KITTELSON & ASSOCIATES

WELLESLEY TOWNWIDE SAFE ROUTES PLAN

Wellesley, MA

February 2025

Inside front cover

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Wellesley Townwide Safe Routes Plan

Wellesley, MA

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Introduction

Introduction

The Town of Wellesley, Massachusetts, prepared this Townwide Safe Routes Plan to continue developing a connected network of low-stress routes that enable residents and visitors to safely walk and bike between key destinations across the Town. Towards this objective, this Plan evaluates existing walking and biking routes in the Town, identifies network gaps, and recommends low-cost improvements to enhance and expand connections to key locations. Building on previous efforts such as the Unified Plan (2019) and Sustainable Mobility Plan (2021), the Townwide Safe Routes Plan will promote active transportation modes like walking and biking, and serve as a guide for the Town's Safe Routes to School program. Accordingly, this Plan is organized as follows:

1. Existing Conditions
2. Network Identification
3. Safety Treatments Toolkit
4. Project Recommendations for Safe Routes

Chapter 2
Existing Conditions

Existing Conditions

This chapter provides an overview of the existing conditions in the Town of Wellesley, with an emphasis on information that will guide the identification of safer walking and biking routes in the Town. This data is obtained from the Town's existing plans, publicly available demographic and socioeconomic data, existing data resources provided by the Town, and information from other public agencies such as the Massachusetts Department of Transportation (MassDOT).

This chapter is organized as follows:

- Relevant Document Review
- Multimodal Trip Generators
- Demographic Analysis
- Roadway Network Inventory
- Existing Pedestrian and Bicycle Facilities
- Pedestrian Network Gap Analysis
- Bicycle Level of Stress Analysis
- Key Existing Conditions Findings

RELEVANT DOCUMENT REVIEW

Table 1 outlines relevant and recent Wellesley documents and includes a short summary of how each document relates to and supports the Townwide Safe Routes Plan.

Table 1. Relevant Document Review Summary

Document	Summary
ADA Transition Plan (2024)	To comply with and go beyond the requirements of the Americans with Disabilities Act, Wellesley created this Plan to document the Town's public facilities and recommend actions to make these facilities accessible, safe, and comfortable for all users. The inventory informed the multimodal trip generators for the Safe Routes Plan.
Open Space and Recreation Plan (2022 – 2029)	The Plan identified several community needs and actions regarding active transportation and safe routes, which will inform the network identification process for the Safe Routes Plan.
Climate Action Plan (2022)	Transportation is one of the key pathways to reducing the Town's greenhouse gas emissions, and the creation of the Safe Routes Plan will support the strategies outlined in the Climate Action Plan to increase walking and biking as a primary transportation mode for community members.
Trails Development and Improvement Plan (2022 – 2026)	The Plan covers major development and improvement projects planned for the Town's trails' network. Accordingly, there are two trails' projects underway (Paintshop Pond Trail and Sudbury Path to Natick), as well as several proposed trail projects aimed at expanding Wellesley's trail network. These facilities will be important connections to consider for the network identification process in the Safe Routes Plan.
Sustainable Mobility Plan (2021)	The Plan was developed to support multimodal travel in the Town through infrastructure projects and policies geared towards providing safe, convenient, and accessible facilities for pedestrians, bicyclists, and transit users. The Safe

Document	Summary
	Routes Plan is a direct outcome of this Plan and supports the vision, goals, and objectives outlined therein.
Complete Streets Prioritization Plan (2020)	To qualify for MassDOT Complete Streets Funding Program grants, Wellesley created the Complete Streets Prioritization Plan that outlines nearly 30 active transportation and transit safety and mobility projects. These projects will inform the Safe Routes Plan development during the network identification process.
Complete Streets Policy (2019)	Complete Streets are streets designed and operated to enable safe use and support mobility for users of all ages and abilities, regardless of whether they are travelling as drivers, pedestrians, bicyclists, or public transportation riders.[1] Wellesley adopted this Policy to guide the integration of Complete Streets principles throughout all transportation work, including the Safe Routes Plan.
Unified Plan (2019)	The Unified Plan outlines a 20-year vision for the Town, focusing on the health and well-being of its residents, sustainability, and conservation. Part IV of the Plan highlights goals for Mobility and Circulation, emphasizing multimodal transportation, the Complete Streets Program, and the creation of safe, low-stress bicycle and pedestrian facilities. The Safe Routes Plan is a key outcome of this vision, aligning with and supporting the goals and objectives of the Plan's Mobility and Circulation element.

MULTIMODAL TRIP GENERATORS

This section identifies the locations of multimodal trip generators in the Town of Wellesley. Multimodal trip generators are locations that attract people on foot, by bike, by transit, or by car, and for the purpose of this Plan, include:

- Civic Buildings
- Schools and Colleges
- Group Housing (College Housing or Senior Housing)
- Places of Worship
- Parks and Recreation Areas
- Commercial/Shopping Areas
- Transit Stops including Massachusetts Bay Transportation Authority (MBTA) Commuter Rail Stations and MetroWest Regional Transit Authority (MWRTA) Bus stops

This data was provided by the Town of Wellesley, except for transit stops, which were provided by the MBTA and the MWRTA.[2,3]

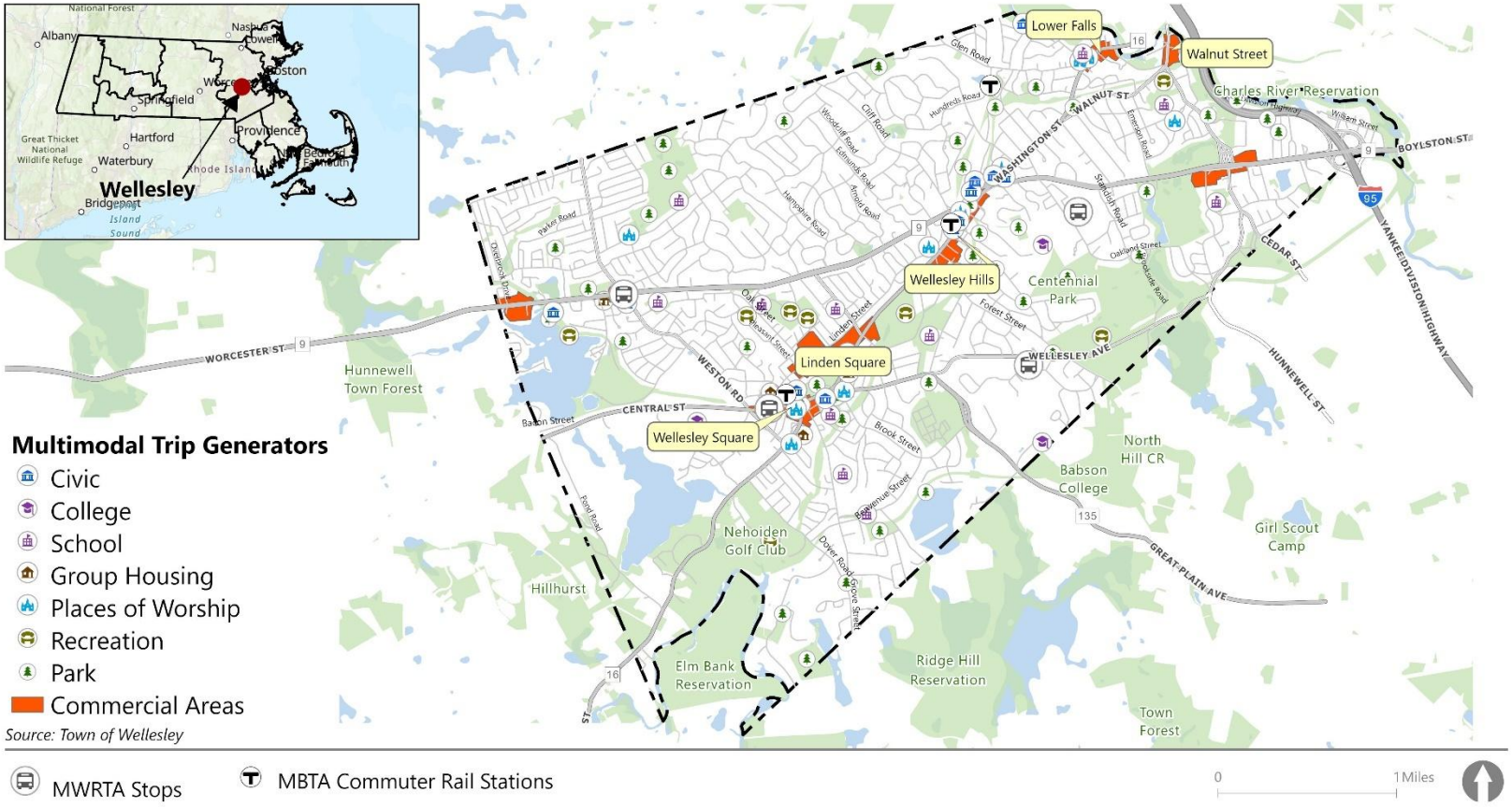
Figure 1 shows the locations of multimodal trip generators in the Town of Wellesley. As depicted below, multimodal trip generators are concentrated in and around Wellesley Square, Linden Square, Wellesley Hills and Lower Falls areas, which are among the primary commercial areas in the Town.

[1] United States Department of Transportation. (August 2015). *Complete Streets.* https://www.transportation.gov/mission/health/complete-streets

[2] https://hub.arcgis.com/maps/massgis::mbta-commuter-rail/about

[3] https://arc-gis-hub-home-arcgishub.hub.arcgis.com/datasets/9f0b255b1a314b70a396d93d4425f531_1/explore?location=42.297944%2C-71.288603%2C13.87

Figure 1. Multimodal Trip Generators



Multimodal Trip Generators
Wellesley Townwide Safe Routes Plan

DEMOGRAPHIC ANALYSIS

According to the US Census Bureau's 2022 American Community Survey (ACS) 5-Year Estimates, the population of Wellesley is 29,862 and there are 8,956 households in the Town.[4] Forty-three percent of the Town's population are workers, and the median household income of the Town exceeds $250,000, which is the highest income category collected by the US Census Bureau. The following demographic characteristics are discussed in this section:

- Population and Employment Density
- Age
- Zero Vehicle Households
- Means of Transportation to Work
- Environmental Justice Populations

Population and Employment Density

Areas with higher population and employment densities often experience greater demand for walking, biking, and transit facilities. Figure 2 displays the population density (in persons per square mile) in the Town of Wellesley by census block group, based on the 2022 ACS 5-Year Estimates. Wellesley Square, Babson Park, and Wellesley Lower Falls are areas with medium to high population densities relative to the rest of Town. The population in the Town is also concentrated around major roadway corridors including State Route 9 (Worcester Street), State Route 16 (Washington Street), Central Street, and Wellesley Avenue. This data indicates key areas to prioritize network improvements as part of this Plan to serve as many residents as possible.

Notably, the areas with higher population density also correspond to high employment density, as shown in Figure 3.[5] As depicted in Figure 3, employment areas are concentrated around the center and northeast portions of the Town, with job densities ranging from 4,066 to 6,350 jobs per square mile. The OnTheMap tool was also used to perform a Distance/Direction Analysis to assess the proximity between workers' homes and their workplaces. According to this analysis, 42% of the individuals employed in Wellesley lived within 10 miles of their workplace, and about 10% of Wellesley residents are also employed in Wellesley. Most (~90%) of Wellesley employees live outside the Town.

[4] United States Census Bureau. (December 2023). *2022 ACS 5-Year Estimates.* https://www.census.gov/data/developers/data-sets/acs-5year.html
[5] United States Census Bureau. (N.D.) *U.S. Census Bureau's OnTheMap Tool. https://onthemap.ces.census.gov*

Figure 2. Population Density

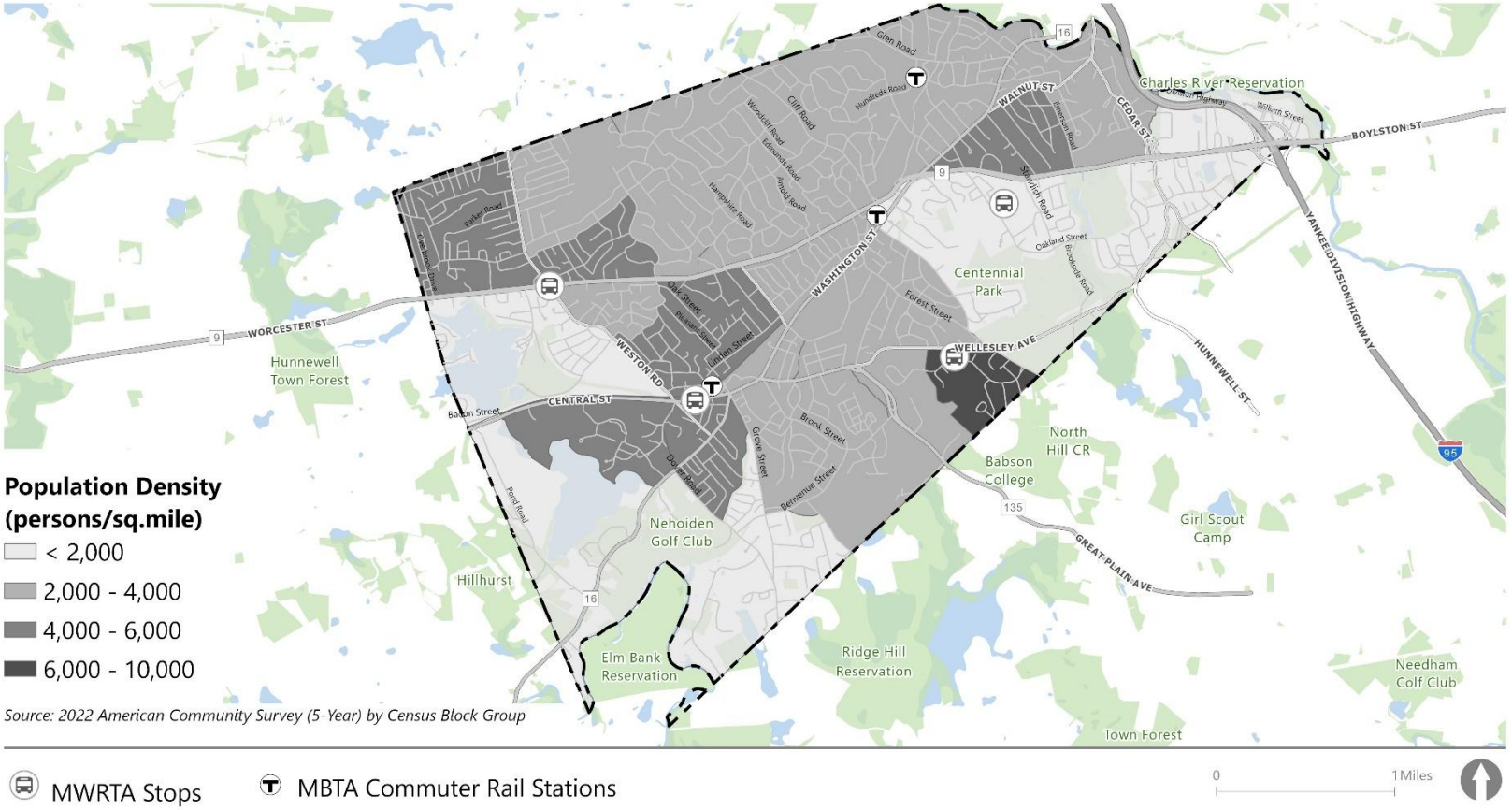
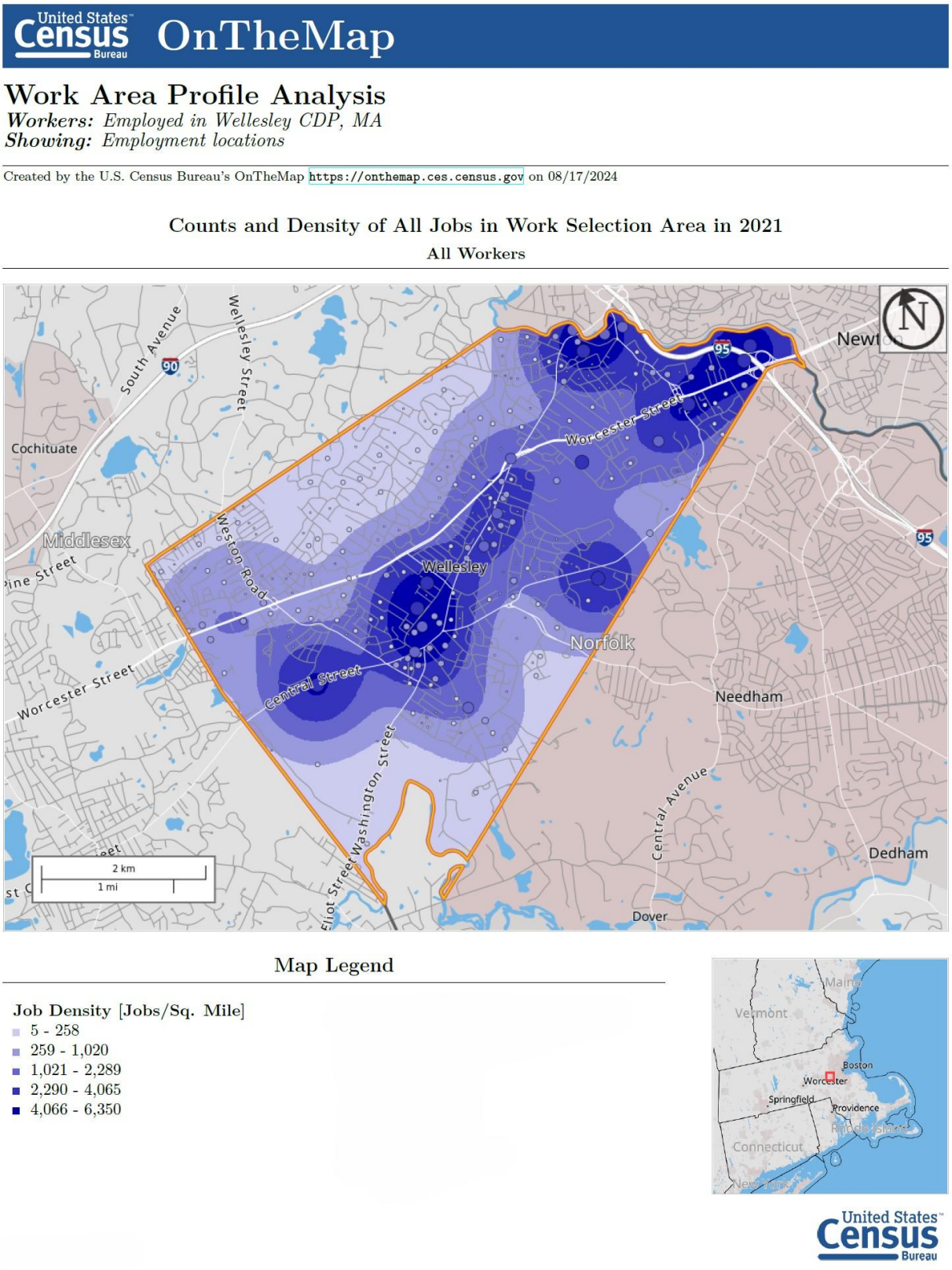


Figure 3. Employment Density

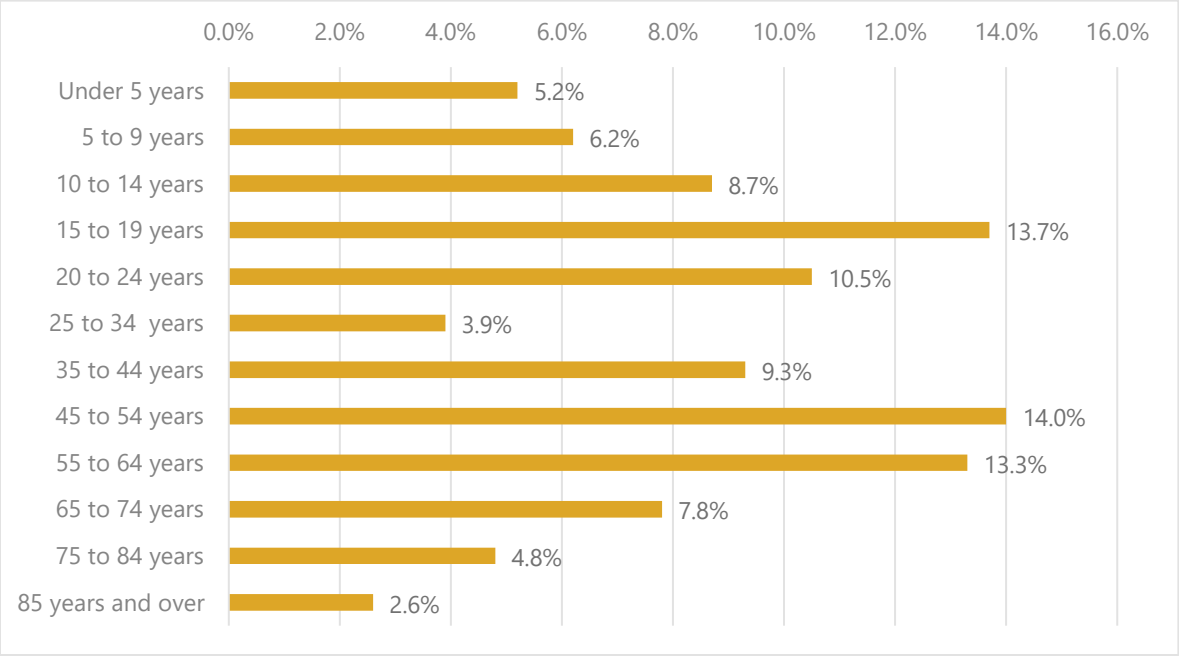


Source: https://onthemap.ces.census.gov/

Age

Figure 4 depicts the age distribution in the Town of Wellesley, based on the 2022 ACS 5-Year Estimates. The largest age group in the Town of Wellesley is those aged between 45 to 54 years, comprising 14% of the population. The second-largest group is individuals aged between 15 to 19 years, making up 13.7% of the population. Individuals under 14 years of age represent 19.1% of the population, while those aged 65 years and above make up 15.2%. As the minimum age to obtain a driver's license in Massachusetts is 16.5 years of age, most of the youthful population (under 19 years of age) either depend on others for transportation or utilize active transportation modes to access their essential destinations. Similarly, while elderly people (age 65 or older) are permitted to drive, health conditions or financial conditions may increase their dependence on transit, walking, or shared rides. By prioritizing safe routes that are accessible for people of all ages and abilities, Wellesley can continue to serve these populations.

Figure 4. Age of Population

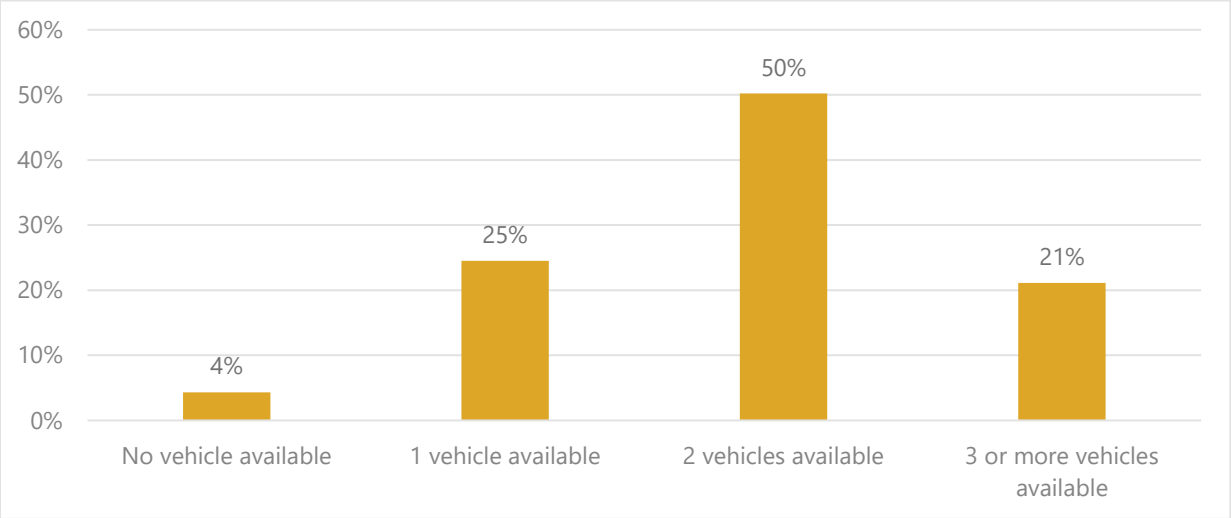


Source: US Census Bureau, 2022 ACS 5-Year Estimates

Zero Vehicle Households

Figure 5 shows the percentage of vehicles available for occupied housing units in the Town of Wellesley, based on the 2022 ACS 5-Year Estimates. About 4% of the Town's occupied housing units do not own a vehicle, while approximately 96% of occupied housing units have at least one vehicle. The percentage of zero vehicle households in Wellesley is low compared to the state of Massachusetts, where approximately 12% of the occupied housing units do not own a vehicle.

