MIDDLESEX 3 COMMUNITY COMPACT TRANSPORTATION STUDY

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EXECUTIVE SUMMARY

Eight communities within the Middlesex 3 Coalition entered into a Commonwealth Community Compact to address transportation issues along the Route 3 corridor. The project study area includes the Towns of Bedford, Billerica, Burlington, Chelmsford, Lexington, Tewksbury and Tyngsborough, as well as the City of Lowell. The Northern Middlesex Council of Governments (NMCOG) served as the lead technical agency for this study, and was assisted by the Metropolitan Area Planning Council (MAPC) and the Central Transportation Planning Staff (CTPS), under contract with the Town of Bedford. In addition to NMCOG, MAPC and CTPS, other project participants included the Middlesex 3 Coalition, MassDOT, local Chambers of Commerce, Workforce Development Boards, business and education leaders, Transportation Management Associations, legislators, and municipal staff and elected officials.

During the study process, the following goals were established:

- Improve access to employment, educational opportunities, and health care for economically disadvantages individuals, middle skilled workers, students,, recent college graduates, second shift workers and others;
- Alleviate traffic congestion and reducing travel time;
- Improve air quality;
- Eliminate existing barriers to providing efficient transportation service; and
- Facilitate economic development by assisting employers in filling job openings through enhanced transportation services.

The Route 3 corridor supports considerable economic activity, including high technology companies, robotics and life science research firms, advanced manufacturing, health care and education sectors, as well as support services such as hotels, restaurants, and retail establishments. One of the most evident transportation challenges along the corridor is the lack of extensive transit connections between the northern and southern ends of Route 3.

Transit service within the study area is provided through two separate transit authorities. The Lowell Regional Transit Authority (LRTA) serves the communities of Billerica, Chelmsford, Lowell, Tewksbury, and Tyngsborough, while the MBTA serves the communities of Burlington, Bedford and Lexington. Transit connections between the LRTA and MBTA service areas are limited, given that the allocation of funding to the regional transit authorities is determined by their service area boundaries. Strengthening connections between the RTA service areas will require interregional coordination and cooperation, creative funding approaches, and changes in policies and regulations.

In this report, several recommendations designed to improve overall transportation operations in the study area are presented, including the following:

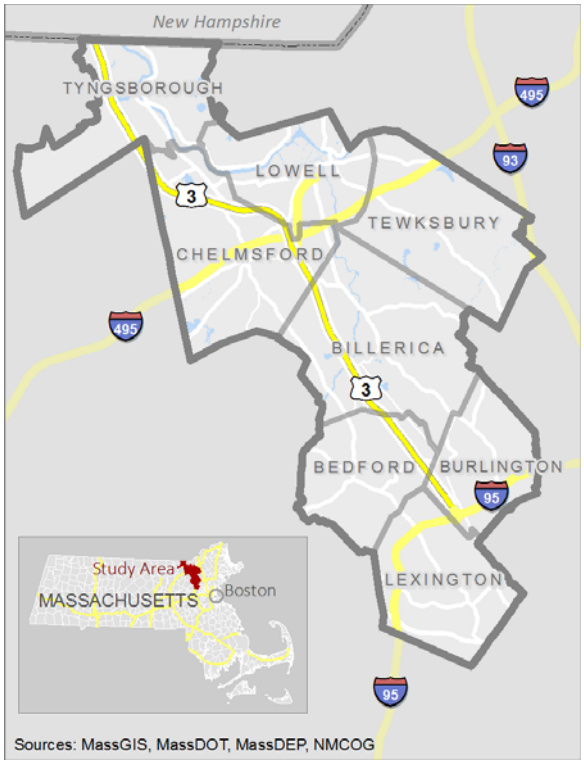
- Expansion of the existing Tyngsborough Park and ride lot, and identification of new park and ride lot locations along the Corridor in the communities of Chelmsford, Billerica and Burlington.

- Expansion of TMA Shuttle services, including implementation of late night shuttle service between Lowell and Burlington, additional service between Burlington and the Anderson/Woburn MBTA Commuter Rail Station, and partnerships between the municipalities, employers and on demand service providers.
- Further study on the establishment of mobility hubs in Burlington and Bedford.
- Strengthening and updating local permitting regulation to require membership in a TMA through the Planning Board's approval process, and updating performance standards within local zoning bylaws and subdivision regulations to include bicycle and pedestrian accommodations as part of the approval process.
- Continue municipal participation in the MassDOT Complete Streets Funding Program.
- Establishment of agreements with private ride-share services to fill gaps in transportation service during hours when public transit is unavailable.
- Expansion of private transportation services, such as through collaboration between the Middlesex 3 Coalition and Boston Express.
- Municipal community development and planning staff should continue to work with private businesses to identify transportation demand management solutions and other strategies for addressing documented parking issues.
- Study the feasibility of coordinating and streamlining Bedford, Burlington and Lexington local transit operations to improve efficiency and enhance service.
- Investigate legislative and policy changes to address the barriers to interregional transportation service by:
    - Consider legislative changes that would allow RTAs to be reimbursed for service provided beyond the service area boundaries;
    - Work with the congressional delegation to address the fleet size limitation tied to federal operating assistance; and
    - Consider legislative changes that would permit MBTA communities to receive service from an adjoining RTA as part of a corridor-wide transportation plan.
- Work with the LRTA and MBTA to implement the following public transit service changes:
    - Expand LRTA Route 17 to add new service along Middlesex Road in Tyngsborough;
    - Expand LRTA Route 15 to add new service along Route 129 and Turnpike Road in Chelmsford;
    - Revise/reconfigure Route 12 to cover a gap in service along Route 38 in Tewksbury;
    - Investigate the feasibility of new LRTA service linking Lowell and Middlesex Community College and the Veterans Hospital in Bedford;
    - Extend LRTA Route 13 from its current terminus at Chestnut Avenue in Burlington to the Burlington Mall during peak periods, to fill missing connections by the MBTA; and
    - Study the feasibility of combining LRTA Routes 13 and 14 to fill in gaps in service in Burlington.

1. INTRODUCTION

Through the State's Community Compact program, eight communities within the Middlesex 3 Coalition entered into a Commonwealth Community Compact to address transportation issues along the Route 3 corridor. The project study area includes the communities of Bedford, Billerica, Burlington, Chelmsford, Lexington, Lowell, Tewksbury and Tyngsborough, as shown on Map 1. The Route 3 corridor supports considerable economic activity, including high technology companies, robotics and life science research firms, advanced manufacturing, health care and education sectors, as well as support services such as hotels, restaurants, and retail establishments.

MAP 1: MIDDLESEX 3 TRANSPORTATION STUDY AREA



The Northern Middlesex Council of Governments (NMCOG) served as the lead technical agency for this study, and was assisted by the Metropolitan Area Planning Council (MAPC) and the Central Transportation Planning Staff (CTPS), under contract with the Town of Bedford. The study was funded through the Commonwealth Community Compact program to address transportation issues along the Route 3 corridor. In addition to NMCOG, MAPC and CTPS, other project participants included the Middlesex 3 Coalition, MassDOT, local Chambers of Commerce, Workforce Development Boards, business and education leaders, Transportation Management Associations, legislators, and municipal staff and elected officials.

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the communities of Billerica, Chelmsford, Lowell, Tewksbury, and Tyngsborough, while the MBTA serves the communities of Burlington, Bedford and Lexington. Transit connections between the LRTA and MBTA service areas are limited, given that the allocation of funding to the regional transit authorities is determined by their service area boundaries, as will be discussed in detail in a latter section of this report. Strengthening connections between the RTA service areas will require interregional coordination and cooperation, creative funding approaches, and changes in policies and regulations.

2. INPUT FROM THE BUSINESS COMMUNITY AND STUDY AREA MUNICIPALITIES

A thorough study of transportation issues along the Route 3 corridor requires input from businesses, municipalities and other project stakeholders. Throughout the study process, meetings were held with municipal staff to discuss their perspectives on the transportation needs that affect economic growth and resiliency along the corridor. Several meetings with the Middlesex 3 Coalition were conducted throughout the study process, providing the valuable feedback needed to ensure that all perspectives were considered. Table 1 below summarizes the six study-related meetings with the Middlesex 3 Coalition and its stakeholders and affiliates. Municipal leaders, legislators, and staff from the transit authorities, Executive Office of Housing and Economic Development, Department of Revenue, and MassDOT also attended these meetings.

TABLE 1: MIDDLESEX 3 COALITION MEETINGS AND PRESENTATIONS

Meeting	Date	Location
Existing Conditions Presentation 1	5/31/17	Lowell (City Hall)
Existing Conditions Presentation 2	6/9/17	Burlington (Grandview)
Study Update Presentation to the Middlesex 3 Coalition	7/21/17	Burlington (Grandview)
Transit Funding Presentation to the Middlesex 3 Executive Committee	9/8/17	Chelmsford (Apollo Drive)
Findings and Recommendations Presentation to Middlesex 3 Coalition	9/15/17	Lowell (UMass Lowell Innovation Hub)
Middlesex 3 Executive Committee meeting to review project recommendations	11/3/17	Billerica (Enterprise Bank)
Final Report Presentation to Middlesex 3 BOD and Transportation Committee	1/26/18	Burlington (Grandview)

In addition to the above meetings, individual interviews were conducted with planning and economic development staff in each participating community. Table 2 below lists the meeting dates and participants for each meeting. During the meetings, information regarding known development projects and the identified need for additional transportation services and facilities was compiled, based on the experience of each community.

TABLE 2: MEETINGS WITH MUNICIPAL STAFF

Community	Staff Person Interviewed	Date
Bedford	Tony Fields	5/18/2017
Billerica	Chris Reilly	5/16/2017
Burlington	Kristin Kassner	5/16/2017

Community	Staff Person Interviewed	Date
Chelmsford	Evan Belansky, Stephen Jahnle	5/11/2017
Lexington	Aaron Henry	6/23/2017
Lowell	Claire Ricker	5/31/2017
Tewksbury	Steve Sadwick	5/19/2017
Tyngsborough	Danielle Mucciarone, Pam Berman	5/25/2017

WRITTEN SURVEY

In addition to the meetings and interviews with stakeholders, the Northern Middlesex Council of Governments created and distributed an online survey for businesses located along the corridor. The survey input was used to gauge demand for additional transportation services between northern and southern ends of the corridor. The survey gathered information on employee commuting characteristics, parking, and the transportation needs of each company. The survey was distributed directly to businesses through the Middlesex 3 Coalition, area Chambers of Commerce, the Workforce Development Boards, and municipal staff.

Responses From Businesses

There were twenty (20) survey responses received. As shown in Table 3, the employment size of the companies varied, with 40% of respondents having less than 10 employees, 25% in the 10-20 employee range, 15% with 25-50 employees, and 20% with more than 50 employees.

Table 3: Respondents to Middlesex 3 Business Survey

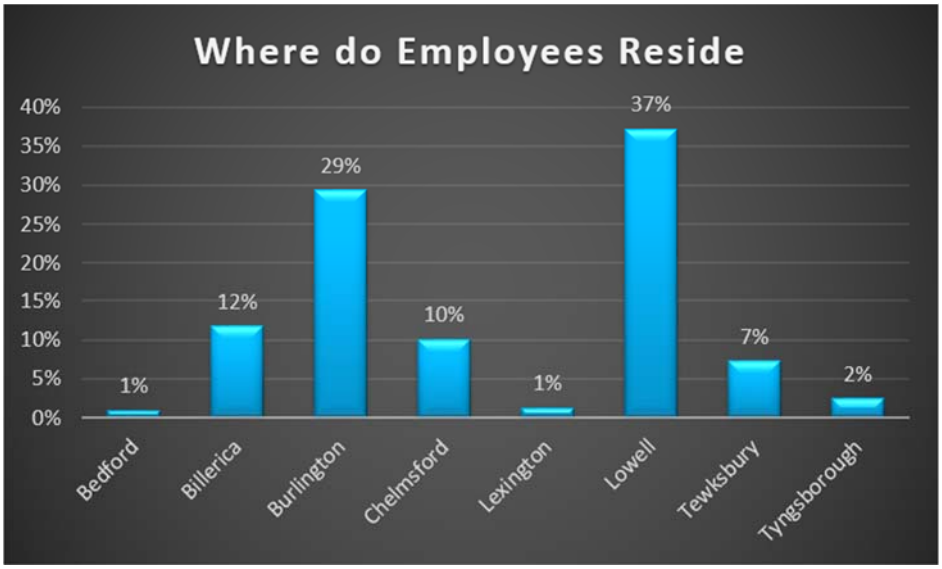
Company/Business	Location	Community	No. of Employees
Lane Bryant	6 Wayside Drive	Burlington	16
Eileen Fisher Company Store	6 Wayside Drive	Burlington	14
MAK Scientific, LLC	151 South Bedford Street	Burlington	4
Erland Construction	71 Third Avenue	Burlington	80
Town of Burlington	29 Center Street	Burlington	316
Alpha Martial Arts Academy	40 Vinal Square	Chelmsford	8
Alpha Tae Kwon Do Academy, LLC	40 Vinal Square	Chelmsford	9
Chelmsford Country Club	66 Park Road	Chelmsford	15
Gilbride Electric, Inc	21 Progress Avenue	Chelmsford	9
Colliers International	300 Apollo Drive	Chelmsford	2
Northeast Med Staff	221 Chelmsford Street	Chelmsford	6
Waddington North America Inc.	6 Stuart Road	Chelmsford	486
Ayotte Plumbing Heating & Air Conditioning	108 Middlesex Street	Chelmsford	15
Law offices of Kevin Sullivan, LLC	9 Fletcher Street	Chelmsford	3
Altid Enterprises, LLC	285 Billerica Road	Chelmsford	4
Innosight	92 Hayden Avenue	Lexington	70
Lexx Restaurant	1666 Massachusetts Ave	Lexington	38
Princeton Properties Mgmt, Inc	1115 Westford Street	Lowell	27
Votze Butler Associates	44 Stedman Street	Lowell	14
Town of Tewksbury	1009 Main Street	Tewksbury	38

The responses to the survey questions are summarized as follows:

Survey Question: Where do your employees reside?

To estimate the percentage of workers that reside within the Middlesex 3 communities, businesses were asked to categorize employees by their home zip codes. Based on the companies that responded, 49% of the employees reside within the study area, with the highest percentages living in Lowell and Burlington, as shown in Figure 1.

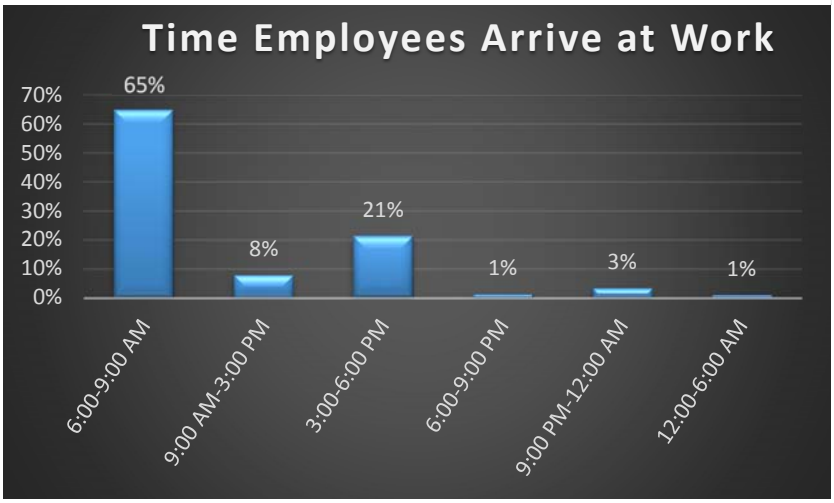
Figure 1: Percentages of Employees Living in the Study Area



Survey Question: When do your employees arrive for work?

The survey asked respondents to identify the times that employees generally arrive for work. The majority of respondents stated that their employees arrive between 6:00 AM and 9:00 AM. However, as shown in Figure 2, 26% of the employees arrive to work after 3:00 PM, indicating that their commute home generally occurs after transit service ends. This clearly documents a need for transportation options for second shift workers who may rely on public transportation.

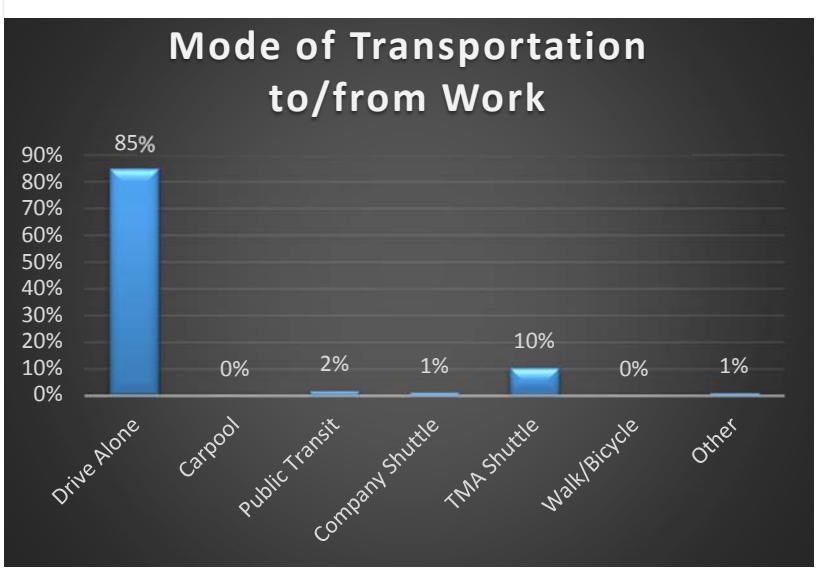
Figure 2: Percentages of Employees versus Work Schedule



Survey Question: How do employees get to/from work?

Figure 3 shows that the majority of commuters employed by companies responding to the survey drive alone (85%). Ten percent (10%) rely on current TMA shuttle service delivered either through the Middlesex 3 TMA or the Route 128 Business Council. The current TMA service provides access to and from the Boston area and surburban campuses in Lexington, Bedford and Burlington. TMA service between the northern and southern portions of the study area does not currently exist. Approximately 2% of the employees at the responding companies utilize public transit, and 1% commute via an employee shuttle.

Figure 3: Employee Percentages versus Mode of Transportation



Question: Does your business provide any transportation assistance, incentives or services for employees?

Only two companies responded to this question. The Lexx Restaurant uses Uber to shuttle employees to and from the Alewife MBTA Station in Cambridge. Innosight uses the 128 Business Council to shuttle employees from Alewife, as well as an on site shuttle to move employees from company parking areas to the office.

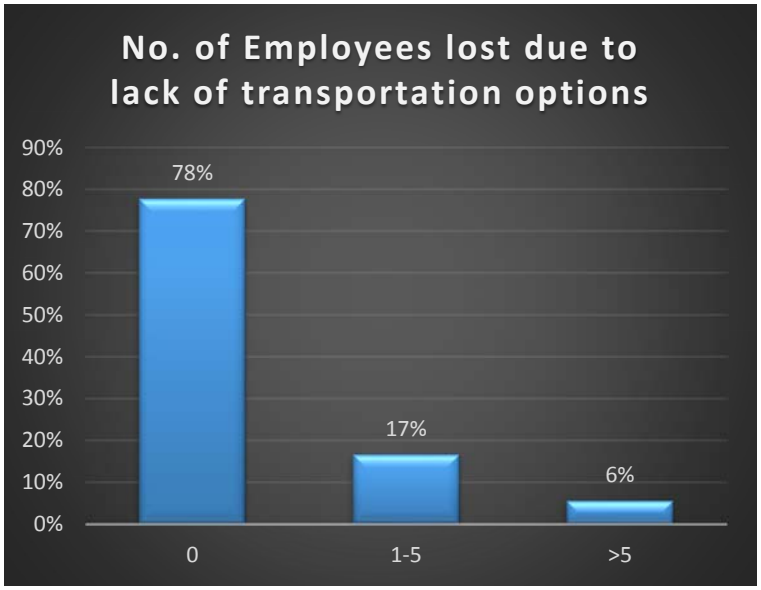
Question: Has your business been affected by a lack of transportation options?

Twenty percent (20%) of respondents stated that their businesses have been affected by a lack of transportation options. The Lexx Restaurant stated that open positions cannot be filled due to insufficient public transportation options. Lane Bryant, located at Wayside Commons in Burlington, expressed concern over the lack of available transportation services, particularly for employees working late evenings.

QUESTION: PLEASE ESTIMATE THE NUMBER OF EMPLOYEES WHO HAVE QUIT IN THE PAST YEAR DUE TO TRANSPORTATION ISSUES.

Of the responses provided, 78% stated that they did not lose any employees due to a lack of public transportation options, as shown in Figure 4. One respondent indicated that the business has not been able to keep employees because of a lack of options, with almost 15 positions remaining unfilled at most times.

FIGURE 4: EMPLOYEE LOSSES BASED ON LACK OF TRANSPORTATION OPTIONS



QUESTION: HOW WOULD YOU RATE EMPLOYEE PARKING AVAILABILITY AT YOUR SITE?

This question was posed to determine if parking needs are currently being met. Figure 5 shows the availability of employee parking at responding locations. Eight-one percent (81%) of respondents stated that the current parking supply at their business was adequate or excellent. Fourteen percent (14%) noted that parking can be sometimes problematic, with one respondent in Vinal Square in Chelmsford noting that traffic congestion results in difficulty gaining access to and from the parking areas. Five percent (5%) identified chronic parking shortages at their locations.

FIGURE 5: EMPLOYER PARKING SUPPLY

3. DEMOGRAPHIC ANALYSIS

Planners have increasingly included transportation among the set of factors that influence socioeconomic outcomes or that reflect real differences in access to opportunity, through transit's role in connecting people with employment, education and health care. The Route 3 corridor provides direct access to employment, education and health care services for area residents and public transit service is critical to linking workers, students and other residents to these opportunities. This section of the report

provides an overview of the study area demographics, including population, income, educational attainment, and employment characteristics.

POPULATION

The population of the study area increased by 2.41% between 2000 and 2010, which was less than the growth rate seen in Middlesex County (2.6%) and the Commonwealth of Massachusetts (3.1%). As outlined in Table 4, the population in every community, with the exception of Chelmsford (-0.17%), increased between 2000 and 2010. The population in the City of Lowell increased by only 1.29%, from 105,167 to 106,519, between 2000 and 2010. However, Lowell's population represented 36.73% of the total population within the study area. The growth occurring in the suburban communities of Lexington (8.34%), Burlington (5.12%) and Billerica (3.24%) exceeded the state average, while Bedford (2.49%), Tyngsborough (1.90%) and Tewksbury (0.38%) had growth rates that were lower than the state average. The population within the study area has continued to increase since 2010, with growth occurring in every community, according to the 2015 American Community Survey estimates provided by the U.S. Census Bureau.

TABLE 4: POPULATION CHANGE IN THE MIDDLESEX 3 STUDY AREA (2000, 2010 AND 2015 (ESTIMATED))

Community	2000 Population	2010 Population	Percent Change	2015 Estimate
Bedford	12,996	13,320	2.49%	13,921
Billerica	38,981	40,243	3.24%	41,956
Burlington	23,302	24,494	5.12%	25,467
Chelmsford	33,858	33,802	-0.17%	34,757
Lexington	28,974	31,391	8.34%	32,700
Lowell	105,167	106,519	1.29%	109,349
Tewksbury	28,851	28,961	0.38%	30,115
Tyngsborough	11,081	11,292	1.90%	12,053
Middlesex 3 Corridor	**283,210**	**290,022**	**2.41%**	**300,318**

SOURCE: 2000 AND 2010 U.S. CENSUS AND 2015 AMERICAN COMMUNITY SURVEY

RACE/ETHNICITY

Table 5 displays the racial/ethnic profiles for the eight communities in the Middlesex 3 study area. Lowell is the most diverse community with 42% of the population identified as African American, Asian and a race other than white. Within the suburban communities, that majority population is white. The Asian population is the second largest racial group, ranging from 3% of the population in Tewksbury to 24% in Lexington. While Lowell is home to the second largest percentage of Asians (22%), the absolute number of Asian residents in Lowell exceeds the other study area communities at 23,480. The African American population represents the third largest racial group in the study area, followed by two or more races.

TABLE 5: % POPULATION BY RACE/ETHNICITY

Community	White	African American	American Indian and Alaska Native	Asian	Some other race	Two or more races	*Hispanic*
Bedford	82%	2%	0%	14%	1%	2%	*5%*
Billerica	91%	2%	0%	5%	1%	2%	*3%*
Burlington	81%	3%	0%	14%	0%	2%	*2%*
Chelmsford	89%	1%	0%	9%	1%	1%	*3%*
Lexington	72%	1%	0%	24%	0%	3%	*2%*
Lowell	58%	7%	0%	22%	10%	4%	*18%*
Tewksbury	95%	1%	0%	3%	0%	1%	*2%*
Tyngsborough	93%	1%	0%	5%	0%	2%	*2%*

SOURCE: 2011-2015 AMERICAN COMMUNITY SURVEY

HOUSEHOLD INCOME

The Middlesex 3 study area is comprised of 107,936 households, with 36% of the households located in Lowell. With the exception of Lowell, most of the communities in the study area are affluent, as shown in Table 6 below. Lexington had the highest median household income at $149,306, while Bedford was the second most affluent community with a median household income of $113,729, according to estimates provided by the American Community Survey. All of the suburban communities located within the study area had median household incomes greater than $90,000. The City of Lowell had the lowest median household income at $48,002, and nearly 20% of the households are living below the poverty level. Poverty is less pronounced within the suburban communities, with rates ranging from a low of 4% in Billerica to high of 5.7% in Tewksbury.

TABLE 6: MEDIAN HOUSEHOLD INCOME AND PERCENT OF HOUSEHOLDS LIVING BELOW POVERTY

Community	Total Households	Median Household Income	Households with Income Below Poverty	Percent Below Poverty
Bedford	5,129	$ 113,729	251	4.9%
Billerica	14,225	$ 96,316	573	4.0%
Burlington	9,359	$ 94,518	558	6.0%
Chelmsford	13,752	$ 95,290	715	5.2%
Lexington	11,531	$ 149,306	572	5.0%
Lowell	38,489	$ 48,002	7,576	19.7%
Tewksbury	11,199	$ 90,484	634	5.7%
Tyngsborough	4,252	$ 106,290	205	4.8%
Middlesex 3 Study Area	**107,936**			

Source: U.S. Census Bureau, 2011-2015 American Community Survey Estimate

Vehicle Availability

Demand for public transportation is often tied to a household's access to a vehicle. Households with no vehicle access or with access to only one vehicle tend to be more reliant on public transportation than the overall population. Table 7 details the number of vehicles available to households within the Middlesex 3 study area. Over ninety-five hundred (9,500) households do not have a vehicle available, representing 9.0% of the households in the study area. Nearly 70% of the households without a vehicle are located within the City of Lowell. Additionally, 32.4% of households have access to one only vehicle, with Lowell households comprising nearly 46% of the one-vehicle households.

