Needham Local Transportation Study

Town of Needham, Massachusetts

June 2023

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Executive Summary

The Needham Local Transportation Study was conducted for the Town of Needham to evaluate the existing transportation options and identify opportunities for improvement. The study concluded that significant parts of the Town do not have access to public transit and shorter, local trips are a particular challenge using the existing network. Five potential public transit alternatives were developed including three bus routes, a microtransit service, and a multimodal alternative that combines microtransit and a bus.

To develop these alternatives, the team evaluated the existing transportation options in the town. Existing services include the MBTA Commuter Rail and bus services, the Needham Community Council Lyft Program, and private commuter services for employees. A public survey was administered and received over 400 responses detailing the transit experiences and needs of the Town's residents and workers. To ensure the study considered the needs of likely transit users, stakeholder conversations were also conducted with people representing important groups such as individuals living with a disability, seniors, students and teens, and major employers.

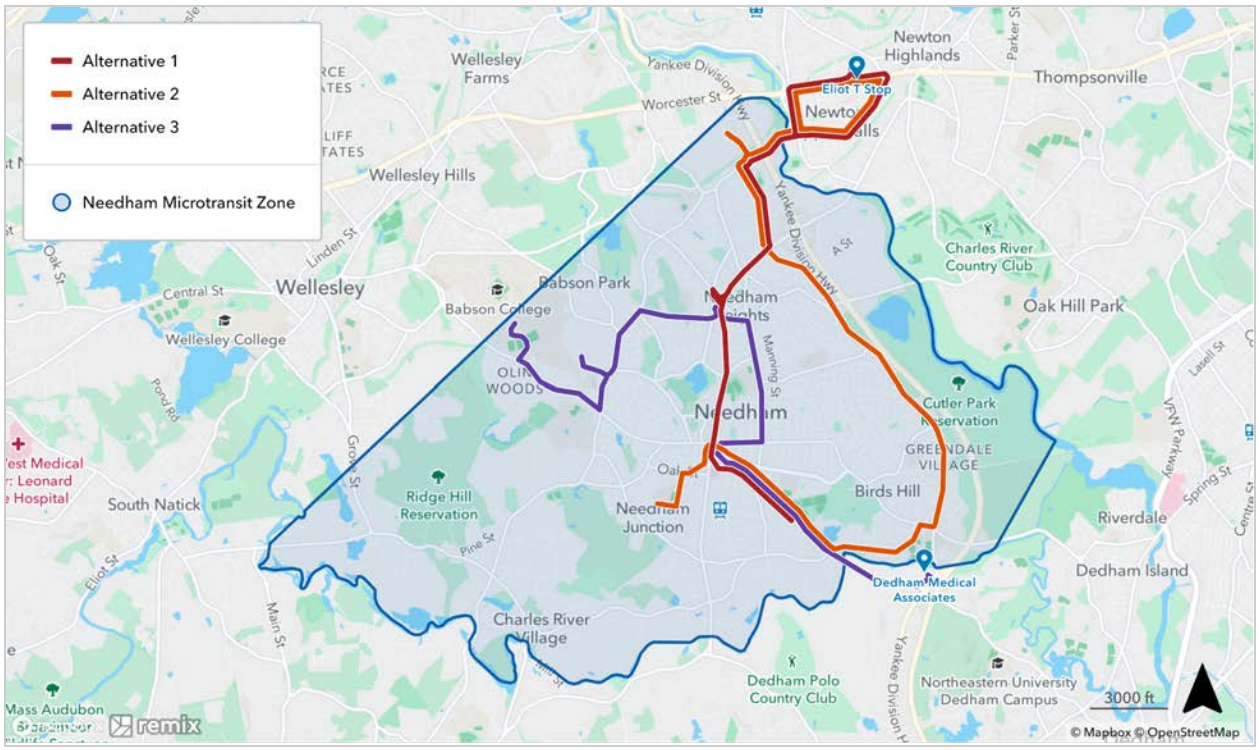
The major findings from the above activities include:

- The primary public transportation in the town of Needham is the commuter rail, which connects to Boston and the Route 59 bus which connects to Watertown. The Green Line T (light rail) is also a popular option and can be taken from nearby Newton.
- There are only limited options for local trips. For the general public, the Route 59 bus is the best option but is only within walking distance of a small share of residents. Additional services are available for older adults and people with disabilities such as the Needham Community Council Lyft Program and the MBTA RIDE.
- Most Needham residents drive personal vehicles as their primary mode of transportation. Those who do not have cars (primarily seniors and young adults) rely on rides from friends/family or costly Ubers/Lyfts.
- Popular travel destinations include Beth Israel Deaconess Hospital, Needham High School, the Commuter Rail and T Stops, Needham Center, Olin and Babson College, DeFazio Park, and Trader Joe's grocery store.
- Employers struggle with parking issues in Needham Center and Needham Heights. Various large employers also operate private transportation service for employees or contribute financially to the 128 Business Council Shuttle. Some of these services are repetitive.
- Residents, workers, and stakeholders are generally interested in improved and expanded transportation services. The majority of those who responded to the survey would use public transit if it was more convenient for their needs.

Based on these findings, the five transportation alternatives that were developed are as follows:

1. **Bus Route 1: Needham Center.** Alternative 1 is a fixed-route bus from the Eliot T stop to DeFazio Park through Needham Heights and Needham Center.
2. **Bus Route 2: Needham East.** Alternative 2 connects Eliot T stop to the High Rock neighborhood through Needham Center, Beth Israel Deaconess Hospital, and DeFazio Park.
3. **Bus Route 3: East/West Needham.** Alternative 3 runs from Olin College to the Dedham Medical Center, through Needham Heights and Needham Medical Center.
4. **Microtransit: Needham + Key Destinations.** Alternative 4 would provide microtransit to the entire town of Needham. It also includes two key destinations outside of the Town, which are the Eliot Green Line T Stop and Dedham Medical Associates. Microtransit is a technology-enabled transit system that dynamically routes vehicles based on real-time passenger demand. Trips are typically booked using a mobile phone app or by calling a dispatcher. There are no fixed routes or pre-determined schedules. Instead, routing is based on where riders want to travel and when. Microtransit is often implemented using small buses or vans, and rides are shared as they are with traditional bus service. Wheelchair-accessible vehicles ensure the microtransit service is accessible to people with disabilities. This alternative is similar to the NewMo transit service in Newton and the Wellesley Catch Connect.
5. **Hybrid: Green Line T Shuttle + Needham Microtransit.** Alternative 5 is a multimodal option with a microtransit service covering the entire town of Needham. A shuttle bus would run from Needham Center to the Green Line to facilitate multimodal trips.

The five alternatives are shown on the map below.



The five alternatives were modeled at a low, medium and high demand estimate. The modeling includes the estimated ridership of each service, the number of vehicles required to operate the service, the average productivity of the service (based on passenger boardings per vehicle hour), and the estimated annual operating costs and cost per passenger. The results of this analysis, for the medium demand level, are shown on the subsequent table.

Alternative	1. Fixed-Route: Needham Center	2. Fixed-Route: Needham East	3. Fixed-Route: East/West	4. Microtransit Needham + Key Destinations	5. Hybrid Combined Microtransit + fixed Route
Weekday Ridership	90	70	70	145	170
Annual Ridership	27,700	33,200	33,500	46,000	53,700
Vehicles Required at Peak	2	3	3	3	5
Annual Vehicle Hours	5,550	9,300	7,800	9,900	13,500
Average Productivity (passengers per vehicle hour)	4.6 - 5.6	3.1 - 4.1	3.9 - 4.9	4.1 - 5.1	3.5 - 4.5
Annual Operating Cost (millions of dollars)	$0.66 - $0.78	$1.11 - $1.30	$0.94 - $1.10	$0.84 - $0.91	$1.32 - $1.47
Average Cost per Passenger	$24 - $28	$34 - $39	$28 - $33	$18 - $20	$25 - $27

The analysis shows that following:

- Alternative 1 (Bus Route 1: Needham Center) has the lowest annual cost but also has a lower ridership estimate, resulting in a relatively high cost per trip. This alternative is the most productive and has the highest average passenger boardings per vehicle hour because it requires the fewest vehicles and has the lowest estimated annual vehicle hours (even though ridership is lowest).
- Alternative 2 (Needham East) and Alternative 3 (East/West) have higher annual operating costs than Alternatives 1 and 4 and the highest average cost per passenger across all the alternatives.
- Alternative 4 (Microtransit) offers the lowest cost per trip and has the second highest ridership estimates. It is also the second most productive alternative.
- Alternative 5 (Hybrid) has the highest ridership estimates but also has a higher cost per trip than Alternative 4, but comparable cost per passenger to Alternative 1 (Bus Route 1: Needham Center).

While this report does not recommend one alternative over another, some do appear to better meet the needs of the Town. The Town should consider the following important metrics when making a recommendation:

1. Cost per trip is the best measure of value for money.
2. Total annual cost is also important as the Town must ensure it can sustainably fund the service from its budgets (with support from grants and other sources).
3. Total ridership is a measure of how many people are using and benefiting from the service.
4. Finally, the Town should also consider the benefits and tradeoffs of the different transit modes.
    a. Some transit users prefer fixed-routes for their regular and predictable schedules, familiarity, and ease of use. Signage at bus stops also helps people navigate the service. They may not like the requirement to book their trips and walk to meet vehicles at unmarked locations that can change from day to day.
    b. Other transit users prefer microtransit as it offers the flexibility of more travel destinations and can offer shorter wait times depending on ridership and the time of day.

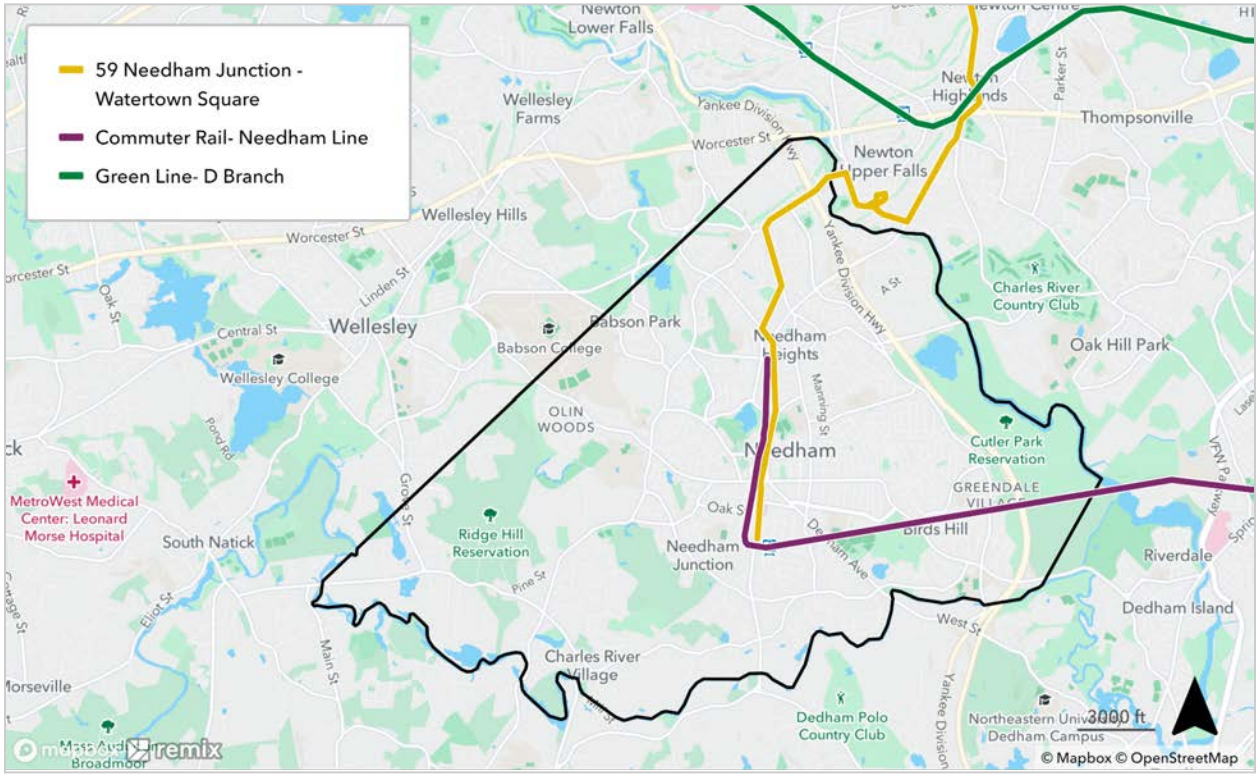
Alternative 4 appears to offer the best value for money while also having higher ridership forecasts than the fixed-route bus alternatives. However, while it is likely to appeal to younger passengers and tech savvy users, seniors, and regular bus users may prefer a fixed-route alternative as it offers a more consistent experience and no advance booking.

1. Project Overview and Study Area

The Needham Local Transportation Study was conducted for the Town of Needham to evaluate the existing transportation options and identify opportunities for improvement. The recommendations were supported by a community survey and stakeholder interviews to understand the needs and preferences of the community. Based on the evaluation of the existing services and the findings from the community outreach process, the project team developed and evaluated five different transportation solutions for the town, including new bus routes, microtransit, and multi-modal alternatives. The study concludes with recommendations for launching new transit services should the Town decide to implement any of the alternatives developed in the study.

The focus area for this study is the Town of Needham, Massachusetts. While all public transit services were examined, the main focus was local trips within Needham. In addition, the project considered transportation between Needham and Boston and other nearby towns via the Green Line or Commuter Rail. The existing public transportation options are shown in Figure 1.

Figure 1. Map of Needham and existing transportation options.



2. Existing Transportation Options Assessment

This section of the report outlines the existing transportation options in Needham. It includes a summary of the fixed-route and demand-response transit options available to Needham residents and workers and an analysis of their performance and use. To further supplement this analysis, various socioeconomic and demographic factors related to Needham's transit needs, including car-free households, seniors, and people with disabilities, are mapped and described. This information helps identify gaps in the existing services and areas that are likely to benefit from improved local transportation options.

2.1 MBTA Services

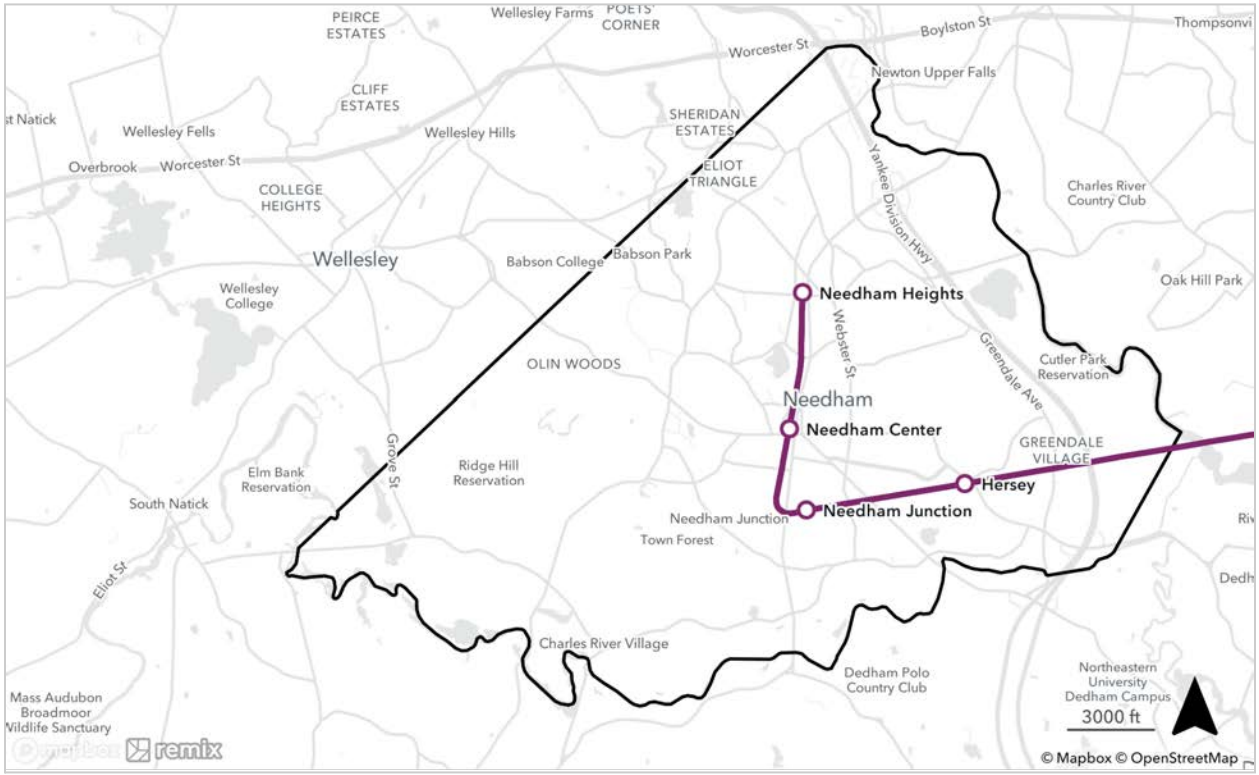
Needham is served by the Massachusetts Bay Transportation Authority (MBTA), which provides public transit services to the Greater Boston area. These services include rapid transit, commuter rail, bus, and paratransit services. The services available in Needham include one commuter rail line, one bus, and paratransit services. Rapid transit is available in Newton, the city east of Needham.

Commuter Rail

Four commuter rail stations are located in Needham: Hersey, Needham Junction, Needham Center, and Needham Heights. All four stops are on the Needham commuter line, which connects the Town to Boston’s Back Bay and South Stations. The service operates hourly on weekdays between Needham to Boston from 5:00 AM to 9:00 PM. It also operates hourly from Boston to Needham,

but from 7:30 AM to 11:30 PM[1]. On weekends, inbound service from Needham to Boston is available every two hours from about 6:00 AM to 8:00 AM. From Boston to Needham (outbound), service is also available every two hours from 7:15 AM to 10:15 PM.

Figure 2. Map of MBTA Commuter Rail in Needham.



[1] Outbound service after 8:30 PM is less frequent.

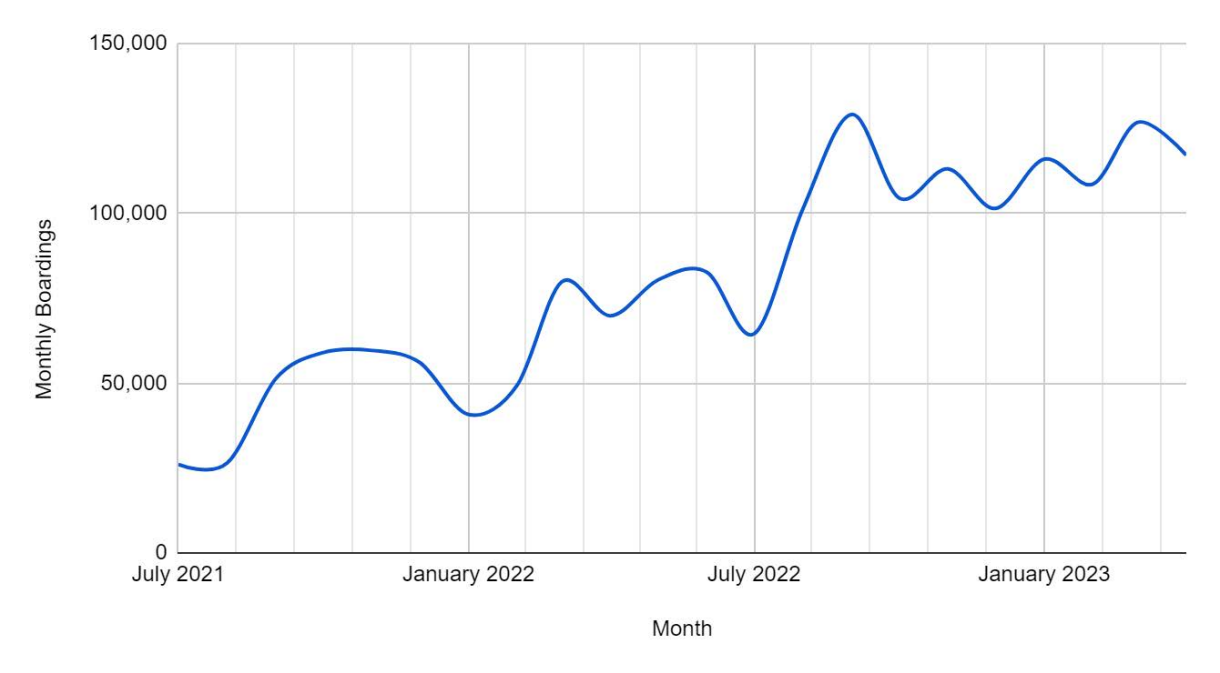
Hersey is the most popular commuter rail station in Needham, with over 500 daily boardings.[2] Table 1 shows the average boardings and alightings for each station.

Table 1. MBTA Commuter Rail Boardings and Alightings in Needham (Spring 2018).

Station	Boardings	Alightings
Hersey	525	338
Needham Junction	366	338
Needham Heights	329	268
Needham Center	224	244

Overall, the Needham Line has seen some recovery in ridership since the pandemic. Monthly ridership since June 2020 was highest in September 2022, with about 139,000 boardings. The chart in Figure 3 shows monthly ridership from July 2021 to February 2023.

Figure 3. Ridership on MBTA Needham Line (Commuter Rail) from July 2021 to April 2023



[2] Spring 2018 MBTA data.

Table 2 shows the average weekday, Saturday, and Sunday ridership for the route by month for the most recent six months of available ridership data. Ridership is seasonal and is lowest during December. Furthermore, weekday ridership is over five times greater than weekend ridership. This trend is likely due to commuter rail being primarily used for travel to work and the reduced frequencies on weekends.

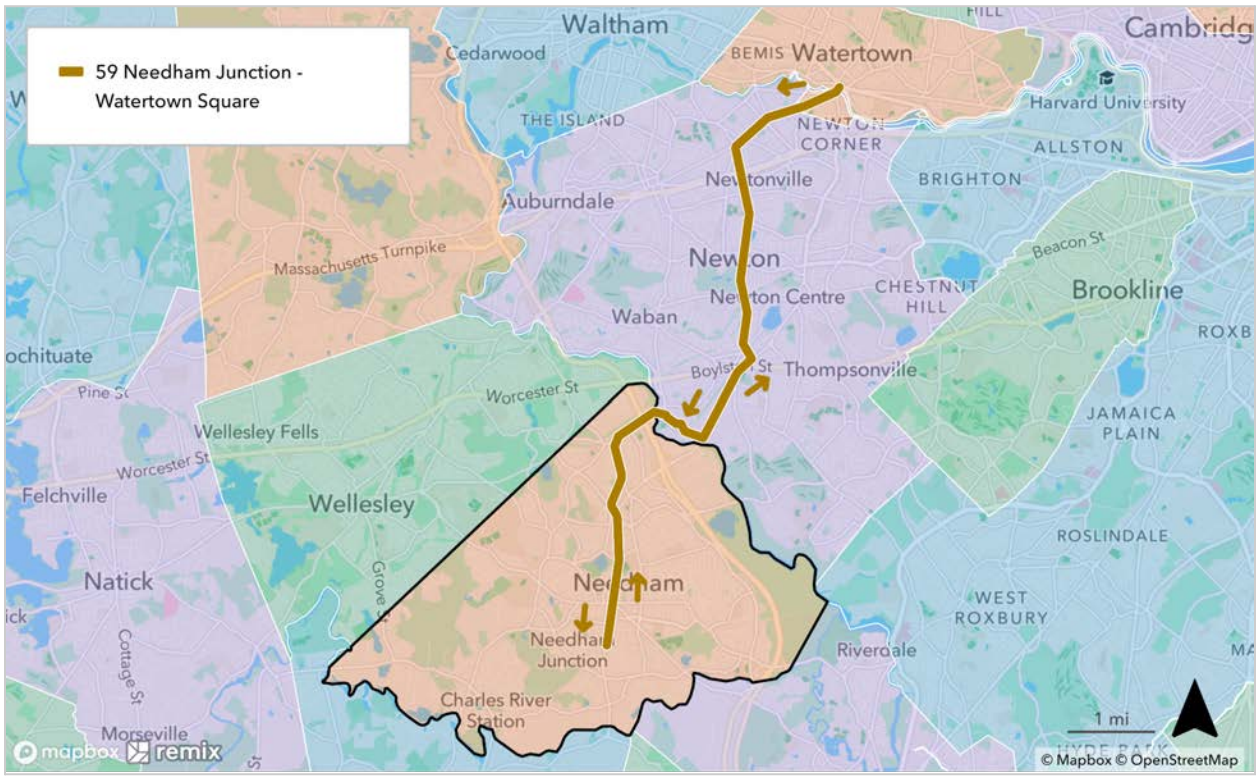
Table 2. Average Daily Ridership on Needham Line (September 2022 through February 2023).

Month	Average Weekday Ridership	Average Saturday Ridership	Average Sunday Ridership
September 2022	5,487	1,162	950
October 2022	4,690	788	422
November 2022	4,906	795	502
December 2022	4,357	641	597
January 2023	5,009	764	549
February 2023	5,224	543	498

Bus

Route 59 is the only MBTA bus service offered in Needham. It connects Needham to Watertown Square via Newton. The bus runs approximately every 30 minutes on weekdays from about 6:00 AM to 8:20 PM. On Saturdays, the bus runs from 6:20 AM to 7:40 PM, making nine trips in each direction (approximately every 90 minutes). Similarly, on Sundays, the bus operates reduced hours from about 7:00 AM to 7:00 PM, making eight trips in each direction (about every 90 minutes). The route is operated using three vehicles, totaling about 9,250 vehicle hours per year.

Figure 4. Map of MBTA Bus 59.



Ridership on Route 59 has steadily declined over the last few years. Before the pandemic, in 2019, the route had about 100,000 boardings. In 2022, ridership has partially recovered since the initial drop due to COVID-19, with a total of about 65,000 riders. In 2022, the bus had a productivity of about seven boardings per vehicle hour (compared to about 10.5 boardings per vehicle hour in 2019). The ridership trends are shown in Figures 5 and 6.

Figure 5. Annual Ridership of MBTA Bus 59 from 2016 to 2022.