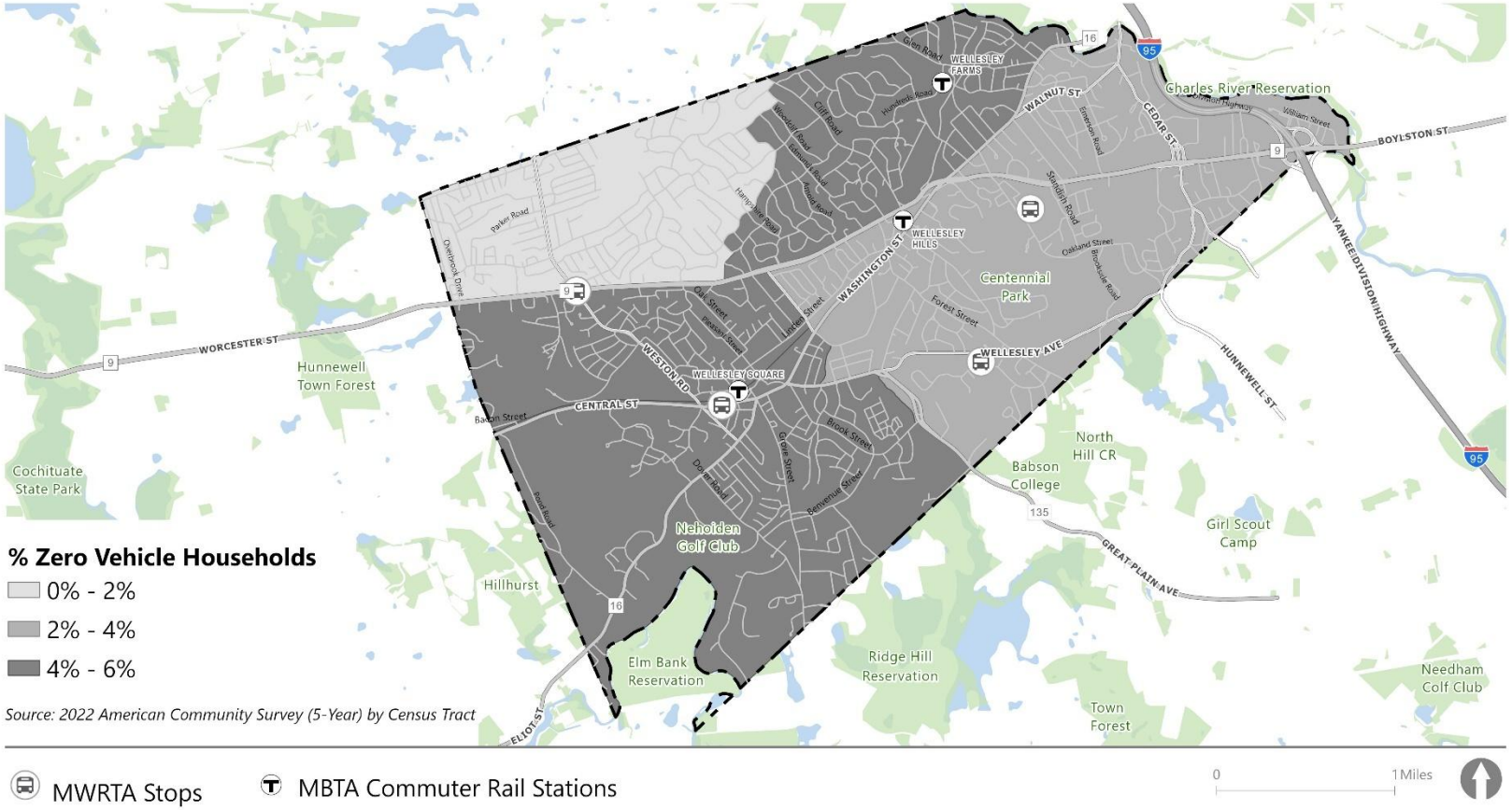
Figure 5. Vehicles Available for Occupied Housing Units



Source: US Census Bureau, 2022 ACS 5-Year Estimates

Figure 6 shows the distribution of zero vehicle households in the Town of Wellesley by census tract. The percentage of zero vehicle households is highest in census tracts to the northeast and southwest of the Town (6%), surrounding Wellesley Farms and Wellesley Square commuter rail stations.

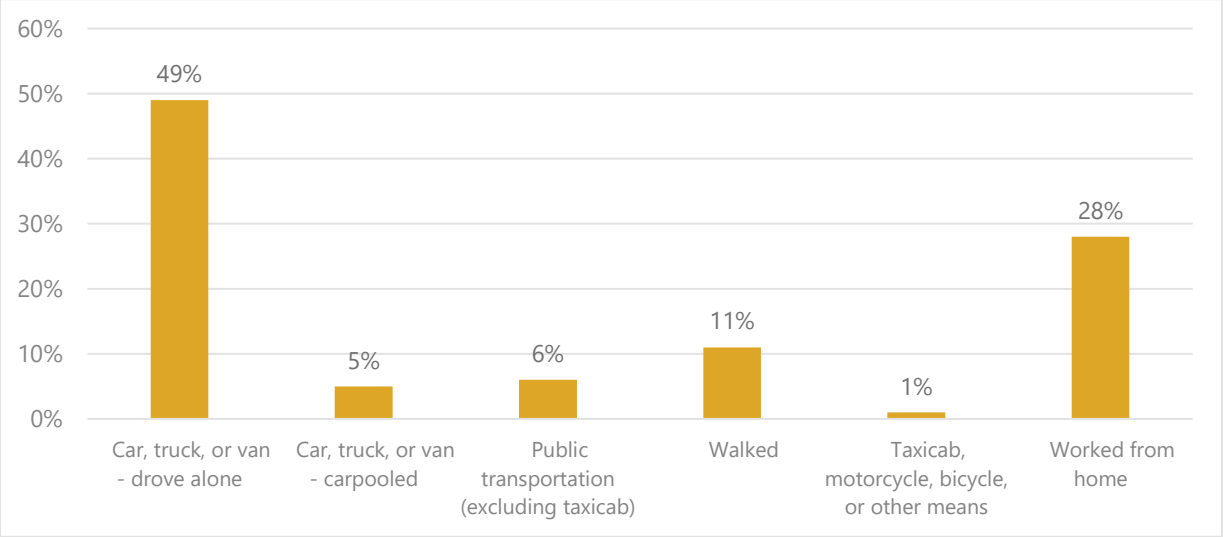
Figure 6. Zero Vehicle Households



Means of Transportation to Work

Figure 7 shows the means of transportation to work for workers aged 16 years and above in the Town of Wellesley, based on the 2022 ACS 5-Year Estimates. Nearly half of the Town's workers (49%) drove alone by car, 11% walked to work, 6% took public transit (either commuter rail or the MWRTA transit services) and fewer than 1% biked to work. 28% of the Town's workers worked from home.

Figure 7. Means of Transportation to Work



Source: US Census Bureau, 2022 ACS 5-Year Estimates

Compared to the travel patterns identified in the Town's Sustainable Mobility Plan (based on the 2019 ACS 5-Year Estimates), the percentage of residents driving alone decreased from 56% between 2015 and 2019 to 49% between 2017 and 2022. The percentage of residents using public transit also declined, from 10% to 6%. Meanwhile, the proportion of residents walking to work stayed consistent, ranging from 11% to 12%, and those biking to work remained at 1%. Notably, the percentage of residents working from home saw a significant rise, increasing from 12% to 28%. These differences may be linked to shifts in work and commuting patterns during and after the COVID-19 pandemic, when remote work became more prevalent. However, since the data presented in this Plan is from the 2022 ACS 5-Year Estimates, it is important to note that the trends may continue to evolve.

Environmental Justice Populations

In Massachusetts, the Executive Office of Energy and Environmental Affairs defines an environmental justice population as a neighborhood where one or more of the following criteria are true:[6]

1. The annual median household income is 65 percent or less of the statewide annual median household income,
2. [Racial] Minorities make up 40 percent or more of the population,
3. 25 percent or more of households identify as speaking English less than "very well"
4. [Racial] Minorities make up 25 percent or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150 percent of the statewide annual median household income.

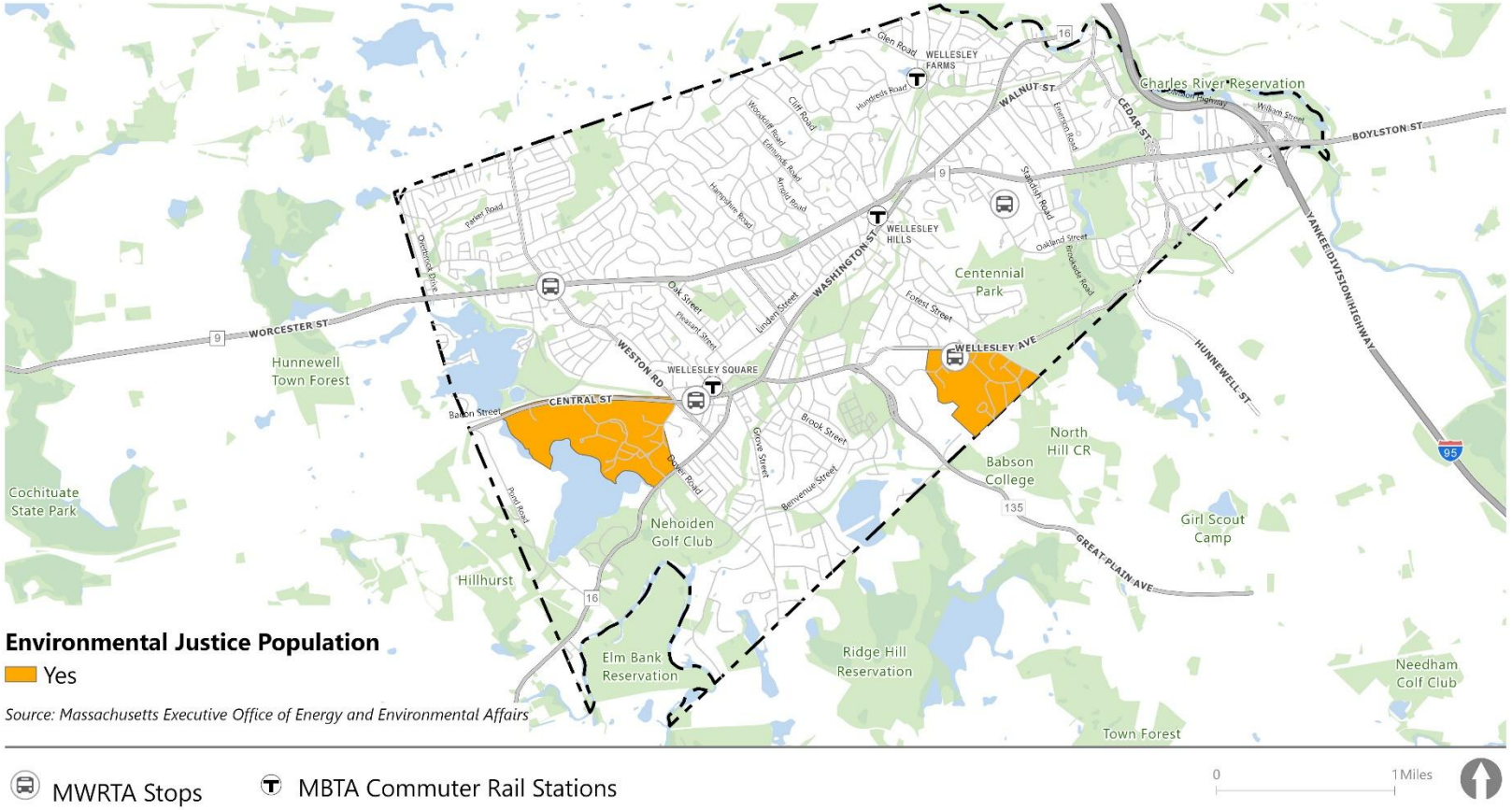
Figure 8 depicts the census block groups with environmental justice populations in the Town of Wellesley. There are two census block groups in Wellesley that meet at least one of the above criteria – one immediately west of Wellesley Square, south of Central Street, and one south of Wellesley Ave and west of the Wellesley Country Club. These census block groups overlap with Wellesley College and Babson College in the Town. Table 2 delineates the percentage of minority population in the Environmental Justice Areas by census block group. As displayed below, both the census block groups have a minority population greater than 45%.

Table 2. Environmental Justice Populations - Percentage of Minority Population

Census Tract	Block Group	Percentage of Minority Population
Census Tract 4044	Block Group 4	54%
Census Tract 4042.02	Block Group 3	49%

[6] Office of Environmental Justice & Equity. (N.D.) *Environmental Justice Populations in Massachusetts*. Executive Office of Energy and Environmental Affairs. *https://www.mass.gov/info-details/environmental-justice-populations-in-massachusetts#what-is-an-environmental-justice-population?-*

Figure 8. Environmental Justice Populations



ROADWAY NETWORK INVENTORY

Walking and biking comfort largely depends on roadway characteristics such as traffic volume and operating speed, which are often influenced by their functional classification (arterial, collector, local), number of lanes, posted speed limit, and vehicular traffic volumes within various land use contexts. This section describes the existing roadway network inventory in the Town of Wellesley. Understanding the existing roadway inventory is crucial for the next phases of the Plan development, as it helps to identify and prioritize roadways where active transportation investments will be most impactful.

The following roadway network characteristics are discussed in this section:

- Functional Classification and Intersection Control
- Surface Width
- Speed Limit
- Vehicular Volumes

Functional Classification and Intersection Control

The roadway functional classification data was obtained from the Town of Wellesley's roadway network database. The number of miles of roadways by ownership is shown in Table 3.

Table 3. Proportion of Total Roadway Miles by Ownership

Ownership	Length (in miles)	% of Total Roadway Miles
Municipal (owned by the Town)	112.7	77%
State	17.7	12%
Private/Institutional/Unaccepted*	16.1	11%
Total	**146.5**	**100%**

Source: Town of Wellesley Roadway Network Database
**Private/Institutional/Unaccepted roads are discussed below.*

The total roadway miles in the Town are 146.5 miles. Approximately 77% of the total roadway miles in the Town are owned by the Town itself, 12% are state-owned, and private/institutional/unaccepted roadways account for the remaining 11% of the roadway miles. The number of miles of town- owned roadways by roadway functional class is detailed in Table 4.

Table 4. Proportion of Total Town-Owned Roadway Miles by Roadway Functional Classification

Roadway Functional Classification	Length (in miles)	% of Total Roadway Miles
Minor Arterial	6.6	6%
Major Collector	6.6	6%
Minor Collector	11.6	10%
Local	87.9	78%
Total	**112.7**	**100%**

Source: Town of Wellesley Roadway Network Database

As shown above, local roads account for over 78% of the total town-owned roadway miles. Other roadway functional classes including minor arterials, and major collectors account for approximately six percent each of the total town-owned roadway miles. Minor collectors account for nearly 10% of the total town-owned roadway miles.

All Interstate (2.1 miles) and Principal Arterial (5.25 miles) roadway miles in the Town are state-owned.

Figure 9 illustrates Wellesley's roadway network with functional classification and signalized intersections. As displayed below, State Route 9 / Worcester Street is the principal arterial in the Town and minor arterials include State Route 16 / Washington Street and State Route 135 / Central Street / Great Plain Avenue.

Most of the signalized intersections in the Town are located along these roadways:

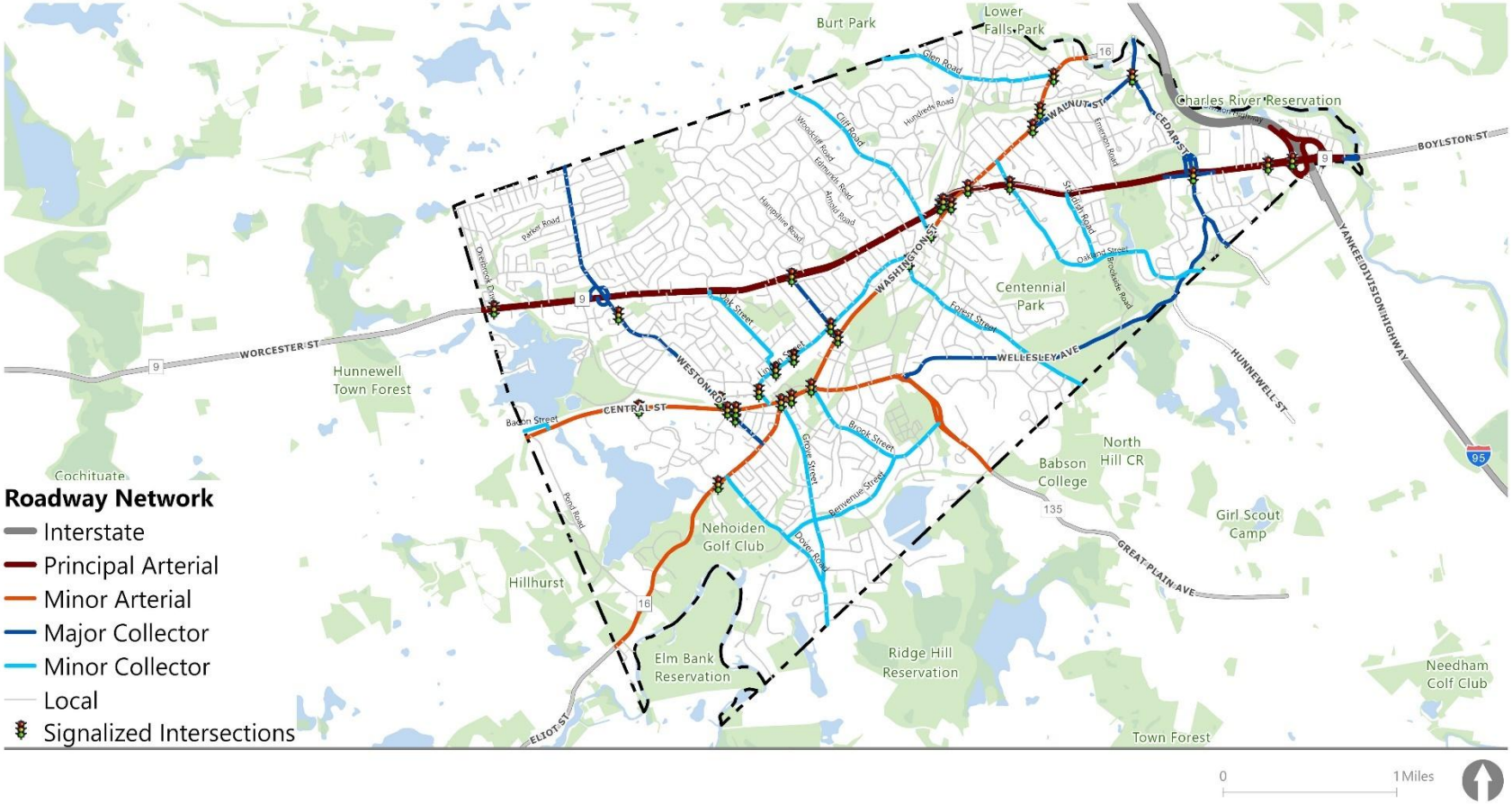
- State Route 9 / Worchester Street
- State Route 135 / Central Street
- State Route 16 / Washington Street
- Weston Road
- Wellesley Avenue
- Linden Street

PRIVATE, INSTITUTIONAL, AND UNACCEPTED STREETS

Private, institutional, and unaccepted streets are roadways within the Town of Wellesley that are not owned or maintained by the Town or State. Typically, these streets are either owned and operated by an institution, such as a college, or by the residents with adjacent properties. The Town of Wellesley maintains roadway standards that streets must meet, including width and grading, among others, for the street to be owned and operated by the Town. Responsibility for the maintenance of these streets and sometimes the related municipal infrastructure (e.g., water and sewer lines lying beneath the street) rests with the abutting property owners.[7] There are approximately sixteen miles of private/institutional/unaccepted streets in the Town, which represent approximately eleven percent of total roadway miles in the Town. All private/institutional/unaccepted streets are classified as local roads but are excluded from further analysis in this Plan. Figure 10 shows private/institutional/unaccepted streets in the Town of Wellesley.

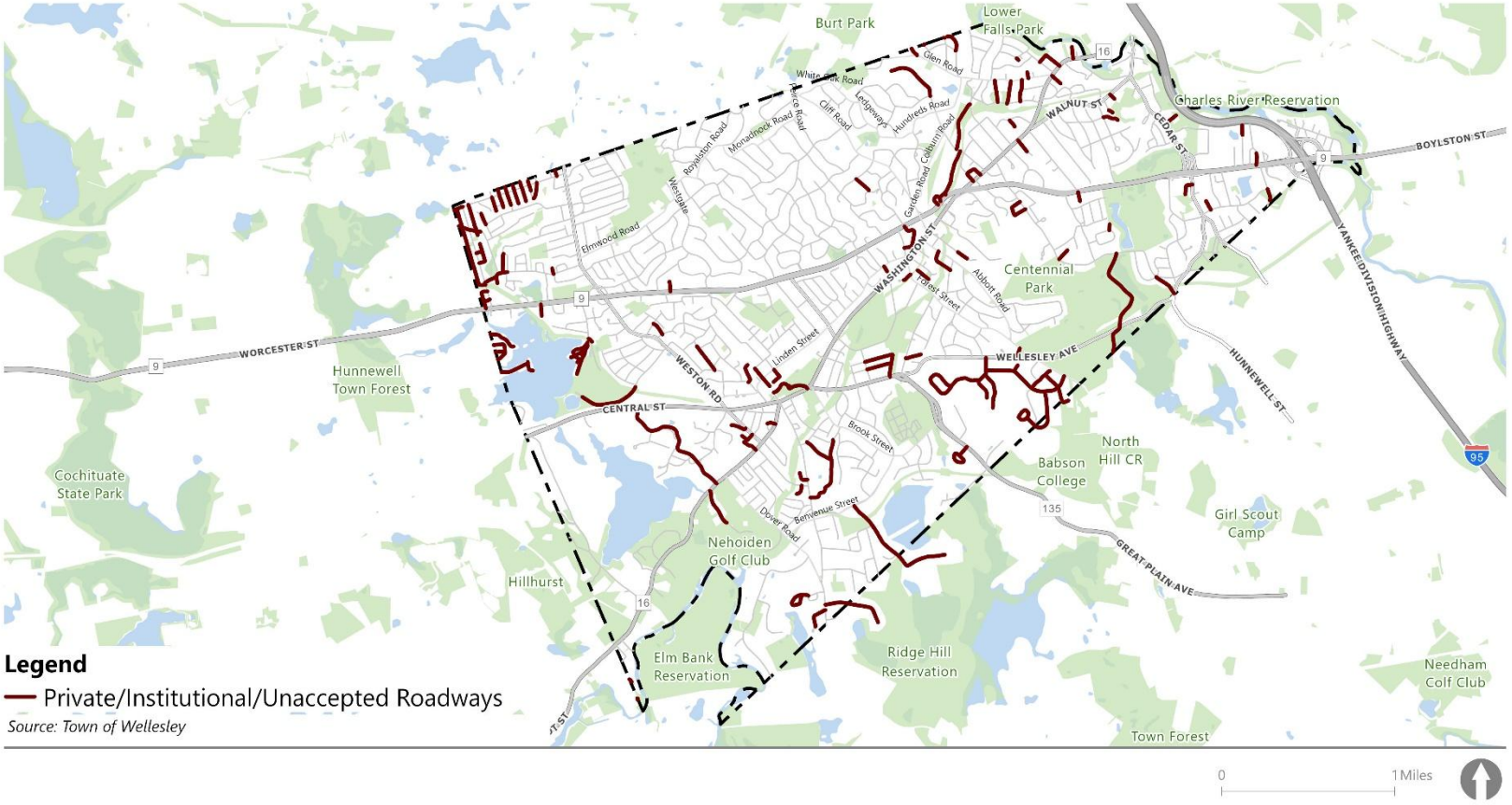
[7] https://www.wellesleyma.gov/DocumentCenter/View/1187/Signed-Street-Acceptance-Policy-PDF

Figure 9. Functional Classification and Signalized Intersections



Roadway Network
Wellesley Townwide Safe Routes Plan

Figure 10. Private/Institutional/Unaccepted Streets



Private/Institutional/Unaccepted Streets
Wellesley Townwide Safe Routes Plan

Surface Width

Roadway surface width data was obtained from MassDOT's Roadway Inventory (2023). The roadway surface width is the measurement of the travel way excluding shoulders/auxiliary lanes on the roadway. Figure 11 illustrates the map of roadway surface width for Wellesley's roadways. Roadway surface width is an acceptable method for estimating the number of lanes on a roadway, based on an assumed 12' lane width. This data will help this Plan understand where roadway space could be allocated to ensure safe and comfortable pedestrian and bicycle facilities. However, the actual road width should be measured before making final decisions on pedestrian or bicycle facilities.