Table 7: Vehicle Availability Per Household

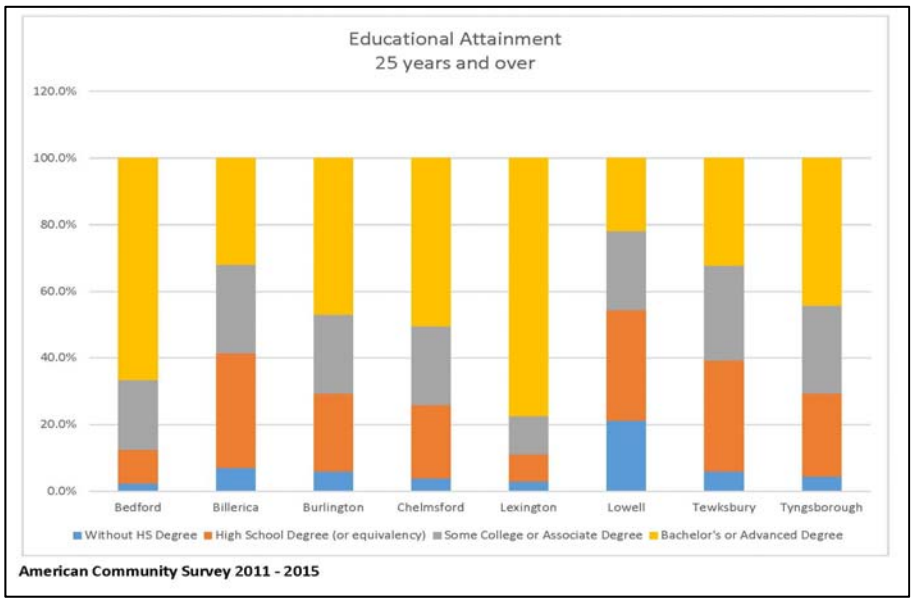
Community	Number of Vehicles Per Household							
	None		One		Two		Three or More	
Bedford	298	5.8%	1,396	27.2%	2,507	48.9%	928	18.1%
Billerica	541	3.8%	3,867	27.2%	5,829	41.0%	3,988	28.0%
Burlington	585	6.3%	2,698	28.8%	4,069	43.5%	2,007	21.4%
Chelmsford	610	4.4%	4,250	30.9%	6,279	45.7%	2,613	19.0%
Lexington	593	4.1%	2,988	25.9%	6,098	52.9%	1,852	16.1%
Lowell	6,604	17.2%	15,916	41.4%	11,113	28.9%	4,856	12.6%
Tewksbury	390	3.5%	3,043	27.2%	5,384	48.1%	2,382	21.3%
Tyngsborough	121	2.8%	813	19.1%	2,114	49.7%	1,204	28.3%
TOTAL	**9,742**	**9.0%**	**34,971**	**32.4%**	**43,393**	**40.2%**	**19,830**	**18.4%**

Source: U.S. Census Bureau, 2011-2015 American Community Survey Estimate

Educational Attainment

Figure 6 shows the level of educational attainment of residents aged 25 and older. Educational attainment is an indicator of the employment sector workforce. Areas with high concentrations of bachelor and advanced degrees have a workforce of executive and professional workers with higher income levels, where communities with significant concentrations of workers with high school degrees or less education often have a lower skilled workforce employed in service sector positions with lower income levels.

Figure 6: Educational Attainment of Residents 25 and Older

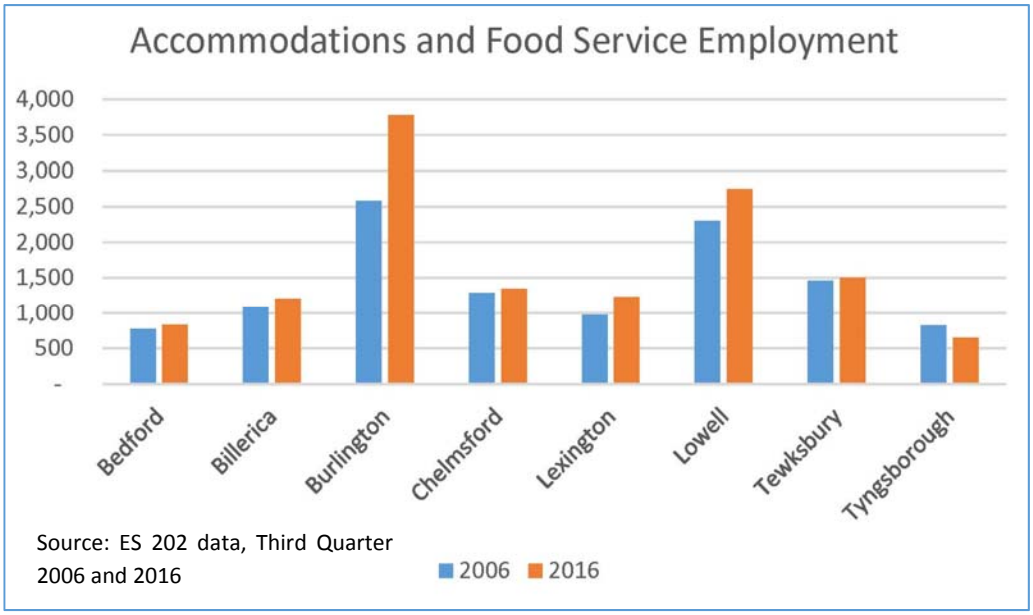


The Middlesex 3 study area communities have a variety of educational attainment levels. Residents without a high school degree make up a small fraction, representing between 2% and 7% of the population in the seven suburban towns, and a more significant percentage of Lowell residents at 21%. Fifty-four (54%) of Lowell residents age 25 and older have a high school degree or less. Within the suburban communities, the percentage of residents with a high school degree or equivalency ranges from 8% of the over age 25 population in Lexington to 34% in Billerica. For the most part, the communities are very similar in terms of the percent of residents age 25 and older with some college or an Associate's degree, ranging between 21% and 27%. Lexington is the exception, with 11% of residents age 25 and over falling under this educational attainment category. In terms of residents with a Bachelors or Advanced Degree, Lexington has the greatest percentage of residents 25 years or older (78%), while just 22% of Lowell residents age 25 and older have a Bachelor or advanced degree.

Employment

A review of employment data was undertaken to examine retail and service sector employment trends along the Route 3 corridor, and to investigate the relationship to demand for enhanced transportation services.

Figure 7: Accommodations and Food Service Employment



Source: ES 202 data, Third Quarter 2006 and 2016

The two service sectors that were examined included Accommodations and Food Service. Overall, the study area experienced a 13.7% growth in both sectors from 2006 to 2016, as shown in Figure 7. Seven of the communities experienced growth in these sectors, while Tyngsborough showed a decline of -21%, from 827 employees in 2006 to 653 employees in 2016. The greatest gain in this sector was in Burlington, which experienced a 46.4% growth rate, from 2,577 employees in 2006 to 3,774 employees in 2016. Lexington had the second highest growth, with 26.2% increase. Lowell experienced the second largest growth in the accommodations and food service sector, in terms of the increase in employees within these sectors, from 2,297 in 2006 to 2,745 in 2016, or 19.5%.

Figure 8 shows employment in the retail trade sector for the third quarters of 2006 and 2016. Half of the communities experienced growth in the retail sector, while half experienced a decline. Burlington and Lowell showed the largest increase in the number of workers employed within this sector, from

5,010 employees in 2006 to 5,767 employees in 2016 (15.1%), while Lowell increased from 2,439 employees to 2,857 employees (17.1) Bedford showed the highest percentage of growth, increasing from 773 employees in 2006 to 978 in 2016, for a growth rate of 26.5%.

FIGURE 8: RETAIL TRADE EMPLOYMENT

Source: ES 202 data, Third Quarter 2006 and 2016

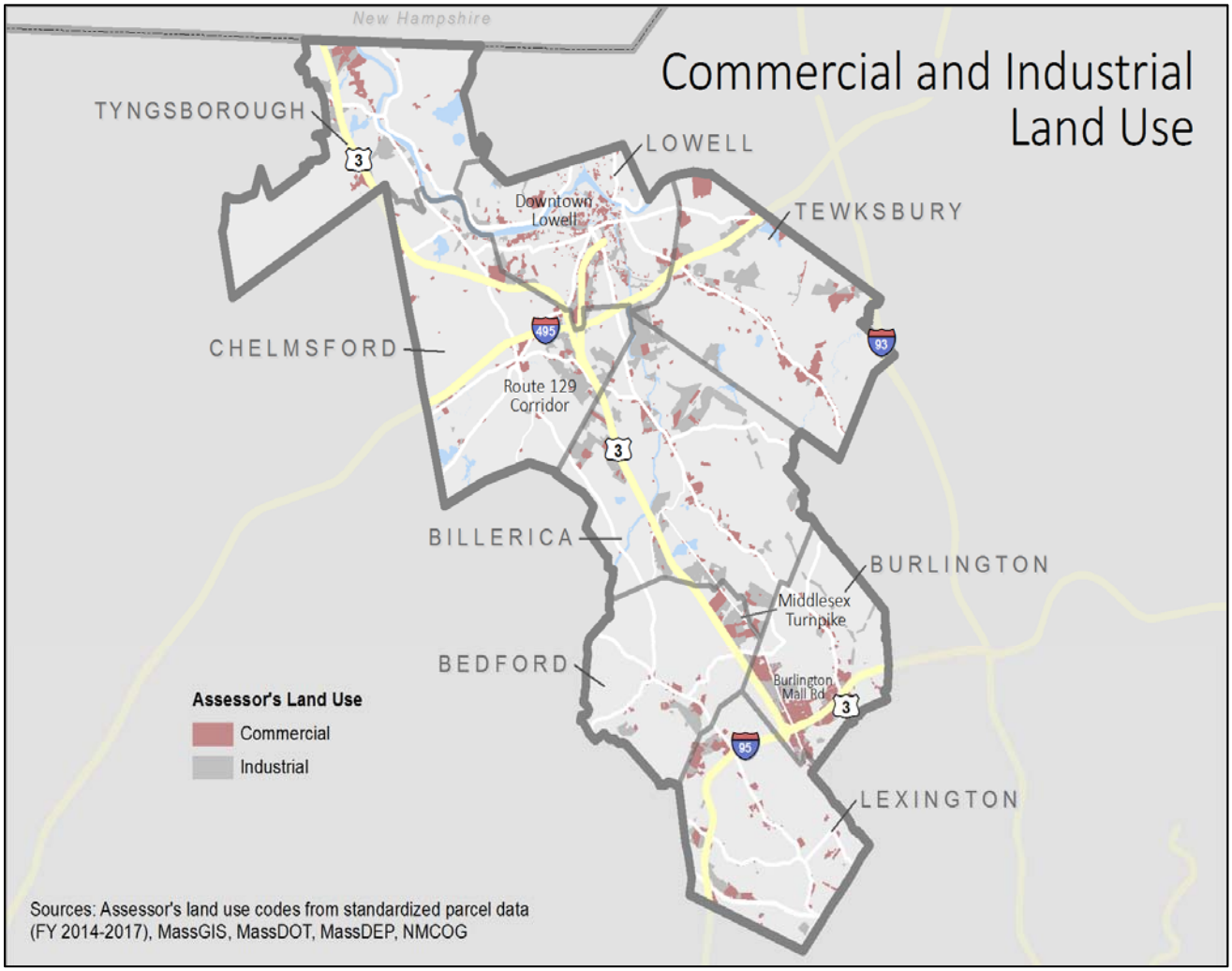
COMMUNITY DEVELOPMENT PATTERNS

An analysis of land use and development patterns was undertaken to identify existing major employment areas, and to determine where new growth is expected to take place in the immediate future. NMCOG staff mapped the existing commercial and industrial land uses from the tax assessor records in each municipality. Map 2 on the following page indicates the commercial areas in red and the industrial areas in gray.

As expected, a significant portion of the commercial and industrial activity is adjacent to Route 3. Looking at the study area from the north to south one finds that the commercial area in Tyngsborough is located primarily along Middlesex Road, while in Chelmsford most commercial and industrial development is located in the Drum Hill area, town center, and along the Route 129 corridor. The commercial development in Lowell is found along the Lowell Connector, in the central business district, and throughout other sections of the City as well. Billerica has a significant amount of commercial and industrial development along the Route 3A corridor, Concord Road, Treble Cove Road, Rangeway Road and the Middlesex Turnpike. Bedford's commercial and industrial area is primarily located along the Middlesex Turnpike, Hartwell Avenue and Great Road. In Burlington, the commercial and industrial is located along the Middlesex Turnpike and Mall Road. Lexington's commercial and industrial development is primarily in the Hartwell Avenue, Lexington Center and Hayden Avenue areas.

The Town of Tewksbury, which is approximately three miles east of Route 3 along Route 495, has concentrations of commercial and industrial properties along the Route 38 corridor, Route 133 corridor, North Street, Shawsheen Street and East Street area.

MAP 2: COMMERCIAL AND INDUSTRIAL LAND USE IN THE MIDDLESEX 3 STUDY AREA



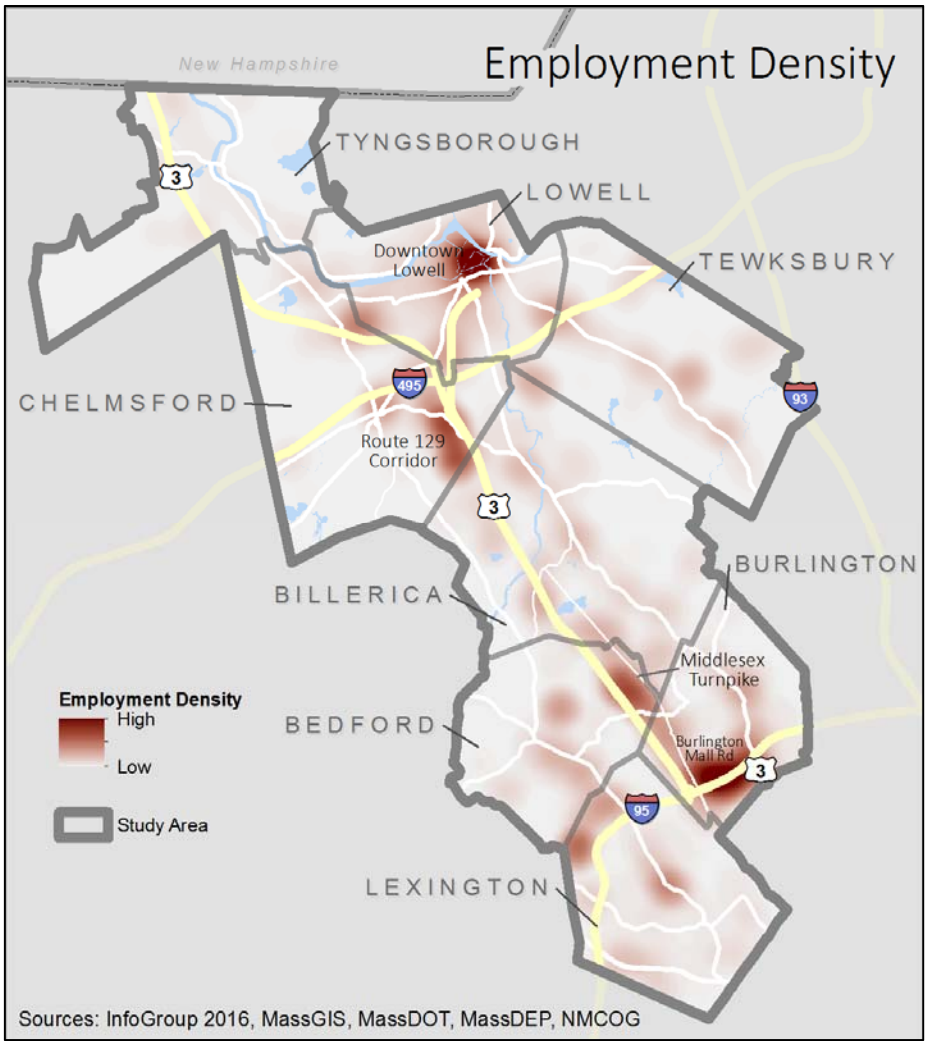
Employment Density

Employment density data for 2016 was obtained from the private data source InfoGroup, through a contract with MassDOT. NMCOG staff reviewed the data with the community planners and made appropriate edits where needed. The data is displayed on Map 3 in a "heat map" style, with the darker shades of red indicating greater employment density. The map clearly shows the areas with the largest employment in the Middlesex 3 study area.

Notable major employment areas include:

- Downtown Lowell
- Burlington Mall Road
- Burlington Northwest Park
- Middlesex Turnpike (Bedford, Billerica and Burlington)
- Chelmsford Route 129 Corridor
- Lowell/Chelmsford Drum Hill
- Lexington Town Center
- Lexington Hartwell Avenue
- Lexington Hayden Avenue
- Tewksbury Route 38 at I-495

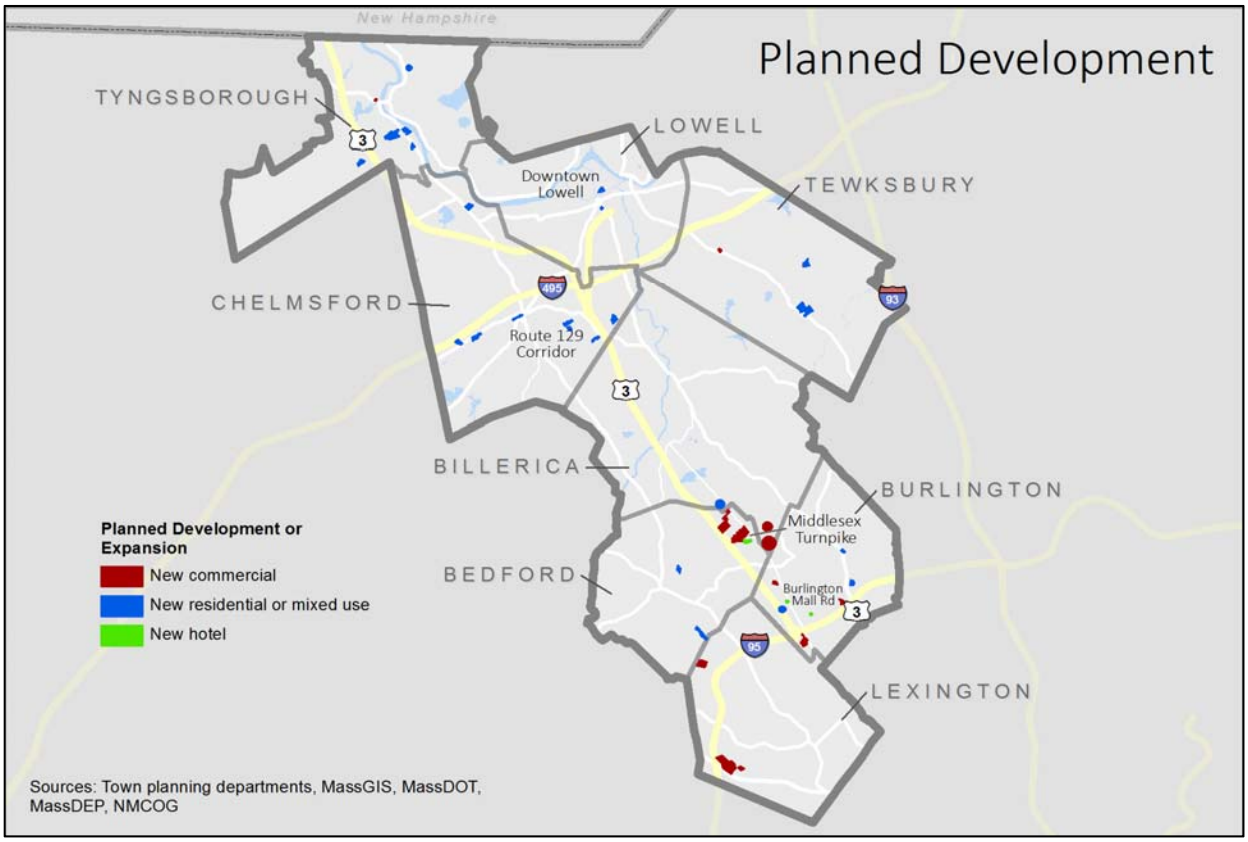
Map 3: Employment Density "Heat Map"



Planned Developments

NMCOG met with municipal staff to inventory significant developments that are either permitted or in the pipeline. The projects are shown on Map 4, with red depicting new commercial development, blue showing new residential or mixed use, and green showing the location of a new hotel.

MAP 4: PLANNED DEVELOPMENTS IN MIDDLESEX 3 COMMUNITIES



COMMUTING PATTERNS

A review of the American Community Survey estimates for 2009-2013 indicated that 45% (66,836) of the approximately 145,000 workers residing in the study area also work in the study area. Table 8 details the work trips between the Middlesex 3 communities.

TABLE 8: COMMUTING PATTERNS – WORK TRIPS BETWEEN STUDY AREA COMMUNITIES

	Place of Employment								
Place of Residence	**Total**	**Bedford**	**Billerica**	**Burlington**	**Chelmsford**	**Lexington**	**Lowell**	**Tewksbury**	**Tyngsborough**
Bedford	**3,088**	1,651	300	419	69	512	104	33	-
Billerica	**9,785**	947	4,236	2,054	703	531	805	457	52
Burlington	**5,199**	404	416	3,234	183	656	211	77	18
Chelmsford	**8,329**	676	786	773	3,561	467	1,683	218	165
Lexington	**4,799**	432	157	882	119	3,087	113	-	9
Lowell	**26,793**	1,107	2,414	1,454	3,743	511	14,900	1,882	782
Tewksbury	**5,716**	420	952	748	313	125	696	2,409	53
Tyngsborough	**3,127**	149	168	193	335	39	1,013	165	1,065
Total	**66,836**	5,786	9,429	9,757	9,026	5,928	19,525	5,241	2,144
American Community Survey 2009 - 2013									

The review was expanded to include the five southern New Hampshire communities of Hollis, Hudson, Merrimack, Nashua and Pelham that had significant commuter traffic along the Route 3 corridor. These five communities have a combined workforce of approximately 81,550, of which nearly 11.5% work in the Middlesex 3 study area. Approximately, 2,356 of these southern New Hampshire residents work in Lowell, while approximately 1,596 are employed in Chelmsford and 1,456 work in Billerica. Approximately, 1,288 of these five New Hampshire workers commute to Burlington. The remaining four Middlesex 3 communities of Bedford, Lexington, Tewksbury and Tyngsborough employ less than 1,000 of the southern New Hampshire commuters. Table 9 details the work trips between the five southern New Hampshire communities and the Middlesex 3 communities.

TABLE 9: COMMUTING PATTERNS - EMPLOYEES LIVING IN SOUTHERN NEW HAMPSHIRE AND WORKING IN THE STUDY AREA

	Place of Employment								
Place of Residence	**Total**	**Bedford**	**Billerica**	**Burlington**	**Chelmsford**	**Lexington**	**Lowell**	**Tewksbury**	**Tyngsborough**
Hollis	**302**	15	31	180	20	24	32	-	-
Hudson	**2,133**	151	324	180	489	98	510	296	85
Merrimack	**822**	57	263	121	107	79	47	99	49
Nashua	**4,732**	572	657	740	859	345	998	330	231
Pelham	**1,344**	83	181	67	121	31	769	71	21
Total	**9,333**	878	1,456	1,288	1,596	577	2,356	796	386
American Community Survey 2009 - 2013									

A license plate survey was conducted at the Orchard Street overpass in Billerica to determine the percentage of New Hampshire cars that regularly commute along Route 3. The southbound data was collected during the morning peak in 30-minute intervals from 7:00 AM to 9:00 AM. The New Hampshire vehicles represented an average of 27% of the traffic moving south in the morning, with Massachusetts vehicles comprising roughly 73% of the traffic flow, and all other states were well below 1%. Results from the license plate survey are displayed in Figure 9.

FIGURE 9: PERCENTAGES OF NEW HAMPSHIRE VERSUS MASSACHUSETTS COMMUTERS ALONG ROUTE 3 SOUTHBOUND (AM PEAK)

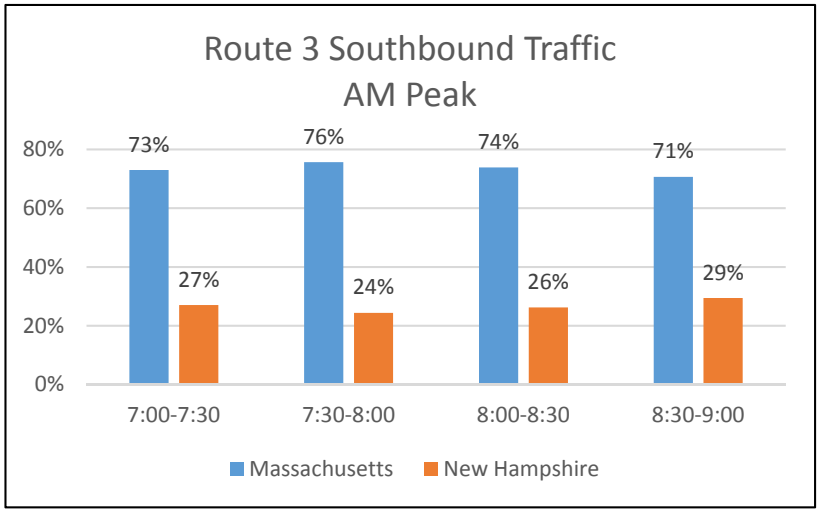


Figure 10 depicts the time of day that workers residing in the study area begin their daily commute. In Lexington, 14% of workers leave home between 5:00 AM and 6:59 AM, according to the American Community Survey, while in Tewksbury 35% of the workers depart home for work during these hours. Overall, the majority of workers residing in study area leave home for work between 7:00 AM and 8:59 AM. However, this pattern is remarkably different for workers residing in Lowell, where the percentage

of workers departing during the afternoon and early evening is much higher than in other communities. This is indicative of a community with a significant number of second shift workers. These workers may be able to get to their jobs using public transit, but service is not available for their return trips where evening service is either extremely limited or non-existent. As shown in Figure 11, most of the second shift workers either drive alone or carpool to their work sites, with only 3% using public transit.

