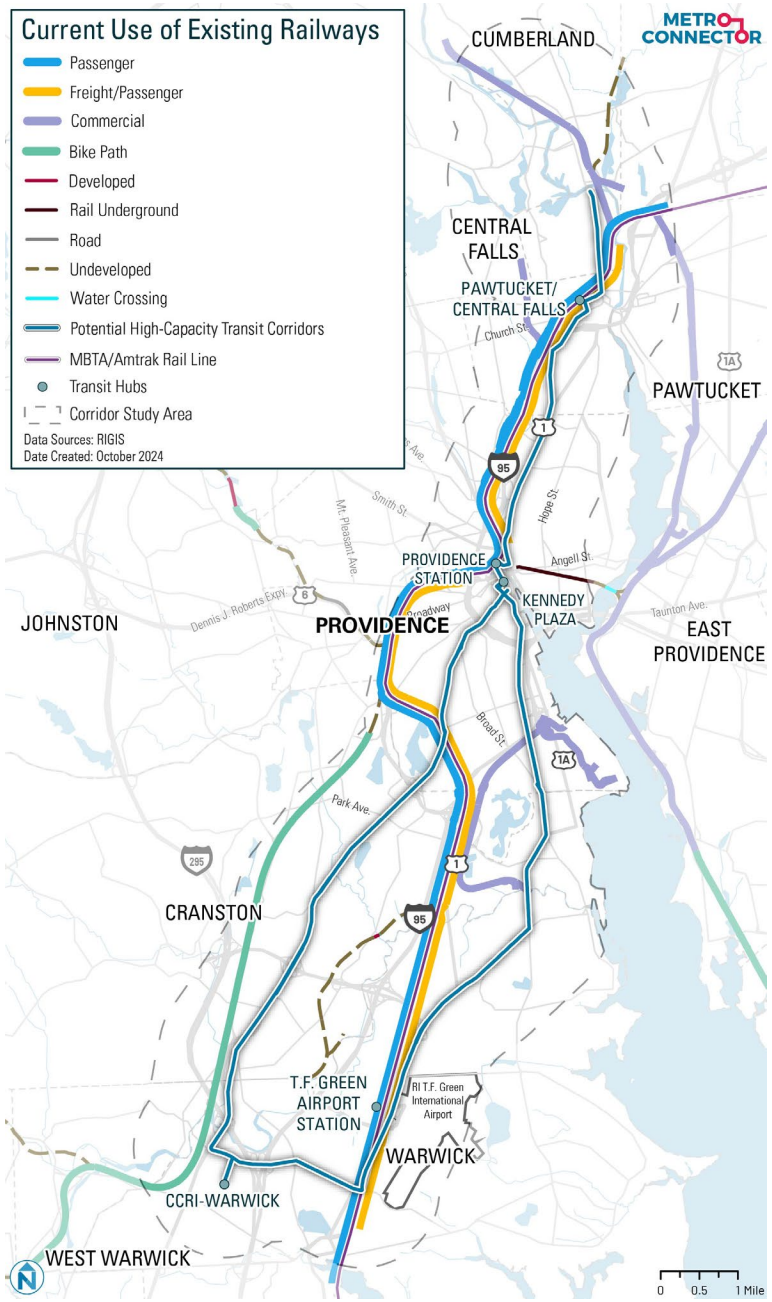


**Figure 5-9 Current Uses of Existing Railroad Rights of Way**

## Ownership of Existing Railroad Rights-of-Way

The existing railroad rights-of-way in the study area are owned by a mix of private, state, and municipal owners (see Figure 5-10). Ownership of existing right-of-way and operating rights maintained by the railroads can greatly influence the legal and logistical feasibility of using the right-of-way for high-capacity transit.

Privately owned railroad rights of way include:

- The NEC owned by Amtrak
- The Wrentham Industrial Track in the northeast section of the study area in Cumberland.
- Moshassuck Valley Industrial Track in Central Falls.
- The Warwick Industrial Track in Warwick.

State owned railroad rights of way include:

- The NEC FRIP Track
- The Washington Secondary Bike Path running through Cranston and Warwick
- The East Providence Secondary Track connecting Providence and East Providence.
- The Pontiac Secondary Branch in Cranston.

Municipally owned railroad rights of way include the Harbor Junction Industrial Track connecting into the Providence Port.