Speed Limit

Speed Limit data is obtained from the Town of Wellesley's roadway speed limit database. Figure 12 shows the speed limits, in miles per hour (mph) on Wellesley's roadways. It is important to note that a speed limit does not ensure that higher vehicle speeds are not regularly experienced on any given road – rather, this data indicates where roadway design permits and encourages higher vehicle speeds. Those facilities could be key areas where active transportation investments would have a substantial impact on increasing the comfort and safety of people walking and biking. Roadways with posted speed limits in excess of 35 miles per hour include:

- Interstate 95
- State Route 9 / Worcester Street
- State Route 135 / Central Street / Great Plain Avenue

STATUTORY SPEED

State statute sets the posted speed limit of the streets in thickly settled areas at 30 mph.[8] Most of the Town's roadways fall under the statutory speed limit.

Vehicular Volumes

Vehicular volume data is obtained from MassDOT's Traffic Inventory (2023). Figure 13 displays the Annual Average Daily Traffic (AADT) for Wellesley's roadways. There are several roadways in the Town that experience daily traffic exceeding 6,000 vehicles, including Worcester Street, Washington Street, Weston Road, Walnut Street, Cedar Street, Central Street, Wellesley Avenue, and Great Plain Avenue. These roads could present barriers to safely and comfortably walking and biking, without the appropriate facilities. Additionally, several roads, including Glen Road, Cliff Road, Forest Street, Linden Street, Oak Street, Dover Road, Grove Street, and Benvenue Street experience between 3,000 and 6,000 vehicles per day, which could also present barriers to all ages and abilities mobility, without appropriate facilities.

[8] Massachusetts Department of Transportation, *Speed Limit and Advisory Speed Signs*, https://www.mass.gov/info-details/speed-limit-and-advisory-speed-signs#:~:text=30%20mph%20in%20a%20Thickly,a%20distance%20of%20%C2%BC%20mile.

Figure 11. Roadway Surface Width

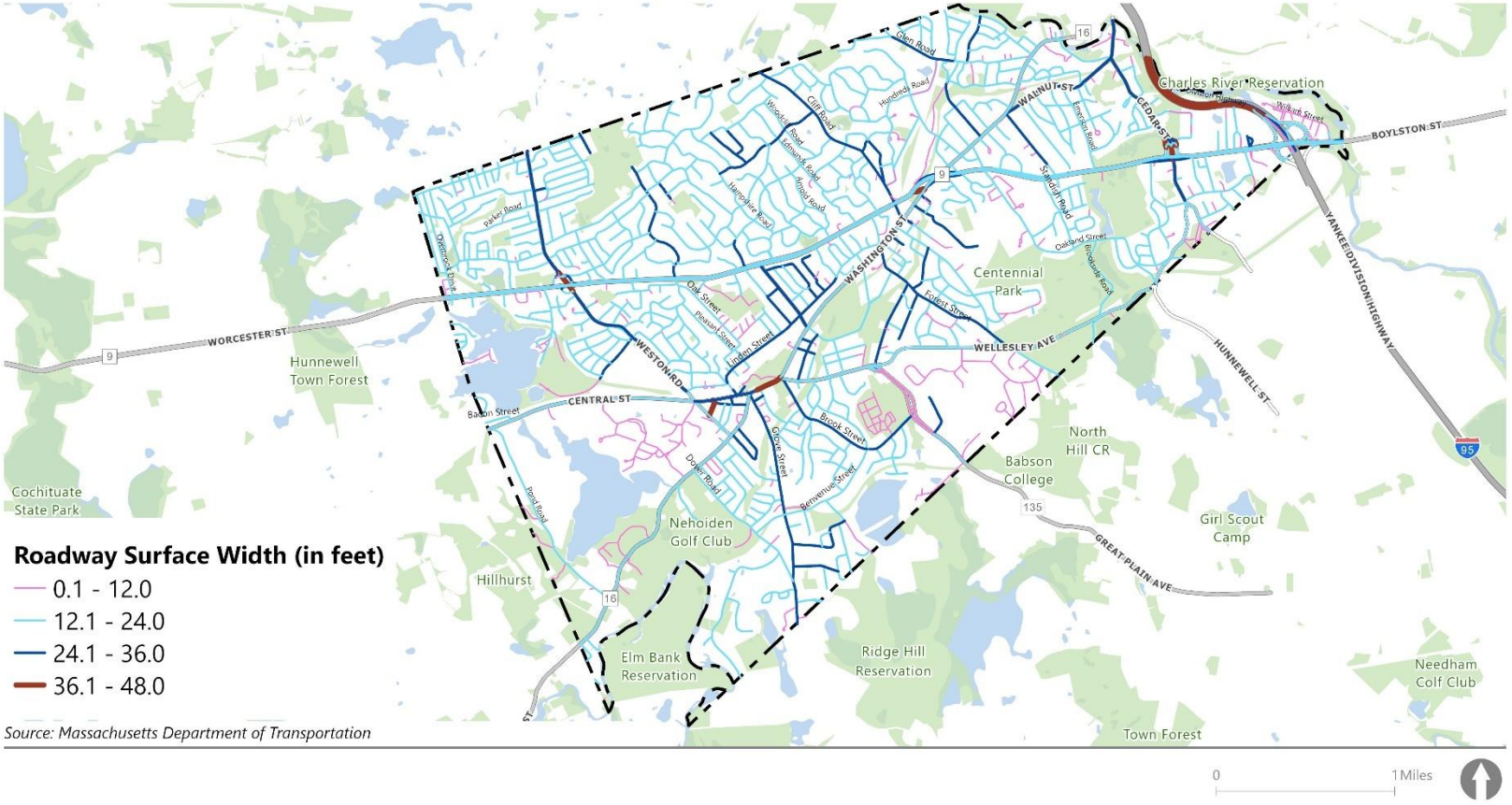
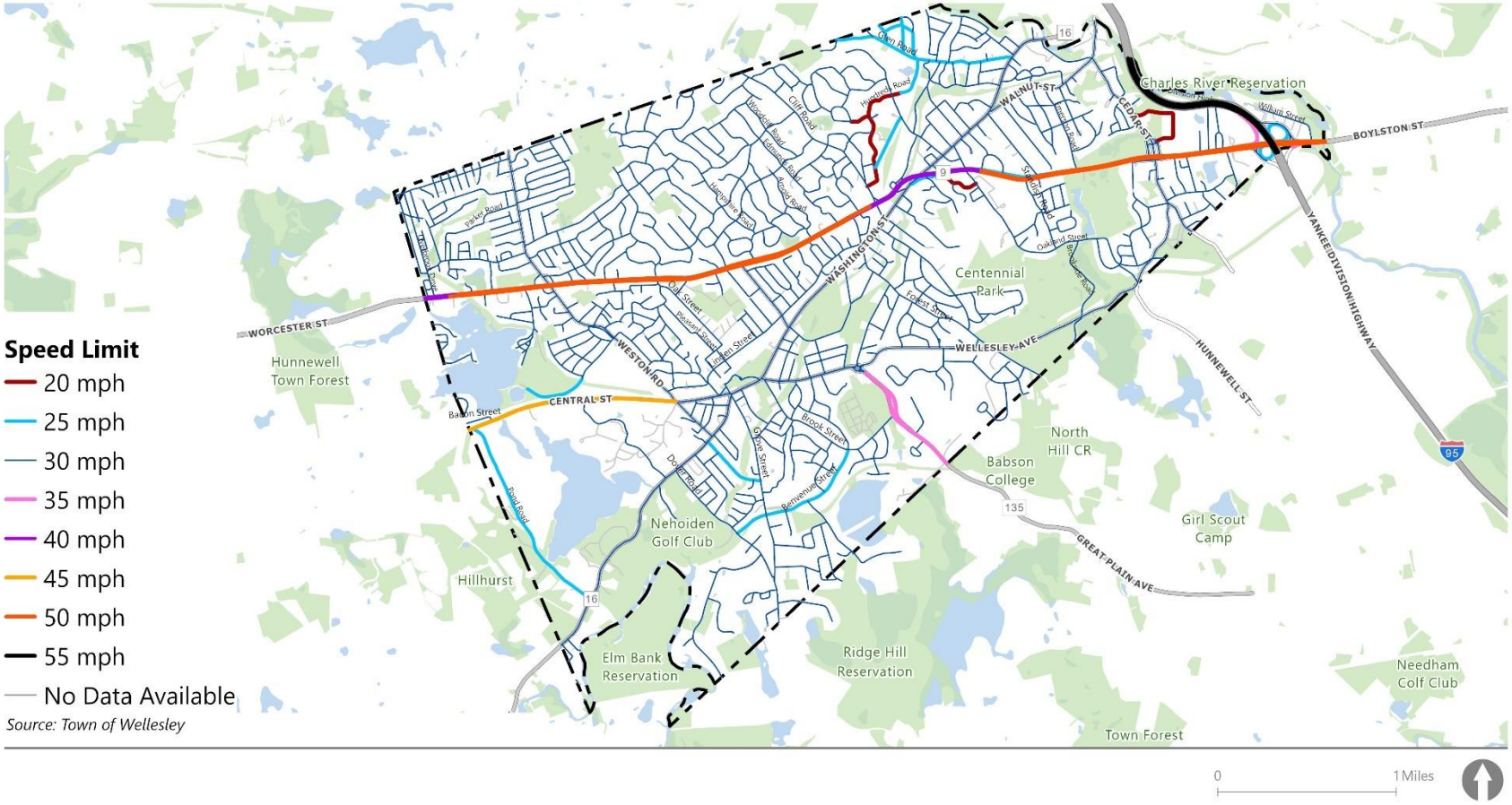
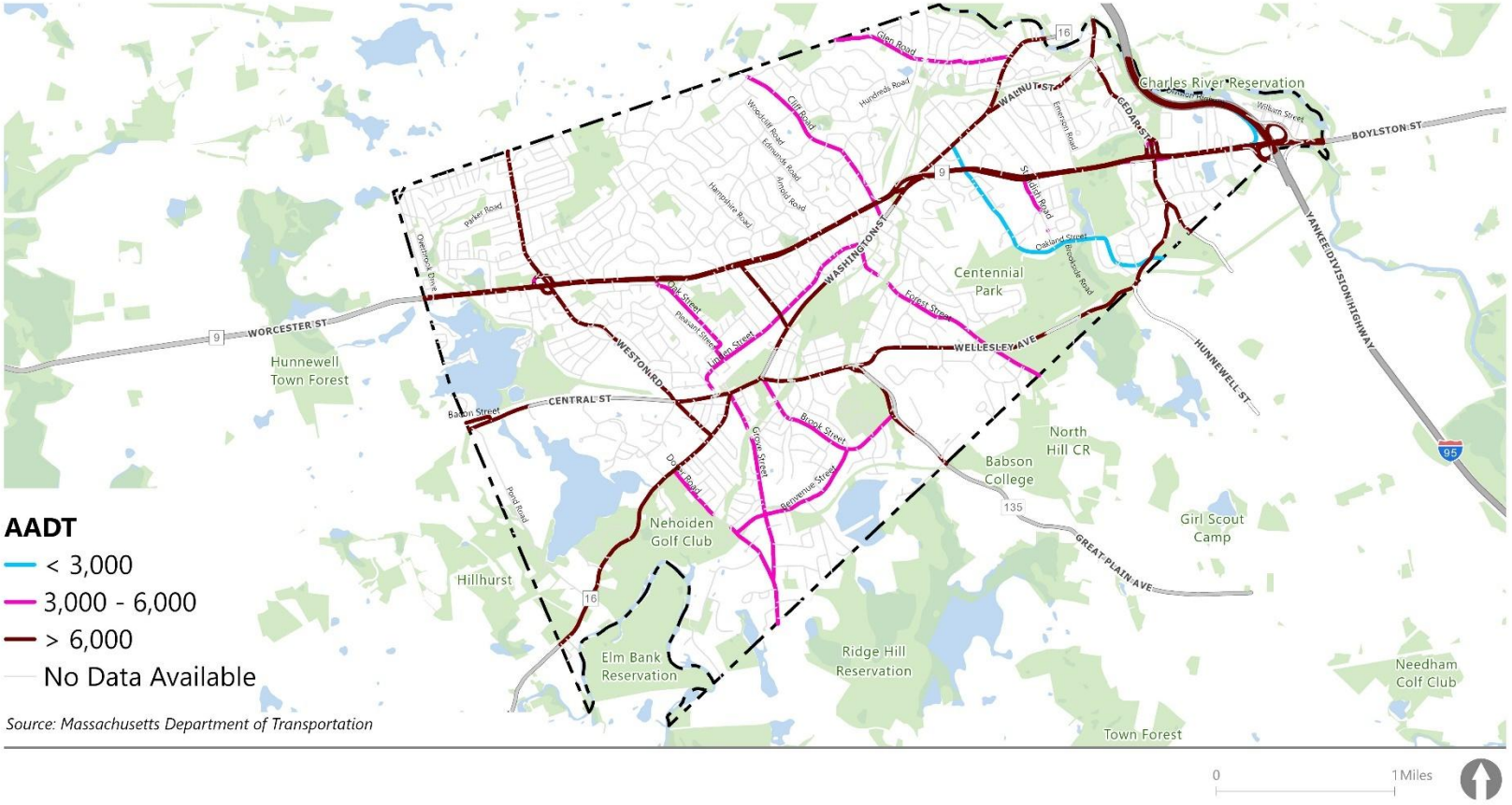


Figure 12. Speed Limit



Speed Limit (mph - miles per hour)
Wellesley Townwide Safe Routes Plan

Figure 13. Annual Average Daily Traffic (AADT)



Average Annual Daily Traffic (AADT)
Wellesley Townwide Safe Routes Plan

PEDESTRIAN AND BICYCLE ANALYSIS

This section outlines the existing pedestrian and bicycle facilities in the Town of Wellesley along with the potential for walking and biking trips, pedestrian network gap analysis, and bicycle level of traffic stress. The insights gained from these analyses will inform subsequent phases of the Plan, including network identification and improvements.

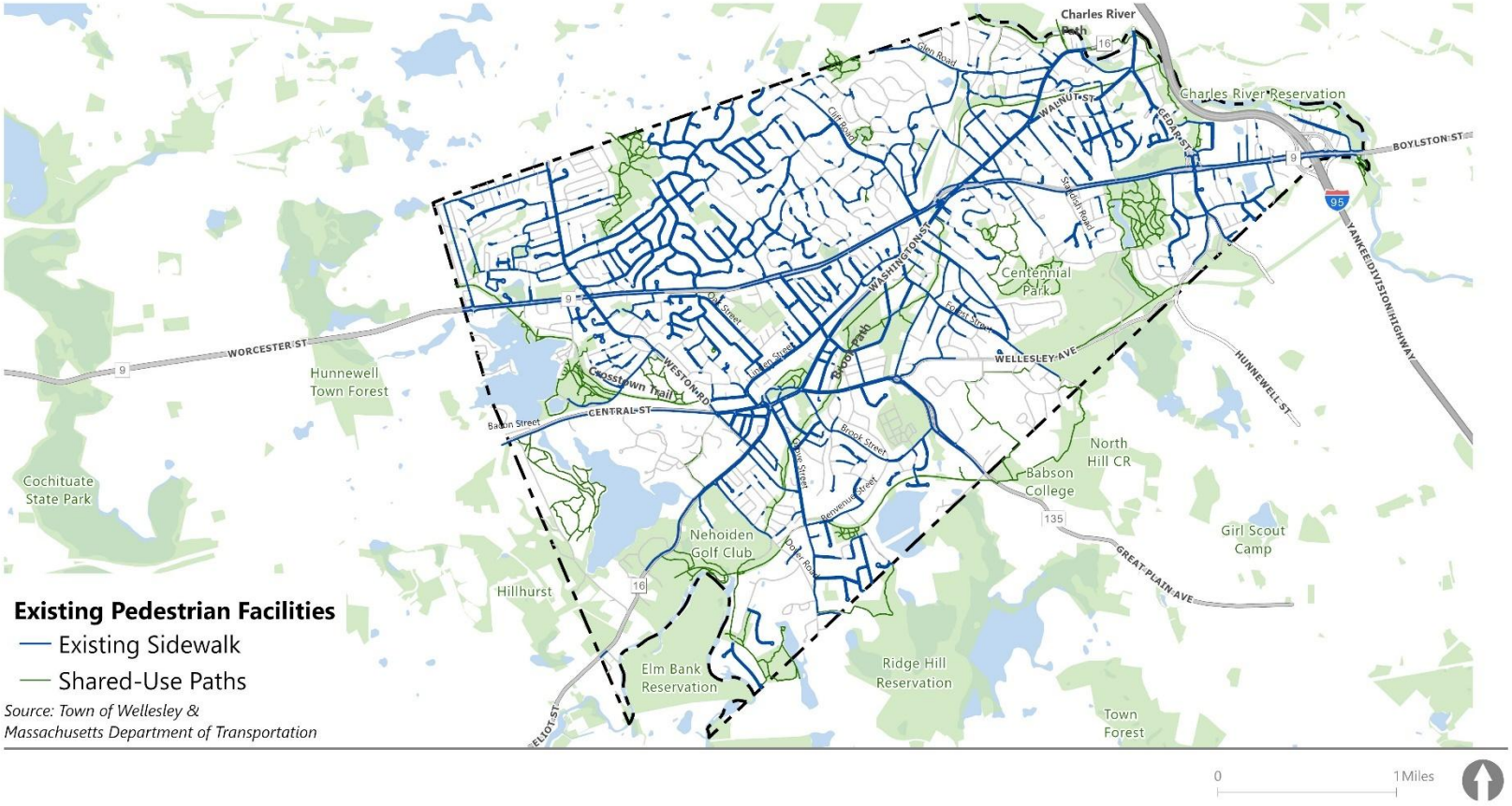
Existing Pedestrian and Bicycle Facilities

Figure 14 displays the existing pedestrian facilities in the Town of Wellesley, including sidewalks and shared use paths. As shown in the figure, most of the arterial and collector roads in the Town include sidewalks on at least one side of the roadway.

Figure 15 displays the existing bicycle facilities in the Town, including bike lanes and shared use paths. Most of the shared use paths are primarily located in parks and conservation areas, and these facilities are both pedestrian and bicycle facilities. Notable bike paths and shared use paths in the Town include the following:

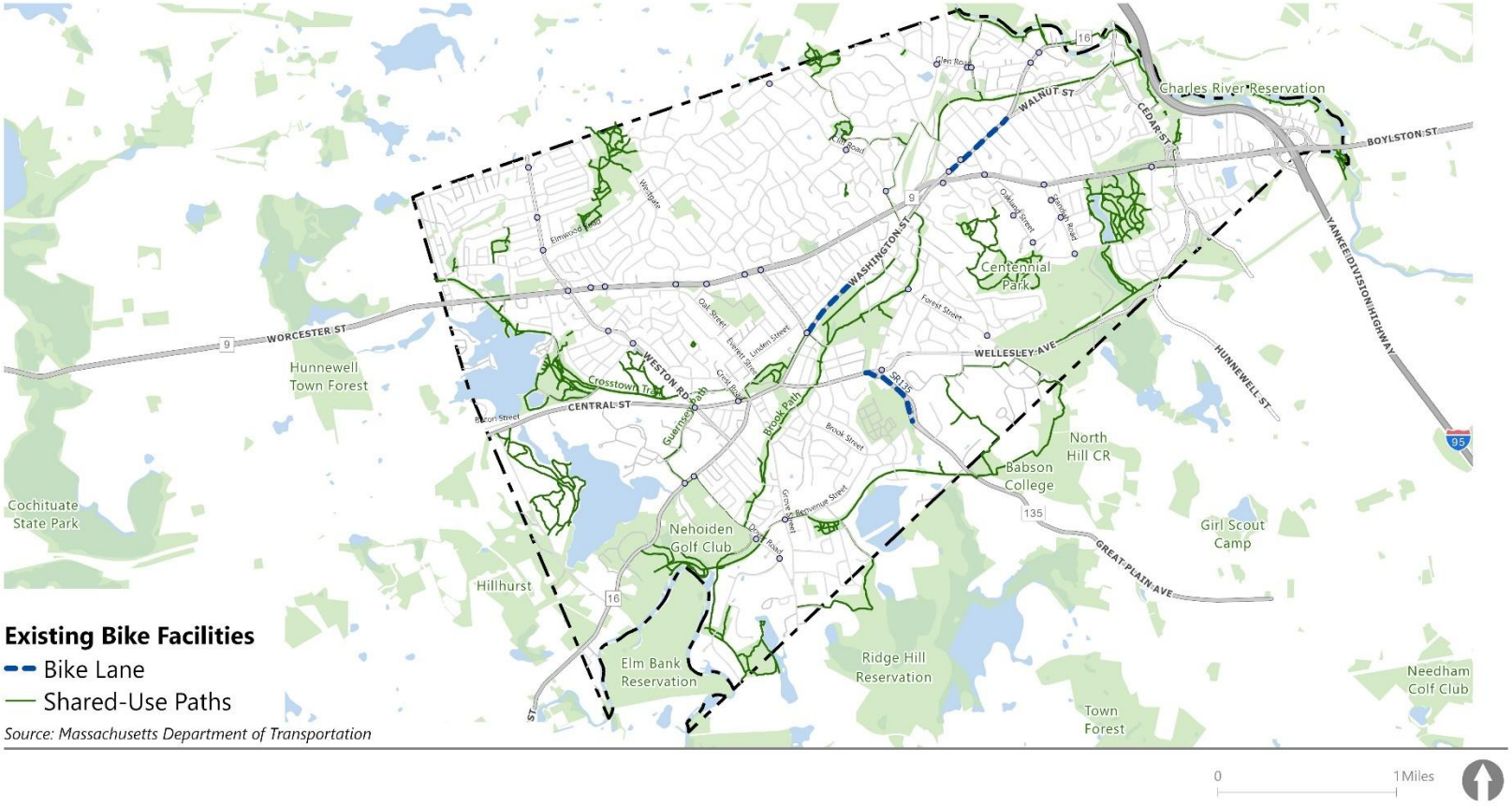
- Bike lane on Washington Street between Walnut Street and Chapel Place
- Bike lane on Washington Street between Rice Street and Kingsbury Street
- Bike lane on Great Plain Avenue between Wellesley Avenue and Brook Street
- Brook Path
- Crosstown Trail
- Guernsey Path
- Woodland Trail
- Charles River Path

Figure 14. Existing Pedestrian Facilities



Existing Pedestrian Facilities
Wellesley Townwide Safe Routes Plan

Figure 15. Existing Bike Facilities



Potential for Active Transportation Trips

This section illustrates the potential for walking and biking trips in the Town of Wellesley based on MassDOT's Potential for Walkable Trips (2022)[9] and Potential for Everyday Biking (2022)[10] datasets. MassDOT's methodology to determine the potential for walking and biking scores for a roadway uses travel demand data, transit access, and social equity.[11] The roadways in the state are classified as having "high", "medium", or "low" potential for walking and biking as follows:

- Top 10% of the roadways in the state rank as "High"
- Top 60% of the roadways in the state rank as "Medium"

Figure 16 depicts the roadways with potential demand for walkable trips in the Town of Wellesley based on access to destinations such as schools, parks, shopping or transit and proximity to reported pedestrian crashes. As shown below, the Town's roadways score in the low to medium category based on the state's criteria for potential for walkable trips. Roadways with medium potential for walkable trips are concentrated along major arterials in the center of the Town in the areas of Wellesley Square, Wellesley Hills, Wellesley Farms and Lower Falls. These areas coincide with high job density, proximity to college campuses and transit stations, and concentrations of environmental justice populations in the Town.