FIGURE 10: PERCENTAGE OF EMPLOYEES BY TIME LEAVING FOR WORK

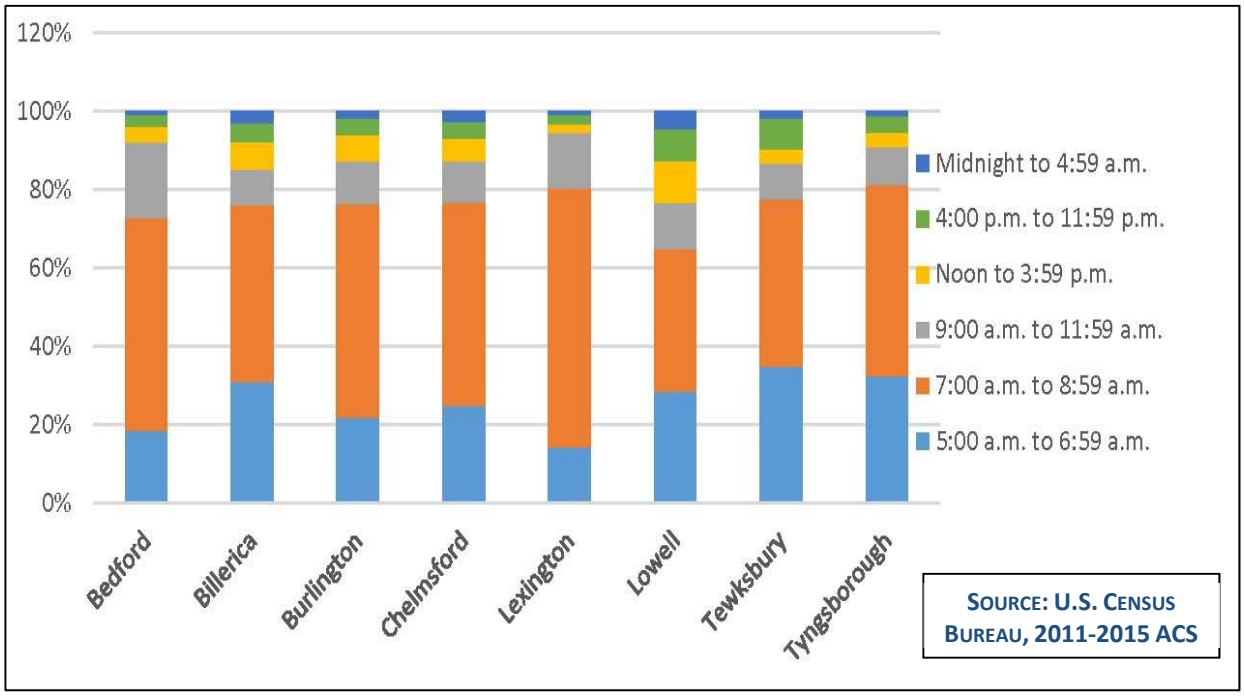
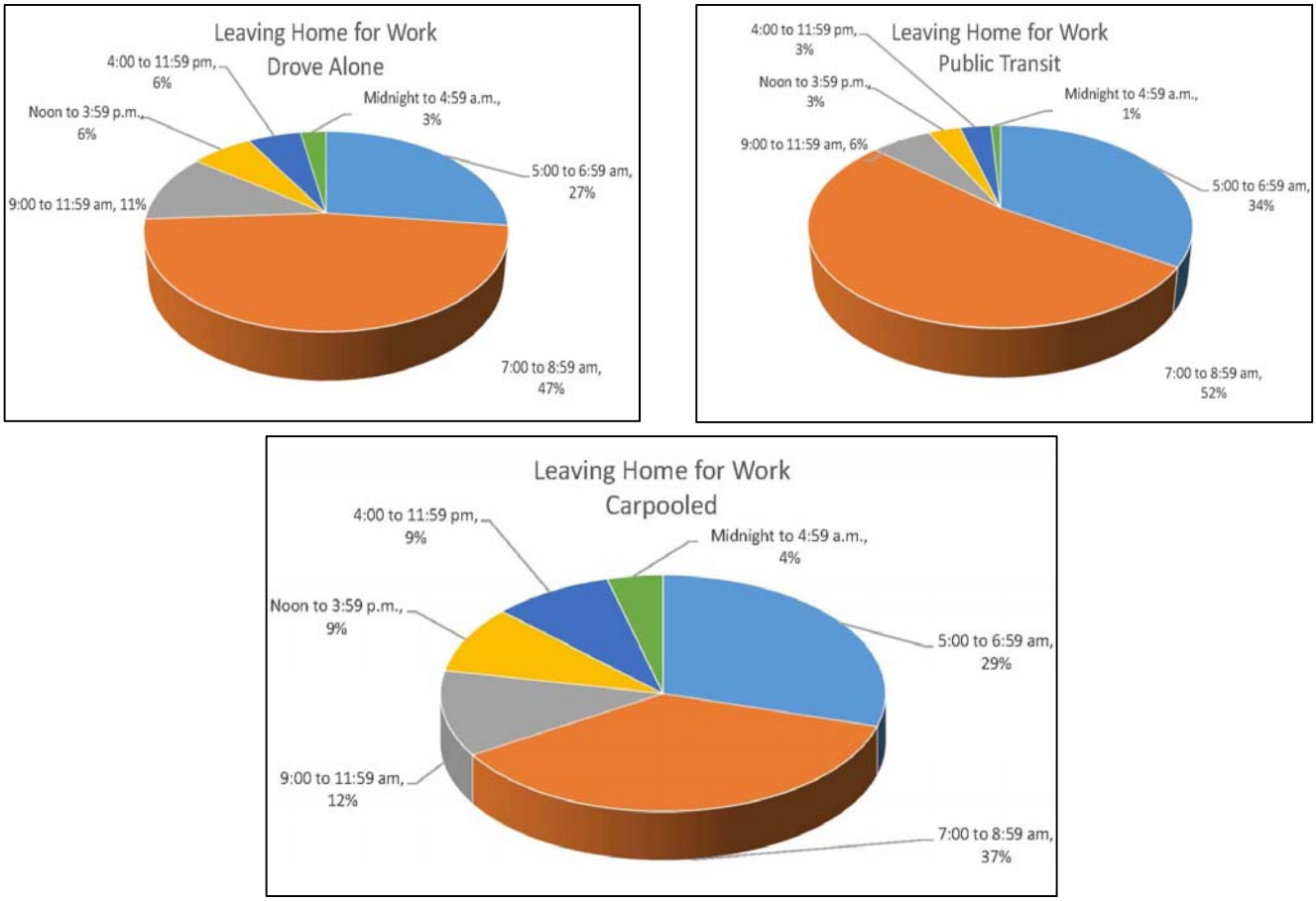


FIGURE 11: TIME OF DEPARTURE TO WORK BY TRANSPORTATION MODE



SOURCE: U.S. CENSUS BUREAU, 2011-2015 ACS ESTIMATES

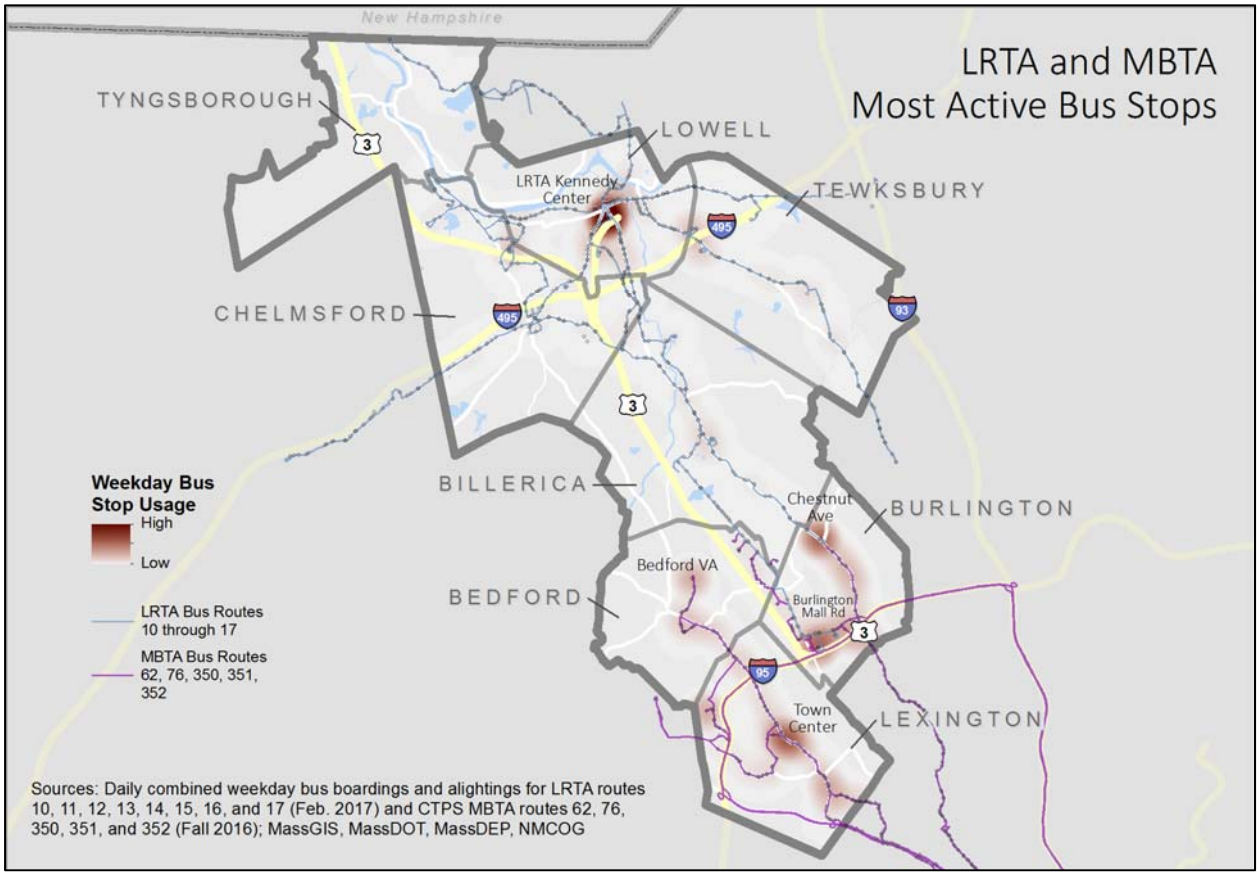
4. REGIONAL TRANSPORTATION NETWORK PERFORMANCE

Mobility and economic development are key factors in evaluating and planning transportation services and facilities throughout the Middlesex 3 study area. A healthy, efficient and well-performing transportation network is necessary to attract future economic development and to retain existing businesses along the corridor. As development activity increases mobility can be affected, leading to the need for increased transportation service. Municipalities, regional and state agencies, and the private sector must identify and prioritize economic and mobility needs.

The transportation network includes roadway infrastructure, pedestrian and bicycle facilities, and rail lines, which rely on each other to operate successfully. Coordination and ongoing planning is needed to ensure that the system is keeping pace with need. Presently, the study area is served by two transit authorities (MBTA and LRTA), two Transportation Management Associations (128 Business Council and Middlesex 3), two Regional Planning Agencies (MAPC and NMCOG), and two Metropolitan Planning Organizations (Boston MPO and Northern Middlesex MPO), as well as community transportation

providers, college and university transit providers, and by private providers. Map 5 shows the most active LRTA and MBTA bus stops throughout the study area. The LRTA Kennedy Bus Hub in Lowell has the greatest bus stop boarding and alighting, followed by the Burlington Mall, Lexington Center, Chestnut Avenue in Burlington, and the Bedford Veterans Administration Hospital.

MAP 5: LRTA AND MBTA MOST ACTIVE BUS STOPS IN MIDDLESEX 3 STUDY AREA



In the past, transportation service needs assessments for the study area have focused on moving people from the Boston/Cambridge area to the southern end of the corridor. As this report outlines, there are several existing options for daily service to and from Alewife through the MBTA, Middlesex 3, and the 128 Business Council. The most recent input provided by local businesses and the municipalities now indicates that there is a need to improve transportation access between the northern and southern ends of the Route 3 corridor, in part to access the available workforce in the Lowell area. Travel between Lowell and the southern end of the study area is presently served by LRTA fixed route bus service, but that service is somewhat limited in terms of route coverage and hours of operation. This study will assess alternatives for addressing the transportation needs of the workforce employed along the corridor.

Because most public transportation options currently available rely on the roadway network, efficient traffic operations are essential to operating a public transit system. Sidewalks, bicycle lanes and multi-

purpose trails are also key facilities that provide pedestrian and bicycle access to public transportation services and facilities. Increased access to public transportation via roadways, sidewalks or bicycle facilities helps support and promote new and sustainable economic development opportunities. For example, input provided during this study indicates that there are retail and restaurant establishments located in the Burlington area that are unable to fill job openings due to the lack of public transportation services for second shift workers. These businesses have identified a potential opportunity to recruit an available workforce in the Lowell area, if the transportation issues outlined can be successfully addressed.

EXISTING TRANSIT SERVICES

The following section of this report provides an overview and assessment of existing transportation services along the corridor. Presently, the study area is served by commuter rail, fixed route bus service, on demand service, TMA shuttles, employer-sponsored shuttles, private bus service, municipal bus service, paratransit service, and ride hailing services. The following is a list of these services:

- MBTA Commuter Rail
- MBTA Bus
- LRTA Bus
- MVRTA Bus
- Town Transit Services
    - Lexington - Lexpress Bus
    - Burlington Transit
    - Bedford - DASH and BLT
- Transportation Management Associations (TMA)
    - Middlesex 3 TMA Shuttles
    - 128 Business Council TMA Shuttles
    - Employer Sponsored Park and Ride, Ride-Hailing, and Other Services
- Private Service
    - Boston Express
- Middlesex College Shuttle and UMass Lowell Roadster Shuttles
- Americans with Disabilities Act (ADA) Service
    - MBTA – The RIDE
    - LRTA – The RoadRunner

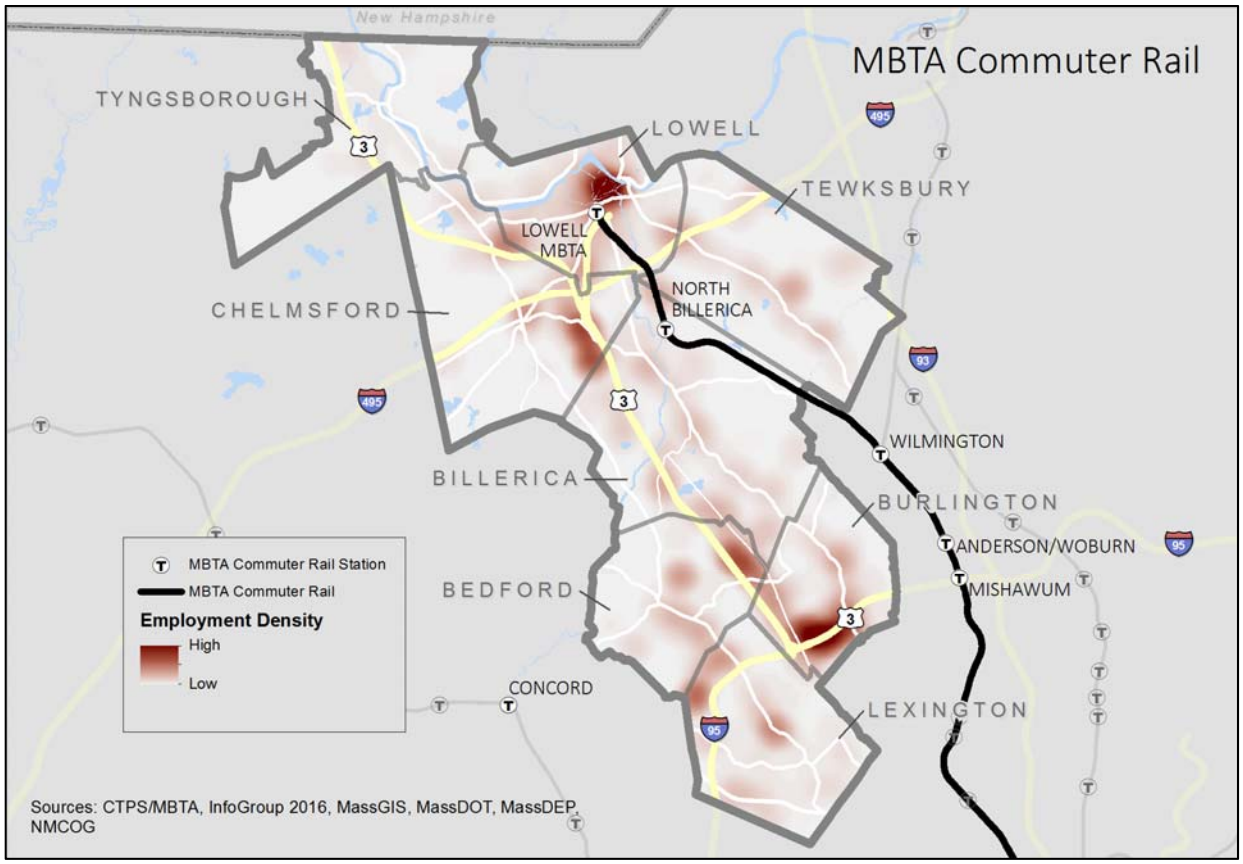
The existing transit services are discussed in detail in the following sections. The average daily ridership information presented below, represents the total passenger trips along the entire length of the transit route and is unavailable at the community level; however, this information is reflected in the Bus Stop Activity data displayed in Map 5 on the preceding page.

Route descriptions, fares and schedules are included in the appendix to this report.

Massachusetts Bay Transportation Authority (MBTA) Commuter Rail

The MBTA operates the commuter rail between Lowell (Gallagher Intermodal Transportation Center) and Boston (North Station) with stops in the study area in Lowell and North Billerica. Map 6 displays the referenced MBTA commuter rail stations relative to employment density. The Gallagher Intermodal Transportation Center, the terminus of the line, is adjacent to the area of high employment density in the center of Lowell.

Map 6: MBTA Commuter Rail Service

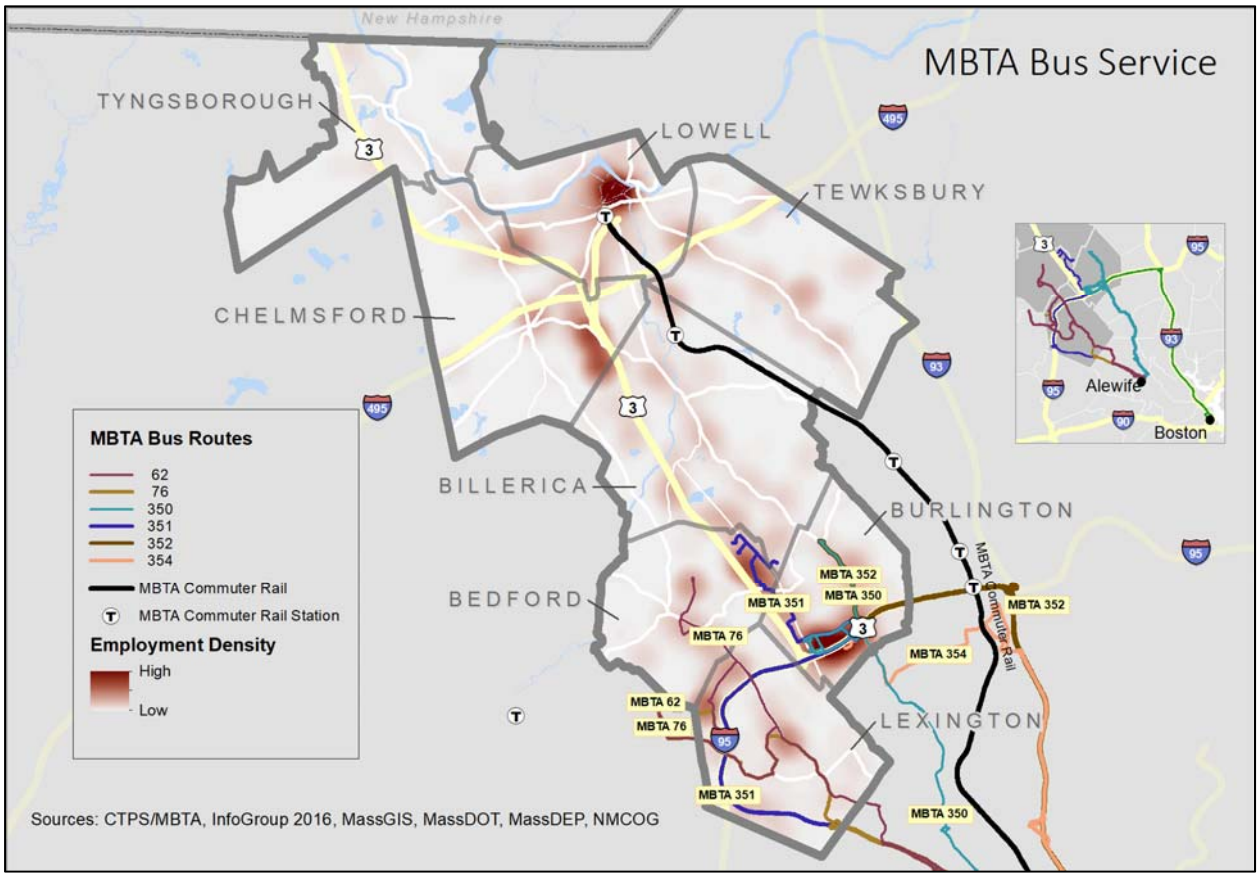


Additional stops along the line include Wilmington (approximately 2 miles beyond study area), Anderson-Woburn (approximately 2.5 miles beyond study area), and Mishawum-Woburn (approximately 2.5 miles beyond study area). The Lowell Commuter Rail line service consists of twenty-two (22) daily inbound trains operating between 5:35 AM and 12:10 AM. Headways are 30 minutes during the peak travel periods, and approximately hourly during other times of the day. Weekend and holiday commuter rail service consists of eight (8) inbound trains operating between 7:00 AM and 9:00 PM, on two-hour headways.

Massachusetts Bay Transportation Authority (MBTA) Bus Service

The MBTA operates six (6) bus routes within the Middlesex 3 study area (Map 7). Bus routes 350, 351, 352 and 354 make stops in the Town of Burlington, while routes 62 and 76 make stops in the Town of Lexington, and routes 76 and 351 make stops in the Town of Bedford.

Map 7: MBTA Bus Service



Burlington

The Town of Burlington has the greatest level of MBTA bus service, with the three (3) weekday express routes and one weekday and weekend local route.

The MBTA Route 351 Express (inbound) begins in Bedford at Bedford Woods, turning onto Middlesex Turnpike and stopping at Northwest Office Park, Burlington Mall Road and along Cambridge Street in Burlington, expressing along Route 128 to Alewife Station. The route operates four (4) round trips per weekday from 3:20 PM to 9:30 PM. The average daily ridership in 2014 was 190 trips per day. There is no weekend service offered on the 351 route.

The MBTA Route 352 (inbound) departs Chestnut Avenue heading south on Cambridge Street (Route 3A) to Route 128. The bus expresses along Route 128 and I-93 to State Street Station in Boston. The 352 operates from 5:50 AM to 9:02 PM with a total of eight (8) outbound and nine (9) inbound runs per day.

The average daily ridership in 2014 was 412 trips per day. There is no weekend service offered on the 352 route.

The MBTA Route 354 Express (inbound), departing from Van De Graaff turning south onto Cambridge Street (Rte. 3) and left onto Lexington Street, makes stops in Woburn, and expresses along I-93 to Boston's State Street Station. The route operates from 5:35 AM to 8:52 PM, with a total of twenty (20) outbound and fifteen (15) inbound runs per day. The average daily ridership in 2014 was 728 trips per day. There is no weekend service offered on the 354 route.

The MBTA local Route 350 operates seven (7) days per week. The inbound route departs Chestnut Avenue heading south on Cambridge Street (Route 3A) to Burlington Mall Road. The bus then travels through Arlington to Alewife Station. The route operates from 6:04 AM to 10:20 PM, with a total of thirty (30) inbound and twenty-eight (28) outbound runs per weekday. The Saturday service is comprised of seventeen (17) inbound and nineteen (19) outbound runs from 6:25 AM to 10:40 PM. Sunday service is comprised of eleven (11) inbound and twelve (12) outbound runs from 7:05 AM to 7:31 PM. The MBTA 350 bus route maintains the highest ridership of these routes, with weekday passenger trips of 1,653, 781 on Saturdays, and 477 on Sundays.

Bedford

Bedford has two (2) MBTA bus routes that operate within the community. The MBTA 351 bus route serves the community on weekdays only and the MBTA 62 route operates both weekdays and Saturdays. The weekday MBTA Route 62 (inbound) begins service at the Bedford V.A. Hospital heading south on Spring Road to Loomis Street. The route continues along Loomis Street turning right onto Great Road (Route 4) eastbound and continuing through Lexington and Arlington to Alewife Station. The route operates from 5:47 AM to 9:25 PM, with a total of twenty-one (21) inbound and eighteen (18) outbound runs per weekday. The average daily weekday ridership in 2014 was 1,644 trips per day.

Route 62 is combined with the MBTA 76 route on Saturdays. The Saturday 62/76 route (inbound) begins service at the Bedford V.A. Hospital heading south on Spring Road to Loomis Street. The route continues along Loomis Street turning right onto Great Road (Route 4) eastbound entering Lexington and onto Hartwell Avenue. The route operates from 7:00 AM to 8:47 PM, with twelve (12) inbound and outbound runs per Saturday. The average daily Saturday ridership in 2014 was 662 trips per day.

The MBTA route 351 Express (inbound) begins service in Bedford at Bedford Woods turning onto Middlesex Turnpike and stopping at Northwest Office Park, Burlington Mall Road and along Cambridge Street in Burlington, expressing along Route 128 to Alewife Station. The route operates four (4) round trips per weekday from 3:20 PM to 9:30 PM. The average daily ridership in 2014 was 190 trips per day. There is no weekend service offered on the 351 route.

Lexington

Lexington has two (2) MBTA bus routes that operate within the community. The MBTA 62 bus route and the MBTA 76 bus route serves the community on weekdays, and a combined MBTA 62/76 route operates on Saturdays with no service available on Sundays.

The weekday MBTA Route 62 (inbound) begins service at the Bedford V.A. Hospital heading south on Spring Road to Loomis Street. The route continues along Loomis Street turning right onto Great Road (Route 4) eastbound into Lexington. The bus travels along Massachusetts Avenue through Lexington Center and Arlington to Alewife Station. The route operates from 5:47 AM to 9:25 PM with a total of twenty-one (21) inbound and eighteen (18) outbound runs per weekday. The average daily weekday ridership in 2014 was 1,644 trips per day.

The weekday MBTA Route 76 (inbound) begins service at Lincoln Laboratories traveling southbound turning right onto Route 2A and into Hanscom Field. The bus returns to Route 2A, turning left onto Waltham Street and Worthen Road and right onto Massachusetts Avenue. The bus route follows Massachusetts Avenue through Lexington Center, turning right onto Pleasant Street and continuing to the Route 2 Service Road. The route operates from 6:00 AM to 10:39 PM, with a total of twenty-one (21) inbound and eighteen (18) outbound runs per weekday. The average daily weekday ridership in 2014 was 991 trips per day.