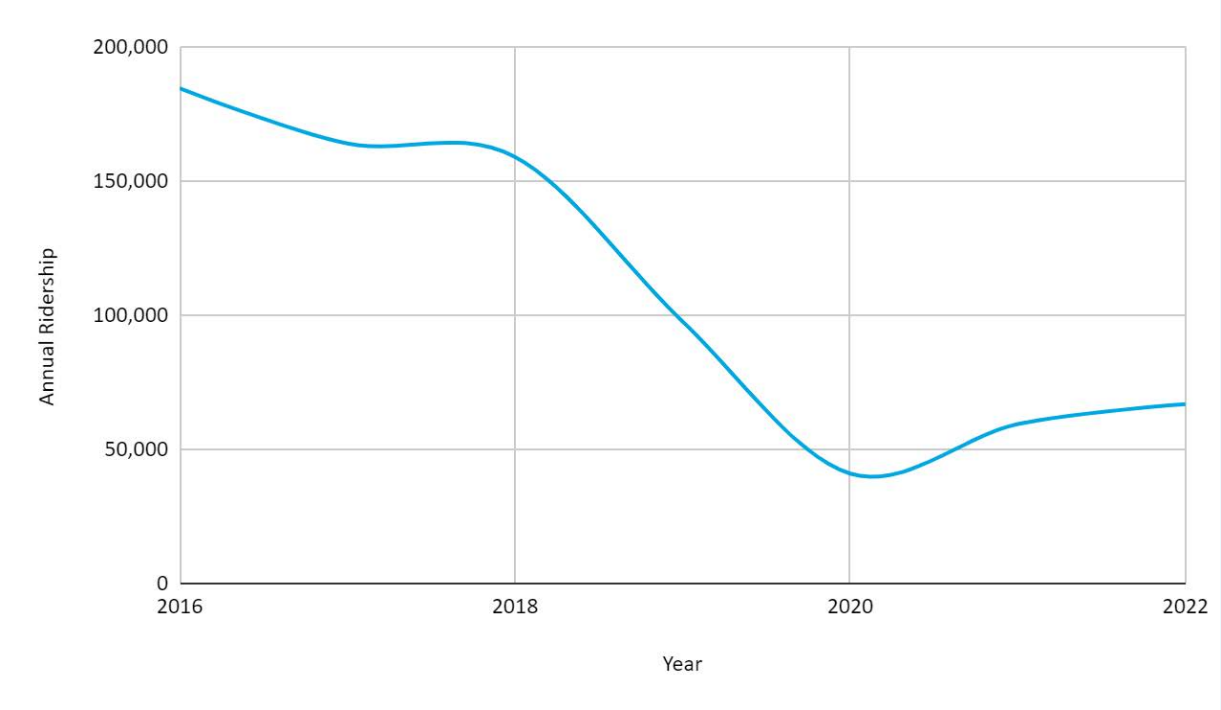
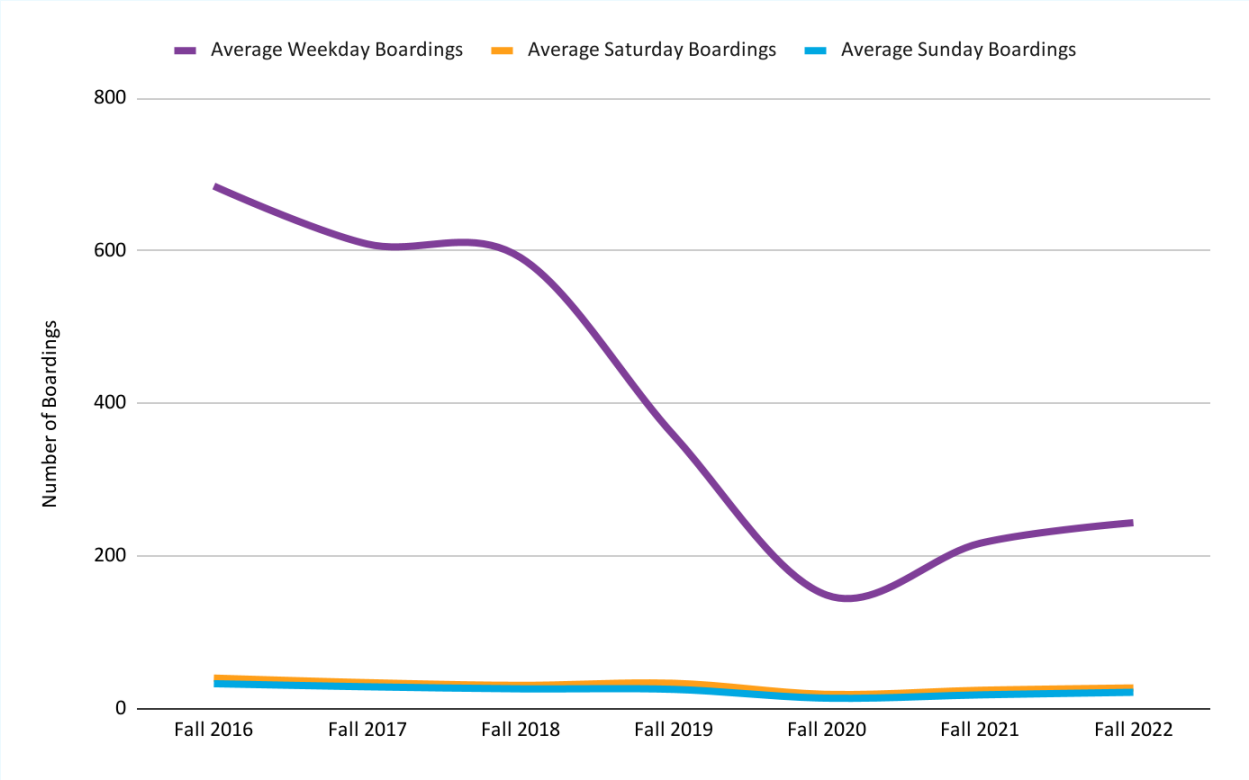
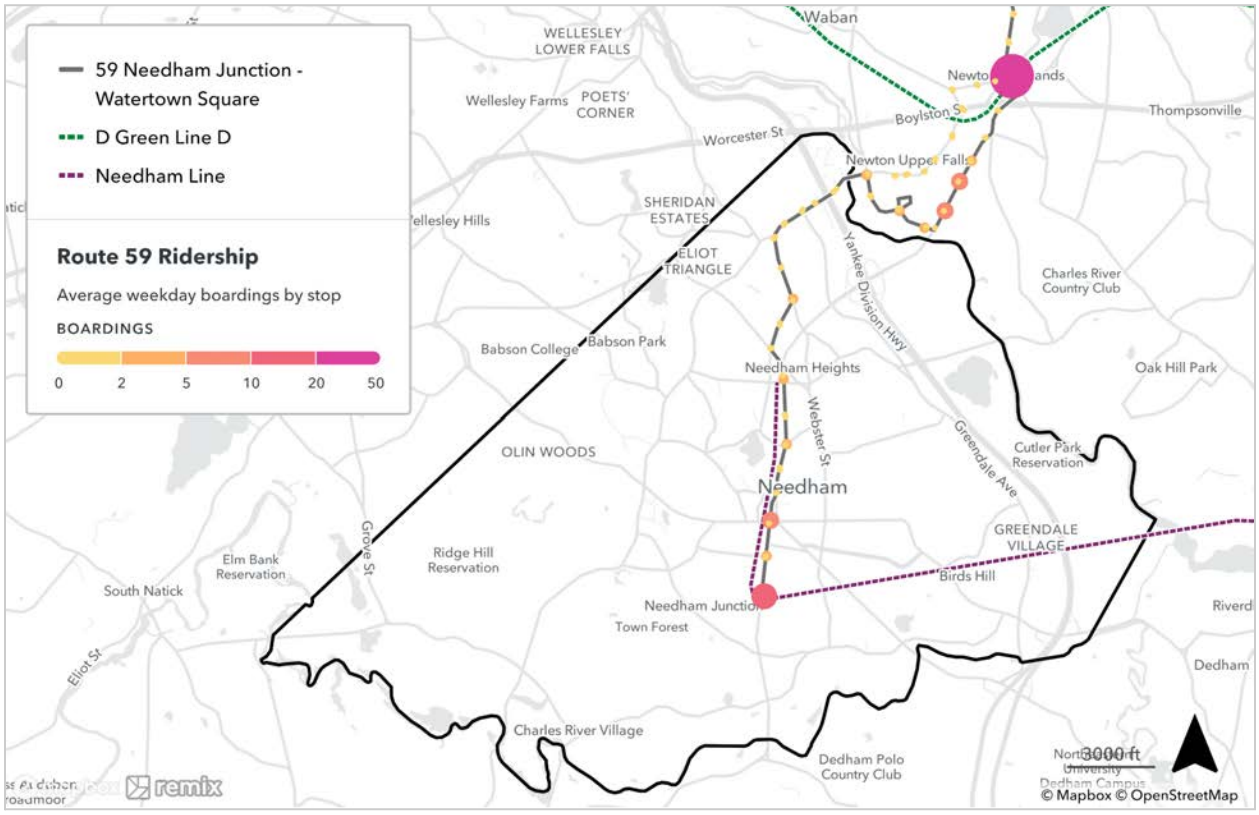


Figure 6. Average Daily Ridership of MBTA Bus 59 from 2016 to 2022.



The map in Figure 7 shows the average boardings by bus stop on weekdays. There are about 45 weekday boardings in Needham. Of the stops in the Town, the Needham Junction commuter rail stop has the highest number of boardings and alightings, with an average of 15 weekday boardings and 14 weekday alightings. The stops at Needham Center and Needham Heights follow with the next highest ridership volumes. This data indicates that many passengers use the bus route to connect to the Needham commuter rail line. However, ridership is even higher at the Newton Highlands Green Line stop than at any of the Needham Commuter Rail stations.[3]

Figure 7. Average Daily Boardings of MBTA Bus 59 by Stop (Fall 2022).



[3] Based on data since Fall 2022.

Paratransit Services (RIDE)

The MBTA provides complementary paratransit services for passengers who are unable to use the buses or subways due to a disability. The RIDE offers door-to-door, shared rides that must be booked by 5 PM the day prior to the requested ride date. Rides can be requested by phone or online, costing $3.35 for local rides and $5.60 for premium non-ADA rides. Premium rides are anywhere where the trip origin and/or destination is more than ¾ mile away from an MBTA bus or subway station. Users must apply and be approved to use the service. Anyone with a disability (temporary or permanent) that prevents them from using traditional public transit is eligible for the RIDE.

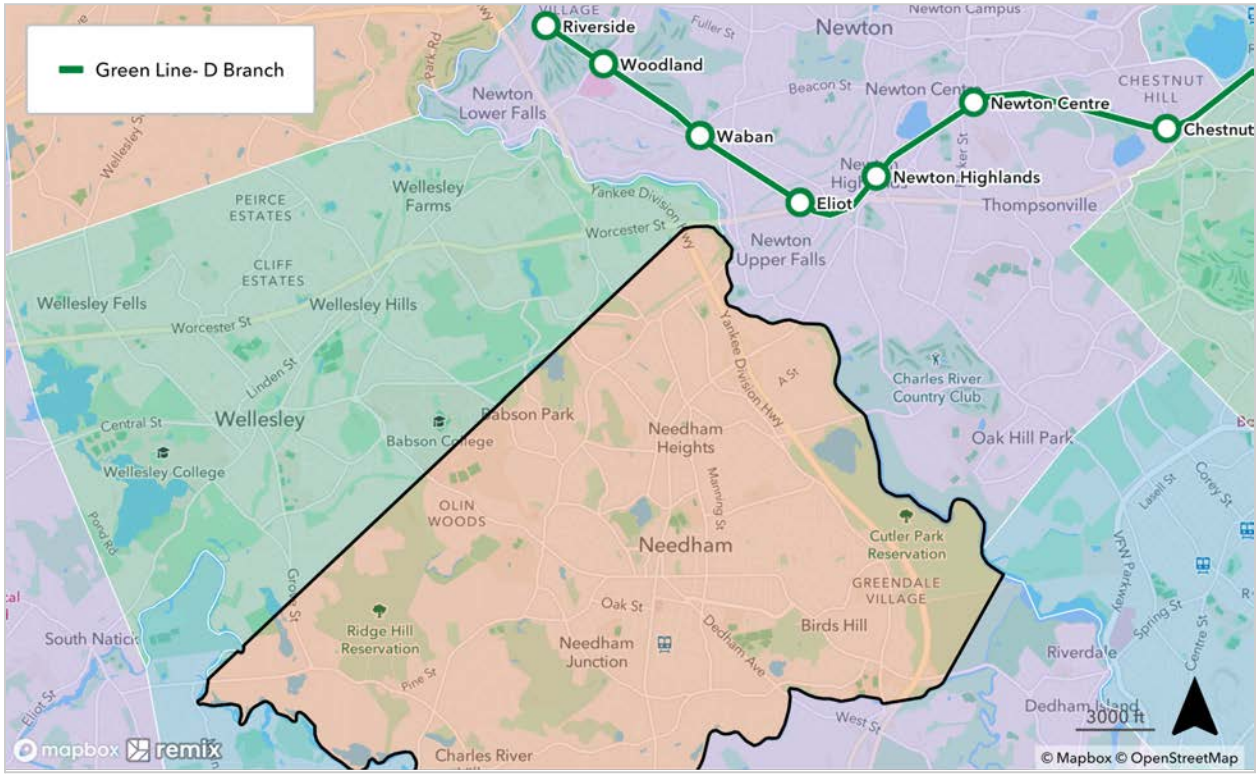
MBTA completes 38 RIDE trips starting and/or ending in Needham per weekday. Saturdays have an average of 24 boardings, and Sundays have an average of 16.[4] Since January 2019, 11% of Needham's MBTA RIDE trips both start and end in the town. Of the trips starting in Needham, about 12% are to Boston, 9% to Newton, 4.5% to Dedham, 3.6% to Westwood, and 2% to Wellesley. The MBTA is also piloting other ridesharing programs for people with disabilities, including on-demand rides offered through Uber and Lyft. This program is called The RIDE Flex. For rides under $50, the cost is subsidized to a $3 co-pay. For rides over $50, users must pay any amount above the $43 limit the MBTA covers.

[4] Based on data from January 2022 through April 2023.

Subway and Light Rail (The T)

In addition to the services offered within Needham, many residents and commuters rely on the Green Line for travel beyond the town. The closest Green Line stations are Eliot and Newton Highlands on the D branch in Newton. The D Branch connects Newton to Boston through Chestnut Hill and Brookline. The average daily boardings at Newton Highlands during the Fall of 2019 was 824, and at Eliot was 487. However, it is unclear how many boardings at these stations are by people traveling to or from Needham.

Figure 8. Map of the Green Line in Newton and Brookline.



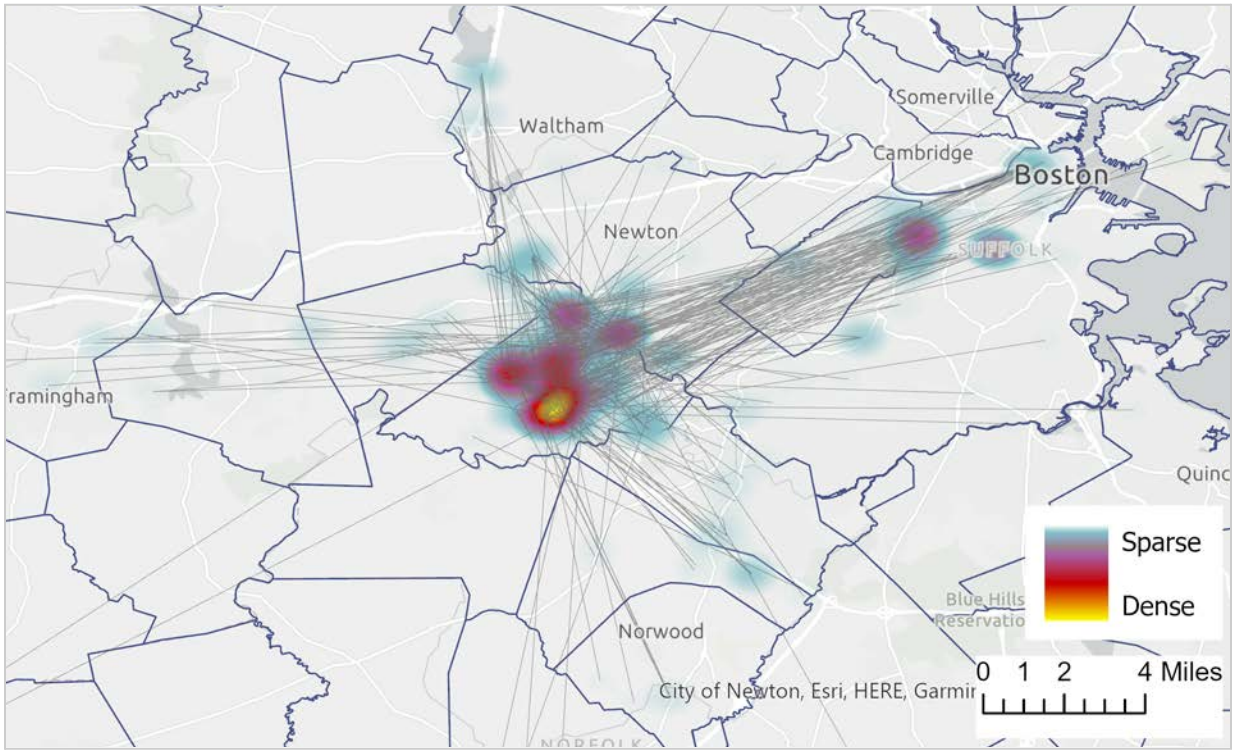
2.2 Needham Transportation Services

Needham Taxi Service

In addition to the MBTA services, Needham offers specialty transportation services through the Needham Council on Aging. The program serves 10,000 to 15,000 trips per year for seniors. There are three main transportation programs.

1. The first focuses on providing rides to senior centers and select shopping locations. These rides cost $1 per trip and must be requested at least 24 hours in advance.
2. The second program provides meal delivery services for those unable to drive. This program delivers about 75 meals per day.
3. The third program uses grant funding to provide longer-distance trips primarily for medical purposes. For example, to the Longwood Medical Area in Boston for a doctor's appointment. Based on data from December 2020 through October 2021, this program provides an average of 4.3 daily trips. Figure 9 shows a relative density of trip requests and destinations for the taxi program. Popular travel destinations include hospitals(such as Brigham and Women's Faulkner Hospital and the Newton-Wellesley Hospital), apartment complexes in Needham, and the North Hill Retirement Community.

Figure 9. Heat map of Needham Taxi Service Rides. Gray lines represent links between origins and destinations for trips between December 7, 2020, and October 4, 2021.

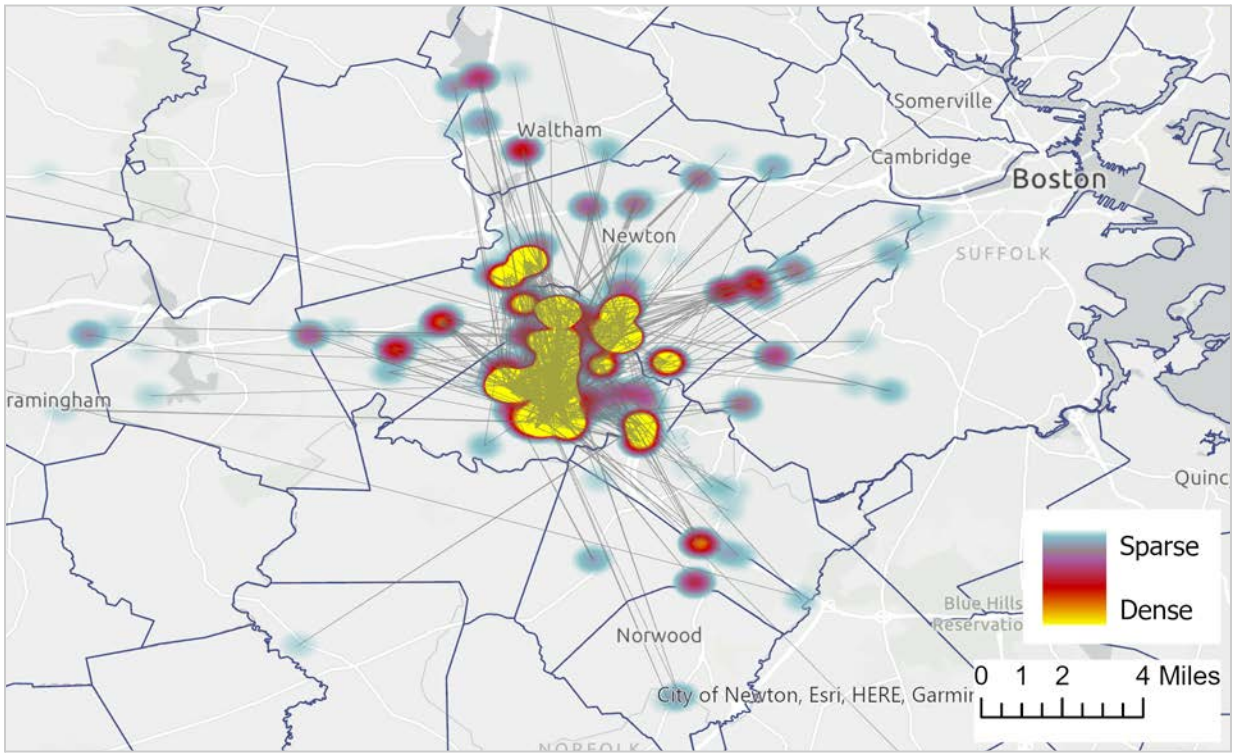


Needham Community Council Lyft Program

The Needham Community Council is a local non-profit organization supporting residents with various services, including transportation. The Lyft Transportation program provides free trips for medical appointments and other services for community members that do not have other transportation options. Rides are offered Monday through Friday from 9:00 am - 3:00 pm, and reservations must be made at least 24 hours before the ride. Trips are limited to Needham and outside of the town if within approximately 5 miles of the Needham border. During March 2023, the program provided 211 trips, an average of about ten trips per day.

Figure 10 shows the relative popularity of trips over the last two years (May 2021 through May 2023). The most popular travel destinations are Beth Israel Deaconess Hospital, Sudbury Farms grocery store, The Center at the Heights, and apartment complexes like Nehoiden Glen. Trips are, on average, 10 minutes long and 2.7 miles in length. The program is fully subsidized for riders, but the average cost per trip to the Council is $23.

Figure 10. Heat map of Needham Community Council Lyft Program. Gray lines represent links between origins and destinations for trips between May 2021 and May 2023.

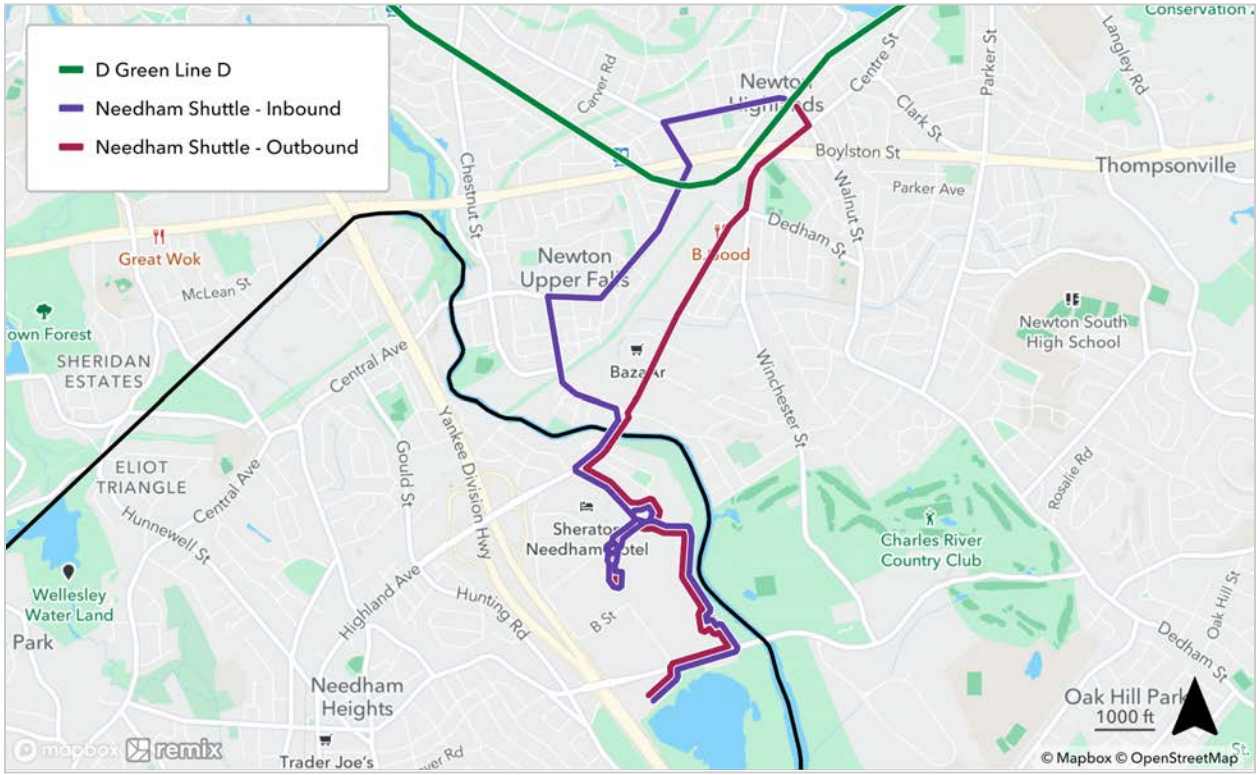


2.3 Other Transportation Options

128 Business Council Shuttle

The 128 Business Council provides transportation solutions for businesses in the Route 128 Corridor area. They offer multiple shuttle services including one dedicated to connecting Newton Highlands Green Line Station to the Needham Crossing area. The shuttle runs on weekdays from about 6:30 AM to 9:30 AM and from 3:15 PM to 6:30 PM. In total, the shuttle provides four trips in the mornings and four trips in the afternoons. The cost to ride is $4. Payment for rides can be made through an app that also allows riders to track the shuttle in real-time. Many businesses in Needham Crossing are required to financially contribute to the 128 Business Council in order to meet a requirement to fund transportation services for their employees.

Figure 11. Map of 128 Business Council: Needham Shuttle.



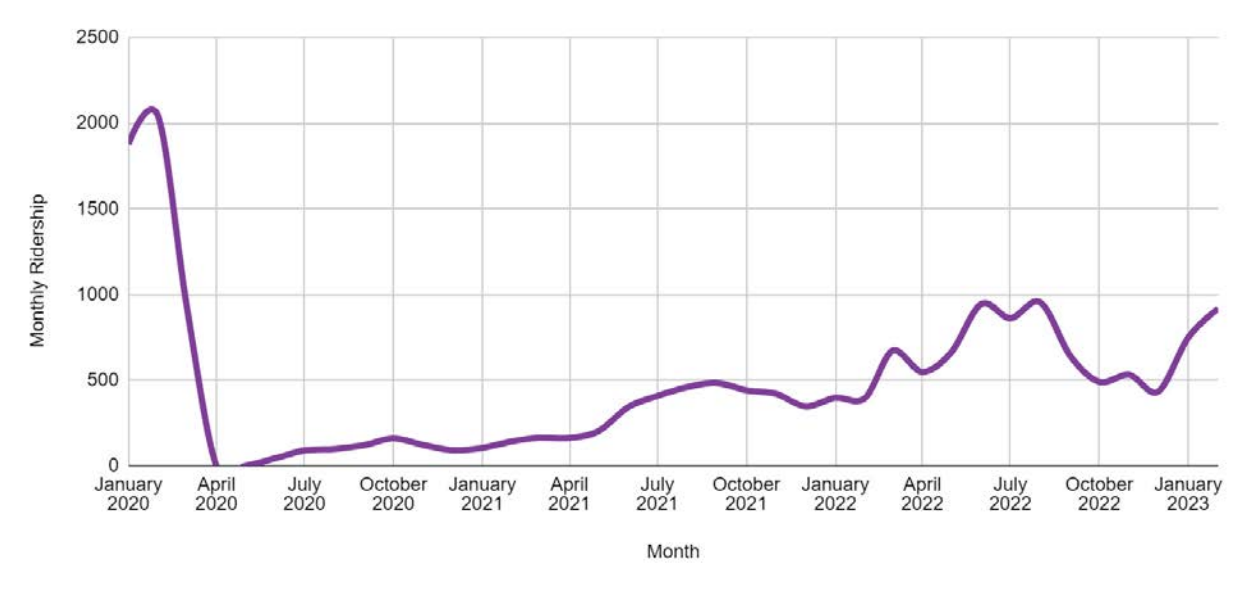
Annual ridership for the service is shown in Table 3. On average, in 2022, the shuttle provided 30 trips per weekday. Ridership on the Needham Shuttle has made a 40% recovery in ridership when comparing January 2020 (before COVID-19) and January 2023 ridership.