Figure 17 shows the roadways with potential for everyday biking in the Town of Wellesley. Everyday biking refers to activities such as going to work, visiting family and friends, shopping, dining or any utility trip for non-recreational purposes. MassDOT's methodology for potential for everyday biking is created to understand where people could be expected to bike for everyday travel if safe, comfortable, and connected bike networks are available. As illustrated in the figure below, the majority of the Town's roadways score in the medium category based on the state's criteria for potential for everyday biking. These areas coincide with high job density, proximity to college campuses and transit stations, and concentrations of environmental justice populations in the Town. The roadways that score low for potential for everyday biking are concentrated in the northwest corner of the Town.

Based on MassDOT's methodology, there are no roadways in the Town of Wellesley with a high potential for walkable/biking trips. This is because the classification is done at the state level, not the individual jurisdiction level, meaning no roadways in Wellesley are ranked in the top 10% when compared to the rest of the state.

[9] https://www.arcgis.com/home/item.html?id=4f36acded5c14bd69d519d47f949e451

[10] https://geo-massdot.opendata.arcgis.com/datasets/MassDOT::potential-for-everyday-biking-2022-update-2/about

[11] https://massdot.app.box.com/s/gunk09ae4g8fibftuaibeern97shf7ag

Figure 16. Potential for Walkable Trips

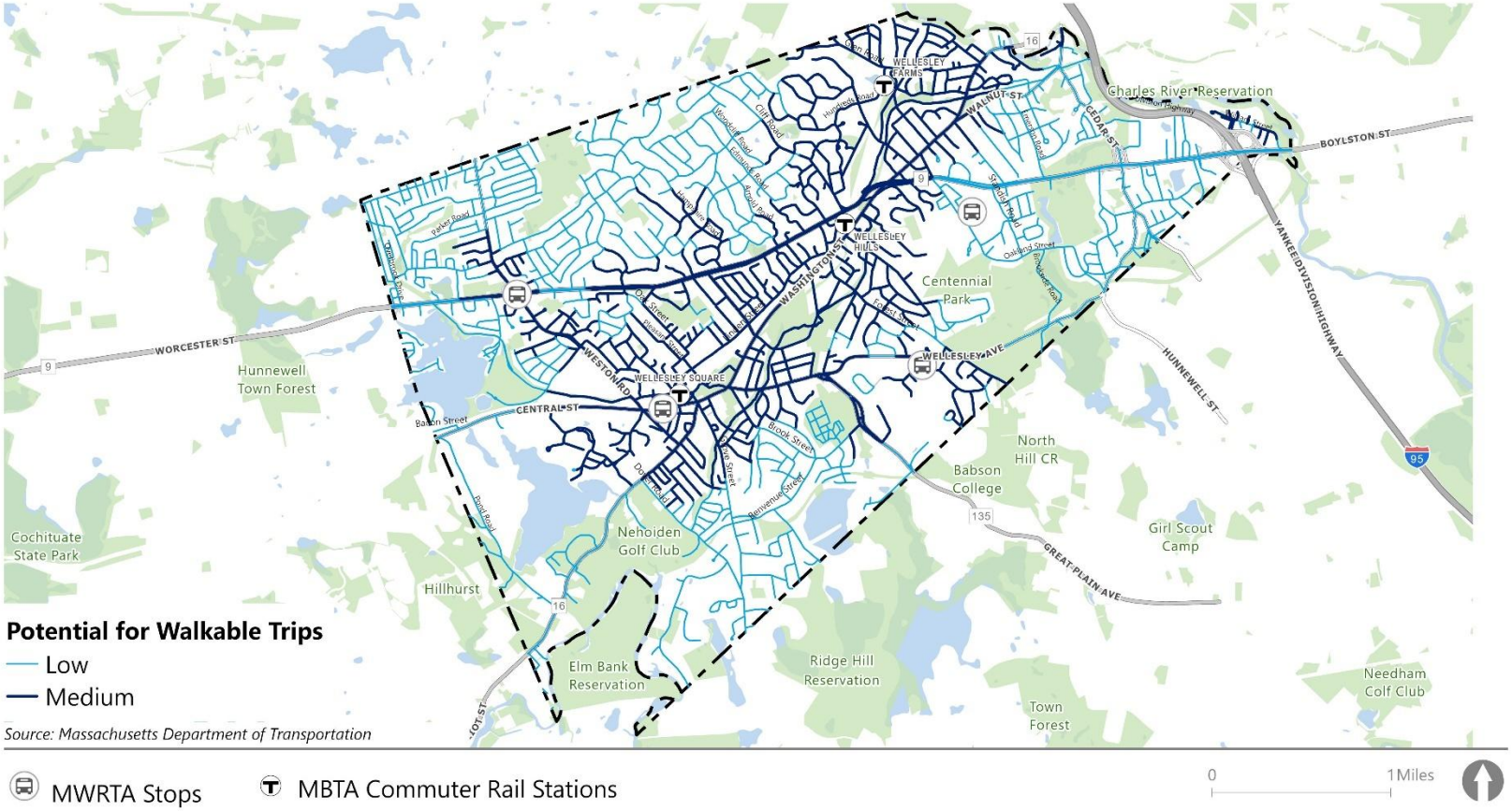
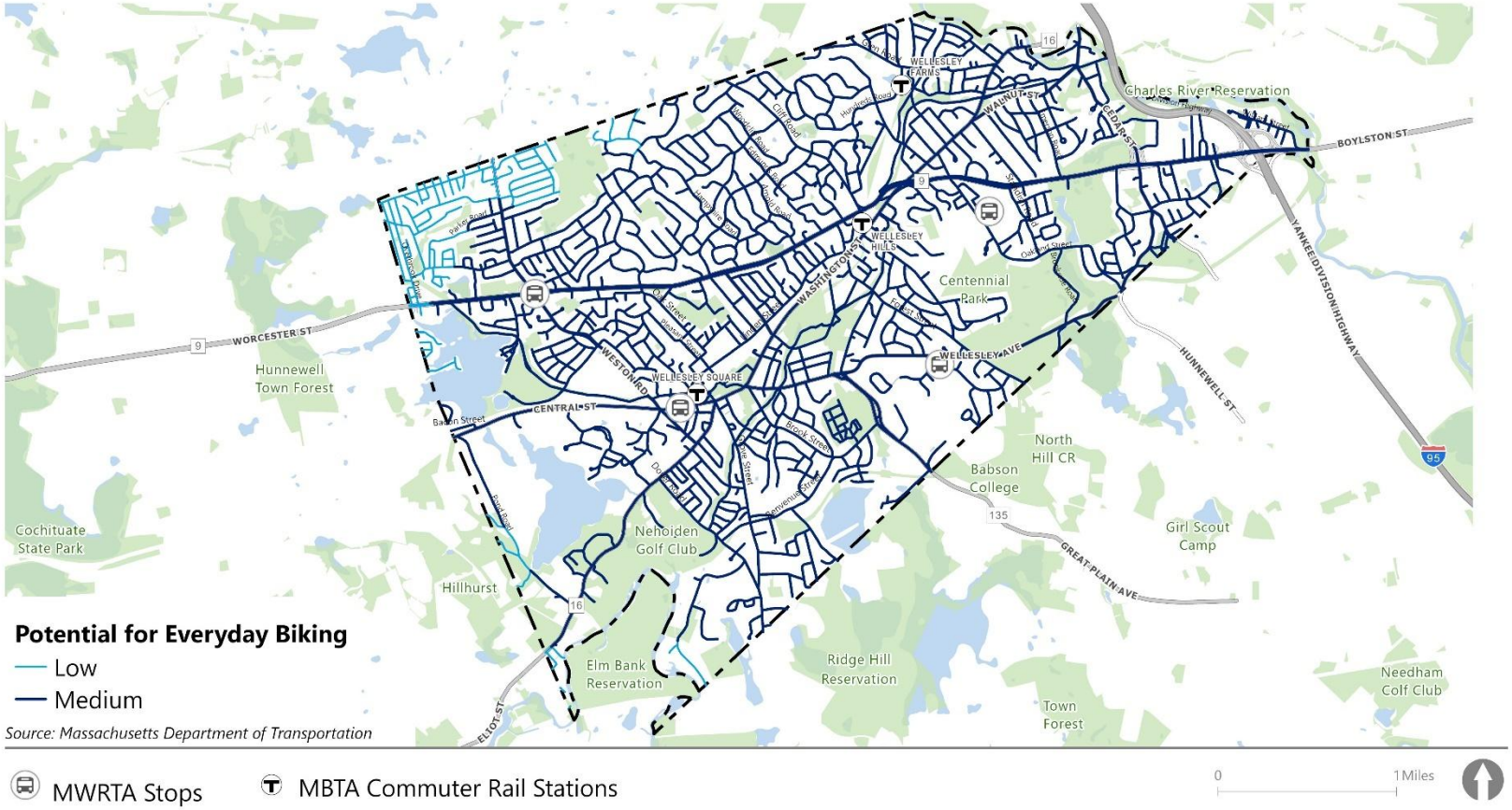


Figure 17. Potential for Everyday Biking



Pedestrian Network Gap Analysis

This section provides an analysis of pedestrian network gaps in the Town of Wellesley, which will help to inform identification of infrastructure improvement needs.

METHODOLOGY

The methodology for analyzing pedestrian network gaps involved the following steps:

1. **Data Collection**: Data sources used for the analysis include the Town of Wellesley's Sidewalk Centerlines and Roadway Network Database.
2. **Network Mapping**: Existing sidewalks were mapped along with the roadway network to establish the current pedestrian infrastructure.
3. **Gap Identification**: The existing sidewalks were compared against the roadway infrastructure. Gaps were identified under these conditions:
   - Sidewalks are absent on one or both sides of an arterial road,
   - Sidewalks are absent on both sides of a collector / local street,[12]
   - Existing sidewalk is discontinuous along a roadway.
4. **Gap Categorization:** After the sidewalk gaps are identified, gaps are categorized as follows:
   - ***Partial Sidewalk Gap:*** Sidewalk is absent on only one side of an arterial or collector roadway.
   - ***Complete Sidewalk Gap:*** Sidewalk is absent on both sides of a roadway of any functional class.
5. **Exclusions:** The following roadways were excluded from this analysis:
   - ***Interstate 95 and Ramps:*** These are classified as limited access roadways and were not included in the pedestrian gap analysis.
   - ***Private/Institutional/Unaccepted Streets:*** As responsibility for these streets rests with the abutting property owners, they are excluded from the pedestrian gap analysis.

RESULTS

Table 5 shows the length of sidewalk gaps (in miles) on Town-owned roadways, by roadway functional classification. It is important to note that 23% of minor arterial roadway miles and 39% of major collector roadway miles have sidewalk gaps, which indicates potentially significant barriers to pedestrian mobility.

Table 5. Length of Sidewalk Gap on Town-Owned roadways (in miles) by Roadway Functional Classification

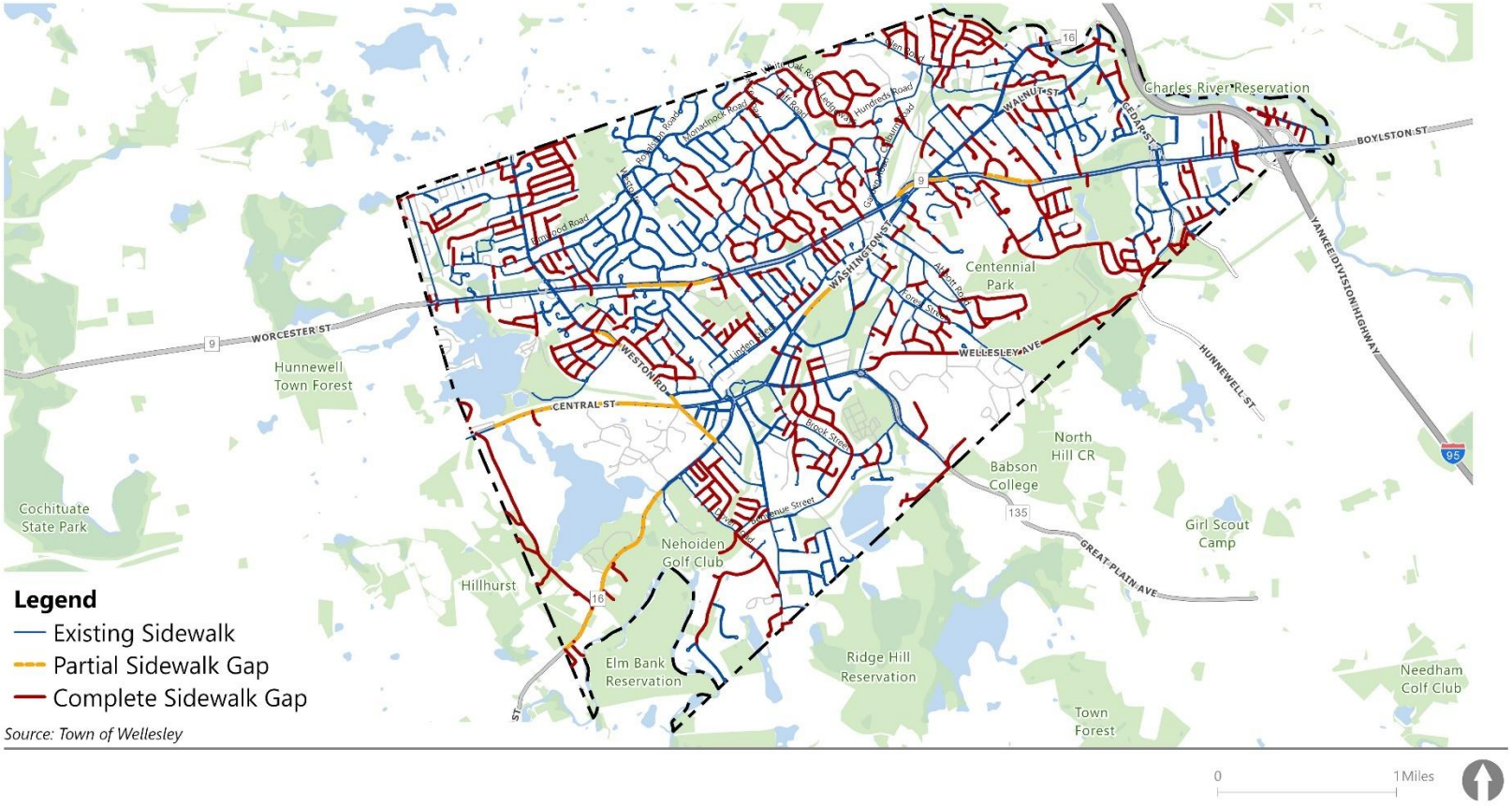
Roadway Functional Classification	Roadway (miles)	Sidewalk Gap (miles)	Roadway Miles without Sidewalk (%)
Minor Arterial	6.6	1.5	23%
Major Collector	6.6	2.6	39%
Minor Collector	11.6	1.9	16%
Local	87.9	45.5	52%
Total	**112.7**	**51.5**	**46%**

[12] *Absence of sidewalk on one side of a collector or local street is not identified as a sidewalk gap*

Figure 18 depicts the existing pedestrian network and associated sidewalk gaps in the Town of Wellesley. As illustrated below, portions of Worcester Street, Washington Street, Central Street, and Weston Road have partial sidewalk gaps (sidewalk absent on one side of the roadway). As these roads are arterials with speed limits greater than or equal to 30 mph and vehicular volumes greater than 6,000 vehicles per day and therefore may be uncomfortable and unsafe for people to cross, these gaps could present a challenge to pedestrian mobility. Collector streets with complete sidewalk gaps (sidewalk absent on both sides of the roadway) include:

- Wellesley Avenue between Great Plain Avenue and Hunnewell Street
- Oakland Street between Putney Road and Hunnewell Street

Figure 18. Pedestrian Network Gap Analysis



Bicycle Level of Traffic Stress

This section presents the Bicycle Level of Traffic Stress (LTS) analysis for the existing roadway network in the Town of Wellesley. LTS is an approach that quantifies the amount of discomfort that people may feel in different bicycling conditions. The LTS methodology adapted for this Plan is described below, followed by the analysis results.

METHODOLOGY

The LTS analysis assigns a numeric "stress level" between 1 and 4 to roadway segments based on roadway attributes such as traffic speed, traffic volume, number of lanes, presence of vehicular parking, ease of intersection crossings and others. **LTS 1 is the least stressful, while LTS 4 is the most stressful**.[13] A definition of each level of traffic stress score is described below in Table 6.

Table 6. Level of Traffic Stress (LTS) Scores

LTS	Description
1	The corridor is comfortable for all ages and abilities including children. LTS 1 roadways are characterized by protected bike lanes or greenways, and very little to no intermingling with vehicular traffic.
2	Tolerated by most adults. There may be some turning conflicts, but cyclists are mostly separated from traffic through bike lanes. This type of corridor demands more attention from riders than an LTS 1 and is likely not suitable for children.
3	Roadways may have bike lanes next to multilane vehicular traffic with above average traffic volumes or vehicular speeds higher than 25 mph. An LTS 3 may also include shared lanes on streets that are not multilane and experience vehicular traffic speeds with a posted speed limit of 25 mph or lower. Tolerated by only a few adults.
4	Tolerated by only the most experienced and able-bodied riders.

Adapted from: City of Boston's Bicycle Level of Traffic Stress Technical Documentation (December 2020)

[13] The LTS methodology in this Plan is adapted from the City of Boston's Bicycle Level of Traffic Stress Technical Documentation, which is adapted from the Mineta Transportation Institute's Low-Stress Bicycling and Network Connectivity Report and NACTO's Urban Bikeway Design Guide.

The methodology primarily uses roadway segment attributes including vehicle volumes, speed limit, bicycle facilities, on-street parking presence, and conflict factors to determine the level of stress a bicycle rider is expected to experience on that street segment. Conflict factors may include commercial, industrial or hospitality land uses, primary bus routes, pick-up/drop-off zones, and school zones. Conflict factors are included in the methodology because they may make bicycle riding more stressful due to increased vehicular traffic during certain times of the day. If one or more of the conflict factor criteria are met, the LTS score is increased by 1. The presence of multiple criteria on a roadway does not increase the score by more than one initial point.

The LTS analysis for the Town of Wellesley was based on the availability and reliability of the Town and state data sources necessary for the LTS methodology outlined in the sections above. It is important to note that Interstate 95 is a limited-access highway and does not permit bicycle access and therefore is not included in this analysis. Private/Institutional/Unaccepted streets are also excluded from this analysis. Table 7 presents the data sources and assumptions used for the various criteria required to determine the LTS score.

Table 7. Bicycle LTS Data Sources and Analysis Assumptions

Data	Source and Analysis Assumptions
Vehicular Volumes	■ Annual Average Daily Traffic (AADT) data is obtained from MassDOT's Traffic Inventory (2023). ■ In instances where AADT information is not available for local roadway segments, the AADT is assumed to be between 1,500 to 3,000.
Bicycle Facilities	■ Information on bike lanes is obtained from MassDOT's Bike Inventory (2023) supplemented by the data on bike trails and shared-use paths from the Town of Wellesley.
Vehicular Parking	■ The presence of parking on roadways with bike lanes is obtained using Google Maps. ■ This is not currently a concern in Wellesley, based on the available bicycle facility data.
Speed Limit	■ Speed limit information is sourced from the Town of Wellesley's roadway network database. ■ For local roadways where speed limit data is not available, a default statutory speed limit of 30 mph is assumed.
Conflict Factors	■ The Town of Wellesley's zoning map provides information on industrial and commercial land uses in the area*. To stay consistent with the City of Boston's LTS analysis methodology, the parcel data was buffered by 75 feet so the data could be joined to the adjacent street centerline spatial data, since parcels do not include street rights-of-way. ■ School zone information is obtained from the multimodal trip generators (Figure 1). To stay consistent with the City of Boston's LTS analysis methodology, the parcel data was buffered by 75 feet so the data could be joined to the adjacent street centerline spatial data, since parcels do not include street rights-of-way. ■ Key bus routes are identified using MetroWest Regional Transit Authority (MWRTA)'s route map, which includes Route 1 serving the Town of Wellesley[14]. Street segments along MWRTA Route 1 are considered to have a conflict factor.

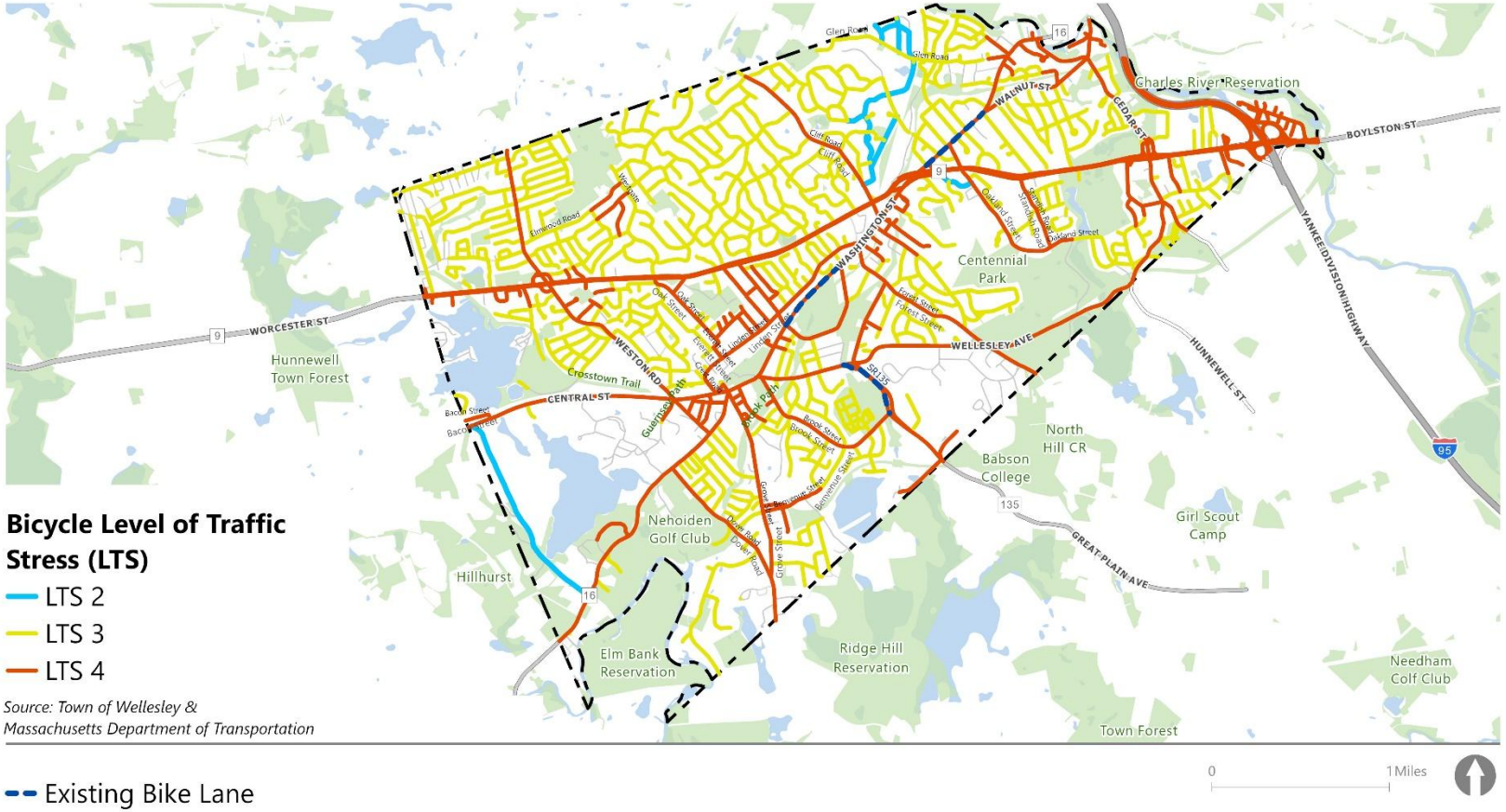
* *Based on the Town of Wellesley's zoning data, there is no industrial land use in the Town of Wellesley. Commercial areas are considered as shown in Figure 1.*

RESULTS

Figure 19 illustrates the bicycle level of traffic stress (LTS) on the Town's roadway network. Most collector and local roads in the Town have a Level of Traffic Stress (LTS) rating of 3, while those with conflict factors including commercial/school zones and key bus routes in the Town have an LTS rating of 4. Most arterial roads in the Town are rated LTS 4. There are no LTS 1 roadways and there are very few LTS 2 roadways in the Town of Wellesley. To qualify as an LTS 1 roadway, speed limits must be 25 mph or lower. However, since most roads in Wellesley meet the statutory requirement of 30 mph speed limit for thickly settled areas, very few roads meet the LTS criteria outlined in the City of Boston's Bicycle Level of Traffic Stress Technical Documentation (December 2020). Additionally, many roads in Wellesley have traffic volumes exceeding 3,000 Annual Average Daily Traffic.