The Saturday combined MBTA Route 62/76 route (inbound) begins service at the Bedford V.A. Hospital heading south on Spring Road to Loomis Street. The route continues along Loomis Street turning right onto Great Road (Route 4) eastbound entering Lexington and onto Hartwell Avenue, generally following the MBTA 76 bus route, back through Lexington Center where the bus remains on the weekday 62 route to Alewife Station. The route operates from 7:00 AM to 8:47 PM with twelve (12) inbound and outbound runs per Saturday. The average daily Saturday ridership in 2014 was 662 trips per day.

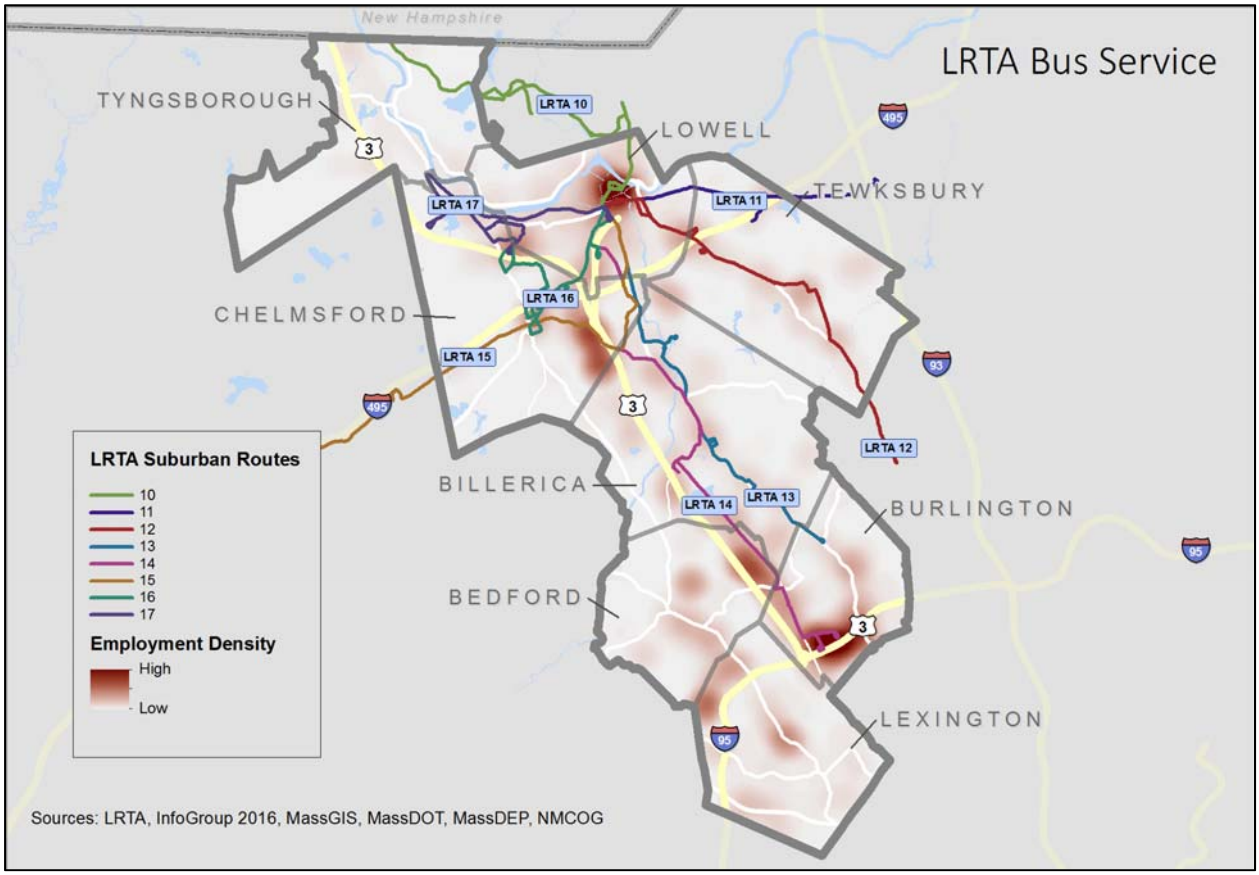
Lowell Regional Transit Authority (LRTA) Bus Service

The LRTA operates bus service in seven of the eight Middlesex 3 study area communities. All eighteen LRTA bus routes originate at the Gallagher Intermodal Transportation Center in Lowell. An LRTA bus route listing by community is provided in Table 10 below and the routes are shown on Map 8 on the following page. LRTA provides service each weekday and on Saturday. Service is not available on Sunday. The following sections provide a description of LRTA service offered in each study area community.

TABLE 10: LRTA BUS ROUTES SERVING MIDDLESEX 3 TRANSPORTATION STUDY AREA

Community	Route Number
Bedford	14
Billerica	03, 13, 14
Burlington	13, 14
Chelmsford	05, 13, 15, 16
Lowell	All LRTA Bus Routes
Tewksbury	03, 11, 12
Tyngsborough	10, 17

MAP 8: LOWELL REGIONAL TRANSIT AUTHORITY BUS SERVICE IN THE MIDDLESEX 3 STUDY AREA



Bedford

The LRTA operates one bus route in the Town of Bedford. The LRTA 14 covers the Middlesex Turnpike corridor, from the Billerica town line to the Burlington town line. The service operates from 6:00 AM to 8:00 PM, with fourteen (14) inbound and outbound runs on weekdays. Saturday service is comprised of ten (10) inbound and outbound runs from 8:00 AM to 5:55 PM. The average daily ridership is 510 trips on weekdays and 265 trips on Saturdays.

Billerica

The LRTA operates three (3) bus routes in the Town of Billerica. The LRTA 03 covers the Billerica Avenue corridor, from Woburn Street in Tewksbury to the North Billerica Commuter Rail Station. The route operates from 5:55 AM to 7:05 PM, with a total of fifteen (15) inbound and sixteen (16) outbound runs per weekday. Saturday service is comprised of ten (10) inbound and outbound runs from 8:00 AM to 5:20 PM. The average daily ridership is 245 trips on weekdays and 40 trips on Saturdays.

The LRTA 13 travels south along Route 3A, turning onto Lowell Street and into the North Billerica commuter rail station. The route rejoins Route 3A, traveling the entire length through Billerica and ending at Chestnut Avenue in Burlington. The bus service operates from 6:30 AM to 7:10 PM, with thirteen inbound and outbound runs per weekday. Saturday service is comprised of ten (10) inbound

and outbound runs from 7:30 AM to 5:10 PM. The average daily ridership is 320 trips on weekdays and 105 trips on Saturdays.

The LRTA 14 travels south along Brick Kiln Road, turning east onto Route 129 and then heading south on Route 3A through Billerica Center. The route turns onto Concord Road and then onto the Middlesex Turnpike, through Bedford to the Lahey Clinic in Burlington. The service operates from 6:00 AM to 8:00 PM, with fourteen (14) inbound and outbound runs on weekdays. Saturday service is comprised of ten (10) inbound and outbound runs from 8:00 AM to 5:55 PM. The average daily ridership is 510 trips on weekdays and 265 trips on Saturdays.

Burlington

The LRTA operates two bus routes in the Town of Burlington. The LRTA 13 bus enters Burlington from Billerica on Route 3A/Cambridge Street south for approximately one mile, to Chestnut Avenue where the LRTA bus route and MBTA 350 and 352 bus routes meet. Additionally, the Burlington Bee also provides service to the Chestnut Avenue area. The service operates from 6:30 AM to 7:10 PM, with thirteen (13) inbound and outbound runs on weekdays. Saturday service is comprised of ten (10) inbound and outbound runs operating from 7:30 AM to 5:15 PM. The average daily ridership is 320 trips on weekdays and 105 trips on Saturdays.

The LRTA 14 covers the Middlesex Turnpike corridor from the Bedford town line to Mall Road. The route turns east into the Mall, terminating at the Lahey Clinic. The service operates from 6:00 AM to 8:00 PM, with fourteen (14) inbound and outbound runs on weekdays. Saturday service is comprised of ten (10) inbound and outbound runs operating from 8:00 AM to 5:55 PM. The average daily ridership is 510 trips on weekdays and 265 trips on Saturdays.

Chelmsford

The LRTA operates four (4) bus routes in the Town of Chelmsford (05, 15, 16 & 17). The 05 route enters Chelmsford from Westford Street in Lowell, connecting with the Lowell General Occupational Health Center on Technology Drive and the Drum Hill Plaza. The service operates from 6:30 AM to 8:36 pm, with thirty (30) inbound and outbound runs on weekdays. Saturday service is comprised of eleven (11) inbound and outbound runs operating from 7:45 AM to 6:15 PM. The average daily ridership is 655 trips on weekdays and 144 trips on Saturdays.

The number 15 bus route enters Chelmsford from Route 3A/Gorham Street in Lowell, and continues to Brick Kiln Road, connecting with the UPS distribution facility, and then extends to the Route 129/ Billerica Road business corridor. The route then continues into Chelmsford Center and out Route 110/ Littleton Road to Westford. The service operates from 6:30 AM to 8:30 PM, with eleven (11) inbound and ten (10) outbound runs on weekdays. Saturday service is comprised of seven (7) inbound and outbound runs from operating from 7:30 AM to 5:10 PM. The average daily ridership is 185 trips on weekdays and 40 trips on Saturdays.

The number 16 bus route enters Chelmsford along Route 110/Chelmsford Street in Lowell, traveling through Chelmsford Center. The route continues from Chelmsford Center to Drum Hill Plaza via North Road, Dalton Road, Stedman Street, and Smith Street. The service operates from 6:45 AM to 8:00 PM with twelve (12) inbound and outbound runs on weekdays. Saturday service is comprised of ten (10)

inbound and outbound runs from 8:00 AM to 5:45 PM. The average daily ridership is 230 trips on weekdays and 120 trips on Saturdays.

The number 17 bus route enters Chelmsford from Westford Street in Lowell, connecting with the Lowell General Occupational Health Center on Technology Drive and the Drum Hill Plaza. The route continues along Route 4 to Princeton Boulevard and Middlesex Street through Vinal Square. The Chelmsford portion of the Route 40 corridor is covered by the number 17 bus, as well as Dunstable Road and Tyngsborough Road (Route 3A). The service operates from 6:00 AM to 7:10 PM, with fifteen (15) inbound and fourteen (14) outbound runs on weekdays. Saturday service is comprised of eleven (11) inbound and ten (10) outbound runs from 8:00 m to 5:55 PM. The average daily ridership is 310 trips on weekdays and 100 trips on Saturdays.

Lowell

The LRTA Kennedy Bus Hub is based at the Gallagher Intermodal Transportation Center (GITC) in Lowell. All eighteen (18) of the LRTA bus routes begin and end their runs at the GITC. The LRTA services all major transportation corridors within the City, with the highest trip frequency for service provided in the study area. The service generally operates from 5:55 AM to 8:45 PM, with the Downtown Shuttle operating until 9:30 PM. Saturday service operates from 7:00 AM to 6:15 PM.

Tewksbury

The LRTA operates two (2) bus routes in the Town of Tewksbury (11 & 12). The 11 route enters Tewksbury from Route 133/Andover Street in Lowell and continues to the Raytheon facility on North Street, then returns to Route 133 and continues into Andover. The route operates as a commuter service, with two (2) runs in the morning and two (2) in the afternoon, operating from 6:00 AM to 7:30 AM, and 3:00 PM to 4:30 PM. The average daily weekday ridership is 25 trips and there is no Saturday service

The number 12 bus route enters Tewksbury from Route 38/Rogers Street in Lowell, serving Stadium Plaza and Walmart, and continuing into Tewksbury Center. The route turns onto East Street, passes through the Tewksbury State Hospital, turns onto Livingston Street and returns to Route 38 southbound. The route continues along Route 38 into Wilmington, terminating at the Wilmington Commuter Rail Station. The service operates from 6:45 AM to 8:00 PM, with thirteen (13) inbound and fourteen (14) outbound runs on weekdays. Saturday service is comprised of eleven (11) inbound and outbound runs from 7:00 AM to 5:45 PM. The average daily ridership is 355 trips on weekdays and 195 trips on Saturdays.

Tyngsborough

The LRTA operates three (3) bus routes in the Town of Tewksbury (07, 10 & 17). The 07 route enters Tyngsborough from Varnum Avenue., traveling for approximately ¼ mile and turning into the Greater Lowell Technical High School. The service operates from 5:55 AM to 9:00 PM, with twenty-eight (28) inbound and twenty-nine (29) outbound runs on weekdays. Saturday service is comprised of eleven (11) inbound and outbound runs from 7:45 AM to 6:25 PM. The average daily ridership is 780 trips on weekdays and 180 trips on Saturdays.

The number 10 bus route enters Tyngsborough from Tyngsborough Road in Dracut. The route travels along Lakeview Avenue to Route 3A/Frost Road, terminating at the Hudson N.H. line. The service operates from 6:45 AM to 8:00 PM, with fifteen (15) inbound and twelve (12) outbound runs on weekdays. Saturday service is comprised of ten (10) inbound and outbound runs from 8:00 AM to 5:45 PM. The average daily weekday ridership is 230 trips and 120 trips on Saturdays.

The number 17 bus route enters Tyngsborough on Mission Road, from Dunstable Road in Chelmsford. The bus route turns off Mission Road onto Wood Street and travels back into Chelmsford. The service operates from 6:20 AM to 7:10 PM, with fifteen (15) inbound and fourteen (14) outbound runs on weekdays. Saturday service is comprised of ten (10) inbound and eleven (11) outbound runs from 8:00 AM to 5:55 PM. The average daily ridership is 310 trips on weekdays and 100 trips on Saturdays.

Merrimack Valley Regional Transit Authority (MVRTA) Bus Service

The MVRTA operates bus service in the City of Lowell. The 41 Lowell-Lawrence bus route enters Lowell from Dracut on Route 110/VFW Highway. The route crosses the Merrimack River on the Hunts Falls Bridge, turns onto East Merrimack Street, then on to High Street, and heads west onto Andover Street. The bus route continues straight and enters the Kennedy Center Bus Hub from Thorndike Street. The service operates from 5:00 AM to 7:00 PM, with twenty-seven (27) inbound and twenty-nine (29) outbound runs on weekdays. Saturday and Sunday service is comprised of eleven (11) inbound and outbound runs from 7:00 AM to 6:00 PM. The average daily ridership in FY 2017 was 963 trips on weekdays, 451 trips on Saturdays, and 305 on Sundays.

Photo 1: MVRTA Bus at Gallagher Terminal in Lowell

Bedford Town Bus Service

The Town of Bedford operates two (2) local bus services in the Town, the BLT (Bedford Local Transit) and DASH. The Bedford DASH is a new on-demand transportation service. The project is a two-year pilot program and is funded by the Town of Bedford, in cooperation with the Middlesex 3 Transportation Management Association, and with a $47,000 federal transportation grant through the Massachusetts Department of Transportation's Community Transit Program. Trips can be booked to Bedford, Billerica, Burlington, Concord (Monday and Tuesday only), and Lexington, depending on availability.

Photo 2: Bedford DASH

The Bedford Local Transit (BLT) offers scheduled fixed runs to shopping malls and other stops in Bedford, Market Basket in Billerica on Tuesdays, and provides on-demand door-to-door service within

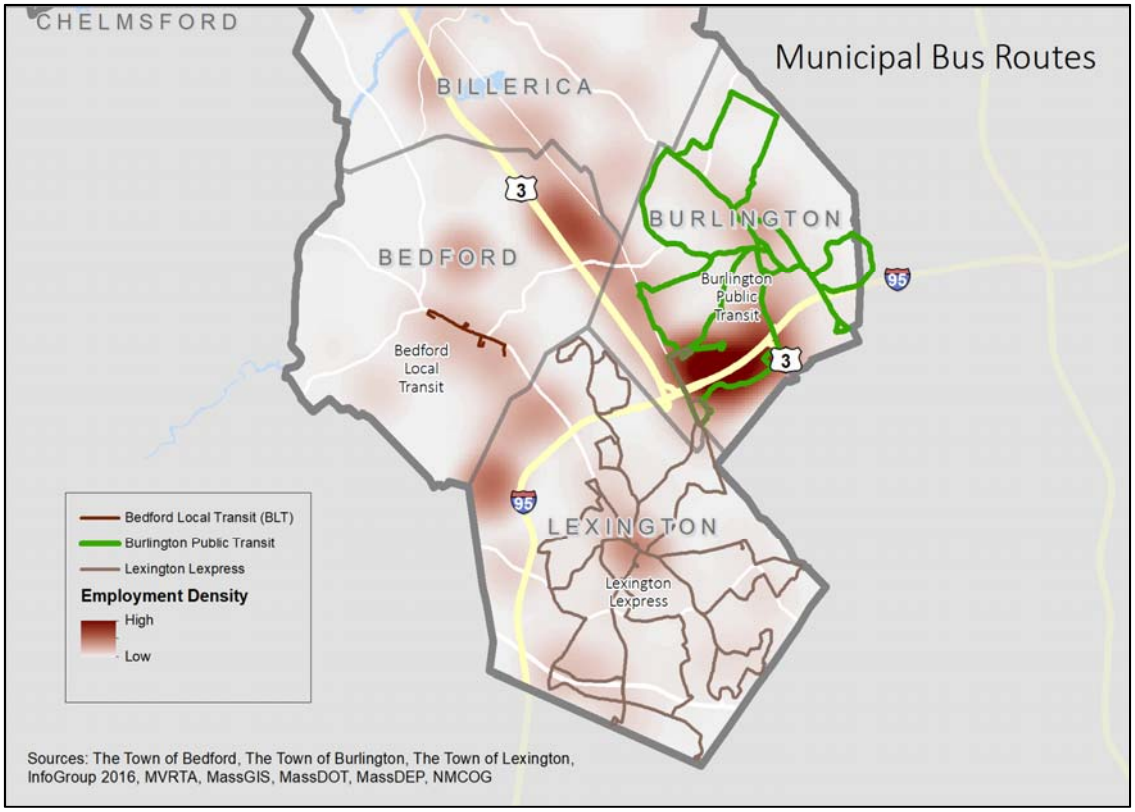
Bedford. The BLT offers door-to-door dial-a-ride service within Bedford throughout each weekday at times when there are no fixed route runs. Rides are arranged on a first-come, first-served basis and all slots may be taken before 9 AM. Medical appointment trips maybe scheduled up to three days in advance.

BURLINGTON TOWN BUS SERVICE

The Town of Burlington operates the Burlington Bee, a fixed route bus service that provides transportation within the Town. The bus accommodates twenty (20) passengers, with standing room for five (5) passengers and accessibility for two (2) wheelchairs. The Burlington service connects with the MBTA, LRTA, Lexpress and Bedford Transit.

The Burlington Bee bus does not operate on Saturdays, Sundays or holidays. The service is funded by the Town of Burlington and the MBTA, and is provided by Joseph's Transportation, Inc., under contract with the Town.

MAP 9: MUNICIPAL BUS SERVICE IN THE MIDDLESEX 3 STUDY AREA



Lexington Town Bus Service

Photo 3: Lexpress Shuttle Buses

The Town of Lexington operates the Lexpress fixed route bus service and the Lex-Connect demand response service, a fixed-route, mini-bus service. Outside of the town center, the system works on a flag-stop system. The service operates Monday through Friday from 6:35 AM to 6:30 PM., featuring six (6) neighborhood routes. Each route runs once per hour throughout most of the day. The vehicles are wheelchair accessible and connect with the MBTA, Burlington B-Line, and the Lowell Regional Transit Authority. Destinations include: Town Center, Arlington Heights, Market Basket, H-Mart, Burlington Mall, Lexington Lahey, Stop & Shop, Wilson Farms, and the Lexington Community Center.

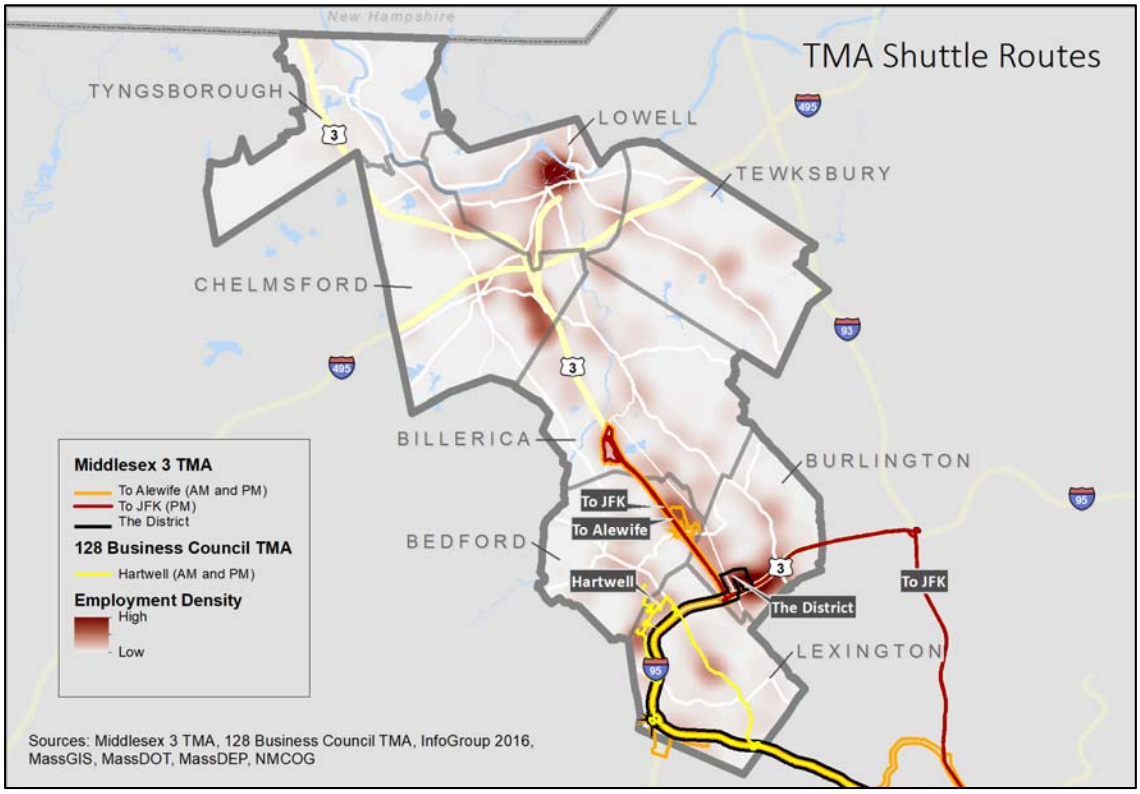
Lex-Connect offers reduced priced taxi rides for Lexington seniors age 60+ and persons under the age of 60 with a disability. Taxi vouchers can be used for destinations within Lexington or in area towns. The service is available Monday through Friday from 9:00 AM to 5:00 PM and Saturday/Sunday from 8:00 AM to 8:00 PM. Rides must be scheduled in advance. Residents must register for the program in person by filling out an application with from the Human Services Department, located at the Lexington Community Center, 39 Marrett Road.

Transportation Management Association (TMA) Shuttle Service

Transportation Management Associations (TMAs) are membership based, public-private partnerships of businesses, institutions and municipalities that join together under a legal agreement for the purpose of providing and promoting transportation solutions for commuters, in order to reduce traffic congestion, improve air quality and increase access to economic development opportunities.

There are two (2) Transportation Management Associations that provide service in the Middlesex 3 study area: the 128 Business Council TMA and the Middlesex 3 TMA. They work closely with public agencies, manage employee transportation networks, oversee shuttle operations, provide legislative advocacy, and operate commuter services and other transportation programs. Map 9 on the following page shows the shuttle routes that are operated by each TMA. Detailed descriptions of these services are provided in the following section.

MAP 10: TMA SHUTTLE SERVICE IN THE MIDDLESEX 3 STUDY AREA



128 Business Council TMA Shuttle Service

The 128 Business Council was formed in 1987 to develop alternative transportation solutions, and to promote sustainability and environmentally friendly practices that enhance the vitality and economic attractiveness of the 128 West region. The 128 Business Council was the first TMA in the Commonwealth. The Council operates shuttles along the Route 128 West Corridor, providing nearly 200,000 rides annually. This service helps reduce the use of single-occupancy vehicles and reduce traffic congestion. The REV shuttle is the 128 Business Council vehicle that operates within the Middlesex 3 corridor, providing three (3) morning and three (3) evening shuttles connecting Wiggins Avenue in Bedford to the Hartwell Avenue area, and Lexington Center to Alewife Station.

Middlesex 3 TMA Shuttle Service

The Middlesex 3 TMA was created as an affiliated organization of the Middlesex 3 Coalition. The Coalition is a 501 (c) (6) non-profit corporation, with community and business partners who share the common goals of fostering economic development, job growth and retention, diversification of the tax base, and enhancement of quality of life in the region. The TMA region includes the participating communities of Bedford, Billerica, Burlington, Chelmsford, Lowell, Tewksbury, Tyngsborough, and Westford. The TMA addresses a variety of transportation needs, including traditional commuting from the suburbs into the Boston/Cambridge area, reverse commuting from Boston/Cambridge to the Middlesex 3 area, and non-commuting trips between communities.

There are three (3) Middlesex 3 TMA shuttles routes operating in the study area: the Bedford/Billerica shuttle to Alewife Station, the Bedford/Billerica shuttle to JFK Station in Boston, and the District shuttle to Alewife Station. The Bedford/Billerica to Alewife shuttle provides two (2) morning and two (2) evening trips. The Bedford/Billerica shuttle to JFK Station offers one evening trip.

PRIVATE COMMUTER BUS SERVICE

Boston Express is the only private commuter bus service currently operating within the Middlesex 3 corridor. Boston Express runs service from Manchester N.H. to Logan Airport, with three (3) intermediate stops, including a stop at the Tyngsborough Park and Ride Lot. The service includes fifteen (15) inbound and outbound trips on weekdays and ten (10) inbound and outbound trips on Saturdays and Sundays. The hours of operation are between 5:30 AM and 11:45 PM on weekdays, and 6:15 AM and 11:45 PM on weekends.

PHOTO 4: BOSTON EXPRESS SERVING THE ROUTE 3 CORRIDOR

COLLEGE AND UNIVERSITY SHUTTLE SERVICE

Middlesex Community College (MCC) and UMass Lowell provide shuttle service to students and staff throughout the school year. Middlesex Community College operates service between its Lowell and Bedford campuses, from 7:00 AM to 9:30 PM Monday through Thursday, and from 7:00 AM to 4:00 PM on Friday. MCC provides additional shuttle service between the Bedford VA and their Bedford campus, from 7:15 AM to 6:00 PM, and operates two (2) shuttle runs to the Billerica Mall, which connect with the LRTA #13 route. There is no service provided on weekends and holidays.

