Needham/Newton Rail Right-of-Way Transit Concept

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Terminology

For the purposes of this report, we will be using the following definitions for key terminology.

Study area- The study area refers to the quarter mile buffer around the abandoned rail corridor plus the New England Business Center. The study area is depicted graphically in a number of maps throughout this report. The transportation analysis zones included in the study area include TAZ #1044-1046, 1491, 1492, 1502, 1503, 1504.

Cross Section- The cross section refers to the measurement of the easily usable space along the rail corridor at different points. This ranges from 11 feet to 35 feet.

RoW- The RoW refers to the official right of way as defined by the MBTA Valuation Maps. This distance is consistently around 80 feet along the entire abandoned rail corridor.

Northeast section of the study area- The Northeast section of the study area includes the RoW to the northeast of Route 128 and the New England Business Center. The transportation analysis zones included in the Northeast section of the study area are #1044-1046 & 1504.

Executive Summary

The Metropolitan Area Planning Council (MAPC) has worked with the Town of Needham and the City of Newton to develop a concept of operations for providing a transit service on an un-used MBTA rail right-of-way (RoW). The municipalities want to better understand if the RoW could be used to provide a shuttle service to serve future growth and economic development in the area along Needham Street in Newton and Highland Avenue and the New England Business Center in Needham.

MAPC consulted with the 128 Business Council to explore the possibility of a rapid shuttle service in conjunction with bicycle and/or pedestrian uses that could provide connections to transit and other trails in the area. The goals of this study are to identify the characteristics and assumptions of this potential transit service and to explore how it might operate alongside bicycle and pedestrian uses. If the city and town are interested in moving forward with this concept, additional studies would need to be conducted to determine the overall feasibility, engineering needs, and cost of providing this service.

The MBTA has provided the Town of Needham and City of Newton the opportunity to lease the approximate two and a quarter-mile segment of rail right-of-way (RoW) that stretches from the Needham Heights Commuter Rail Station, north and east across Rte 128 and the Charles River, ending just short of the Newton Highlands Green Line Station, where the RoW is taken exclusively by the MBTA Green Line. The following factors were examined in order to understand what potential demand for transit exists in the area, what portion of the RoW would be most appropriate for a potential transit service, and how many people could potentially be served by this RoW.

- Existing public transportation service;
- Traffic operations;
- The Route 128 Add-A-Lane Project;
- The Highland Avenue/Needham Street Reconstruction project;
- Demographic and land use characteristics in the study area;
- Regional commuting patterns, and;
- Future development in the study area.

The physical characteristics of the RoW were also examined, including the width, grading, topography, encroachments, bridges, and road crossings to understand how a shuttle could run along the RoW in addition to bicyclists and pedestrians and where on the RoW it would be most appropriate for a shuttle to run.

The findings reveal that traffic congestion along Highland Avenue/Needham Street is severe. However, much of the traffic is pass-through with many origins and destinations that occur outside the study area in places inaccessible via the Green Line, making it difficult for a new shuttle connection to have a significant impact on mode shift (converting single

occupant vehicles to transit) that would reduce traffic congestion[1]. The relatively low population densities and high household auto-ownership rates indicate lower existing public transit usage by surrounding residents. The existing Needham Heights Commuter Rail Station, as well as MBTA 52 and 59 buses serve much of the current demand for traditional transit commuting. Furthermore, the ongoing Route 128 Add-A-Lane project and planned improvements for Highland Avenue/Needham Street will ease some of the traffic congestion, making auto movements easier and thereby initially causing less transit demand. However, the number of jobs in the study area is about twice the number of residents in the study area and the land uses in the study area do have high employment densities, with additional development occurring in the future. Because of these factors, there is an opportunity for a modest amount of reverse commute potential (commuters travelling from Boston, Brookline, and parts of Newton along the Green Line) to serve employment in the study area. The shuttle service could also serve as an impetus for future development to locate in the area, thereby potentially increasing the use of the service.

Based on this analysis, the Concept Plan focuses on a rapid shuttle service that would use the RoW to connect commuters exiting the Newton Highlands Green Line station to employment centers along the RoW in Newton, and into the New England Business Center in Needham. This shuttle service would only travel along the section of the RoW that is Northeast of Route 128. Since this service would primarily serve commuters, it would run only during the peak AM/PM periods and not on the weekends, creating an opportunity to co-exist well with recreational biking and walking that might also take place along the RoW. The 128 Business Council, a Transportation Management Association that currently provides an employer funded shuttle service from Newton Highlands along Needham Street and into the New England Business Center, was extensively consulted. The rapid shuttle service concept assumes that the service would be provided by a non-profit business-funded entity similar to the 128 Business Council, with the capital costs to the RoW coming from a combination of private, local, state and federal sources.

The shuttle would run on approximately 20 minute headways during the AM peak period and approximately 25 minute headways during the PM peak period, attracting a daily ridership of around 65 people, approximately a 44% increase from current ridership on the 128 Business Council shuttle. While MAPC staff have not done a complete trail usage analysis, to understand the number of bicycle/pedestrian users, we examined Journey to Work data for the AM Peak hour. Based on 2010 Transportation Analysis Zone (TAZ) data[2], during the AM peak period, there are around 48 bicycle/walk work trips coming into the Northeast section of the study area from towns and cities along the Green Line (Boston, Brookline, and Newton) and around 66 bike/walk work trips out of the Northeast section of the study area to Boston, Brookline, and Newton. Even if 100% of these trips were to occur on the corridor, this is a small number, suggesting there would likely be a low amount of commuter bicyclists encountering transit shuttles while traveling the RoW. It is important to

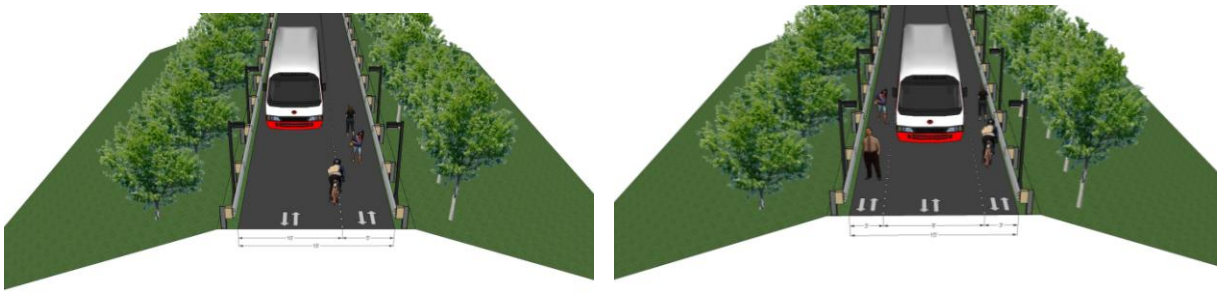
[1] Central Transportation Planning Staff for the Boston Metropolitan Planning Organization. *Potential I-95 (Route 128)-Kendrick Street Interchange, Needham, Massachusetts: An Evaluation of Traffic Impacts.* December 2003.
[2] CTPS Base Year Travel Demand Model Results, 2010.

clarify that this is just a count of commuter bicyclists/pedestrians and does not account for the numerous bicyclists and pedestrians that will likely use this RoW for recreation.

Based on MAPC field work, the typical cross section for construction along the RoW is approximately 15 feet, with short sections that become 20 to 30 feet wide. Although the MBTA Valuation Maps outline a RoW of 80 feet consistently along the corridor, the usable space at this point in time is much less. Some of the wider areas, such as at Oak Street would require minimal grading, as the land is flat and the cross section is clear of encroachments. But for most of the abandoned rail corridor, widening this space would require reclaiming land from encroachments, performing earthwork, adding retaining walls, and grading. While future funding could be identified to create a wider cross section, for the purposes of this study, the Concept Plan is based on a 15 foot cross section because of the significant investment that would be required to create more space.

One of the biggest challenges with this narrow cross section is accommodating space for transit as well as pedestrians and bicyclists. Fifteen feet is not enough room to accommodate bi-directional shuttle service, which would also require design, scheduling, and communication efforts to allow multiple shuttles on the RoW. Both Newton and Needham are interested in accommodating transit, pedestrians, and bicycle modes, and given the expected headways of the shuttle service and the lack of mid-day or weekend shuttle service, it would be very challenging to effectively prohibit cyclists and pedestrians from using a RoW that is not in use for the majority of the week. To make sure the safety of all potential users is planned for, the Concept Plan identifies all three modes sharing the cross-section.

Two potential cross sections were analyzed and are included in this Concept Plan, including A) a concept where the shuttle would operate on one side of the cross section in a ten foot lane and pedestrians would travel on the other side of the cross section in a five foot lane, with bicycles allowed to use the entire space, and B) an advisory lane concept where the shuttle would travel down the center of the cross section in a nine foot travel lane and the pedestrians would travel on the outsides of the cross section, with bicycles allowed to use the entire space. These concepts are shown below in Figure 1 and are described in more detail in Chapter 5.



There are a number of physical and planning challenges along the RoW. These challenges include encroachments on the RoW as well as engineering and connection challenges, such as:

- Cross Section width
- Shuttle Access into the New England Business Center
- Charles River Crossing
- Parking Lot Encroachments at Oak Street Crossing
- Avalon Apartments Fencing
- National Lumber Encroachment
- Lack of Direct Connection to Newton Highlands Station

The work needed to create this kind of shuttle service would be costly and challenging, so key next steps include:

- Evaluate this proposed Concept Plan to see if it meets the goals of both communities and if there is public support.
- Monitor construction adjacent to the RoW and make sure it does not preclude a potential shuttle service
- Identify funding to conduct a feasibility and cost/benefit analysis.
- Work to produce a more detailed ridership estimate for the potential service that includes a comprehensive consideration of the many different factors that could influence ridership.
- Study the replacement of the existing train bridge over Route 128 (Bridge N-04-020) that will be removed as part of the Route 128 Add-A-Lane Project. A bridge could be planned that is wide enough to accommodate potential future transit uses as well as bicycle and pedestrian modes. Any planning process for this bridge replacement should engage MassDOT and the MBTA.

Chapter One: Introduction and Existing Conditions

Introduction

The Town of Needham and the City of Newton are committed to increasing economic development and housing opportunities and to facilitating mobility for all modes of transportation in their respective municipalities and throughout the region. The abandoned rail RoW that is the focus of this study provides an opportunity to modestly increase the reverse commute potential for workers coming to this area and to also provide a connection for bicyclists and pedestrians traveling in the area.

The shuttle service may also serve as an impetus for future development to locate in the area, thereby potentially increasing the use of the service. Future residential development along the RoW could increase demand for shuttle service to Newton Highlands and future commercial development could increase the amount of reverse commuters travelling into Newton and Needham for work.

The potential re-use of the RoW is important to both municipalities because its location is vital to the economies of both Needham and Newton, with significant retail and office floor area along the RoW. Both municipalities are anticipating commercial and residential growth in the study area and see the rail RoW as a potential means to encourage growth as well as serve existing and future residents and employees. There are many possibilities for what the re-use of this RoW could look like, but the Town of Needham and the City of Newton have requested that MAPC complete a concept of operations for a shuttle service either alone or in conjunction with pedestrian and bicycle accommodations.

Local Context

There are several groups within Needham and Newton that are advocating for this RoW to be re-used as a shared-use bicycle and pedestrian path. The Massachusetts Bay Transportation Authority (MBTA) recently authorized a 99 year lease that opened up a number of abandoned rail areas, including the one referenced in this study, to be leased by cities and towns and re-used as transportation corridors, with a rail trail use in mind. Newton is taking advantage of this opportunity and is signing a lease with the MBTA that will convert the RoW into a pedestrian and bicycle path. Newton sees this as a first step to also potentially allowing a public transit use along the RoW in the future.

While the City of Newton is advancing a bicycle and pedestrian trail, they are still interested in the potential for also accommodating more robust transportation options that would support residential and economic growth. The Town of Needham is very interested in seeing

the future use of the corridor preserved for mass transit options, particularly into the New England Business Center and is not signing a lease with the MBTA at this time.

MAPC staff met with MBTA officials and Transit Realty Associates who noted that while there has been no historical precedent for allowing a private service to run shuttles on MBTA rights of way, the MBTA would be open to discussing the lease to allow such a use. Shuttle service is not currently included in the lease authorization.

Existing Conditions

Study Area

The abandoned MBTA RoW runs approximately two and a quarter miles through Needham and Newton. It extends from the Needham Heights commuter rail station in Needham north and east across Route 128 and the Charles River, ending close to the Newton Highlands MBTA Green Line (D Line) in Newton. This RoW parallels the busy Highland Avenue/Needham Street corridor in the two municipalities, which is currently in the planning phase for a complete roadway reconstruction. The RoW is also in close proximity to the New England Business Center in Needham, a major employment hub in the region, as well as sites in Newton that can support redevelopment.

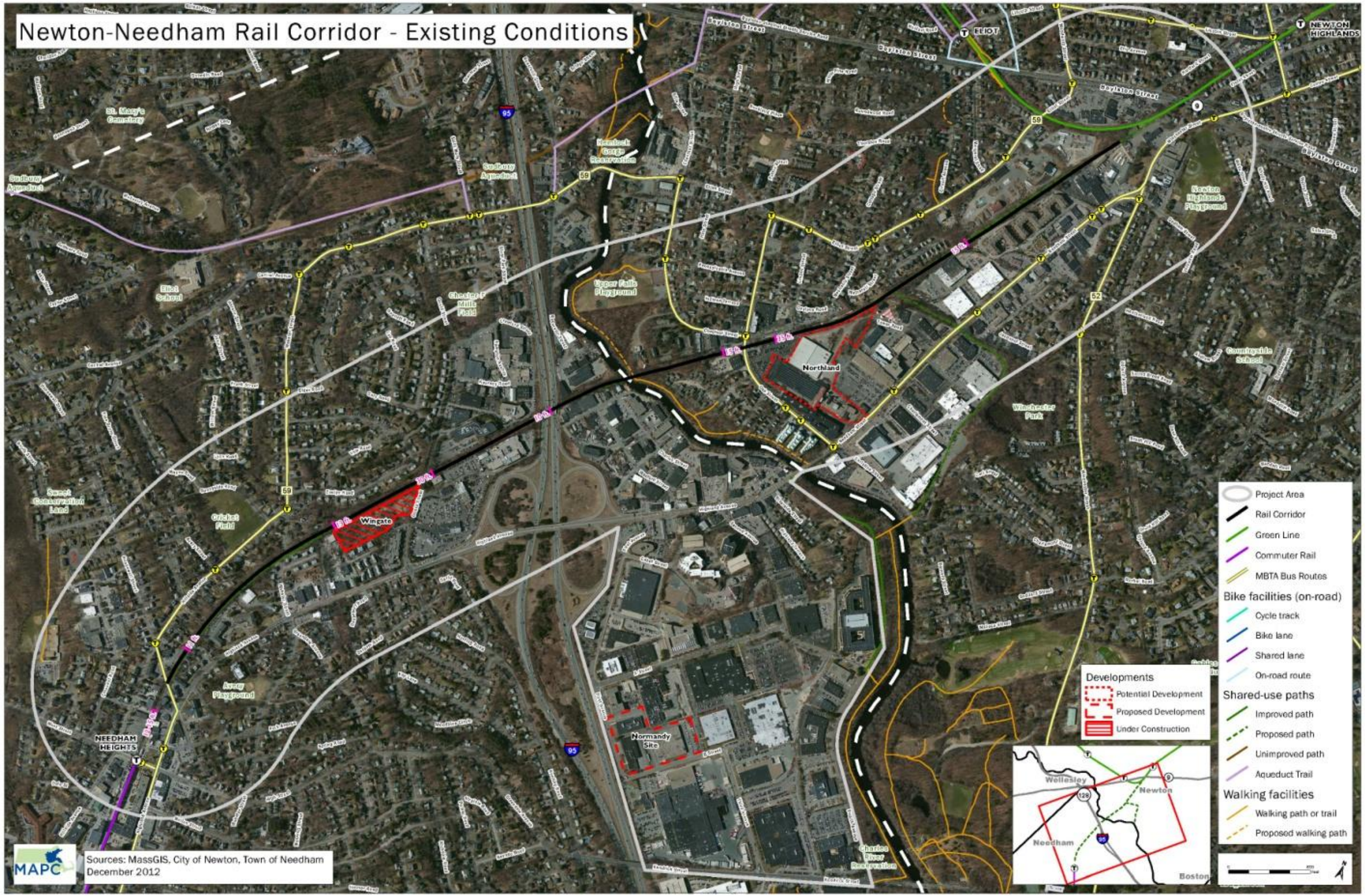


Figure 1: Existing Conditions Map

MBTA Bus

In the surrounding area, the MBTA is currently providing limited public transportation through bus routes on Needham Street and Winchester Street. These bus routes include the #59 and the #52 bus. There are no MBTA bus routes along Highland Avenue in Needham.[3]

The #52 bus runs between Watertown Yard and Dedham Mall and operates on 20-90 minute headways as the headways vary throughout the day. The bus operates from about 9 AM to 8 PM. It takes anywhere from 30-45 minutes for the bus to travel from Dedham Mall to Watertown Yard depending on the traffic and the route taken. The daily average weekday boardings for this bus route are 653.[4]

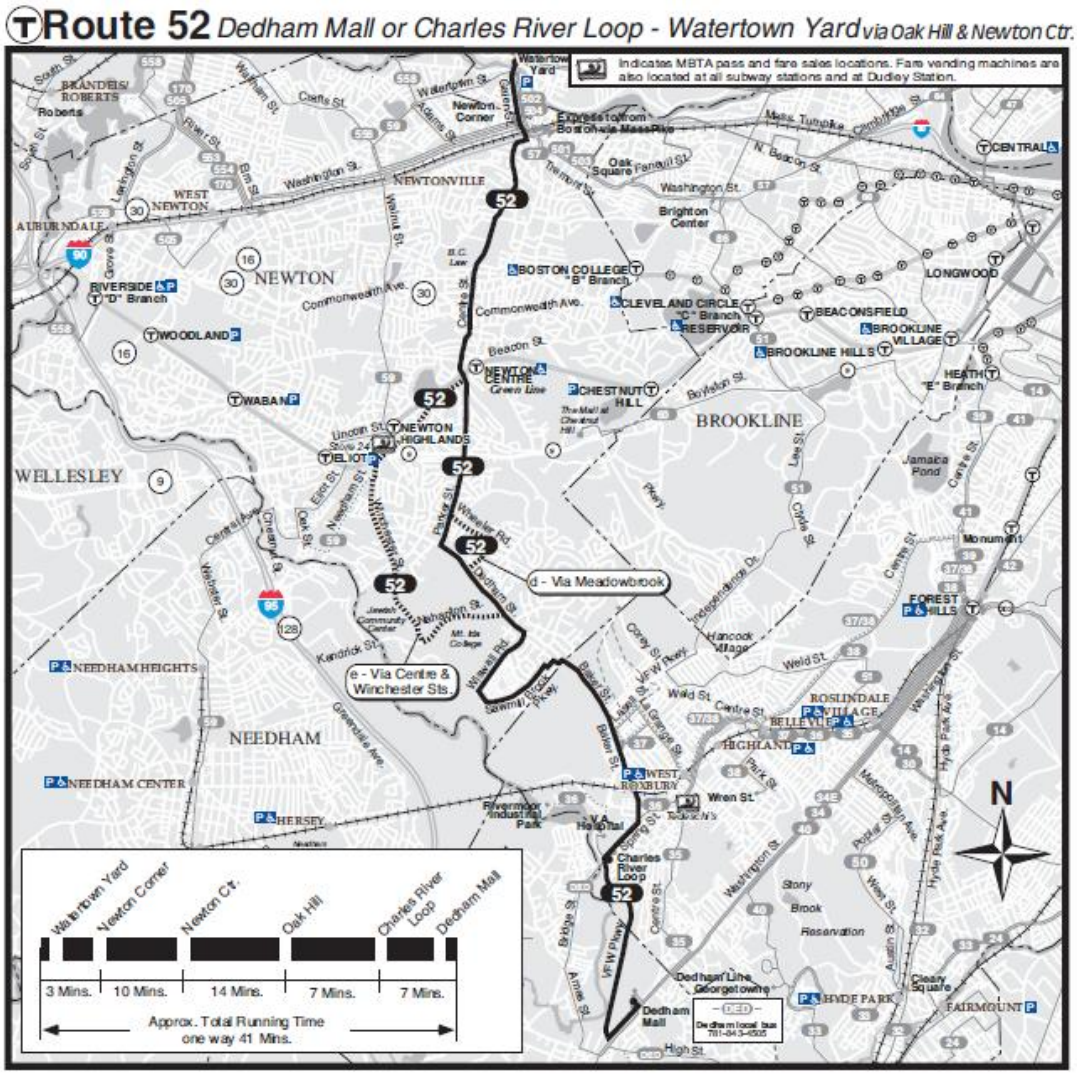


Figure 2: MBTA Bus Route #52

[3] Fay, Spofford & Thorndike, LLC. *Functional Design Report: Highland Avenue/Needham Street/Winchester Street*. May 2011.
[4] Massachusetts Bay Transit Authority. *Ridership and Service Statistics*. Thirteenth Edition. April 2010.