[14] *https://mwrta.com/routes/fixed-routes/route-1*

Figure 19. Bicycle Level of Traffic Stress (LTS)



Bicycle Level of Traffic Stress (LTS)
Wellesley Townwide Safe Routes Plan

KEY FINDINGS

Key findings from the existing conditions analysis include:

- **Multimodal Trip Generators**: Multimodal trip generators in the Town are concentrated in and around Wellesley Square, Linden Square, Wellesley Hills and Lower Falls areas, which are the primary commercial areas in the Town.
- **Population Density**: Areas such as Wellesley Square, Babson College, and Lower Falls exhibit medium to high population densities compared to the rest of the Town. Additionally, population density is notably concentrated around major roadway corridors, including the State Route 9/Worcester Street, and State Route 16/Washington Street, Central Street and Wellesley Avenue.
- **Employment Distribution**: Employment in the Town is predominantly concentrated in the central and northeast, with job densities ranging from 4,066 to 6,350 jobs per square mile.
- **Age**: Children under 14 years of age and older adults 65 years or older comprise greater than 30% of the Town's population. Safe and accessible infrastructure is crucial to promote walking and biking as transportation modes among vulnerable population groups, including children and older adults, ensuring that all age groups can use these modes safely and comfortably.
- **Vehicle Ownership**: Approximately 4% of the Town's occupied housing units do not own a vehicle, which is low compared to the State of Massachusetts where approximately 12% of the occupied housing units do not own a vehicle.
- **Commuting Patterns:** Nearly half of the Town's workers (49%) drove alone by car, 11% walked to work, 6% took public transit either commuter rail or the MWRTA transit services and fewer than 1% biked to work. 28% of the Town's workers worked from home. Compared to 2019 ACS 5-Year Estimates, the percentage of residents driving alone or using public transit decreased, while the percentage of residents working from home increased and percentage of residents walking/biking to work remained stagnant.
- **Environmental Justice Populations**: Two census block groups with minority populations greater than 45% are designated as Massachusetts Environmental Justice (EJ) Populations. The EJ populations coincide with Wellesley College and Babson College.
- **Roadway Network:** More than 77% of the Town's roadway network is owned by the Town itself and 78% of these roadways comprise of local roads. Worcester Street, Central Street and Great Plain Avenue have speeds exceeding 35 mph. Several roadways in the Town have vehicular volumes greater than 6,000 vehicles per day, and several more experience between 3,000 and 6,000 vehicles per day.
- **Sidewalk Gaps:** Portions of arterial roadways including Worcester Street, Washington Street, Central Street and Weston Road have partial sidewalk gaps with sidewalks being absent on one side of the roadway. Collector streets including Wellesley Avenue and Oakland Street have complete sidewalk gaps with sidewalks absent on both sides of the roadway.
  - During the development of this Plan, a new sidewalk was constructed on Washington Street to the Natick town border. This new sidewalk is not reflected in this Plan.
- **Bicycle Facilities**: The Town's existing bicycle infrastructure is limited to shared use paths located within parks and conservation areas and bike lanes on portions of Washington Street and Great Plain Avenue.

- **Level of Traffic Stress (LTS)**: Most local roads and collector streets in the Town have a LTS rating of 3, while arterial roads are rated LTS 4. LTS 3 and LTS 4 are observed on roadways with AADT greater than 3,000 vehicles per day and are in the areas with conflict factors including commercial/school zones and key bus routes in the Town. While LTS 4 roadways are generally arterials in the Town, LTS 3 roadways are in Wellesley Square, Wellesley College, Babson College, Lower Falls and near Weston Road/Worchester Street intersection.

Chapter 3
Network Identification

Network Identification

This chapter summarizes the existing network of routes for walking and biking in Wellesley and identifies the critical connections that could enhance the network.

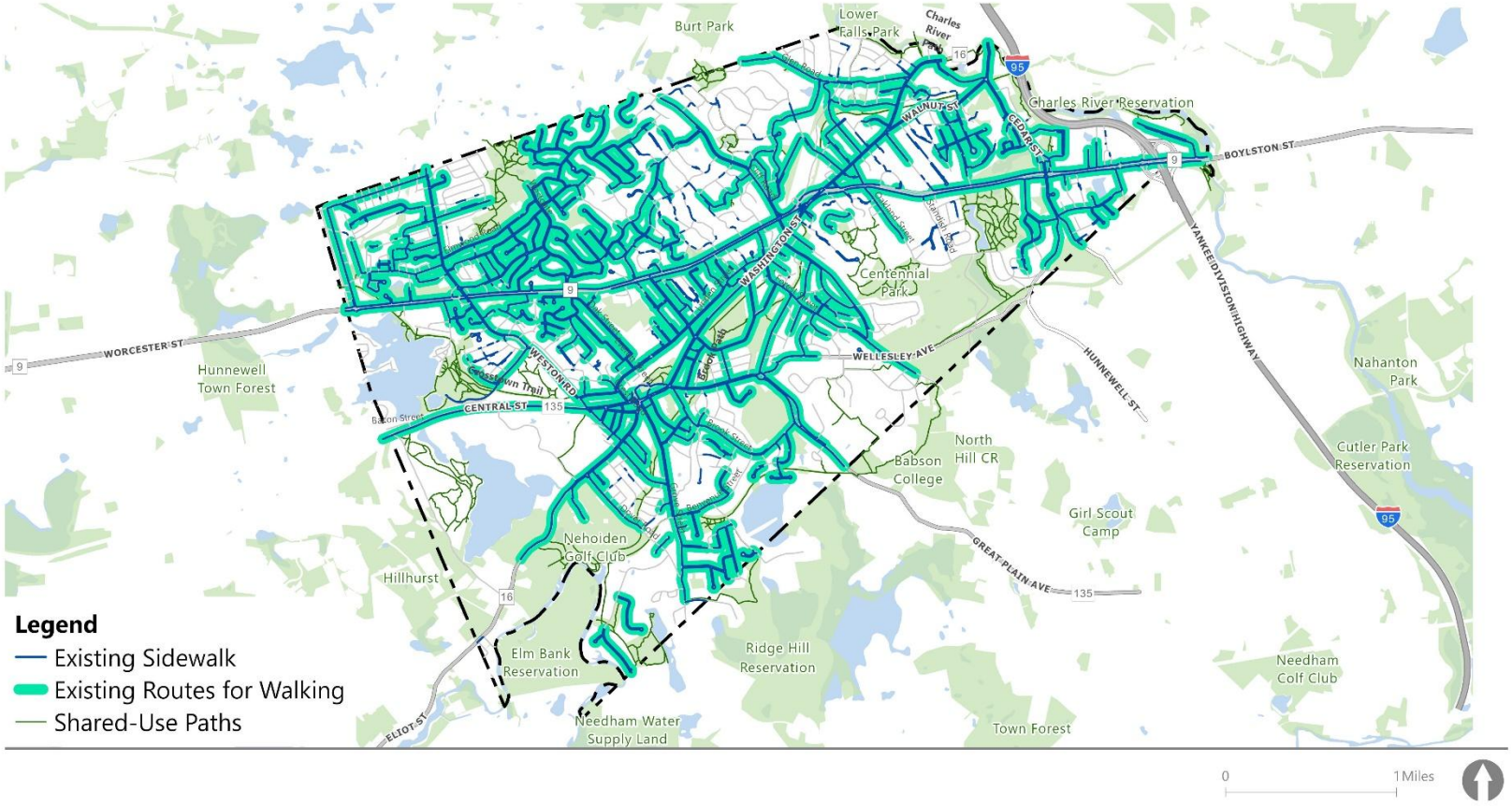
PEDESTRIAN NETWORK

Existing Routes for Walking

Figure 20 displays the existing routes for walking in the Town of Wellesley. An existing route for walking was identified along corridors where there are continuous sidewalks along a roadway. If sidewalks are present but discontinuous, the route is not highlighted as an existing walking route, although there may be pedestrian activity occuring in these locations. The intention of this analysis to highlight areas where a lack of connectivity could inhibit pedestrian mobility. Key findings regarding the existing routes for walking are as follows:

- Most principal arterials and minor arterials in the Town have a sidewalk on at least one side of the roadway, except for Washington Street between Schaller Street and north of Pond Road which was under construction during this project. This new sidewalk is not reflected on the maps.
- Most major collectors in the Town have a sidewalk on at least one side of the roadway, except for Wellesley Avenue between Whiting Road and Hunnewell Street and Hunnewell Street between Wellesley Avenue and Oakland Street.
- There are several minor collectors with sidewalks on at least one side of the roadway, including Glen Road, Cliff Road, Forest Street, Grove Street, Linden Street, and Oak Street.
- There are also several key minor collectors that do not have a sidewalk on either side of the roadway, including Dover Road between Ingraham Road and Grove Street, Oakland Street between north of Putney Road and Hunnewell Street, and Standish Road between Worcester Street and Oakland Street.

Figure 20. Existing Routes for Walking



Proposed Locations for Pedestrian Network Improvements

To identify opportunities to enhance pedestrian safety and connectivity in the Town, a systematic approach to prioritizing pedestrian network improvements was employed, which includes a tiered system that categorizes pedestrian network improvements into priority levels:

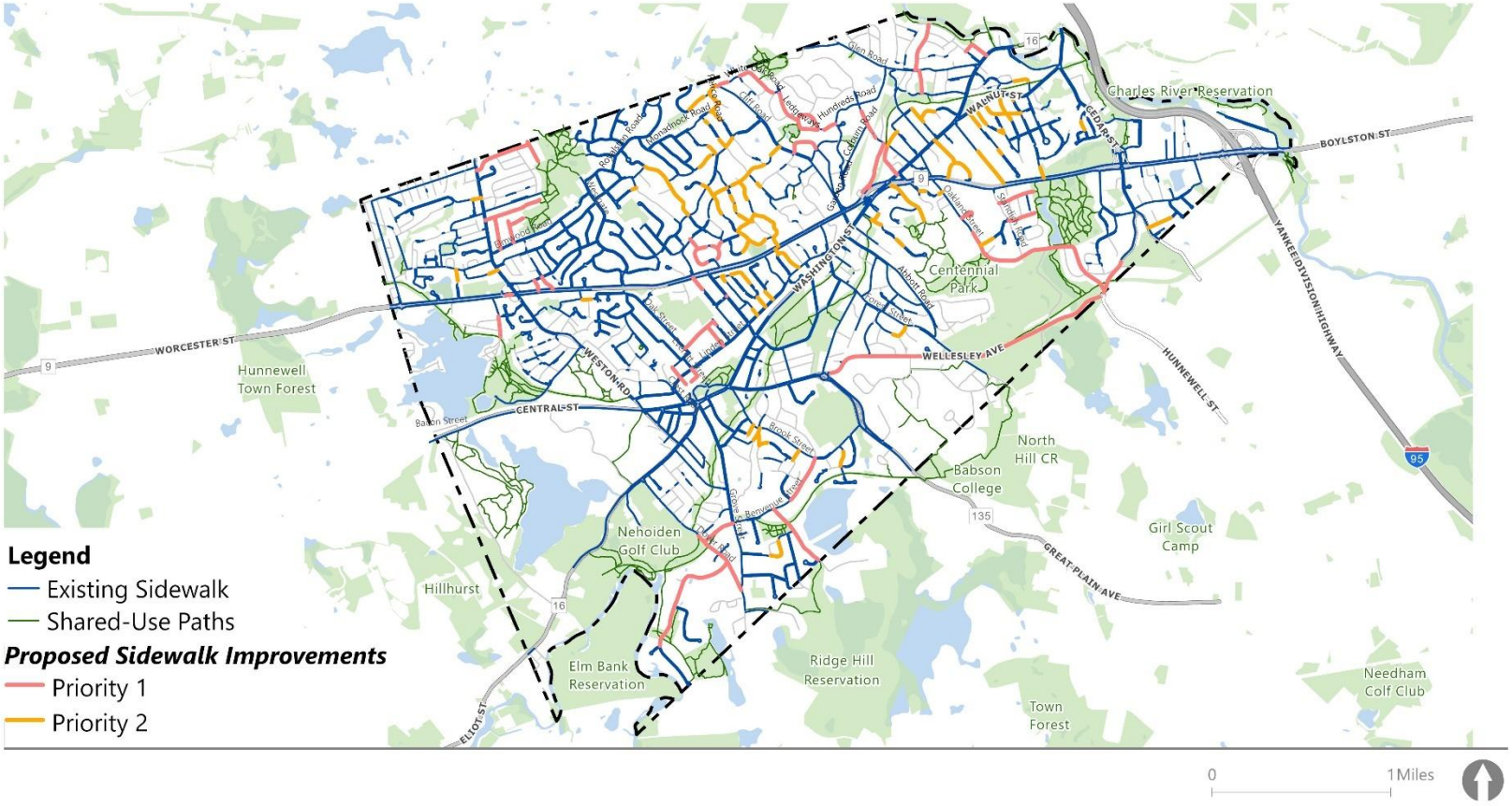
- **Priority 1:**
  - Complete sidewalk gaps on arterial or collector roadways
  - Complete sidewalk gaps along a local roadway that connects to multimodal trip generators or shared use path
- **Priority 2:**
  - Complete sidewalk gaps along local roadways where filling the gaps would create a continuous sidewalk along the roadway.

This tiered system for prioritizing pedestrian network improvements will help to streamline decision-making and resource allocation by directing investments to the most critical gaps first, ensuring that resources have the maximum potential impact on safety and connectivity. This approach also aids in strategic planning and allows phased implementation of projects, creating a more systematic and effective framework for improving walking routes in the Town. Figure 21 displays the proposed locations for pedestrian network improvements based on the prioritization methodology discussed above. Priority 1 pedestrian network locations include:

- Wellesley Avenue from Great Plain Avenue to South Town limits
- Dover Road from Ingraham Road to Grove Street
- Oakland Street from north of Putney Road to Hunnewell Street
- Livingston Road from Dover Road to Winding River Circle
- Northgate Road from Weston Road to Meadowbrook Road
- Pine Plain Road from Weston Road to Boulder Brook Reservation Trail.

It is important to note that the pedestrian network gap analysis identified partial sidewalk gaps, which are locations where there is sidewalk present along one side of the street. As this Plan focuses on key connections to create safe routes for walking, partial sidewalk gaps are not considered to be a priority for implementation at this time. However, as capital projects are programmed for these roads, or as development occurs adjacent to the identified gaps, completing the pedestrian network by addressing these gaps is encouraged.

Figure 21. Proposed Locations for Pedestrian Network Improvements



Proposed Locations for Pedestrian Network Improvements
Wellesley Townwide Safe Routes Plan

BICYCLE NETWORK

Existing Routes for Biking

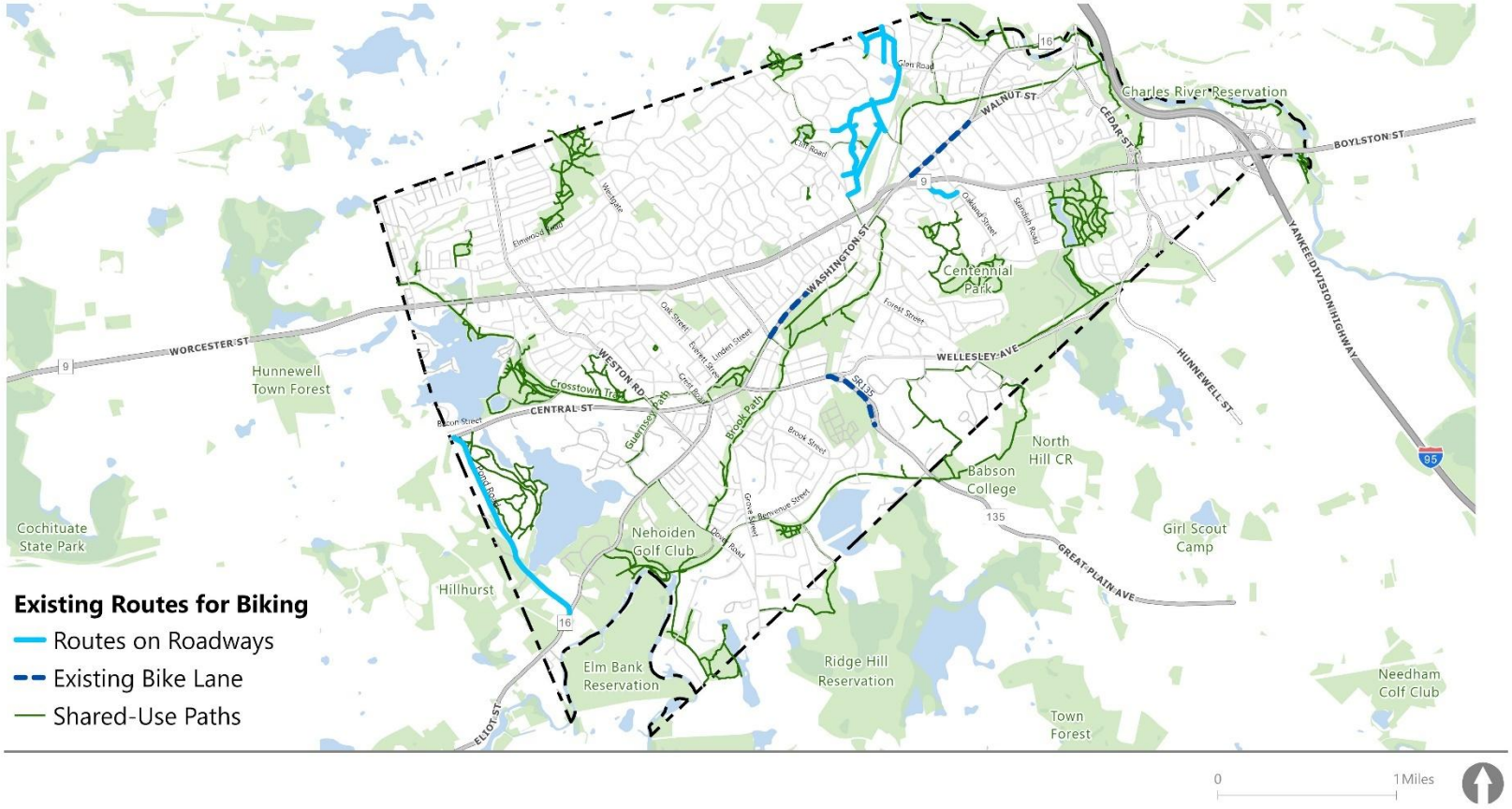
The identified existing routes for biking include:

- Arterials, collectors and local roadways classified as Level of Traffic Stress 2[15] or less.
- Bike lanes on roadways or shared use paths.

Figure 22 displays the existing routes for biking in the Town of Wellesley. In addition to the few LTS 2 facilities on roadways and shared-use paths, most of the existing bike routes in the Town are limited to bike lanes on sections of Washington Street and Great Plain Avenue. However, these lanes still fall under Level of Traffic Stress 4.

[15] *Level of Traffic Stress is defined in Chapter 2: Existing Conditions*

Figure 22. Existing Routes for Biking



Existing Routes for Biking
Wellesley Townwide Safe Routes Plan

Key findings regarding the existing routes for biking are as follows:

- Many of the roadways in the Town are Level of Traffic Stress 3 facilities which can only be considered as comfortable for biking only for a few adults.
- Although Washington Street and Great Plain Avenue have bike lanes or shared lane markings, they are still classified as Level of Traffic Stress 4, meaning they are only suitable for biking by experienced riders.
- Brook Path and Crosstown Trail are off-road facilities that connect to multimodal trip generators and serve as alternative routes to Level of Traffic Stress 3 or 4 facilities.
- Multimodal trip generators that are connected through the existing bike lanes/shared-use paths include Wellesley Square commercial area, Wellesley Hills commercial area, Wellesley Community Center, Hills Branch Library, MassBay Community College MWRTA Bus Stop, Wellesley Farms MBTA Commuter Rail Station, Wellesley High School, Hunnewell Field and Bird Island Sanctuary at Pine Point.