PHOTO 5: MCC SHUTTLE BUS SERVING STUDENTS AND FACULTY

UMass Lowell operates extensive transit service, connecting various education facilities with student housing. The service includes six (6) individual routes that operate from 7:00 AM to 7:00 PM seven (7) days a week. There is also a demand response service that is available until 2:00 AM on Sunday through Wednesday, and until 2:30 AM on Thursday, Friday and Saturday. Additionally, the University has agreements with the LRTA and MVRTA, enabling students to ride on those systems at no charge using their UCARDs.

PHOTO 6: UMASS LOWELL TRANSIT BUSES SERVING STUDENTS AND FACULTY

PRIVATE RIDE HAILING SERVICE

Uber and Lyft are the best-known ride-hailing services that operate in the Middlesex 3 study area. Ride-hailing services over the last few years have expanded to include employer and community subsidized transportation.

In Massachusetts, the North Shore Community College launched the innovative transportation partnership with Uber in the fall of 2016. The program is designed to connect the MBTA bus and commuter rail to the NSCC's Danvers campus, by providing discounted trips to and from the Beverly Depot or the North Shore Mall in Peabody.

The ride must be requested through the Uber app and registered students must request the NSCC option when commuting to and from the Danvers Campus. When a student requests the North Shore Community College option, NSCC will automatically cover the first $10 of the ride. The ride must remain within the program boundaries to receive the discount. If the trip were to end outside of the predetermined locations, the discount would be cancelled and the student would be responsible for the full fare.

The MBTA ended bus service to the North Shore Community College Danvers campus in 2002 due to the lack of ridership. The NSCC administration is hopeful that with strong ridership numbers provided by Uber, that the MBTA might consider reestablishing the bus connection.

Many examples of ride-share service partnerships exist from around the country. Generally, "first and last mile" gap connections enable communities to connect employment locations to existing public transit services at a reduced cost.

5. FUNDING TRANSIT SERVICE

Since 2000, the Commonwealth has worked to address transportation deficiencies in infrastructure, operations, finance and funding. Significant milestones include the MBTA Forward Funding legislation (2000), the Transportation Finance Commission (2007), The Transportation Reform Act (2009), the Transportation Finance Act of 2013, and the creation of the MBTA Fiscal and Management Control Board (2015). Some progress has been made, but the Commonwealth still lacks the resources to meet the state's overall transportation needs. Changing demographics, such as fewer drivers due to aging baby boomers and fewer millennials owning cars, rapid changes in transportation technology, such as autonomous vehicles, and the challenges of climate change, will require significant changes in the way we fund transportation services in the future. The following narrative provides an overview on transit funding, and outlines some of the challenges to expanding service along the Route 3 corridor.

RTA FUNDING

Regional Transit Authorities were established in the early 1970s when private bus companies serving communities outside of Boston concluded that their businesses were no longer profitable and consequently cutback or eliminated service. In 1973, M.G.L. Chapter 161B defined the process by which RTAs could be formed or expanded. The law outlines the role and membership of RTA Advisory Boards and their ability to appoint administrators, approve budgets, and approve significant changes in service

or fares. Additional responsibilities, roles and duties of the RTAs and the state, as defined in Chapter 161B include:

- RTAs may accept state (or federal) grants or loans, but must accede to such conditions and obligations imposed by such funds.
- RTAs must determine net cost of service and local assessment levels in consultation with MassDOT
- They must prepare an annual program, including a long range program for construction, reconstruction, or alteration of facilities
- The Commonwealth must pay 50% of the RTA's net cost of service and debt service (unless revenues of the RTA can cover debt). This amount is equivalent to each RTA's operating deficit, after federal operating assistance, fares, and local assistance payments are deducted. Each RTA has a contract with MassDOT for SCA.
- RTAs require funding for annual operations and capital spending. The MassDOT Rail and Transit Division provides financial assistance.
- RTAs manage their own operations but must hire an operating company to provide service.

The Massachusetts Department of Transportation (MassDOT) Rail and Transit Division (RTD) oversees 15 regional transit authorities (RTAs), not including the MBTA, that function as independent transit operators serving over 260 communities throughout the Commonwealth. The RTD carries out its responsibility of providing and managing financial assistance for RTAs through its Community Transit Program Unit (CTP), which oversees the federal, state and local programs that financially support the RTAs. The CTP also manages the Commonwealth's capital funding programs for all 15 RTAs.

RTA operations are funded through fares and with assistance from various federal, state and local sources. The largest source of funding is state contract assistance (SCA), followed by Federal Transit Administration (FTA) grants and local assistance payments. SCA is based on the expenses incurred by the RTA during the fiscal year. SCA funds are provided through the Commonwealth Transportation Fund and the Massachusetts Transportation Trust Fund.

RTAs receive Federal Transit Administration (FTA) grants that partially fund services under the Americans with Disabilities Act (ADA), preventive maintenance programs and rural operation. These funds are allocated to the State based on population and administered by MassDOT's RTD. RTAs must apply for these funds through a Community Transit Grant application. RTAs are reimbursed with federal funds for approved federal transportation activities that occurred in the previous fiscal year.

FTA formula funding programs are based on demographic data from the U.S. Census for each urbanized area (UZA). (A UZA is an area defined by the US Census Bureau with a population of 50,000 or more.) For UZAs with populations of more than 200,000, such as the Boston UZA, the allocations also take into account transit service data reported by recipients of the federal funds. MassDOT sub allocates these funds to RTAs based on a negotiated split agreement. The FTA requires a 20 percent non-federal match to the 80 percent federal share of formula grants. In the case of the MBTA, the matching funds are generally revenue bonds. The other RTAs use funds from the state's RTA Capital Assistance Program or toll credits for the match.

Formula funding includes Sections 5307, 5337, and 5339. Section 5307 is the Urbanized Area Formula Program, which funds capital, planning, and operating assistance for transit agencies. Section 5337, the State-of-Good-Repair Program, supports the maintenance, rehabilitation, and replacement of transit assets to maintain a state of good repair. Section 5339, the Bus and Bus Facilities Formula Grants Program, provides funding to replace, rehabilitate, and purchase buses and related equipment as well as construct bus-related facilities.

MAP-21 changed the formula for Section 5307 funds, specifically allocating 3.07% of the funding available for apportionment for low-income persons residing within an urbanized area (UZA), with 25% of these funds allocated to areas below 200,000 in population and 75% allocated to areas with a population of 200,000 or more. MAP-21 also added a nationwide exemption allowing public transportation operators that operate fewer than 100 buses in peak service, including the LRTA, to use the formula funds for operating assistance.

Boston is the tenth largest UZA in the nation, with a population of approximately 4.2 million people. The UZA includes three states: Massachusetts, New Hampshire and Rhode Island. There are nine FTA-designated recipients in the Boston UZA. The designated recipients in the Boston UZA have executed a Memorandum of Understanding (MOU) stipulating the distribution of funds and the administrative requirements of receiving FTA grants. The listing below indicates the percentage of Section 5307 funding allocated to each recipient under the funding split. In FY 2017, $158 million in Section 5307 funds were available within the Boston UZA.

- Massachusetts Bay Transportation Authority (MBTA)-88.13%
- Brockton Area Transit (BAT) -1.91%
- Merrimack Valley Regional Transit Authority (MVRTA)-3.56%
- Lowell Regional Transit Authority (LRTA)-2.36%
- Greater Attleboro Regional Transit Authority (GARTA)-0.49%
- Cape Ann Transit Authority (CATA)-0.33%
- New Hampshire DOT-1.72%
- Rhode Island Public Transit Authority (RIPTA)-0%
- Metro West RTA (MWRTA)-1.42
- Montachusett Regional Transit (MART)-0.08%

Local RTA assessments are based on the “loss” (operating cost minus revenue) for each specific transit route. RTA member communities are assessed at least 25%, and not more than 50%, of the net cost of service. The annual increase in local assessments is capped at 2.5%, except when new service is implemented. In order to establish assessment amounts, RTAs are subject to an annual independent audit. Audited reports are submitted to the Division of Local Services (LDS), which generates the Local Aid Assessment sheets. Assessments are deducted from lottery revenue payments made to each community. At the end of any fiscal year in which a member community does not have sufficient funds in its lottery revenues to pay its RTA assessment, DLS directs the community to remit the unpaid funds

to OST, which then deposits them to the appropriate MassDOT agency fund account to be forwarded to the RTA.

An audit performed in 2014 by the State Auditor concluded that local assessments cover as much as 50% of an RTA's net cost of service and that these assessments were being paid up to 24 months in arrears. This caused RTAs to borrow for operating funds through revenue anticipation notes (RANs). Late assessment payments also made it difficult to fund any new service. Chapter 38 of the Acts of 2013 forward funded the RTA's operating assistance and reduced the cost of issuing RANs. The Office of the State Treasurer and the Department of Revenue are now responsible for the timely billing, collection and disbursement of local assessments. RTAs must seek approval from the Secretary of Transportation to issue bonds, use their Reserve Fund or Stabilization Fund. MassDOT imposes conditions in the operating contracts between the RTAs and private operators. MassDOT also establishes guidelines for the distribution of bond funds among the RTA, with 75% of the bond proceeds going to match federal and non-state funding.

MBTA Funding

The MBTA was created in 1964 under Chapter 161A to supersede the MTA. Under its enabling legislation, local assessments to cover the operating deficit were levied on municipalities based on a formula that included population and the operating deficit of the individual services provided to each community. Assessments and fares partly covered operations and the remaining funds were provided by the legislature in arrears.

Chapter 127 of the Acts of 1999 established forward funding for the MBTA using 20% of the state sales tax revenue as a dedicated funding stream. In addition, the MBTA service area was expanded to include 175 communities for the purposes of annual assessments. MBTA revenues are used to fund operations and maintenance cost and to secure revenue bonds to federal funds for capital projects. Revenue sources include fares, non-fare sources, state contract assistance, state appropriations, and federal operating assistance. Under Chapter 27 of the Acts if 2009, $160 million per year was transferred to the MBTA by the legislature to account for debt from the Central Artery/Tunnel project. Chapter 46 of the Acts of 2013 provided additional revenue transfers and capped MBTA fare increases at 5% every two years.

In FY 2016, the MBTA's budget was approximately $1 billion, while the RTAs had a total combined budget of $82 million. This is due to the high ridership on the T, where the top ten MBTA routes carry more trips than all other regional bus networks combined.

The MBTA assessments are calculated by classifying municipalities into three subgroups:

1. "14 cities and towns" that comprise the original members of the pre-1964 MTA district;
2. "51 cities and towns" that consist of a majority of the remaining municipalities that were in the original post-1964 MBTA district (including Bedford, Burlington and Lexington); and

3. "other served communities" which includes the balance of 110 communities and principally those that were added to the MBTA district after the 1999 legislation (including Billerica, Chelmsford, Lowell, Tewksbury and Tyngsborough).

Table 11 below shows the LRTA and MBTA assessments for the study area communities, while Tables 12 and 13 show the operating and capital funding sources for both transit agencies.

TABLE 11: MBTA AND LRTA MIDDLESEX 3 COMMUNITY ASSESSMENTS

2018 Cherry Sheet Assessments	MBTA	LRTA
Bedford	$305,001	
Billerica		$300,492
Burlington	$556,612	
Chelmsford		$247,241
Lexington	$715,935	
Lowell		$994,016
Tewksbury		$264,723
Tyngsborough		$81,549
Middlesex 3 Study Area	$1,577,548	$1,888,021

TABLE 12: OPERATIONS FUNDING SOURCES FOR MBTA AND LRTA

Funding Source	MBTA	LRTA
Fare Revenues	33.80%	12.50%
Local Funds (Assessments)	7.90%	22.40%
State Funds	54.50%	28.80%
Federal Assistance	0.70%	23.10%
Other Funds	3.10%	13.20%

Source: National Transit Database 2014

TABLE 13: CAPITAL FUNDING SOURCES FOR MBTA AND LRTA

Funding Source	MBTA	LRTA
Fare Revenues	0%	0%
Local Funds (Assessments)	20.80%	0%
State Funds	24.00%	10.00%
Federal Assistance	54.70%	90.00%
Other Funds	0.40%	0%

Source: National Transit Database 2014

FTA REGULATIONS

There are a number of FTA regulations that govern RTAs, such as the Charter Bus Service Rule Under 49 U.S.C. 5323(d) that protects private charter operators from unauthorized competition from FTA grant recipients. An FTA recipient must enter into a Charter Service Agreement if it receives Federal funds for equipment or facilities under the Federal Transit Laws. This means that charter service can only be provided under certain exceptions, such as to Government officials on official government business, as long is the service is within the RTA service area, and does not generate revenue. Under this circumstance, the RTA is limited to 80 charter service hours per year. An FTA grant recipient may also provide charter service to a qualified human service organization (QHSO) for the purpose of serving persons: (1) With mobility limitations related to advanced age; (2) With disabilities; or (3) With low income.

The Americans with Disabilities Act of 1990 (ADA) prohibits discrimination and ensures equal opportunity and access for persons with disabilities. FTA requirements ensure nondiscriminatory transportation to enhance the social and economic quality of life for all Americans. Complementary paratransit service must be provided by any public entity operating fixed route service that is not otherwise exempt from the regulations. This paratransit service must be "comparable" to the fixed route service.

The requirement for complementary paratransit service applies to all fixed route bus and rail transit service except for commuter bus, commuter rail, and intercity rail (Amtrak) services, which are specifically exempt. In order to comply with the ADA requirements, the LRTA and MBTA are required to provide demand response "origin to destination" service within a ¾-mile radius of the fixed routes. The demand response service must operate during the same hours as the bus operating along the route. Reservations for the ADA service are made on a next day basis.

LRTA ADA - Road Runner Service

The LRTA operates the Road Runner demand response service in compliance the FTA's ADA requirements. Service is provided within 3/4 of a mile of each route during the hours that the fixed route bus is operating along the line. Generally, the service is available from 6:00 AM to 9:00 PM on weekdays, and from 7:00 AM to 6:30 PM on Saturdays. The ending hours vary depending on the route, with the suburban routes ending service at an earlier hour than the routes serving the City of Lowell. (The LRTA does not operate transit service on Sundays.)

PHOTO 7: LRTA ROAD RUNNER SHUTTLE IN LORD OVERPASS

TABLE 14: LRTA ROAD RUNNER ANNUAL TRIPS BY COMMUNITY

LRTA Road Runner	FY 2015 Trips
Billerica	8,000
Chelmsford	5,600
Lowell	32,700
Tewksbury	6,100
Tyngsborough	3,500

Historically, the Road Runner service has been available to both ADA clients and seniors in each of the LRTA communities. The growth in the number of ADA customers in the recent years, however, has resulted in limited available space for seniors on the Lowell based Road Runner, with greater reliance instead on service operated by the local councils on aging (COA). Table 14 shows the annual number of trips provided by the LRTA Road Runner service within the Middlesex 3 study area. (COA ridership is not included.)

MBTA ADA - RIDE Service

The RIDE is the MBTA's door-to-door, shared-ride paratransit service. The RIDE as operated, exceeds the ADA requirements and MBTA operates the service on a community-wide basis, running from 5:00 AM to 1:00 AM seven days a week, 356 days a year.

PHOTO 8: MBTA THE RIDE SHUTTLE

Within the Middlesex 3 study area, the RIDE is available in the towns of Bedford, Burlington and Lexington. Table 15 shows the annual number of trips provided by the MBTA RIDE service within each of the Middlesex 3 study area communities served.

TABLE 15: MBTA THE RIDE TRIPS BY COMMUNITY

MBTA The RIDE	FY 2015 Trips
Bedford	8,200
Burlington	18,800
Lexington	14,800

INSTITUTIONAL, REGULATORY AND FINANCIAL BARRIERS TO ENHANCING TRANSIT SERVICE

The regional transit enabling legislation MGL Chapter 161B, Section 3, as amended on April 12, 2017, allows an MBTA member community to join an additional transit authority as long as that community does not already receives MBTA fixed route bus service. Bedford, Burlington and Lexington currently have MBTA fixed route bus service, and are therefore prohibited from joining a second regional transit authority.

Legislation would be needed for one or more of the communities along the southern end of the Middlesex 3 study area to join the LRTA. An MBTA member community could opt out of the MBTA fixed route bus service and join another regional transit authority, but the community would lose the MBTA's Ride Program. The Ride provides outstanding service to the disabled community, and the MBTA fixed routes are also well utilized by the commuting public in the southern study area communities.

While an RTA can technically extend service beyond its service area, the RTA receives no funding for service provided beyond its service area boundaries, except for fare revenues. The MBTA and LRTA have different policies and funding procedures for implementing new service. The MBTA assessment to member communities is based upon a weighted percentage of population of each community. The cost of service provided by the MBTA is spread across the one-hundred and ten (110) MBTA member communities. As a result, any additional service provided by the MBTA is at a nominal cost to the community receiving the service, as it is spread out across the entire service area. The regional transit authorities, on the other hand, are required to assess the community receiving any new service at 100% of the operating cost of that service.

There is no mechanism available to the LRTA that allows them to charge a non-member community for new service. For example, the LRTA is not reimbursed for service it provides in Bedford or Burlington. A change in policy that allows an RTA to receive reimbursement for service provided beyond its service area would be extremely beneficial to encouraging more efficient transportation service delivery along a corridor such as Route 3. Further complicating this issue is the fact that the FTA would likely define any direct payment from a non-member community to LRTA as Charter Service under current regulations, which is prohibited, as previously discussed.

The ADA regulations discussed earlier require that demand response/door-to-door paratransit service be provided for a ¾-mile buffer around all fixed route bus lines. The demand response service must be in operation during the same days and hours as those of the fixed route bus. This requirement, while very beneficial to the community, can be very expensive for the transit operator. The communities of Bedford, Burlington and Lexington are currently served by the MBTA's Ride Program, which operates until 1:00 AM, while the communities in the LRTA service area receive paratransit service until approximately 9:00 PM, when LRTA fixed route service ends. The cost of providing ADA paratransit service for any newly initiated route or for late-night service would need to be fully analyzed and considered.

If the LRTA were to increase the size of its vehicle fleet beyond 100 vehicles, the authority would lose significant federal operating funds, as outlined in current federal legislation. Any proposal to significantly increase service will need to carefully consider the limitations imposed by these federal requirements.

6. HIGHWAY PERFORMANCE

With the exception of commuter rail lines and off-road trails, all transportation facilities directly rely on the performance of the roadway network. To assess the overall network, NMCOG and CTPS evaluated

roadway performance throughout the Middlesex 3 study area, primarily focusing on limited access highways and arterials, as they provide the highest levels of mobility and capacity for moving people and goods throughout the study area.

Speed Index

Speed data was compiled for key roadways in the study area, in order to measure roadway network performance. A speed index measure calculates the ratio of average speed for the study period and compares that speed with the free flow speed during non-peak periods of the day. Once the speed index is determined, congestion is calculated by categorizing the data into indices. Table 16 outlines the threshold speed index values for congested and acceptable roadway operations. A value of less than 0.70 is considered "congested." Segments rated between 0.70 and 0.9 experience some congestion, but traffic flows through these areas at a higher relative speed than in congested areas. Segments with indices greater than 0.90 experience acceptable traffic operations during the monitored time period.

For purposes of this study, conditions were assessed for the AM Peak (6-10 AM) and the PM Peak (3-7 PM), as most travel demand occurs during these two periods of the day. One hundred eighty-four (184) roadway segments were monitored during each peak period. During the AM peak period, 8% of the monitored segments were "congested", compared with 16% during the afternoon peak (Table 16). Maps 11 and 12 provide a visual depiction of congestion levels throughout the Middlesex 3 study area. Tables 17 and 18 provide a list of congested segments during each peak period.

TABLE 16: CONGESTED ROADWAY SEGMENTS IN MIDDLESEX 3 STUDY AREA

Roadway Conditions Category	Speed Index Threshold	AM Peak		PM Peak	
		# of Roadway Segments by Condition	Percentage of Total Segments Monitored	# of Roadway Segments by Condition	Percentage of Total Segments Monitored
Acceptable	> 0.9	93	51%	66	36%
Somewhat Congested	0.71-0.89	76	41%	88	48%
Congested	< 0.70	15	8%	30	16%

MAP 11: AM PEAK PERIOD ROADWAY OPERATIONS

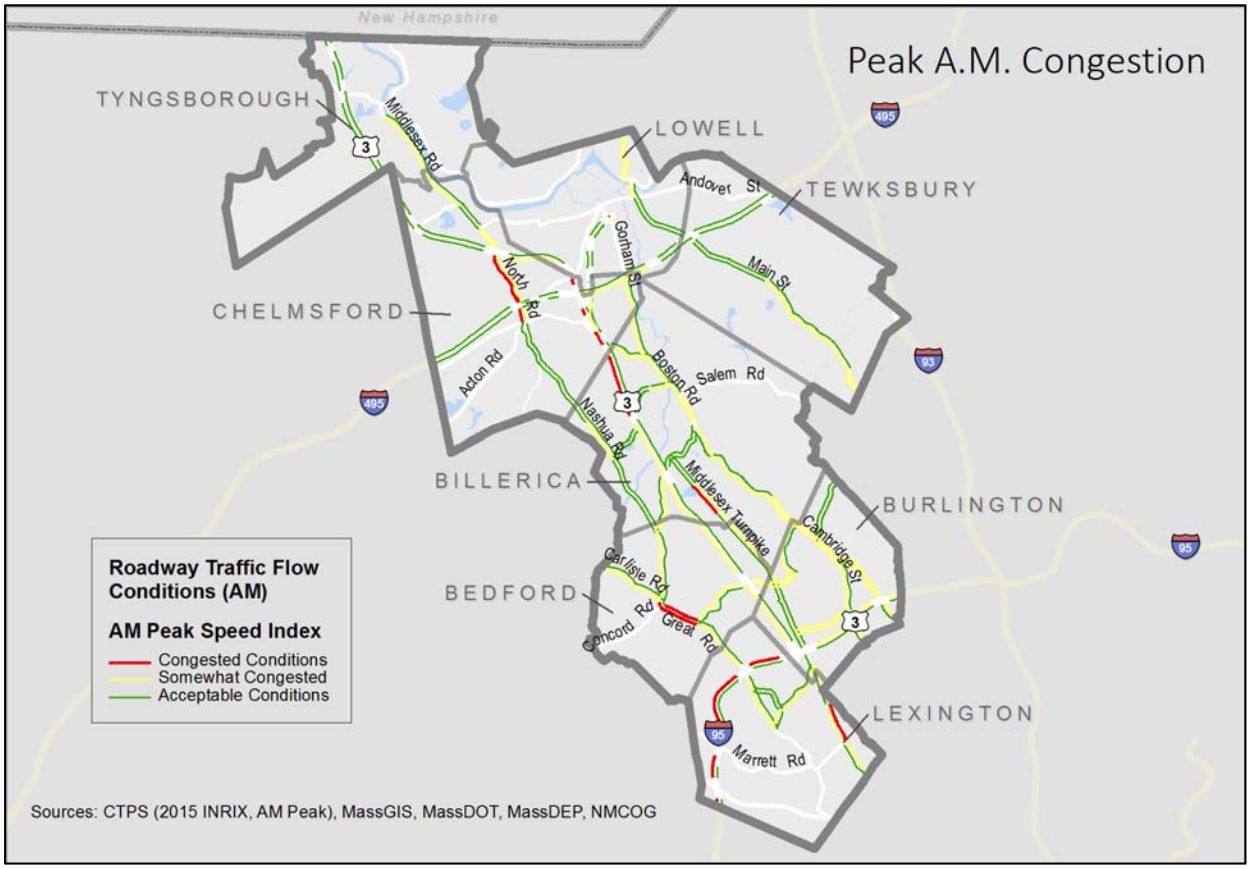


TABLE 17: CONGESTED ROADWAY SEGMENTS IN AM PEAK PERIOD (2015 INRIX DATA)

Road Name	Community	Direction	Segment Beginning	Segment End	AM Average Speed (MPH)	Free Flow Speed (MPH)	AM Peak Speed Index
US Route 3	Lowell	SB	Route 110 (Chelmsford St - Exit 35B & 35C)	I-495 (Exit 35B & 35C)	38.66	66.72	0.58
	Chelmsford	SB	I-495 (Exit 35B & 35C)	Lowell Connector (Exit 35B & 35C)	19.76	64.23	0.31
	Chelmsford	SB	Lowell Connector (Exit 35B & 35C)	Route 129 (Billerica Rd - Exit 29)	24.72	64.14	0.39
	Billerica	SB	Route 129 (Billerica Rd - Exit 29)	Treble Cove Rd - Exit 28	38.16	65.90	0.58
I-95	Burlington	SB	US-3/Middlesex Tpke (Exit 32)	Route 225/4 - Bedford St (Exit 31)	28.85	65.48	0.44
	Bedford	SB	Route 225/4 - Bedford St (Exit 31)	Route 2A (Exit 30)	30.07	64.15	0.47
	Lexington	SB	Route 2A (Exit 30)	Route 2 (Exit 29)	30.07	64.03	0.47
	Lexington	SB	Route 2 (Exit 29)	Trapelo Rd (Exit 28)	39.35	64.71	0.61

TABLE 17: CONGESTED ROADWAY SEGMENTS IN AM PEAK PERIOD (2015 INRIX DATA)

Road Name	Community	Direction	Segment Beginning	Segment End	AM Average Speed (MPH)	Free Flow Speed (MPH)	AM Peak Speed Index
Route 4	Chelmsford	SB	US-3/Old Westford Rd/Drum Hill Rd	I-495	21.26	31.63	0.67
	Chelmsford	SB	I-495	Route 110/27	12.57	25.85	0.49
Route 225	Bedford	EB	Route 4 (North Rd)	Route 62 (Brooksbie Rd)	18.08	27.29	0.66
Middlesex Turnpike	Billerica	SB	Lake St/Water St	Lexington Rd	23.29	34.77	0.67
Lowell Street	Lexington	NB	Park Ave	East St	21.58	31.32	0.69
Hancock Street	Lexington	SB	Adams St	Route 4/225 (Bedford St)	17.50	25.13	0.70