The MBTA #59 bus travels between Watertown Square and Needham Junction, parallel to the RoW during the middle of the route as pictured in Figure 3 below. It then diverts onto Central Street and routes back to either travel along Elliot Street which runs parallel to the RoW on the north or along Needham Street to the south of the RoW (depending on the time of day the bus takes a different route here). The #59 operates on 30-50 minute headways from 6 AM to 8 PM (as the headways vary throughout the day) and is currently serving as a connection between the Needham Heights commuter rail station and the Newton Highlands Green Line station. It takes anywhere from 30-50 minutes for the bus to travel from Needham Junction to Watertown Square Terminal depending on the traffic and the route taken. The daily average weekday boardings for this bus route are approximately 1200.[5]

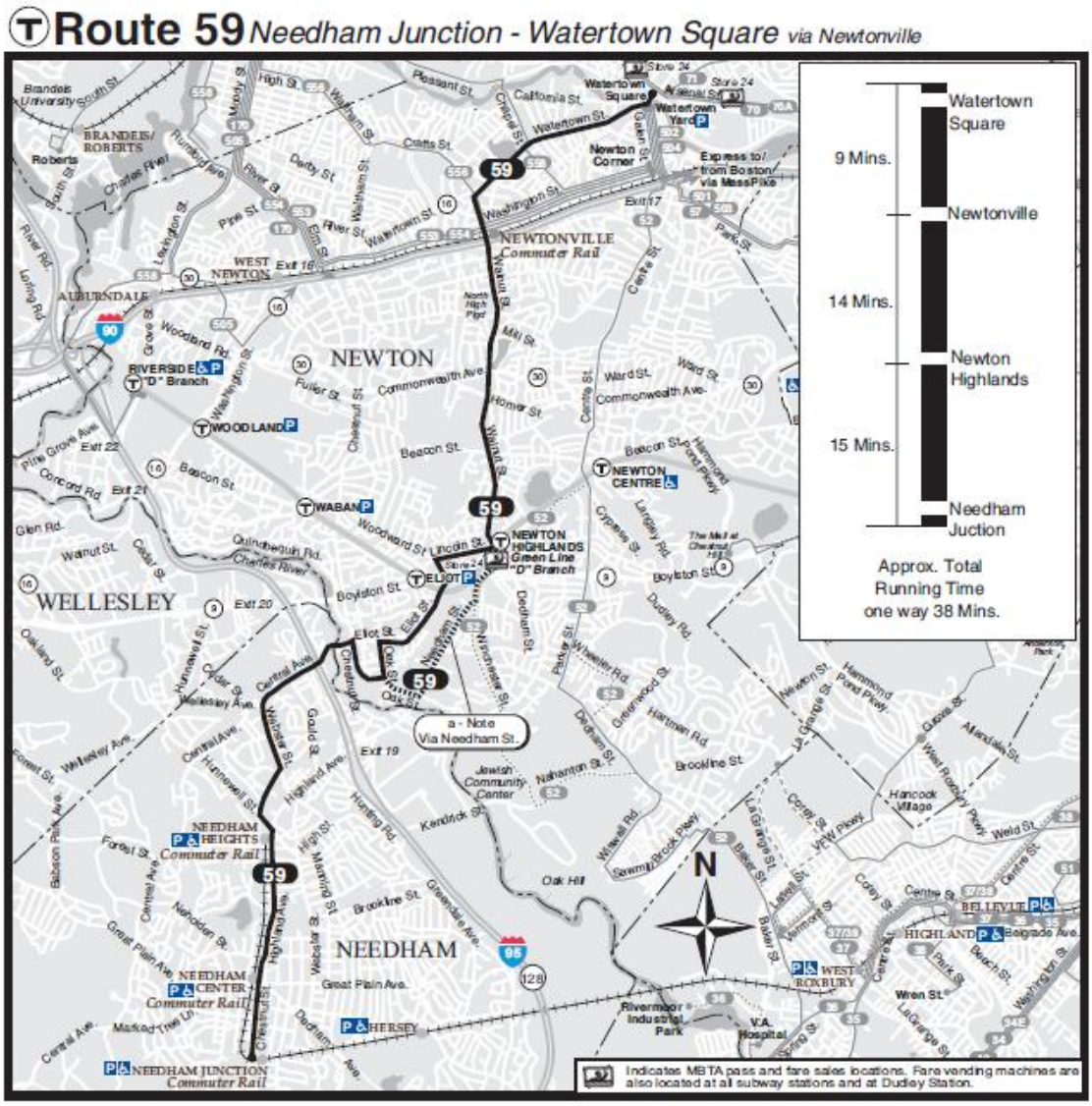


Figure 3: MBTA Bus Route #59

[5] Massachusetts Bay Transit Authority. *Ridership and Service Statistics*. Thirteenth Edition. April 2010.

128 Business Council Shuttle Service

There is currently a commuter shuttle service provided by the 128 Business Council that runs from Newton Highlands station to the New England Business Center along Needham Street and that makes several stops within the New England Business Center. The 128 Business Council is one of 10 Massachusetts Transportation Management Associations (TMAs) that leverage public and private funds to increase ridesharing and the use of commuting alternatives. The 128 Business Council is funded by private business memberships in addition to project specific state and federal agency transportation project grants and they operate shuttles along the Route 128 West corridor[6].

Figure 4: 128 Business Council Needham Shuttle Route

[6] 128 West Transportation Council, Inc. *128 Business Council: About Us*. 2012, < http://www.128bc.org/shuttles/> (accessed September 10, 2012).

MBTA Commuter Rail

The Needham Heights Commuter Rail Station (the end of the Needham Heights commuter rail line) is at the southern terminus of the abandoned RoW. According to an MBTA Survey conducted in 2008-2009 by the Central Transportation Planning Staff (CTPS), 89% of riders who take the Needham line from Needham Heights are travelling from their home to work. Riders cited convenience and avoiding driving/traffic as the top reasons why they were using this service. The majority of riders using this service fell between the ages of 35 and 64 and most riders had a household income of $100,000 or more. The majority of riders reported using the service 5 days a week. 77% of riders did have a household vehicle available to them but chose to take the commuter rail instead. The majority of riders who boarded the train at Needham Heights were travelling all the way into Boston for work. In addition, the overwhelming majority of people getting off at Needham Heights station were travelling to work or for a work related purpose.[7] The full survey results can be found in Appendix A.

MBTA Green Line

The Newton Highlands Green Line Station is at the northern terminus of the abandoned RoW, although encroachments and access limitations prevent the final 1770 feet from being utilized. According to the MBTA survey conducted by CTPS in 2008-2009, 72% of commuters who boarded at Newton Highlands station are traveling from their home to work. Riders cited avoiding driving and traffic and avoiding parking at their destination as the top reasons why they were using this service.

The majority of riders boarding at the Newton Highlands stop are starting in Newton, with about 10% of riders coming from Needham and other places such as Watertown and Waltham. About 20% of riders are taking the MBTA bus to the Newton Highlands station, the majority of those bus commuters riding the #59 bus. The most popular destinations are Fenway-Longwood with 23% of riders exiting, Park Street station with 9.9% of riders exiting, and Government Center station with 9.2% of riders exiting. 43.4% of riders are getting off at downtown Boston T stations[8].

Of reverse commuters who are exiting at Newton Highlands Station, the most popular origins are Brookline Village-Brookline Hills with 9.8% of riders boarding and Park Street Station with 8.7% of riders boarding. 35.9% of riders exiting at Newton Highlands entered at a downtown Boston T stop. About 243 of the riders that exit at the Newton Highlands station then connect to the bus. 80% of riders who are exiting at Newton Highlands are

[7] Humphrey, Thomas J. & Wilson, Alicia et al. *MBTA Systemwide Passenger Survey: Rapid Transit 2008-09, Green Line.* June 2012.

[8] Downtown Boston T stops were considered to be North Station, Haymarket, Government Center, Park Street, Boylston, Arlington, Copley , Hynes Convention Center, Kenmore, Prudential, and Symphony.

traveling to Newton with 18% of riders ending in Needham[9] The full survey results can be found in Appendix B.

Traffic Operations

According to the Functional Design Report on Highland Ave/Needham Street/Winchester Street, there are high traffic volumes on Highland Avenue, Needham Street and Winchester Street. Levels of service at the following intersections along the corridor operate at LOS of "D/E" during peak hours, with individual movements at LOS "F".

Highland Ave/Webster Street

Highland Ave/Gould Street/Hunting Road

Highland Ave/Second Ave

Needham Street/Oak Street/Christina Street

Needham Street/Winchester Street/Dedham Street

The un-signalized approaches to Highland Avenue, Needham Street and Winchester Street at Cross Street, Wexford Street, Tower Road, Industrial Place and the Route 9 ramps all are operating at LOS "F" during peak hours. At the Route 9 eastbound and westbound off ramp approaches to Winchester Street, there is excessive delay during peak hours. Many of the other cross streets in this area also operate at poor levels of service.

In April 2002, a license plate study was conducted by the Central Transportation Planning Staff (CTPS) to determine travel patterns near the primary business in the study area in order to help identify which type of interchange would be appropriate for I-95/Kendrick Street. One important finding from this study was that the majority of the morning peak period traffic on Highland Avenue, Needham Street, Kendrick Street, and Nahanton Street has its beginning and end outside of the primary destination area (New England Business Center and Wells Avenue Office Park).[10]

Below in Table 1 are the 2011 AM Peak Traffic Volumes in the area by intersection.

[9] Humphrey, Thomas J. & Wilson, Alicia et al. *MBTA Systemwide Passenger Survey: Rapid Transit 2008-09, Green Line.* June 2012.
[10] Central Transportation Planning Staff for the Boston Metropolitan Planning Organization. *Potential I-95 (Route 128)-Kendrick Street Interchange, Needham, Massachusetts: An Evaluation of Traffic Impacts.* December 2003.

Table 1: 2011 AM Peak Traffic Volumes in the Study Area

		AM Peak Hour		PM Peak Hour	
Location	**Daily Volume**	**Peak Hour Volume**	**Dir. Dist**	**Peak Hour Volume**	**Dir. Dist.**
Highland Avenue west of Webster Street	14100	905	56% EB	955	53% EB
Highland Avenue west of Gould Street	23700	1765	60% EB	1700	55% WB
Highland Avenue west of Second Avenue	34100	2415	53% EB	2775	66% WB
Webster Street South of Highland Avenue	9000	840	64% NB	655	57% SB
Gould Street north of Highland Avenue	9300	815	63% NB	770	69% SB
Hunting Road south of Highland Avenue	9500	870	53% NB	940	55% NB
Second Avenue south of Highland Avenue	11800	905	55% SB	800	72% NB
Needham Street East of Oak Street	27600	1940	63% NB	1975	57% NB
Needham Street West of Winchester Street	19600	1400	54% WB	1380	60% EB
Winchester Street North of Needham Street	18300	1270	51% SB	1160	56% NB
Oak Street North of Needham Street	10600	790	53% EB	1015	57% EB
Christina Street South of Needham Street	5900	580	52 % WB	605	55% WB
Industrial Place South of Needham Street	1800	40	55% EB	170	60% WB
Tower Road North of Needham Street	3600	100	63% WB	305	56% EB
Columbia Ave South of Needham Street	500	40	68% EB	55	63% EB
Rte 9 EB Ramps East of Winchester Street	9400	645	68% OFF	720	53% ON
Rte 9 WB Off-Ramp East of Winchester Street	2300	145	100% WB	135	100% WB

Chapter Two: Future Roadway Conditions & Journey to Work Data

Future Roadway Conditions

128 Add-A-Lane Project

The 128 Add-A-Lane project is the final bridge contract of the I-95/93 (Route 128) Transportation Improvement Project. The project includes five bridges and about 3.25 miles of roadway reconstruction on I-95. The roadway work spans from south of Kendrick Street in Needham to North of Route 9 and includes installing an additional 12 foot travel lane and 10 foot shoulder in each direction toward the median. The work also includes new collector and distributor roads between Highland Avenue and Kendrick Street to allow for safer traffic movement in and out of the New England Business Center[11].

The bridge locations affected that are relevant to the concept outlined in this report include the Highland Avenue bridge over I-95 (Route 128) in Needham and the MBTA Railroad Bridge (Newton Upper Falls Branch) over I-95 in Needham. The Highland Avenue bridge will be replaced and the MBTA Railroad bridge will be removed. MassDOT and the MBTA have committed to keep some of the abutments for a future bridge and to support Needham and Newton in any future planning to reconstruct a bridge over Rte 128. However, there is no legal requirement for MassDOT or the MBTA to replace the bridge, and no funding has been set aside for this purpose.

The Add-a-lane project began construction in spring 2012 and the Highland Avenue section of this corridor has an advertising date scheduled for November 2013 with construction beginning spring 2014[12]

[11] Massachusetts Department of Transportation Highway Division. *Needham/Wellesley: I-95/Route 128 Add-A-Lane Project.* Commonwealth of Massachusetts.2012, <http://www.mhd.state.ma.us/default.asp?pgid=content/128_95_addLane&sid=about>(accessed September 10, 2012).

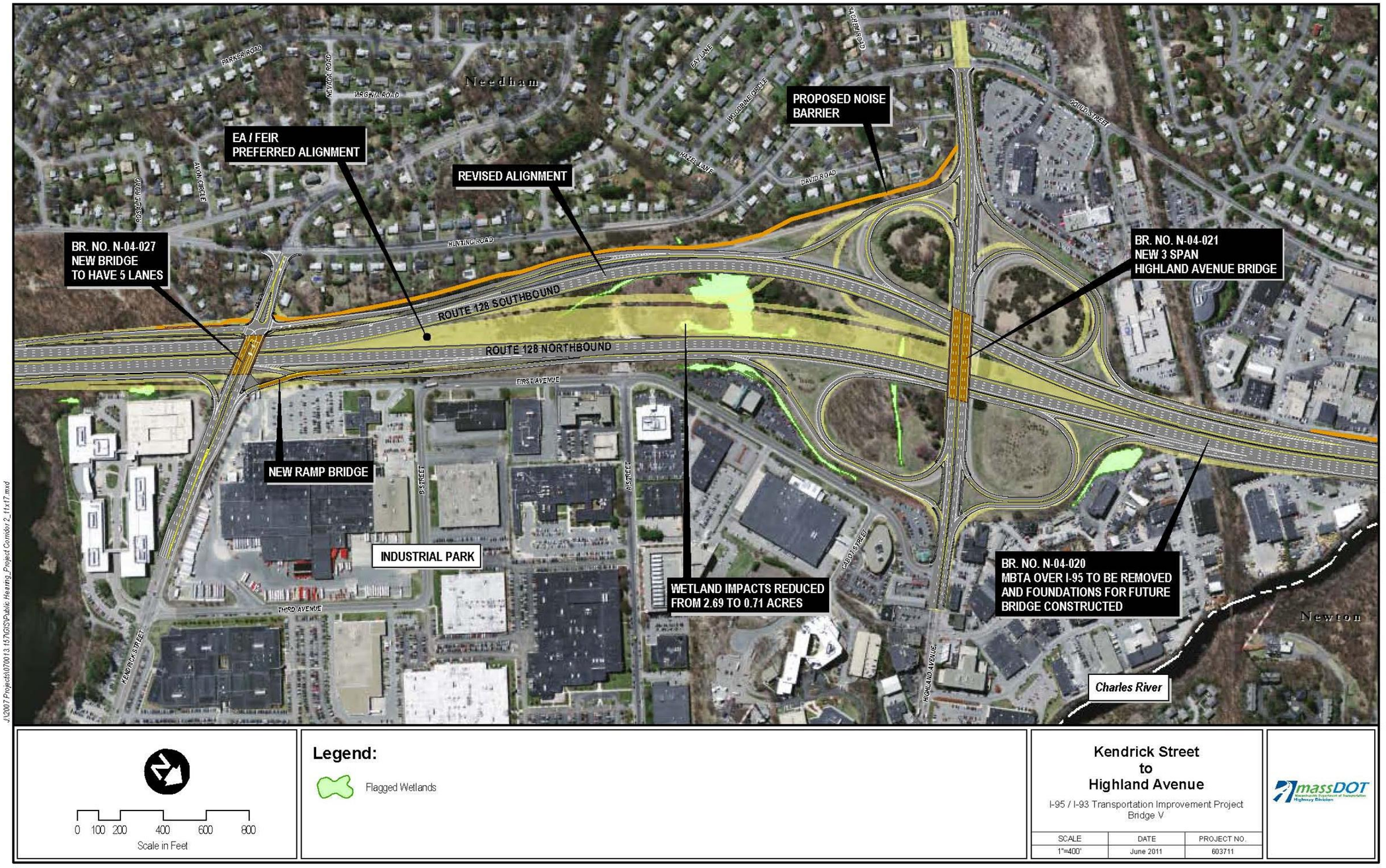


Figure 5: Route 128 Add-A-Lane Study-25% Design/Public Hearing Drawing[13]

[13] Massachusetts Department of Transportation Highway Division. *Needham/Wellesley: I-95/Route 128 Add-A-Lane Project.* Commonwealth of Massachusetts.2012,<http://www.mhd.state.ma.us/default.asp?pgid=content/128_95_addLane&sid=about>(accessed September 10, 2012).

Highland Avenue/Needham Street Reconstruction Project

The objectives of the Highland Avenue/Needham Street Reconstruction project are to improve the traffic flow and safety along Highland Avenue/Needham Street/Winchester Street. This project is currently in the planning phase. A functional design report was prepared by Fay, Spofford, and Thorndike LLC in May 2011 under a contract with MassDOT. In this report, there are recommendations for roadway improvements along the Highland Avenue Corridor in Needham and Newton.

The proposed improvements will widen Highland Avenue which will allow for two through lanes and four-foot wide shoulders in each direction. The improvement plan will also include specific capacity improvements at key intersections with Highland Ave/Needham Street/Winchester Street. These improvements include sidewalk reconstruction and the upgrading of traffic signalization in the corridor. These improvements are scheduled as part of the Boston MPO's Long Range Transportation Plan for 2021-2025.[14]

Journey to Work Data

MAPC staff looked at the study area to get an idea of the potential reduction in Drive to Work trips that this transit service could affect. Staff also examined the Northeast section of the study area specifically because the potential service would directly serve this area and residents living in this section would be the most likely transit riders[15]. In order to determine how many of the AM peak Drive to Work trips coming from the study area could potentially be removed from the road and converted to the potential transit service, MAPC staff looked at the neighboring municipalities that have MBTA Green Line access that would enable riders to disembark at the Newton Highlands MBTA Green Line stop and connect to this potential shuttle service. These municipalities include Boston, Brookline, and Newton and the Drive Alone to Work and Carpool trips to work coming from the study area into Boston, Brookline, and Newton are outlined in each table. It is however important to keep in mind when examining these numbers that many locations in Newton are in very close proximity to the corridor and it may be even less likely that AM peak Drive to Work trips into Newton would be converted onto this transit service when compared to AM peak Drive to Work trips into Boston and Brookline.

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[14] Boston Region Metropolitan Planning Organization. *The Long-Range Transportation Plan (LRTP: Paths to a Sustainable Region.* September 2011, < http://www.ctps.org/bostonmpo/3_programs/1_transportation_plan/plan_2035.html> (accessed September 10, 2012).

[15] The transportation analysis zones included in the study area include TAZ #1044-1046, 1491, 1492, 1502, 1503, 1504. The transportation analysis zones included in the Northeast section of the study area are #1044-1046 & 1504.

According to analysis of the CTPS Base Year Travel Demand Model Results 2010 output[16], below is the mode-share of work trips that residents in the study area take to get to work as well as how many work trips are going specifically into Boston, Brookline, and Newton.

Table 2: AM Peak Trips from Study Area

	Mode				
Destination Municipality	Drive Alone	Carpool	Transit	Walk	Totals
All trips	1075	104	140	90	*1409*
Boston	185	24	110	0	*319*
Brookline	8	1	1	0	*10*
Newton	120	11	10	35	*176*

Table 3: AM Peak Trips from Northeast section of the study area

	Mode				
Destination Municipality	Drive Alone	Carpool	Transit	Walk	Totals
All Trips	335	32	64	35	*466*
Boston	73	9	51	0	*133*
Brookline	5	0	1	0	*6*
Newton	86	7	8	33	*134*

As identified in Table 2 and Table 3, driving is the most dominant mode for people living in the study area who are traveling outside of the study area for work. Current transit and walk to work trips are much lower in comparison.

By totaling the number of Drive Alone and Carpool trips for Boston, Brookline, and Newton in Table 2, we can see that there are only 349 AM peak Drive Alone and Carpool trips to work being made into these three municipalities from the study area. This indicates that there are only a small number of current car trips to work that have the potential to be converted to a transit service. By totaling the number of Drive Alone and Carpool trips for Boston, Brookline, and Newton in Table 3, we can see that there are currently only 180 AM Peak work trips being made by car from the Northeast section of the study area, the area that would be directly served by the potential transit.

[16] CTPS Base Year Travel Demand Model Results, 2010.

Below is the MAPC analysis of the Regional Travel Demand Model Base Year 2010 output for the total AM peak work trips ending in the study area as well as those that originate in Boston, Brookline, or Newton.

Table 4: AM Peak Trips to Study Area

	Mode				
Origin Municipality	Drive Alone	Carpool	Transit	Walk	Totals
All Trips	3,666	355	151	104	*4276*
Boston	470	42	65	0	*577*
Brookline	45	4	5	0	*54*
Newton	320	28	25	50	*423*

Table 5: AM Peak Trips to Northeast section of the study area

	Mode				
Origin Municipality	Drive Alone	Carpool	Transit	Walk	Totals
All Trips	2,706	265	135	60	*3166*
Boston	380	34	60	0	*474*
Brookline	40	3	5	0	*48*
Newton	300	26	25	50	*401*

As identified in Tables 4 & 5, driving is the dominant mode to work to the study area. Current transit and walk to work trips are again much lower in comparison. By adding the total Drive Alone and Carpool trips for Boston, Brookline, and Newton in Table 4, we can see that there are 909 Drive to Work trips coming into the study area. By adding the total Drive Alone and Carpool trips in Table 5, we can see that there are only 783 Drive to Work trips coming into the Northeast section of the study area, the area that this potential transit would directly service.

These numbers indicate that while the potential transit service would be a good option for reverse commuters, it would not have the ability to significantly reduce car trips to work, considering how many other Drive to Work trips are coming from outside these three municipalities. This implies that the potential transit would not be able to significantly shift the predominant mode to work in this area from automobiles to transit.