Table 3. 128 Business Council Needham Shuttle: Annual Ridership.

Year	Annual Ridership
2020	5,583
2021	3,680
2022	7,534

Figure 12 shows monthly ridership on the Needham Shuttle from January 2022 through February 2023. Since the COVID-19 pandemic started, ridership was highest in August 2022, with over 950 rides.

Figure 12. Monthly Ridership on the Needham 128 Business Council Shuttle from January 2020 through February 2023.



Beth Israel Deaconess Hospital - Needham - Shuttle

While not a form of public transit (as it is not open to the public), Beth Israel Deaconess Hospital operates an employee shuttle to alleviate demand for parking at hospital facilities in Needham. The shuttle connects parking facilities at St. John of Damascus Orthodox Church with hospital facilities (if the church parking is unavailable, MEDITECH parking facilities are used instead). The shuttle operates on weekdays between 5:45 am and 9:00 pm. It has no set schedule and runs continuously when passengers are on board.

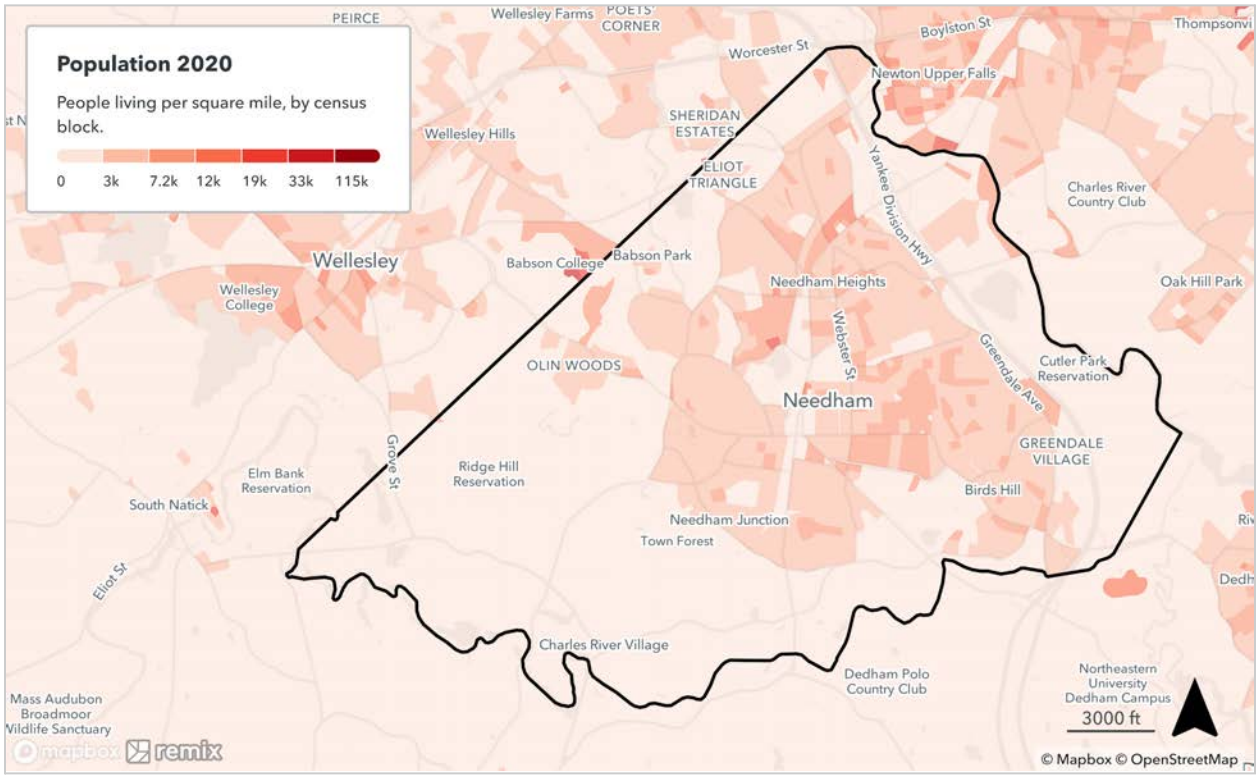
3. Study Area Analysis

The project team mapped information on the land use, demographic, and socioeconomic patterns of the town. This information can help to identify areas with significant concentrations of high-need populations such as seniors, individuals living with disabilities, car-free households, low-income households, and more.

3.1 Population

The Town of Needham has a population of approximately 32,100 people. The population is mostly concentrated around Needham Center and Needham Heights, with a much lower population density in the western and southern parts of the Town. The average population density of the town is about 2,500 people per square mile.

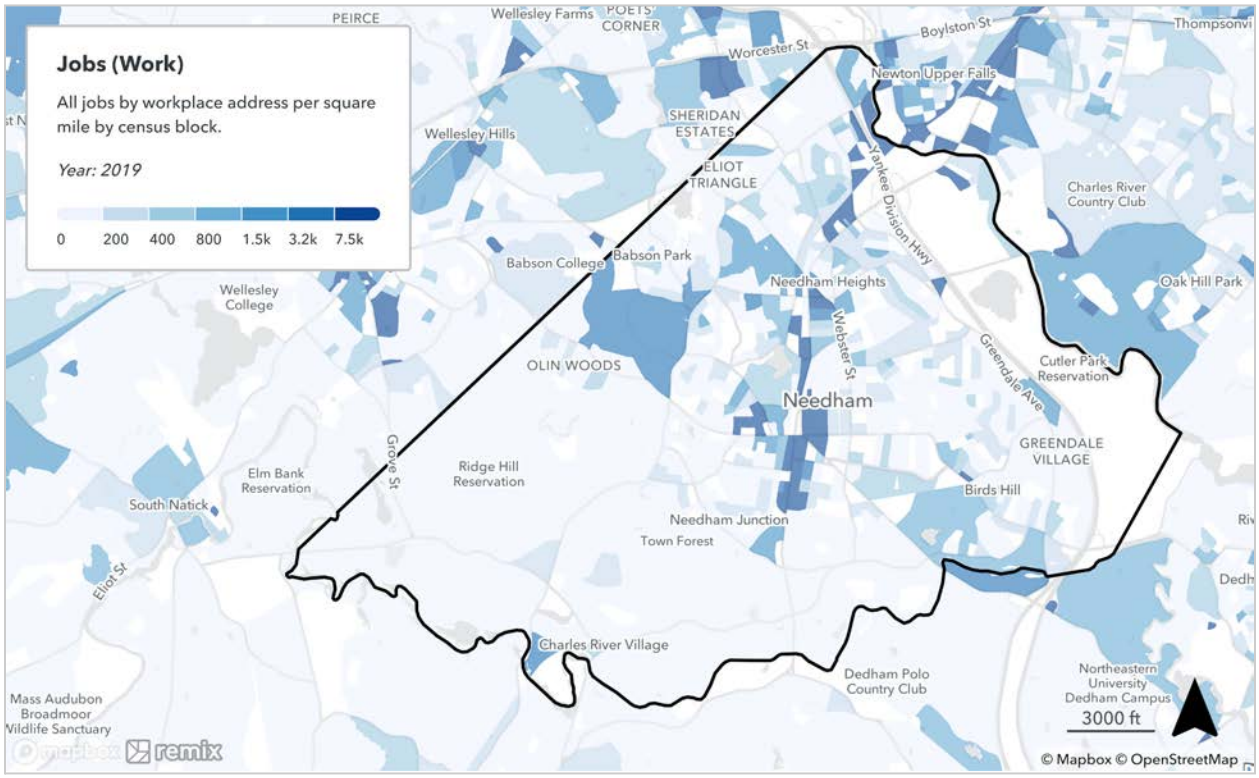
Figure 13 Population Density Map.



3.2 Jobs

The location and density of employment opportunities is one of the most significant predictors of transit usage for an area as many people use public transportation as a means of commuting. As of 2019, there are about 23,000 jobs in Needham. Most of the jobs are located in Needham Center, Needham Heights, and Needham Crossing. Less than 2,000 of Needham's jobs are held by residents. About 14% of jobs in Needham are held by people living in Boston. In addition, people commute from nearby Newton, Waltham, Brockton, Framingham and Norwood to work in Needham. About a third of Needham residents work in Boston, 11% work in Needham and 7% work in Newton. The largest industry sector in Needham is health care and social assistance, representing about a quarter of jobs in Needham.

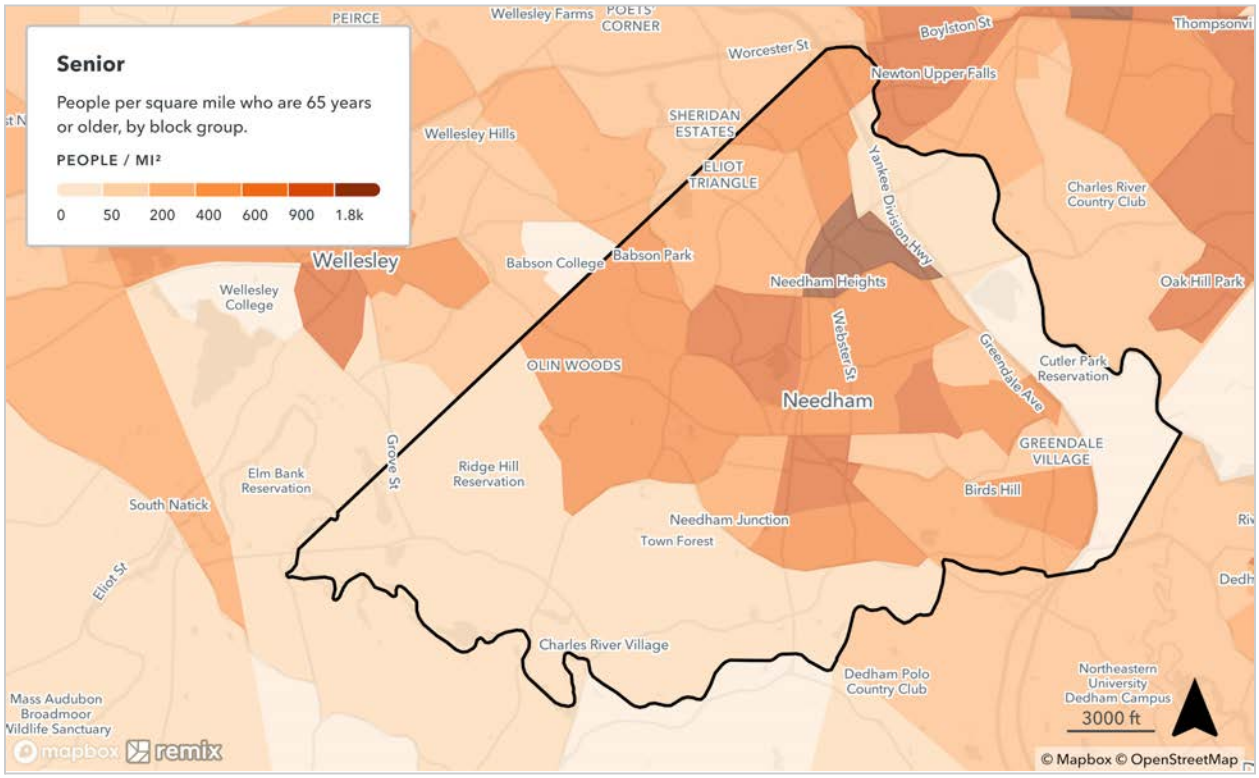
Figure 14. Employment Density Map.



3.3 Seniors

Older adults are more likely to rely on public transit due to lower incomes and lower vehicle ownership rates. For these reasons, some seniors are sometimes referred to as "transit-dependent" riders. About 19% of Needham's population is over the age of 65 (similar to the state average of 17%). The highest density of older adults is in Needham Heights, likely due to the Wingate Residences at Needham (assisted living facility) that is located in Needham Heights. Other assisted living and retirement communities exist in Needham Center, and the North Hill Retirement Community is located in western Needham. The main senior center in Needham, The Center at the Heights, is in Needham Heights.

Figure 15. Density Map of Seniors.

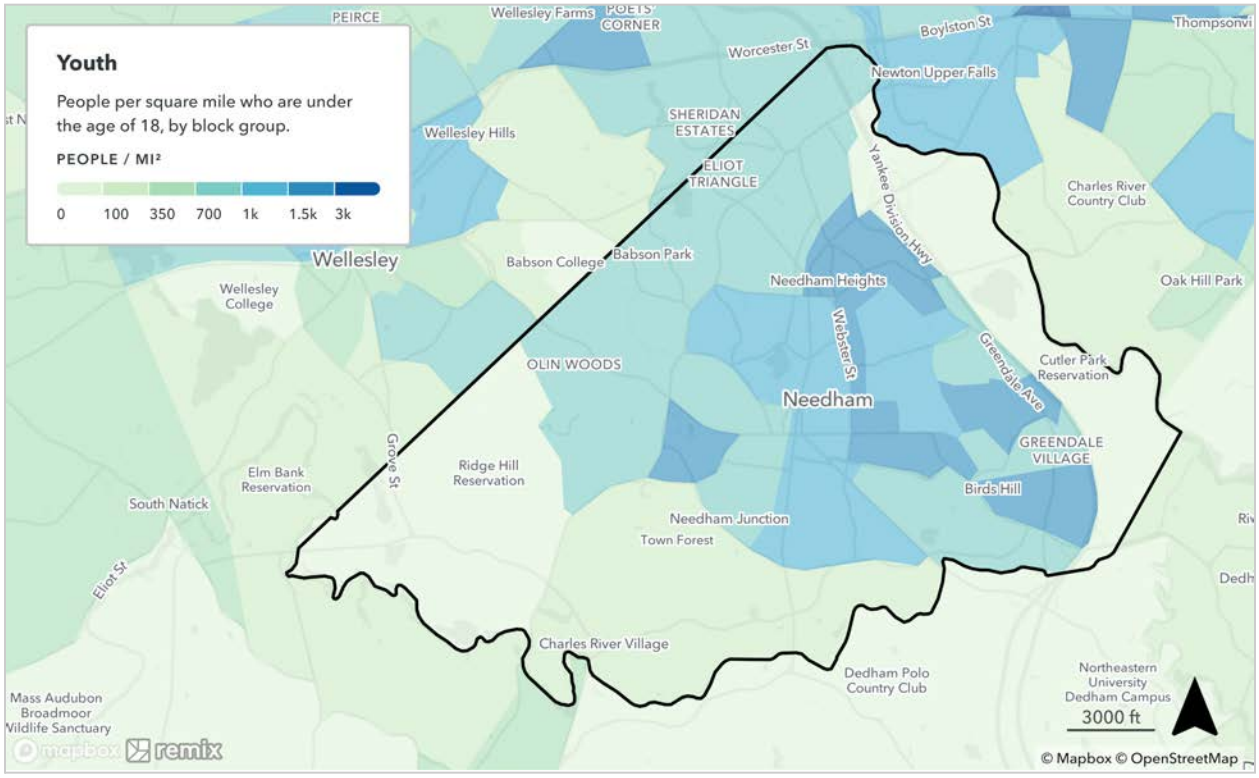


Transit-Dependent Riders are those who have limited transportation options and rely heavily on public transit to access jobs and services. Many transit-dependent riders do not drive, either because they cannot or because it is too costly. Many seniors, students, low-income individuals, and people with disabilities are transit-dependent. Alternatives to transit-dependent riders include walking or biking and relying on friends and family for rides. For many transit-dependent people, ridehailing services, like Uber and Lyft, are too expensive to be used regularly. In other cases, if public transportation is unavailable, people who are transit dependent may not be able to complete their trip at all, this is especially problematic if their journey relates to accessing employment, groceries, or medical services.

3.4 Youth

Youth are often frequent users of public transit as many do not have a driver's license or access to a personal vehicle. 28% of Needham residents are under the age of 18. This is higher than the average of 19.5% across the state. The highest concentrations of youth are in Needham Heights and east of Needham Center.

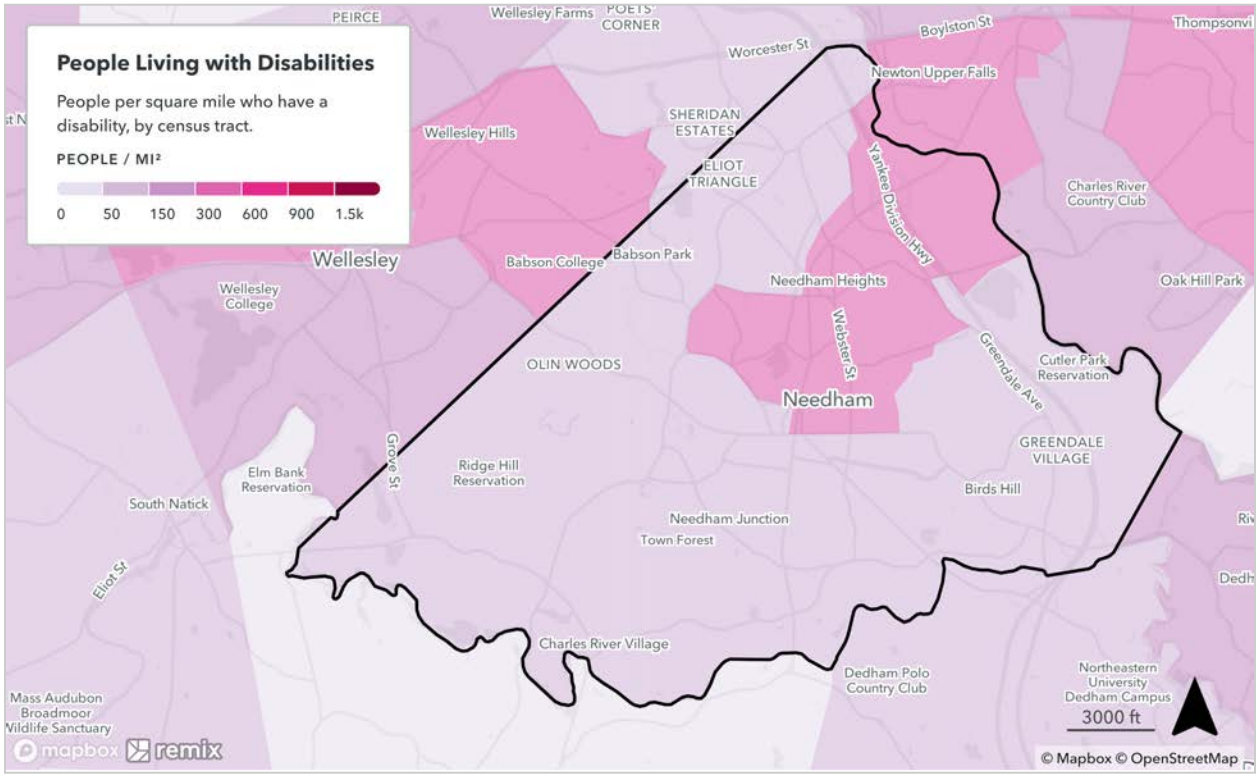
Figure 16. Density Map of Youth.



3.5 People Living with Disabilities

People with disabilities tend to rely on public transit, as many cannot drive themselves or afford a private vehicle. Overall, 6% of Needham residents (about 2,000 people) self-identify as having a disability.

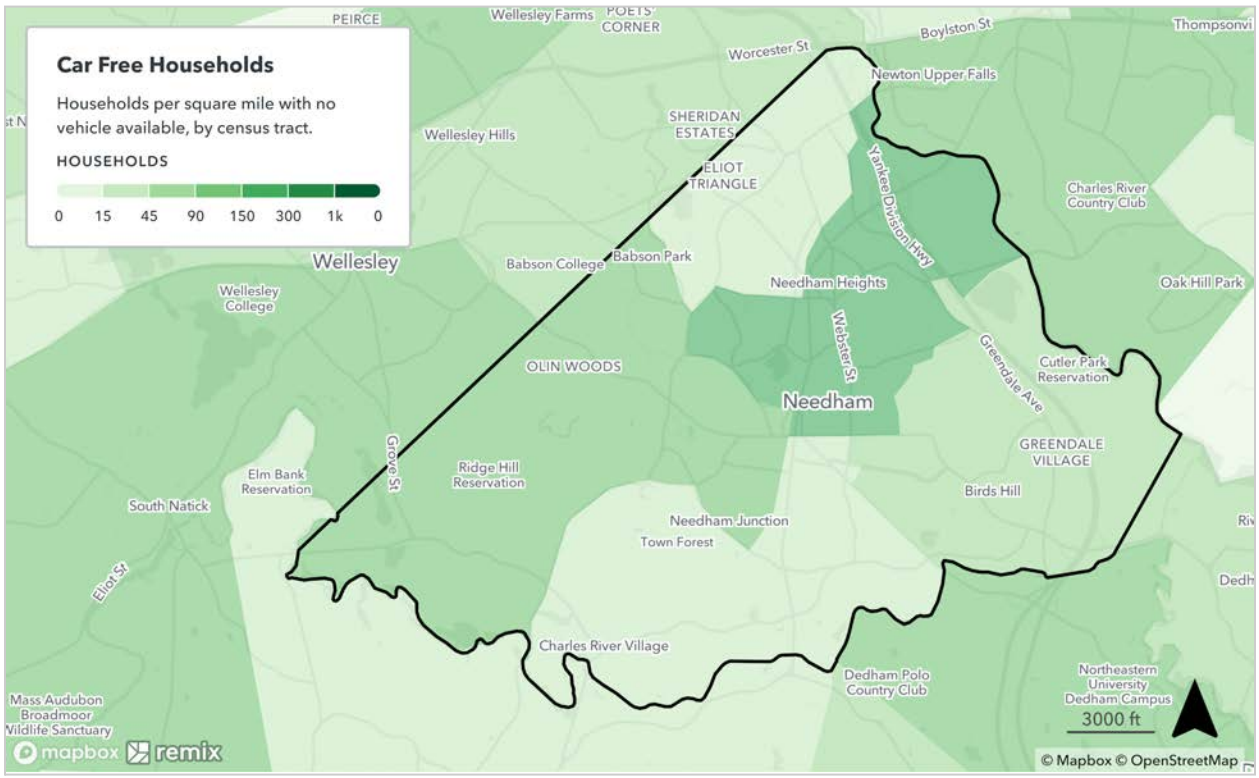
Figure 17. Density Map of People with Disabilities.



3.6 Car-free households

Car-free households are more likely to rely on public transportation to access employment and other services. If public transportation is unavailable, these households may have to rely on friends/family to drive them, walk long distances, or pay for costly ride-hailing services. 6% of Needham households have zero vehicles (this is similar to the rate in nearby Wellesley and Newton but much lower than the rate of car-free households in Boston, 35%). An additional 23% of Needham households only have one vehicle.

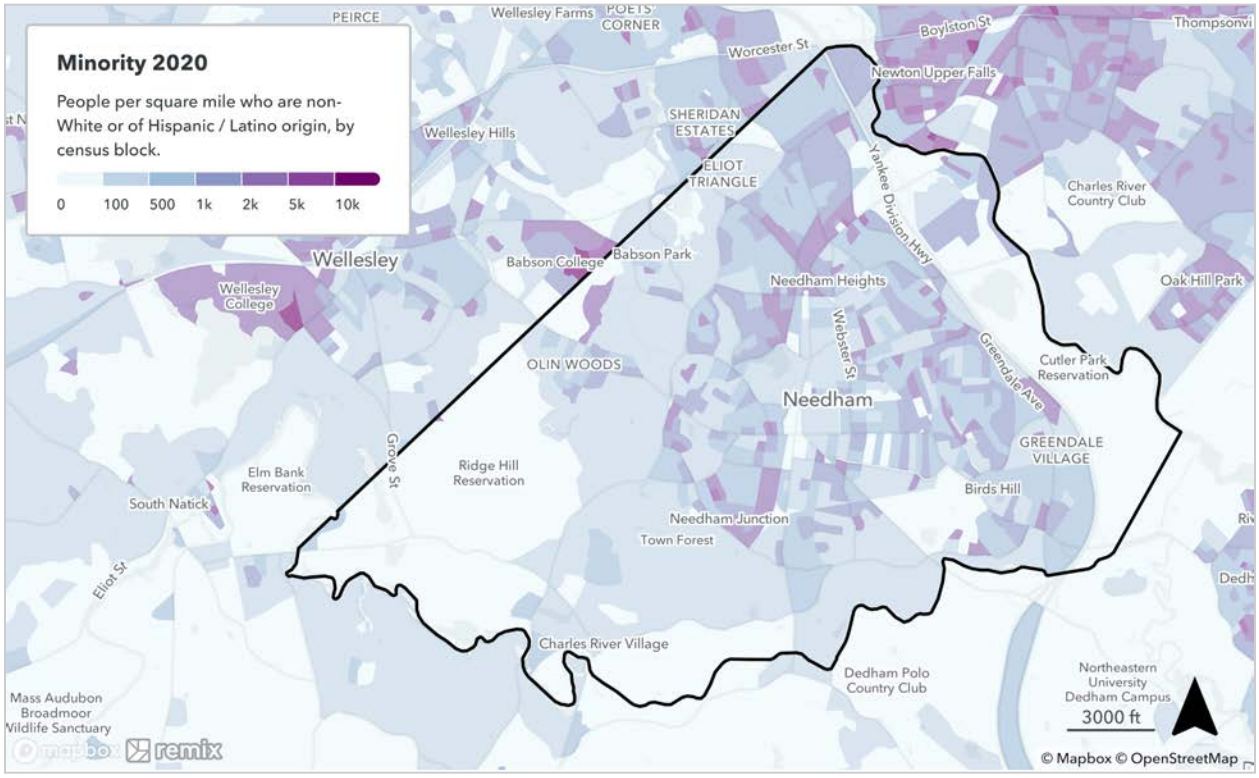
Figure 18. Density Map of Car-Free Households.



3.7 Minorities

Nonwhite and Hispanic/Latino communities may have a higher tendency to use public transit, with lower incomes and rates of vehicle ownership than white residents in most of the US. 19% of Needham's population are non-white or of Hispanic/Latino origin. About half of Needham's minority population are Asian.