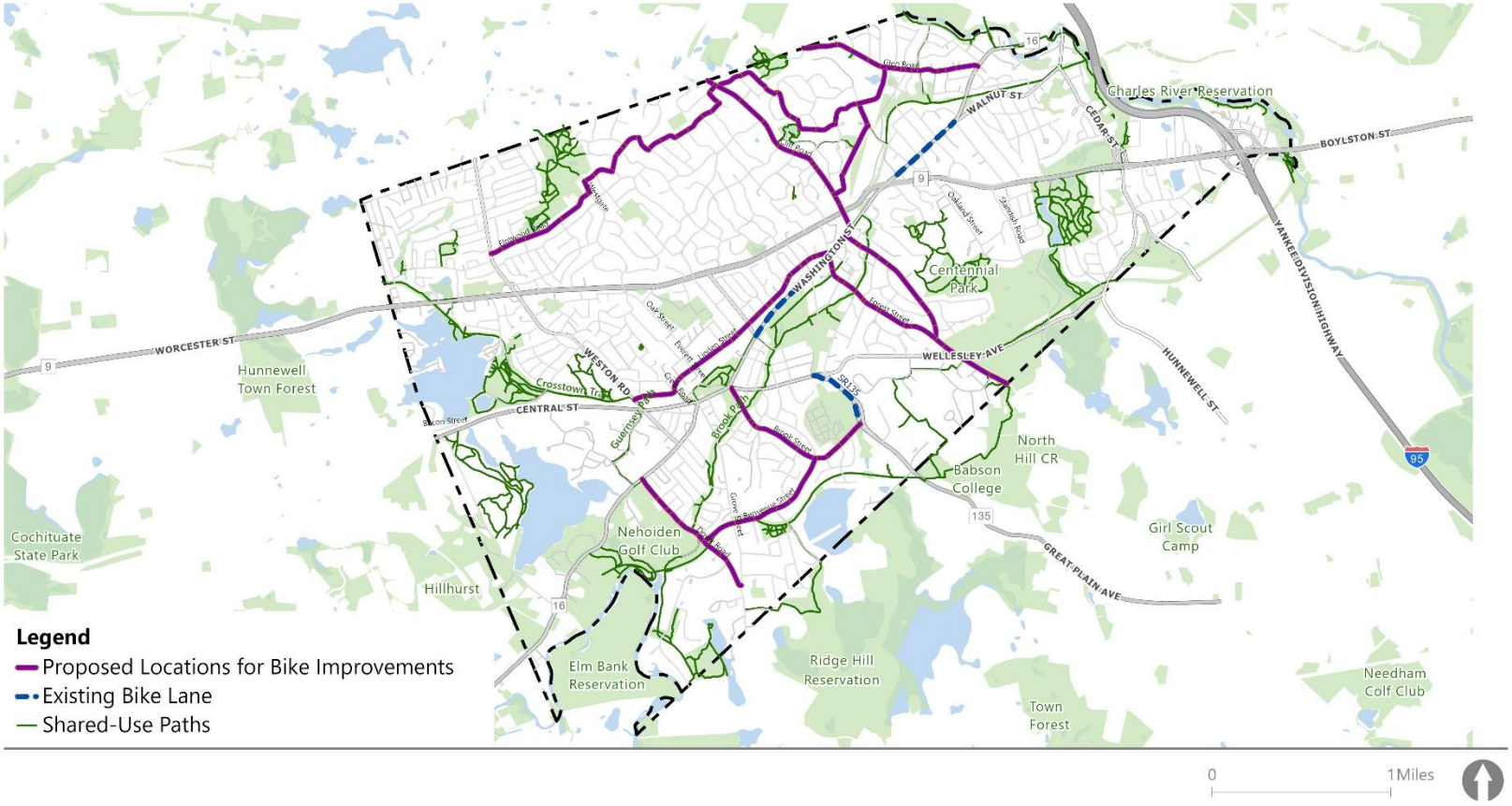
The identification of existing routes for biking recognizes the existing network of bike-friendly roads, while highlighting potential areas for improvement in the bicycle network. However, it is important to note that while this Plan focuses on the low-cost, high-impact investments that the Town of Wellesley can make to improve the bicycle network, there are several critical gaps in the network that will require higher-cost treatments to create bicycle facilities that are safe and comfortable for people of all ages and abilities. For many of these roads, such as Worcester Street and Washington Street, coordination with MassDOT will be necessary to redesign these roads as truly multimodal facilities. For others, such as Central Street, Wellesley Avenue, and Great Plain Avenue, the Town will likely need to study and redesign these roadways to create safe spaces for bicycle travel. With that in mind, the following section highlights locations where low-cost, high-impact bicycle network improvements could be made to better connect the existing safe routes for biking with additional multimodal trip generators.

Proposed Locations for Bicycle Network Improvements

This section outlines the proposed locations for bicycle network improvements in the Town of Wellesley. The proposed locations for bicycle network improvements are areas where targeted lower-cost treatments will have a high impact on making biking less stressful (refer Chapter 4 for list of treatments), identified based on the existing infrastructure, surrounding land use, and existing Level of Traffic Stress on the roadway. The proposed locations were identified if the roadway is an arterial, collector, or local road with Level of Traffic Stress 2, 3 or 4 that connects to multimodal trip generators, existing bike trails, or shared-use paths and if the roadway had more than 24 feet of surface width to accommodate bicycle improvements.

Figure 23 shows the proposed locations for bicycle network improvements and Table 8 lists these locations along with key roadway characteristic information.

Figure 23. Proposed Locations for Bicycle Network Improvements



Proposed Locations for Bicycle Network Improvements
Wellesley Townwide Safe Routes Plan

Table 8. Proposed Locations for Bicycle Network Improvements

Roadway / Trail	Functional Class	Level of Traffic Stress	Key Connections	
			Trails	Multimodal Trip Generators
Abbott Road	Local	3	-	Wellesley Hills Post Office, Wellesley Historical Society
Dover Road, Washington St to Grove St	Minor Collector	4	Sudbury Aqueduct Path	Nehoden Golf Club
Forest Street, Washington St to Town Limits	Minor Collector	4	-	Wellesley Country Club, connects to Brook Path.
Cliff Road, White Oak Rd to Worcester St	Minor Collector	4	Rockridge Pond Trail	-
Glen Road, Town Limits to Washington St	Minor Collector	3	Charles River Path	Wellesley Farms MBTA Commuter Rail Station
Elmwood Road, Weston Rd to Westgate	Local	3	-	Bates School, Boulder Brook Reservation Trail
Linden Street, Forest St to Weston Road	Minor Collector	4	-	Wellesley Square

Several of the corridors in Table 8 include shorter segments of roadways that would be included in the low-cost, high-impact treatments, including Colburn Road, Ledgeway Road, Monadnock Road, Pierce Road, Royalston Road, Stanford Road, Westgate and White Oak Road.

CROSSINGS

Safe crossings are crucial for creating a complete network of routes for walking and biking, particularly in areas identified as higher stress. This section identifies these higher stress crossings in the Town based on the existing infrastructure, land use, connections to multimodal trip generators, and proposed pedestrian and bicycle network improvements identified in previous sections. Figure 24 describes the methodology used to identify the higher stress crossings in Wellesley.

Figure 24. Methodology to Identify Priority Crossings

Identify Locations

- Identify all intersections where at least one roadway is an arterial or collector with sidewalk gaps OR is at the terminus of proposed bicycle network improvements.

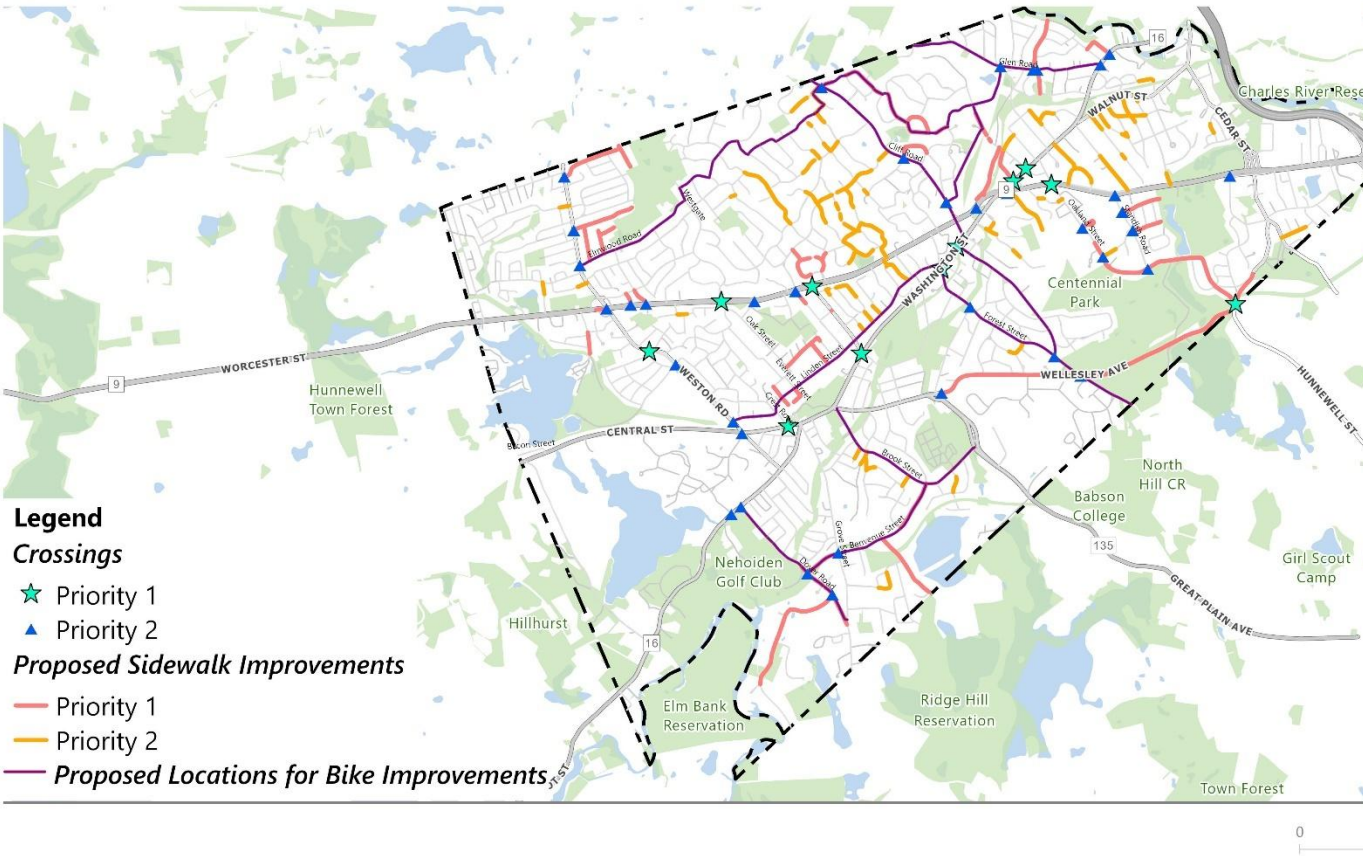
Assess Intersection Features Based on Desktop Review

- Assess whether the intersection control is signalized or unsignalized, and if there are pedestrian signals
- Note if there are existing crosswalks
- Note if there are other active transportation infrastructure present, such as pedestrian crossing signs, Rectangular Rapid Flashing Beacons (RRFBs), or bicycle lanes

Prioritize Intersection Improvements

- **Priority 1**: Intersections with at least one arterial or collector roadway that has sidewalk gaps OR is at the terminus of proposed bicycle network improvements AND has limited existing pedestrian infrastructure based on roadway speed, number of lanes and vehicular volumes OR is identified based on community input.
- **Priority 2**: Intersections that have existing crosswalks on approaches of major roadways OR where only local roadway approaches have sidewalk gaps.

Figure 25. Proposed Locations for Pedestrian Crossing Improvements



Error! Reference source not found.Figure 25 shows locations for desired pedestrian crossings improvements and the crossings identified as Priority 1 are:

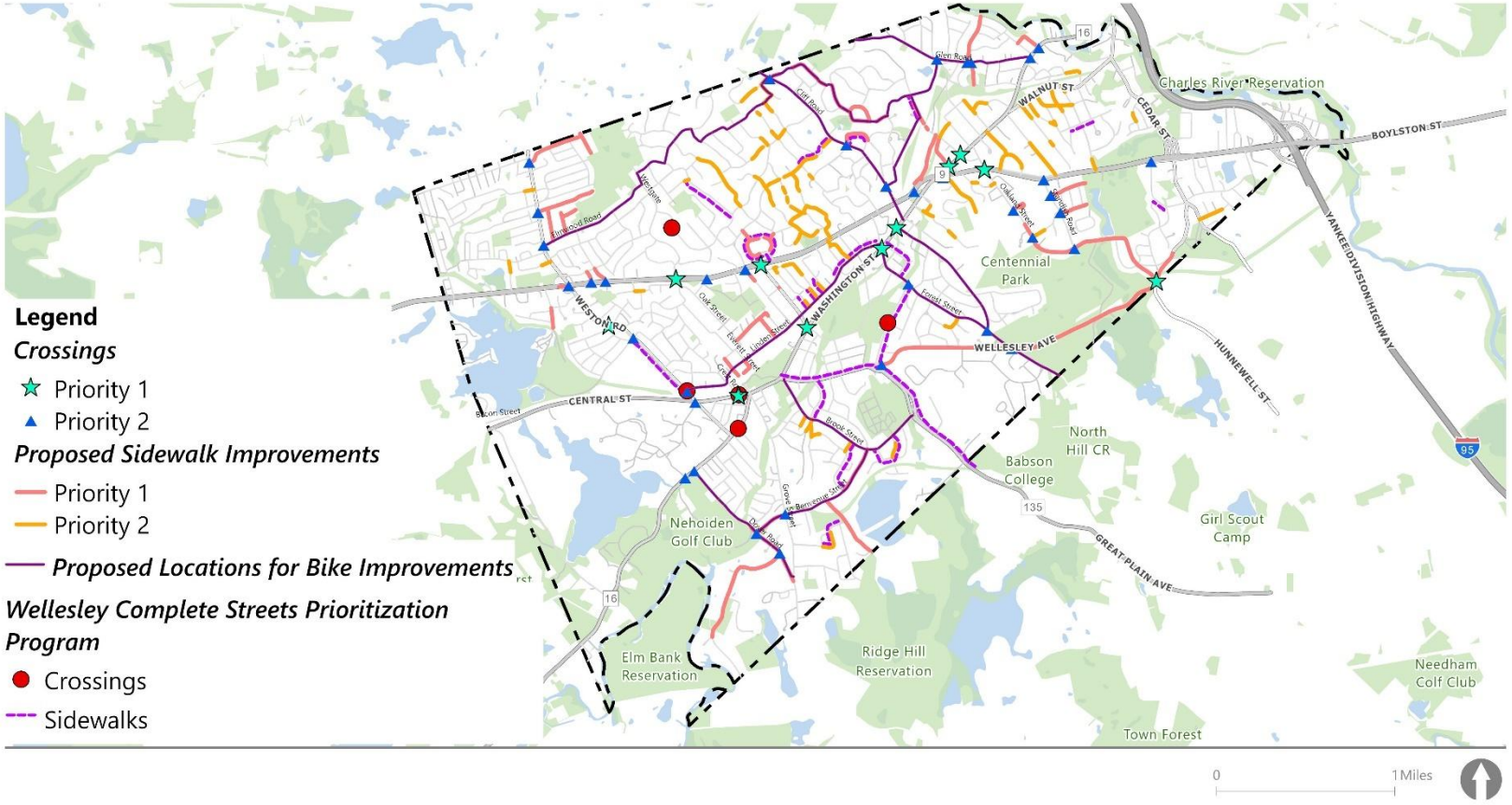
- Worcester St/Oak St
- Worcester St/Kingsbury St
- Worcester St/Oakland St
- Central Rd/Crest Rd
- Washington St/State St
- Washington St/Forest St
- Washington St/Abbott St
- Washington St/Chapel Pl
- Washington St/Woodlawn Ave
- Weston Rd/MacArthur Rd/ Willow Rd
- Wellesley Ave/Hunnewell St

Four of the eleven Priority 1 crossings are on State-owned facilities (Worcester Street and Central Road), while six of the eleven crossings are on Town-owned facilities. The Wellesley Ave/Hunnewell St intersection is in the Town of Needham, but was identified as a key crossing for Wellesley community members. The crossing at Kingsbury and Worcester was recently updated but is still difficult because of the high speed and volume. Because Worcester Street is a regional arterial with high volume and speeds any new crossings need careful evaluation and may require a pedestrian-activated signal for crossing.

PLANNED PROJECTS

This section outlines the projects included in the Complete Streets Prioritization Plan (CSPP) for the Town of Wellesley and compares them with the planned locations for sidewalk, bicycle, and crossing improvements discussed in earlier sections. The CSPP is a document updated every few years to prioritize projects that are eligible for the MassDOT Complete Streets Funding Program grants, of up to $500,000. This overlap identification will assist the Town in prioritizing investments that correspond with the available funding sources for active transportation projects. Figure 26 shows the projects identified in the Wellesley Complete Streets Prioritization Plan.

Figure 26. Complete Streets Funding Program Project Prioritization Plan



Complete Streets Funding Program Project Prioritization Plan
Wellesley Townwide Safe Routes Plan

Chapter 4

Safety Treatments Toolkit

Safety Treatments Toolkit

This chapter summarizes the safety treatments toolkit that the Town can consider to improve its pedestrian and bicycle networks and provide safe routes for walking and biking throughout the Town. The safety treatments toolkit is built from industry's best practices, including resources from MassDOT, National Association of City Transportation Officials (NACTO) and National Cooperative Highway Research Program (NCHRP) such as:

- MassDOT Municipal Resource Guide for Walkability
- MassDOT Municipal Resource Guide for Bikeability
- MassDOT Separated Bike Lane Planning and Design Guide
- MassDOT Bicycle and Pedestrian Plan Update (2021)
- NACTO (National Association of City Transportation Officials) Urban Bikeway Design Guide
- NACTO Urban Street Design Guide
- NACTO Don't Give Up at the Intersection Guide
- NCHRP (National Cooperative Highway Research Program) Report 1036: Roadway Reallocation Guide

The safety treatment toolkit ("the toolkit") is intended to provide a menu of options that can be applied throughout the Town to address the critical barriers to safe routes for walking and biking for people of all ages and abilities. Table 9 summarizes the treatments by category (pedestrian, bicycle, crossing and traffic calming). The treatments identified in the toolkit are tailored to the local context based on the existing conditions analysis outlined in Chapter 2, input from the Town of Wellesley staff, and feedback from community members at a public meeting (please reference Appendix A: Community Engagement). Many of the treatments will require further study and design to determine cost and ease of implementation. The next chapter identifies the recommended treatments from the toolkit for the priority locations determined through the network analysis in Chapter 3.

Table 9. Safety Treatments Toolkit

Treatment	Estimated Cost	Pedestrian	Bicycle	Crossing	Traffic Calming
Pedestrian Treatments					
Sidewalk	$ - $$$	X			
Shared Use Path	$$ - $$$	X	X		
Bicycle Treatments					
Shared Lane Markings ("Sharrows")	$		X		
Standard Bike Lane	$		X		
Buffered Bike Lane	$ - $$		X		
One-Way Separated Bike Lane	$$		X		
Two-Way Separated Bike Lane	$$ - $$$		X		
Raised Bike Lane	$$ - $$$		X		
Bicycle Signal Heads	$ - $$		X	X	
Wayfinding Signage	$		X		
Crossing Treatments					
High Visibility Crosswalk	$	X	X	X	

Treatment	Estimated Cost	Pedestrian	Bicycle	Crossing	Traffic Calming
Pavement Markings through Intersections	$		X	X	
Curb Extensions	$ - $$	X	X	X	X
Raised Crosswalk	$$	X	X	X	X
Median Refuge Island	$$	X	X	X	
Pedestrian Countdown Signal Heads	$$	X	X	X	
Leading Pedestrian Interval (LPI)	$	X	X	X	X
Rectangular Rapid Flashing Beacon (RRFB)	$$	X	X	X	X
Pedestrian Hybrid Beacon (HAWK)	$$ - $$$	X	X	X	X
Traffic Calming Treatments					
Reducing Speed	$	X	X		X
Dynamic Speed Feedback Signs	$	X	X		X
No Right Turn on Red	$	X	X	X	X
All Way Stop Control	$	X	X	X	X
Speed Table	$$	X	X		X
Mini Roundabout/Traffic Circle	$$ - $$$	X	X	X	X
Reduce Intersection Corner Radii	$ - $$	X	X	X	X

Pedestrian Treatments

SIDEWALK

A sidewalk is a dedicated pedestrian facility adjacent to the roadway and is separated from traffic by a curb. Sidewalks may also have an additional buffer zone between the roadway and the walking area. Figure 27 shows an example of a sidewalk on Washington Street in the Town of Wellesley.

Figure 27. Sidewalk

Source: Google Street View

Typical Applications: Sidewalks can be added to most streets, except for limited access freeways, unaccepted streets and narrow roadways with limited right-of-way.

Benefits:

- Provides separation to pedestrians from motor vehicles which is key to the comfort of non-motorized users.
- Provides means of mobility for people using wheelchairs, strollers, or others who may not be able to travel on an unpaved surface.

Constraints:

- Retrofitting sidewalks onto facilities that do not currently have them may require additional right-of-way.
- Right-of-way and environmental constraints such as topography or wetlands may increase design difficulty and costs.
- Landscaping and mature tree removal or reconfiguration may be necessary.

Cost: $-$$$ depending on existing roadway configuration and available right-of-way.

Considerations:

- Widths may vary from 6 to 8 feet, with a minimum of 5 feet required.
- Landscaped buffer from the roadway or wider sidewalks may be desirable depending on surrounding land use context.
- Additional resources may be required for winter maintenance and plowing.

SHARED USE PATH

Shared use paths are paved, two-way facilities separated from the road by curbs or grass/tree strip, designed for travel by people of all ages and abilities, including pedestrians, bicyclists, skaters, joggers, wheelchairs and others. Figure 28 shows an example of shared use path in the Town of Wellesley.

Figure 28. Shared Use Path

Source: Brook Path, Town of Wellesley

Typical Applications: Shared-use paths can be considered

- On streets where bicycle and pedestrian volumes are anticipated to be high.
- On streets that serve as links between communities and as recreational facilities.

Benefits:

- Serves as a combined facility for bicyclists and pedestrians providing separation from vehicular traffic.
- Designed for people of all ages and abilities.
- Serves as a parallel alternative route to streets where sidewalks or bike lanes or other on-street facilities for pedestrians and bicyclists are not provided.

Constraints:

- Requires a wide right-of-way.
- Different user speeds and behaviors can create conflicts. Bicyclists may travel faster than pedestrians or fail to yield to pedestrians, potentially leading to conflicts between users.
- Potential conflicts with motorists at crossings.
- Maintenance of the path surface is crucial. Uneven surfaces, debris, or weather-related issues (like ice or snow) can pose risks for all users.

Cost: $$-$$$ depending on available right-of-way or open space easements.

Considerations:

- The recommended width of the path is 10 to 12 feet with a minimum of 6-8 feet required.

Bicycling Treatments

SHARED LANE MARKINGS

Shared Lane Markings (SLMs), or "sharrows," are road markings used to indicate a shared lane environment for bicycles and motorists. They may only be considered along low speed, low volume residential roadways to reinforce the legitimacy of bicycle traffic on the roadway, recommend proper bicycle positioning, and may be configured to offer additional wayfinding guidance. Figure 29 shows the shared lane markings along Washington Street in Wellesley.

Figure 29. Shared Lane Markings or Sharrows

Source: Google Street View

Typical Applications: Per NACTO Urban Bikeway Design Guide, shared lane markings may be considered

- On streets with posted speed limit less than 35 miles per hour and Average Daily Traffic (ADT) less than 3,000 vehicles and
- On streets where the speed differential between motor vehicles and bicyclists is anticipated to be minimal.

Benefits:

- Indicates a potential presence of bicyclists on the roadway.
- Requires no additional street space.

Constraints:

- Shared lane markings offer no physical separation between bicyclists and vehicles, increasing vulnerability for bicyclists.
- May encourage close passing by vehicles, which can intimidate or endanger bicyclists.
- Bicyclists may be forced to ride at prevailing travel speeds on the roadway.
- On roads with higher speed limits, the speed differential between vehicles and bicyclists may create safety risks.
- In high-traffic or high-speed areas, shared lane markings may not provide the level of safety needed for bicyclists.
- Shared lane markings are not a substitute for other bicycle accommodations especially in locations with high traffic volumes and speeds.

Cost: $

Considerations:

- Shared lane markings shall not be used on shoulders, in designated bicycle lanes, or to designate bicycle detection at signalized intersections.
- Frequent, visible placement of markings is essential.
- If on-street parking is not present, shared lane markings should be placed far enough away from the curb to direct bicyclists away from gutters, seams and other obstacles.

STANDARD BIKE LANE

A standard bike lane is an on-street facility that provides space reserved for bicyclists, delineated with pavement markings. Figure 30 shows an example of a standard bike lane along Washington Street in Wellesley.

Figure 30. Standard Bike Lane

Source: Google Street View

Typical Applications: Per NACTO Urban Bikeway Design Guide, a standard bike lane may be considered

- On streets with posted speed limit greater than 25 miles per hour and ADT greater than 3,000 vehicles and
- On streets without sufficient right-of-way or pavement width to provide buffered or separated bike lanes.

Benefits:

- Provides a designated space for people biking and reduces potential conflicts between vehicles and bicyclists.
- Bicyclists can ride at their preferred speed without interference from prevailing traffic conditions.
- Facilitates predictable behavior between bicyclists and vehicles.

Constraints:

- Does not provide physical separation from vehicular traffic.
- Parking is prohibited in bike lanes. However, drivers may often park or stand in bike lanes.

Cost: $

Considerations:

- A standard bike lane width is typically 6 feet but may be reduced to 4 feet in constrained locations where parking is not present.