MAP 12: PM PEAK PERIOD ROADWAY OPERATIONS

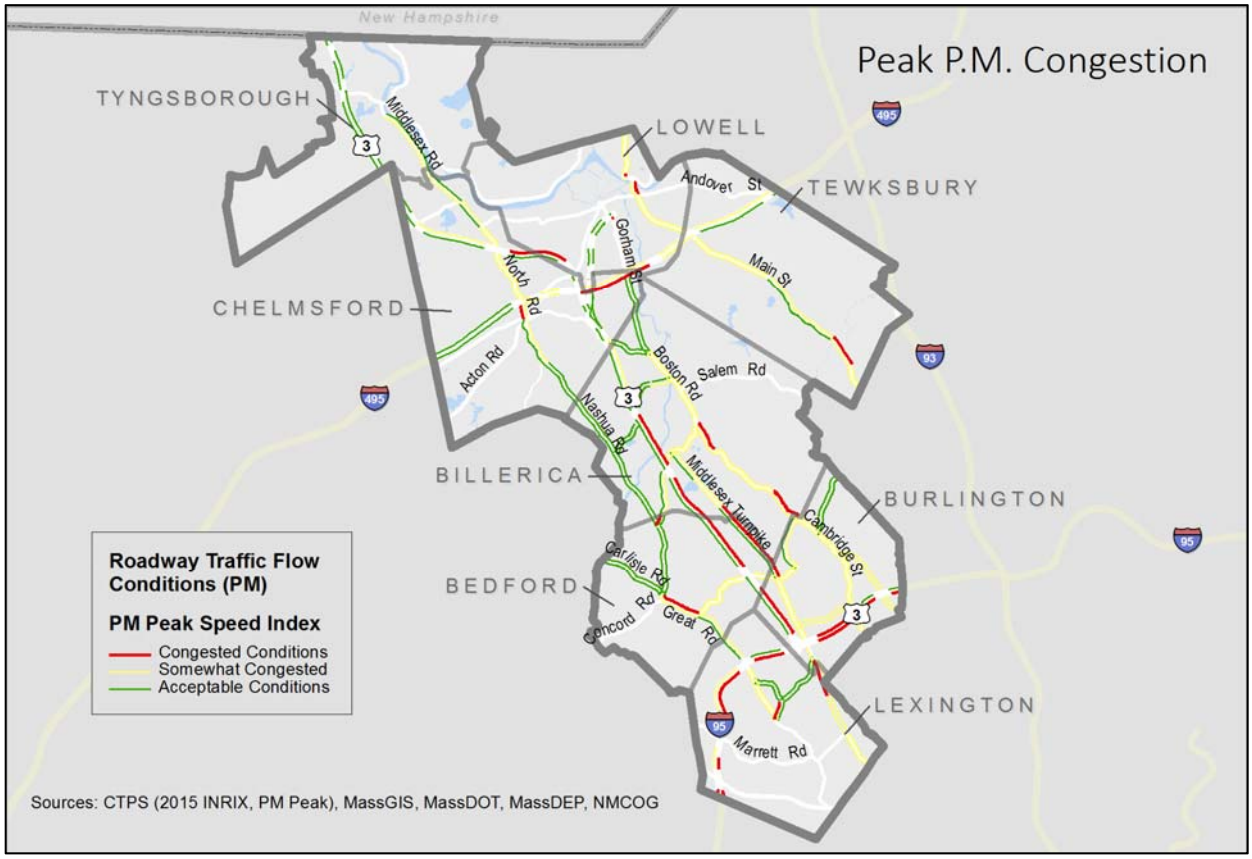


TABLE 18: CONGESTED ROADWAY SEGMENTS IN PM PEAK PERIOD (2015 INRIX DATA)

Road Name	Community	Direction	Segment Beginning	Segment End	PM Average Speed (MPH)	Free Flow Speed (MPH)	PM Peak Speed Index
I-495	Lowell	NB	Route 3 (Exit 35B & 35C)	Woburn St (Exit 37)	41.67	67.39	0.62
I-95	Burlington/ Woburn	NB	Winn St (Exit 34)	Route 38 (Exit 35)	32.03	63.22	0.51
	Burlington	NB	Route 3/3A Cambridge St (Exit 33)	Winn St (Exit 34)	33.66	62.75	0.54
	Lexington	NB	Route 2A (Exit 30)	Route 4/225 (Exit 31)	34.82	64.59	0.54
	Burlington	NB	Route 3/Middlesex Tpke (Exit 32)	Route 3/Cambridge St (Exit 33)	38.30	61.08	0.63
	Lexington	NB	Route 4/225 (Exit 31)	Route 3/Middlesex Tpke (Exit 32)	38.45	61.13	0.63
	Lexington	NB	Route 2 (Exit 29)	Route 2A (Exit 30)	42.74	63.59	0.67
	Lexington	NB	Trapelo Rd (Exit 28)	Route 2 (Exit 29)	42.87	63.44	0.68
	Lexington	SB	Route 2 (Exit 29)	Trapelo Rd (Exit 28)	43.90	64.71	0.68
	Burlington	SB	Route 3/3A Cambridge St (Exit 33)	Route 3/Middlesex Tpke (Exit 32)	40.63	59.23	0.69
Route 225	Bedford	WB	Route 62 (Brooksbie Rd)	Route 4 (North Rd)	14.02	23.94	0.59
Route 38	Lowell	NB	MA-110/Hunts Fall Brdg/VFW Hwy	Bridge St/VFW Hwy/Lakeview Ave	9.74	21.96	0.44
	Tewksbury	NB	South St	Shawsheen St	18.41	29.71	0.62
	Lowell	NB	MA-110/MA-133/Andover St	MA-110/Hunts Fall Br/VFW Hwy	14.04	21.78	0.64
Route 3A	Billerica	NB	Lexington Rd	Andover Rd/Concord Rd/River St	18.21	29.27	0.62
	Burlington/ Billerica	NB	Route 62 (Francis Wyman Rd)	Cook St	21.35	33.77	0.63
	Burlington	NB	I-95	Winn St	19.54	27.96	0.70
Route 4	Chelmsford	SB	I-495	MA-110/MA-27/Billerica Rd	17.76	25.85	0.69
Route 4/62/225	Bedford	WB	Brooksbie Rd	Concord Rd	12.81	23.97	0.53
Lowell Connector	Lowell	NB	Route 3A (Thorndike St - Exit 5)	Gorham St	14.38	38.31	0.38
Lowell Street	Lexington	SB	Park Ave	East St	19.17	32.61	0.59

TABLE 18: CONGESTED ROADWAY SEGMENTS IN PM PEAK PERIOD (2015 INRIX DATA)

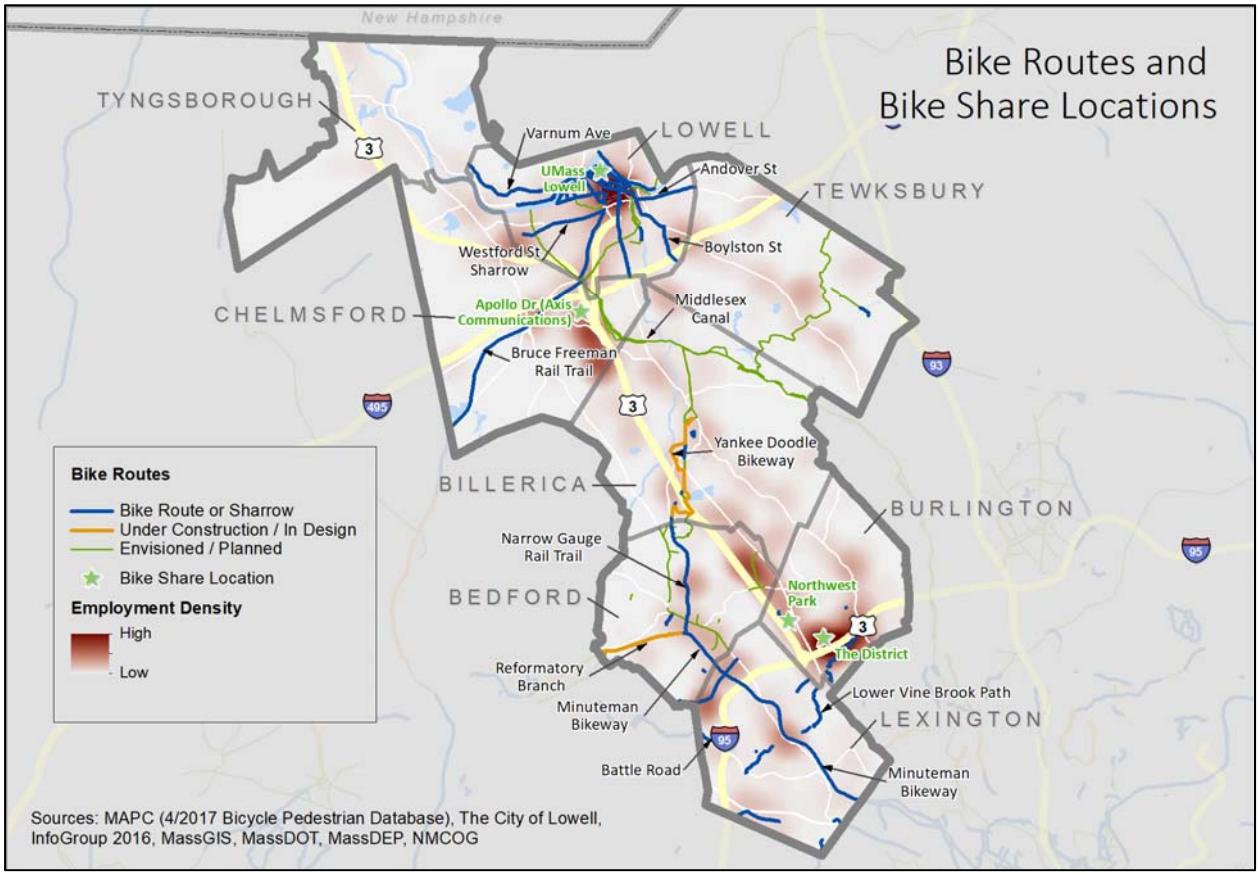
Road Name	Community	Direction	Segment Beginning	Segment End	PM Average Speed (MPH)	Free Flow Speed (MPH)	PM Peak Speed Index
Middlesex Turnpike	Bedford/ Billerica	NB	Route 62 (Bedford St)	Lexington Rd	20.91	33.16	0.63
North Road	Bedford	NB	Billerica Town Line	Chelmsford Rd	23.13	35.23	0.66
Hancock Street	Lexington	NB	Adams St	Route 4/225	17.19	25.13	0.68
Route 3	Burlington/ Bedford	NB	I-95 (Exit 25)	Route 62 (Exit 26)	45.27	66.63	0.68
	Bedford/ Billerica	NB	Route 62 (Exit 26)	Concord Rd (Exit 27)	35.25	66.72	0.53
	Billerica	NB	Concord Rd (Exit 27)	Treble Cove Rd (Exit 28)	39.65	66.94	0.59
	Chelmsford	NB	Route 110 (Exit 31)	Route 4 (Exit 32)	44.17	64.86	0.68

7. NON-MOTORIZED TRANSPORTATION

BICYCLE FACILITIES

Access to public transportation through a connected and convenient network of bicycle facilities is key to providing better transportation options for all users of the network. The overall health of the transportation system can affect a business's ability to recruit or retain employees. This section looks at existing and planned on road and off road bicycle facilities designed to provide access throughout the Middlesex 3 corridor. The bicycle transportation network is shown on Map 13.

MAP 13: BICYCLE FACILITIES IN THE MIDDLESEX 3 STUDY AREA



Existing Off Road Bicycle Facilities

Minuteman Bikeway is multi-use paved asphalt rail trail runs for ten miles through Bedford, Lexington, Arlington and Cambridge (Photo 9). The trail experiences a high volume of bicycle commuter traffic during weekdays, and is heavily used for recreation on weekends. It is a key part of the Bay Circuit Trail in the Boston metro area. The northernmost point of the Minuteman Bikeway is located in Bedford Center at Depot Park. At this point, users can connect to the Narrow Gauge Rail Trail or the Reformatory Branch, both of which are stone dust trails. The Alewife Red Line MBTA Station is located at the trail's southern point in Cambridge, providing access to the urban trails, subways and buses.

PHOTO 9: MINUTEMAN BIKEWAY AT DEPOT PARK IN BEDFORD, MA

Narrow Gauge Rail Trail is a 3-mile stone dust trail running from Depot Park in Bedford to the Billerica Town Line. The Yankee Doodle Bike Path, currently under design, is expected to connect with the Narrow Gauge Rail Trail, providing more access to the north for users of the trail system.

The Reformatory Branch Trail is a 4-mile unimproved trail running west from Bedford Center to Concord. The trail provides connections to both the Narrow Gauge Trail and the Minuteman Bikeway, and provides access to the Elm Brook Conservation Area, the Mary Putnam Webber Wildlife Preserve, the Great Meadows Wildlife Sanctuary, and Concord Center.

The Bruce Freeman Rail Trail is a multi-use paved asphalt rail trail that currently extends from Lowell to Westford, for a distance of 7 miles (Photo 10). Phase 2A, extending from Westford to Acton, is currently under construction, while other future phases are still in planning and design stages. The complete trail will eventually run approximately 25 miles, from Lowell to Framingham.

PHOTO 10: BRUCE FREEMAN RAIL TRAIL IN CHELMSFORD, MA

A portion of the five-mile long **Battle Road Trail** runs through the Town of Lexington near Hanscom Air Force Base. The trail roughly parallels Route 2A and is made of stone dust, with boardwalks over the wetland areas. The trail is part of the Minuteman National Historical Park (Photo 11).

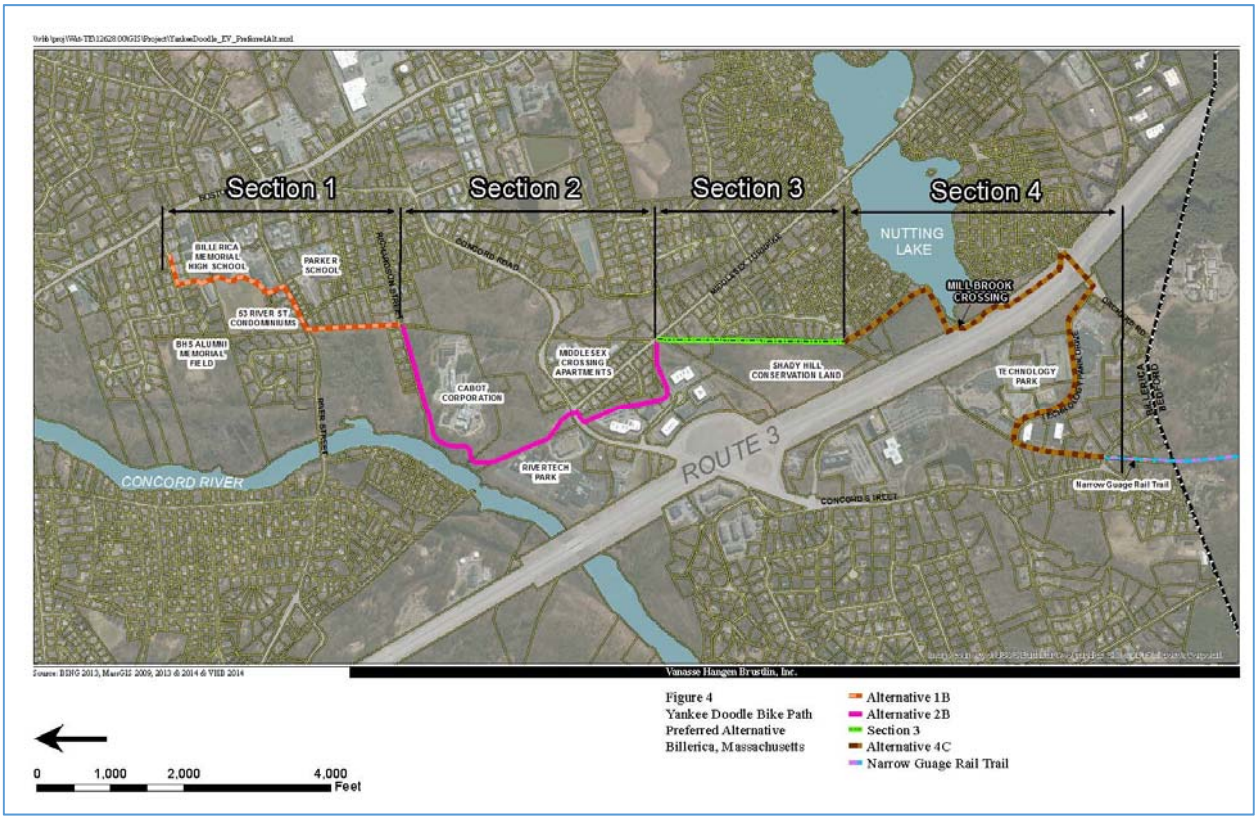
PHOTO 11: BATTLE ROAD TRAIL IN LEXINGTON, MA

Lower Vine Brook Path is a paved recreation trail running along Vine Brook in Lexington, from Fairfield Drive to North Street. At North Street, bicyclists and pedestrians can access the Middlesex Turnpike in Burlington via Adams Street.

Planned Off Road Bicycle Facilities:

Yankee Doodle Bikeway is currently being designed by the Town of Billerica. The 4-mile bikeway will connect Billerica Center with the Narrow Gauge Rail Trail in Bedford, ultimately providing access between Billerica and Boston via an off-road bicycle trail network. Construction of the project is currently programmed in the FFY 2018-2022 Northern Middlesex Transportation Improvement Program. Figure 12 outlines the proposed route of the Yankee Doodle Bikeway.

FIGURE 12: PROPOSED YANKEE DOODLE BIKE PATH ROUTE



Concord River Greenway – Partially complete, this multipurpose trail runs through the City of Lowell extending along the eastern bank of the Concord River. The Greenway connects Lowell's largest parks, Rogers Fort Hill Park and Shedd Park, with the Riverwalk and a network of trails running throughout the City. The Greenway will also fill in a missing link in the

FIGURE 13: CONCORD RIVER GREENWAY CONCEPT PLAN

Bay Circuit Trail, and will eventually connect with the Bruce Freeman Trail. Approximately 2,700 feet of trail has been constructed, with the additional phases (3, 3A, 3B) planned for construction.

Existing On Road Bicycle Facilities

Lowell has an extensive network of bicycle lanes and sharrows providing access to employment and transportation centers throughout the City as detailed in Table 19 below.

TABLE 19: LOWELL BIKE LANES AND SHARROWS

Location/Street	Length of Bike Lane (ft)	Length of Marked Shared Lane (ft)
Varnum Avenue	14,000	-
Andover Street	7,000	750
Broadway Street	1,400	5,200
Merrimack Street	1,400	5,000
Chelmsford Street	2,400	7,100
Boylston Street	5,400	-
Rogers Street	3,500	-
Gorham/Central Street	-	11,500
High Street	-	3,100
Fletcher Street	-	4,100
Pawtucket Street	-	5,000
Arcand Drive	-	700
French Street	-	1,800
Wilder Street	-	1,200
Westford Street	-	11,000

Planned On Road Bicycle Facilities

Lowell is planning to add additional bike lanes along Upper Merrimack Street, as well as multipurpose paths along Thorndike and Dutton Streets as part of the Lord Overpass Project, providing improved access from Downtown to the Lowell Commuter Rail Station and LRTA Bus Center.

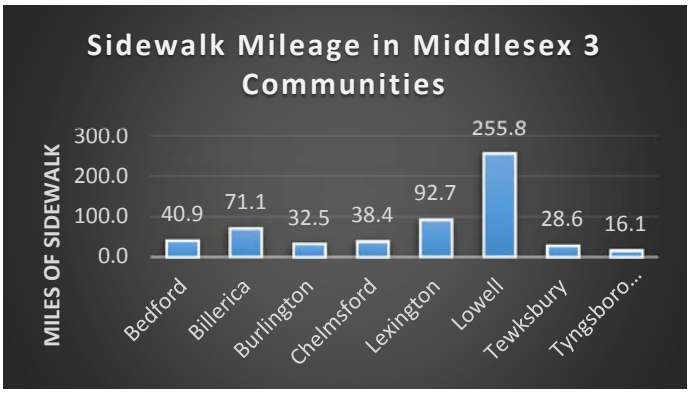
Bikeshare Facilities

Several bikeshare programs are currently available in the study area (Map 13). The District and Northwest Park in Burlington has installed popular bikeshare systems available for first/last mile connections and shorter trips in the area. Zagster is also available in Chelmsford on Apollo Drive at the Axis Communications building. UMass Lowell offers bikeshare facilities for students and employees of the University, which are often used to travel between campuses and student facilities.

Pedestrian Facilities

Sidewalk access can often be a barrier to public transportation. If a person cannot safely walk to and from a bus stop, he or she will either not use public transportation or will be exposed to potentially dangerous conditions. This may affect a business's ability to attract or retain employees who rely on public transportation.

Figure 14: Middlesex 3 Community Sidewalk Mileage



Existing Pedestrian Facilities

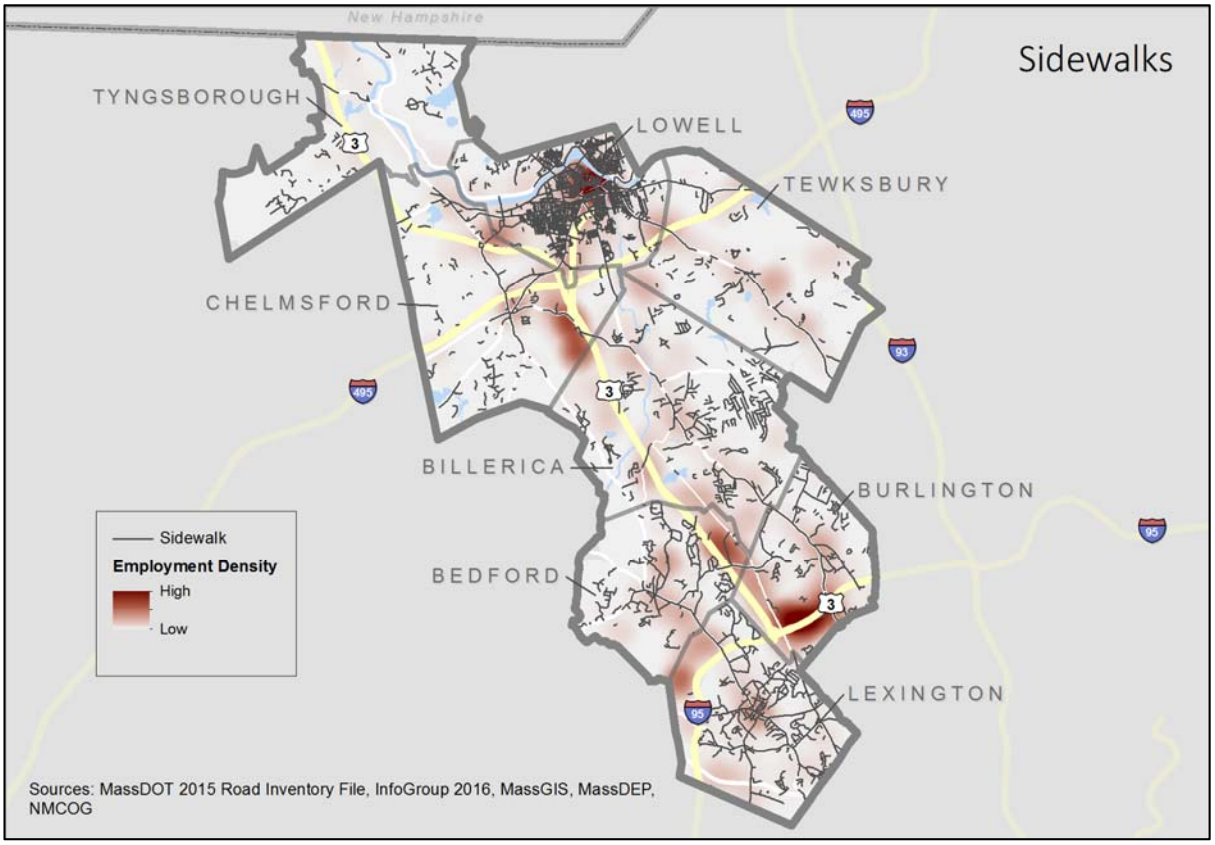
There are approximately 576 miles of sidewalks within the study area. Figure 14 and Table 20 provide a summary of sidewalk mileage by community and by functional class of roadway. Arterials include major roadways like Route 3A, Middlesex Turnpike and Great Road. Collector type roadways provide connections between local neighborhood roads and arterials. Lowell, by far, has the most sidewalk in place, with over 250 miles within the City limits. Map 14 shows the existing sidewalk network within the study area communities, according to MassDOT's 2015 Roadway Inventory File. The map also shows employment density throughout the study area. Many of the higher density employment areas lack a robust pedestrian network.

Table 20: Middlesex 3 Community Sidewalk Mileage by Functional Class

Middlesex 3 Community	Sidewalk Mileage			
	Arterial	Collector	Local	Total
Bedford	9.9	7.1	23.9	40.9
Billerica	11.7	1.2	58.3	71.1
Burlington	15.0	2.2	15.2	32.5
Chelmsford	18.6	1.3	18.5	38.4
Lexington	37.0	13.2	42.5	92.7
Lowell	75.4	36.6	143.8	255.8
Tewksbury	11.5	1.5	15.6	28.6
Tyngsborough	2.2	0.0	13.9	16.1
Totals	181.3	63.1	331.7	576.1

Source: MassDOT Road Inventory File

MAP 14: SIDEWALK NETWORK IN MIDDLESEX 3 TRANSPORTATION STUDY COMMUNITIES



Planned Pedestrian Facilities

The following provides a brief overview of pedestrian facilities planned throughout the Middlesex 3 study area:

- The Town of Bedford has secured Safe Routes to Schools funding to improve the pedestrian path at the High School, and is looking at improving pedestrian facilities around the Route 4/62 triangle.
- In Bedford and Billerica, the Middlesex Turnpike Phase II project will include new sidewalks between Crosby Drive and Manning Road as part of the roadway expansion.
- In Burlington, sidewalks along the length of Middlesex Turnpike are currently under construction.
- In Chelmsford, the Town has received Complete Streets funding for new sidewalks along Richardson Road, between Route 3A and the Route 3 overpass. In addition, the Town has received funding for sidewalk improvements along Billerica Road (Route 129), between Central Square and Hildreth Street.
- In Lowell, the Lord Overpass project will provide new pedestrian connections between the Gallagher Terminal, the Hamilton Canal District, and Downtown. Several projects are planned as part of the Canalway system, including the Merrimack Riverwalk extension and the Swamp Locks pedestrian bridge over the Pawtucket Canal. The Pawtucket Falls Overlook project will

improve pedestrian access between the Vandenberg Esplanade along Pawtucket Boulevard and the School Street Bridge. Connections between the Bruce Freeman Rail Trail and the Concord River Greenway are also in the planning stage, as previously discussed.

8. PARKING FACILITIES

Municipal staff and regional stakeholders were interviewed to gather local insight on existing parking issues within each community. Issues with parking are similar to those of sidewalk and bicycle access, in that the lack of available parking may cause workers and patron to avoid an area or seek out other options. The existing parking issues in each community are summarized below.

Existing Parking Issues

A number of parking issues were uncovered through stakeholder interviews. Determining the appropriate amount of parking in any given community is challenging, as too little parking could inhibit further growth and too much results in wasted area that could be used for other economic purposes. Parking supply demand management is increasingly seen as tool for better managing overall transportation demand by encouraging mode shift. However, implementing such policies can be challenging from a political perspective. As technology and medical facilities in the study area continue to grow, parking and transportation issues will take on increased importance. The following parking related challenges already exist within the study area:

- In Burlington, parking demand at private high tech centers seems to be the most prevalent parking issue. At Lahey Clinic, employees often park at off-site locations and take shuttles to the facilities. Other locations identified with on-site parking shortages include Oracle and the Microsoft Tech Center (Photo 12). Restaurants often see their highest parking demand in the early evenings as Tech Center workers leave nearby offices.