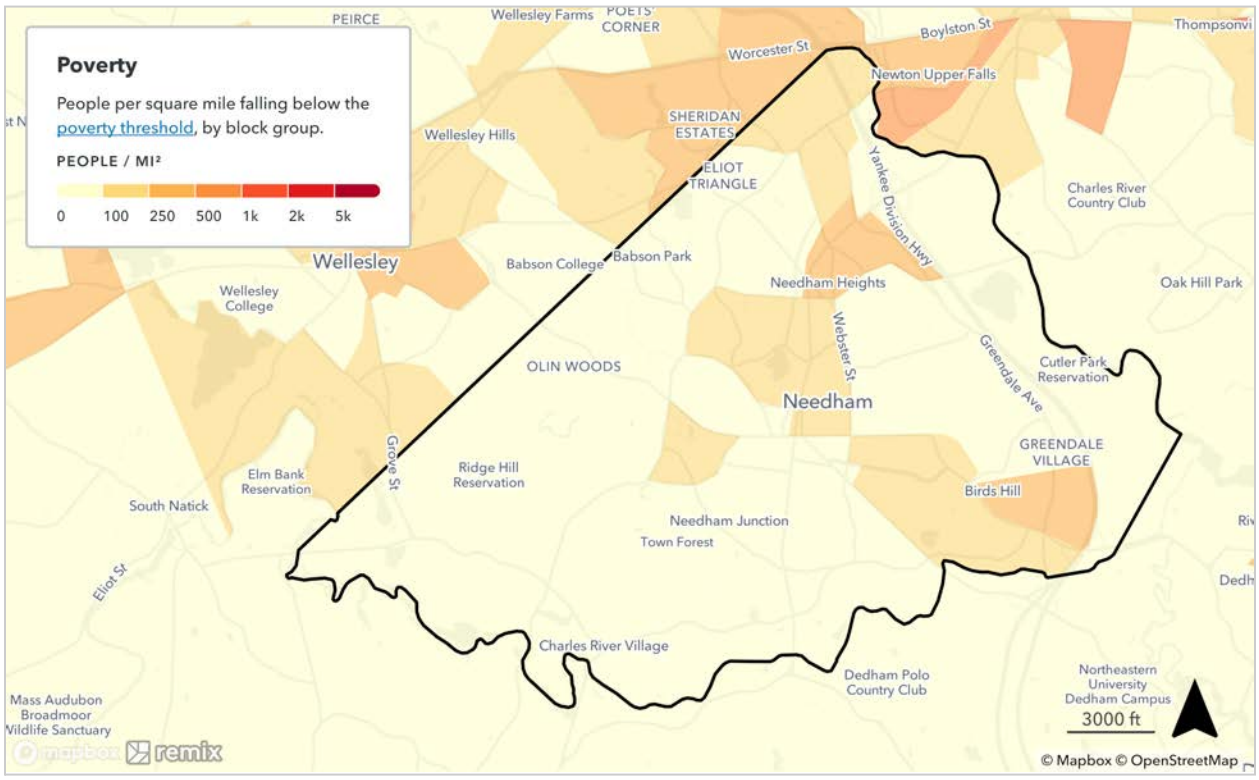
Figure 19. Density Map of Minorities.



3.8 Income

Low-income households are less likely to be able to afford a private vehicle and are more likely to rely on public transportation. About 2% of Needham residents fall below the poverty threshold. The median household income (in 2021 dollars) was over $180,000, more than double the state average of $89,000. Given the relatively low poverty rates in Needham, it is likely that most households that would like to drive can afford to do so. In such communities, public transportation can be catered to serve "choice riders."

Figure 20. Poverty Density Map.



Choice Riders typically use public transit when it is the most convenient option for them (as opposed to the only option due to the cost of driving or not having a driver's license due to age—these riders are sometimes referred to as "transit-dependent" riders). Choice Riders may also use public transit as a supplement to driving for specific trips, such as when parking is difficult. Other Choice Riders may choose public transit over driving in an effort to reduce their carbon emissions. Choice Riders will likely only use public transportation options if they are easy to use, convenient, and offer comparable trip times to driving. For some Choice Riders, public transit competes with ridehailing services, such as Uber and Lyft, as the cost for those services is usually not as important as the speed and convenience they may offer compared to some public transit options.

4. Community Survey Findings

From April 21 to May 16, workers and residents of Needham had the opportunity to share their opinions with the project team through an online survey. The survey was distributed through the town newsletter and through various stakeholder networks. A total of 417 responses were received (70% of which were fully complete). This section includes a summary of the key survey findings and a complete analysis of the survey results can be found in **Appendix 1**.

Demographics

- The survey successfully targeted Needham residents and workers, with 91% of the survey respondents living in Needham and 51% working in Needham. 13% of respondents both live and work in the town.
- The survey also successfully targeted populations with a high propensity to use public transit including:
    - Seniors (31% of responses compared to 19% of Needham's population)
    - Young adults (11% of responses compared to 8% of Needham's population)
    - Individuals with disabilities (12% of responses compared to 6% of Needham's population)
    - No personal vehicle access (18% of responses compared to 6% of Needham's households)

Public Transit Usage and Perceptions

- Driving is the most common form of transportation in Needham followed by walking. Roughly two thirds of respondents use public transit at least infrequently, with commuter rail being the most common form of public transit used by respondents.
- As Needham is relatively affluent, many of the responses indicate a significant percentage of 'choice' public transit users. For example, rather than using public transit due to lack of a personal vehicle or affordability, two of the three most common reasons for using public transit were lack of parking and convenience. This is further supported by the most common trip type being recreational, social, or special events. These trips are likely to involve travel using the commuter rail to Boston.
- Respondents would be more likely to use public transit if it was more convenient, more frequent, and required shorter walks to meet a vehicle.

Microtransit Perceptions

- More than half of respondents would use a microtransit service at least occasionally while 14% would not use microtransit at all. The willingness to use microtransit did not significantly vary by age, gender, disability, income level, or vehicle ownership status.
- 87% of respondents would book using a smartphone, but phone booking and/or other methods would be required for a small percentage of the population.
- Common destinations for a microtransit service would be:

- Green Line Stops
- Commuter Rail Stations
- Needham Library
- Newton Highlands
- Needham Center
- Needham Heights
- Olin College of Engineering
- Babson College
- Trader Joe's in Needham

Other Comments

Survey participants were invited to share anything else they wanted the town to know about their transportation needs or experiences. 182 respondents answered this question and a wide range of comments were received. The comments can be summarized into three categories:

1. **Availability and Reliability of Transit Services:** Most comments requested improved reliability and availability of public transit services in Needham. Several comments mentioned challenges accessing existing services and were appreciative of the Town for exploring improved transit services. The most common request was for more frequent commuter rail services. Access to the Green Line was also a very common request. Local transportation needs were also discussed, although less frequently.
2. **Transportation Needs:** Several comments elaborated on individual transportation needs. For example, many of those living with a disability expressed a desire to live a more independent lifestyle. Several parents spoke of limited options for students and children to travel freely.
3. **Non-Public Transit Related Comments:** Others expressed concerns that traffic has increased and walking has become unsafe. Several comments would like to see a shift from private vehicles through better public transit availability, as well as safe bike and pedestrian facilities.

5. Stakeholder Conversations

The project team met with six different stakeholder groups. Each interviewee was asked about the group they represent and the specific local transportation needs for that community. A total of eight stakeholders were interviewed, representing the following groups:

- Individuals living with a disability
- Seniors
- Students and teens
- Major employers
- Community organizations

Common themes that emerged from the discussions are shown in Table 4.

Table 4. Summary of stakeholder conversations.

Topic	Common Themes
Existing public transit services	• Public transit options for local trips are extremely limited and generally don't meet the needs of the community. • The commuter rail or bus services are useful for some commuters but limited service on weekends and holidays makes some trips difficult. • The Route 59 bus is not within walking distance of most of Needham and isn't frequent enough for many passengers. Awareness of this bus route is low. • Seniors and individuals with disabilities have access to several services, such as the MBTA RIDE and Needham Community Council's Lyft service, but these have restrictions that limit their use for all trips. Some assisted living facilities also provide transportation to the hospital for their residents. • Uber and Lyft are available in Needham and are used by several groups but can be too expensive for lower-income groups such as students and seniors. • There are no bike share or similar micromobility options (although Olin College students have a small number of communal bikes for use). • Riders with disabilities, especially those who need additional assistance boarding vehicles, have very few public transit options.
Popular Travel Destinations	• Trader Joe's, CVS Pharmacy, and other restaurants and businesses in Needham Center. • Public transit connections to the Commuter Rail and Green Line T (connections to Boston). • Beth Israel Deaconess Hospital (Needham) and Dedham Medical Center. • Olin College and Babson College. • DeFazio Park, Needham Park & Recreation facilities, and the YMCA (especially for high school students).

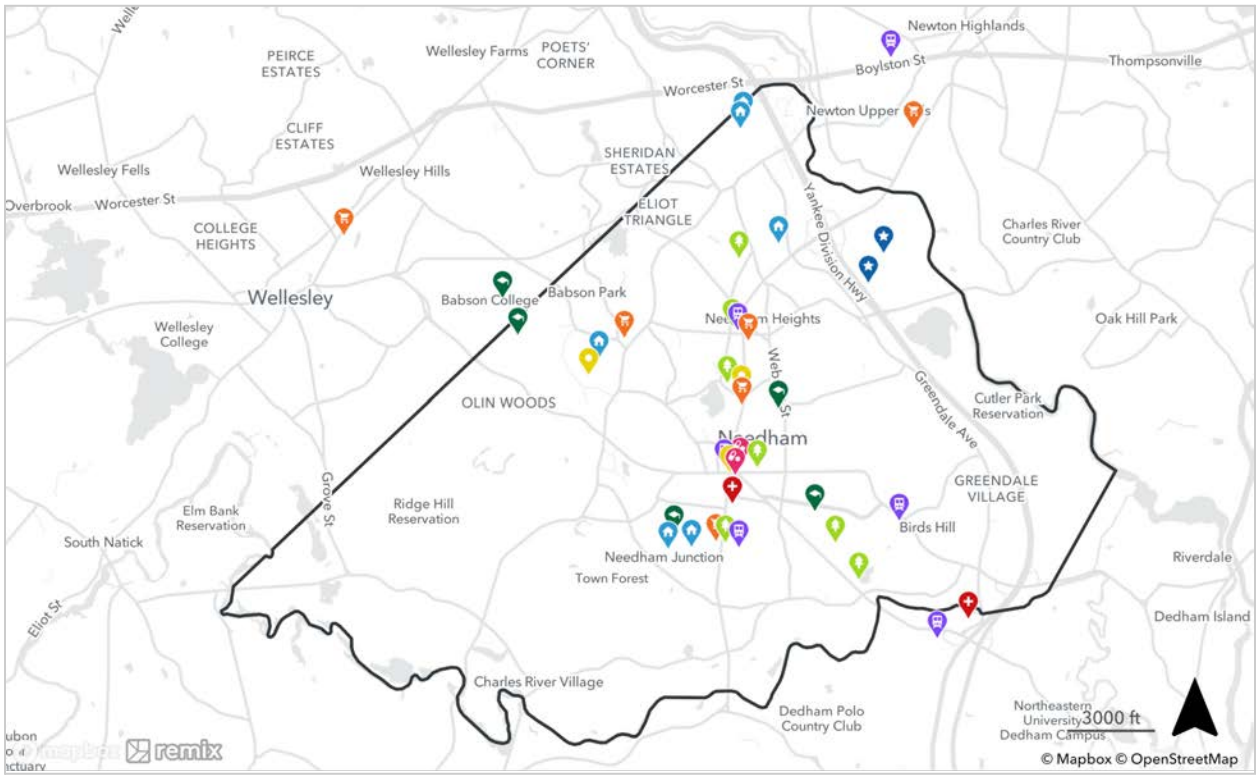
Potential Transit Users	• Youth, primarily middle and high school-aged kids that do not have access to vehicles, struggle to travel around town independently. • Parents could benefit from improved public transit for their children, as this would reduce the time spent driving their children around. • Employers struggle with parking issues in Needham Center and Needham Heights. For example, Beth Israel Hospital (the town's largest employer) also operates a private shuttle service for employees and restricts parking using a permit system. • Some businesses in Needham are required to contribute financially to support public transportation for their commuters. Many contribute to the 128 Business Council to meet this requirement. There are multiple employee transit programs across the town, some of which are duplicative.
Recommendations for new transit services	• Running background checks and training drivers are important to ensure a safe transit system, especially for vulnerable users such as youth and seniors. • Extended service hours will be important for any new services, as there are several reasons for traveling later in the evening (after-school sports, college students attending social events, etc.). • Vehicles should be wheelchair accessible.

6. Transportation Alternatives

Based on the findings from the existing conditions analysis and the community and stakeholder outreach, the project team identified several local transportation alternatives for Needham. The alternatives include fixed-route buses, microtransit, and hybrid solutions. These alternatives were selected and evaluated using the following methodology:

1. **Identified areas with transit needs.** Alternatives were designed based on the density of population and jobs, key destinations, and anticipated local travel patterns. The map in Figure 21 identifies some common destinations people may want to visit with public transit in Needham and nearby communities. The maps include destinations such as:
    - Grocery stores
    - Schools
    - Hospitals
    - Major employers
    - Recreation (indoor and outdoor)
    - Commuter Rail and Green Line stations

Figure 21. Map of Key Destinations in and near Needham.



2. **Determined service hours and quality of service targets** that best achieved the goals, as determined by the town and other stakeholders. The quality of service parameters that were modeled are listed below.
3. **Estimated demand** for each alternative. For microtransit, by assessing each zone's population, employment, and demographic attributes. For fixed-route alternatives, the generally accepted benchmark of a half-mile around each route was analyzed as the route's "catchment area." A low, medium, and high estimate for daily and annual ridership was developed.
4. **Modeled each alternative** to determine the number of necessary vehicles and estimated operating costs required to implement the alternative. For each microtransit alternative, a simulation was performed to allow the project team to assess the tradeoffs between service parameters.

6.1 Development of Alternatives

Both fixed-route and microtransit alternatives were developed for this study and were selected and designed based on similar criteria. The main goal of the study was to develop alternatives that improve and expand local transportation options for residents and workers in Needham. Generally, the following frameworks were used when considering whether to explore fixed-route buses, microtransit, or both:

- **Fixed-route bus** services perform well when connecting relatively densely developed areas with easily aggregated demand patterns (for example, two town centers with bidirectional travel demand, or a linear corridor with a mix of housing and employment). The route should be on roads with good pedestrian infrastructure to allow easy and safe access to and from bus stops.

- **Microtransit** services perform well in a range of densities and can successfully operate in areas with a lower density than is considered necessary for a fixed-route bus. They are able to capture more dispersed demand patterns than fixed-route buses. See the section below for more information on how microtransit works.

Microtransit Overview

Microtransit, also known as on-demand transit, is a technology-enabled transit system that dynamically routes vehicles based on real-time passenger demand. While demand-response transit has existed for decades, often in the form of Dial-a-Ride and other paratransit services, microtransit has grown in popularity just in the last few years. The key difference is that microtransit is technology driven and encourages riders to book trips through a mobile phone app, allowing on-demand booking in addition to pre-booking. While the configuration of each microtransit service is different, typically, passengers are asked to walk to meet a vehicle at a nearby intersection to reduce detours and maximize the efficiency of the service. There are no fixed routes or pre-determined schedules. Instead, routing is based on where riders want to travel and when. Microtransit is often implemented using small buses or vans, and rides are shared as they are with traditional bus service. Wheelchair-accessible vehicles ensure the microtransit service is accessible to people with disabilities.

Typically, microtransit services operate within a pre-defined zone, meaning passengers can only book trips where both their origin and destination are within the same area. For passengers who want to travel beyond the zone boundaries, microtransit can provide a first/last-mile connection to fixed-route buses or trains that connect beyond the zone boundaries. In this case, passengers will only be able to complete part of their journey using microtransit.

Vehicles have no predetermined routes or stops. Instead, they are scheduled and routed as trip requests are made. If there are no requests, vehicles usually have designated terminals or staging areas where they can wait until a new trip request is scheduled - the terminal number and locations are determined based on the size of the zone and frequent ride request locations. This minimizes the amount of driving a vehicle does with no passengers on board.

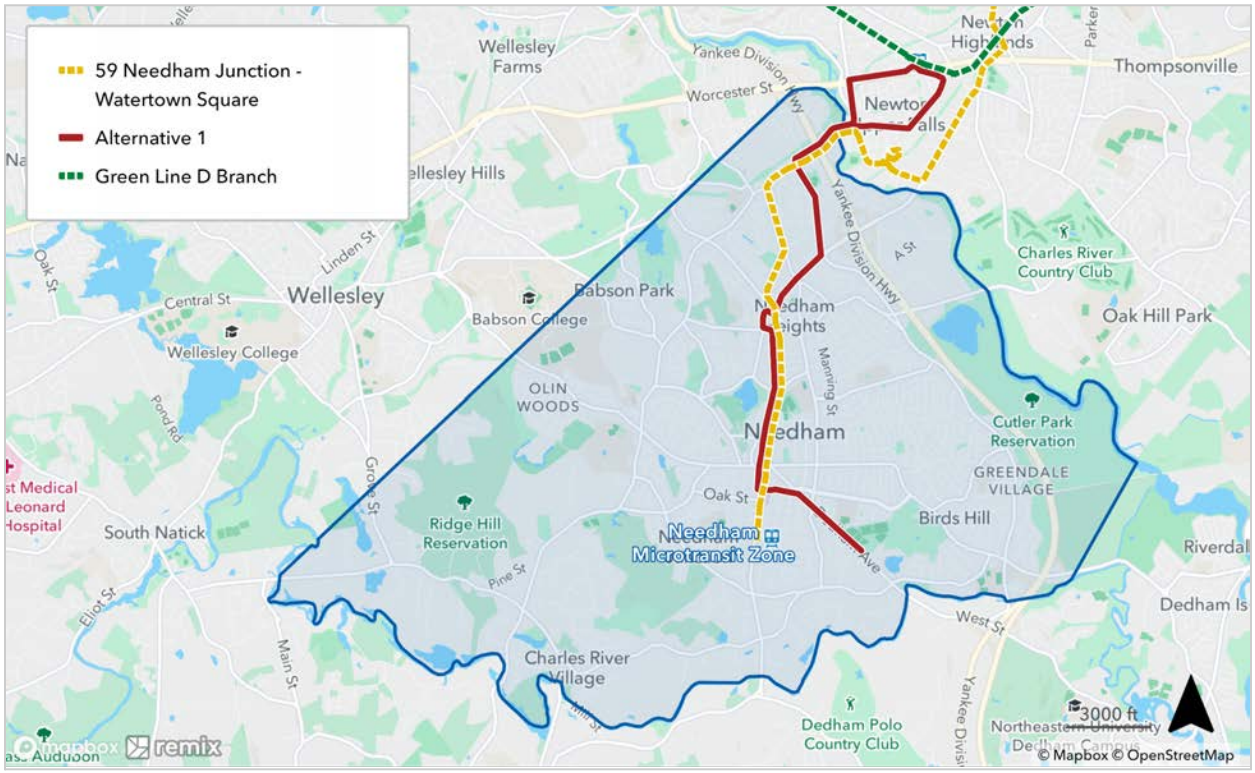
Most services allow passengers to book a trip using a smartphone application, a website, or by calling a dispatcher. To book a ride, a customer indicates the number of passengers in their party and their desired pickup and dropoff locations. When booking using the app, passengers will see a map of the service zone where they can book rides. The application often shows key destinations and transit hubs in the service area. Once the passenger submits a trip request, they are given a proposal that tells them when the vehicle will arrive and where to meet it. Typically, passengers must wait between five and twenty minutes for a trip, although this may vary depending on the level of demand and the number of vehicles available. Passengers can track the vehicle in real-time using the app. The passenger is also provided with vehicle information—for example, license plate, driver name, driver photo, and vehicle ID number. For trip requests made through a call center, passengers can choose to receive text message updates for their trips. Call center bookings also ensure the service is accessible to those without access to a smartphone.

Once the passenger(s) has boarded the vehicle, they are driven to their destination. Along the way, the vehicle will pick up and drop off other passengers heading in a similar direction, but services are configured to avoid lengthy detours for passengers already on board. The passenger can continue to track their trip's progress using the app. Passengers may also be asked to walk a few minutes from their dropoff point to their final destination. For passengers who are unable to walk, most services provide curb-to-curb service for these passengers or an alternative ADA paratransit service.

Five transportation alternatives were developed:

1. **Bus Route 1: Needham Center.** Option 1 is a fixed-route bus from the Eliot T stop to DeFazio Park through Needham Heights and Needham Center. This proposed route takes approximately 20 minutes to run in each direction. It connects to the Green Line and the Commuter Rail. With two buses, it could run every 30 minutes.[5]

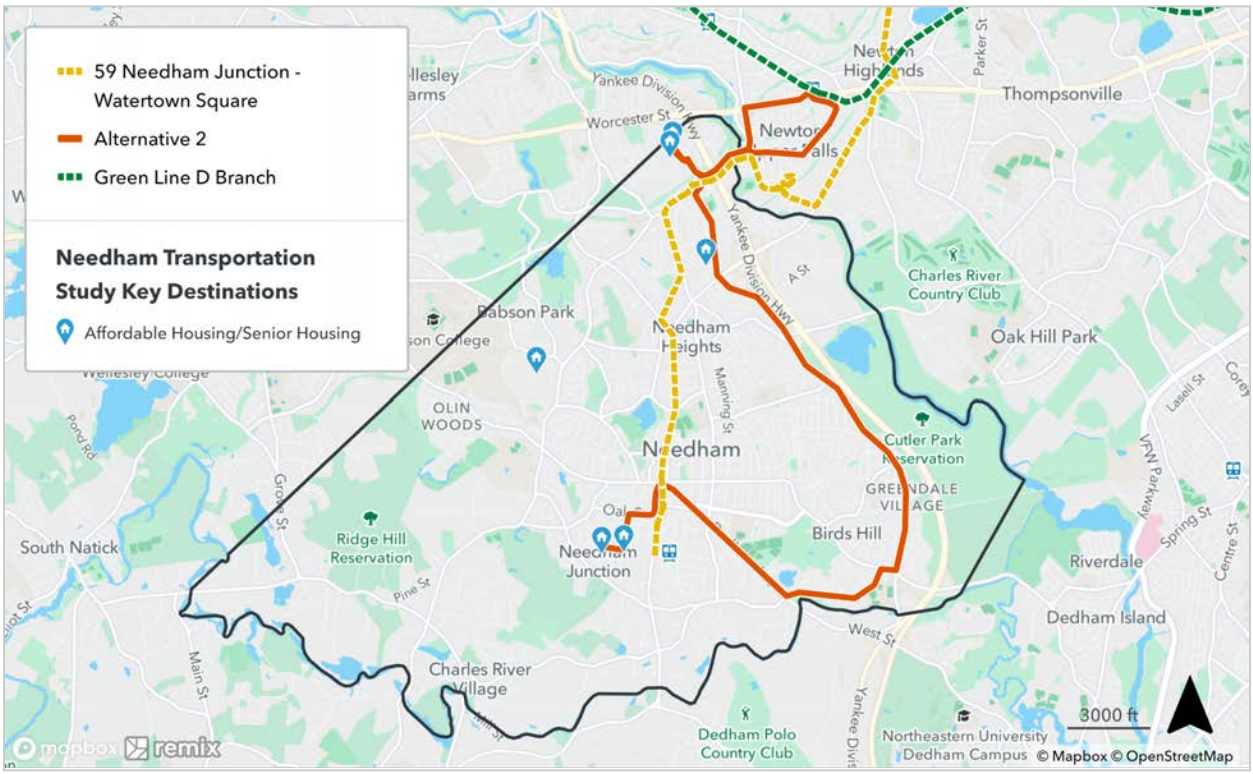
Figure 22. Bus Route 1: Needham Center.



[5] A branch of the Alternative 1 route could be implemented that goes west from the hospital to Olin College (instead of DeFazio Park). This alternative could be implemented seasonally or at certain times of day when useful to Olin students.

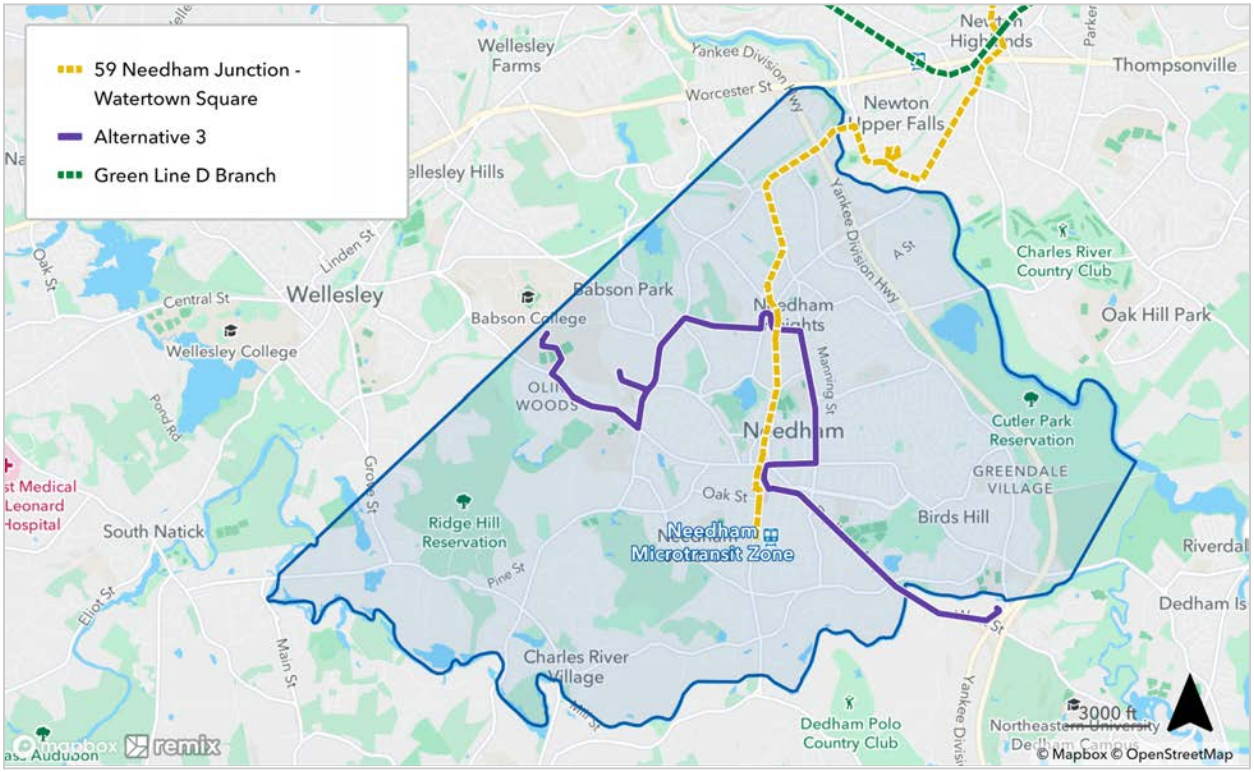
2. **Bus Route 2: Needham East.** Alternative 2 connects Eliot T stop to the High Rock neighborhood through Needham Center, Beth Israel Deaconess Hospital, and DeFazio Park. The route avoids redundancy through Needham Center and Needham Heights which is provided by the MBTA Route 59 and instead prioritizes affordable housing and senior housing complexes. The route has a runtime of just over 30 minutes in each direction.