Another important observation is that 74% of the total trips coming into the study area by car are trips to the Northeast section of the study area where the New England Business Center and many businesses in Newton are located. The 74% indicates that a significant amount of Drive to Work trips that are coming from the Brookline, Boston, and Newton are driving into the area that will be served by transit and implies that the route outlined for the current

transit service aligns with the current need. This percentage is determined by adding the total number of Drive Alone and Carpool trips coming into the Northeast section of the study area in Table 5 and dividing it by the total number of Drive Alone and Carpool trips coming into the larger study area in Table 4.

While the analysis does not indicate the shuttle service would be a significant strategy for reducing congestion, it may be an incentive for employers that want to locate in an area with a strong reverse commute option for their employees. These new businesses could encourage employees to use the transit service rather than driving to work, keeping potential future Drive to Work trips off the road and strengthening the use of the transit service.

It is also important to note that the household automobile ownership rate in this area is very high. The average vehicles per household in Newton is 1.57 vehicles and the average vehicles per household in Needham is 1.79 vehicles. The average vehicles per household for the entire study area are 1.27[17][18]. This is another factor that would inhibit a significant mode shift from Drive to Work to Transit to work in the area.

While MAPC staff have not done a complete trail usage analysis, to understand the number of bicycle/pedestrian users, we considered the Journey to Work data in Tables 3 and Table 5 for bicyclists and pedestrians traveling to and from the Northeast section of the study area in the AM Peak hour. From Table 3, we can see that there are around 33 bike/walk work trips out of the Northeast section of the study area to Boston, Brookline, and Newton and from Table 5 we can see that during the AM peak period, there are around 50 bicycle/walk work trips coming into the Northeast section of the study area from towns and cities along the Green Line (Boston, Brookline, and Newton)[19]. Even if 100% of these trips were to shift onto the corridor, this is a small number, suggesting that commuter bicyclists would not often encounter transit shuttles while traveling through the RoW. It is important to clarify that this is just a count of *commuter* bicyclists/pedestrians and does not account for the numerous bicyclists and pedestrians that will likely use this RoW for recreation.

[17] Registry of Motor Vehicles. *Registry of Motor Vehicles Data.* 2010.
[18] United States Census Bureau. *Census Data.* 2010.
[19] CTPS Base Year Travel Demand Model Results include both pedestrian and bicyclist trips under the heading "Walk."

Chapter Three: Demographics & Development

Demographics

The total population in the study area is 5,569 people[20] and the average population density is 7.2 people/acre[21]. Based on InfoGroup business location data, there are approximately 12,697 employees within the study area. Of the total jobs in the study area, 6,199 or 49% are concentrated within the New England Business Center[22]. There are a number of significant employment centers in Newton that are accessible via the RoW, including the Newton Technology Park at 143-165 Needham Street and the 109 Oak Street building to name a few.

[20] United States Census Bureau. *Census Data.* 2010.
[21] MassGIS, City of Newton, Town of Needham, December 2012.
[22] InfoGroup Business Location Data, 2011.

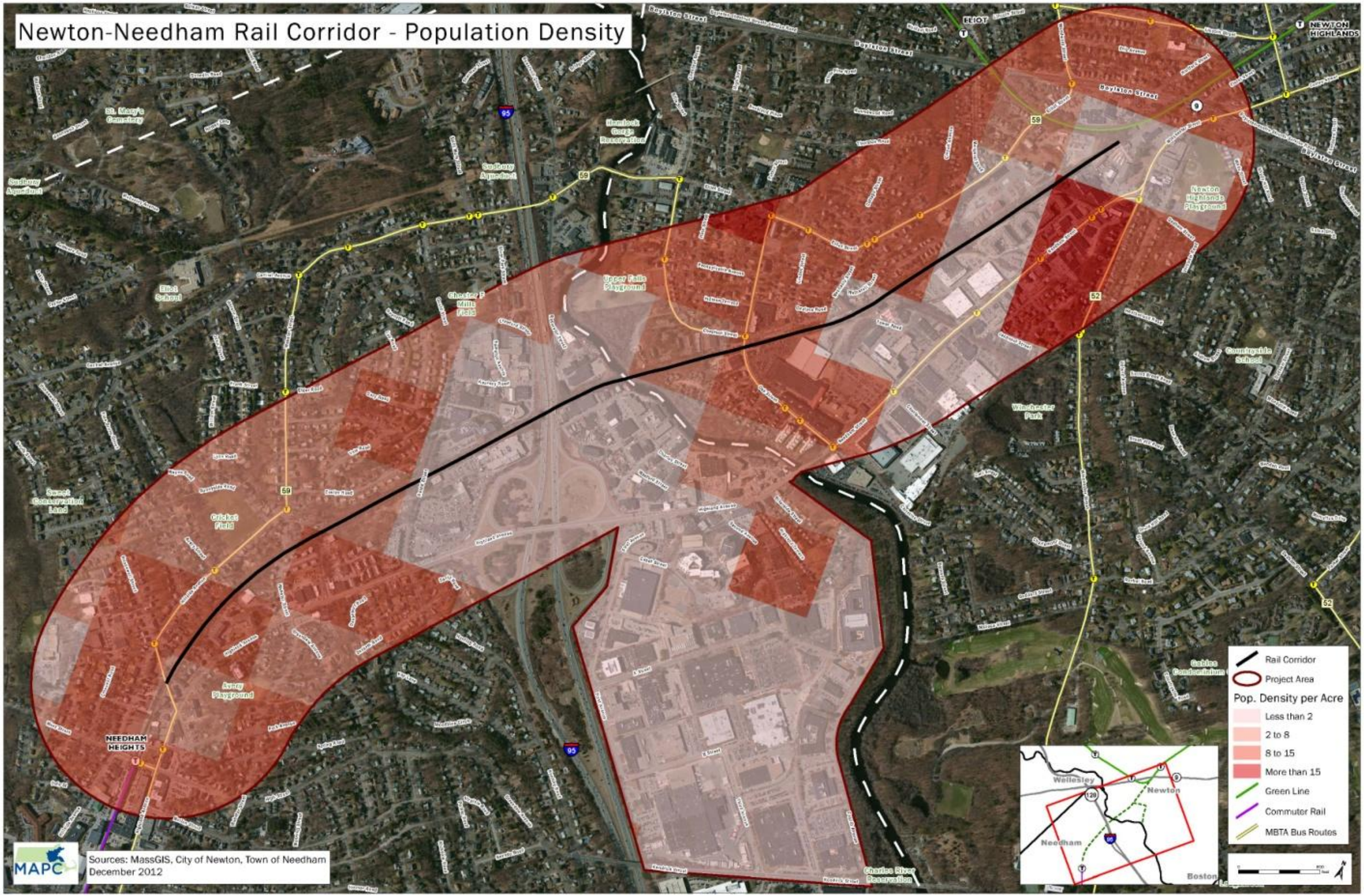


Figure 6: Study Area Population Density

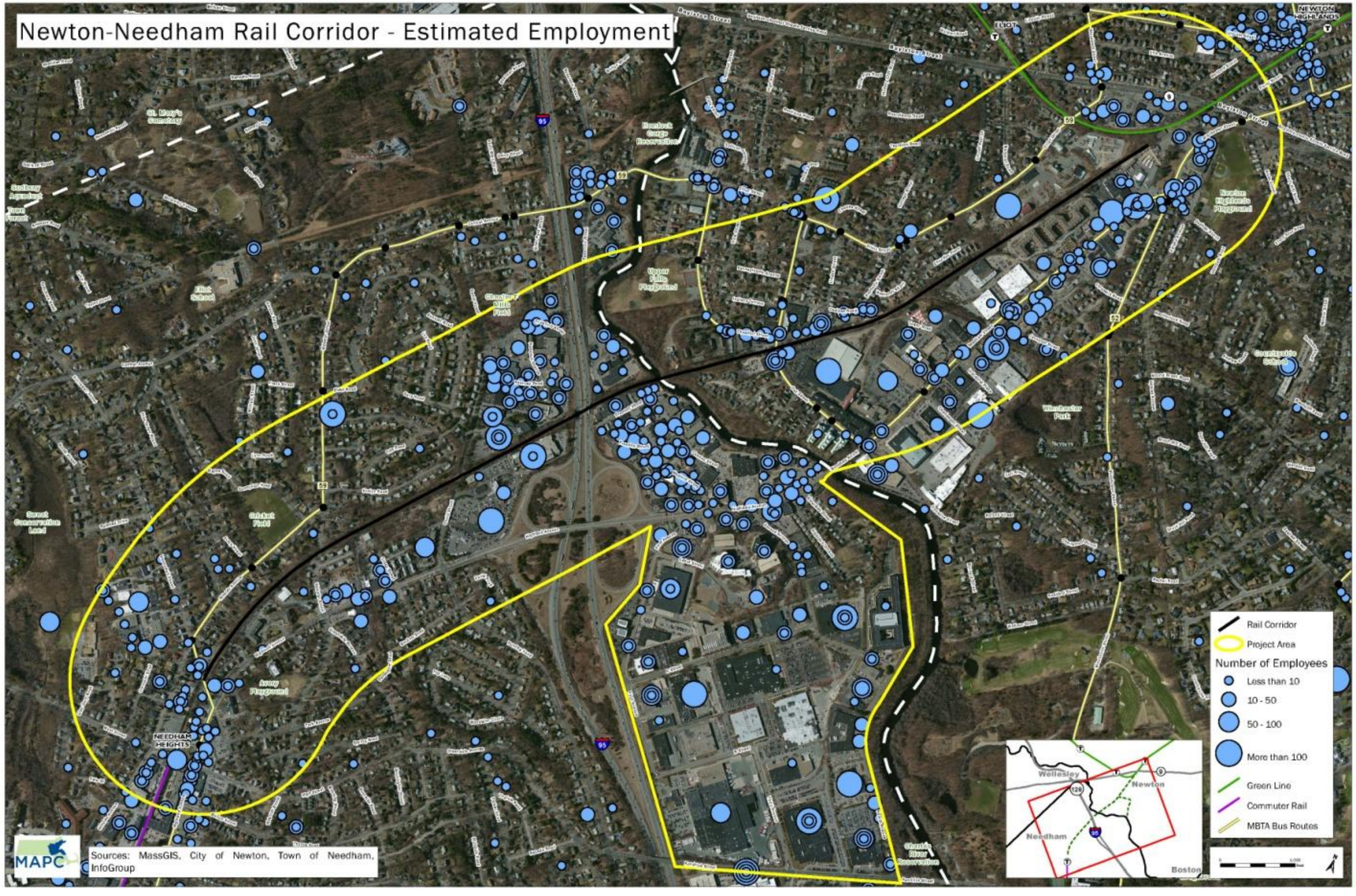


Figure 7: Study Area Estimated Employment

Commercial & Residential Development

In order to assess the feasibility of implementing a rapid shuttle service, it is important to consider the current and potential development in proximity to the abandoned RoW in both Newton and Needham and how it might support the transit option. The study area includes 7.5 million square feet of office/commercial floor area. This includes 2.5 million square feet of retail and office floor area in Newton and the 215 acre New England Business Center. There is also industrial and residential development in the study area[23]. Below are some of the major development sites in the area, including the section to the southwest of the bridge over Route 128.

Table 6: Current Office and Residential Along the RoW

Name	Address	Type
Webster Green Apartments	757 Highland Avenue, Needham, MA	Residential
WCVB Channel 5 News	WCVB-TV 5 TV Place Needham, MA	Office
Needham Corporate Center	160 Gould Street, Needham, MA	Office
Needham Executive Center	144 Gould Street, Needham, MA	Office
330 Reservoir Street, Needham	330 Reservoir Street, Needham, MA	Office space (not yet fully occupied)
New England Business Center	Highland Avenue on the North, Kendrick Street on the South, 1st Street on the west, and 4th Avenue on the east, Needham, MA	Industrial, Office, Retail
Village Falls	173, 183, 193 Oak Street, Newton, MA	Residential/Office
109 Oak Street Office Building	109 Oak Street, Newton, MA	Office
Newton Technology Park	143-165 Needham Street, Newton, MA	Office, R&D, Industrial
Avalon Apartments	89 Needham Street, Newton, MA	Residential

[23] Town of Needham. *Metro Boston Consortium for Sustainable Communities Place-Based Project Proposal.* February 2012.

Table 7: Developments under Construction

Name	Address	Scheduled Completion	Type
Wingate at Needham	Located on Gould Street adjacent to the Wingate at Needham skilled nursing facility at 589 Highland Ave.	May 2013	Residential

Table 8: Proposed for Development

Name	Address	Scheduled Completion	Type
Normandy Project in New England Business Center	66 B Street, Needham, MA 360 1st Ave, Needham, MA 410 1st Ave, Needham, MA	January 2015	Office/R & D, 740,000 sq ft. 237,094 sq ft new office space at the site.

At the December 3, 2012 Special Town Meeting in Needham, the town indicated that TripAdvisor is planning to move its executive offices to 230,000 square feet of the new six-story office building to be constructed by Normandy GAP-V Development Needham, LLC as part of the Normandy project at the New England Business Center. TripAdvisor will bring 450 employees to Needham from Newton and plans to expand by hiring an additional 250 full-time employees.[24] The overall Normandy development is projected to provide a total of approximately 1650 jobs with about 526 of these jobs being new[25].

Potential Development Sites

Northland Site

There is a 22-acre site ripe for redevelopment at the northern corner of where Needham Street and Oak Street intersect in Newton. Some past analyses have suggested that the site could hold between 300,000 to 500,000 sq. feet of office and retail space in addition to 200 to 300 residential units and might produce 600 to 800 construction jobs and 300 to 500 permanent jobs[26]. Northland Investment Corporation has discussed the possibility of

[24] Town of Needham. *Tax Increment Financing Plan and Zone, Town of Needham & TripAdvisor LLC. & Normandy Gap-V Development Needham, LLC*. December 2012.
[25] This number is based on the square footage, using a multiplier of one employee per 450 square feet. The multiplier is consistent with other projections that the town of Needham has done regarding the total potential number of jobs that development in the New England Business Center could yield. This number is based on a build-out analysis. For more accurate numbers, a market analysis is recommended.
[26] Town of Newton. *MassWorks Infrastructure Program Grant Application*. 2011

redeveloping this site as a mixed-use development. However, a formal proposal was never submitted and a development scenario was never identified.

Filene's Basement Expansion

The site of the former Filene's basement at 215 Needham Street in Newton was sold at a public foreclosure auction on September 13, 2012 and is another potential site for future development.[27]

New England Business Center

In addition to the Normandy development, there is potential for a significant amount of redevelopment in the New England Business Center (NEBC). Needham recently up-zoned this area in order to allow for more flexible development. The zoning changes put in place in fall 2011 will allow for taller buildings and denser development. The goal of the zoning changes is to allow the business park to move from a manufacturing and industrial park to a regional office district.[28] Needham has projected the build-out of the NEBC to be as much as 2.5 million-3 million square feet in new office space over the next 15-20 years. Based on a multiplier of one employee per 450 square feet, the projected employment would be about 7000 additional people working in this area if the projected square footage was satisfied. With 6,199 employees currently working in the business park, this has the potential to double the amount of jobs in the New England Business Center.

The zoning changes made in the New England Business Center are summarized below-

1) Raised maximum building height from 68' to 72' or 84' with special permit
2) Raised maximum lot coverage from 50% to 65%
3) Lowered minimum front setback from 20' to 15'

Overall Development Conclusions

The analysis indicates that the majority of significant commercial development is located on the northeast side of Route 128, supporting a shuttle bus concept that runs only on the northeast side. It is also clear that the study area currently has significant retail and office floor area along with commercial uses and residential development. There is significant potential for new development in the area, in particular within the New England Business Center in Needham and at the Northland site in Newton.

Although the New England Business Center is located in Needham, any significant development and job creation at this site would also benefit Newton as an influx of new employees in the area would also be shopping, eating lunch, and spending money in the

[27] Graham, Melanie. *Filene's Basement Site in Newton Will Go to Auction Next Month.* August 2012, http://newton.patch.com/articles/filene-s-basement-site-in-newton-will-go-to-auction-next-month (accessed September 10, 2012).
[28] Town of Newton. *MassWorks Infrastructure Program Grant Application*. 2011

many businesses that are located along Needham Street in Newton. While there are currently 12,697 employees within the study area, if projections regarding the New England Business Center and the Northland site are an indication of future growth, there could be an additional 7500 employees working in the area over the next 15-20 years. The rapid shuttle service could help to support future development and growth in both Needham and Newton.

Chapter Four: Physical & Planning Challenges along the RoW

Physical Constraints

There are planning and physical constraints and challenges along the RoW that would need to be addressed in order to accommodate this Concept Plan. As part of this work, physical constraints have been identified for the RoW from the Newton Highlands Green Line station to the Route 128 MBTA railroad bridge. Due to the lower population and employment densities south of Rte 128 and the grading of the RoW in Needham, the shuttle service concept will be focused on the north end of the RoW, east of Rte 128, from the New England Business Center connecting up to the Newton Highlands MBTA station.

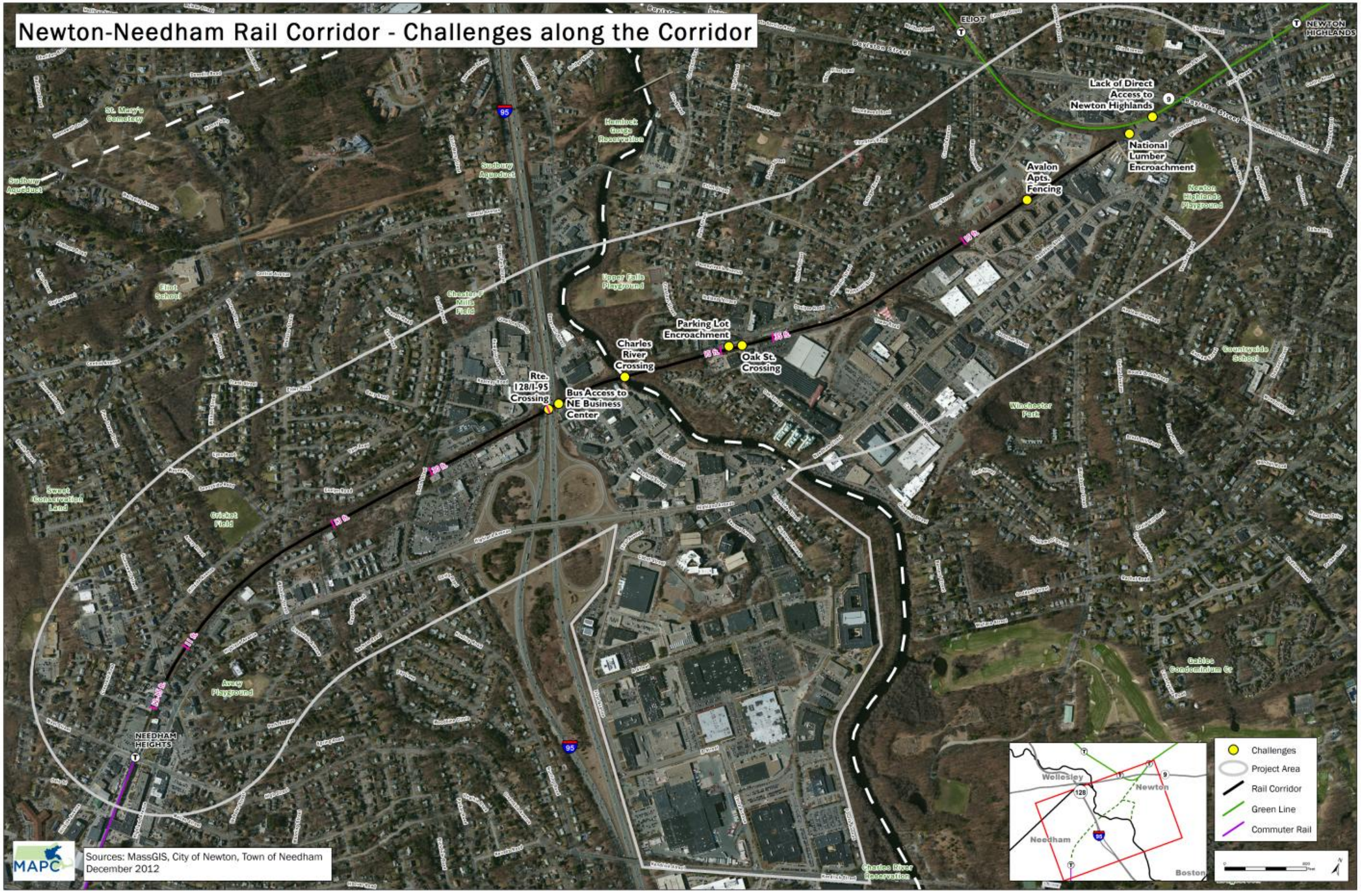


Figure 8: Challenges along the RoW

Cross Section Width

As shown in Figure 8, there are several places along the corridor where the width is severely restricted. Although the MBTA Valuation Maps, attached in Appendix C, identify that the RoW is consistently about 80 feet wide, it is clear that the RoW has been encroached upon over the years by adjacent property owners, and includes tree lines, fencing, parking, buildings, and homeowner backyards that make the existing usable cross section much narrower. Because these encroachments are illegal, the MBTA does have the right to address them and require them to be removed, but the actual removal of these encroachments can sometimes be a lengthy and time consuming process. The engineering challenges, however, may be the most costly to address as sections of the RoW include a steep embankment with a raised rail-bed.

MAPC staff walked the length of the RoW and took key measurements along the way. The typical cross section that is consistently free and clear is approximately 15 feet. In some locations the cross section is wider, but not for long sections. Aside from the encroachments, the steep rail-bed embankment would also make it very challenging and costly to create a wider space.

Lack of Direct Connection to and from Newton Highlands Station

There is no direct connection to the RoW from the Newton Highlands station. The RoW merges with the existing Green Line tracks and there is no space to accommodate additional access. In order for a shuttle to pick people up at the Newton Highlands station and to access the RoW, it must divert onto local roads for a portion of the trip, slowing down the service.