PHOTO 12: MICROSOFT CENTER IN BURLINGTON, MA

- In Bedford, parking demand is highest on the weekends near the confluence of the Town's trail network. With the Narrow Gauge Rail Trail, the Reformatory Branch and the Minuteman Trail meeting in the Depot Park area, the small amount of parking supply provided by the Depot and the VFW Hall often leads to competition with other retail and business parking demands.
- In Chelmsford, parking demand is highest around the Town Center and Vinal Square.
- In Tyngsborough, parking demand around the Town Center can be an issue, especially on weekends when Town events are being held. The MassDOT Park and Ride Lot on Route 113 east of Route 3 is over capacity on a daily basis, with vehicles often parking in grassy areas surrounding the lot.
- In Billerica, parking issues were noted at EMD Serono and at 600 Technology Drive. It was also noted that the MBTA Commuter Rail Lot in North Billerica fills up early on weekdays.

- In Lowell, the downtown parking garages experience high parking demands, particularly the Edward Early Garage (Middlesex Street), the Leo Roy Garage (Market Street) and the Ayotte Garage (Arcand Drive). Parking at the area colleges is a concern as well, as resident report that students park on residential streets, creating parking conflicts within the neighborhoods and in some business areas.
- In Lexington, planners reported that parking issues have been evident at businesses along Spring Street and Hayden Avenue near Route 2. A Town Center parking study (Photo 5) has led to improvements, including metered parking and adding all-day parking options along the periphery of the Town Center.

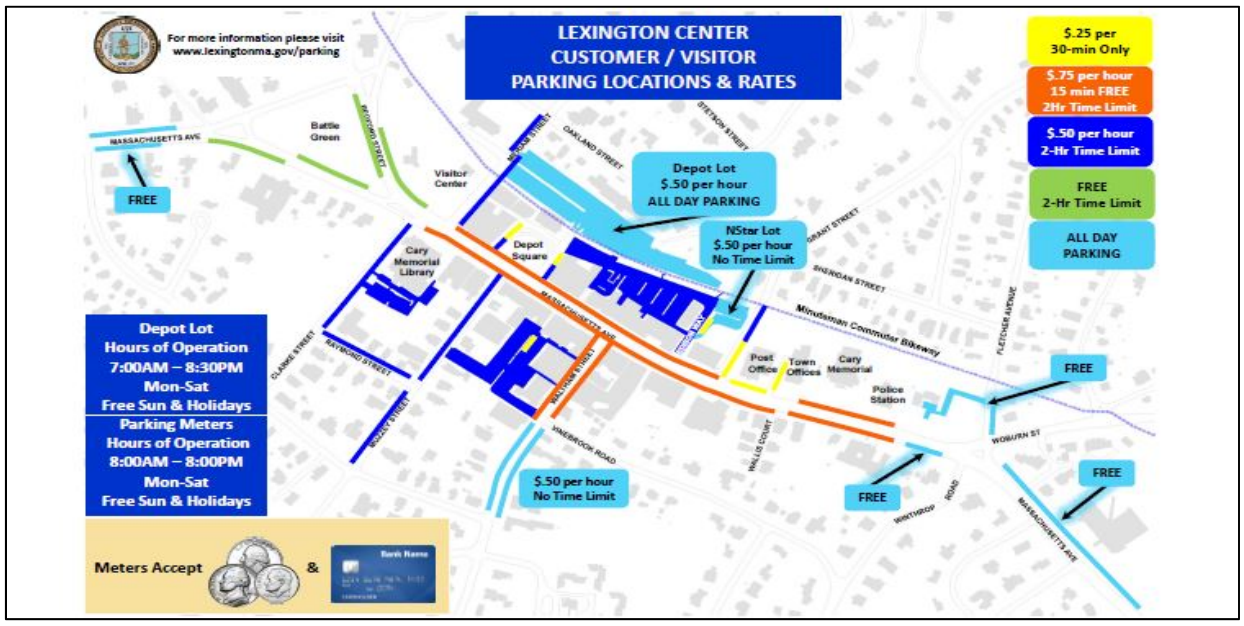
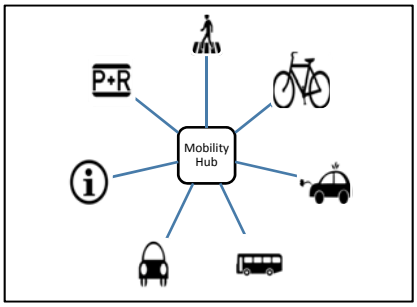


PHOTO 13: LEXINGTON CENTER PARKING MAP

Future Parking Facilities and Mobility Hubs

Chelmsford and Billerica have expressed an interest in adding park and ride lots along the Route 3 corridor, focusing on the Route 129 area for regional travel, and on Middlesex Turnpike to offset parking issues at nearby businesses. Burlington has expressed an interest in examining a potential park and ride location at the former Building 19 site. Billerica in interested in an expansion of the North Billerica Commuter Rail parking area, which is now overcapacity.



Burlington identified the Burlington Mall as a potential future location for a Mobility Hub, and Bedford identified Depot Park and Crosby Drive as potential Mobility Hub locations. A mobility hub is a location providing "one stop shopping" for mobility, where patrons can find a variety of transportation services. The physical location is the "hub", with various transportation options as "spokes" for personal mobility. Amenities can include transit, shelters and

designated curb space for buses and shuttles, taxi stands and ride hailing pick up/drop off zones, bicycle sharing stations, car sharing stations, vehicle charging stations, connections to sidewalks and bicycle paths (including regional trails), as well as functional signage and maps showing destinations within a 10 to 20 minute walk. Mobility hubs should also include placemaking, which can consist of landscaping, public art, meeting space, and food or retail establishments. Mobility hubs are typically located at major transit centers (such as commuter or rail stations) or at major activity areas, such as downtowns, universities, or mixed use/shopping centers.

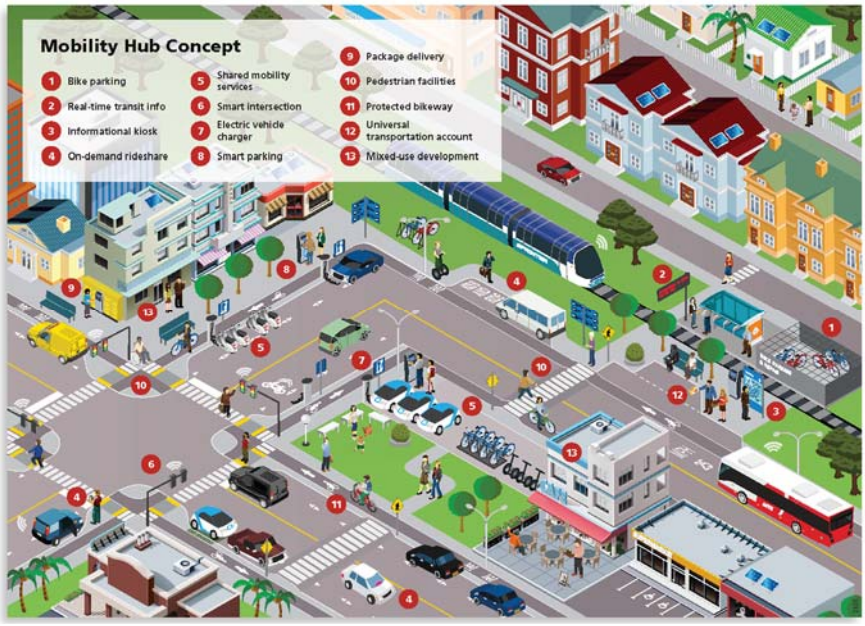


IMAGE 1: FROM SAN DIEGO FORWARD: HTTP://WWW.SDFORWARD.COM/MOBILITY-PLANNING/MOBILITYHUBS

While the model of integrating various transportation modes in a single location is not new, the mobility hub concept is intended to ensure that available transportation services are integrated with well-defined areas for every mode, showing the mode's availability and function within the larger transportation network. Mobility hubs should be designed to provide clear, user-friendly options for commuters, residents, and nearby workers, whether they use these services regularly or infrequently. Finally, each mobility hub should be designed and scaled according to its surrounding built environment.

Image: Sophia von Berg
@multi mobility

Neighborhood Mobility Hub, Hamburg, Germany.
Images: Sophia von Berg
@multi_mobility

Mobility Hub at heavy rail station. Hamburg, Germany
Image: Sophia von Berg

Mobility hubs can be seen in places such as Hamburg, Germany and are under construction in San Diego and Los Angeles, and have been proposed in Boston as part of the Go Boston 2030 plan.

9. RECOMMENDATIONS

A number of recommendations are outlined below including public private partnerships, regional transit service improvements, and planning initiatives and practices.

Park and Ride Recommendations:

- Work with MassDOT to expand the Tyngsborough Park and Ride Lot on Route 113. The current capacity of the lot is 250 spaces and monitoring has shown demand to be greater than available capacity for the past two years. This lot was developed as mitigation for the Route 3 widening project and additional land is available to double to current capacity. Anecdotal information has been provided indicating that long-term parking has become popular at this location, as motorists are parking at no cost and taking the Boston Express, rather than paying for long-term parking at Logan Airport or South Station.
- Identify and study potential new Park and Ride Lot locations along Route 3, including near the Route 129 interchange in Chelmsford and Middlesex Turnpike in Billerica.
- Study the inclusion of park and ride facilities at future Mobility Hub locations in Burlington and Bedford.

Expand TMA Shuttle Services:

- Implement late night shuttle service between Lowell and Burlington for second shift workers. For reasons discussed previously, providing late night service is financially difficult for public transit agencies. The most efficient means of accommodating added service between the northern and southern ends of the corridor will be through the TMA utilizing public/private partnerships.
- Implement additional service between Burlington and the Anderson/Woburn MBTA Commuter Rail Station
- Use the TMA to implement partnerships between the municipalities, employers and on demand service providers. In an effort to complete first mile/last mile connections, municipalities and businesses can develop partnerships with on demand service providers including Lyft, UBER and Taxi companies. Lexington is currently using taxi services to meet some of its paratransit needs, as discussed earlier. Such a program could run as a subscription service for businesses that may have a need to move employees to and from work. Alternatively, such a program could be administered by the regional transit authority or by a municipality, with set parameters relative to eligibility, geography, schedule of service and number of rides established, in order to limit non-work trips. The program could be seeded with State grants and employer contributions.

Investigate the establishment of mobility hubs:

- Study the concept of Mobility Hubs in Burlington and Bedford. The Burlington Mall area is a natural hub location with LRTA, MBTA, municipal transit, and private providers already operating in the area. In addition, the high density of office and retail businesses in the area

brings the demand to a centralized area. Burlington should work the Burlington Mall owner and the Boston MPO to study this concept further. Recent reports of changes to Mall occupancy and the closing of at an anchor store may offer a timely opportunity to further explore this concept. Bedford could also approach the Boston MPO for funding for a mobility hub feasibility study, as they have set aside federal funding in the Transportation Improvement Program (TIP) for development of mobility hubs.

Strengthen the local permitting processes:

- Update municipal permitting regulations to require membership in a TMA as a condition of the Planning Board's approval process. For example, the Town of Woburn requires project proponents to participate in a TMA and to implement TDM strategies.
- Strengthen performance standards within local zoning bylaws and subdivision regulations to provide bicycle and pedestrian accommodations as part of site plan approval process.

Participate in Complete Streets:

- Continue municipal participation in the MassDOT Complete Streets Funding Program which offers state funding for pedestrian and bicycle facilities. Currently, three communities in the study area have been awarded funding for projects (Table 21), three communities have a policy in place, and one has a prioritization plan. Burlington is not actively participating in the program.

TABLE 21: MUNICIPAL COMPLETE STREET FUNDING PROGRAM PARTICIPATION

Community	Complete Streets Participation
Bedford	CS Prioritization Plan
Billerica	CS Policy
Burlington	NA
Chelmsford	CS Award
Lexington	CS Award
Lowell	CS Award
Tewksbury	CS Policy
Tyngsborough	CS Policy

Expand private transportation services:

- Boston Express currently runs commuter bus service between New Hampshire and Boston with a stop at the Tyngsborough Park and Ride lot. Middlesex 3 Coalition and the municipalities should approach Boston Express or other private transportation service providers relative to expanded bus service along the corridor. Additional stops at future Mobility hubs or park and ride locations would help alleviate the traffic and parking demand.

Coordinate local transportation services:

- Study the feasibility of coordinating and streamlining Bedford (Dash), Burlington and Lexington (Lexpress) operations and services to improve efficiency and avoid duplication of effort. Examining overlapping service, schedule coordination, shared dispatch, transfer ability and fare system coordination will be beneficial.
- Study enhanced coordination between Community Councils on Aging by investigating current bus and shuttle services available, fleet utilization and shared dispatch opportunities.

Regional ride-hailing opportunities:

- Investigate the establishment of agreements with private ride-hailing services to fill gaps in transportation service during hours when public transit is unavailable and to complete fist mile/last mile connections. Develop a subsidy program to assist second and third shift workers as part of a public-private partnership.

Investigate legislative and policy changes to address the barriers to interregional transportation service provision, as outlined in Section 5:

- Propose legislative changes that would allow RTAs to be reimbursed for service provided beyond their service area boundaries.
- Work with the congressional delegation to address the 100-vehicle fleet size limitation tied to federal operating assistance.
- Consider legislative changes that would permit MBTA communities to receive service from an adjoining RTA as part of a corridor-wide transportation plan.

Address private parking issues throughout the study area:

- Work with private businesses that have expressed concerns with current parking occupancy demands to explore TDM measures such as preferential parking for carpools/vanpools, transit pass subsidies, and other strategies.

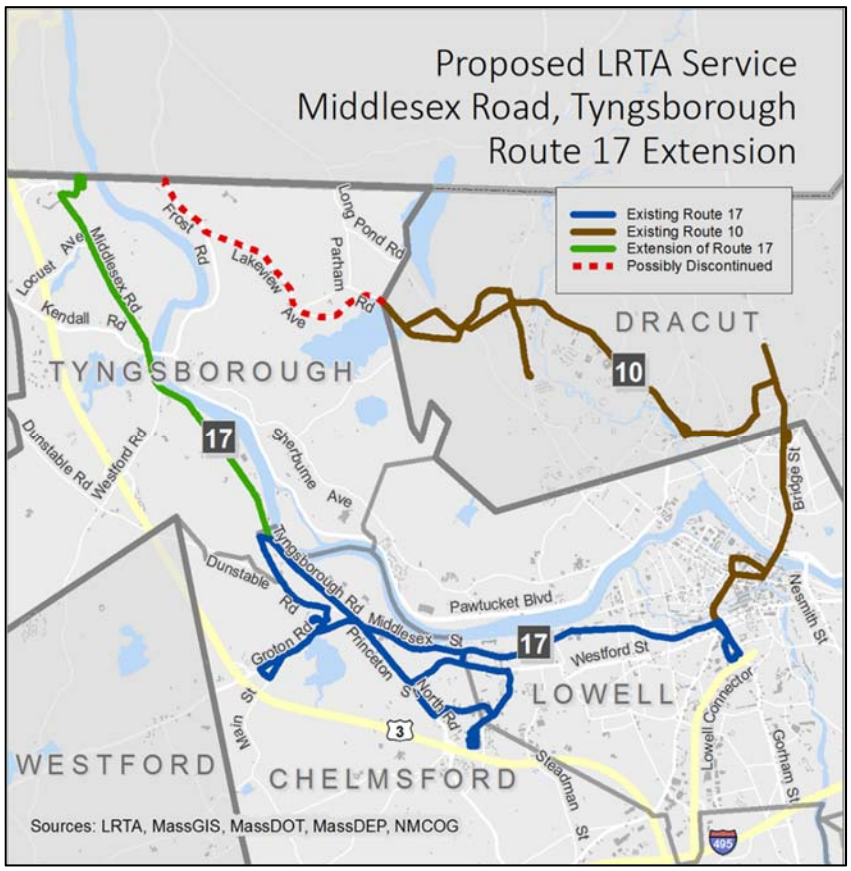
LRTA and MBTA Transit Service Recommendations

Gaps in public transit service were identified in four of the eight communities in study area. Representatives from the towns of Tyngsborough, Chelmsford, Tewksbury, Bedford and Burlington indicated that the routing of existing fixed route bus service does not meet the needs of community. Recommended service changes within the LRTA and MBTA service areas are outlined in this section.

Tyngsborough

The Town of Tyngsborough is experiencing growth in commercial and residential development along Middlesex Road, which currently has the highest concentration of employment in the Town, based upon the 2016 InfoGroup data. Currently, the LRTA does not serve the Middlesex Road corridor with regular transit service. The corridor has been identified in the 2015 LRTA Service Plan as being appropriate for a new bus route.

MAP 15: PROPOSED LRTA ROUTE 17 EXTENSION



The existing LRTA bus route enters the Town east of the Merrimack River from Dracut, joining Route 3A at Frost Road and continuing to the New Hampshire state line. The bus

used to travel past the Tyngsborough Senior Center on Lakeview Ave, however the Senior Center recently moved to a new location on Westford Road, reducing usage of the current route. Service along Middlesex Road would move the bus closer to the new Senior Center location.

The Middlesex Road corridor could be served by an extension of the #17 North Chelmsford bus route, by the rerouting of the #10 Dracut / Tyngsborough bus route, or by establishing a new route as proposed in the 2015 plan.

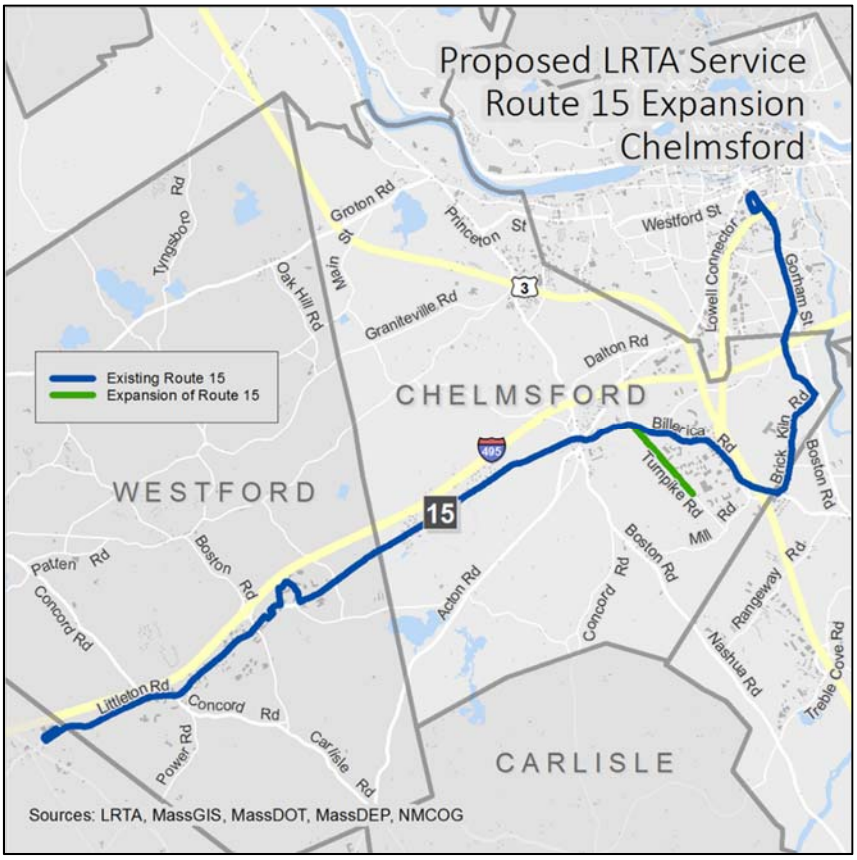
The cost estimates for the various route options range greatly. The estimated cost for the extension of the #17 with the elimination of the Tyngsborough portion of the #10 is $60,000, while the cost of adding the extension without the elimination of the Tyngsborough portion of the route #10 is $230,000. The cost of the new route identified in the Service Study is dependent on additional service changes in Chelmsford, and is therefore more complicated and likely more expensive.

The LRTA should undertake an analysis of ridership along the current bus route to determine the number of customers that would be impacted by truncating the #10 bus route at the Dracut / Tyngsborough town line.

Chelmsford

The Town of Chelmsford is redeveloping the Route 129 business area with mixed-uses and has expressed interest in having the Lowell Regional Transit Authority adjust the #15 Chelmsford/ Westford bus route so that the route travels along Turnpike Road. This change could be accomplished by either turning off Billerica Road to Turnpike Road for approximately ¾ of a mile and returning to Billerica Road, or by looping the bus in one direction on Mill and Turnpike Roads.

MAP 16: PROPOSED LRTA ROUTE 15 EXTENSION



If the current bus route were looped around Mill and Turnpike roads, there would be minimal additional cost of operating the route. However, the loop would inconvenience workers and visitors along Billerica Road. The section that would become one of the one-way pairs currently serving

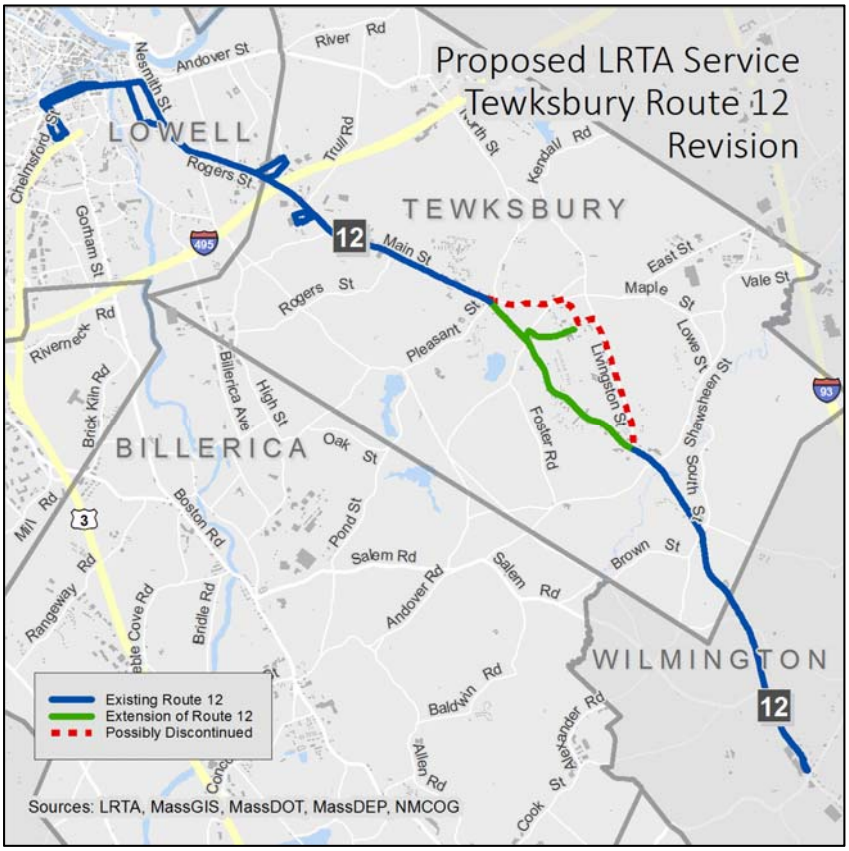
Harvard Vanguard Medical Associates, Sunny Acres Nursing and Rehab Center, as well as Cintas Facility Services on Apollo Drive.

The second option of sending the bus south on Turnpike Road to a turn-a-round location would add 1.5 directional miles to each bus trip. The #15 route operates 6,040 trips per year, for a total of 9,060 additional route miles per year. At the 2014 NTD cost estimate of $6.75 per mile, the total cost estimate of the additional service is around $61,200 per year.

Tewksbury

The Town of Tewksbury is seeing a significant increase in multifamily housing development, as well as redevelopment of commercial properties along Route 38 (Main Street). The LRTA operate the #12 Tewksbury route over much of Main Street, with the exception of a 3-mile segment from East Street to Livingston Street, where the bus diverts to the Tewksbury State Hospital. On the current layout of the route, the bus passes the Tewksbury Senior Center, several housing developments and the Town recreation fields. The bus route could be altered to remain on Main Street to Chandler Street and up to the State Hospital via Hospital Drive, returning to Chandler Street and back out onto Main Street. This change could be accomplished at a nominal annual cost in a very short time frame.

MAP 17: PROPOSED LRTA ROUTE 12 REVISION



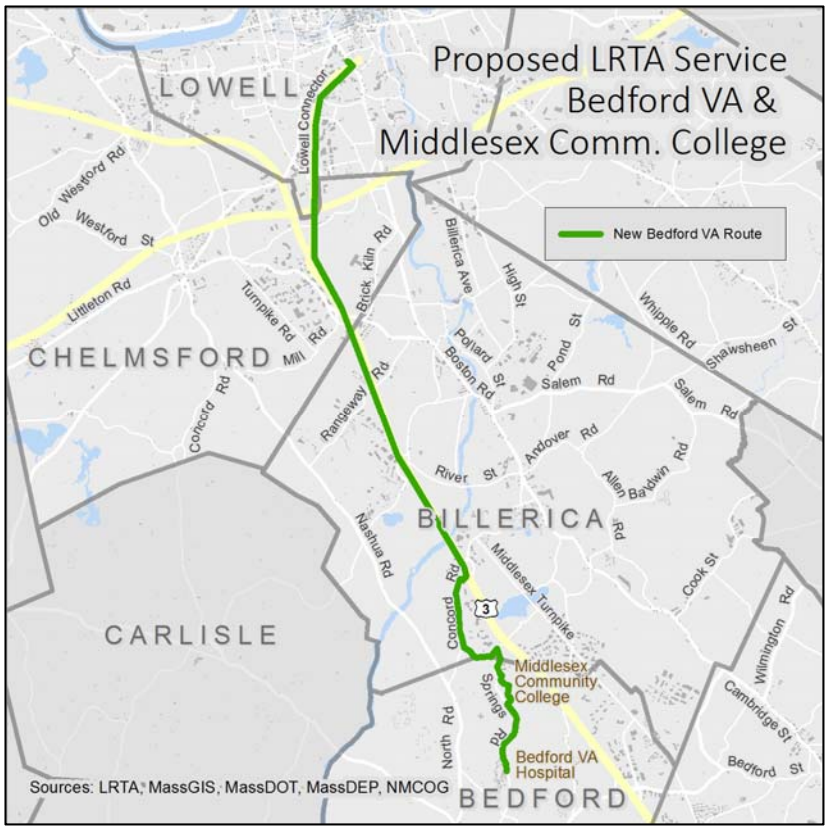
The LRTA should undertake an analysis of ridership along the current bus route to determine the number of customers that would be impacted by moving the route.