Figure 23. Bus Route 2: Needham East.



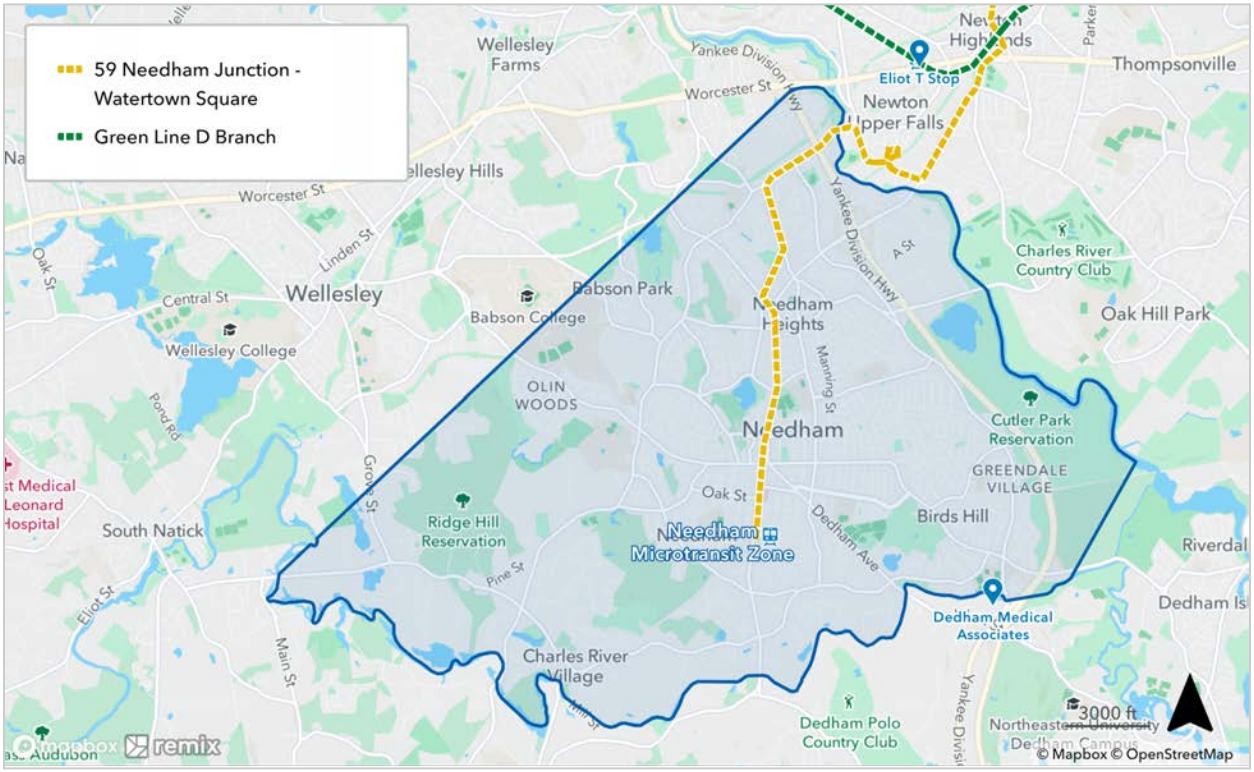
3. **Bus Route 3: East/West Needham.** Alternative 3 runs from Olin College to the Dedham Medical Center, through Needham Heights and Needham Medical Center. The route takes about 25 minutes in each direction. Transfers can be made in Needham Center or Needham Heights to Route 59 for connections to the Green Line.

Figure 24. Bus Route 3: East/West Needham.



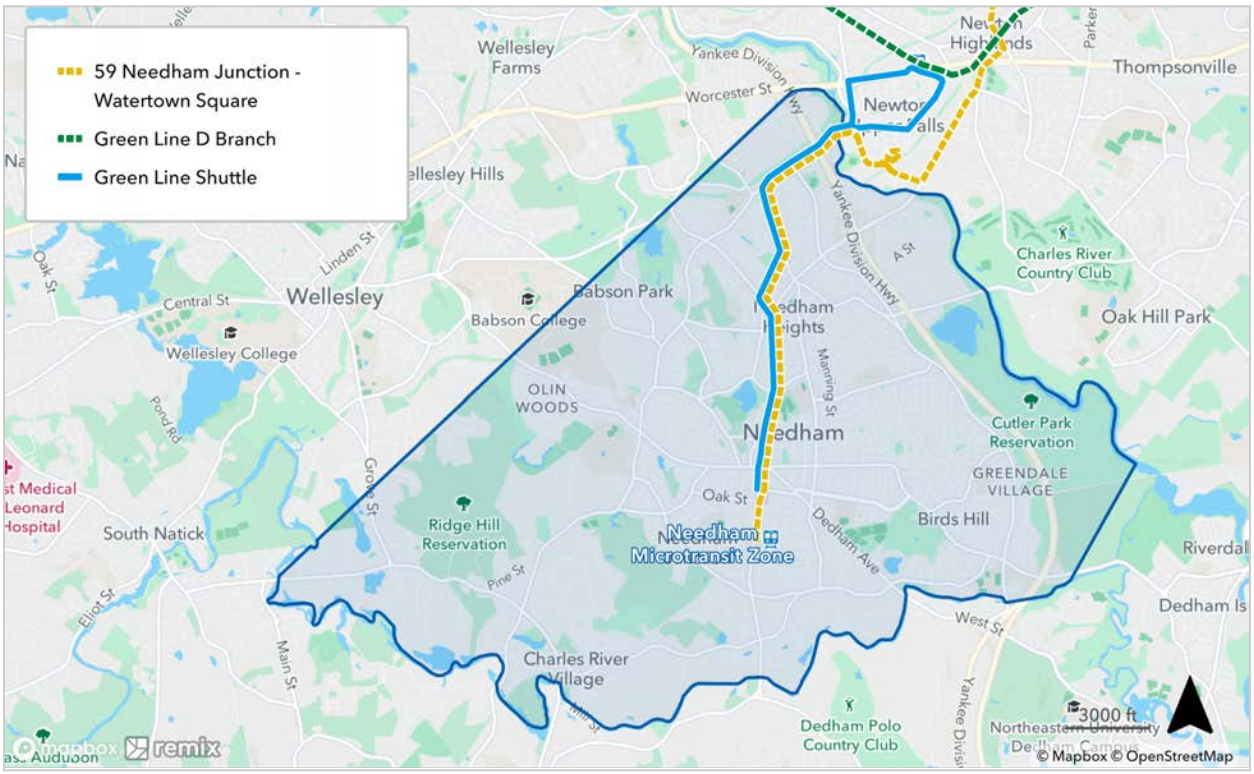
4. **Microtransit: Needham + Key Destinations.** This alternative would provide microtransit to the entire town of Needham. It also includes two key destinations outside of the Town which are the Eliot Green Line T Stop and Dedham Medical Associates. All trips will have to either start or end in Needham.

Figure 25. Microtransit: Needham + Key Destinations Alternative.



5. **Hybrid: Green Line T Shuttle + Needham Microtransit.** This zone would provide microtransit to the entire town of Needham. A shuttle bus would run from Needham Center to the Green Line to facilitate multimodal trips. The shuttle should be timed to run between runs of the 59 bus to provide residents twice the frequency of service, offering more opportunities to connect from Needham Center and Needham Heights to the Green Line.[6]

Figure 26. Hybrid: Green Line T Shuttle + Needham Microtransit Alternative.



[6] Route 59 runs from Needham Center and Needham Heights to the Newton Highlands Green Line Stop. Headways are 30 to 60 minutes, depending on the time of day.

6.2 Modeling Methodology and Ridership Estimates

Once the alternatives were developed, they were each modeled to assess their potential impact, feasibility and costs of implementation.

Fixed-Route Bus: Remix planning software was used to estimate route headways, journey times, driver and vehicle requirements, service efficiency, and estimated operating costs. The estimates are based on the route and stop alignments, travel demand patterns, service hours, vehicle speeds, and layover parameters.

Microtransit: Designing a microtransit service is a trade-off between supply, demand, and service quality within a specific zone. Simulations allowed the project team to evaluate these tradeoffs and make service design recommendations including wait times, service hours, and vehicle sizes. For each microtransit alternative, simulations were conducted to understand the average wait times, walking distances, service efficiency, vehicle and driver requirements, and estimated operating costs.

Two levels of performance were evaluated for each scenario, a 'basic' version with an acceptable quality of service and a 'standard' service with longer operating hours, shorter wait times, walking requirements, and trip durations[7].

[7] Shorter wait times, walking requirements and trip durations apply only to the microtransit component in the hybrid alternatives.

Table 5 indicates the main parameters used to simulate the microtransit alternatives.

Table 5. Microtransit modeling parameters.

Modeling Parameter	Description	Recommendation for 'Basic' Quality of Service	Recommendation for 'Standard' Quality of Service
Service Hours	Service hours are the times when a customer can request a ride and should, at a minimum, be set to match the existing transit service hours, or extended to also provide service during times when there currently is no service such as later in the evenings or weekends. While longer service hours are useful for many people, they also make the service more expensive to operate, especially during low ridership hours.	Mon - Fri: 7 AM to 6 PM Sat - Sun: 9 AM to 4 PM	Mon - Fri: 7 AM to 6 PM Sat - Sun: 9 AM to 4 PM
Bus Stop Model	The operator must choose where people can get picked up for rides. There are many options, but the most popular is curb-to-curb, point-to-point (sometimes called corner-to-corner), or key destinations only. A combination of these models is also possible. Curb-to-curb picks up and drops off passengers as close to their requested origins and destinations as possible, usually on the curb in front of the entrances. Point-to-point services typically require a short walk to a nearby intersection. The point-to-point model offers many pickup and dropoff points by allowing vehicles to stop near most intersections and major destinations. In a point-to-point model, vehicles will only stop at intersections where it is safe for passengers to board and ascend vehicles. Compared to a curb-to-curb model, services that ask passengers to walk have shorter wait times and higher efficiency (lower cost per passenger) since they are directing people to pickup points closest to the vehicle's existing route. Under all models, riders with accessibility needs may request a curb-to-curb service. In a key destinations-only model, microtransit pickups and dropoffs are limited to specific locations pre-determined by the operator.	**Microtransit:** Point-to-point in Needham + Key destinations outside of Needham	**Microtransit:** Point-to-point in Needham + Key destinations outside of Needham

	Typically, these include hospitals, grocery stores, schools, and large employers. A service that is limited to only key destinations is likely to be limited in its usefulness as many people do not live near a key destination. An operator may choose to also require either the pickup or dropoff destination to be a key destination but allow a point-to-point service on the other end of the trip. This still somewhat limits the usefulness of the service however encourages aggregation of trips and can make the service more efficient.		
Walking Distances	This refers to the maximum and average distances a passenger must walk from their origin to their vehicle and from their vehicle to their destination. In most cases, there are multiple potential pickup locations. Allowing longer walking distances means a passenger may be asked to walk further than their closest pickup location to minimize the distance a vehicle must detour to pick them up. Longer walking distances will increase the efficiency of the service but result in lower ridership as passengers may choose another mode of travel (or not to travel) if they are asked to walk too far. Average walking distance will vary in each scenario depending on the street grid, distribution of trip requests, and level of demand. Walking distances are not relevant for curb-to-curb services.	Average: 400 - 600 ft Maximum: 1,320 ft (.25 mile) (total walking distance is ~twice the distance shown as passengers walk at both ends of the trip)	Average: 300 - 500 ft Maximum: 1,050 ft (.2 miles) (total walking distance is ~twice the distance shown as passengers walk at both ends of the trip)
Wait Times	This refers to the maximum and average time a passenger must wait for a vehicle to arrive at their pickup location from when they request a ride and only applies to on-demand microtransit. Shorter wait times are targeted in dense areas, while longer wait times are often more acceptable in rural areas. Longer maximum wait times allow for more flexibility in vehicle routing and may require fewer vehicles. However, longer maximum wait times can lead to more significant fluctuations in waiting times experienced by passengers, which can be a poor experience for passengers.	Average: 20 minutes Maximum: 45 minutes	Average: 15 minutes Maximum: 30 minutes

Detour Threshold	This refers to the allowable detour a passenger can experience (measured in both time and distance) compared to the base route (quickest route) between a rider's pickup and dropoff. Microtransit does not have fixed-routes and the exact routing of a vehicle is based on the trip requests received in real-time. When the software is determining a vehicle's route, the detour threshold gives the vehicles the flexibility to aggregate rides. Large detour thresholds can lead to longer journey times for passengers, rendering the service less useful to some, especially those with access to a private vehicle and the option to drive the direct route.	2x direct trip journey length/duration	1.5x direct trip journey length/duration
Vehicle Capacity	This is the number of seats and wheelchair spaces per vehicle. A larger vehicle is often useful when a family or large group chooses to travel together. However, it is usually the number of vehicles, rather than the number of seats in the vehicles, that tends to limit the number of trips a microtransit service can complete in a given time period.	6+ regular seats including 1 wheelchair space	6+ regular seats including 1 wheelchair space

The modeling assumptions used for the fixed-route analysis are shown in Table 6.

Table 6. Fixed-route modeling parameters.

Modeling Parameter	Description	Recommendation for 'Basic' Quality of Service	Recommendation for 'Standard' Quality of Service
Service Hours	Service hours are the times when a customer can request a ride and should, at a minimum, be set to match the existing transit service hours, or extended to also provide service during times when there currently is no service such as later in the evenings or weekends. While longer service hours are useful for many people, they also make the service more expensive to operate, especially during low ridership hours.	Mon - Fri: 7 AM to 6 PM Sat - Sun: 9 AM to 4 PM	Mon - Fri: 7 AM to 6 PM Sat - Sun: 9 AM to 4 PM
Headways	Headways are the amount of time between the arrival of buses at each stop. Also known as the route's frequency. A route with longer headways arrives less frequently and is less useful to riders as they will need to plan their journeys further in advance and may have to wait longer for their trip. Shorter headways are more useful to passengers but require more vehicles to operate.	30 mins.	30 mins.

Ridership Estimates. Ridership estimates impact important decisions regarding the size of the fleet and the level of funding required for each alternative. It can take twelve months or longer for the ridership of a zone to mature and reach these estimates. Moreover, ridership growth rates are strongly correlated with marketing efforts (see 8.3.2 Marketing Transit Services for more details). The demand estimates were based on three factors:

1. The number of residents living in each catchment area,
2. The number of jobs located in each catchment area, and
3. The expected transit mode share (the percentage of individuals who live or work in the catchment area that are likely to use the service).

For microtransit alternatives, the "catchment area" was considered to be the zone boundary within which customers can travel within. For fixed-route alternatives, the "catchment area" was anywhere within a half-mile of the route. This distance is based on research showing transit users may be willing to walk up to a half-mile to stop, although this varies depending on the individual.[8]

For each alternative, a low, medium, and high ridership estimate was developed.

- **Low:** This scenario assumes the service does not perform as well as comparable peer services. While there are several potential reasons for this, the most common reasons for low ridership include poor marketing, a lack of community support, or unforeseen technical or operational challenges that affect the reliability of the service.
- **Medium:** The medium scenario was the project team's best estimate for the ridership within the first 12 to 24 months of operation. This estimate assumed that ridership is similar to peer services.
- **High:** This scenario assumes the service is more successful than most peers. Common reasons for a highly successful service include strong community support and viral marketing campaigns. If the decision is made to offer a free service, this will also increase ridership.

[8] "Pedestrian Safety Guide for Transit Agencies," 2008, U.S. Department of Transportation, Federal Highway Administration.

Table 7 summarizes the estimated weekday and annual demand for each alternative.

Table 7. Demand Estimates by alternative.

Alternative	Weekday			Annual
	Low	Medium	High	Medium
1. Fixed-Route: Needham Center	45	90	130	27,700
2. Fixed-Route: Needham East	50	70	155	33,200
3. Fixed-Route: East/West	50	70	155	33,500
4. Microtransit Needham + Key Destinations (Basic)	70	145	215	46,000
4. Microtransit Needham + Key Destinations (Standard)	80	160	245	51,000
5. Hybrid Combined Microtransit + fixed Route (Basic)	85	170	255	53,700
5. Hybrid Combined Microtransit + fixed Route (Standard)	100	195	295	61,900

6.3 Modeling Analysis and Recommendations

Modeling each alternative allowed the project team to understand how different service parameters, route alignments, zone boundaries, and fleet configurations will perform as an actual service. Modeling also helped predict the number of vehicles needed for a service and the initial capital costs that may be associated with each alternative. Simulations predicted various performance indicators, such as service productivity (a measure of boardings per vehicle hour) and average trip durations.

This section presents the modeling results for each alternative. The following results and metrics are detailed for each fixed-route alternative:

- **Service hours:** The hours of service that were modeled for each alternative.
- **Passenger demand:** The number of expected boardings per weekday and annually.
- **Vehicles required:** The minimum number of vehicles needed to operate the bus route with headways of 30 minutes.
- **Runtime:** The number of minutes that are estimated for the bus to make a roundtrip of the route, does not include layover time.
- **Route length:** The estimated length in miles for the bus route (one-way).
- **Average weekday runs:** The number of weekday round-trips that could be completed with the estimated vehicles at 30-minute headways.
- **Average Productivity:** Productivity is a measure of how efficient a service is and is measured by the number of passenger boardings per vehicle revenue hour.
- **Annual Revenue Hours:** The total vehicle revenue hours required to operate the service. These are defined as when a vehicle is actively driving the route. This does not include driving time to and from depots or driver breaks.

The analysis for the microtransit alternatives includes:

- **Service hours:** The hours of service that were modeled for each alternative.
- **Passenger demand:** The number of expected boardings per weekday and annually.
- **Vehicles required at peak:** The minimum number of vehicles needed to accommodate demand during the peak hours when demand is highest. The modeling may suggest fewer vehicles are needed during off-peak hours, however, at a minimum, two vehicles are recommended to be used at all times to ensure reliable operations.
- **Average Productivity:** Productivity is a measure of how efficient a service is and is measured by the number of passenger boardings per vehicle revenue hour.
- **Average wait times:** The average time a passenger is asked to wait from the time they request a ride to the time they are asked to meet the vehicle.
- **Average trip duration:** A passenger's average journey length from when they are picked up to when they are dropped off. Detour allowance will impact the trip durations.

- **Average total walk:** The average total walking distance a passenger is asked to complete from their original request location to their pickup point and from their dropoff point to their final requested destination.
- **Annual Revenue Hours:** The total vehicle revenue hours required to operate the service. These are defined as when a vehicle is “online” and available to complete trip requests or actively driving to pickup passengers and drop them off. This does not include driving time to and from depots or scheduled breaks.

Fixed-Route Analysis

Table 8 details the modeling results of each of the fixed-route alternatives. The results assume the service hours from the 'basic' quality of service level.

Table 8. Fixed-route modeling results.

Route Alternative	**1 (Needham Center)**	**2 (Needham East)**	**3 (East/West)**
Service Hours	Mon - Fri: 7 AM to 6 PM; Sat - Sun: 9 AM to 4 PM		
Frequency (minutes)	30		
Fleet Size (buses)	2	3	3
Round-Trip Runtime (minutes)	40	70	60
Round-Trip Route Length (miles)	10	17	15
Weekday Round-Trip Runs	17	21.5	21.5
Annual Vehicle Hours	5,550	9,300	7,800
Annual Vehicle Miles	69,500	118,200	107,800
Daily Ridership (weekdays, medium estimate)	90	70	70
Annual Passengers (medium estimate)	27,700	33,200	33,500
Average Weekday Productivity (boardings per vehicle hour)	4.6 - 5.6	3.1 - 4.1	3.9 - 4.9

To provide 30 minute frequencies across all three alternatives, each route will require either two or three vehicles in operation at any given time.

The Needham Center route has the highest expected ridership as it is focused on the parts of town with the highest population and job density. The higher ridership, in combination with the shortest runtime, results in the Needham Center route having the highest average weekday productivity at approximately five passengers per vehicle hour.

Microtransit Simulation Results: Needham + Key Destinations

Table 9 details the simulation findings for the Needham microtransit alternative at both quality of service standards.

Table 9. Microtransit modeling results.

Quality of Service	**Basic Quality-of-Service**			**Standard Quality-of-Service**		
Service Hours	Mon - Fri: 7 AM to 6 PM Sat - Sun: 9 AM to 4 PM			Mon - Fri: 7 AM to 8 PM Sat - Sun: 8 AM to 8 PM		
Demand Scenario	Low	Medium	High	Low	Medium	High
Passengers (boardings per weekday)	70	145	215	80	160	245
Vehicles Required at Peak (min. number of vehicles to accommodate demand)	2	3	4	3	4	5
Average Productivity (passengers per vehicle hour)	2.8 - 3.8	4.1 - 5.1	4.7 - 5.7	1.6 - 2.6	3.2 - 4.2	3.8 - 4.8
Average Wait Time at Peak (minutes)	10 - 12	9 - 11	9 - 11	8 - 10	5 - 7	9 - 11
Average Trip Duration at Peak (minutes)	13 - 15	12 - 14	12 - 14	8 - 10	11 - 13	10 - 12
Average Total Walking Distance at Peak (feet)	325 - 375	575 - 625	450 - 500	375 - 425	475 - 525	475 - 525
Annual Passengers	23,000	46,000	68,000	25,000	51,000	77,000
Annual Revenue Hours	7,200	9,900	13,200	12,400	13,900	18,900

The simulations show that at the basic quality-of-service level, 2 to 4 vehicles are required to meet the expected levels of demand. An additional vehicle is required at each demand level to upgrade to the standard quality of service level. In general, as demand increases, so does the number of vehicles required, and the productivity. With a higher quality of service, there will be slightly more demand, however, the increase in demand is not proportional to the increase in vehicles required, and the productivity is lower in the standard scenario than in the basic. In comparison to the fixed-route alternatives, the microtransit scenario is expected to have more ridership, this is because the microtransit scenario covers the entire town of Needham.

Hybrid: Green Line T Shuttle + Needham Microtransit Service.

The shuttle component of the hybrid scenario requires 2 vehicles to operate at 30 minute frequencies, the full results are shown in Table 10. The hybrid scenario has the highest expected ridership across all the scenarios, however, at the medium demand level, it requires the most vehicles and thus has the highest cost.

Table 10. Hybrid alternative modeling results.

Quality of Service	**Basic Quality-of-Service**			**Standard Quality-of-Service**		
Service Hours	Mon - Fri: 7 AM to 6 PM Sat - Sun: 9 AM to 4 PM			Mon - Fri: 7 AM to 8 PM Sat - Sun: 8 AM to 8 PM		
Demand Scenario	Low	Medium	High	Low	Medium	High
Passengers (boardings per weekday)	85	170	255	100	195	295
Vehicles Required at Peak (min. number of vehicles to accommodate demand)	Microtransit: 2 Shuttle: 2	Microtransit: 3 Shuttle: 2	Microtransit: 4 Shuttle: 2	Microtransit: 3 Shuttle: 2	Microtransit: 4 Shuttle: 2	Microtransit: 5 Shuttle: 2
Average Productivity (passengers per vehicle hour)	1.9 - 2.9	3.5 - 4.5	4.5 - 5.5	1.4 - 2.4	2.8 - 3.8	3.7 - 4.7
Annual Passengers	26,300	53,700	80,000	30,900	62,000	92,800
Annual Revenue Hours	Microtransit: 7,200 Shuttle: 4,800	Microtransit: 8,700 Shuttle: 4,800	Microtransit: 11,200 Shuttle: 4,800	Microtransit: 10,500 Shuttle: 6,250	Microtransit: 13,200 Shuttle: 6,250	Microtransit: 16,400 Shuttle: 6,250

Cost-analysis

This section estimates the annual operating costs and the average cost per passenger for each alternative. The average cost per passenger is a measure of cost efficiency. This study estimated that the hourly cost to operate a microtransit service is between $85 and $92 per vehicle hour. The estimated hourly cost for a fixed-route bus is estimated to be between $120 to $140 per vehicle hour. The hourly cost for fixed-route buses is higher as they typically require larger vehicles (such as a large van or cutaway bus) when compared to microtransit (which can be operated using a minivan). In addition, fixed-route buses typically have higher operating costs as drivers often receive higher compensation and benefits, whereas often turnkey microtransit services are operated by independent contractors. Finally, larger vehicles often require more fuel and are more expensive to maintain. We do not recommend Needham operate the bus routes with full-sized buses as these are not necessary given the ridership forecast.

Table 11. Cost-analysis summary by alternative.

Alternative	Annual Cost			Average Cost per Passenger		
	Low	Medium	High	Low	Medium	High
1. Fixed-Route: Needham Center	$0.66 - $0.78M			$48 - $56	$24 - $28	$16 - $19
2. Fixed-Route: Needham East	$1.11 - $1.30 M			$67 - $78	$34 - $39	$22 - $26
3. Fixed-Route: East/West	$0.94 - $1.10 M			$56 - $65	$28 - $33	$19 - $22
4. Microtransit Needham + Key Destinations (Basic)	$0.61 - $0.66 M	$0.84 - $0.91 M	$1.12 - $1.21 M	$27 - $29	$18 - $20	$16 - $18
4. Microtransit Needham + Key Destinations (Standard)	$1.05 - $1.14 M	$1.18 - $1.28 M	$1.61 - $1.74 M	$41 - $45	$23 - $25	$21 - $23
5. Hybrid Combined Microtransit + fixed Route (Basic)	$1.19 - $1.34 M	$1.32 - $1.47 M	$1.53 - $1.70 M	$45 - $51	$25 - $27	$19 - $21
5. Hybrid Combined Microtransit + fixed Route (Standard)	$1.64 - $1.84 M	$1.87 - $2.09 M	$2.14 - $2.38 M	$53 - $59	$30 - $34	$23 - $26

The cost for the fixed-route alternatives is consistent across the three demand levels. As ridership increases, the cost per passenger decreases. The costs for the hybrid and microtransit scenarios increase as the total number of vehicle hours increases since the modeling showed that additional demand requires additional vehicles. As demand increases, the cost per passenger also decreases, however, at a slower rate compared to the fixed-route alternatives.

While Alternative 1 (Needham Center route) has the lowest annual cost, the microtransit scenario at the basic level of quality has the lowest average cost per passenger. The hybrid alternatives are the most costly but since the ridership is also highest, the cost per passenger for the basic scenario at the medium demand level is comparable to the cost per passenger of Alternative 1.