National Lumber Encroachment

A major encroachment at the northeast end of the RoW is from National Lumber (seen below in Figure 9). National Lumber was offered a lease for this area, but refused the lease and has indicated they will vacate the premises. If this encroachment is removed, the RoW could continue a few hundred feet further north and potentially connect with Curtis Street so that a shuttle service could use this road to access the RoW instead of using Easy Street for access.

Figure 9: National Lumber Encroachment on RoW

Avalon Apartments Fencing

There is a steep downgrade away from the tracks as the RoW approaches Avalon Apartments. Behind Avalon Apartments, there is a fence up on both sides. Because of the presence of the fence, the cross section is now at about 15 feet across again. The fencing is pictured below in Figure 10.

Figure 10: Fencing Behind Avalon Apartments

Oak Street Crossing

Oak Street would be a potential stop for the shuttle in Newton. At Oak Street there is a parking lot that has encroached on the RoW, but could be easily reclaimed without impacting too many parking spaces. Pictured below in Figure 11 is the north side of Oak Street where there is an old railroad depot currently being used as a café.

Figure 11: Old Train Depot at Oak Street

Parking Lot Encroachments

Between Oak Street and the Charles River Bridge, there are some parking lots that are encroaching on the RoW. The second track ends here. See Figure 12 below.

Figure 12: Parking Lot Encroachments before Oak Street

Charles River Crossing

The bridge over the Charles River appears structurally sound with the exception of the worn and damaged rail ties currently covering the bridge, although a structural engineering assessment would have to be made. See Figure 13 below.

Figure 13: Charles River Bridge Crossing

Shuttle Access into New England Business Center

The potential shuttle service would be travelling southwest along the RoW and would exit the RoW right before Route 128. There is currently an industrial building (Sud-Chemie AG) and parking lot in this area. An access point and ramp down into the New England Business Center would have to be determined. Figure 14 is looking onto the site of the potential shuttle access, showing the Sud-Chemie AG building and the fire lane behind it. The cross section here is about 15 feet.

Figure 14: Site of Potential Shuttle Access

Rte 128/I-95 Crossing

The old MBTA railroad bridge is being removed as part of the 128 Add-A-Lane project. If the shuttle concept is advanced, additional study should be undertaken to identify the kind of bridge that could be replaced at this site. A bridge could be planned that is wide enough to accommodate potential future transit uses as well as bicycle and pedestrian modes.

Figure 15: Route 128/I-95 Crossing

Chapter Five: Cross Section and Concept of Operations

Based on the analysis of the study area demographics, commuting trends, and physical constraints, the concept for the RoW focuses on providing a reverse commute transit option connecting commuters from the Newton Highlands MBTA Station to employment centers along the RoW in Newton and into the New England Business Center in Needham. The concept is that the RoW would accommodate rapid shuttle service, cyclists, and pedestrians, but no personal motor vehicles.

Based on MAPC field work, the typical cross section for construction along the RoW is approximately 15 feet, with short sections that become 20 to 30 feet wide. Although the MBTA Valuation Maps outline a RoW of 80 feet across consistently along the corridor, the usable space at this point in time is much less. Some of the wider areas, such as at Oak Street would require minimal grading, as the land is flat and the cross section is clear of encroachments. But for most of the abandoned rail corridor, widening this space would require significant investment in reclaiming land from encroachments, performing earthwork, adding retaining walls, and grading. While future funding could be identified to create a wider cross section, for the purposes of this study, the Concept Plan is based on a 15 foot cross section because of the significant investment that would be required to create more space.

One of the biggest challenges with this narrow cross section is accommodating space for transit as well as pedestrians and bicyclists. Fifteen feet is not enough room to accommodate bi-directional shuttle service, which would also require design, scheduling, and communication efforts to allow multiple shuttles on the RoW. Both Newton and Needham are interested in accommodating transit, pedestrians, and bicycle modes, and given the expected headways of the shuttle service and the lack of mid-day or weekend shuttle service, it would be very challenging to effectively prohibit cyclists and pedestrians from using a RoW that is not in use for the majority of the week.

Below MAPC has identified two alternatives to accommodate all three users in a 15 foot space. Each scenario has its benefits and drawbacks.

Right-of-Way Cross Section

Pedestrian Separation with pavement marking

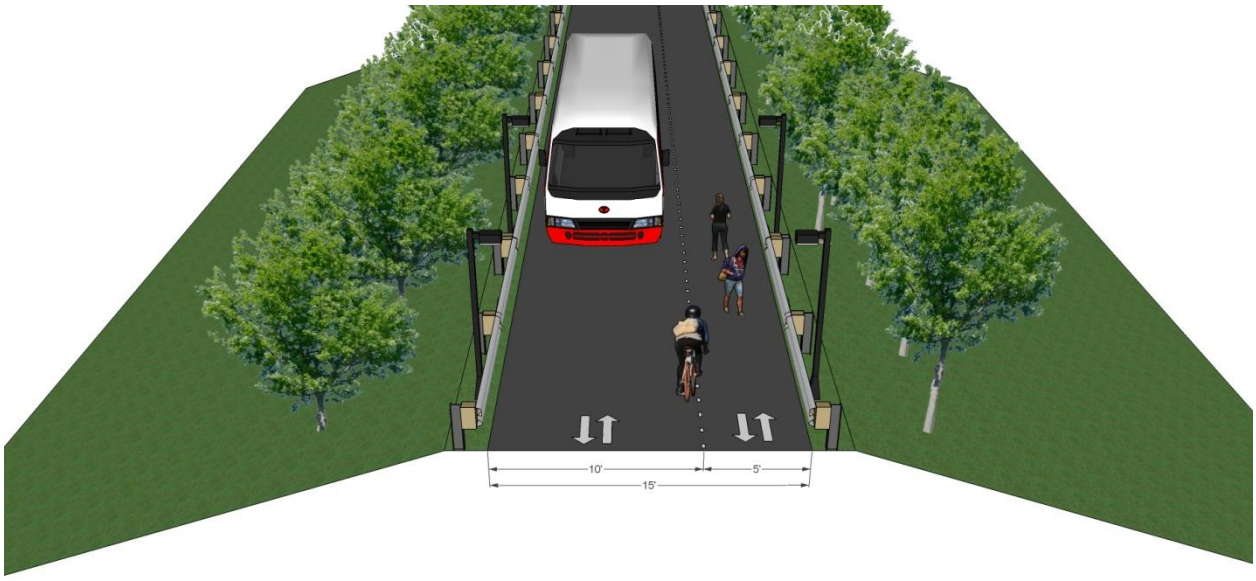


Figure 16: Pedestrian Separation with Pavement Marking

In the above scenario, the shuttle would operate on one side of the cross section in a ten foot lane and pedestrians would travel on the other side of the cross section in a five foot lane. Bicyclists would operate in the shuttle lane and move into the pedestrian area when shuttles are overtaking bicyclists. Pavement markings along the corridor would instruct bike/peds to give way to the shuttle in shuttle lane.

The stretch of the RoW that the shuttle will operate on is only about 1.5 mile and the shuttle will be running only during peak hours on 20 - 25 minute headways. Therefore, many encounters between bicyclists and the shuttle are unlikely. However, since the shuttle will travel in both directions along the RoW there is the possibility that a bicycle could be approaching a shuttle that is travelling towards it in the same lane. If the bicyclist is travelling northeast on the corridor and the shuttle is travelling southwest on the corridor, the bike would have to pull over all the way across the cross section and to the left. This is not a natural pullover for the bike and may cause confusion in this potential cross section.

Advisory Lane Concept

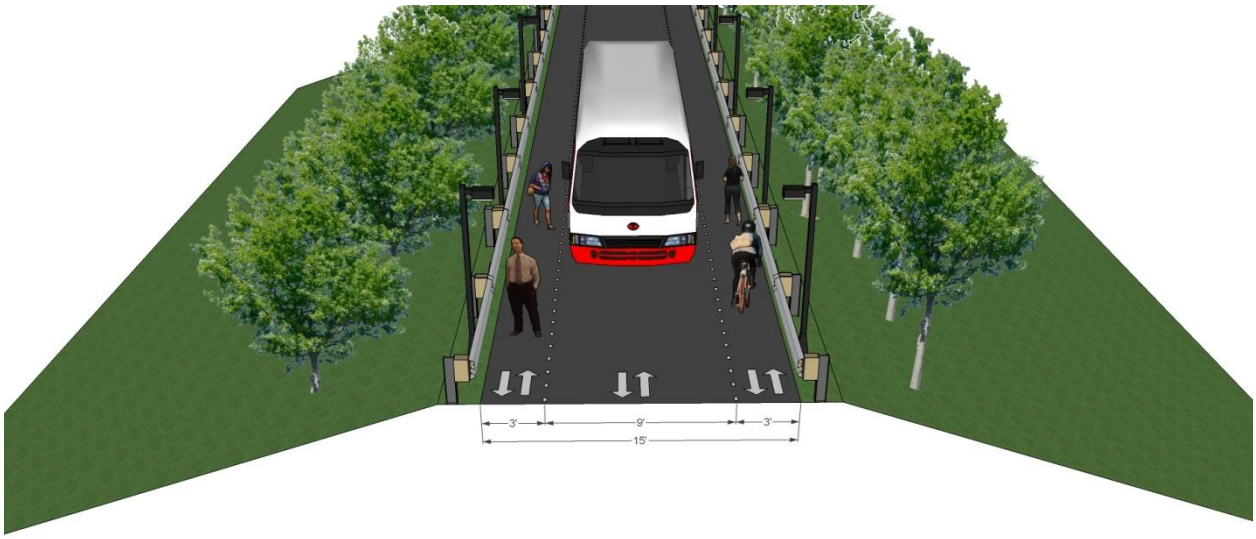


Figure 17: Advisory Lane Concept

In the second potential cross section, the shuttle would travel down the center of the cross section in a nine foot travel lane and the pedestrians would travel on the outside of the cross section. Again the shuttle lane would function as a shared lane with bicyclists also utilizing this lane. The advantage of this concept is that bicycles and pedestrians can easily move off to the appropriate side if they are in the cross section at the same time as a shuttle. There are some areas along the RoW where the width is significantly more than 15 feet and this concept would be easier to work with if the city and town desired to widen the paved area where possible. There is however less of a clear separation between the transportation modes in this scenario and there is less room on either side for the shuttle to pass by if there are pedestrians and bicyclists on either side.

It is important to reiterate the infrequency with which the shuttle will be traversing the RoW. Below is a rendering of the cross section as it would appear in off peak hours and on weekends when the shuttle would not be in service.

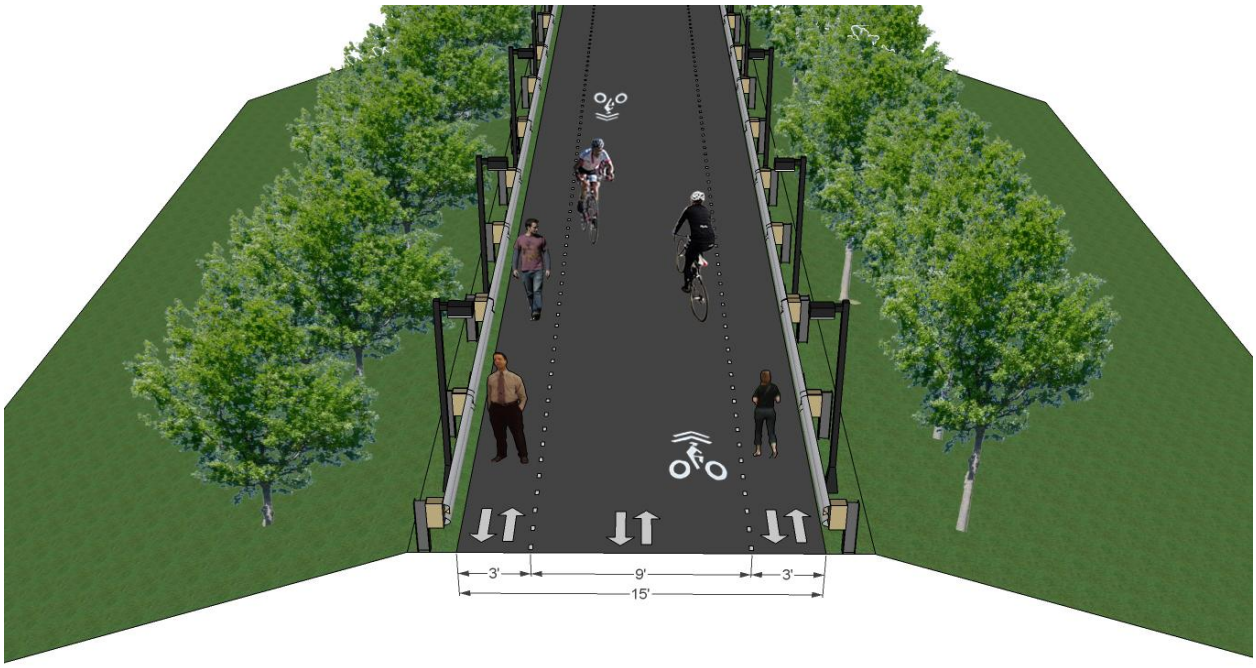


Figure 18: Cross Section at off-peak hours and on weekends[29]

The sections where the cross section is wider and the path could be potentially expanded over 15 feet are on the northeast side of the Depot at Oak Street in Newton where the cross section is about 35 feet and remains slightly wider as it travels northeast to the current site of the TripAdvisor headquarters where it becomes more narrow again. Directly southwest of Oak Street there are a couple of short segments that are also slightly wider with around an 18-20 feet cross section.

Bicycle and Pedestrian Operations

It is also important to accommodate pedestrians and bicyclists on this RoW. As previously stated, it would be nearly impossible to prohibit bicyclists and walkers from using this RoW if the area is paved and the shuttle is making infrequent trips. It is also important to provide bicycle/pedestrian access because of the potential that the RoW has to provide connections with other trails.

Clearly identifiable signage would be located at every access point to and along the RoW to identify the duration and frequency of shuttle service, and to instruct cyclists and pedestrians to allow the shuttle to pass if encountered. There would need to be excellent lighting along the corridor as well so that bicyclists and shuttles could easily see one another from long distances. There might be some potential challenges with providing

[29] You would see a similar layout of bicyclists and pedestrians in both cross sections although the advisory lane concept is pictured here.

lighting because the RoW is located close to residential areas. One potential solution could be to provide LED lighting at street level to reduce light impacts.

Below is one example of what embedded LED lighting could look like. This is a photo in Copenhagen of a bike lane along a vehicular street.

Figure 19: Example of LED Embedded Lighting[30]

Connections to Regional Trail Network

The RoW would serve as an important connection to the Charles River Waterway Trail. At the north end of the RoW, bicyclists could access the trail through either Easy Street or Circuit Avenue. Easy Street is a private road which runs off of Needham Street between National Lumber and National Tire & Battery. Circuit Avenue is a quieter residential road that passes conservation land, although a connection from where Circuit Road hits Eliot Street over to the RoW would have to be explored.

The railroad spur that currently extends from the RoW adjacent to the TripAdvisor parking lot could provide a connection all the way to the existing walking trail that runs along the Charles River. On the Needham side of the Charles River, there is great potential for redevelopment. Part of this redevelopment could include taking advantage of the Charles River as an asset and constructing a river walk to further enhance the connections here.

[30] The Recumbent Blog, *High Tech Bike Lanes,* 2007. < http://www.recumbentblog.com/2007/> (accessed December 10, 2012).

Shuttle Operations

Shuttle Service Provider & Vehicle

The shuttle service would be provided by a non-profit Transportation Management Agency, similar to the 128 Business Council. Private companies served by the shuttle would pay a subsidy for the service, allowing their employees to ride for free and the general public to pay MBTA bus fare rates to be competitive with existing MBTA service (currently $2.00).

There would be two shuttles serving the route and operating at an average speed of 20 mph. The shuttles would each hold approximately 21 passengers and be 7.5 feet wide and 26.5 feet long. This is a fairly small shuttle so that it will be appropriately suited to sharing the narrow width of the cross section with bicyclists and pedestrians. Although the passenger capacity is low in these vehicles, with two shuttles operating, it will more than accommodate the ridership projected to use this service.

Figure 20: Exterior of the Shuttle

Figure 21: Interior of the Shuttle

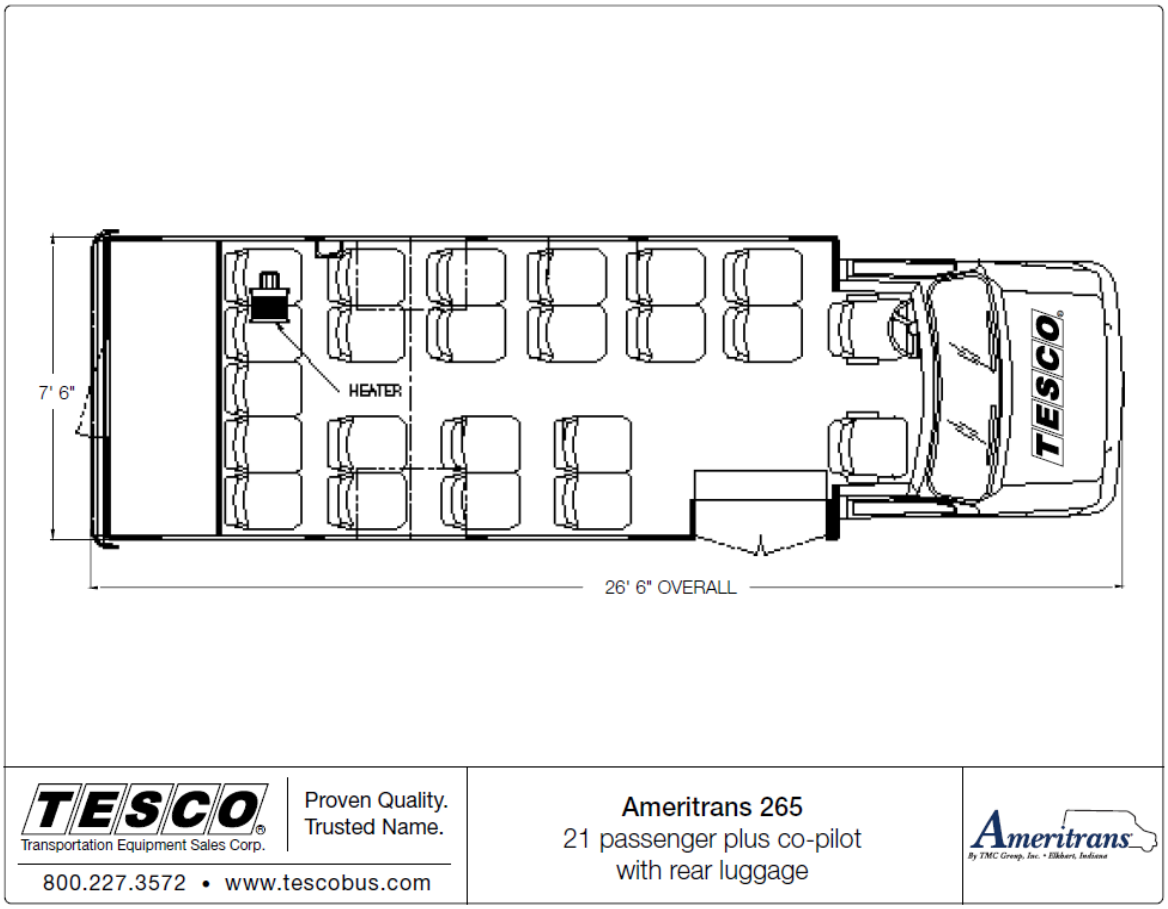


Figure 22: Cross Section of the Shuttle

Shuttle Service Plan

The shuttle service plan assumes that all riders would access the shuttle on foot because there would be no parking associated with any of the proposed stops. Additionally, very few riders would be dropped off or picked up at these stops by automobile given the 1 mile proximity to the Green Line. The shuttle stops would, at the bare minimum, have basic signage. However, with the numerous developments planned for the New England Business Center, the Town of Needham should consider asking developers to include shuttle shelters or lighting at shuttle stops during the permitting process. The shuttle system should also be complemented by a website with schedules and route maps, as well as real-time GPS that could be accessed via smart phone.