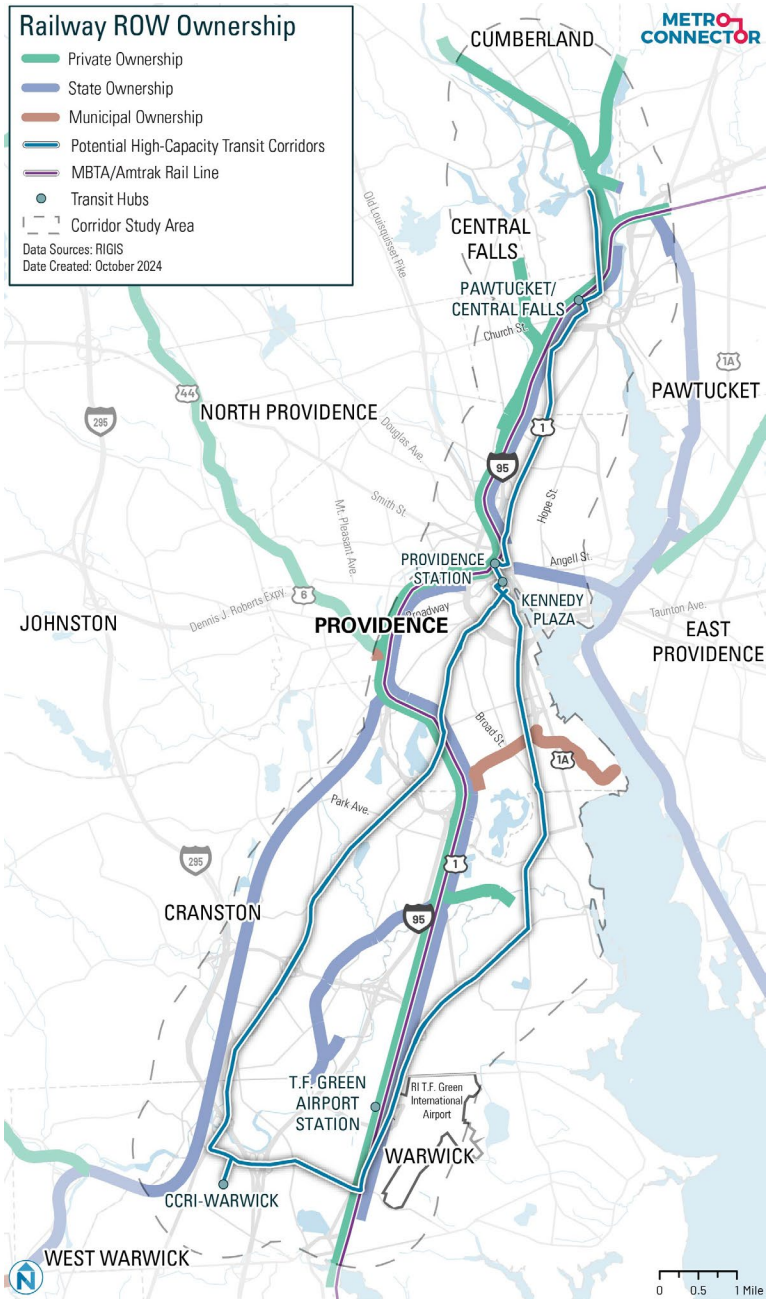


**Figure 5-10 Ownership of Existing Railroad Rights of Way**

# Summary and Opportunities

Characteristics related to the width, intersections, and safety of existing roadways will impact the implementation and operation of any future high-capacity transit. Additionally, the current use and ownership of rail rights-of-way could impact the possibility to use these corridors for high-capacity transit. The analysis found the following opportunities in which existing roadway characteristics are already aligned with future rapid transit corridors:

- There are several north-south corridors within the study area that have continuous stretches of two or more lanes. These corridors would likely be wide enough to accommodate transit priority infrastructure.
- There are several east-west corridors both at the northern and southern ends of the study area that could potentially connect the two future high-capacity transit corridors at the end of their routes.
- The vast majority of the potential high-capacity transit corridors lie along roadways that are at least two lanes in width and could potentially accommodate transit priority infrastructure.
- While most rail rights-of-way in the study area have an active use, there are sections which are inactive or undeveloped. Like with roadway rights-of-way, additional study is required to evaluate the feasibility of using railroad rights-of-way as future high-capacity transit corridors. The operating rights maintained by railroads and the current use of these spaces is an important consideration.
- Several high crash areas are located on roadways that may also be well-suited for high-capacity transit. The redesign of roadways to accommodate future high-capacity transit service may also address existing safety issues.

Analysis also identified the following challenges to high-capacity transit posed by existing roadway conditions:

- Careful planning will be required to identify feasible corridors through Downtown Providence and Pawtucket, as these areas have the lowest bus speeds in the entire study area and a dense network of narrow streets and signalized intersections.
- Signalized intersections occur frequently throughout the entire study area, but almost exclusively on corridors with two or more lanes. Intersection treatments like transit signal priority will likely be important to the success of future high-capacity transit service.