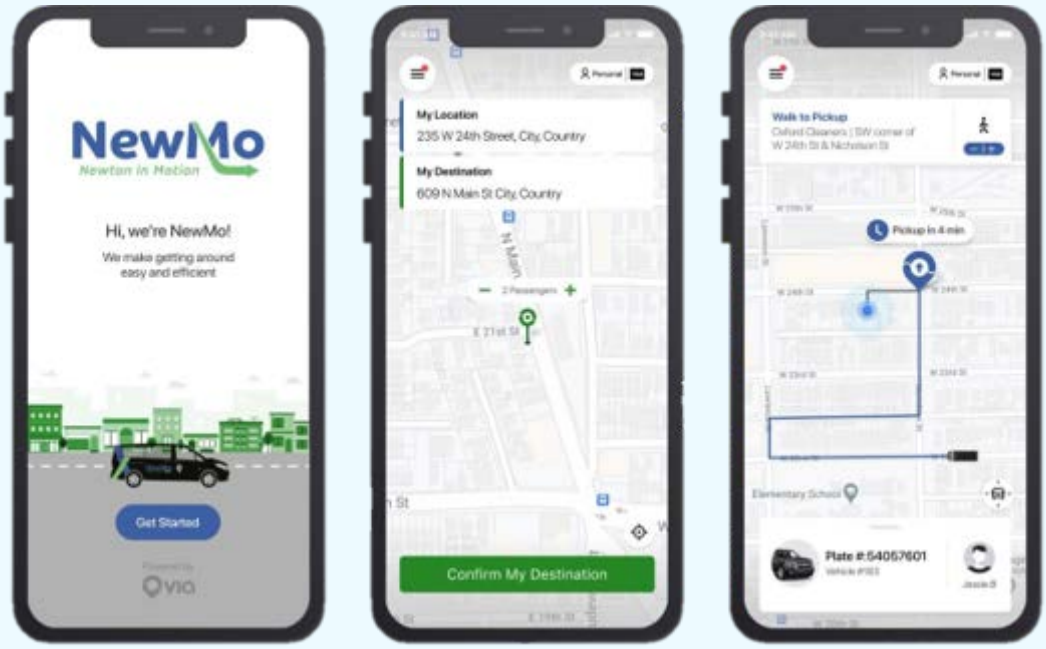
7. Case Studies

Microtransit services have become commonplace across the United States in recent years. This section describes two local case studies that may be relevant for the Town of Needham.

7.1 NewMo (Newton, MA)

NewMo is a contracted microtransit service managed and funded by the City of Newton. Passengers can travel anywhere within the City of Newton. Unlike Catch Connect, NewMo provides corner-to-corner service for most passengers, meaning a customer is required to walk a short distance to meet the vehicle. Fares are $4 per trip for most passengers and trips can be booked from Monday to Friday between 7 AM and 6:30 PM. Trips must be booked at the time of travel (no advanced bookings). Wheelchair-accessible vehicles are available upon request. NewMo offers several additional services for seniors.

Figure 27. NewMo Microtransit Smartphone Application.



The most popular travel destinations on the NewMo service are Newton North and Newton South High Schools, which represent over 10% of the demand for the service. About 8% of rides are to or from shopping or grocery areas. About 4% of rides are to or from the various colleges and universities in Newton. Less than 5% of rides are to the commuter rail or T stops.

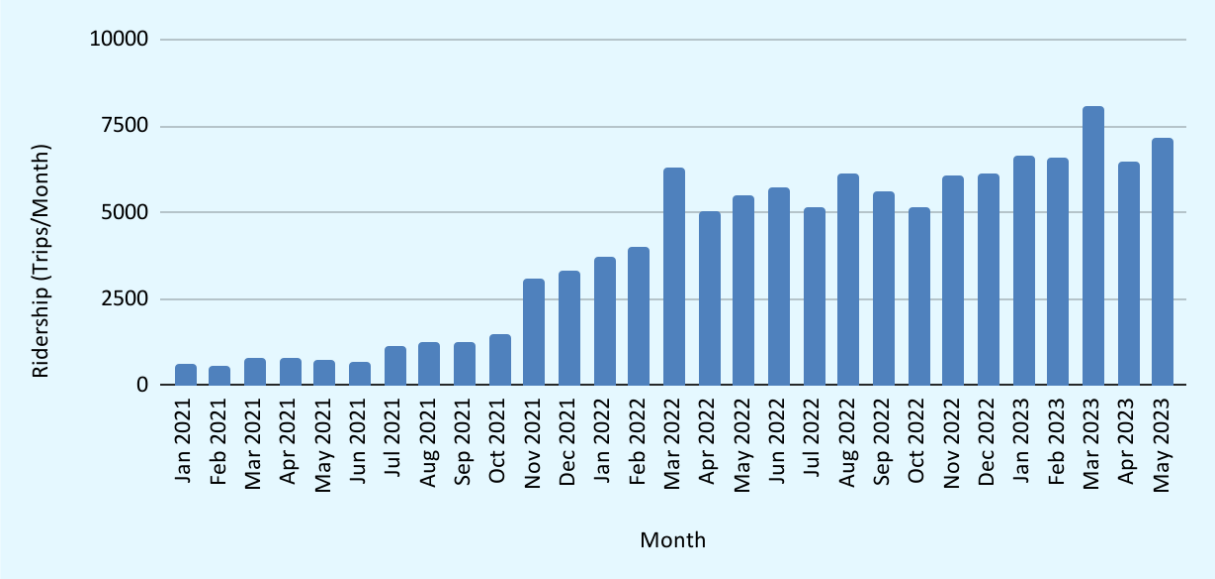
For passengers aged 60 or older, the service has several modifications:

- Discounted fares ($3 instead of $4)
- Curb-to-curb service (instead of corner-to-corner)
- Weekend service from 9 AM to 12 PM
- Pre-booking ride options, especially useful for medical appointments

The service covers the entire town of Newton which has a population of about 90,000 and about 45,000 jobs. Based on data from the last year, the service completes on average 275 daily trips and 1,400 weekly trips. The average wait time for a trip is 25 minutes and the average trip duration is 14 minutes or 3.6 miles. On average, passengers walk 240 feet to meet a vehicle. Compared to the Needham microtransit alternative, the trip durations are quite similar, however, the estimated wait times for Needham are less for both quality-of-service scenarios.

The service initially started as a seniors-only service, in the fall of 2021, the service was opened to all residents, and ridership grew significantly.

Figure 28. NewMo Microtransit Monthly Ridership.



The service is operated with an average of 8 minivans, with up to 9 during peak hours. The average productivity during weekdays is 3.2 passengers per vehicle hour. The NewMo service requires more vehicles than the microtransit alternative evaluated for this study because there are more rides than is expected in Needham due to the larger population and workforce. However, the productivity is similar to what would be expected in Needham at the medium demand level for both quality of service alternatives. Passengers have the option to book rides in advance and approximately 7% of rides are pre-booked.

NewMo is partially funded by the Boston Region Metropolitan Planning Organization, through its Community Connections grant program.

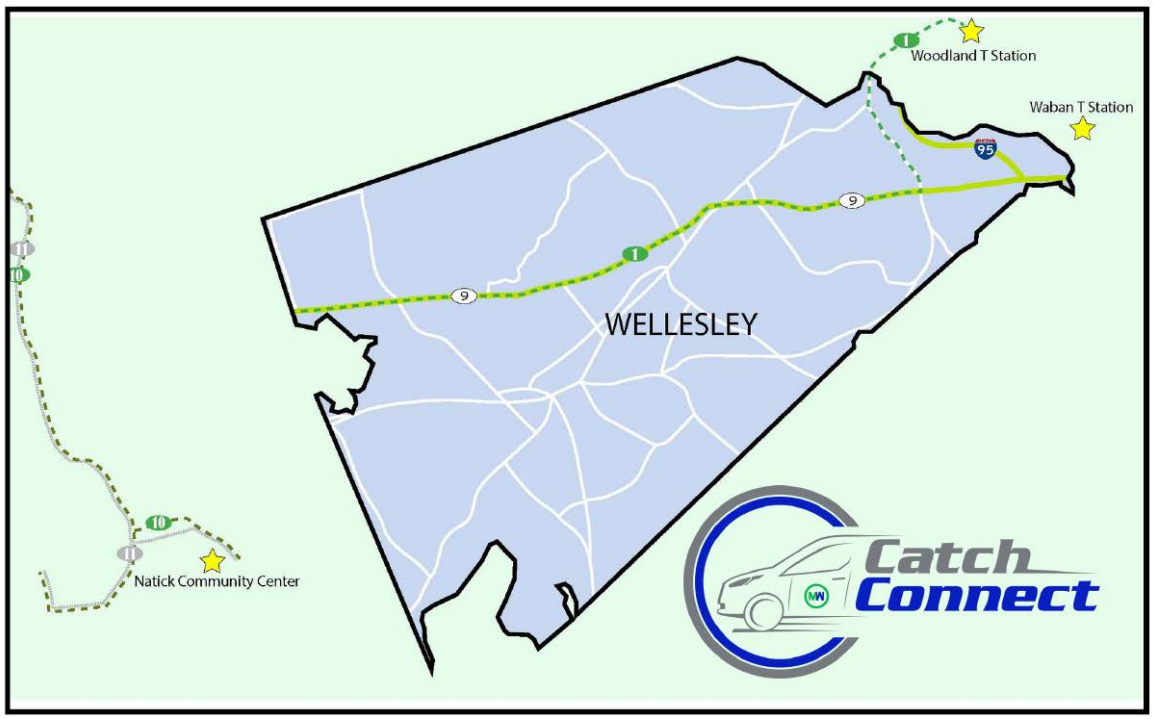
7.2 Wellesley Catch Connect

Wellesley Catch Connect is a microtransit system operated by MetroWest Regional Transit Authority (MWRTA). Catch Connect launched in February 2021 and services any address within the Town of Wellesley, as well as the following destinations outside the Town:

- Newton Wellesley Hospital
- Natick Community Center
- Woodland MBTA Station
- Waban MBTA Station.

The service provides curb-to-curb trips from 6:45 AM - 6:45 PM, Monday to Friday. Fares are currently $2.00 per trip and can be paid using a credit or debit card. All Catch Connect vehicles are fully accessible, and drivers are trained in customer service and ADA requirements. Passengers can book using a smartphone application, or by calling a dispatcher. Only on-demand bookings are accepted, meaning a passenger cannot reserve a trip in advance. Wait times are less than 30 minutes, which is comparable to the maximum wait time at the 'Standard' Quality of Service level for the Needham microtransit alternative. No Catch Connect ridership data was obtained as part of this study.

Figure 29. Map of the Wellesley Catch Connect service area.



8. Recommendations For Implementation

The following section outlines the next steps and recommendations for successful implementation should the Town decide to move forward with any new transportation alternatives outlined above.

8.1 Operating Model

In order to implement new or expanded transit services, there needs to be a managing entity responsible for the service. While the MBTA is responsible for Route 59 in Needham and the 128 Business Council also manages a separate commuter shuttle, this study assumes that the managing entity for new transportation services will be the Town of Needham.

If the Town decides to implement a new transportation service, an operating model must be selected. The two most common operating models for public transportation services are a directly-operated service and a vendor-operated turnkey model, also known as Transportation as a Service (TaaS).

- **Direct Operations Model.** Also known as agency-operated, the Town would directly operate the transit services in this model, including hiring and managing staff and drivers and procuring vehicles. If a microtransit alternative is selected, they must also procure a software platform to manage the requests and routing (see section 8.2.1 Procurement and pre-launch tasks). The biggest advantage of a directly operated service is that the town maintains the most control over the day-to-day operations. However, for managing entities new to transportation operations, directly operating services will require more initial investment and time to set up processes needed to run a transportation service effectively.

- **Turnkey purchased transportation (vendor-operated).** In this model, the town would be the managing entity that contracts with a third-party vendor who will provide the operations and drivers. If a microtransit service is implemented, this vendor will also be responsible for the microtransit software platform. Turnkey services are typically easier to scale up quickly than agency-operated alternatives, as third-party vendors can flex vehicle supply or extend operating hours more easily than transit agencies. Disadvantages of using a turnkey model include reliance on a vendor for all aspects of service delivery and less direct agency control over operational decisions (potentially including vehicle make/model, driver recruitment and pay, and maintenance). However, a well-designed contract can address many of these concerns. A turnkey model is specifically recommended for managing entities that are new or do not already have the capacity, staff, vehicles, and other capital assets required to operate transit services.

These models can be considered two ends of an operating model spectrum, and while they are the most common, the Town may choose something different with aspects of each of these models.

For example, Needham could procure operations (vehicles and drivers) and software separately from two third-party vendors or proceed with an almost fully turnkey model but purchase and own the vehicles.

8.2 Funding Opportunities

A common challenge municipalities face when launching new transit services is identifying and securing sustainable funding for initial capital and ongoing operating costs. One of the first steps in implementing any of the alternatives will be determining how the service will be funded. Potential funding sources for public transportation can be divided into the following categories:

Federal Competitive Grants and Formula Funding

- **Section 5399(c) Low or No Emissions Vehicle Program (Low-No):** Should the town decide to directly operate transit services, or own the vehicles for a new service, the FTA Low or No Emission competitive program provides funding to state and local governmental authorities for the purchase or lease of zero-emission and low-emission transit buses as well as acquisition, construction, and leasing of required supporting facilities. Eligible applicants include direct or designated recipients of FTA grants, states, and local governmental authorities. Entities must create a Zero-Emissions Fleet Transition Plan in order to apply for Low-No funding. The program requires a 20% local match.

- **Bus and Bus Facilities Program (Section 5339):** Administered by FTA, this discretionary grant program provides capital funding to agencies and cities who are looking to purchase new public transit vehicles, replace vehicles, or build or upgrade transit facilities. Eligible applicants include transit agencies, and state or local governments that operate fixed-route bus service. Applicants should consider how their projects will improve access and mobility, particularly for underserved communities, and improve system conditions. Grant applications open up annually, typically in the spring, and require a 20% local match. The town would only be eligible for this program if they choose to implement a fixed-route alternative and after they operate the route for at least a year.

- **Enhancing Mobility Innovation (EMI):** Funded by the Federal Transit Administration and formerly known as the Accelerating Innovative Mobility (AIM) Program, Integrated Mobility Innovation (IMI) Program, and Mobility on Demand Sandbox (MOD) program, this competitive grant program funds forward-thinking approaches that improve transit financing, planning, system design, and service. Eligible activities include all activities leading to the development and testing of innovative mobility, such as planning and developing business models, obtaining equipment and service, acquiring or developing software and hardware interfaces to implement the project, operating or implementing the new service model, and evaluating project results. For Example, in 2022, Richmond, CA, was awarded a grant from the FTA's Enhancing Mobility Innovation (EMI) grant program to launch a commingled microtransit and paratransit service. There is a 20% local match requirement.

- **Carbon Reduction Program:** USDOT will distribute roughly $6.4 billion over the next five years to states and MPOs to reduce carbon emissions in the transportation sector. The USDOT has allocated a little more than $18M to MassDOT this year alone (MassDOT should expect a similar amount annually). Some of this funding will be allocated through MassDOT and the Boston Region MPO. This funding can be allocated towards any project that will reduce emissions by helping users take transit; this includes microtransit and fixed-route buses. Both capital and operating costs are eligible for the carbon reduction program, and a 20% local match is required.

- **Advanced Transportation Technologies & Innovative Mobility Deployment (ATTIMD):** Administered by the Federal Highway Administration and formerly known as the Advanced Transportation & Congestion Management Technologies Deployment (ATCMTD), this program provides competitive grants for the development of model deployment sites for large-scale installation and operation of advanced transportation technologies to improve safety, efficiency, system performance, and infrastructure return on investment. Grant recipients may use funds under this program to deploy advanced transportation and congestion management technologies, including microtransit and fixed-route or multimodal services. As of 2022, $60 million of ATCMTD funding is available annually. This program has a 20% local match requirement.

- **Congestion Relief Program:** The congestion relief program is a competitive federal grant aiming to advance innovative, integrated, and multimodal solutions to congestion relief in large metro areas. Both microtransit and fixed-route solutions would be eligible, especially if the services promoted a modal shift away from driving private vehicles. Funding through the congestion relief program requires a 20% local match, and grants will be at least 10 million dollars.

- **Congestion Mitigation and Air Quality Improvement Program (CMAQ):** The CMAQ grant program is administered by the Federal Highway Administration to support projects and programs that work to improve air quality and maintain or attain the requirements set forth by the Clean Air Act. In Massachusetts, the Boston Region MPO funds the Community Connections program (see more information below) with their federal CMAQ allocation. For FY23, the state was allocated about 70 million dollars.

- **Congressional Earmarks:** U.S. Senators and Members of Congress are increasingly using the recently revived congressional earmark process to advance promising transportation projects in their communities, including microtransit. A Community Project Funding (previously referred to as an earmark) is a funding provision inserted into an appropriations bill in Congress that directs funds to a designated recipient for a specific project. For example, during FY 2023, 37 Members of Congress and 38 Senators submitted earmark requests to the House/Senate Appropriations Committees. In both chambers, more than

half of earmark requests ultimately received funding. The Salem Skipper Microtransit service was recently awarded over $2 million in congressional earmarks to expand into nearby cities.

State Competitive Grants

- **Community Connections Funding Program:** This program is issued by the Boston Region MPO to municipalities and regional transit authorities. The program allocates about 2 million in yearly funding for projects between $50,000 and $500,000. Both capital and operating costs for transportation programs are eligible, and a 20% local match is required. The MPO uses CMAQ funding to finance the Community Connections program, so projects related to improving air quality are specifically relevant, however, MPO has stated that the program is aimed at supporting local transportation and improving TransitTech. The NewMo Microtransit service in Newton is partially funded through this program. Watertown has recently been awarded over a million dollars in funds for a local shuttle service expansion.

- **Community Transit Grant Program:** Administered by MassDOT, this annual program provides funding to meet local or regional unmet transportation needs. Both microtransit and fixed-route buses would be eligible for funding. A 20% local match is required for capital expenses, and a 50% local match is required for operating expenses. Recently, the Town of Ware and the Quaboag Valley Community Development Corporation (QVCDC) were granted funding for a rural demand-response service, the Quaboag Connector.

Local Funding

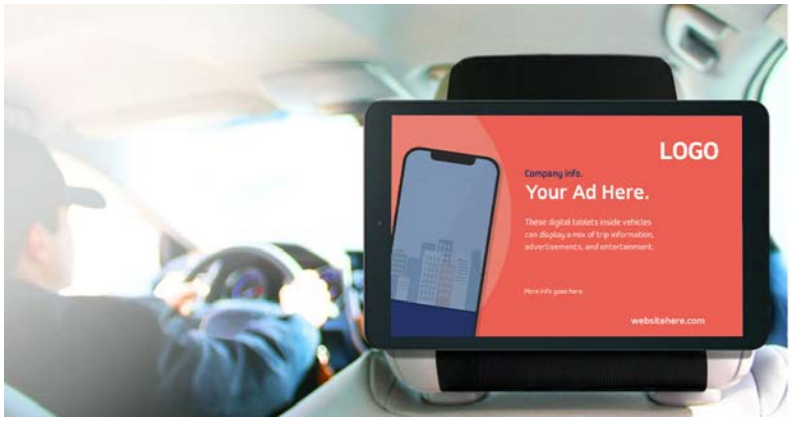
- **Ballot measures:** Transit ballot initiatives provide opportunities for local communities to raise dedicated funding for transportation through voter-approved property tax increases. In 2019, over $8B in new transit funding was approved in elections across 80 ballot measures, and in 2020 voters approved 13 out of 15 transit initiatives providing $38B in transit funding. Local funding in other parts of the United States has also come from fees, such as for parking, vehicle registration (up to $5 per vehicle), vehicle leasing, rental, and mortgage recording fees.

- **Local Partnerships:** The town could also partner with key stakeholders in the region to fund or partially fund transportation services. For example, community organizations and nonprofits that believe funding transit services furthers their mission and help the communities they work in may choose to help fund services. Schools and universities such as Olin College may be willing to contribute funding to a new transportation service if it increases access for students and employees, meets climate goals and/or addresses excessive parking expenses. Similarly, assisted-living facilities may choose to support local

public transit initiatives in order to help get their residents to medical appointments or stores in a more cost-effective manner. Like educational providers, healthcare providers may be interested in funding a new transportation service if it helps get patients and employees to their facilities. And similarly, private employers (many of which already provide transportation services for their employees) may be interested in supporting the services if it improves accessibility for their current employees or helps them attract new workers. These partners can contribute funding in various ways, including lump-sum annual contributions, direct reimbursements for specific trips, or by purchasing transportation passes for particular groups.

- **Fares:** While transit fares rarely cover the entire operating costs of a service, even low fares can reduce the subsidy required to operate a service. For example, if the Needham Bus Route alternative is implemented and fares of $2 are charged, about 7% of the operating costs could be covered by medium ridership demand estimates.

- **Advertising:** Additional revenue can be obtained by selling advertising space. These ads can be on the outside of vehicles, either as wraps or rooftop digital screens, on in-vehicle screens, or in the microtransit app itself. Other services have generated funding through naming rights and sponsorships. The contribution of advertising will depend on the type of branding and the number of interested companies.



8.3 Launch Planning

After the preliminary service design process is complete and funding is secured, there are several steps the Town must take before launching a new service. This process can be divided into three phases. During the first phase, the pre-launch process, the operator must procure any technology or vehicles necessary for the service and finalize the service design. After this, the operator can proceed with the launch preparations, including training drivers and dispatchers, educating the public, and marketing the new or adjusted service. Once a service has been launched, it is recommended that the service be continually evaluated against a set of predetermined Key Performance Indicators (KPIs). As noted below, some of these steps only apply if Needham chooses to directly operate the service, in many cases the third party vendor will be responsible for these tasks (with oversight from the Town).

8.3.1 Procurement and pre-launch tasks

The time taken to launch a new or adjusted transit service will vary depending on the alternative selected. For example, if a microtransit service is selected, we advise budgeting between 6 and 12 months from publishing the procurement for any required service through to launch day. If the town chooses to directly operate services and new vehicles are needed, vehicle procurement timelines are likely to be one of the critical factors for determining the time to launch the service. If a fixed-route alternative is selected, additional time for capital investments like new bus stops, may also lengthen the launch process.

Acquiring Vehicles. The results in section 6.3 Modeling Analysis and Recommendations outline the estimated number of vehicles needed to serve each alternative during peak hours. The operator should also maintain spare vehicles in its fleet—at least 15% more vehicles than the minimum fleet size needed during peak hours (or a minimum of one spare vehicle if the fleet size is less than 6 vehicles). These additional vehicles may be necessary to cover shift changes or fill in for vehicles that are out for regularly scheduled cleaning or maintenance. Having spare vehicles available also ensures consistent and reliable service in case of a vehicle malfunction or if an incident occurs that requires long-term repairs.

To reduce carbon emissions, the Town could provide transportation services with electric vehicles (EVs). However, there are limited options for electric vehicles of the size being considered for the transit alternatives in this study. As of 2023, most larger EVs are retrofitted vehicles produced by companies like Lightning Motors and GreenPower Motor Company. For example, a retrofitted Ford Transit with 14 seats, a driving range of up to 140 miles (80 kWh battery capacity) and fast charging capabilities is one option. The EV Star is a wheelchair-accessible option that fits 12 passengers including 2 wheelchair spaces. The EV Star has a range of up to 150 miles (118 kWh battery capacity). The limited range of these options may result in needing additional vehicles than the estimates provided in 6.3 Modeling Analysis and Recommendations. For the microtransit alternatives, it is possible to operate using electric sedans such as a Tesla, however, they are not

wheelchair accessible and have a smaller capacity than was estimated for the services. It is also possible to choose a mixed fleet, with some EVs and some non-electric vehicles.

Procuring Software. If a microtransit alternative is selected for implementation, it will be necessary to procure either a software solution for the Town's microtransit operations or a turnkey software plus operations package. For microtransit software, the following capabilities are recommended at a minimum:

- Dynamic vehicle routing and passenger aggregation (shared rides)
- Customer mobile application (available for iOS and Android) providing trip booking and providing real-time estimated time for pickups and arrivals and other trip updates
- Driver mobile application for real-time transmission of routing and trip information
- Ability for administrators/schedulers to book trips on behalf of customers (so customers can book trips over the phone)
- Ongoing technical, operational, and marketing support

Microtransit software contracts are typically subscription-based, priced either by vehicle hour or by the number of vehicles used in a service per month. In other cases, charging is done on a per-passenger or per-trip basis. In some cases, per-unit costs may be lower for larger services as there can be sharing of overhead items like app maintenance.

Finalize fare structure. The fares for any new transportation services should be comparable to the prices of nearby services. Most microtransit services charge less than $5 per ride. Fixed-route buses are usually less than $3 per ride. The MBTA charges $1.70 for local bus rides and $2.40 for subways. In general, fares can be set as flat rates per trip or charged by distance or journey length. Fares can also be set as a combination of the two types. For example, a base fare of $2 plus an additional $0.50 for every mile could be charged. Fares should be affordable for residents and offering reduced fares for vulnerable populations like seniors, people with disabilities and low-income groups can ensure the accessibility of the service. Some transit services are moving toward fare-free models, which can eliminate a barrier to using the service and encourage higher ridership. While it is not recommended to charge fares that mirror the actual cost of a service, fares can still contribute to the economic viability of a service. Farebox recovery ratios measure how much of the total operating expenses are covered by fares. Depending on the alternative chosen and the level of ridership, with fares of $3, the service could achieve a farebox recovery ratio of up to 15%.

Finalize service setup. These steps vary depending on the model being implemented and the capital assets required:

- **Microtransit**: Once a software platform is procured, the agency should work with the vendor to finalize the service design. This includes finalizing the zone boundaries, trip restrictions, target quality of service metrics, and service hours. All possible pickup and

dropoff locations to which the platform can assign trips should be safe places for vehicles to stop. The contractor may be responsible for some of these tasks if a turnkey approach is chosen.

- **Fixed-Route Bus:** Before implementing a bus route alternative, the operator will need to validate trip times, confirm the exact routing and schedule, and finalize the timed stop locations. Some infrastructure, such as signage, seating, and curb cutouts, may be required at high-ridership stops.

8.3.2 Launch Preparation

Once the procurement process is complete, the Town can prepare to launch the new transportation service.

Driver Training. If Needham proceeds with an operating model where the Town will hire drivers to deliver service, drivers will need to be trained in advance of the launch. For a microtransit service, this includes how to use the software platform, best practices for service delivery, and best practices for customer service. For the fixed-route buses, drivers should also be trained on their route and schedule. If a turnkey model is chosen, the procured service operator will be responsible for hiring and training drivers.

Administrator Training. Administrative staff (including dispatchers, schedulers, and customer service representatives) will need to be trained. Depending on the Town's selected operating model and transportation mode, administrative requirements may include supervision of live service and responding to issues when needed, booking trips for customers making reservations over the phone (for microtransit).

Marketing and Rider Education. Marketing and community engagement are important steps to inform the public about the new service, particularly when new services and modes are being introduced. Many potential customers will be unfamiliar with public transit and will need to learn how to book rides or use the service. The Town can do this in various ways, including creating a dedicated website for the service, developing informational videos, sharing information on social media channels, and meeting with local community organizations. Please find additional information in 8.3.2 Marketing Transit Services.