Shuttle Route

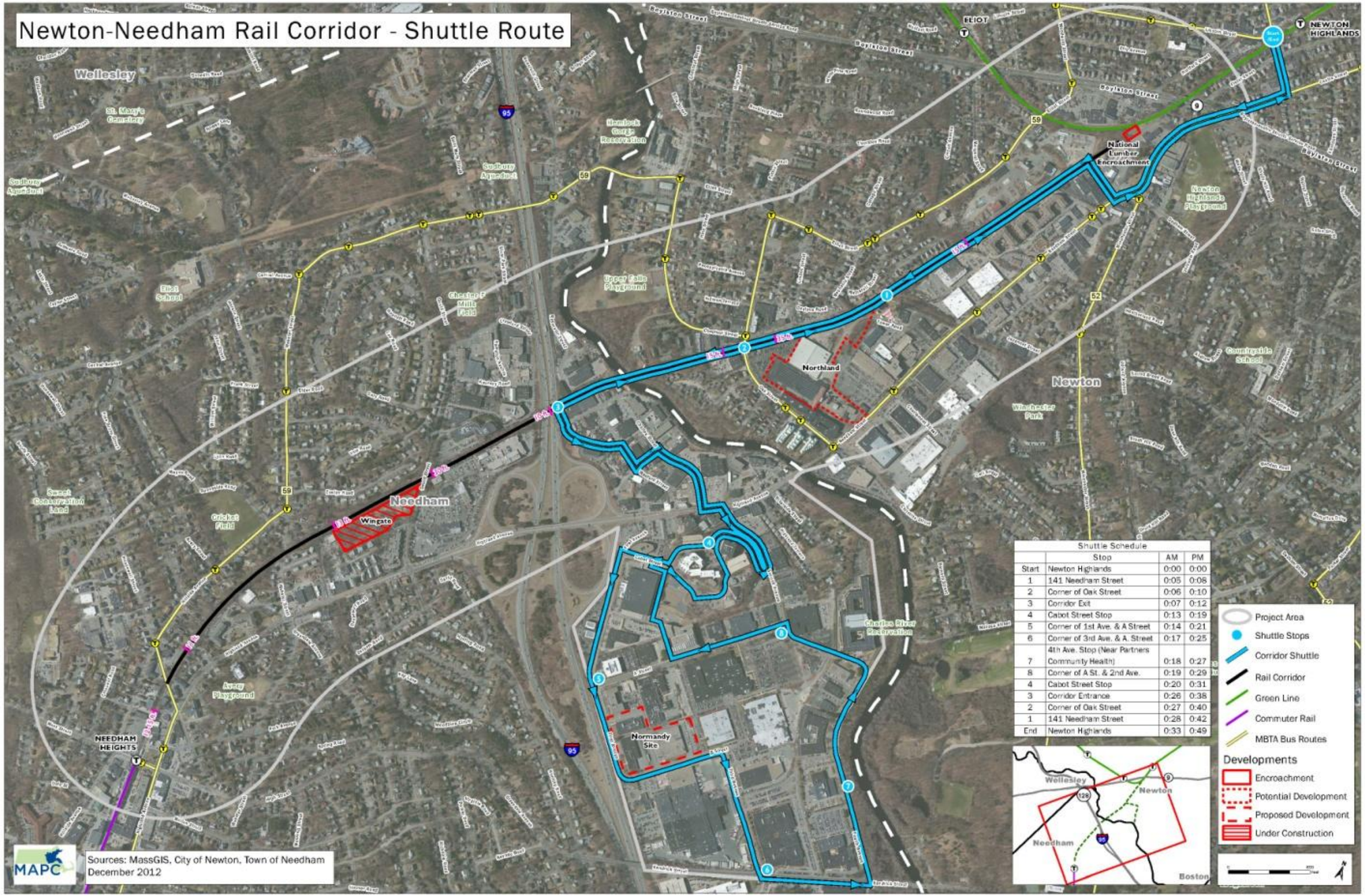


Figure 23: Shuttle Route Map

Leaving Newton Highlands

The shuttle would pick up commuters at the Newton Highlands MBTA Station approximately every 20 minutes during the peak AM period, and every 25 minutes in the peak PM period, Monday through Friday. Service times would be similar to the existing 128 Business Council Shuttle Service which runs from 6:30 to 9:30 in the AM and 3:45 to 6:00 in the PM. There would be no mid-day service and no weekend service.

The shuttle would leave Newton Highlands Station and travel on local roads to connect to the RoW because there is no available RoW to connect directly to the station. Therefore, the shuttle would travel on Walnut Street, take a right onto Centre Street, and travel under Route 9, onto Winchester Street and onto Needham Street. It would then take a right onto Easy Street and the shuttle would enter the RoW. If the National Lumber encroachment at the northeast end of the RoW were cleared there is a possibility that the RoW could continue a few hundred feet further north and that the shuttle could potentially connect to the RoW via Curtis Street instead of using Easy Street, resulting in less time on local roads in local traffic.

141 Needham Street/Railroad Spur

Figure 24: Crosspoint Parking Lots at 141 Needham Street/Railroad Spur Stop

Figure 25: View of the Railroad Spur from Needham Street at 141 Needham Street/Railroad Spur Stop

The first proposed stop on the RoW would be close to 141 Needham Street, owned by Crosspoint Associates and currently leased by TripAdvisor. As seen in Figure 30, there is a large parking lot here adjacent to an abandoned railroad spur (Figure 31) that currently connects the abandoned RoW to Needham Street. This is a logical point for a stop because the spur could be cleared to provide access from Needham Street to the RoW. The stop could also provide access to some of the businesses on Needham Street. The adjacent property owner and tenants would need to be brought into the process, especially Crosspoint, as they already service their employees with a separate shuttle service. This location is also close to Avalon Apartments so there could be an access point created for residents living in these apartments as well. It would take approximately 5 minutes to reach this stop from Newton Highlands.

Directly to the Northeast of the second stop at Oak Street, the cross section widens to about 35 feet. This wider space could be potentially used as a shuttle pull over area. The wider space is pictured below in Figure 32.

Figure 26: Wider Area by Oak Street that could be used as a shuttle pull-over area

Oak Street Stop

Figure 27: Old railroad Depot at Oak Street Intersection

The second proposed stop would be where the RoW crosses Oak Street. The cross section here is about 25 feet across with about 20 feet of easily usable cross section on the south side of Oak Street. There is good access to the stop with sidewalks on both sides of Oak Street. There is office space in the area and it is also located near the Northland site, an area that the City of Newton is promoting for re-development. As pictured in Figure 33, there are some challenges on the north side of the intersection where an old rail depot is currently serving as a café and is limiting the cross section to about 11 feet. There would also need to be a stop control or signalization at this intersection to ensure that the shuttle can operate efficiently and safely across Oak Street. It would take approximately 6 minutes to reach this stop from Newton Highlands.

Rte 128/I-95 Stop

Figure 28: Site of Potential Shuttle Access

The next proposed shuttle stop would be at the northern edge of the New England Business Center, known as the 128 Mixed Use Overlay District, before the RoW crosses Rte 128. At this location the shuttle would leave the RoW and enter the 128 Mixed Use Overlay District. This would be the only stop serving the 128 Mixed Use Overlay District. If the Route 128 bridge is replaced and allows shuttle riders to cross, this stop could also potentially serve the offices located directly across Route 128. The biggest challenge at this location is in accessing space behind the Sud-Chemie AG building, pictured in Figure 34 above. The RoW has a steep embankment and a carefully engineered access point would need to be established.

Coordination with the owners of this property would be critical, as the shuttle service would need to be established where there is currently parking at the western side of the building. The widening of Rte 128 for the Add-A-Lane project will not impact this area so, pending negotiations with the property owners, there should be enough space for the shuttle to pass through the existing parking lot out to Fremont Street. It would take approximately 7 minutes to reach this stop from Newton Highlands.

New England Business Center Stops

The following stops would all be located within the New England Business Center and service the various businesses. The shuttle would travel through the 128 Mixed Use Overlay District on Franklin, Wexler, and Charles Streets, briefly onto Highland Avenue, and into the New England Business Center. There would be five stops within the Business Center, located at 1) Cabot Street near the Needham Sheraton; 2) the corner of 1st Avenue and A street; 3) the corner of 3rd Avenue and Kendrick Street; 4) 4th Avenue near Partners Community Health, and 5) the corner of A street and 2nd Avenue.

Travel Back to Newton Highlands

The shuttle would then travel back to the RoW from A Street by travelling along the road directly to the northeast of 40 A Street and continuing through the parking lot behind the 141 1st Avenue building to access Cabot Street. It would then make a stop again at the Needham Sheraton, exit the New England Business Center, cross Highland Avenue, enter the 128 Mixed Use Overlay District via Charles Street, connect to Fremont Street, and access the RoW again behind the Sud-Chemie AG building by traveling through the parking area on the west side of the building.

Traveling northeast along the RoW, the shuttle would make stops again at Oak Street and behind the 141 Needham Street building to pick up riders that would want to connect to the Green Line. The shuttle would then follow the same route to return to Newton Highlands Station, exiting the RoW at Easy Street, taking a left onto Needham Street, and then onto Winchester Street, under Route 9, with a final left onto Walnut Street to drop off passengers at the Green Line station.

Shuttle Schedule

The below schedule (Table 9) outlines the time it will take for the shuttle to travel the full route as well as the time it will take in between each of the aforementioned stops. MAPC staff worked with the 128 Business Council in order to estimate an AM schedule for the shuttle as it travels along the corridor. The PM schedule has a longer total trip time as it can vary widely depending on how many people are waiting at each stop for pick up, how long loading times take, and the amount of traffic that the shuttle will encounter while travelling on local roads.

Table 9: Shuttle Schedule

	Stop Name	AM (mins)	PM (mins)
Start	Newton Highlands	0:00	0:00
1	141 Needham Street	0:05	0:06
2	Corner of Oak Street	0:06	0:08
3	Corridor Exit	0:07	0:10
4	Cabot Street Stop	0:13	0:17
5	Corner of 1st Ave. & A Street	0:14	0:18
6	Corner of 3rd Ave. & A. Street	0:17	0:21
7	4th Ave. Stop (Near Partners Community Health)	0:18	0:22
8	Corner of A St. & 2nd Ave.	0:19	0:23
9	Cabot Street Stop	0:20	0:24
10	Corridor Exit	0:26	0:30
11	Corner of Oak Street	0:27	0:31
12	141 Needham Street	0:28	0:32
13	Newton Highlands	0:35	0:40
	Travel Time	0:35	0:40

Ridership Projections

Currently, the 128 Business Council Needham Shuttle, which picks up commuters at the Newton Highlands MBTA station and travels along Needham Street to access the New England Business Center, provides service for approximately 90 passenger trips a day, or approximately 45 people a day assuming each person takes two trips a day. This totals approximately 23,500 passenger trips a year.

Using the RoW instead of Needham Street could reduce the travel time by approximately 5 minutes in AM peak hours and approximately 10 minutes in the evening, and provide additional service during the peak morning and evening commute times.

Based on the above information, MAPC estimated the potential ridership for this shuttle service using a transit elasticity analysis[31]. For the purposes of the estimate, the current 128 Business Council service was used for comparison and is represented in Table 10 below

[31] The transit elasticity analysis used was developed by the Central Transportation Planning Staff. The analysis uses elasticities to estimate demand due to changes in headways and travel times. It is important to note that there are many other factors that were not considered in this estimate that have the potential to affect ridership numbers, including changes in cost and any new development along the corridor.

under "current conditions." These ridership estimates only take into account the changes in headways and travel time that shuttles operating on the RoW would offer in comparison to the current headways and travel times of the Route 128 Business Council shuttle running along Needham Street. It is important to note that there are many other factors that were not considered in this estimate that have the potential to affect ridership numbers, including changes in cost and any new development along the corridor.

Table 10: Shuttle Ridership Projections

AM Peak	**Headway (minutes)**	**Travel Time (minutes)**	**Ridership (people)**
Existing Conditions	40	40	45
New Route – 1 shuttle	35	35	*50 (+ 11%)*
New Route – 2 shuttles	20	35	*63 (+ 40%)*
New Route – 3 shuttles	13	35	*75 (+ 67%)*
PM Peak	**Headway**	**Travel Time**	***Ridership***
Existing Conditions	50	50	*45*
New Route – 1 shuttle	40	40	*54 (+ 20%)*
New Route – 2 shuttles	25	40	*65 (+ 44%)*
New Route – 3 shuttles	15	40	*79 (+ 76%)*

The exact level of new job growth within the New England Business Center is speculative. However, if the New England Business Center were to double in size based on the build-out analysis, the ridership estimate predicts there would be 90 riders in the AM peak with current conditions, 100 riders with 1 shuttle, and 127 riders with 2 shuttles. In the PM peak there would be 90 riders with current conditions, 107 riders with 1 shuttle, and 130 riders with 2 shuttles.

In addition, the service would likely attract new riders who would want to use the shuttle to connect to the Newton Highlands MBTA Green Line station from points along the RoW in Newton, for a traditional commute into Boston. These people would access the shuttle service at the Oak Street and 141 Needham Street Shuttle stops. The catchment area for these two shuttle stops would be a ¼ mile radius.

However, because there is currently a low residential population along the corridor, the demand for connecting via shuttle service to the Green Line at this time for a traditional

commute trip would likely be low, and did not factor into the above ridership analysis. Future residential development may create demand for traditional transit commute trips via the Green Line into Brookline and Boston and could potentially elevate the projected ridership numbers above.

Chapter Six: Concept Renderings

Below the advisory lane cross section was inserted into the actual abandoned rail RoW to provide a visualization of how this concept would look.

Figure 29: Rendering of Cross Section

Figure 30: Rendering of Cross Section 2

Chapter Seven: Shuttle Operation Challenges

Many of the physical constraints previously documented in this report also present challenges for shuttle operations. First, the width of the cross section is a major limitation because it can only provide space for one shuttle to travel safely in one direction at a time. This limits the number of shuttles that could be provided. Additional shuttles could be provided if shuttle pullover space was incorporated to allow shuttles to safely pass each other. The sections where the cross section is wider and the path could be potentially be expanded over 15 feet would be on the northeast side of the Café at Oak Street in Newton where the cross section is about 35 feet and remains slightly wider as it travels northeast until it reaches the current site of the TripAdvisor headquarters.

Directly southwest of Oak Street there are a couple of short segments of the RoW that also have a slightly wider cross section at about 18-20 feet. Running simultaneous shuttles in opposite directions would be challenging to coordinate however and would require more sophisticated signal timing and radio communication.

The cross section width will also create conflicts with pedestrians and bicyclists that will likely slow down shuttle travel speeds. It's estimated the average shuttle speed would be 15-20 mph.

At the point where the shuttle is currently entering the 128 Mixed Use Overlay District, there is a private parking lot so the potential route would need the support of property owners. Furthermore, the grading in this area would have to be addressed in order to ensure a smooth transition from the RoW into the parking lot.

As mentioned above, there would have to be some kind of stop control or signalization put in place at the intersection of the RoW with Oak Street.

There is a significant challenge in getting from the Green Line Newton Highlands station to the RoW. There is a major encroachment from National Lumber currently present and even if this encroachment were removed, there is no clear connection regardless. The shuttle will have to go out onto Winchester Street and then cut over to the RoW via Easy Street. Easy Street is currently a private way and Winchester Street has significant congestion so this could slow down the headways and the efficiency of the shuttle service.

There are also various grading issues and encroachments that will have to be dealt with along the corridor, including the old train depot that is currently in the RoW at the Oak Street stop, the fencing behind Avalon Apartments, and the parking lots that encroach on the RoW just southwest of Oak Street. Because these encroachments are illegal, the MBTA does have the right to address them and require them to be removed, but the actual removal of these encroachments can sometimes be a lengthy and time consuming process.

The bridge currently crossing the Charles River would have to be examined for structural soundness. It would also need to be widened and a new surface would need to be acquired in order to accommodate this concept.

Maintenance and upkeep along the trail could also be a challenge. The city and town would most likely have to foot the bill for services like snow removal, providing lighting and electricity, and making sure that the trail is kept clean and in good condition. This would have to be negotiated between the city, the town, and the private shuttle operator. Lighting in particular could pose some potential challenges as the abandoned RoW is located very close to residential areas. It is however crucial to have appropriate lighting along the RoW because pedestrians, bicyclists, and shuttles will be operating together in a narrow space. There are some potential alternatives to traditional overhead lighting such as street level lighting with less of a footprint.

If the private shuttle operator were to try to coordinate two shuttles within the RoW *at the same time* it would require a high level of training and coordination for shuttle drivers. On-board GPS on a mounted tablet device might prove to be a cost-effective way for drivers to see each vehicle and determine if yielding at the pullover areas is necessary. Other methods such as embedded roadway sensors and indicator lights should be explored, although these methods would add additional cost to the project. Radio communication would also be required to ensure that drivers are aware of each other's location. The time required to ensure that each vehicle can pass each other safely would factor into the headways.

Chapter Nine: Next Steps

If the Town of Needham and City of Newton wish to further advance this Concept Plan, there are several next steps that should be taken:

- Evaluate this Concept Plan to understand if it meets the goals of both communities and if there is public support. Both Needham and Newton are interested in a transit service that could potentially ease traffic congestion and provide a catalyst for economic growth. While the analysis does not indicate the shuttle service would be a significant strategy for reducing congestion in the near future, it may be an incentive for employers that want to locate in an area with a strong reverse commute option for their employees. It could provide an option for the employees of new future developments to use transit instead of driving their car and adding traffic to the already congested roadways. Additionally, each municipality should work with appropriate public committees to assess the level of support for this concept.

- Monitor construction adjacent to the RoW. In the short-term each community may wish to advance a shared use bicycle and pedestrian path on the RoW. Careful thought must be given to the creation of structures or amenities that could preclude shuttle service in the future. Additionally, sections of the RoW have been encroached upon. Efforts to clear those encroachments and make sure additional development on the RoW does not occur should be pursued.

- Work to identify funding to conduct a feasibility analysis if the municipalities decide that they want to move forward with this concept.

- Conduct feasibility analysis and cost/benefit study. Significant additional studies would be needed to understand the exact usable width of the RoW and how the challenges identified in this write-up could be addressed. MAPC estimates that such a feasibility study would cost $200,000 to $300,000 in 2013 dollars. A key question that must be answered is whether the capital costs required to address all of the physical and operational constraints identified in this write-up are equal to or greater than the ridership benefit of providing an improved transit connection to the employment centers.

- Create a more detailed ridership estimate. Included in any cost/benefit analysis should be a more detailed estimate of potential transit ridership using the Boston MPO travel demand model.

- Study the replacement of the existing train bridge over Route 128 (Bridge N-04-020) that will be removed as part of the Route 128 Add-A-Lane Project. A bridge could be planned that is wide enough to accommodate potential future transit uses as well as

bicycle and pedestrian modes. Any planning process for this bridge replacement should engage MassDOT and the MBTA.

Chapter Ten: Potential Funding For Next Steps

In Massachusetts there is currently an unmet need for transportation infrastructure investments and maintenance programs. A recent report by MassDOT, *The Way Forward: A 21st Century Transportation Plan* identifies over one billion dollars of transportation infrastructure needs a year statewide for the next ten years.

Therefore, conducting the feasibility study outlined in the concept plan is highly dependent upon communities working together and in concert with state and federal officials to obtain funding. This chapter identifies some potential funding opportunities that may be appropriate to advance next steps in the concept plan from Local and State sources. A description of the funding source is provided for each program.

Local

One source of local funding could be from the businesses that are located in the area. The private sector, whether it is property owners, businesses that rent space in building, or developers, gain tremendously from transportation improvements. Working in coordination with the area businesses and commercial property owners, Needham and Newton could pool resources to fund the feasibility study. The funds could be given to the municipalities to oversee the study or be managed by a separate entity like the 128 Business Council. Funding could also come as part of developer mitigation as more businesses locate in the study area.

Another strategy could be to create a Business Improvement District (BID) that could assist with further study and potentially even fund some of the capital costs. Although it would be rare for a BID to fund a feasibility study, once there are a number of established businesses in the area, a BID might be a good option for continuing to improve and maintain the RoW because many of the employees could be using the shuttle service or path to get to work. Under Massachusetts law communities are authorized to establish BIDs (M.G.L. Chapter 40O). While BIDs can be complicated and sometimes controversial to establish, they can be used to fund infrastructure improvements to an identified business area[32].

Because Needham and Newton are both CPA communities they could petition to use CPA funds in order to conduct a feasibility study, but both communities would have to commit to allowing bicycle and pedestrian access to this RoW. It is unclear whether CPA would allow funds to help with the transit portion of the study but because this space would be available

[32]Commonwealth of Massachusetts. *Business Improvement Districts (BID).*2013. http://www.mass.gov/hed/community/planning/bid.html (accessed December 10,2012)

for bicyclists and pedestrians at all times, it is possible funding may be allowed in this instance.

State

MassDOT

MassDOT's Office of Transportation Planning develops transportation plans, programs, and projects to advance the transportation policies and objectives of the Secretary of Transportation and to ensure compliance with federal and state transportation and environmental laws and regulations so that federal funding to Massachusetts continues. One of the principal activities that is performed to accomplish this mission includes developing multimodal and modal-specific statewide transportation plans, and project-specific transportation improvement programs. The Office of Transportation Planning can support, obtain funding for, and oversee a feasibility study, but given MassDOT's financial constraint and other regional priorities, obtaining funding for a feasibility study would be challenging.

Economic Development Fund

The Economic Development Fund (EDF) finances projects and programs that create and/or retain jobs, improve the local and/or regional tax base, or otherwise enhance the quality of life in the community. EDF gives priority assistance for physical improvements in support of job creating/retention. Historically, EDF has funded a range of economic and community development projects. Currently, the program funds physical improvements supporting downtown and commercial center economic development, assistance to non-profit development organizations, planning projects supporting economic development, and Section 108 Loan Guarantees.

Job Access Reverse Commute (JARC)

Although JARC was not included in the most recent Federal Transportation Bill, MassDOT does have some JARC money left in their budget that is available at the State level. The Job Access and Reverse Commute (JARC) program was established to address the unique transportation challenges faced by welfare recipients and low-income persons seeking to obtain and maintain employment. Many new entry-level jobs are located in suburban areas, and low-income individuals have difficulty accessing these jobs from their inner city, urban, or rural neighborhoods. JARC funds capital, planning, and operating expenses for projects that transport low income individuals to and from jobs and activities related to employment, and for reverse commute projects.

Eligible sub recipients are private non-profit organizations, State or local governments, and operators of public transportation services including private operators of public transportation services.

Because this project provides a reverse commute and there are a number of industrial jobs in the 128 Mixed Use Overlay District, this might be a source of funding to explore. However, it is important to keep in mind that many entry level jobs require working late at night or on weekends when conventional transit services are either reduced or non-existent so running additional transit service on the RoW might need to be explored in order to qualify for this funding.

Chapter Eleven: Conclusion

A shuttle service along the RoW has the potential to modestly increase the reverse commute potential for workers coming into the study area and in particular to serve offices along Needham Street in Newton and the New England Business Center in Needham. The shuttle service may also serve as an impetus for future development to locate in the area, thereby potentially increasing the use of the service.

There would however be many challenges associated with implementing the Concept of Operations outlined in this report. Challenges include the limited width of the abandoned RoW, the potential conflict between pedestrians, bicycles, and the shuttle, as well as various encroachments and providing access from the RoW into the 128 Mixed Use District. The bridge over the Charles River would need to be assessed by structural engineers in order to determine its structural soundness. The bridge would also need to be widened to accommodate all users, a process that could take a significant period of time.

If the municipalities feel that this concept is worth pursuing, the key next step would be to identify funding for a feasibility study and cost/benefit analysis to determine if the investment involved in implementing this concept would be worth the return.