BUFFERED BIKE LANE

Buffered bike lanes are similar to standard bike lanes but include an additional striped buffer typically 2 to 3 feet in width, separating the bike lane from the adjacent motor vehicle travel lane and/or parking lane. Figure 31 shows an example of a buffered bike lane.

Figure 31. Buffered Bike Lane

Source: NACTO

Typical Applications: Per NACTO Urban Bikeway Design Guide, a buffered bike lane may be considered

- On streets with posted speed limit greater than 35 mph and ADT greater than 3,000 vehicles.
- On streets with adequate right-of-way to provide buffer space.
- On streets with extra travel lanes or extra lane width.

Benefits:

- Added separation from vehicular traffic compared to standard bike lanes.
- Provides a greater space for bicycling without making the bike lane appear so wide that it might be mistaken for a travel lane or a parking lane.

Constraints:

- Does not provide physical separation from vehicular traffic.
- Requires a wide right-of-way compared to standard bike lanes.
- Parking is prohibited in bike lanes. However, drivers may often park or stand in bike lanes.

Cost: $ - $$

Considerations:

- Buffer may consist of diagonal striping or rumble strips to deter motor vehicles from using the buffer space.

ONE WAY SEPARATED BIKE LANE

A one-way separated bike lane, also known as a one-way protected cycle track, is a bicycle facility within the street right-of-way separated from vehicle traffic by a physical barrier such as planters, flexible posts, parked cars, or curb. Figure 32 shows an example of a one-way separated bike lane.

Figure 32. One-Way Separated Bike Lane

Source: CalBike

Typical Applications: A one-way separated bike lane may be considered

- On streets with adequate right-of-way to provide a physical separation between the bike lane and the travel lane.
- Critical bike network segments where additional protection is warranted.

Benefits:

- Dedicates and protects space for bicyclists to improve perceived comfort and safety.
- Prevents drivers from standing or double-parking, unlike a standard bike lane or a buffered bike lane.
- Reduces the risk and fear of collisions with overtaking vehicles.
- More attractive for bicyclists of all levels and ages.

Constraints:

- Winter maintenance and plowing.
- Availability of adequate right-of-way to provide physical separation from vehicular traffic. Requires a wide right-of-way compared to standard bike lane or buffered bike lane.

Cost: $$

Considerations:

- Intersections should be designed for visibility of bicyclists and may warrant separate signal phasing depending on context.
- The type of physical barrier varies depending on application, presence of parking, and available right-of-way.

TWO-WAY SEPARATED BIKE LANE

A two-way separated bike lane, also known as a two-way protected cycle track, is a bicycle facility within the street right-of-way separated from vehicle traffic by a physical barrier such as planters, flexible posts, parked cars, or curb. Two-way separated bike lanes serve bidirectional bicycle travel on one side of the street. Figure 33 shows an example of a two-way separated bike lane.

Figure 33. Two-Way Separated Bike Lane

Source: NYC Street Design Manual

Typical Applications: A two-way separated bike lane may be considered

- On streets with few conflicts such as driveways or cross-streets on one side of the street.
- On streets where there is not enough space for one-way separated bike lanes on both sides of the street or on streets with extra right-of-way on one side of the street.
- On streets with high bicycle volumes, high vehicle volumes and high posted speeds.
- As connections between shared use paths or as critical bike network segments where additional protection is warranted.
- On one-way streets where contra-flow bicycle travel is desired.

Benefits:

- Dedicates and protects space for bicyclists to improve perceived comfort and safety.
- Prevents motorists from easily entering the bike lane.
- Encourages bicyclists to ride on the bikeway rather than on the sidewalk.
- More attractive for bicyclists of all levels and ages.
- On one-way streets, they may reduce the number of cyclists riding against the traffic by providing a dedicated lane for safe travel in the opposite direction.

Constraints:

- Requires a wide right-of-way compared to other types of bike lanes.
- Additional construction may be required to move curbs.
- Two-way separated bike lanes may add complexity for drivers, as they need to monitor both vehicular traffic and bicyclists traveling in both directions at intersections.

Cost: $$ - $$$

Considerations:

- The desirable width of the two-way separated bike lane is 12 feet with 8 feet in constrained locations.
- Lanes markings are needed to indicate direction of travel.
- Color, yield, and "Yield to Bikes" signage should be used to identify conflict areas with motor vehicles and make it clear that the bicyclists have priority over entering/existing traffic.
- Special consideration should be given at transit stops to manage bicycle and pedestrian interactions.
- To be designed such that an adjacent bike lane is travelling in the same direction as the vehicular traffic

RAISED BIKE LANE

Raised bike lanes are bicycle facilities that are vertically separated from vehicle traffic. Raised bike lanes may be at the level of the adjacent sidewalk or set at an intermediate level between the roadway and sidewalk to segregate the bike lane from the pedestrian area. Figure 34 shows an example of a raised bike lane.

Figure 34. Raised Bike Lane

Source: NACTO

Typical Applications: A raised bike lane may be considered

- Along higher speed streets with few driveways and cross streets.
- Along streets with high bicycle volumes.
- On streets with numerous curves where vehicle encroachment into bike lanes may be a concern.

Benefits:

- Dedicates and protects space for bicyclists to improve perceived comfort and safety.
- Keeps away motorists from easily entering the bike lane.
- Encourages bicyclists to ride on the bikeway rather than on the sidewalk.
- More attractive for bicyclists of all ages and abilities.

Constraints:

- Availability of adequate right-of-way.

Cost: $$ - $$$

Considerations:

- Vertical separation between the roadway and the bike lane should be between 1 and 6 inches.
- Color, yield, and "Yield to Bikes" signage should be used to identify conflict areas with motor vehicles and make it clear that the bicyclists have priority over entering/existing traffic.
- Special consideration should be given at transit stops to manage bicycle and pedestrian interactions.

BICYCLE SIGNAL HEADS

Bicycle signals can be utilized at intersections and crossings to make crossing intersections safer for bicyclists. These signals clarify when bicyclists can enter an intersection. Figure 35 shows an example of a bicycle signal head in the City of San Luis Obispo, California. As Wellesley continues to develop bicycle routes suitable for people of all ages and abilities, considering the installation of bicycle signal heads at existing signalized intersections along bike routes, or at trail crossings, may be an appropriate treatment.

Figure 35. Bicycle Signal Head

Source: BikePortland

Typical Applications: According to the NACTO Urban Bikeway Design Guide, bicycle signal heads may be considered at intersections:

- Where a stand-alone bike path or multi-use path crosses a street.
- With a highly used bicycle route that must cross major signalized intersections to connect users to the rest of the route.
- At complex intersections or at intersections with high numbers of bicycle and motor vehicle crashes that may otherwise be difficult for bicyclists to navigate.

Benefits:

- Minimizes delays experienced by bicyclists.
- Provides separation from vehicle movements.

Constraints:

- Requires signal timing considerations for bicycle phasing.

Cost: $-$$

Considerations:

- Needs to be placed in a location clearly visible to oncoming bicyclists.
- Adequate clearance interval needs to be provided for bicyclists.

WAYFINDING SIGNAGE

A bicycle wayfinding system consists of comprehensive signing and/or pavement markings to guide bicyclists to their destinations along preferred bicycle routes. Signs are placed at decision points along bicycle routes – typically at the intersection of two or more bikeways and at other key locations leading to and along bicycle routes. Figure 36 shows an example of bicycle wayfinding signage in the City of Davis, California.

Figure 36. Bicycle Wayfinding Signage

Source: The Davis Enterprise

Typical Applications: Per NACTO Urban Bikeway Design Guide, wayfinding signage may be considered

- Along all streets and/or bicycle facility types that are part of the bicycle network.
- Along corridors with circuitous bikeway facility routes to guide bicyclists to their intended destination.

Benefits:

- Familiarizes users with the bicycle network.
- Helps bicyclists navigate safely by directing them along the safest routes, avoiding areas with high vehicular traffic or intersections that are difficult to navigate.
- Visually indicates to motor vehicle drivers that they are driving along a bicycle route and should use caution.
- Wayfinding signage works well with an established network of bicycle crossings or nearby bicycle links.

Constraints:

- Too many signs or poorly placed signs can confuse the bicyclists or motor vehicle drivers.

Cost: $

Considerations:

- Signage should be placed in advance of all turns or decision points along the bicycle routes and include destinations, directional arrows, and distance.
- For wayfinding signage to be effective, they must be easily recognizable, readable and understandable to users of all ages and abilities.

Crossing Treatments

HIGH VISIBILITY CROSSWALK

High-visibility crosswalks use patterns and/or reflective paint that are visible to both the motor vehicle driver and pedestrian from farther away. Figure 37 shows an example of a high visibility crosswalk.

Figure 37. High Visibility Crosswalk

Source: Town of Wellesley

Typical Applications: High Visibility Crosswalks can be considered at

- Intersections with moderate to high vehicle volumes and speeds.
- Mid-block crossings.

Benefits:

- Makes drivers more aware of crosswalks and pedestrians, which can improve safety.
- By clearly marking pedestrian paths, high visibility crosswalks can help improve traffic flow, as drivers are more likely to anticipate pedestrian movement.

Constraints:

- Compliance is not high at unsignalized intersections compared to other treatments.
- Most effective with other types of traffic control (such as stop signs, traffic signals, or flashing beacons).
- High visibility markings fade over time due to weather and wear, requiring regular maintenance and repainting to remain effective.

Cost: $

Considerations:

- The minimum recommended width of the crossing is 6 feet, but wider crossings may be preferred in areas with a high number of people walking.
- Street lighting should be provided at and near crosswalks to enhance pedestrian visibility to drivers.

PAVEMENT MARKINGS THROUGH INTERSECTIONS

Bicycle pavement markings through intersections indicate the intended path of bicyclists through an intersection or across a driveway or ramp. They guide bicyclists on a safe and direct path through the intersection and provide clear boundaries between the paths of bicyclists and motorists. Figure 38 shows an example of bicycle pavement markings through intersections. As Wellesley continues to develop bicycle routes suitable for people of all ages and abilities, considering the installation of bicycle signal heads at intersections along bike routes, or at trail crossings, may be an appropriate treatment.

Figure 38. Pavement Markings through Intersections

Source: NACTO

Typical Applications: Bicycle pavement markings through intersections may be considered for application at wide or complex signalized intersections, where the bicycle path may be unclear or where approaching drivers may not expect bicyclists.

Benefits:

- Increases driver awareness for people biking and makes bicycle movements more predictable.
- Guides bicyclists through the intersection in a straight and direct path.

Constraints:

- May require additional maintenance due to vehicles crossing pavement markings more frequently.

Cost: $

Considerations:

- White dashed lines should be used at a minimum to extend a bike lane through an intersection or across a conflict zone.
- Dashed green pavement can enhance driver awareness and bicyclist visibility.

CURB EXTENSIONS

Curb extensions visually and physically narrow the roadway, creating safer and shorter crossings for pedestrians. They may be used at intersections or at mid-block crossing locations. Figure 39 shows an example of a curb extension. Many different types of locations are appropriate for curb extensions, including at intersections where there is on-street parking along the roadway, in locations where wide lanes (11+ ft) and wide curb radii (15+ ft) create large roadways, and skewed intersections, among others.

Figure 39. Curb Extension

Source: NYC Street Design Manual

Typical Applications: Per the NACTO Urban Bikeway Design Guide, curb extensions can be considered at

- Intersections with moderate to high vehicle volumes and speeds.
- Mid-block crossings and bus stops.

Benefits:

- By shortening the crossing distance, curb extensions reduce pedestrian exposure to motor vehicles and enhance pedestrian visibility at intersections through improved sight lines.
- They slow down vehicle speeds by narrowing the road, which encourages more cautious driving in pedestrian-heavy areas.
- Curb extensions may be used to place landscaping and street furnishings; this is especially beneficial where sidewalks are otherwise too narrow.

Constraints:

- Retrofitting curb extensions onto existing roadways may require roadway reallocation.
- May conflict with bicyclists using the roadway.
- May require loss of curbside parking.

Cost: $ - $$

Considerations:

- Turning needs of larger vehicles such as school buses and trucks needs to be considered in designing curb extensions.
- Curb extensions must not extend into bicycle lanes or travel lanes.

RAISED CROSSWALK

A raised crosswalk introduces a vertical element spanning the entire width of the roadway and raises the entire intersection and all crosswalks at grade with the sidewalk. The crosswalk is demarcated with paint and/or special paving materials. Figure 40 shows an example of a raised crosswalk. It is important to note that raised crosswalks currently conflict with town policy.

Figure 40. Raised Crosswalk

Source: NYC Street Design Manual

Typical Applications:

- Most streets, with the exception of limited access freeways.

Benefits:

- An elevated crossing makes the pedestrian more prominent in the driver's field of vision.
- Allows pedestrians to cross at grade with the sidewalk.
- Approach ramps may reduce vehicle speeds and improve motorist yielding.

Constraints:

- Implementing a raised crosswalk can be costly, especially with drainage needs.
- May not be appropriate for bus transit routes or primary emergency vehicle routes.

Cost: $$

Considerations:

- The crosswalk table is typically at least 10 feet wide and designed to allow the front and rear wheels of a passenger vehicle to be on top of the table at the same time.
- Typically installed on 2-lane or 3-lane roads with posted speed limit of 30 mph or less and Annual Average Daily Traffic (AADT) is below 9,000 vehicles.
- Raised crossings should generally be avoided on truck routes, emergency routes, and arterial streets.
- Currently, raised crosswalks conflict with town policy.

MEDIAN REFUGE ISLAND

A median refuge island is a protected area in the middle of a crosswalk for people walking or biking to stop/wait while crossing the street. Figure 41 shows an example of a median refuge island at Worcester Street and Kingsbury Street intersection in Wellesley.

Figure 41. Median Refuge Island

Source: Google Street View

Typical Applications: Median Refuge Island can be considered

- On streets with moderate to high volumes or speeds.
- Along streets with high bicycle and pedestrian volumes.
- Along streets with few acceptable gaps to cross both directions of traffic.

Benefits:

- Shortens crossing distances and exposure time experienced by pedestrians.
- Provides a safe place for pedestrians while crossing and improves pedestrian visibility for drivers.
- May contribute to traffic calming by narrowing lanes and reducing speeds.

Constraints:

- Available right-of-way or existing pavement width may not provide adequate space to add a refuge island.

Cost: $$

Considerations:

- The recommended width for a median refuge is 10 feet or more, with 6 feet being the absolute minimum.
- When placed on a two-way street, the median refuge should be placed along the centerline of the roadway between the opposing directions of travel.

PEDESTRIAN COUNTDOWN SIGNAL HEADS

A pedestrian countdown signal contains a timer display and counts down the number of seconds left in the crossing phase. Countdown signals reassure pedestrians who are in the crosswalk when the flashing "DON'T WALK" interval appears that they still have time to finish crossing. Countdown signals may begin counting down either when the "WALK" or when the flashing "DON'T WALK" interval appears and stop at the beginning of the steady "DON'T WALK" interval. Figure 42 shows an example of pedestrian countdown signal heads.

Figure 42. Pedestrian Countdown Signal Heads

Source: FHWA

Typical Applications: Pedestrian countdown signal heads can be considered

- At any signalized intersections with high pedestrian volumes such as near schools, employment or commercial centers.
- At locations used by mobility-challenged or elderly pedestrians.

Benefits:

- Help pedestrians judge whether there is sufficient time to cross the roadway.
- Pedestrian countdown signal heads have been shown to encourage more pedestrians to use the push button rather than cross against the signal.

Constraints:

- Can only be implemented at signalized intersections.

Cost: $$

Considerations:

- May require retiming if existing signal phasing does not provide adequate time for crossing.

LEADING PEDESTRIAN INTERVAL (LPI)

A leading pedestrian interval (LPI) gives pedestrians the opportunity to begin crossing 3-7 seconds before vehicles are given a green indication. With this head start, pedestrians better establish their presence in the crosswalk before vehicles have priority to turn left to increase their visibility and reduce potential conflicts. Figure 43 shows an example of a leading pedestrian interval.

Figure 43. Leading Pedestrian Interval (LPI)

Source: FHWA

Typical Applications: Leading pedestrian intervals can be considered at

- Intersections with medium to high motor vehicle turning volumes and pedestrian volumes.
- Intersections where right-turning vehicles do not yield to pedestrians.
- Intersections with a crash history of vehicle-pedestrian crashes.

Benefits:

- LPIs increase visibility of crossing pedestrians and reduce conflicts between pedestrians and vehicles.
- Increases the likelihood of motorists yielding to pedestrians because pedestrians are in the crosswalk by the time traffic signal turns green for parallel vehicle movements.
- Enhanced safety for pedestrians who may be slower to start into the intersection.
- Reduces vehicle-pedestrian conflicts.

Constraints:

- Can only be implemented at signals with concurrent phasing, which is not currently implemented in Wellesley.
- Reduces green time for vehicles.
- May add to delays for intersections at capacity.

Cost: $

Considerations:

- LPIs should give pedestrians a minimum head-start of 3 to 7 seconds, depending on the overall crossing distance.

- Intervals of up to 10 seconds may be appropriate where pedestrian volumes are high, or the crossing distance is long.
- Additional time before the lead interval may be needed to ensure that no drivers are running the red light.
- Right turn on red rules might limit the effectiveness of LPIs. Restricting right turns on red use at intersections with LPIs may be considered.

RECTANGULAR RAPID FLASHING BEACONS (RRFBS)

Rectangular Rapid Flashing Beacons (RRFBs) include pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings. They use an irregular flash pattern that is similar to emergency flashers on police vehicles. RRFBs may be installed at unsignalized intersections and at mid-block pedestrian crossings. Figure 44 shows an example of rectangular rapid flashing beacons at Dover Road and Buckingham Terrace intersection in Wellesley.

Figure 44. Rectangular Rapid Flashing Beacons (RRFBs)

Source: Google Street View

Typical Applications: According to the FHWA, RRFBs are particularly effective at multilane crossings with moderate to high traffic volumes and speeds of less than 40 miles per hour.[16]

Benefits:

- Provides a visible warning to drivers at eye level.
- Increases driver yielding behavior at crossings and allows drivers to proceed after yielding.

Constraints:

- Must be activated by people walking.
- Driver compliance may be lower than when compared with a traffic signal.
- Can provide a false sense of security for pedestrians, sometimes it is associated with a red light.

Cost: $$

Considerations:

- RRFBs shall not be used without the presence of a pedestrian crossing sign.
- An RRFB should also be installed in the median if there is a pedestrian refuge or other type of median.
- Push button placement should be easily accessible to people walking, in wheelchairs, and bicycling.
- Advance yield pavement markings and signs may be used to supplement RRFBs.

[16] https://highways.dot.gov/safety/proven-safety-countermeasures/rectangular-rapid-flashing-beacons-rrfb

PEDESTRIAN HYBRID BEACON (PHB)

A Pedestrian Hybrid Beacon (PHB) is a traffic control device that uses flashing overhead beacons to stop vehicle traffic to facilitate a pedestrian crossing, when activated by a pedestrian (previously known as a HAWK signal). When activated, the beacon displays a sequence of flashing and solid lights that indicate when vehicles must stop and then yield to crossing pedestrians. Figure 45 shows an example of a pedestrian hybrid beacon. Instructional signs are typically installed for drivers to understand when to stop and when to yield throughout the PHB's cycle.

Figure 45. Pedestrian Hybrid Beacon (PHB)

Source: MassDOT

Typical Applications: According to the FHWA, pedestrian hybrid beacons can be considered

- On roadways where it is difficult for pedestrians to cross, such as when gaps in traffic are not sufficient or posted speed limit exceeds 35 mph.
- On roadways with three or more lanes or the AADT is above 9,000 vehicles.

Benefits:

- The PHB is an intermediate option between RRFB and a full pedestrian signal because it assigns right of way and provides positive stop control.
- Allows motorists to proceed once the pedestrian has cleared their side of the travel lane(s), reducing vehicle delays.

Constraints:

- Must be activated by people walking.
- Driver compliance may be lower than when compared with a standard traffic signal.

Cost: $$ - $$$

Considerations:

- Push button placement should be easily accessible to people walking, in wheelchairs, and bicycling.
- Must be installed with a marked crosswalk and a pedestrian countdown signal.

Traffic Calming Treatments

REDUCING SPEED LIMITS

Vehicular speed plays a critical role in the number of collisions and the severity of their outcomes. Reducing vehicle speeds has the potential to increase safety by reducing the risk of collisions between non-motorized road users including pedestrians and bicyclists and drivers. Vehicular speeds are influenced both by the speed limit and the roadway design – in Wellesley, where speed limits are not posted, the statutory speed limit is 30 mph. To implement lower statutory speed limits, as well as speed limits for specific roadways, the Town of Wellesley must collaborate with MassDOT. Lowering statutory speed limits must also be accompanied by changes in roadway design, such as the treatments in this Safety Toolkit, to safely and effectively lower vehicular speeds.

Typical Applications:

- Most streets, particularly corridors with high pedestrian and bicyclist volumes, are candidates for speed reductions.

Benefits:

- Allows for more reaction time from motor vehicle drivers and pedestrians, which may reduce the number of collisions.
- Minimizes vehicle impact during a collision, thereby reducing the potential for fatal and serious injuries.
- Reduced speeds raise the comfort level of vulnerable users.

Constraints:

- Generally, reducing speeds is policy-guided and not design-oriented.
- The reduction of speed limits may be controlled by state statute in the Commonwealth of Massachusetts (see M.G.L. c. 90 §17C).[17]

Cost: $

Considerations:

- With lower speeds, there tends to be lower curb radii needed. Reduced corner radii can help reduce speeds.

[17] https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXIV/Chapter90/Section17C

DYNAMIC SPEED FEEDBACK SIGNS

Speed feedback signs provide drivers with feedback about their speed in relationship to the posted speed limit on a roadway. It is intended to get the driver's attention and give them a visual warning that they may be traveling over the recommended speed. Alternate names for this treatment include dynamic warning sign, radar speed/message sign, and dynamic speed display sign. Figure 46 shows an example of dynamic speed feedback signs. Traffic volume, vehicular speeds, roadway geometry, crash history, and presence of vulnerable roadway users are important considerations when siting feedback signs.

Figure 46. Dynamic Speed Feedback Signs

Source: Mass.gov

Typical Applications: Dynamic Speed Feedback Signs can be considered

- In high-speed zones and roadways with an unacceptable level of collisions due to excessive speeds.
- Areas with conflicting movements and pedestrian and bicyclist related collision history.

Benefits:

- Makes drivers aware of their traveling speed versus the speed limit.

Constraints:

- This treatment is not self-enforcing.
- This treatment may not be effective for longer stretches of roadway.
- Overuse could reduce the effectiveness of this treatment

Cost: $-$$

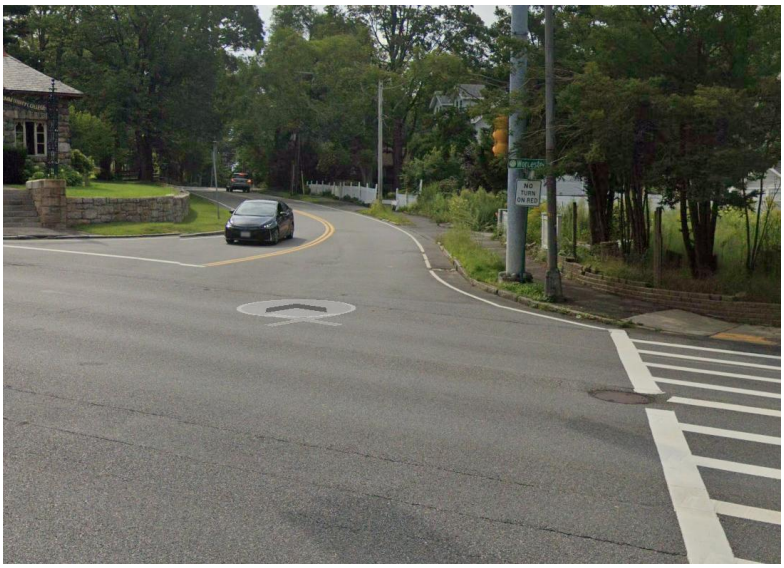
Considerations:

- Generally considered when the 85th percentile speeds exceed the posted speed limit by 5 mph or more. A speed study should first be conducted to determine if a change in speed limit is appropriate.
- Placement needs to consider availability of power either solar or wired.