8.2.3 Post-Launch

After a service has been launched, consistent monitoring and additional community engagement activities can be used to inform necessary changes to the system. Service design adjustments can also be made to encourage further growth of the service. Suggested indicators to monitor include:

- **Ridership:** A successful service must attract riders. If ridership is high, this indicates that the service is providing a useful form of mobility for residents and commuters. Ridership

can be benchmarked to the demand estimates in section 6.2 Modeling Methodology and Ridership Estimates. It can take up to a year for ridership levels to mature and for ridership growth rates to slow down.

- **Efficiency:** To ensure the transit service delivers a good value for its investment, the Town can set targets for the efficiency of the service. For example, passengers per vehicle hour (also known as productivity or utilization) and the average cost per passenger ride are both measures of efficiency.

- **Quality of service:** The performance of a service can impact ridership. For a fixed-route bus, this can be measured by on-time performance of the service, for the microtransit service, the Town can look at the average wait time for a ride or the average trip duration.

8.4 Community Engagement and Marketing

We recommend that the town conduct parallel community engagement and marketing activities to ensure the success of new transportation services.

8.3.1 Community Engagement

The ability to move conveniently and affordably between homes, work, school, childcare, and healthcare is central to a community's ability to thrive. The transit systems that enable this movement play such a crucial role in people's everyday lives, and any changes to these systems — even positive ones — can naturally be a source of apprehension. A high-touch and proactive approach to community engagement not only helps mitigate concerns, but can turn those in the community who could potentially be opponents of change into advocates. When launching a transit service, support from the community is essential, both to ensure a smooth launch and to set the service up for continued success and growth.

Pre-Launch. Community engagement should begin several months before launch, giving the Town time to incorporate feedback from stakeholders, and potentially to adjust service design. Starting community engagement early in the launch process also helps preempt passenger and stakeholder concerns through thorough education about service offerings. Engagement can build off the survey and stakeholder outreach that was conducted as part of this study. To continue this process:

1. Identify subcommunities that may be sensitive to service changes, or might require personalized outreach in order to adapt service. Examples of communities that should play a central role in community engagement efforts are included in Table 12.

Table 12. Groups and stakeholders for targeted engagement.

Customers with High Barriers to Entry	Stakeholder Groups Sensitive to New Services or Service Changes
Seniors	Employee unions
Non-native English Speakers	Rider advocacy groups
Unbanked individuals, or those who prefer cash	Elected Officials
Those without cellphones	Civic and business leaders
Customers with disabilities	Major local employers

Once key stakeholders have been identified, steps can be taken to preemptively address their concerns. For example, if accessibility is an expected concern, educate customers about the wheelchair-accessible vehicles.

2. Develop materials that engage with likely responses to the new service to proactively answer questions. These materials can include pamphlets, mailers, videos, or physical or digital advertisements. The materials should explain the mechanics of the new service, service zone/routes, how to book a ride (if applicable), and fares and payment options. Be sure to address how passengers in high-barrier groups will be able to access the service such as including information around phone booking, voucher payment, and accessibility features.

3. Speak with advocacy groups, elected officials, civic and business leaders, and major local employers as part of the broader community outreach.

Launch. Leading up to the launch of new transit service, the Town can continue its community engagement strategy through three channels:

- **Stakeholder Organizations.** As the Town approaches launch and finalizes key service parameters, it should re-engage previously-contacted organizations to enlist their help in publicizing key information about the service. Helpful organizations may include libraries, health centers, care facilities, civic groups, and social services organizations. These organizations can help create informational materials that are relevant to the audiences they serve and can help distribute these materials.

- **Customers with high barriers to entry.** The operator can build a list of users who are likely to have trouble accessing service and conduct phone calls to help them create accounts (if applicable), and alleviate any concerns they may have. This may be their first interaction

with public transit and can impact how much they promote the service to their peers, so it's important to keep the communication open and keep a detailed record of their feedback, both positive and negative.

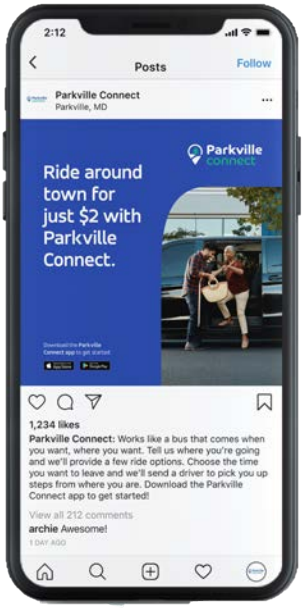
- **The public.** Needham should make information available to the general public by posting information about service changes as early as possible and in as many places as possible. We recommend posting physical signage (e.g., at local businesses and town buildings) to explain the new service, along with posting information digitally on local websites and social media.

Post Launch. After the service has been launched, community engagement activities can inform continuing improvements to the system. The town can re-engage stakeholder communities to see how service is going, and identify opportunities for improvement. Stakeholder organizations can also play a central role in continuing to promote service to their constituent communities.

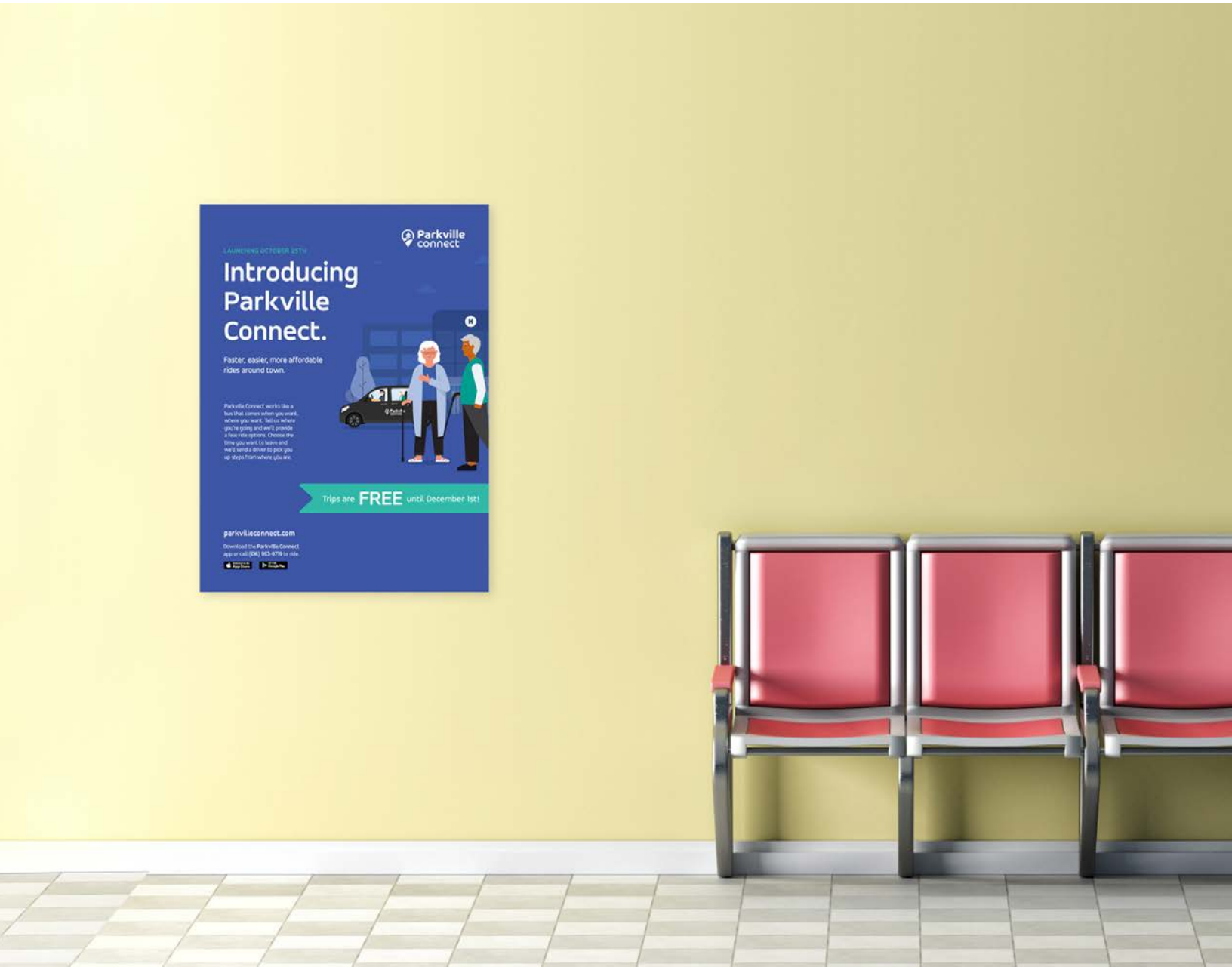
8.3.2 Marketing Transit Services

Marketing is an important step to ensure the public is aware of the new transit service, both to ensure existing transit customers are prepared for changes to service, and to attract new customers to the system. Creating sustained awareness of the microtransit service prior to launch is essential, and some of the following strategies may be useful:

- **Webpage.** Create a dedicated website for the service with key service information.
- **Press release.** Develop a pre-launch press release for distribution in local media.
- **How-to video.** Create a short informative video on how to use the service and share it on the service website and social media.
- **Targeted outreach.** Targeted emails or print and social media advertisements. Targeted outreach, including "how-to" instructions, may be particularly useful for seniors and at retirement communities. This is especially relevant for microtransit, as this will be a new transit mode for many.
- **Community announcements.** Announce the transit service in municipal communications, newsletters, and social groups.
- **Street marketing.** Placing wrapped (branded) vehicles in high foot traffic areas can increase awareness and encourage conversation about the service.
- **Promotional fare discounts or free rides.** Offer reduced or promotional fares for new users. Suggested promotions include:
    - First (or first 2) rides are free for new users.
    - Refer a new customer, and both parties get a free ride.
    - A friend rides with a paying customer for free.



- Discounted fares during off-peak periods.
- Subscriptions such as flat fares for unlimited rides during a certain period (1 day, 1 week, or 1 month).
- Discounted fares for frequent users, such as getting the 10th ride for free after 9 rides.



The Town can conduct marketing activities in phases to ensure success at each phase of the service's lifecycle, this is detailed in Table 13.

Table 13. Marketing activities timeline.

	Pre-launch	Months 1-3	Months 4+
Focus	Establish marketing channels and develop materials	Promote service visibility and attract first-time riders	Continue attracting customers and retain customers with engagement promotions
Activities	• Design marketing materials • Begin pre-launch awareness: social media, local press, and local government outlets	• Digital (social media) and physical ads (flyers, direct mail, bus station signage). • Press releases • Events and direct public engagement	• Rider surveys and focus groups • Referral campaigns • Promotion of discounted tickets and referral campaigns • Outreach to specific communities

8.5 Accessibility

Needham's transit system should prioritize accessibility to ensure all potential customers have access to the service, including passengers with disabilities, and those without smartphones and credit cards. We recommend the following accessibility measures:

For customers with limited mobility. For fixed-route bus service, all vehicles should be wheelchair accessible. For a microtransit service, the entire fleet does not need to be accessible. This is because wheelchair-accessible vehicles (WAVs) can be strategically deployed for passengers who require them. If a mixed accessibility fleet is acquired, the service should include at least 20% wheelchair-accessible vehicles (WAV). If the service only has 1-2 vehicles, all vehicles should be WAVs. About two to five percent of trips are expected to require an accessible vehicle. A fleet with 20% WAVs will ensure an equivalent quality of service can be offered for customers using wheelchairs, thus complying with ADA policies.

To make the microtransit booking process accessible to passengers with disabilities, the software platform should remember a passenger's need for a WAV and ensure that a WAV request is the default for their future bookings. It should then automatically assign those passengers to vehicles with an available wheelchair position. Some passengers may be unable to walk to meet a vehicle but do not require a WAV. In those cases, customers can be offered a curb-to-curb trip in any vehicle. It is important to decide who is eligible for curb-to-curb service. Some agencies choose to

have riders self-identify as having limited mobility when creating an account. Others choose a more formal process that may require a form or an interview.

Customers with hearing, vision, or cognitive impairments. For a microtransit service, passengers should be able to voluntarily indicate their disability status, either directly through the app or by notifying the customer service agent at the time of booking. This information can be used to modify the service to better adapt to their needs, whether it's through enabling curb-to-curb pick-up and drop-offs, concessionary pricing, or notification to the driver to provide additional assistance. Voiceover (reads the text on the screen aloud for those with visual impairments), adaptive font size, and Switch Control app capabilities can also make the request process easier for some riders. For a fixed-route bus, information can be provided in multiple formats, for example, with voice announcements and on screens with large font text.

Microtransit Booking. For a microtransit service, the public should have multiple options to request rides. In addition to the smartphone app for booking trips, offering phone booking options can ensure passengers without smartphones (or those who prefer not to use an app) can access the service. Dispatchers should be able to easily book on-demand microtransit rides for customers calling in. Those who do not book with a smartphone but have SMS capabilities (i.e., texting) should have the option to receive text updates about their rides.

Payment. Unbanked or underbanked passengers should be able to pay for services with several different options, which may include physical or digital vouchers (purchased in cash at community centers and other key locations), prepaid debit cards, or cash on board the vehicle.

Some agencies choose to have cashless services as cash payments can slow down the boarding process, introduce additional logistics around collecting cash from vehicles, and be more costly for the agency to collect. For riders that prefer paying with cash, there should be opportunities to purchase vouchers or passes at kiosks or key destinations such as recreation centers, libraries, or grocery stores.

Language. To ensure the service is accessible to non-English speakers, signs, public information, and microtransit apps can be made available in multiple languages. However, this may not be necessary as 95% of the residents in the study area speak English, so there is not likely to be significant demand for other languages. Using clear and universal symbols can also make it easier for non-native English speakers.

Appendix 1 - Survey Results

91% of the survey respondents live in Needham and 51% work in Needham. 13% of respondents both live and work in the town. Table 4 summarizes the demographic breakdown of survey respondents and how they compare to the demographics of Needham and the state.

Table A1. Survey Respondent Demographics

Metric	Survey Population	Needham[9]	Massachusetts[10]
Age			
Under 18	<1%	28%	20%
18 - 29	11%	8%	17%
30 - 64	59%	46%	47%
65+	31%	19%	17%
Gender[11]			
Female	65%	53%	51%
Male	34%	47%	49%
Non-binary/Other	<1%	n/a	n/a
Race Ethnicity			
White	91%	83%	80%
Asian	8%	9%	8%
Other non-white ethnicity	<5%	7%	12%
Hispanic/Latino			
Not of Hispanic/Latino origin	96%	96%	87%
Of Hispanic/Latino origin	4%	4%	13%
Employment Status			
Work or study full time	54%	49%	53%

[9] American Community Survey 5-year; 2017-2021, by Census Block Groups.
[10] U.S. Census, 2020, by State.
[11] The U.S. Census and American Community Surveys asks respondents to identify their sex not gender, a non-binary option or other is unavailable.

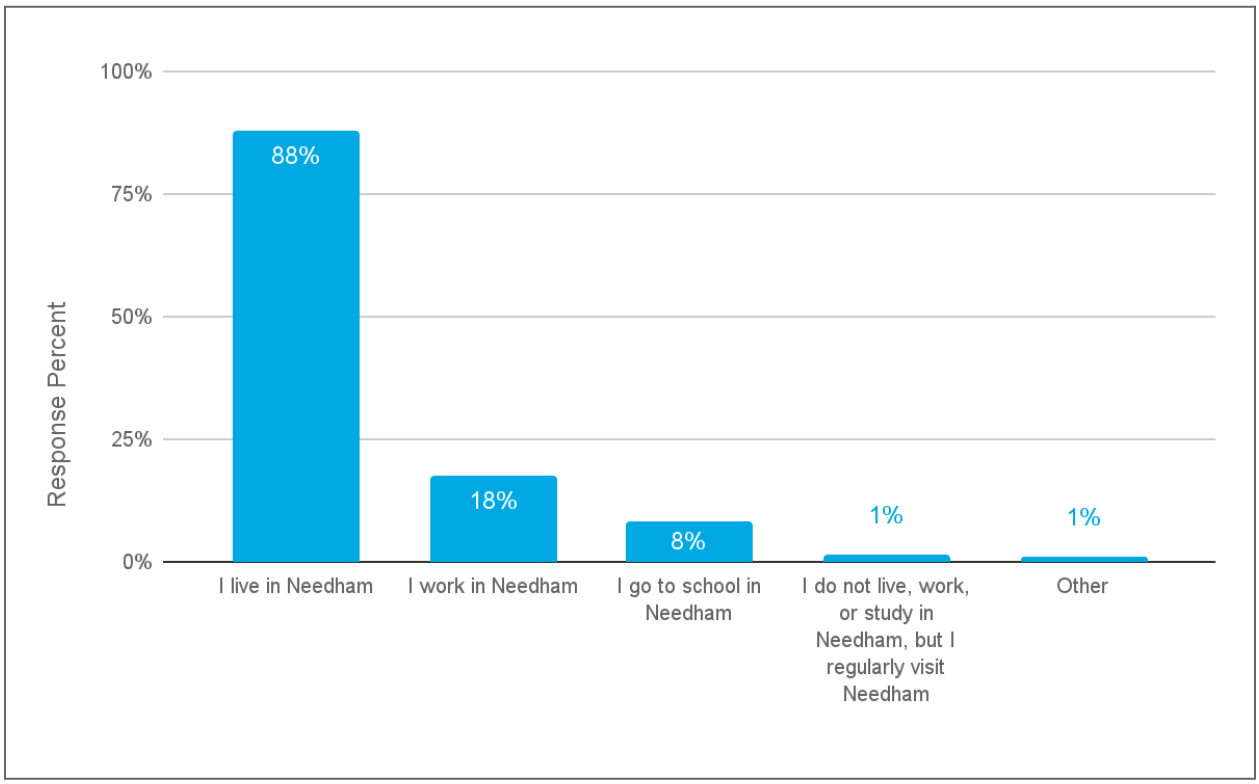
Work or study part time	12%	n/a	n/a
Retired	29%	n/a	n/a
Other	5%	n/a	n/a
Income			
Under $25,000	15%	18%	20%
$25,001 - $50,000	6%	10%	16%
$50,001 - $75,000	11%	7%	12%
$75,001 - $100,000	10%	6%	8%
$100,001 - $200,000	27%	32.6%	14%
Over $200,000.	32%		
Disability Status			
Has a disability	12%	6%	12%
Does not have a disability	88%	94%	88%
Access to personal Vehicle[12]			
Has access to a personal vehicle	82%	94%	88%
Does not have access to a personal vehicle	18%	6%	12%

[12] Respondents in the study's survey were asked about access to a personal vehicle, the American Community Survey and U.S. census asks about vehicle ownership at the household level.

The survey consisted of two main sections. The first asked questions related to current transportation behaviors and preferences. In the second section, respondents were asked questions about a hypothetical microtransit service in Needham. A summary of the survey questions and findings is outlined below.

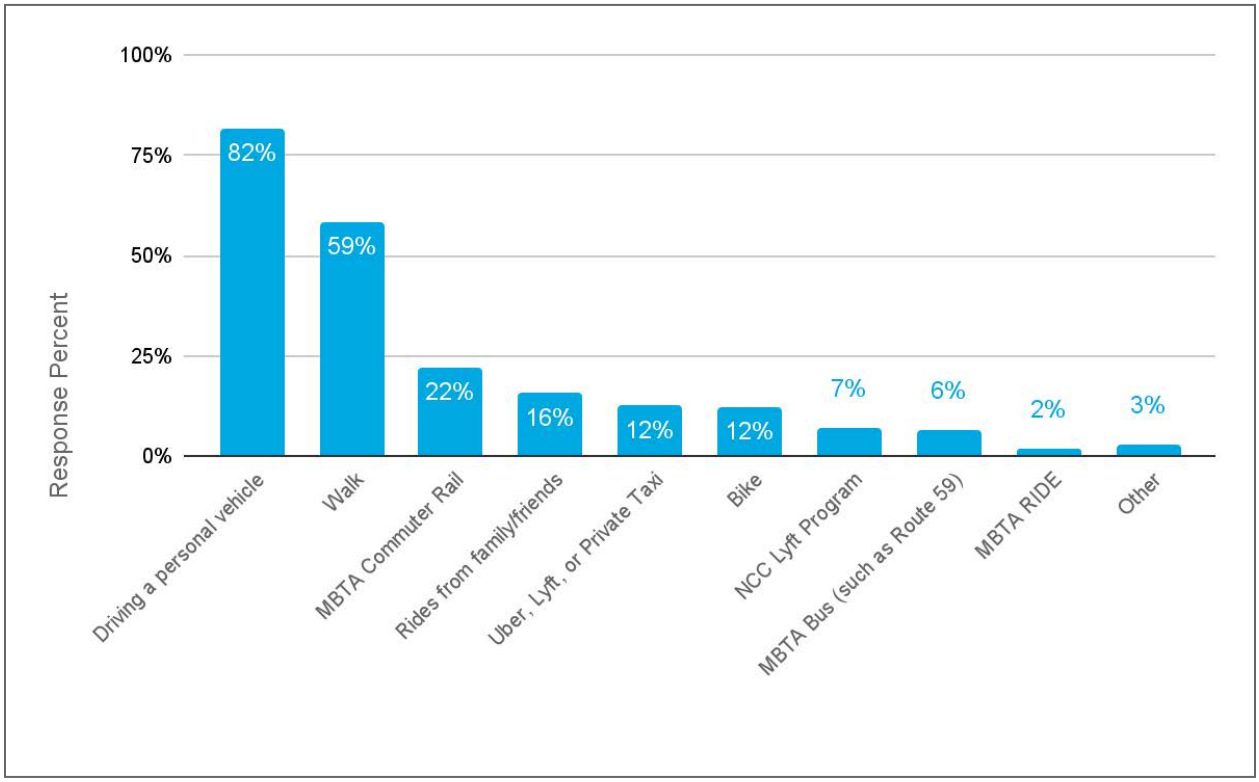
Relationship to the Town. Most respondents live in the Town of Needham (88%). Nearly one in five respondents work in Needham, and 8% go to school in Needham. This question indicates that the survey successfully targeted individuals with a relationship to Needham, with only 1% of respondents not living, working, or studying in the Town.

Figure A1. Question: Please select your relationship to the Town of Needham (select all that apply). Number of responses: 416.



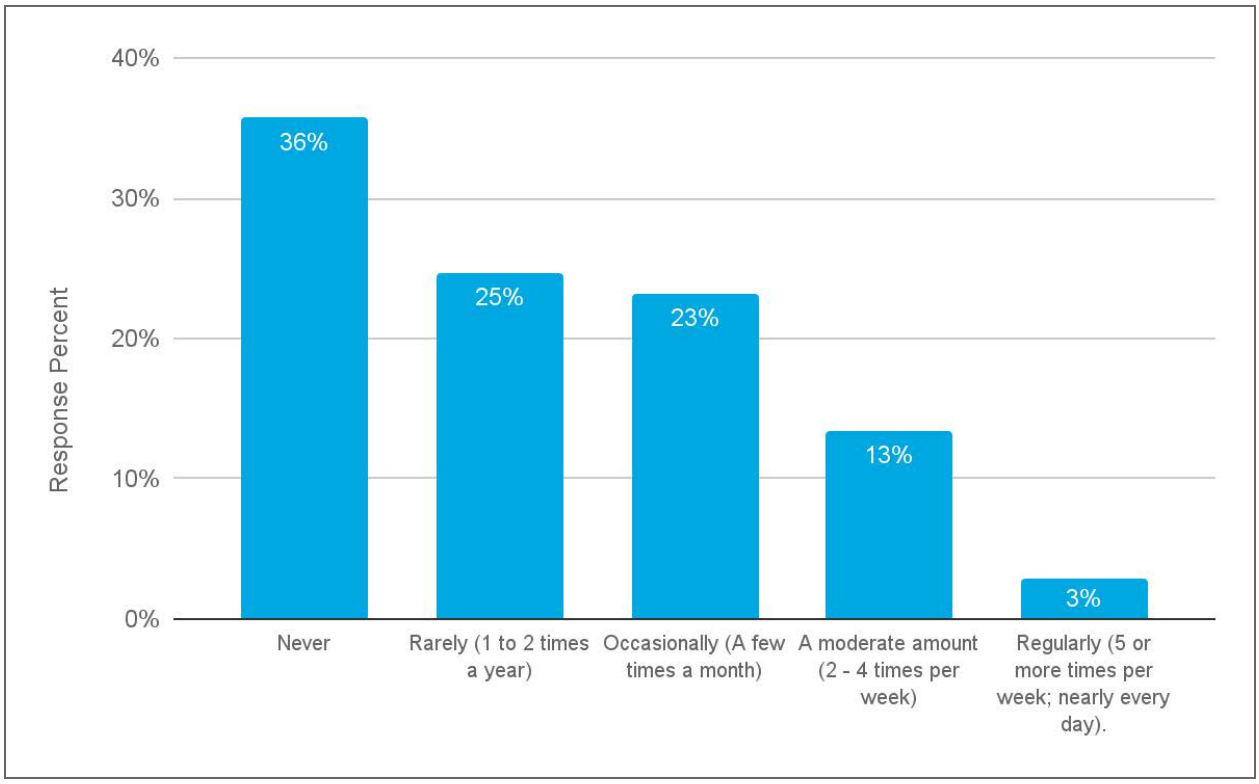
Primary Travel Mode. Most respondents primarily rely on their personal vehicle to travel within Needham (82%). Walking was the second most preferred mode (59%), followed by MBTA Commuter Rail (22%). As this question asked how people travel within Needham rather than to other communities, the Green Line was not featured (nor was it mentioned in the 'other' category by respondents.

Figure A2. Question: How do you primarily travel in Needham? (select up to 3 modes you use most). Number of responses: 417.