Appendix A

MBTA Surveys 2008-2009

Commuter Rail Survey

Needham Heights

MBTA Surveys: 2008-09

Commuter Rail Survey

Trip Purpose, Reasons for Using the MBTA, and Alternative Means

Needham Line

Expanded Results

Entry Station: Needham Heights

Trip Purpose:	Number of Riders	Percent of Riders	Cumulative Percentage
Home-based Work	312	89.2%	89.2%
Home-based School	11	3.2%	92.4%
Home-based Shopping	0	0.0%	92.4%
Home-based Social Activity	0	0.0%	92.4%
Home-based Personal Business	0	0.0%	92.4%
Home-based Work-related	0	0.0%	92.4%
Home-based Other	4	1.2%	93.6%
Work-based	22	6.4%	100.0%
Non-Home/Non-Work-based	0	0.0%	100.0%
TOTAL	349		
No Answer	15		

Reasons for Using the MBTA:	Number of Riders	Percent of Riders*
Convenience	240	67.3%
Speed/travel time	118	33.2%
Avoid driving/traffic	267	75.0%
Avoid parking at destination	239	67.1%
Environmentally responsible	186	52.1%
Less expensive	100	28.0%
Can read/do work	212	59.4%
Only transportation available	38	10.6%
Other	0	0.0%
TOTAL RIDERS GIVING AT LEAST 1 REASON:	357	

Use Other Mode to Make Same Trip?	Number of Riders	Percent of Riders
Yes	172	49.1%
No	178	50.9%
TOTAL	349	100.0%
No answer	15	

Other Modes Reported by Riders Who Checked "Yes":	Number of Riders	Percent of Riders*
Drive alone	120	71.6%
Non-MBTA bus	4	2.4%
Carpool/vanpool	31	18.7%
Bicycle	0	0.0%
Other MBTA service	56	33.7%
Other	0	0.0%
TOTAL RIDERS GIVING AT LEAST 1 OTHER MODE:	167	
(No other modes reported)	4	

**Note: Percentages may total to more than 100 because of multiple choices checked.*

MBTA Surveys: 2008-09

Commuter Rail Survey

Origin Locations and Activities

Expanded Results

Needham Line

Entry Station: Needham Heights

ORIGIN LOCATIONS			ORIGIN ACTIVITIES								
City/Neighborhood Origins	Total Riders	Pct. of Riders	No Resp.	Home	School	Work	Store	Pers. Bus.	Work-rel.	Social/ Rec.	Other
Needham	321	88.1%		88.5%	2.2%	4.5%	2.2%	1.3%		1.3%	
Dover	12	3.3%		100.0%							
Medfield	8	2.2%		100.0%							
Newton	8	2.2%		100.0%							
Wayland	7	2.0%		100.0%							
Natick	4	1.1%		100.0%							
Wellesley	4	1.1%		100.0%							
Other (< 0.5 % of riders)	0	0.0%									
OVERALL TOTAL	365	100.0%		89.9%	2.0%	4.0%	2.0%	1.1%		1.1%	

Note: Totals shown may differ from column total because of rounding.

MBTA Surveys: 2008-09

Commuter Rail Survey

Access to the Commuter Rail System

Expanded Results

Needham Line

Entry Station: Needham Heights

Access Mode:

	Number of Riders	Percent of Riders
Walk Access	179	50.6%
Drive/Park Access	122	34.6%
Drop-off Access	48	13.7%
Taxi Access	0	0.0%
Shuttle/Van Access	0	0.0%
Bicycle Access	4	1.1%
Other Access	0	0.0%
Total Private Trans.	353	100.0%
MBTA Bus	0	0.0%
Other Bus	0	0.0%
Rapid Transit	0	0.0%
Boat	0	0.0%
Other	0	0.0%
Total Public Trans.	0	0.0%
TOTAL	353	100.0%
No Answer	11	

Wait Time at Board Station:

	Number of Riders	Percent of Riders	Cumulative Percent
0-1 minute	142	40.2%	40.2%
2-4	68	19.2%	59.4%
5-7	97	27.4%	86.8%
8-10	31	8.9%	95.7%
11-15	8	2.3%	98.0%
16-20	0	0.0%	98.0%
Over 20	7	2.0%	100.0%
TOTAL	353	100.0%	100.0%
No Answer	12		
Avg. Wait Time (min)		3.7	

Trip time from trip origin to station by private transportation:

	WALK		DRIVE/PARK		DROP-OFF		OTHER		TOTAL	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
0-5 minutes	32	18.9%	56	47.7%	32	72.7%	4	100.0%	125	37.0%
6-10	84	49.1%	27	23.1%	12	27.3%	0	0.0%	123	36.5%
11-15	43	25.0%	15	12.9%	0	0.0%	0	0.0%	58	17.2%
16-20	12	7.1%	12	10.2%	0	0.0%	0	0.0%	24	7.2%
21-30	0	0.0%	7	6.1%	0	0.0%	0	0.0%	7	2.1%
31-45	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Over 45	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
TOTAL	171	100.0%	118	100.0%	44	100.0%	4	100.0%	337	100.0%
No Answer	8		4		4		0		16	
Avg. Time (min)	10.2		9.5		4.8		5.0		9.2	

Transfers to the Commuter Rail System

Expanded Results

Needham Line

Entry Station: Needham Heights

No responders provided information about their modes of access.

MBTA Surveys: 2008-09

Commuter Rail Survey

Egress from the Commuter Rail System

Needham Line

Expanded Results

Exit Station: Needham Heights

Egress Mode:

	Number of Riders	Percent of Riders
Walk Egress	63	87.5%
Drive/Park Egress	0	0.0%
Pick-up Egress	9	12.5%
Taxi Egress	0	0.0%
Shuttle/Van Egress	0	0.0%
Bicycle Egress	0	0.0%
Other Egress	0	0.0%
Total Private Trans.	72	100.0%
MBTA Bus	0	0.0%
Other Bus	0	0.0%
Rapid Transit	0	0.0%
Commuter Rail	0	0.0%
Boat	0	0.0%
Other	0	0.0%
Total Public Trans.	0	0.0%
TOTAL	72	100.0%
No Answer	0	

Trip time from station to trip destination by private transportation:

	WALK		DRIVE/PARK		PICK-UP		OTHER		TOTAL	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
0-5 minutes	18	40.0%			0	0.0%			18	33.3%
6-10	9	20.0%			0	0.0%			9	16.7%
11-15	9	20.0%	(No		9	100.0%	(No		18	33.3%
16-20	0	0.0%	responses)		0	0.0%	responses)		0	0.0%
21-30	9	20.0%			0	0.0%			9	16.7%
31-45	0	0.0%			0	0.0%			0	0.0%
Over 45	0	0.0%			0	0.0%			0	0.0%
TOTAL	45	100.0%			9	100.0%			54	100.0%
No Answer	18				0				18	
Avg. Time (min)	12.6				15.0					

Transfers from the Commuter Rail System

Expanded Results

Needham Line

Exit Station: Needham Heights

No responders provided information about their modes of egress.

Destination Locations and Activities

Needham Line

Expanded Results

Exit Station: Needham Heights

DESTINATION LOCATIONS			DESTINATION ACTIVITIES								
City/Neighborhood Destinations	Total Riders	Pct. of Riders	No Resp.	Home	School	Work	Store	Pers. Bus.	Work-rel.	Social/ Rec.	Other
Needham	63	87.5%		14.3%		71.4%			14.3%		
Wellesley	9	12.5%				100.0%					
Other (< 0.5 % of riders)	0	0.0%									
OVERALL TOTAL	72	100.0%		12.5%		75.0%			12.5%		

Note: Totals shown may differ from column total because of rounding.

MBTA Surveys: 2008-09

Commuter Rail Survey

Origin-Destination Cross-tabulation

Expanded Results

Needham Line

Entry Station: Needham Heights

Destination Town/Neighborhood:

Origin Town/ Neighborhood:	Boston: Financial/Retail	Boston: Back Bay	Boston: Prudential/ Hancock	Boston: Waterfront	Boston: Park Square	Boston: Beacon Hill	Boston: Govt Center	Boston: Fenway	Boston: Unspecified	Boston: So Bos Indust	Other & % of Row	Row Total & % of Overall
Needham	81	31	31	15	23	20	20	8	12	12	59	321
											18.3%	*88.1%*
Dover	4	0	4	0	0	0	0	0	0	0	4	12
											33.3%	*3.3%*
Newton	0	4	0	4	0	0	0	0	0	0	0	8
											0.0%	*2.2%*
Medfield	0	4	0	4	0	0	0	0	0	0	0	8
											0.0%	*2.2%*
Wayland	0	0	0	0	0	0	0	7	0	0	0	7
											0.0%	*2.0%*
Wellesley	0	0	0	0	0	0	0	4	0	0	0	4
											0.0%	*1.1%*
Natick	0	0	0	4	0	0	0	0	0	0	0	4
											0.0%	*1.1%*
Column Total & % of Overall	85	39	35	27	23	20	20	19	12	12	63	**365**
	23.2%	*10.8%*	*9.7%*	*7.5%*	*6.4%*	*5.5%*	*5.5%*	*5.3%*	*3.3%*	*3.3%*	*17.2%*	

Socioeconomic Characteristics

Needham Line

Expanded Results

Entry Station: Needham Heights

Age of Riders:	Number of Riders	Percent of Riders	Cumulative Percentage
18 and Under	11	3.1%	3.1%
19 - 24	8	2.2%	5.4%
25 - 34	52	14.5%	19.9%
35 - 44	118	32.8%	52.7%
45 - 64	159	44.2%	96.9%
65 and Older	11	3.1%	100.0%
TOTAL	361	100.0%	100.0%
No Answer	4		

Gender of Riders:	Number of Riders	Percent of Riders
Male	186	54.5%
Female	155	45.5%
Transgender	0	0.0%
TOTAL	341	100.0%
No Answer	23	

Annual Household Income of Riders:

	Number of Riders	Percent of Riders	Cumulative Percentage
Under $20,000	4	1.4%	1.4%
$20,000 - $29,999	0	0.0%	1.4%
$30,000 - $39,999	11	4.0%	5.4%
$40,000 - $49,999	0	0.0%	5.4%
$50,000 - $59,999	7	2.6%	8.0%
$60,000 - $74,999	15	5.4%	13.4%
$75,000 - $99,999	28	10.0%	23.3%
$100,000 or more	217	76.7%	100.0%
TOTAL	283	100.0%	100.0%
No Answer	82		

Mean Household Size: 2.99

Ethnicity of Riders

Needham Line

Expanded Results

Entry Station: Needham Heights

Self-Identified Race:	Number of Responses	Percent of Responses
American Indian/Alaskan Native	0	0.0%
Black or African-American	7	2.1%
Native Hawaiian or Other Pacific Islander	0	0.0%
Asian	43	12.4%
White	295	84.3%
Other	4	1.2%
TOTAL	349	100.0%

Note: Responders were allowed to check more than 1 box; percentages shown represent fractions of total responses.

Are You Hispanic/Latino?:	Number of Responses	Percent of Responses
Yes	4	1.2%
No	337	98.8%
TOTAL	341	100.0%
No Answer	23	

MBTA Surveys: 2008-09

Commuter Rail Survey

Usage Rates and Fare Types

Needham Line

Expanded Results

Entry Station: Needham Heights

Number of Days per Week Riders Use the Service:	Number of Riders	Percent of Riders	Cumulative Percentage
Less than One	4	1.1%	1.1%
One Day	23	6.5%	7.6%
Two Days	4	1.1%	8.7%
Three Days	11	3.1%	11.8%
Four Days	27	7.6%	19.4%
Five Days	275	76.4%	95.8%
Six Days	0	0.0%	95.8%
Seven Days	11	3.1%	98.9%
Only Visiting	4	1.1%	100.0%
TOTAL	361	100.0%	100.0%
No Answer	4		

Weekend Usage:	Sunday Usage*				Saturday Total
Saturday Usage*	Regularly	Occasionally	Not at All	No Answer	
Regularly	15 4.7%	0 0.0%	0 0.0%	4	15 4.7%
Occasionally	0 0.0%	4 1.2%	151 46.4%	28	155 47.6%
Not at all	0 0.0%	0 0.0%	155 47.6%	0	155 47.6%
No Answer	0	0	0	8	
Sunday Total	15 4.7%	4 1.2%	305 94.1%		324 *

** Totals and percentages reflect only riders who responded to both Saturday and Sunday questions.*

Usage Rates by Fare Type: Fare Payment Type	Number of Riders	Percent of Riders	Avg. No. of Days Line Used/Wk.
Adult full fare	35	9.5%	3.2
Family fare	0	0.0%	0.0
Monthly pass	267	73.3%	4.9
12-ride ticket	36	9.9%	3.4
Senior citizen half fare	11	3.1%	2.4
Student half fare	4	1.1%	5.0
Blind Access Card	0	0.0%	0.0
10-ride half fare ticket	7	2.0%	5.0
Disability half fare	0	0.0%	0.0
Child under age 12 free fare	0	0.0%	0.0
Other	4	1.1%	5.0
All Payment Types	365	100.0%	

Zones Reported by Users of Zone Passes: Zone	Number of Riders	Percent of Riders
1A	0	0.0%
1	0	0.0%
2	260	71.3%
3	0	0.0%
4	0	0.0%
5	0	0.0%
6	0	0.0%
7	0	0.0%
8	0	0.0%
Interzone	7	2.0%
No Zone Selected	0	0.0%
Total Riders Using Zone Passes	267	73.3%

MBTA Surveys: 2008-09

Commuter Rail Survey

Vehicle Availability

Needham Line

Expanded Results

Entry Station: Needham Heights

Licensed Drivers:	Number of Riders	Percent of Riders
Licensed	331	91.8%
Not Licensed	30	8.2%
TOTAL	361	100.0%
No Answer	4	

Usable Vehicles per Household:	Number of Riders	Percent of Riders
No vehicles	7	2.0%
1 vehicle	88	24.3%
2 vehicles	211	58.5%
3 or more vehicles	55	15.2%
TOTAL	361	100.0%
No Answer	4	

Was a Household Vehicle Available to Rider?:	Number of Riders	Percent of Riders
Yes	279	77.2%
No	82	22.8%
TOTAL	361	100.0%
No Answer	4	

Vehicles Owned per Capita:	Number of Riders	Percent of Riders	Cumulative Percentage
No vehicles	7	2.0%	2.0%
0.01 to 0.49 vehicles	52	14.4%	16.5%
0.50 to 0.99 vehicles	176	49.2%	65.7%
1.00 to 1.49 vehicles	118	33.2%	98.9%
1.50 to 1.99 vehicles	4	1.1%	100.0%
2 or more vehicles	0	0.0%	100.0%
TOTAL RESPONSES	357		

Service Quality

Needham Line

Expanded Results

Entry Station: Needham Heights

Service Quality	Mean	1 (Poor)	2	3 (Average)	4	5 (Excellent)	Total	No Response	Impor-tance*
Reliability (on-time performance)	3.7	5.5%	5.8%	19.4%	54.7%	14.5%	349	16	205
Safety and security	4.3	0.0%	1.1%	13.7%	38.6%	46.5%	353	12	71
Cleanliness/condition of vehicles	3.5	2.3%	10.4%	38.3%	34.4%	14.5%	349	16	35
Courtesy of train crews	4.3	0.0%	2.3%	8.9%	41.6%	47.3%	353	12	35
Announcement of stations	3.2	8.1%	12.7%	37.4%	29.8%	12.0%	349	16	4
Availability of seating on trains	4.0	0.0%	11.4%	15.8%	34.7%	38.1%	353	12	60
Frequency of service	3.5	1.1%	6.9%	43.2%	37.0%	11.8%	353	12	120
Travel time/speed	3.4	2.3%	15.8%	34.0%	32.9%	15.0%	353	12	111
Parking availability	4.1	2.9%	4.4%	11.7%	42.2%	38.7%	275	90	15
Station amenities	2.8	15.7%	21.1%	39.3%	16.8%	7.1%	283	82	0

* The number of respondents who indicated that this service quality measure was one of the three most important to them. Many respondents checked no measures, while others checked more than three.

Appendix B

MBTA Surveys 2008-2009

Rapid Transit Survey

Newton Highlands

MBTA Surveys: 2008-09

Rapid Transit Survey

Trip Purpose, Reasons for Using the MBTA, and Alternative Means

Expanded Results

GREEN LINE-D

Entry Station: Newton Highlands

Trip Purpose:	Number of Riders	Percent of Riders	Cumulative Percentage
Home-based Work	415	72.3%	72.3%
Home-based School	19	3.3%	75.6%
Home-based Shopping	10	1.7%	77.3%
Home-based Social Activity	4	0.7%	77.9%
Home-based Personal Business	27	4.7%	82.6%
Home-based Work-related	29	5.0%	87.6%
Home-based Other	15	2.7%	90.3%
Work-based	42	7.4%	97.7%
Non-Home/Non-Work-based	13	2.3%	100.0%
TOTAL	575		
No Answer	15		

Reasons for Using the MBTA:	Number of Riders	Percent of Riders*
Convenience	299	51.7%
Speed/travel time	100	17.2%
Avoid driving/traffic	387	66.9%
Avoid parking at destination	401	69.2%
Environmentally responsible	334	57.7%
Less expensive	282	48.6%
Can read/do work	265	45.7%
Only transportation available	86	14.9%
Other	8	1.3%
TOTAL RIDERS GIVING AT LEAST 1 REASON:	579	

Use Other Mode to Make Same Trip?	Number of Riders	Percent of Riders
Yes	274	47.7%
No	301	52.3%
TOTAL	575	100.0%
No Answer	15	

Other Modes Reported by Riders Who Checked "Yes":	Number of Riders	Percent of Riders*
Drive alone	192	74.0%
Non-MBTA bus	4	1.5%
Carpool/vanpool	37	14.1%
Bicycle	27	10.4%
Other MBTA service	42	16.4%
Other	12	4.5%
TOTAL RIDERS GIVING AT LEAST 1 OTHER MODE:	259	
(No other modes reported)	15	

**Note: Percentages may total to more than 100 because of multiple choices checked.*

MBTA Surveys: 2008-09

Rapid Transit Survey

Origin Locations and Activities

GREEN LINE-D

Expanded Results

Entry Station: Newton Highlands

ORIGIN LOCATIONS			ORIGIN ACTIVITIES								
City/Neighborhood Origins	Total Riders	Pct. of Riders	No Resp.	Home	School	Work	Store	Pers. Bus.	Work-rel.	Social/ Rec.	Other
Newton	468	79.2%	0.8%	86.0%		3.3%	4.9%	1.7%	0.8%		2.5%
Needham	65	11.1%		76.4%		17.7%					5.8%
Watertown	27	4.5%		100.0%							
Unspecified	15	2.6%		49.8%		25.1%					25.1%
Waltham	8	1.3%		100.0%							
Medfield	4	0.7%				100.0%					
Natick	4	0.6%		100.0%							
Other (< 0.5 % of riders)	0	0.0%									
OVERALL TOTAL	590	100.0%	0.7%	84.3%		5.9%	3.9%	1.3%	0.7%		3.3%

Note: Totals shown may differ from column total because of rounding.

MBTA Surveys: 2008-09

Rapid Transit Survey

Access to the Rapid Transit System

GREEN LINE-D

Expanded Results

Entry Station: Newton Highlands

Access Mode:	Number of Riders	Percent of Riders
Walk Access	364	62.5%
Drive/Park Access	58	9.9%
Drop-off Access	27	4.6%
Taxi Access	0	0.0%
Shuttle/Van Access	0	0.0%
Bicycle Access	0	0.0%
Other Access	0	0.0%
Total Private Trans.	449	77.0%
MBTA Bus	126	21.7%
Other Bus	4	0.7%
Commuter Rail	0	0.0%
Boat	0	0.0%
Other	4	0.7%
Total Public Trans.	134	23.0%
TOTAL	583	100.0%
No Answer	8	

Trip time from trip origin to station by private transportation:

	WALK		DRIVE/PARK		DROP-OFF		OTHER		TOTAL	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
0-5 minutes	159	47.7%	23	46.2%	11	50.0%			194	47.7%
6-10	111	33.3%	8	15.4%	11	50.0%			130	32.1%
11-15	63	18.9%	8	15.4%	0	0.0%	(No		71	17.4%
16-20	0	0.0%	0	0.0%	0	0.0%	responses)		0	0.0%
21-30	0	0.0%	8	15.4%	0	0.0%			8	1.9%
31-45	0	0.0%	0	0.0%	0	0.0%			0	0.0%
Over 45	0	0.0%	4	7.6%	0	0.0%			4	0.9%
TOTAL	333	100.0%	50	100.0%	23	100.0%			406	100.0%
No Answer	31		8		4				42	
Avg. Time (min)	7.4		15.6		5.7				8.3	

MBTA Surveys: 2008-09

Rapid Transit Survey

Transfers to the Rapid Transit System

GREEN LINE-D

Expanded Results

Entry Station: Newton Highlands

Transferring from:

Commuter Rail, Boarded at Station Indicated:
(None identified)

MBTA Bus Routes:	Number of Riders
59	123
70A	4

Boat, Boarded at Dock Indicated:
(None identified)

Other Bus Routes:	Number of Riders
Unspecified Bus	4

MBTA Surveys: 2008-09

Rapid Transit Survey

Exits from the Rapid Transit System

GREEN LINE-D

Expanded Results

Entry Station: Newton Highlands

Red Line	Exits:	Percent of Riders	Transfers:*
Alewife	0	0.0%	
Davis	4	0.7%	
Porter	0	0.0%	
Harvard	8	1.3%	
Central	4	0.7%	
Kendall/MIT	15	2.6%	
Charles/MGH	23	4.0%	
Park Street-R	0	0.0%	
Downtown Crossing-R	0	0.0%	
South Station	15	2.6%	
Broadway	0	0.0%	
Andrew	0	0.0%	
JFK/UMass	0	0.0%	
Savin Hill	0	0.0%	
Fields Corner	0	0.0%	
Shawmut	0	0.0%	
Ashmont-R	0	0.0%	
North Quincy	0	0.0%	
Wollaston	0	0.0%	
Quincy Center	0	0.0%	
Quincy Adams	0	0.0%	
Braintree	0	0.0%	
Red Line: Unspecified	0	0.0%	
Red Line Total:	69	11.8%	

Orange Line	Exits:	Percent of Riders	Transfers:*
Oak Grove	0	0.0%	
Malden	0	0.0%	
Wellington	0	0.0%	
Sullivan Square	0	0.0%	
Community College	0	0.0%	
North Station-O	0	0.0%	
Haymarket-O	0	0.0%	
State-O	0	0.0%	
Downtown Crossing-O	0	0.0%	
Chinatown	0	0.0%	
NE Medical Center	0	0.0%	
Back Bay	0	0.0%	
Massachusetts Ave	0	0.0%	
Ruggles	0	0.0%	
Roxbury Crossing	0	0.0%	
Jackson Square	0	0.0%	
Stony Brook	0	0.0%	
Green Street	0	0.0%	
Forest Hills	0	0.0%	
Orange Line: Unspecified	0	0.0%	
Orange Line Total:	0	0.0%	

Blue Line	Exits:	Percent of Riders	Transfers:*
Wonderland	0	0.0%	
Revere Beach	0	0.0%	
Beachmont	0	0.0%	
Suffolk Downs	0	0.0%	
Orient Heights	0	0.0%	
Wood Island	4	0.7%	
Airport	4	0.7%	
Maverick	4	0.7%	
Aquarium	0	0.0%	
State-B	0	0.0%	
Government Center-B	0	0.0%	
Bowdoin	0	0.0%	
Blue Line: Unspecified	0	0.0%	
Blue Line Total:	12	2.0%	

Mattapan High Speed Line	Exits:	Percent of Riders	Transfers:*
Ashmont-M	0	0.0%	
Cedar Grove	0	0.0%	
Butler	0	0.0%	
Milton	0	0.0%	
Central Avenue	0	0.0%	
Valley Road	0	0.0%	
Capen Street	0	0.0%	
Mattapan	0	0.0%	
Mattapan Line Total:	0	0.0%	

* The role of transfers in these exit data tables is explained in section 6.1.