NO RIGHT TURN ON RED

A "No Right Turn on Red" sign is placed at a signalized intersection to restrict drivers from turning right during a red light. Figure 47 shows an example of a No Right Turn on Red sign at the Worcester Street/Oakland Street intersection in Town of Wellesley.

Figure 47. No Right Turn on Red Sign



Source: Google Street View

Typical Applications: Signalized intersections near pedestrian or bicycle trip generating land uses such as school, commercial zones, and shared-use paths.

Benefits:

- Reduces conflict between right-turning vehicles and pedestrians and bicyclists traveling through.
- Dynamic electronic signs may be used to regulate right turns, limiting them to specific times of day or signal phases.

Constraints:

- May reduce capacity at intersections with high right-turn volumes.
- Rates of compliance may vary and require enforcement.

Cost: $

Considerations: Signage should be positioned in a way that ensures it is clearly visible to drivers.

MINI ROUNDABOUT / TRAFFIC CIRCLE

A roundabout is a type of circular intersection without traffic signals or stop signs, where drivers travel counterclockwise around a center island. When entering the roundabout, drivers yield to existing traffic, then enter the intersection and exit in their desired direction. Figure 48 shows an example of a mini roundabout/traffic circle.

Figure 48. Mini Roundabout/Traffic Circle

Source: Institute of Transportation Engineers (ITE)

Typical Applications: Mini roundabouts can be considered

- At minor intersection crossings or uncontrolled intersections.
- Near Areas where space is limited to install larger roundabouts.
- In Commercial districts or areas with small intersections with high pedestrian and bicyclist volumes.
- At Intersections with frequent turning movement conflicts.

Benefits:

- Reduces traffic speeds and discourages cut-through traffic by making it an uncomfortable route
- Slows vehicular speeds
- Require less maintenance compared to signalized intersections.

Constraints:

- Requires adequate spacing and may require additional right-of-way.

Cost: $$ - $$$

Considerations:

- Lane widths and turning radiuses must be reviewed and are dependent on intersection physical restraints.
- Splitter islands for roundabouts should be at least 6 feet at crosswalks.

REDUCE INTERSECTION CORNER RADII

The size of the intersection corner is directly linked to the length of the pedestrian crossing. Longer crossings require more time to cross, which increases pedestrian exposure to risk and reduces safety. A smaller corner radius enhances the pedestrian area, improving the alignment of pedestrian ramps. Figure 49 shows an example of reduced intersection corner radii to reduce pedestrian crossing distances.

Figure 49. Intersection Corner Radii

Source: NACTO

Typical Applications: Corner radius reduction can be considered at low truck volumes.

Benefits:

- Shortens crossing distances, reducing exposure to traffic and enhancing safety.
- Encourages vehicles to slow down, lowering the risk of collisions.
- Facilitates safer and more efficient ramp placement for accessibility.
- Frees up space for wider sidewalks, bike lanes, and other pedestrian-friendly features.

Constraints:

- Smaller radii may make it harder for larger vehicles, such as trucks and buses, to navigate the turn without encroaching on adjacent lanes.
- Corner radii that are too small may encourage motor vehicles to drive over the curb and onto sidewalks and bikeways.
- Emergency vehicles might face challenges when turning at intersections with reduced corner radii, potentially delaying response times.

Cost: $$ - $$$

Considerations:

- The corner radius should make intersections as compact as possible while accommodating large vehicles that frequent the intersection.
- In some instances, large vehicles may encroach on the opposing travel lane when turning.

Chapter 5

Project Recommendations for Safe Routes

Project Recommendations for Safe Routes

Based on the safety treatment toolkit summarized in the previous section, this section outlines the recommended projects for the priority locations identified in Chapter 3 and locations identified based on community comments (please reference Appendix A: Community Engagement). The recommended projects are categorized by the type of priority location – crossing, pedestrian, or bicycle – and the suggested treatments for each location are illustrated in Figure 50. Pedestrian and Crossing Priority Locations - Safety TreatmentsFigure 50 and Figure 51. Table 10, Table 11, and Table 12 outline the crossing, pedestrian, and bicycle project recommendations, respectively. The recommendations for safety treatments consider community input as well as professional staff and consultant judgement on the appropriate applications based on data such as roadway functional classification, roadway surface width, posted speed limits, and other existing conditions on the roadway or at the crossing. The project recommendations are intended to guide Town programming as funds become available. Where shared-use paths are recommended, the Town may consider utilizing either the existing right-of-way, or if available, an adjacent open space. It is important to emphasize that these recommendations are at the planning level and will require further study for feasibility and implementation.

Community comments identified the following locations that have specific issues or potential needs:

- Crossing at Worcester St / State Route 9 and Kingsbury St
    - It is important to note that this intersection was upgraded within the past ten years.
- Crossing at Weston Rd / MacArthur Rd / Willow Rd
    - It is important to note that there is an existing RRFB approximately 300’ from this identified location.
- Crossings and Bicycle Facilities on Washington St
- Bicycle Facilities on Walnut St
    - It is important to note that in the past five years, a community visioning exercise informed the current configuration of this roadway, which resulted in a wide sidewalk on the northern side to facilitate increased pedestrian activity and slow speed bicycling, with a shared lane marking for more advanced bicyclists.
- Traffic Calming on Longfellow St
    - It is important to note that there is no documented speeding at this location, nor is there documented higher pedestrian or bicycle activity.

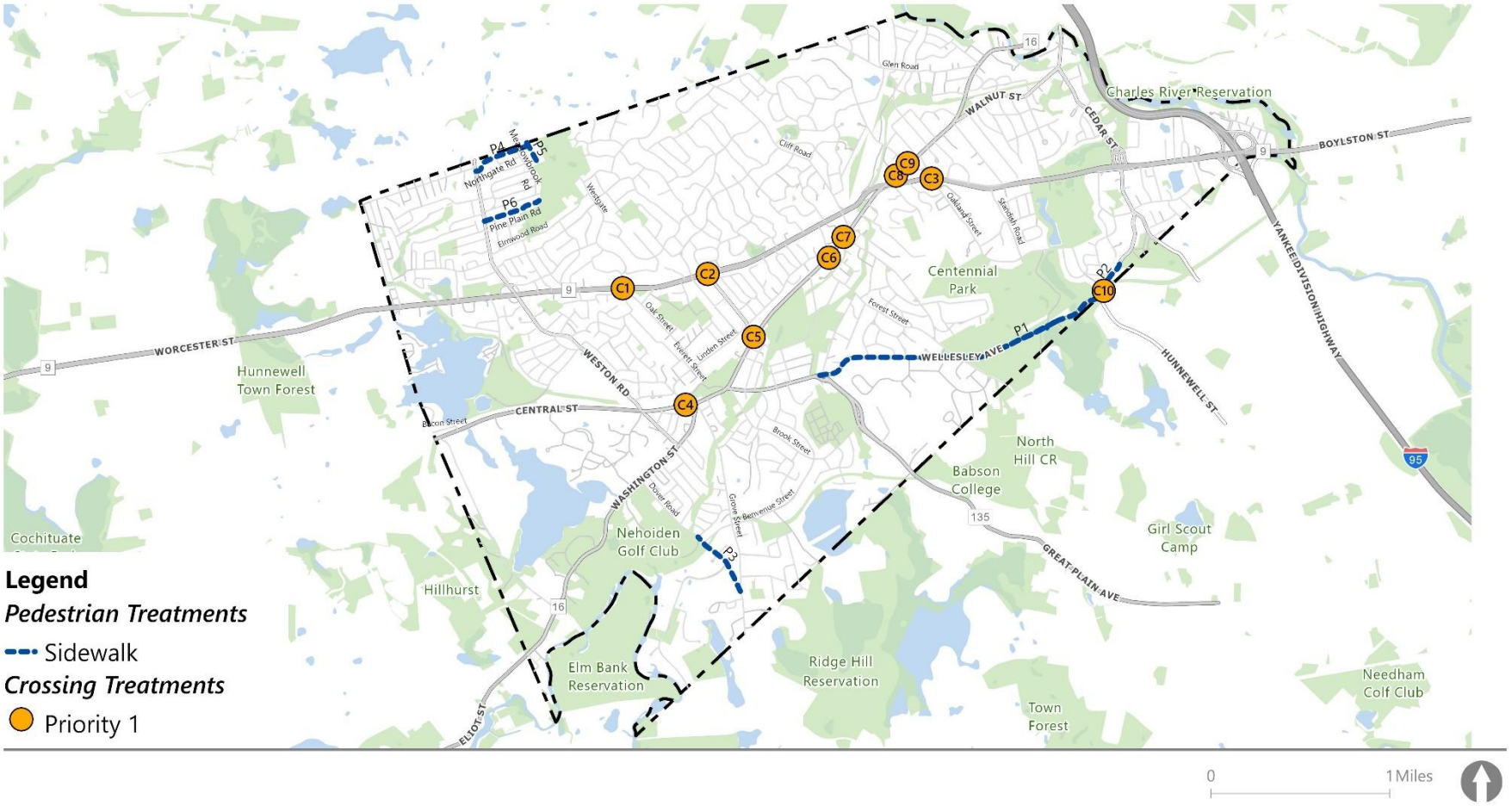
There were several crossings along Washington Street that were categorized as Priority 2 in the initial network identification analysis summarized in Chapter 3 which emerged as a community priority as a result of community engagement.

Table 10. Crossing Priority Locations - Safety Treatments

Map ID	Intersection	Control Type	Roadway Jurisdiction	High Visibility Crosswalk	Curb Extensions	Median Refuge Island	LPI*	Pedestrian Countdown Signal	RRFB**
C1	Worcester St/Oak St	Unsignalized	State	X		X			X
C2	Worcester St/Kingsbury St	Signalized	State		X		X	X	
C3	Worcester St/Oakland St	Signalized	State	X	X	X	X	X	
C4	Central Rd/Crest Rd	Unsignalized	Town of Wellesley	X	X				X
C5	Washington St/State St	Signalized	Town of Wellesley		X		X	X	
C6	Washington St/Forest St	Signalized	Town of Wellesley		X		X	X	
C7	Washington St/Abbott St	Unsignalized	Town of Wellesley		X				
C8	Washington St/Chapel Pl	Unsignalized	Town of Wellesley						
C9	Washington St/Woodlawn Ave	Unsignalized	Town of Wellesley						
C10	Wellesley Ave/Hunnewell St	Unsignalized	Town of Needham						

* Leading Pedestrian Interval; **Rectangular Rapid Flashing Beacon

Figure 50. Pedestrian and Crossing Priority Locations - Safety Treatments

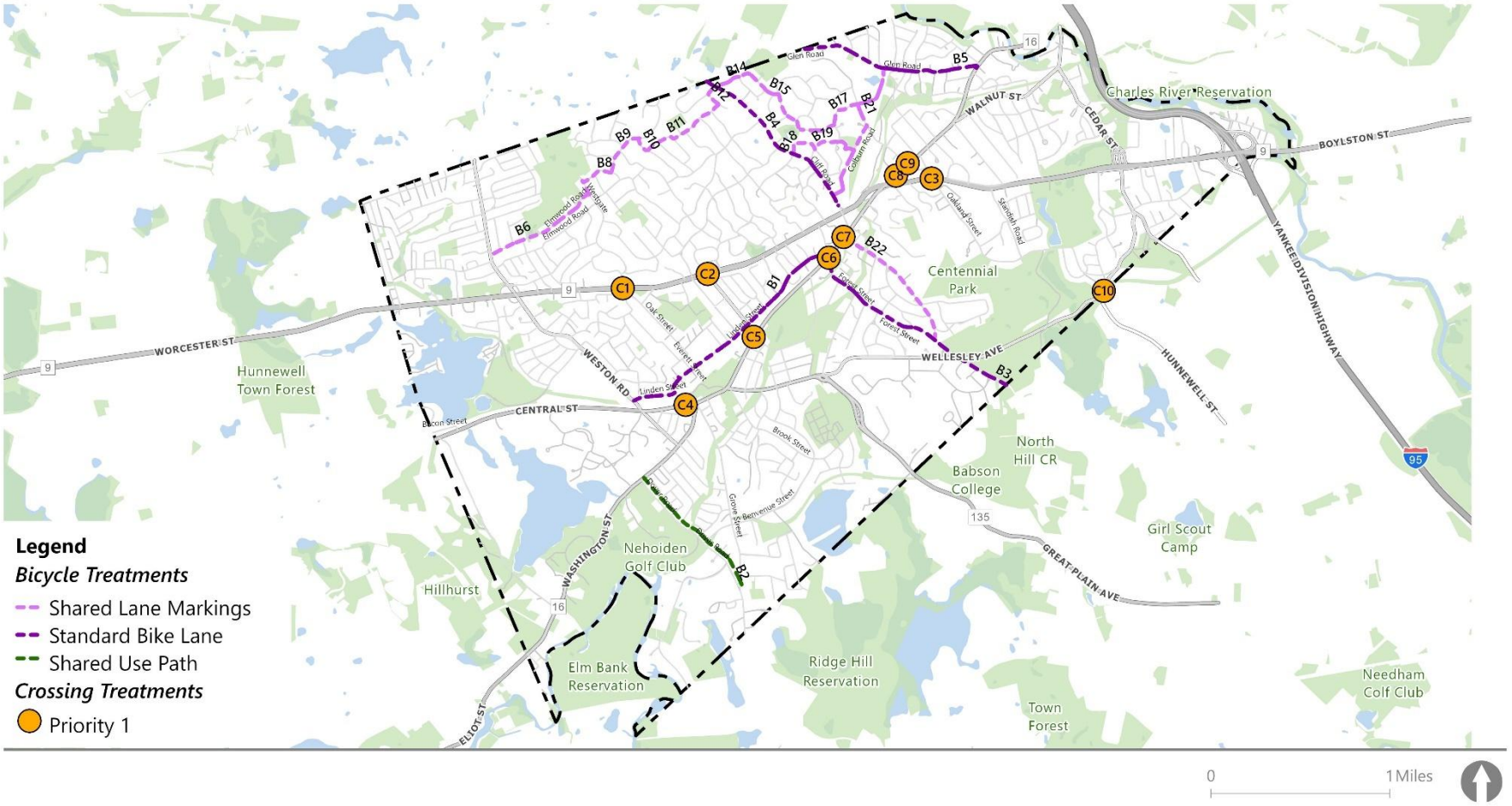


Pedestrian Priority Locations - Safety Treatments
Wellesley Townwide Safe Routes Plan

Table 11. Pedestrian Priority Locations - Safety Treatments

Map ID	Roadway	Extents	Functional Class	Roadway Jurisdiction	Sidewalk	Wayfinding Signage	Reduce Posted Speed
P1	Wellesley Ave	Great Plain Ave to Hunnewell St	Major Collector	Town	X	X	X
P2	Hunnewell St	Wellesley Ave to north of Oakland St	Major Collector	Town	X	X	
P3	Dover Rd	Ingraham Rd to Grove St	Minor Collector	Town	X	X	
P4	Northgate Rd	Weston Rd to Meadowbrook Rd	Local	Town	X		
P5	Meadowbrook Rd	North Town Limits to Terminus	Local	Town	X		
P6	Pine Plain Rd	Weston Rd to Terminus	Local	Town	X		

Figure 51. Bicycle and Crossing Priority Locations - Safety Treatments



Bicycle Priority Locations - Safety Treatments
Wellesley Townwide Safe Routes Plan

Table 12. Bicycle Priority Locations - Safety Treatments

Map ID	Roadway	Extents	Functional Class	Shared Use Path	Standard Bike Lane	Shared Lane Markings	Wayfinding Signage
B1	Linden St	Weston Rd to Rockland St	Minor Collector		X		X
B2	Dover Rd	Washington St to south Town limits	Minor Collector	X			X
B3	Forest St	Linden St to south Town limits	Minor Collector		X		X
B4	Cliff Rd	North Town limits to Worcester St	Minor Collector		X		X
B5	Glen Rd	North Town limits to Washington St	Minor Collector		X		X
B6	Elmwood Rd	Weston Rd to Westgate St	Local			X	X
B7	Westgate	Elmwood Rd to Stanford Rd	Local			X	
B8	Stanford Rd	Westgate to Royalston Rd	Local			X	
B9	Royalston Rd	Stanford Rd to Cranmore Rd	Local			X	
B10	Cranmore Rd	Royalston Rd to Monadnock Rd	Local			X	
B11	Monadnock Rd	Cranmore Rd to Peirce Rd	Local			X	
B12	Peirce Rd	Monadnock Rd to Greylock Rd	Local			X	
B13	Greylock Rd	Peirce Rd to Cliff Rd	Local	X			
B14	White Oak Rd	Cliff Rd to Ledgeway Rd	Local	X			X
B15	Ledgeway Rd	White Oak Rd to Hundreds Cr	Local			X	X
B16	Hundreds Circle	Ledgeway Rd to Hundreds Rd	Local			X	X
B17	Hundreds Rd	Hundreds Cr to Glen Rd	Local			X	X
B18	Rockridge Rd	Cliff Rd to Lanark Rd	Local			X	X
B19	Lanark Rd	Rockridge Rd to Colburn Rd	Local			X	X
B20	Colburn Rd	Cliff Rd to Woodlawn Ave	Local			X	X
B21	Woodlawn Avenue	Hundreds Rd to Colburn Rd	Local			X	
B22	Abbott Rd	Washington St to Forest St	Local			X	X

ADDITIONAL RECOMMENDATIONS FOR SAFE ROUTES

In addition to the infrastructure projects, there are several actions that the Town and other partners can take to address some of the network needs identified.

- **Address Higher Functional Class Roads through MassDOT Partnership**: As noted in Chapter 1, there are several corridors in Wellesley that are of functional class - principal arterials and minor arterials, that experience vehicle volumes more than 6,000 vehicles per day and are posted at speeds in excess of 35 miles per hour. These roadways pose a barrier to many of the safe routes for walking and biking that connect across the Town. Some of these roadways, including Route 9 and portion of Route 135, are owned and operated by MassDOT. Route 9 bisects the Town and is challenging to cross safely and comfortably, even with recent improvements. The Town of Wellesley should work with MassDOT District 6 to evaluate opportunities for improve multimodal crossing opportunities.
- **Collaborate with MassDOT District 5, the MBTA, and the City of Newton to Create a Multimodal Connection to the Woodland Station**: Located off of Washington Street, the Woodland MBTA Green Line station is a short walk or bike ride for many residents of Wellesley to travel into Newton, Brookline, and Boston. However, this connection is currently hostile to multimodal access. The Town of Wellesley should pursue a partnership with key agencies including the City of Newton, the MBTA, and MassDOT District 5 to redesign Washington Street between Wellesley and Newton to promote walking and biking trips to the Woodland station.
- **Engage with the Boston Region MPO's Regional Vision Zero Action Plan**: MPO is currently working on completing a Vision Zero Action Plan for the region, and this plan will qualify communities like Wellesley for federal and state funding to support future transportation safety projects.

Current Town Projects

In addition to the above recommendations, it is important to recognize that the Town of Wellesley is currently pursuing projects that will improve the safety and connectivity for people walking, biking, and driving. These projects include:

- Washington Street Sidewalk Extension Project: The Town recently completed adding sidewalks, wheelchair ramps and curbs along Washington Street between 849 Washington Street and Natick Town Line. The project also includes adding new pedestrian signal installation at Cheney Drive and line striping for the crosswalks at Pond Road and Cheney Drive.
- Weston Rd Sidewalk: The project is currently in design phase and construction is expected to begin in 2025.
- Kingsbury St / Calvin St and Kingsbury St / Washington St: This intersection renovation project will upgrade signal equipment at the intersections near the Wellesley Middle School which is also a frequently used as a commuting thoroughfare to Wellesley High School and commercial areas by pedestrians, bicyclists, and motorists.

- Weston Rd / Linden St: This signalization project is tentatively funded by a MassDOT Bottleneck Grant, and will include right-of-way acquisition, as the current footprint cannot support the signal equipment and necessary upgrades
- Wellesley recently submitted a MassDOT Complete Streets Funding Program grant application for:
  - An RRFB at Washington St / Denton Rd
  - An RRFB on Croton Rd near the Wellesley Farms MBTA Commuter Rail Station
  - Sidewalk gaps on Alba Street, Wall Street and Windemere Street
- The Town of Wellesley recently solicit consultant support for:
  - Wellesley Square Amenities Project: redesign of area, with signal upgrades along Central St including the Central/Weston, Central/Cross, and Central/Washington/Grove intersections.

Appendix A: Community Engagement

This appendix summarizes the community engagement efforts completed as part of the Wellesley Townwide Safe Routes Plan, in addition to providing an overview of the key themes that emerged from the public meeting.

PUBLIC MEETING

On Wednesday, October 30th, 2024, between 6:30 – 7:30pm, a public meeting for the Wellesley Townwide Safe Routes Plan was held to discuss the key findings of the existing conditions analysis and facilitate an opportunity for Wellesley community members to provide feedback on the proposed priority locations and safety treatments for walking and bicycling. The public meeting was hosted in-person at the Tolles Parsons Center (500 Washington Street) and online on Zoom, in addition to being broadcasted on Wellesley's local access television channel.

In advance of the meeting, a flyer advertising the meeting was posted at Wellesley Town Hall. A digital version of the flyer, in addition to a Zoom link, was circulated via email outreach to the following groups to share among the community:

- Wellesley Town Department Directors
- Wellesley Select Board
- Wellesley Mobility Committee – including representatives from the Planning Board, Trails Committee, School District, Parent-Teacher Organization, Advisory Committee, Council on Aging, and Natural Resources Commission
- Sustainable Wellesley
- School Committee
- Recreation Committee
- Climate Action Committee
- Traffic Committee
- Local Disability Advocate
- Local Bicycle Advocates

Figure 52. Flyer Advertising the Public Meeting

Additionally, a dedicated webpage hosted on the Town of Wellesley website was created to advertise the public meeting and post the meeting materials: https://wellesleyma.gov/2338/Wellesley-Safe-Routes-Plan

Overall, there were 30 community members who signed in and attended the meeting in person, in addition to 15 community members who attended online. Three comment sheets were completed and returned to the project team, and 15 community members spoke to the gathered group. Additionally, two community members submitted comments via email.

The public meeting began with a presentation about the Safe Routes Plan, including an overview of the planning process and schedule, the key findings from the existing conditions analyses, and the proposed locations for walking, biking, and crossing improvements. Following the presentation, community

members on Zoom and in the room were invited to speak about locations they felt were priorities for safety treatments, to ask questions about the plan, or to discuss relevant issues related to safe routes for walking and biking in Wellesley.

PUBLIC COMMENTS

Several key themes emerged from the comments provided by Wellesley community members, each of which informed the network of priority locations and recommended treatments discussed in Chapter 3. These themes include:

- The Townwide Safe Routes Plan should support the goals and objectives of the town's Climate Action Plan, which aims to increase the share of trips taken by lower-carbon modes such as walking and bicycling.
- Several signalized intersections have clearance phases (when the traffic signals are "all red") that are too short to accommodate the queues clearing through the intersection. Community members feel that it would be safer for people walking and bicycling if the "all red" phase was increased to ensure that there are no vehicle conflicts when crossing.
- Traffic calming is desired by community members on higher-speed, higher-volume roads in Wellesley, with a focus on the roads that connect with Route 9 (Worcester St).
- Wellesley community members would prefer to have separated bicycle facilities or wide shoulders instead of shared vehicle-bicycle lanes on roads that are higher-speed and higher-volume.
- Several specific locations were mentioned as safety concerns for pedestrians and bicyclists, including:
  - Crossing at Weston Rd / MacArthur Rd / Willow Rd
  - Sidewalk Connection from the current terminus on Dover Road to the Sudbury Aqueduct Trail
  - Crossing at Route 9 and Kingsbury St
  - Crossings and Bicycle Facilities on Washington St
  - Traffic Calming on Longfellow St
  - Bicycle Facilities on Walnut St