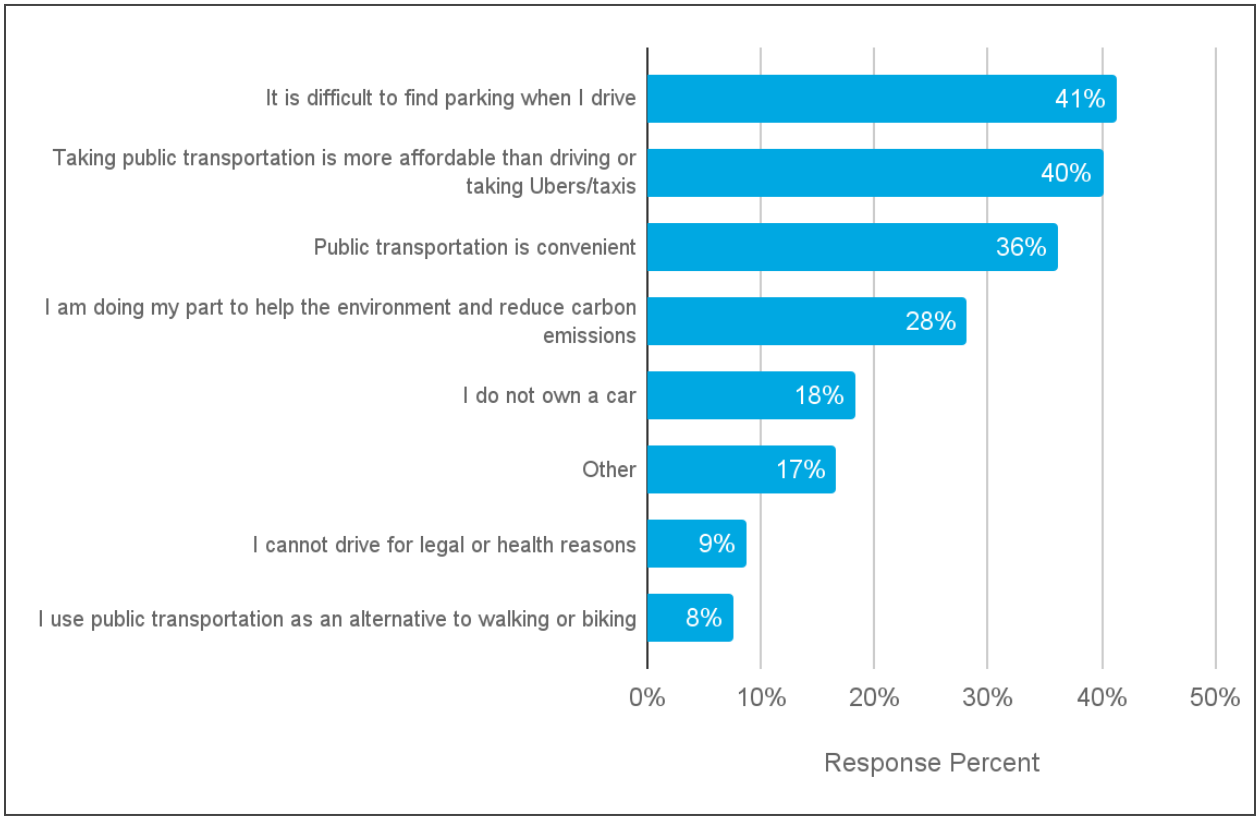
Frequency of Public Transit Use. Roughly one-third of the respondents never use public transit (36%). Slightly over one-third use public transit at least a few times per month or more frequently. This indicates that the survey captured responses from both frequent and infrequent public transit users.

Figure A3. Question: How often do you use public transportation in Needham? Number of responses: 417.



Reasons for using public transit. For those who use public transit, the most common reason for using it was that it is difficult to find parking (41%), followed by affordability (40%) and convenience (36%). This supports the finding that many public transportation users in Needham likely have access to a private vehicle but choose not to drive to avoid these challenges.

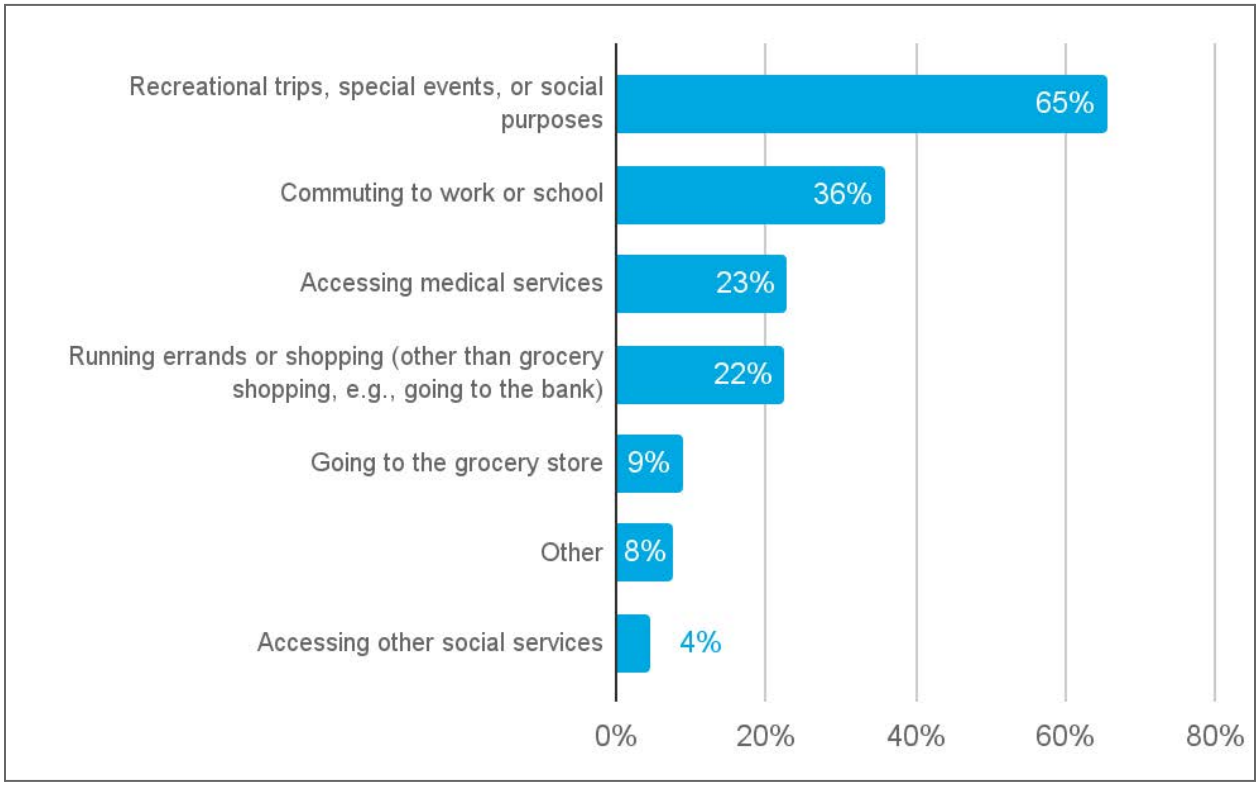
Figure A4. Question: What are the primary reasons you use public transportation? (select up to 3 reasons). Number of Responses: 252.



Many of the 17% of responses under "Other (please specify)" described the stress of driving and the ease of using public transportation, especially when traveling to locations in Boston.

Types of Public Transit Trips. The most common reason for public transit trips was recreational trips, special events, or social purposes (65%). As many respondents indicated using public transit occasionally, these trips may be to Boston due to the ease of accessing the city using MBTA Commuter Rail or the Green Line. Commuting to work or school was the second most common reason (36%), followed by accessing medical services (23%).

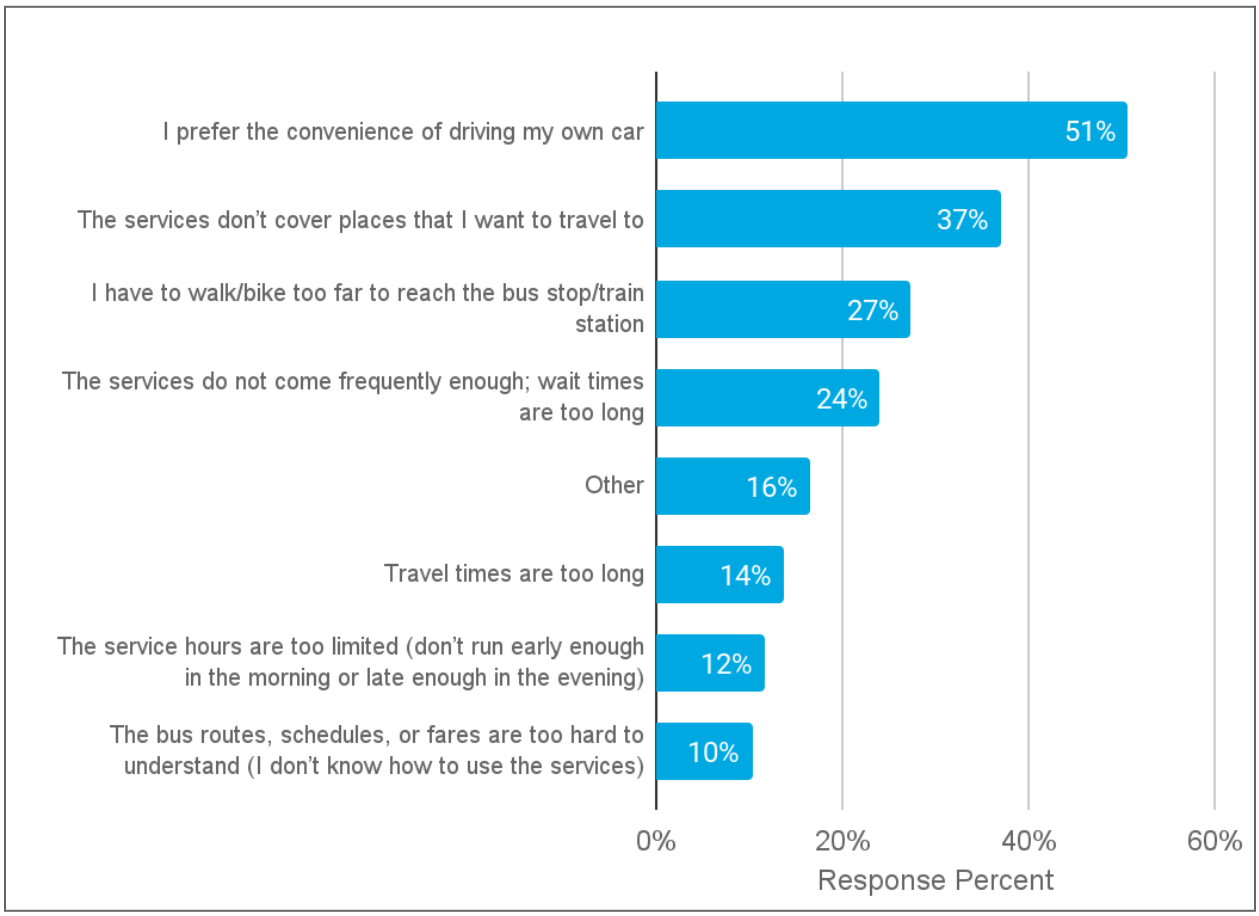
Figure A5. Question: What types of trips do you use public transportation for? (select all that apply). Number of responses: 249.



Many of the 8% of responses under "Other (please specify)" described various reasons for traveling to Boston. Many of these reasons were occasional trips and could be reclassified under recreational.

Reasons to not use public transit. The 36% of people who responded that they never use public transit in question 2 were prompted why. The most common reasons for not using public transit are that driving a personal vehicle is more convenient (51%), followed by public transit services not covering desired locations (37%), and the walk/bike to reach public transit is too far (27%). This indicates that while many individuals prefer to drive, many more may be willing to use public transit if it were easier to access services. This supports the hypothesis that the existing public transit does not sufficiently cover many areas within the Town of Needham.

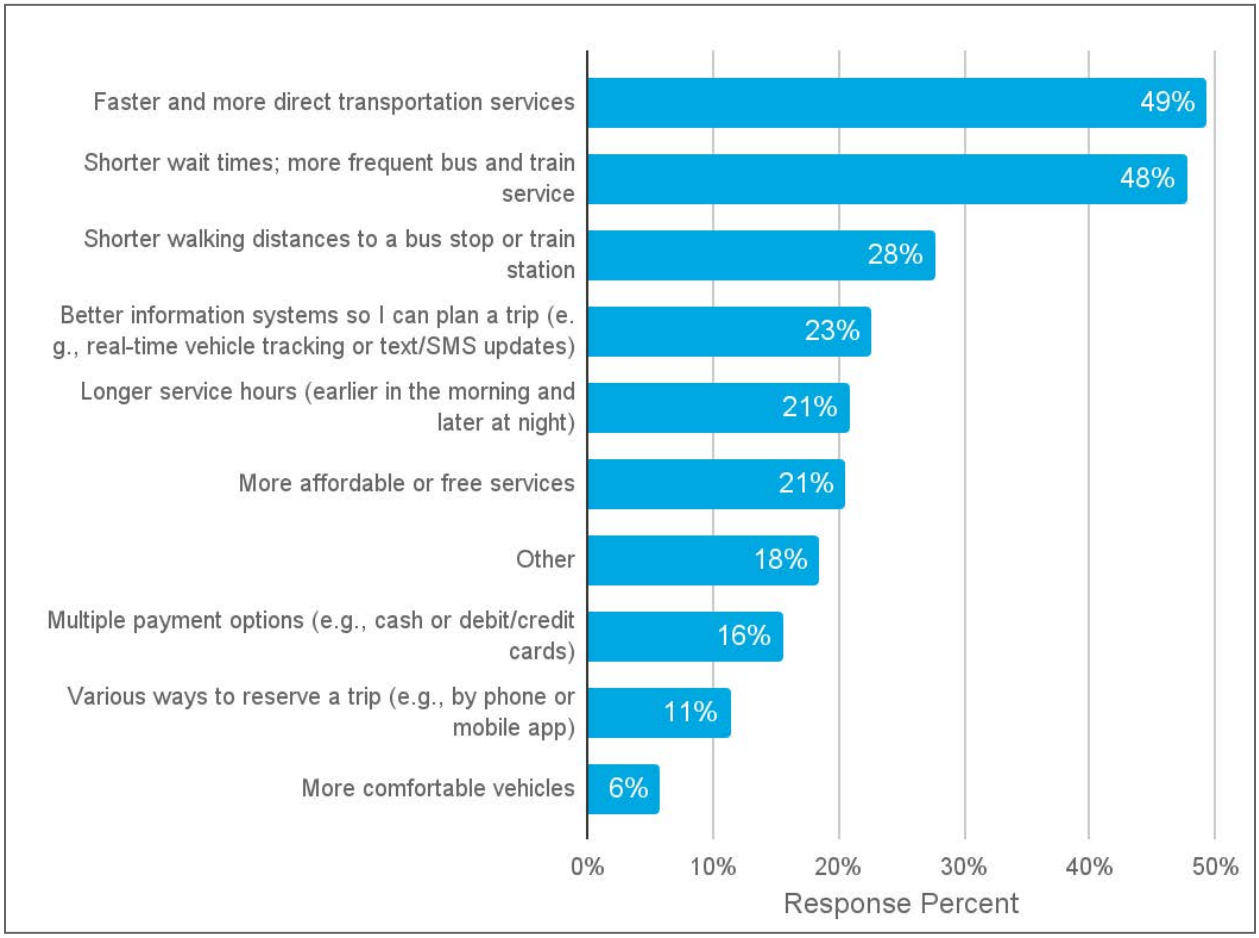
Figure A6. Question: What are the primary reasons you do not use public transportation? (select up to 3 reasons). Number of responses: 146.



Many of the 16% of responses under "Other (please specify)" mentioned challenges accessing existing public transit, either due to the location and distances to bus stops or accessibility of the service due to a disability.

Interventions to Encourage Public Transit Use. The most popular intervention to encourage public transit use would be faster and more direct service (49%), followed by shorter wait times and more frequent service (48%). The third most popular intervention is shorter walking distances to access bus or train routes (28%). These responses are common from 'choice' riders, meaning individuals who will use public transportation when it is fast, safe, and convenient. Given the relatively affluent population and high vehicle ownership rates, this indicates that high-quality public transit will be required if the Town is to encourage mode shift.

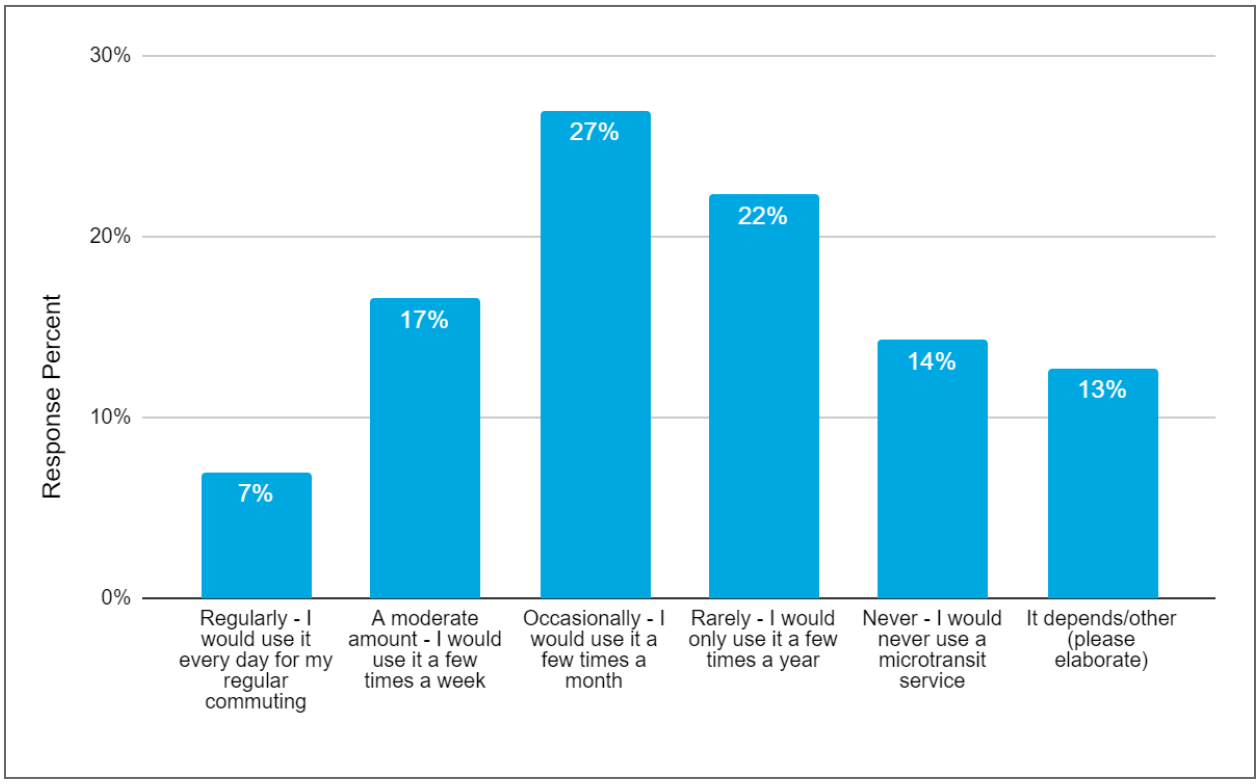
Figure A7. Question: Which of the following interventions would encourage you to use public transportation more often in Needham? (select up to 3 options). Number of responses: 146.



The 18% of responses under "Other (please specify)" mentioned a range of interventions, and several individuals stated they are not likely to use public transit even if improvements were implemented. Suggestions for improvements included better reliability, improved safety, reduced cost, more accessible parking at rail stations, and more bus routes.

Use of microtransit. Half of the respondents (51%) indicated they would use a microtransit service at least occasionally. Only 14% stated that they would not use the service at all. The willingness to use microtransit did not significantly vary by age, gender, disability, income level, or vehicle ownership status.

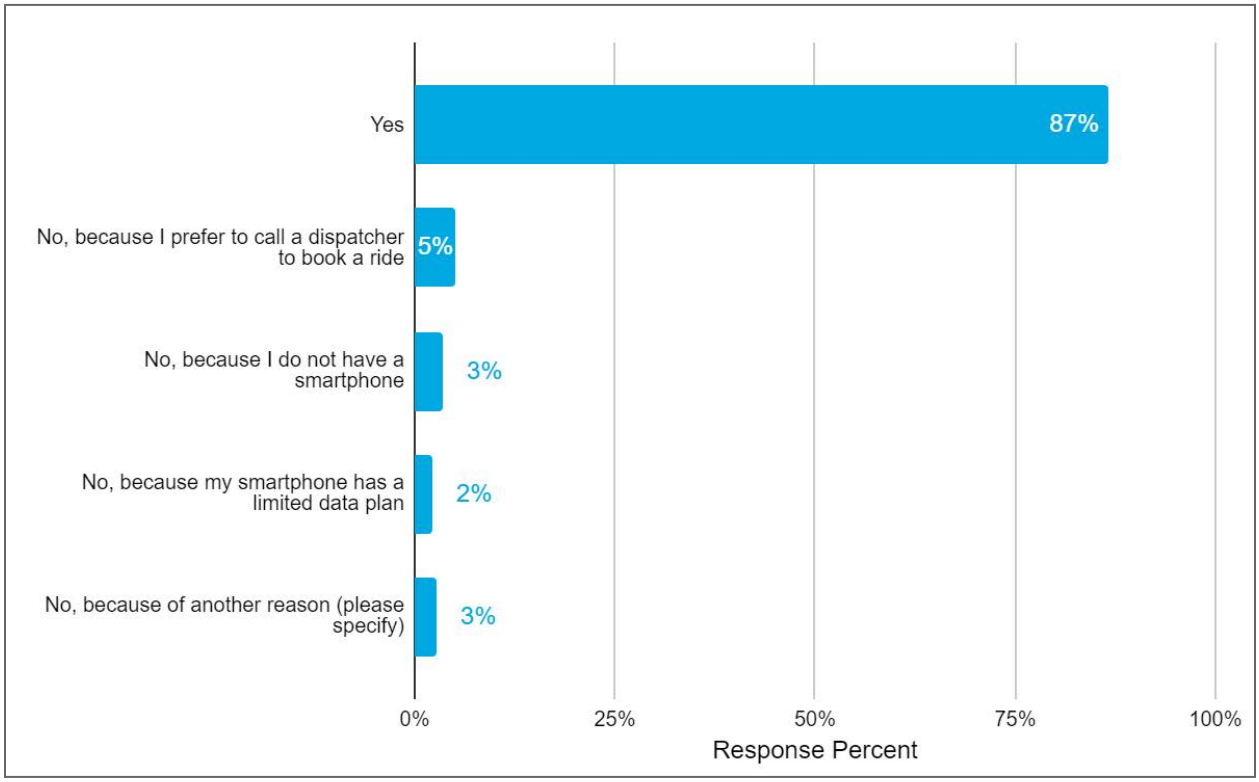
Figure A8. Question: If a microtransit service were to be implemented in Needham, how often would you (or someone in your household) use it? Number of responses: 385.



The 13% of respondents who selected "It depends/other" primarily were unsure as they did not fully understand how the service would work. They requested more information, such as details on where they could travel before being able to make a decision. Several respondents stated that if the service only provided travel within Needham, they would probably just continue to walk. In particular, access to Newton and the Green Line was mentioned several times.

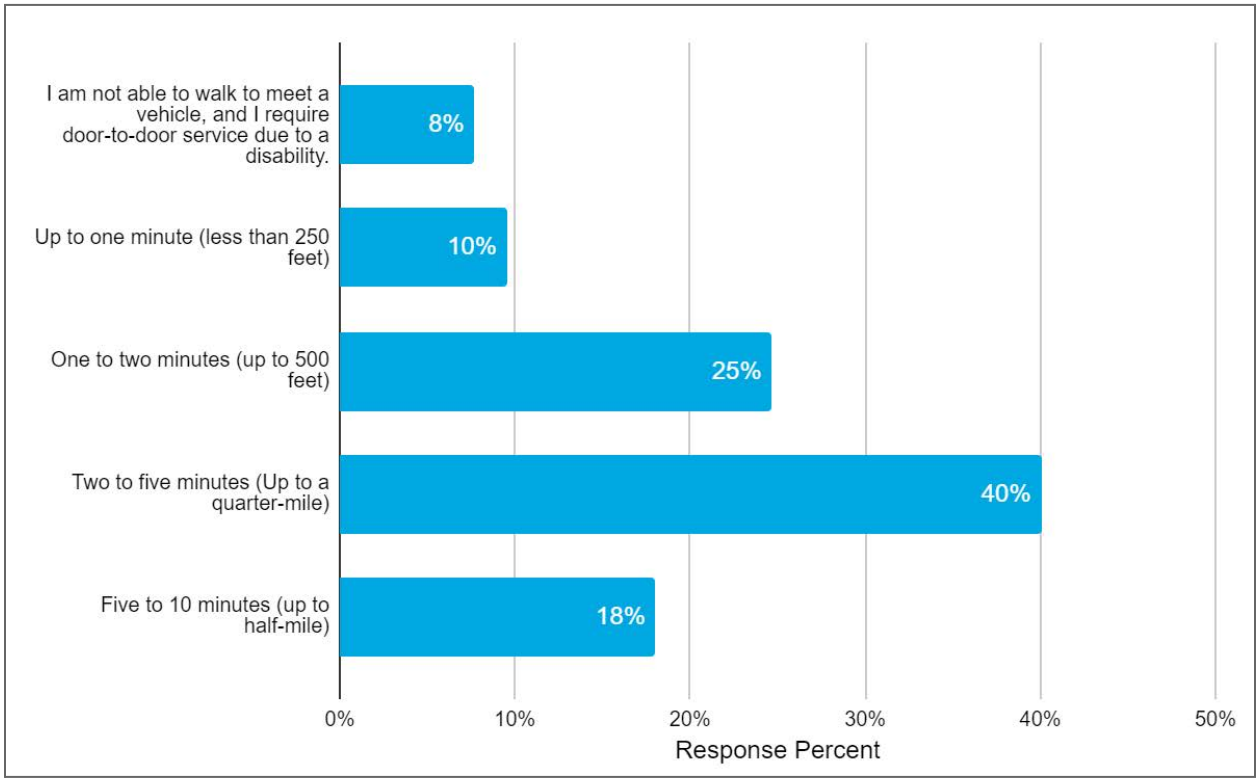
Booking preferences. Nearly nine out of ten respondents would book a microtransit trip using a smartphone. 5% would prefer to call a dispatcher, and 3% do not have access to a cell phone. The number of respondents aged 65+ that are willing to book using a smartphone was lower than the overall average at 67%. Those who are not willing to use a smartphone mostly did not have a smartphone (10%) or just preferred to speak with a dispatcher (15%).

Figure A9. Question: Would you be able to use a smartphone app to book a ride? Number of responses: 385.



Willingness to walk. Over half of the respondents would be willing to walk for two minutes or more (58%). This number was lower for those aged 65+, with only 46% willing to walk for more than two minutes. 8% of respondents would not be able to walk due to a disability, which is slightly higher than seen in a typical microtransit service. Most of those who are unable to walk to meet a vehicle are at least 65 years of age.

Figure A10. Question: Would you be able to use a smartphone app to book a ride? Number of responses: 377.



Inaccessible Destinations. Respondents were also asked to list any specific destinations that are currently inaccessible by public transportation and where they would like to see transit service improved. 192 responses were received for this question. Below is the list of the most frequently mentioned locations:

- Green Line Stops
- Commuter Rail Stations
- Needham Library
- Newton Highlands
- Needham Center
- Needham Heights
- Olin College of Engineering
- Babson College
- Trader Joe's in Needham

Other comments. Lastly, survey participants were invited to share anything else they wanted the town to know about their transportation needs or experiences. 182 respondents answered this question and a wide range of comments were received. The comments can be summarized into three categories:

4. **Availability and Reliability of Transit Services:** Most comments requested improved reliability and availability of public transit services in Needham. Several comments mentioned challenges accessing existing services and were appreciative of the Town for exploring improved transit services. The most common request was for more frequent commuter rail services. Access to the Green Line was also a very common request. Local transportation needs were also discussed, although less frequently.
5. **Transportation Needs:** Several comments elaborated on individual transportation needs. For example, many of those living with a disability expressed a desire to live a more independent lifestyle. Several parents spoke of limited options for students and children to travel freely.
6. **Non-Public Transit Related Comments:** Others expressed concerns that traffic has increased and walking has become unsafe. Several comments would like to see a shift from private vehicles through better public transit availability, as well as safe bike and pedestrian facilities.