Exits from the Rapid Transit System *(cont'd)*

GREEN LINE-D

Expanded Results

Entry Station: Newton Highlands

Green Line	Exits:	Percent of Riders	Transfers:*
Lechmere	4	0.7%	
Science Park	0	0.0%	
North Station-G	4	0.7%	
Haymarket-G	0	0.0%	
Government Center-G	54	9.2%	19
Park Street-G	57	9.9%	69
Boylston	35	5.9%	
Arlington	34	5.9%	
Copley	34	5.9%	
Hynes Convention Center	23	3.9%	
Kenmore	12	2.0%	12
Prudential	0	0.0%	
Symphony	0	0.0%	
B Blandford-Babcock	8	1.3%	
B Pack.Cnr.-Warren St.	8	1.3%	
B Washington St.-BC	0	0.0%	
C St.Mary's-Summit/Winchest	4	0.7%	
C Brandon-Cleveland Cir.	0	0.0%	
D Fenway-Longwood	134	23.0%	
D Brook. Vill.-Brook.Hills	19	3.3%	
D Beaconsfield-Ches.Hill	27	4.6%	8
D Newton Ctr.-Eliot	8	1.3%	
D Waban-Riverside	38	6.6%	
E Northeastern-Museum	0	0.0%	
E Long.Med.-Brig Cir.	0	0.0%	
E Fenwood Rd-Heath	0	0.0%	
Green Line: Unspecified	0	0.0%	
Green Line Subway: Unspecified	0	0.0%	
Green Line B: Unspecified	0	0.0%	
Green Line C: Unspecified	0	0.0%	
Green Line D: Unspecified	0	0.0%	
Green Line E: Unspecified	0	0.0%	
Green Line Total:	502	86.2%	

Summary	Exits:	Percent of Riders
Red Line Total:	69	11.8%
Mattapan Line Total:	0	0.0%
Orange Line Total:	0	0.0%
Blue Line Total:	12	2.0%
Green Line Total:	502	86.2%
Overall Total	583	100.0%
No Response	8	

* The role of transfers in these exit data tables is explained in section 6.1.

MBTA Surveys: 2008-09

Rapid Transit Survey

Entries to the Rapid Transit System

GREEN LINE-D

Expanded Results

Exit Station: Newton Highlands

Red Line	Entries:	Percent of Riders	Transfers:*
Alewife	7	0.7%	
Davis	15	1.5%	
Porter	0	0.0%	
Harvard	10	1.0%	
Central	11	1.1%	
Kendall/MIT	0	0.0%	
Charles/MGH	0	0.0%	
Park Street-R	0	0.0%	
Downtown Crossing-R	0	0.0%	
South Station	20	2.1%	
Broadway	0	0.0%	
Andrew	0	0.0%	
JFK/UMass	26	2.6%	
Savin Hill	0	0.0%	
Fields Corner	0	0.0%	
Shawmut	0	0.0%	
Ashmont-R	0	0.0%	
North Quincy	0	0.0%	
Wollaston	0	0.0%	
Quincy Center	0	0.0%	
Quincy Adams	0	0.0%	
Braintree	0	0.0%	
Red Line: Unspecified	0	0.0%	
Red Line Total:	88	9.0%	

Orange Line	Entries:	Percent of Riders	Transfers:*
Oak Grove	6	0.6%	
Malden	79	8.2%	
Wellington	0	0.0%	
Sullivan Square	0	0.0%	
Community College	0	0.0%	
North Station-O	0	0.0%	
Haymarket-O	0	0.0%	
State-O	0	0.0%	
Downtown Crossing-O	0	0.0%	
Chinatown	0	0.0%	
NE Medical Center	0	0.0%	
Back Bay	0	0.0%	
Massachusetts Ave	0	0.0%	
Ruggles	32	3.3%	
Roxbury Crossing	0	0.0%	
Jackson Square	0	0.0%	
Stony Brook	0	0.0%	
Green Street	5	0.5%	
Forest Hills	30	3.1%	
Orange Line: Unspecified	0	0.0%	
Orange Line Total:	152	15.7%	

Blue Line			
Wonderland	0	0.0%	
Revere Beach	0	0.0%	
Beachmont	0	0.0%	
Suffolk Downs	0	0.0%	
Orient Heights	17	1.8%	
Wood Island	0	0.0%	
Airport	0	0.0%	
Maverick	0	0.0%	
Aquarium	0	0.0%	
State-B	0	0.0%	
Government Center-B	0	0.0%	
Bowdoin	0	0.0%	
Blue Line: Unspecified	0	0.0%	
Blue Line Total:	17	1.8%	

Mattapan High Speed Line			
Ashmont-M	0	0.0%	
Cedar Grove	0	0.0%	
Butler	0	0.0%	
Milton	0	0.0%	
Central Avenue	0	0.0%	
Valley Road	0	0.0%	
Capen Street	0	0.0%	
Mattapan	0	0.0%	
Mattapan Line Total:	0	0.0%	

* The role of transfers in these entry data tables is explained in section 7.1.

Entries to the Rapid Transit System *(cont'd)*

GREEN LINE-D

Expanded Results

Exit Station: Newton Highlands

Green Line	Entries:	Percent of Riders	Transfers:*
Lechmere	20	2.0%	
Science Park	0	0.0%	
North Station-G	57	5.9%	54
Haymarket-G	0	0.0%	
Government Center-G	0	0.0%	129
Park Street-G	84	8.7%	163
Boylston	37	3.8%	
Arlington	13	1.3%	28
Copley	47	4.8%	
Hynes Convention Center	35	3.6%	
Kenmore	48	4.9%	19
Prudential	0	0.0%	
Symphony	28	2.9%	
B Blandford-Babcock	0	0.0%	
B Pack.Cnr.-Warren St.	70	7.2%	
B Washington St.-BC	0	0.0%	
C St.Mary's-Summit/Winchest	19	2.0%	
C Brandon-Cleveland Cir.	0	0.0%	
D Fenway-Longwood	31	3.2%	
D Brook. Vill.-Brook.Hills	95	9.8%	
D Beaconsfield-Ches.Hill	74	7.6%	89
D Newton Ctr.-Eliot	15	1.5%	
D Waban-Riverside	42	4.3%	
E Northeastern-Museum	0	0.0%	
E Long.Med.-Brig Cir.	0	0.0%	
E Fenwood Rd-Heath	0	0.0%	
Green Line: Unspecified	0	0.0%	
Green Line Subway: Unspecified	0	0.0%	
Green Line B: Unspecified	0	0.0%	
Green Line C: Unspecified	0	0.0%	
Green Line D: Unspecified	0	0.0%	
Green Line E: Unspecified	0	0.0%	
Green Line Total:	713	73.5%	

Summary	Entries:	Percent of Riders
Red Line Total:	88	9.0%
Mattapan Line Total:	0	0.0%
Orange Line Total:	152	15.7%
Blue Line Total:	17	1.8%
Green Line Total:	713	73.5%
Overall Total	970	100.0%
No Response	0	

* The role of transfers in these entry data tables is explained in section 7.1.

MBTA Surveys: 2008-09

Rapid Transit Survey

Egress from the Rapid Transit System

GREEN LINE-D

Expanded Results

Exit Station: Newton Highlands

Egress Mode:	Number of Riders	Percent of Riders
Walk Egress	526	54.5%
Drive/Park Egress	54	5.6%
Pick-up Egress	47	4.8%
Taxi Egress	0	0.0%
Shuttle/Van Egress	69	7.2%
Bicycle Egress	0	0.0%
Other Egress	26	2.7%
Total Private Trans.	722	74.8%
MBTA Bus	243	25.2%
Other Bus	0	0.0%
Commuter Rail	0	0.0%
Boat	0	0.0%
Other	0	0.0%
Total Public Trans.	243	25.2%
TOTAL	965	100.0%
No Answer	5	

Trip time from station to trip destination by private transportation:

	WALK		DRIVE/PARK		PICK-UP		OTHER		TOTAL	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
0-5 minutes	144	29.5%			0	0.0%	0	0.0%	144	24.8%
6-10	96	19.7%			0	0.0%	15	19.7%	111	19.1%
11-15	175	36.0%			0	0.0%	17	22.0%	192	33.1%
16-20	21	4.3%	(No responses)		0	0.0%	19	25.1%	40	7.0%
21-30	40	8.3%			16	100.0%	26	33.1%	82	14.1%
31-45	11	2.2%			0	0.0%	0	0.0%	11	1.9%
Over 45	0	0.0%			0	0.0%	0	0.0%	0	0.0%
TOTAL	487	100.0%			16	100.0%	77	100.0%	580	100.0%
No Answer	39		54		31		18		142	
Avg. Time (min)	12.3				30.0		18.6		13.6	

MBTA Surveys: 2008-09

Rapid Transit Survey

Transfers from the Rapid Transit System

GREEN LINE-D

Expanded Results

Exit Station: Newton Highlands

Transferring to:

Commuter Rail, Alighted at Station Indicated:
(None identified)

MBTA Bus Routes:	Number of Riders
59	243

Boat, Alighted at Dock Indicated:
(None identified)

Other Bus Routes:
(None identified)

Destination Locations and Activities

GREEN LINE-D

Expanded Results

Exit Station: Newton Highlands

DESTINATION LOCATIONS			DESTINATION ACTIVITIES								
City/Neighborhood Destinations	Total Riders	Pct. of Riders	No Resp.	Home	School	Work	Store	Pers. Bus.	Work-rel.	Social/ Rec.	Other
Newton	767	79.1%	6.0%	22.6%		61.0%		2.0%	2.0%	1.0%	5.3%
Needham	172	17.7%		9.1%		90.9%					
Waltham	31	3.2%		100.0%							
Other (< 0.5 % of riders)	0	0.0%									
OVERALL TOTAL	970	100.0%	4.7%	22.7%		64.3%		1.6%	1.6%	0.8%	4.2%

Note: Totals shown may differ from column total because of rounding.

MBTA Surveys: 2008-09

Rapid Transit Survey

Origin-Destination Cross-tabulation

GREEN LINE-D

Expanded Results

Entry Station: Newton Highlands

Destination Town/Neighborhood:

Origin Town/ Neighborhood:	Boston: Longwood Med Area	Boston: Financial/Retail	Boston: Park Square	Newton	Boston: Govt Center	Boston: Back Bay	Boston: Fenway	Boston: Prudential/ Hancock	Boston: Beacon Hill	Cambridge: Kendall/MI	Other & % of Row	Row Total & % of Overall
Newton	65	50	38	19	35	35	27	27	19	23	111	468
											23.8%	*79.2%*
Needham	12	4	4	8	4	0	8	4	4	0	19	65
											29.4%	*11.1%*
Watertown	4	0	0	19	0	0	0	0	0	0	4	27
											14.2%	*4.5%*
Unspecified	0	4	0	0	4	0	0	0	4	0	4	15
											25.1%	*2.6%*
Waltham	4	0	4	0	0	0	0	0	0	0	0	8
											0.0%	*1.3%*
Medfield	0	0	0	0	0	0	0	0	0	0	4	4
											100.0%	*0.7%*
Natick	0	4	0	0	0	0	0	0	0	0	0	4
											0.0%	*0.6%*
Column Total & % of Overall	84	61	46	46	42	35	34	31	27	23	142	**590**
	14.3%	*10.4%*	*7.8%*	*7.8%*	*7.1%*	*5.8%*	*5.8%*	*5.2%*	*4.6%*	*3.9%*	*24.0%*	

Socioeconomic Characteristics

GREEN LINE-D

Expanded Results

Entry Station: Newton Highlands

Age of Riders:	Number of Riders	Percent of Riders	Cumulative Percentage
18 and Under	8	1.3%	1.3%
19 - 24	46	7.9%	9.2%
25 - 34	136	23.2%	32.3%
35 - 44	111	18.9%	51.3%
45 - 64	211	36.0%	87.2%
65 and Older	75	12.8%	100.0%
TOTAL	587	100.0%	100.0%
No Answer	4		

Gender of Riders:	Number of Riders	Percent of Riders
Male	274	47.4%
Female	305	52.6%
Transgender	0	0.0%
TOTAL	579	100.0%
No Answer	11	

Annual Household Income of Riders:

	Number of Riders	Percent of Riders	Cumulative Percentage
Under $20,000	31	6.0%	6.0%
$20,000 - $29,999	23	4.5%	10.5%
$30,000 - $39,999	33	6.4%	16.9%
$40,000 - $49,999	42	8.3%	25.2%
$50,000 - $59,999	23	4.5%	29.7%
$60,000 - $74,999	40	7.9%	37.6%
$75,000 - $99,999	57	11.3%	48.9%
$100,000 or more	260	51.1%	100.0%
TOTAL	510	100.0%	100.0%
No Answer	81		

Mean Household Size: 2.71

Ethnicity of Riders

GREEN LINE-D

Expanded Results

Entry Station: Newton Highlands

Self-Identified Race:	Number of Responses	Percent of Responses
American Indian/Alaskan Native	11	2.0%
Black or African-American	27	4.7%
Native Hawaiian or Other Pacific Islander	4	0.7%
Asian	84	14.8%
White	458	80.5%
Other	23	4.0%
Riders who gave at least 1 response	569	

Note: Because responders were allowed to check more than 1 box, percentages shown may add up to more than 100 percent over all categories.

Are You Hispanic/Latino?:	Number of Responses	Percent of Responses
Yes	34	6.1%
No	535	93.9%
TOTAL	569	100.0%
No Answer	21	

MBTA Surveys: 2008-09

Rapid Transit Survey

Usage Rates

GREEN LINE-D

Expanded Results

Entry Station: Newton Highlands

Number of Days per Week Riders Use the Service:	Number of Riders	Percent of Riders	Cumulative Percentage
Less than One	63	10.8%	10.8%
One Day	37	6.2%	17.0%
Two Days	25	4.3%	21.3%
Three Days	42	7.2%	28.5%
Four Days	59	10.1%	38.6%
Five Days	306	52.2%	90.9%
Six Days	27	4.6%	95.4%
Seven Days	27	4.6%	100.0%
Only Visiting	0	0.0%	100.0%
TOTAL	586	100.0%	100.0%
No Answer	4		

Weekend Usage:	Sunday Usage*				Saturday Total
Saturday Usage*	Regularly	Occasionally	Not at All	No Answer	
Regularly	35 6.1%	17 3.1%	4 0.7%	0	56 9.9%
Occasionally	0 0.0%	322 57.3%	35 6.2%	17	356 63.5%
Not at all	0 0.0%	8 1.4%	142 25.2%	4	149 26.6%
No Answer	0	0	0	8	
Sunday Total	35 6.1%	347 61.8%	180 32.1%		562 *

** Totals and percentages reflect only riders who responded to both Saturday and Sunday questions.*

Fare Types and Pass Usage

GREEN LINE-D

Expanded Results

Entry Station: Newton Highlands

Usage Rates by Fare Type: Fare Payment Type	Number of Riders	Percent of Riders	Avg. No. of Days Line Used/Wk.
Pay-per-ride CharlieCard (plastic)	159	29.0%	3.0
Pay-per-ride CharlieTicket (paper)	27	4.9%	1.4
Monthly pass	329	59.9%	4.9
Full cash fare on-board trolley	0	0.0%	0.0
Reduced fare	8	1.4%	2.8
Student	*4*	*0.7%*	*5.0*
Senior	*4*	*0.7%*	*0.5*
Disability	*0*	*0.0%*	*0.0*
No Reduced Fare Selected	*0*	*0.0%*	*0.0*
Child under age 12 free fare	4	0.7%	5.0
Blind Access Card	0	0.0%	0.0
1-Day LinkPass	0	0.0%	0.0
7-Day LinkPass	19	3.5%	5.4
Other	4	0.7%	0.0
No Fare Payment Type Selected	40		
All Payment Types	550	100.0%	4.2

Monthly Pass Users by Type of Pass: Pass Type	Number of Riders	Percent of All Riders Responding to Fare Question	Avg. No. of Days Line Used/Wk.
Link (Subway + Bus)	280	50.8%	4.9
Zone	23	4.2%	4.0
Boat	0	0.0%	0.0
Inner Express Bus	0	0.0%	0.0
Outer Express Bus	0	0.0%	0.0
Student	4	0.7%	7.0
Senior	19	3.5%	5.6
Disability	0	0.0%	0.0
No Pass Selected	4	0.7%	5.0
Total Riders Using Monthly Passes	329	59.9%	4.9

Zones Reported by Users of Zone Passes: Zone	Number of Riders	Percent of All Riders Responding to Fare Question	Avg. No. of Days Line Used/Wk.
1A	4	0.7%	5.0
1	4	0.7%	5.0
2	8	1.4%	4.0
3	0	0.0%	0.0
4	4	0.7%	1.0
5	0	0.0%	0.0
6	0	0.0%	0.0
7	0	0.0%	0.0
8	0	0.0%	0.0
Interzone	0	0.0%	0.0
No Zone Selected	4	0.7%	5.0
Total Riders Using Zone Passes	23	4.2%	4.0

Vehicle Availability

GREEN LINE-D

Expanded Results

Entry Station: Newton Highlands

Licensed Drivers:	Number of Riders	Percent of Riders
Licensed	533	90.8%
Not Licensed	54	9.2%
TOTAL	587	100.0%
No Answer	4	

Usable Vehicles per Household:	Number of Riders	Percent of Riders
No vehicles	79	13.4%
1 vehicle	236	40.3%
2 vehicles	237	40.5%
3 or more vehicles	34	5.9%
TOTAL	587	100.0%
No Answer	4	

Was a Household Vehicle Available to Rider?:	Number of Riders	Percent of Riders
Yes	385	65.2%
No	205	34.8%
TOTAL	590	100.0%
No Answer	0	

Vehicles Owned per Capita:	Number of Riders	Percent of Riders	Cumulative Percentage
No vehicles	71	12.9%	12.9%
0.01 to 0.49 vehicles	109	19.9%	32.8%
0.50 to 0.99 vehicles	221	40.1%	72.9%
1.00 to 1.49 vehicles	138	25.1%	97.9%
1.50 to 1.99 vehicles	8	1.4%	99.3%
2 or more vehicles	4	0.7%	100.0%
TOTAL RESPONSES	550		

Service Quality

GREEN LINE-D

Expanded Results

Entry Station: Newton Highlands

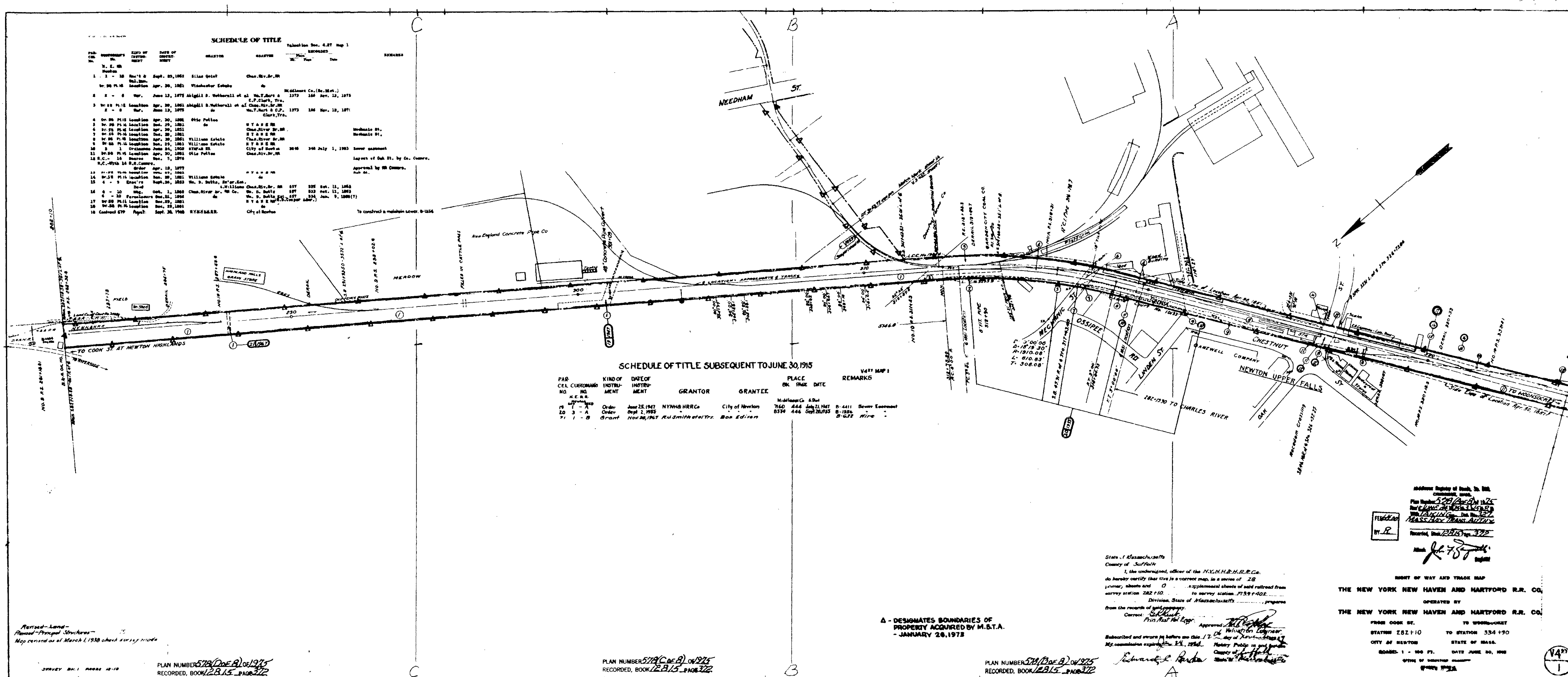
Service Quality	Mean	1 (Poor)	2	3 (Average)	4	5 (Excellent)	Total	No Response	Impor-tance*
Reliability (on-time performance)	2.9	12.1%	20.1%	40.6%	21.8%	5.4%	571	19	278
Safety and security	3.7	0.0%	6.6%	29.8%	46.0%	17.6%	579	11	125
Cleanliness/condition of vehicles	3.1	4.4%	13.3%	51.3%	27.0%	4.0%	575	15	38
Courtesy of train crews	3.2	5.4%	12.9%	44.9%	27.0%	9.8%	567	23	15
Announcement of stations	3.5	4.1%	16.6%	25.3%	35.8%	18.3%	567	23	12
Availability of seating on trains	2.6	17.1%	24.3%	38.5%	18.1%	2.0%	583	8	134
Frequency of service	2.8	12.0%	24.7%	36.4%	21.3%	5.7%	575	15	238
Travel time/speed	2.9	9.9%	25.0%	36.2%	25.7%	3.3%	583	8	173
Parking availability	2.5	22.3%	28.4%	32.5%	10.1%	6.6%	378	213	11
Station amenities	2.6	14.2%	27.7%	43.9%	11.9%	2.4%	485	105	8
Fare collection system	3.2	11.2%	14.2%	27.8%	34.4%	12.3%	579	12	23

* The number of respondents who indicated that this service quality measure was one of the three most important to them. Many respondents checked no measures, while others checked more than three.

Appendix C

MBTA Valuation Maps

Needham/Newton Rail Right-of-Way



SCHEDULE OF TITLE

Valuation Sec. 4.27 Map 1

PAR-CEL No.	CUSTOMARY No.	KIND OF INSTRU-MENT	DATE OF INSTRU-MENT	GRANTOR	GRANTEE	RECORDED Bk.	Page	Date	REMARKS
	N. E. RR Newton								
1	1 - 10	Rec't & Rel.Dee.	Sept. 29,1852	Silas Quint	Chas.Riv.Br.RR				
	Dr.98 Pt.10	Location	Apr. 30, 1851	Winchester Estate	do				
						Middlesex Co.(So.Dist.)			
2	2 - 6	War.	June 13, 1873	Abigail S. Wetherell et al	Wm.T.Hart & C.P.Clark, Trs.	1373	156	Nov. 12, 1875	
3	Dr.58 Pt.12	Location	Apr. 30, 1851	Abigail S.Wetherell et al	Chas.Riv.Br.RR				
	2 - 6	War.	June 13, 1875	do	Wm.T.Hart & C.P. Clark,Trs.	1373	156	Nov. 12, 1875	
4	Dr.98 Pt.12	Location	Apr. 30, 1851	Otis Pettee					
5	Dr.98 Pt.14	Location	Dec. 29, 1881	do	N Y & N E RR				
6	Dr.58 Pt.16	Location	Apr. 30, 1851		Chas.River Br.RR				Mechanic St.
7	Dr.58 Pt.16	Location	Dec. 29, 1881		N Y & N E RR				Mechanic St.
8	Dr.98 Pt.18	Location	Apr. 30, 1851	Williams Estate	Chas.River Br.RR				
9	Dr.98 Pt.14	Location	Dec. 29, 1881	Williams Estate	N Y & N E RR				
10	3 - 1	Ordinance	June 24, 1902	NYNH&H RR	City of Newton	3046	348	July 1, 1903	Sewer easement
11	Dr.98 Pt.15	Location	Apr. 30, 1851	Otis Pettee	Chas.Riv.Br.RR				
12	R.C.- 14	Decree	Dec. 5, 1876						Layout of Oak St. by Co. Commrs.
	R.C.-With 14 R.R.Commrs. Order		Apr. 18, 1877						Approval by RR Commrs. Oak St.
13	Dr.58 Pt.16	Location	Dec. 29, 1881		N Y & N E RR				
14	Dr.58 Pt.16	Location	Dec. 29, 1881	Williams Estate	do				
15	4 - 9	Exec'rs Deed	Sept.26, 1853	Wm. D. Dutts, Ex'or.Est. A.Williams	Chas.Riv.Br. RR	657	535	Oct. 11, 1853	
16	4 - 10	Mtg.	Oct. 1, 1853	Chas.River Br. RR Co.	Wm. D. Dutts	657	533	Oct. 11, 1853	
	4 - 10	Foreclosure	Dec.21, 1854	do	Wm. D. Dutts Est. (G.B.Cooper Adm.)	657	534	Jan. 9, 1888(?)	
17	Dr.58 Pt.11	Location	Dec.29, 1881		N Y & N E RR				
18	Dr.58 Pt.16	Location	Dec. 29,1881		do				
18	Contract 679	Agmt.	Sept. 30, 1948	N.Y.N.H.&H.R.R.	City of Newton				To construct a maintain sewer. B-1456

SCHEDULE OF TITLE SUBSEQUENT TO JUNE 30, 1915

V4.27 MAP 1

PARCEL NO.	CUSTOMARY NO. N.E.R.R. Newton	KIND OF INSTRUMENT	DATE OF INSTRUMENT	GRANTOR	GRANTEE	PLACE BK. (Middlesex Co. S.Dist.)	PAGE	DATE	REMARKS	
19	1 - A	Order	June 25, 1947	NYNH&HRRCo	City of Newton	7160	444	July 21, 1947	B-4411	Sewer Easement
20	3 - A	Order	Sept 2, 1953	"	" " "	8334	446	Sept 28, 1953	B-1384	" "
21	1 - B	Grant	Nov. 30, 1967	R.J. Smith et al Trs.	Bos. Edison				B-622	Wire "

Δ - DESIGNATES BOUNDARIES OF PROPERTY ACQUIRED BY M.B.T.A. - JANUARY 26, 1973

State of Massachusetts
County of Suffolk
I, the undersigned, officer of the N.Y.N.H.&H.R.R.Co. do hereby certify that this is a correct map, in a series of 28 primary sheets and 0 supplemental sheets of said railroad from survey station 282+10 to survey station 1739+40X ... Division, State of Massachusetts, prepared from the records of said company.
Correct: [signature] Prin.Asst.Val.Engr.
Approved: [signature] Valuation Engineer.
Subscribed and sworn to before me this 17th day of November 1967
My commission expires Dec. 14, 1968
Notary Public in and for the County of Suffolk, State of Massachusetts
[signature]

Middlesex Registry of Deeds, So. Dist. Cambridge, Mass.
Plan Number 578 (D of 8) of 1975
Rec'd June 24, 1975 at 3h 45m P.M.
With TAKING Doc. No. 327
MASS. BAY TRANS. AUTH'Y.
Recorded, Book 12815 Page 372
Attest: [signature] Register
FEE $4.00 BY R

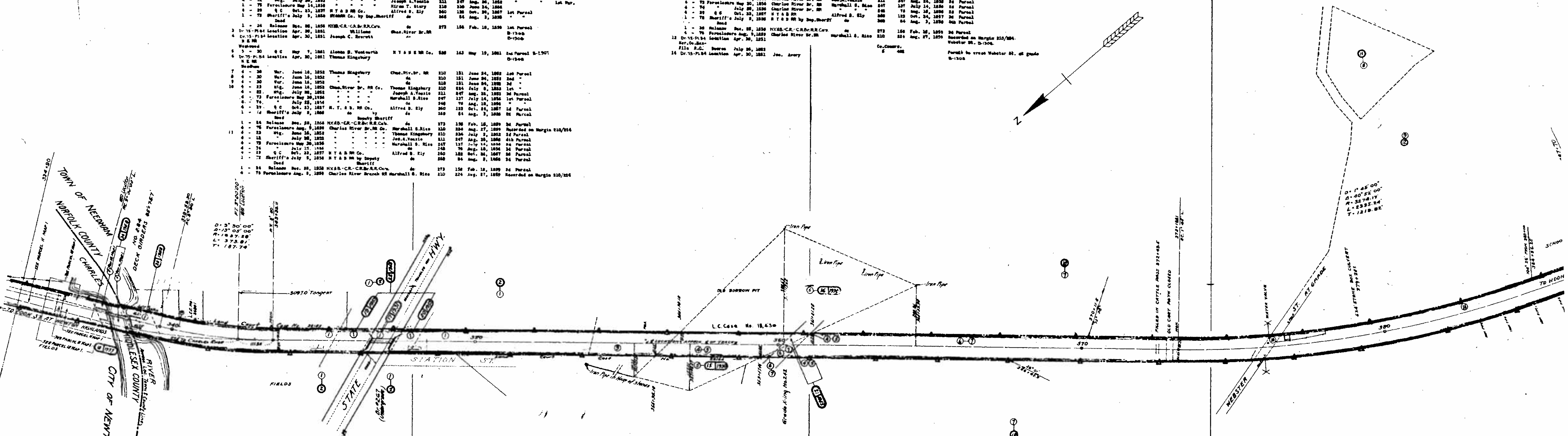
RIGHT OF WAY AND TRACK MAP
THE NEW YORK NEW HAVEN AND HARTFORD R.R. CO.
OPERATED BY
THE NEW YORK NEW HAVEN AND HARTFORD R.R. CO.
FROM COOK ST. TO WOONSOCKET
STATION 282+10 TO STATION 334+90
CITY OF NEWTON STATE OF MASS.
SCALE: 1 - 100 FT. DATE JUNE 30, 1915
OFFICE OF VALUATION ENGINEER
V4.27 / 1

Revised - Land -
Revised - Principal Structures -
Map revised as of March 1, 1938 check survey made
SURVEY BK. 1 PAGES 12-18

PLAN NUMBER 578 (D of 8) of 1975
RECORDED, BOOK 12815 PAGE 372

PLAN NUMBER 578 (C of 8) of 1975
RECORDED, BOOK 12815 PAGE 372

PLAN NUMBER 578 (B of 8) of 1975
RECORDED, BOOK 12815 PAGE 372



SCHEDULE OF TITLE

(Sheet #1 of 2 Sheets)

Valuation Sec. 4.27 Map 2

Parcel No.	Customer's No.	Kind of Instrument	Date of Instrument	Grantor	Grantee	Recorded Place Bk.	Page	Date	Remarks
	N E RR Needham					Norfolk Co.			
1	1 - 17	War.	Apr. 1, 1852	Hiram T.Story et al	Chas.River Br.RR	210	43	June 12, 1852	
2	1 - 20	Mtg.	Apr. 1, 1852	Chas. River Br. R.R.	Hiram T. Story	210	310	July 16, 1852	Reserving location
	4 - 22	Mtg.	July 30, 1852	" " " "	Joseph A.Vossie	211	247	Aug. 26, 1852	" " 1st Par.
	1 - 75	Foreclosure	May 14,1856	" " " "	Hiram T. Story	210	330	June 14, 1856	
	4 - 29	Q C	Oct. 23, 1857	N Y & B RR Co.	Alfred B. Ely	260	130	Oct. 24, 1857	1st Parcel
	1 - 73	Sheriff's Deed	July 5, 1858	NY&BRR Co. by Dep.Sheriff	do	266	84	Aug. 3, 1858	" "
	1 - 24	Release	Dec. 28, 1858	NYBB-CR-CR.Br.RR.Cors.	do	273	156	Feb. 18, 1859	1st Parcel
3	Dr.15-Pl.84	Location	Apr. 30, 1851	Williams	Chas.River Br.RR				B-1306
4	Dr.15-Pl.84	Location	Apr. 30, 1851	Joseph C. Everett	do				B-1306
	N E RR Westwood								
5	5 - 30	Q C	May 7, 1881	Alonzo B. Wentworth	N Y & N E RR Co.	520	163	May 19, 1881	1st Parcel B-1307
6	Dr.15-Pl.84	Location	Apr. 30, 1851	Thomas Kingsbury					B-1306
	N E RR Needham								
7	4 - 30	War.	June 16, 1852	Thomas Kingsbury	Chas.Riv.Br. RR	210	151	June 24, 1852	1st Parcel
8	4 - 30	War.	June 16, 1852	" "	do	210	151	June 24, 1852	2nd "
9	4 - 30	War.	June 16, 1852	" "	do	210	151	June 24, 1852	3d "
10	4 - 23	Mtg.	June 16, 1852	Chas.River Br. RR Co.	Thomas Kingsbury	210	224	July 8, 1852	1st "
	4 - 22	Mtg.	July 30, 1852	" " " "	Joseph A.Vossie	211	247	Aug. 26, 1852	2d Parcel
	4 - 73	Foreclosure	May 30,1856	" " " "	Marshall S.Rice	247	137	July 14, 1856	1st Parcel
	4 - 74	"	July 25, 1856	" " " "	do	248	78	Aug. 18, 1856	" "
	4 - 29	Q C	Oct. 23, 1857	N. Y. & B. RR Co.	Alfred B. Ely	260	133	Oct. 24, 1857	2d Parcel
	1 - 72	Sheriff's Deed	July 5, 1858	do by Deputy Sheriff	do	268	84	Aug. 3, 1858	2d Parcel
	1 - 24	Release	Dec. 28, 1858	NY&B-CR-CR.Br.RR.Cors.	do	273	156	Feb. 18, 1859	2d Parcel
	4 - 76	Foreclosure	Aug. 9,1859	Charles River Br.RR Co.	Marshall S.Rice	210	224	Aug. 27, 1859	Recorded on Margin 210/224
11	4 - 23	Mtg.	June 16, 1852	" " " " "	Thomas Kingsbury	210	224	July 8, 1852	2d Parcel
	4 - 22	"	July 30, 1852	" " " " "	Jos.A.Vossie	211	247	Aug. 26, 1852	4th Parcel
	4 - 73	Foreclosure	May 30,1856	" " " " "	Marshall S. Rice	247	137	July 14, 1856	2d Parcel
	4 - 74	"	July 25, 1856	" " " " "	do	248	78	Aug. 18, 1856	3d Parcel
	4 - 29	Q C	Oct. 23, 1857	N Y & B RR Co.	Alfred B. Ely	260	133	Oct. 24, 1857	3d Parcel
	1 - 72	Sheriff's Deed	July 5, 1858	N Y & B RR by Deputy Sheriff	do	268	84	Aug. 3, 1858	3d Parcel
	1 - 24	Release	Dec. 28, 1858	NY&B-CR-CR.Br.RR.Cors.	do	273	156	Feb. 18, 1859	3d Parcel
	4 - 76	Foreclosure	Aug. 9, 1859	Charles River Branch RR	Marshall S. Rice	210	224	Aug. 27, 1859	Recorded on Margin 210/224

SCHEDULE OF TITLE

(Sheet #2 of 2 Sheets)

Valuation Sec. 4.27 Map 2

Parcel No.	Customer's No.	Kind of Instrument	Date of Instrument	Grantor	Grantee	Recorded Place Bk.	Page	Date	Remarks
	N E RR Needham					Norfolk Co.			
12	4 - 23	Mtg.	June 16, 1852	Charles River Br. RR	Thomas Kingsbury	210	224	July 8, 1852	3d Parcel
	4 - 22	"	Jul. 30, 1852	Charles River Br. RR	Jos.A.Vossie	211	247	Aug. 26, 1852	3d Parcel
	4 - 73	Foreclosure	May 30, 1856	Charles River Br. RR	Marshall S. Rice	247	137	July 14, 1856	2d Parcel
	4 - 74	"	July 25, 1856	Charles River Br. RR	" " "	248	78	Aug. 18, 1856	2d Parcel
	4 - 29	Q C	Oct. 23, 1857	N Y & B RR	Alfred B. Ely	260	133	Oct. 24, 1857	3d Parcel
	1 - 72	Sheriff's Deed	July 5, 1858	N Y & B RR by Dep.Sheriff	do	268	84	Aug. 3, 1858	4th Parcel
	1 - 24	Release	Dec. 28, 1858	NY&B-CR-CR.Br.RR.Cors.	do	273	156	Feb. 18, 1859	3d Parcel
	4 - 76	Foreclosure	Aug. 9,1859	Charles River Br.RR	Marshall S. Rice	210	224	Aug. 27, 1859	Recorded on Margin 210/224.
13	Dr.15-Pl.84	Location	Apr. 30, 1851						Webster St. B-1306.
	Nor.Co.Rec-File R.C.	Decree	July 26, 1881			Co.Commrs. 5	461		Permit to cross Webster St. at grade B-1306
14	Dr.15-Pl.84	Location	Apr. 30, 1851	Jos. Avery					

SCHEDULE OF TITLE SUBSEQUENT TO JUNE 30, 1915

V.S. 4.27 Map 2

Parcel No.	Customers No.	Kind of Instrument	Date of Instrument	Grantor	Grantee	Recorded Place Bk.	Page	Date	Remarks
	N.E.R.R. Needham					Norfolk Co.			
15	3 - A	Q.C.	Mar. 26, 1930	N.Y.N.H.&H.R.R.	Filica Generagio	1890	342	May 7, 1930	B-2907, 1st. Par.
16	" "	"	" " "	"		"	"	" " "	" 2nd. "
17		Taking	Dec. 22, 1931	"	Comm. of Mass.	1952	481	Jan. 15, 1932	B-4875 - See R.C. Env. Greendale Ave. Deed B - Needham Br.
	N.E.R.R. Newton					Middlesex Co (So. Dist)			
18	4 - A	Ordnce	Dec. 6, 1933	N.Y.N.H.&H.R.R.	City of Newton	5778 - 72		Dec. 17, 1933	Sewer easement.
	Needham					Norfolk Co.			
19	3 - B	Taking	July 21, 1953	N.Y.N.H.&H.R.R.	Comm. of Mass.	3189	310	Aug 3, 1953	B4875 Taking par. E5
20	" "	"	" " "	" " "	" "	"	"	" " "	" E8
21	" "								" E/T
22	3 - C	Decree	Dec. 8, 1953	N.Y.N.H.&H.R.R.	Comm. of Mass.	3224	596	Dec 11 1953	B4875 alteration of bridge
	3 - D	Agreement	Oct. 13, 1953						B-4875 with Comm. of Mass. alteration of bridge No. 267 Route 128
21	3 - F	Agreement	Oct. 13, 1953						B-4875 with Comm. of Mass. Grade xing 242
23	3 - G	Taking	May 1, 1958	N.Y.N.H.&H.R.R.Co.	Comm. of Mass. (MDC)	3637	13	May 15, 1958	Par. 23 Perm. Easement
	Newton					Middlesex Co. (So. Dist)			
24	4 - B	Taking	May 1, 1958	"	"			May 15, 1958	Par. 24 " "

Revised - Land -
Revised - Parcel Structures - 1915
Map revised as of March 2 1938 check survey made

SURVEY BK. I PAGES 16-21

PLAN NUMBER 578 (H of 8) OF 1975
RECORDED, BOOK 12815 PAGE 372

PLAN NUMBER 578 (G of 8) OF 1975
RECORDED, BOOK 12815 PAGE 372

Δ - DESIGNATES BOUNDARIES OF PROPERTY ACQUIRED BY M.B.T.A.
JANUARY 26, 1972

PLAN NUMBER 578 (F of 8) OF 1975
RECORDED, BOOK 12815 PAGE 372

PLAN NUMBER 578 (E of 8) OF 1975
RECORDED, BOOK 12815 PAGE 372

SHEET NO. 2 OF TWENTY EIGHT SHEETS OF THE NEW YORK NEW HAVEN AND HARTFORD R.R.
FROM SURVEY STATION 334+90 TO SURVEY STATION 387+70

CORRECT: [signature] PRIN. ASST. VALUATION ENGINEER

APPROVED: [signature] VALUATION ENGINEER

RIGHT OF WAY AND TRACK MAP

THE NEW YORK NEW HAVEN AND HARTFOR

OPERATED BY

THE NEW YORK NEW HAVEN AND HARTFOR

FROM COOK ST. TO WOONSOCK

STATION 334+90 TO STATION 387+

CITY OF NEWTON
TOWN OF NEEDHAM STATE OF MASS.

SCALE: 1 = 100 FT. DATE JUNE 30, 19

OFFICE OF VALUATION ENGINEER
BOSTON, MASS.