Bedford

The Town of Bedford has expressed interest in the establishment of a bus route that would connect the Veterans Administration Hospital and the Middlesex Community College (MCC) to Lowell. Currently, the VA operates a weekday shuttle linking the Lowell VA Clinic to the Bedford hospital and the MCC

operates regular service between their two campuses with eleven trips Monday through Thursday and seven trips on Friday. Additionally, the Community College operates shuttles from their overflow parking lots at the VA to the Bedford campus, approximately 1.7miles.

MAP 18 PROPOSED NEW LRTA SERVICE TO BEDFORD VA AND MCC



A new LRTA route would begin at the Kennedy Bus Hub in Lowell and would travel south along Route 3 to the Concord Road exit in Billerica, turning left onto Concord Road and left into the Technology Park, and through to a right on Orchard Road and left into the Middlesex Community College. Departing the MCC via the campus road, the bus would turn left onto Spring Road and terminate at the front of the VA Hospital.

The Bedford VA route would operate on weekdays only and would add twenty-two directional route miles per trip with approximately 2,510 one-way trips per year, totaling an additional 55,220 annual miles. At the 2014 NTD cost estimate of $6.75 per mile, the total cost estimate of the additional service is around $372,700 per year.

Burlington

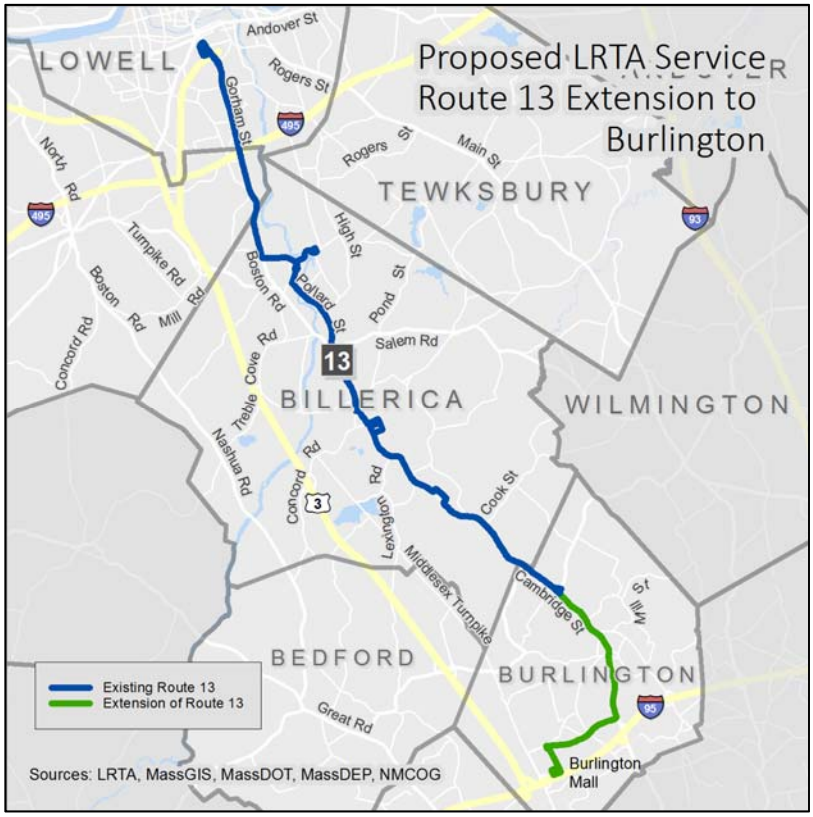
The Town of Burlington has been experiencing a growing demand for service workers during the second and third shifts, which makes existing public transit options only viable on only one of leg of the commute. Additionally, the local Town operated transit service has experienced a decline in ridership that the provider has partly blamed on the increased availability of LRTA transit service in town. To address these issues, several alternatives have been developed and are discussed below.

The Lowell Regional Transit Authority #13 Billerica route connects with the MBTA 350 and 352 routes along with the Burlington Bee Route 12 at the Chestnut Ave bus shelter. In order to maintain running times, the MBTA bus departs from the shelter and bypasses Burlington Mall Road during the morning and evening rush hours. The LRTA #13 bus from Chestnut Avenue could be extended to the Burlington Mall to fill the missing connections on two morning and two evening trips. The extension would add approximately 3 directional route miles to each bus trip. The two one-way inbound and outbound trips

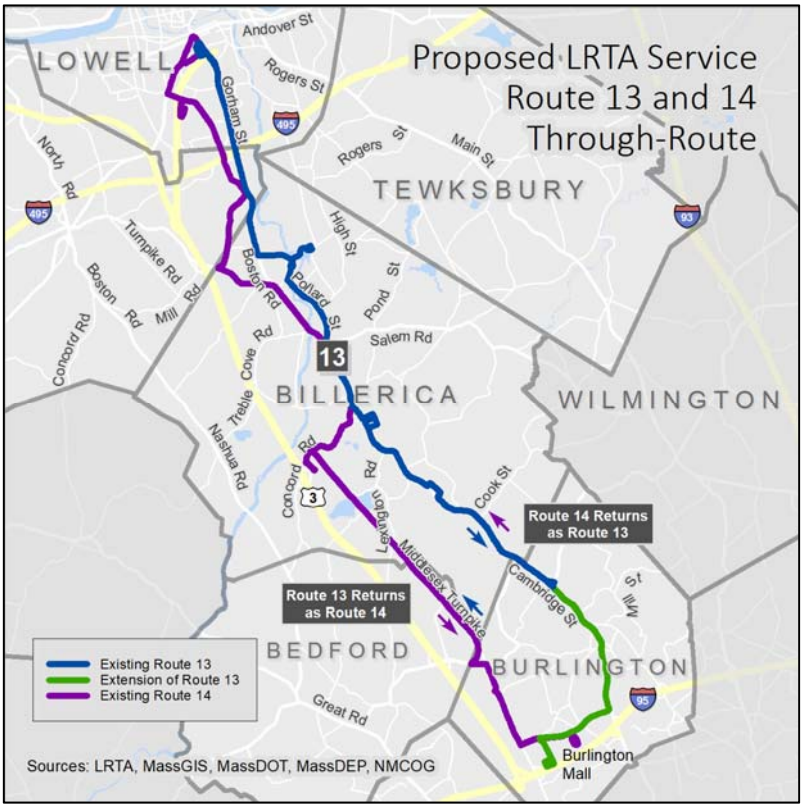
extensions to the nearly 1,000 trips per year would add 3,000 miles to the route or approximately $20,300 per year in cost.

An additional option for the Lowell Regional Transit Authority #13 bus route is to create a through-route by completing the trip with the #14 Burlington bus route. The basic concept would be to have the #13 outbound continue the route to the Mall and become the #14 inbound. The #14 bus would become the #13 inbound bus. This would enable riders from 3A in Billerica and Burlington to access businesses along Burlington Mall Road and the Middlesex Turnpike with a one-seat ride. Likewise, riders along the Turnpike in Billerica, Bedford and Burlington would be able to access business and residential areas along Route 3A. This new through-route would also handle a section of the Burlington Bee #12 route, potentially freeing up the vehicle so that it could reallocated to better serve Burlington residents. The through routing of the #13 and 14 LRTA bus routes would add roughly $60,000 to $80,000 per year, depending on number of trips. There would need to be revisions to the bus schedules, as well as a significant

MAP 19: PROPOSED LRTA ROUTE 13 EXTENSION



MAP 20: PROPOSED LRTA ROUTE 13 AND 14 REVISIONS

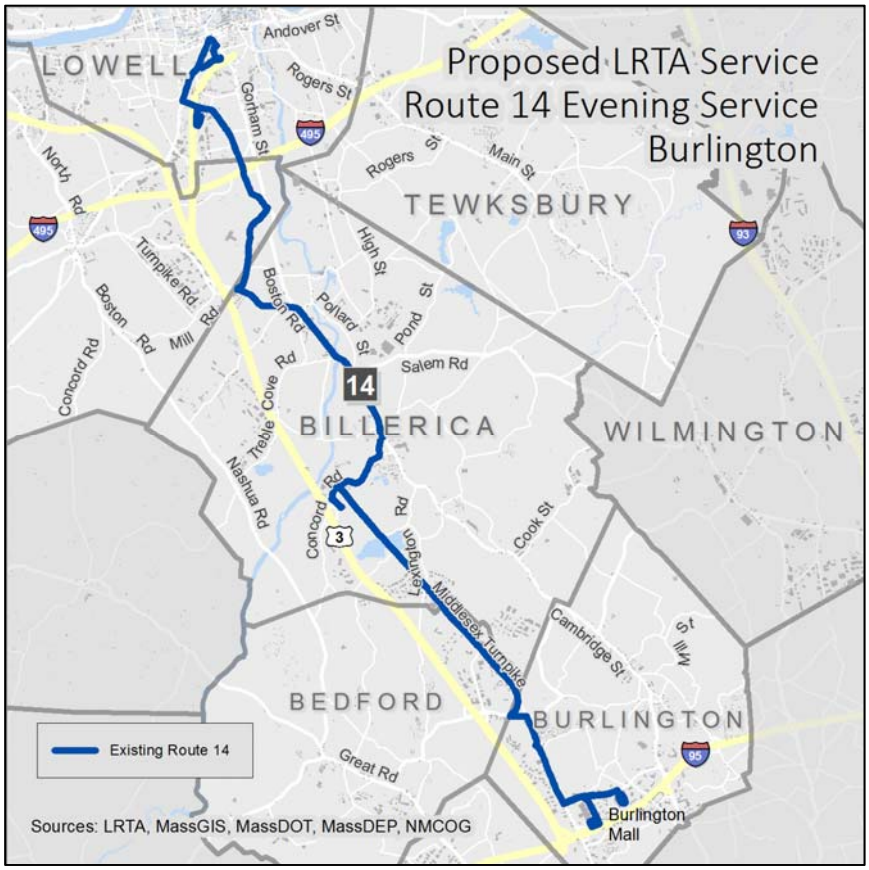


reworking of the driver's run-cuts to initiate this service change. The cost of the service would be significantly higher if the route #14 operated later into the evenings.

The Lowell Regional Transit Authority #14 Burlington route is one of the LRTA's top performing routes carrying an average weekday volume of 510 trips and a Saturday average of 265 trips. The ridership reflects a typical commuter route with the greatest number of trips in the morning and the largest number of inbound trips in the afternoon. The Saturday ridership has a similar pattern with some variation throughout the day.

The towns of Burlington and Bedford expressed an interest in increased hours of service on the LRTA 14 bus route, to better serve the workers and customers of the businesses along the southern end of the Route 3 corridor. Currently, the latest outbound bus leaving Lowell for Burlington is 7:00 pm and the last inbound is at 8:00 pm. The Saturday service has the latest outbound bus leaving Lowell at 5:00 pm and the last inbound is at 6:00 pm.

MAP 21: PROPOSED LRTA ROUTE 14 EXTENDED EVENING SERVICE



In order to meet the needs of the service worker force in the Burlington area, the last inbound trip leaving Lahey Clinic and the Burlington Mall should be at 1:00 am. This would require 10 additional weekday trips and 14 additional Saturday and holiday trips or 3,332 additional one-way trips per year. The route is 17 miles in length resulting in an additional 56,644 route miles per year.

The cost estimate for the new service, using the NTD 2014 cost of $6.75 per mile, for operating the LRTA number 14 fixed route bus is $382,350. ADA service requirements would add a minimum of an additional 1,640 hours of LRTA Road Runner service at a cost of $42.73 (NTD 2014) per hour or $70,100 per year. The total estimated cost for extending the LRTA 14 route to 1:00 am approximately $452,450 per year.

10. IMPLEMENTATION PLAN

Implementation of the proposed recommendations will involve collaboration, cooperation, planning and funding. Table 22 summarizes the recommendations, identifies implementation responsibility, outlines a proposed timeframe for implementation, and lists potential funding sources. Short-term recommendations are those that can be implemented within three years, Intermediate recommendations are likely to require 3 or 4 years to implement, and long-term recommendations will require at least five years.

TABLE 22: RECOMMENDATIONS SUMMARY

Recommendations	Implementation Responsibility	Potential Funding Sources
SHORT-TERM RECOMMENDATIONS		
Implement late night TMA shuttle service between Lowell and Burlington for second shift workers	Middlesex 3 Coalition/TMA	CMAQ and Private Businesses
Add TMA shuttle service between Burlington and Anderson/Woburn MBTA Commuter Rail Station	Middlesex 3 Coalition/TMA, Town of Burlington	CMAQ and Private Businesses
Implement partnerships between Municipalities, Employers and On Demand Service Providers to address first/last mile connections. Develop a subsidy program to assist second and third shift workers as part of a public-private partnership.	Municipalities, Employers, Middlesex 3 Coalition/TMA	State Grants, Employer Subscription or subsidies
Update Municipal Permitting Regulations to Require membership in a TMA through the Planning Board approval process	Municipalities	Municipal staff time
Strengthen Performance Standards with local zoning bylaws and subdivision regulations to provide bicycle and pedestrian accommodations as part of site plan approval	Municipalities	Municipal staff time
Continue Municipal Participation in MassDOT Complete Streets Funding Program	Municipality, MassDOT	Complete Streets Funding Program (State funds)
Study opportunities for additional private transportation services along the Route 3 Corridor	Private Transit Service Providers, Middlesex 3, municipalities	Private
Further study potential Tyngsborough Route 17 extension/revision	LRTA	FTA 5307
Study the feasibility of improving and enhancing Bedford, Burlington and Lexington local bus service by coordinating schedules and operations, shared dispatch, transfer ability and fare system coordination.	Burlington, Bedford and Lexington	Community Compact Grant Program or Boston MPO UPWP
Study enhanced coordination between community Councils on Aging by investigating current bus and shuttle services available, fleet utilization and shared dispatch opportunities	COAs, municipalities and RTAs/RPAs	MPO UPWP resources
Further study Potential Tewksbury Route 12 Revisions	LRTA	FTA 5307

Recommendations	Implementation Responsibility	Potential Funding Sources
Study Potential Route 13 Extension to Burlington	LRTA	FTA 5307
INTERMEDIATE RECOMMENDATIONS		
Pursue modifications to RTA Enabling Legislation to allow RTA reimbursement for service provided outside of the service area	Middlesex 3, LRTA and State Legislature	State
Further explore the Concept of Mobility Hubs in Burlington and Bedford	Municipalities, Property owners, Boston MPO staff, transportation service providers	Federal Funds through Boston MPO (UPWP, TIP)
Pursue legislation to allow communities receiving MBTA fixed route service to also join an additional RTA as part of a corridor-wide transportation plan	Middlesex 3, MBTA, RTAs and State Legislature	State
Expand MassDOT Park and Ride Lot on Route 113 in Tyngsborough	MassDOT	Statewide Park and Ride Lot Expansion Program
Work with private companies to address parking issues through TDM measures, etc.	Municipalities, businesses, and Middlesex 3/TMA	Private
Identify and study potential Park and Ride Lot locations along the Route 3 Corridor	Municipalities and MassDOT	Statewide Park and Ride Lot Expansion Program
Further study potential Chelmsford Route 15 Expansion	LRTA	FTA 5307
Study the potential for the Route 13 and 14 Through Route	LRTA	FTA 5307
LONG-TERM RECOMMENDATIONS		
Study potential Route 14 late night service	LRTA	FTA 5307
Study potential new LRTA Service to Bedford VA and Middlesex Community College	LRTA	FTA 5307
Meet with Congressional delegation relative to the 100-vehicle fleet size limitation tied to federal operating assistance	Middlesex 3 and LRTA	None needed

APPENDIX: PUBLIC TRANSPORTATION SCHEDULES AND ROUTE INFORMATION

Municipality	Provider / Route	Fares (One Way)*	Major Stops/Service Areas (within Municipality)	Number of Weekday Bus Trips within Community		Weekday Bus Scheduled Departure Times		Number of Saturday Bus Trips within Community		Saturday Bus Scheduled Departure Times		Average Daily Ridership by Route (entire route)		
				Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Weekday	Saturday	Sunday
Bedford	Lowell Regional Transit Authority Route 14	$1.00 Local, $1.50 two or more communties; transfers $0.50. Senior and Disabled discount 50%	Chestnut Street, Middlesex Tpke, Mitre Facility, Burlington Mall and Lahey Clinic	14	14	6:00 AM 7:00 PM	7:00 AM 8:00 PM	10	10	8:00 AM 5:00 PM	8:55 AM 5:55 PM	510	265	-
	MBTA Route 62 62/76 (Saturday)	$2.00 local, $5.00 Inner Express/$7.00 Outer Express	VA Hospital; South Rd and Great Rd	18	21	5:47 AM 8:05 PM	6:24 AM 8:40 PM	12	12	7:00 AM 7:00 PM	8:00 AM 8:00 PM	1,644	662	-
	MBTA Route 351		Wood Dr, Oak Park Dr, Middlesex Tpke, Crosby Dr, Burlington Rd	4	4	6:15 AM 8:45 PM	3:20 PM 6:20 PM	0	0	N/A	N/A	190	-	-
	Middlesex Community College Lowell / Bedford Shuttle	MCC students are Free	MCC	10	9	8:00 AM 9:05 PM	7:30 PM 5:15 PM	0	0	N/A	N/A		-	-
	Middlesex 3 Shuttle - Elink / Crosby / MITRE	Subscription	Elink / Crosby / MITRE	3	3	6:30 AM 6:15 AM	4:30 PM 6:40 PM	0	0	N/A	N/A	60	-	-
	Middlesex 3 Shuttle - The District	Subscription	The District	3	3	7:30 AM 9:40 AM	3:40 PM 6:00 PM	0	0	N/A	N/A	65	-	-
	Town of Bedford - Dash and Dine Shuttle	$2.00 Local, $4.00 outside town	Crosby Corporate Center, The Xchange, Bedford Center	Demand Response	Demand Response	12:00PM 6:00 PM	12:00PM 6:00 PM	0	0	N/A	N/A	-	-	-
Billerica	Lowell Regional Transit Authority Route 3	$1.00 Local, $1.50 two or more communties; transfers $0.50. Senior and Disabled discount 50%	Worburn St, Billerica Ave, N. Billerica Commuter Rail Station	16	15	5:55 AM 6:35 PM	6:15 AM 7:05 PM	10	10	8:00 AM 5:00 PM	8:20 AM 5:20 PM	245	40	-
	Lowell Regional Transit Authority Route 13		N. Billerica Commuter Rail Station, Billerica Mall, Towne Plaza	13	13	6:30 AM 6:30 PM	7:10 AM 7:10 PM	10	10	7:30 AM 4:30 PM	8:10 AM 5:10 PM	320	105	-
	Lowell Regional Transit Authority Route 14		Rte 129, Rte 3A, Concord Rd, Middlesex Tpke	14	14	6:00 AM 7:00 PM	7:00 AM 8:00 PM	10	10	8:00 AM 5:00 PM	8:55 AM 5:55 PM	510	265	-
	MBTA Commuter Rail	$10.00 - Zone 6 to Boston $2.75 - 1 Interzone to North Billerica	Gallagher Terminal / Kennedy Bus Hub	24	25	5:35 AM 12:15 AM	5:35 AM 11:05 PM	24	24	8:00 AM 11:30 PM	7:00 AM 9:00 PM	11,965	3,789	2,597

Municipality	Provider / Route	Fares (One Way)*	Major Stops/Service Areas (within Municipality)	Number of Weekday Bus Trips within Community		Weekday Bus Scheduled Departure Times		Number of Saturday Bus Trips within Community		Saturday Bus Scheduled Departure Times		Average Daily Ridership by Route (entire route)		
				Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Weekday	Saturday	Sunday
Burlington	Burlington Transit Route 10 / 10 Reversed and 10A / 10A Reversed	$3.00 per ride, Transfers $0.50. No joint tickets or passes with other services	Center School, Peach Orch., Beacon, Shaw's, Cross, Blanchard, Mkt Basket, Mall, Lahey, A Street	10	Loop Route	7:30 AM 6:35 PM	N/A	0	0	N/A	N/A	50	-	-
	Burlington Transit Route 11/11 Reversed		Center School, A St., Mall, Lahey, Lexington St	1	Loop Route	3:30 PM	N/A	0	0	N/A	N/A	10	-	-
	Burlington Transit Route 12 / 12 Reversed and 12A / 12A Reversed		Center School, Shaw's, Cross, Leroy, Westwood, Fox Hill, CVS, Shaw's, Lahey, Mall	4	Loop Route	8:30 AM 5:30 PM	N/A	0	0	N/A	N/A	10	-	-
	Burlington Transit Route 13		Center School, Wyman, Wilmington Rd, CVS, Shaw's, Cross, Olympia Way	2	Loop Route	11:00 AM 2:30 PM	N/A	0	0	N/A	N/A	10	-	-
	Burlington Transit Route 14		Center School, Birchcrest, Peach, Beacon, Wyman, Shaw's, Olympia Way	2	Loop Route	9:30 AM 3:00 PM	N/A	0	0	N/A	N/A	10	-	-
	Lowell Regional Transit Authority Route 13	$1.00 Local, $1.50 two or more communties; transfers $0.50. Senior and Disabled discount	Chestnut Ave w/ connections to MBTA buses	13	13	6:30 AM 6:30 PM	7:10 AM 7:10 PM	10	10	7:30 AM 4:30 PM	8:10 AM 5:10 PM	320	105	-
	Lowell Regional Transit Authority Route 14		Mitre Facility, Middlesex Tpke, Mall and Lahey Clinic	14	14	6:00 AM 7:00 PM	7:00 AM 8:00 PM	10	10	8:00 AM 5:00 PM	8:55 AM 5:55 PM	510	265	-
	Lexpress Route 5	$2.75. No joint tickets or passes with other services	Burlington Mall - connections with LRTA and MBTA service	12	Loop Route	6:35 AM 6:00 PM	N/A	0	0	N/A	N/A	115	-	-
	MBTA Route 350	$2.00 local, $5.00 Inner Express/$7.00 Outer Express	Chestnut Ave, Town Center, Mall, Lahey, Lextington St, Wood Dr, Oak Park Dr, Middlesex Tpke, Crosby Dr, Burlington Mall	28	30	6:20 AM 10:20 PM	6:04 AM 10:20 PM	19	17	6:25 AM 10:40 PM	7:10 AM 9:50 PM	1,653	781	477
	MBTA Route 351			4	4	6:15 AM 8:45 PM	3:20 PM 6:20 PM	0	0	N/A	N/A	190	-	-
	MBTA Route 352 (Express)		Chestnut Ave, Bedford St, Burlington Mall	8	9	3:20 PM 6:00 PM	5:50 AM 9:02 PM	0	0	N/A	N/A	412	-	-
	MBTA Route 354 (Express)		Van De Graff, S. Bedford St	20	15	6:15 AM 8:15 PM	5:35 AM 6:00 PM	0	0	N/A	N/A	728	-	-

Municipality	Provider / Route	Fares (One Way)*	Major Stops/Service Areas (within Municipality)	Number of Weekday Bus Trips within Community		Weekday Bus Scheduled Departure Times		Number of Saturday Bus Trips within Community		Saturday Bus Scheduled Departure Times		Average Daily Ridership by Route (entire route)		
				Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Weekday	Saturday	Sunday
Chelmsford	Lowell Regional Transit Authority Route 5	$1.00 Local, $1.50 two or more communties; transfers $0.50. Senior and Disabled discount 50%	Technology Dr, Drum Hill	30	30	6:30 AM 6:30 PM	6:00 AM 8:36 PM	11	11	7:45 AM 5:55 PM	8:05 AM 6:15 PM	665	144	-
	Lowell Regional Transit Authority Route 15		IBM, Residence Inn, Vallley Mkt Place, Nashoba Tech	10	11	6:30 AM 6:30 PM	6:00 AM 8:36 PM	7	7	7:30 AM 4:30 PM	8:10 AM 5:10 PM	185	40	-
	Lowell Regional Transit Authority Route 16		Drum Hill, Village Sq, Radisson Hotel, Khol's Plaza	12	12	6:45 AM 7:15 PM	6:00 AM 8:00 PM	10	10	8:00 AM 5:00 PM	8:45 AM 5:45 PM	230	120	-
	Lowell Regional Transit Authority Route 17		Senior Center, Vinal Sq, Technology Dr., Drum Hill	14	15	6:20 AM 6:45 PM	6:00 AM 7:10 PM	10	11	8:00 AM 5:00 PM	7:55 AM 5:55 PM	310	100	-
Lexington	Lexpress Route 1	$2.75. No joint tickets or passes with other services	Depot Square, Community Center, Fottler Ave, Lillian Rd, Arlington Hights	12	Loop Route	6:35 AM 6:00 PM	N/A	0	0	N/A	N/A	20	-	-
	Lexpress Route 2		Depot Square, Community Center, Lexington Hill, Clarke School, Vynebrooke Village	11	Loop Route	7:00 AM 5:30 PM	N/A	0	0	N/A	N/A	90	-	-
	Lexpress Route 3		Depot Square, Lahey Clinic, Lexington Ridge, Lincoln St, Hayden Rec Center	12	Loop Route	6:35 AM 6:00 PM	N/A	0	0	N/A	N/A	50	-	-
	Lexpress Route 4		Depot Square, Greeley Village, Sunny Knoll, Countryside Village	11	Loop Route	7:00 AM 5:30 PM	N/A	0	0	N/A	N/A	30	-	-
	Lexpress Route 5		Depot Square, Lowell & East St., Middlesex Com. Burlington Mall, Fiske School	12	Loop Route	6:35 AM 6:00 PM	N/A	0	0	N/A	N/A	115	-	-
	Lexpress Route 6		Depot Square,Diamond Middle School, Carriage Dr, Estabrook School	11	Loop Route	7:00 AM 5:30 PM	N/A	0	0	N/A	N/A	80	-	-
	MBTA Route 62	$2.00 local, $5.00 Inner Express/$7.00 Outer Express	VA Hospital; South Rd and Great Rd	18	21	5:47 AM 8:05 PM	6:24 AM 8:40 PM	12	12	7:00 AM 7:00 PM	8:00 AM 8:00 PM	1,644	662	-
	MBTA Route 76		Lincoln Lab, Air Terminal, Marrett Rd, 1666 Mass Ave	22	23	6:05 AM 9:30 PM	6:00 AM 10:15 PM	0	0	Combined with Route 62	Combined with Route 62	991	-	-
	128 Business Council - REV Shuttle	Subscription		3	3	6:30 AM 9:90 AM	4:10 PM 7:00 PM	0	0	N/A	N/A	70	-	-

Municipality	Provider / Route	Fares (One Way)*	Major Stops/Service Areas (within Municipality)	Number of Weekday Bus Trips within Community		Weekday Bus Scheduled Departure Times		Number of Saturday Bus Trips within Community		Saturday Bus Scheduled Departure Times		Average Daily Ridership by Route (entire route)		
				Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Weekday	Saturday	Sunday
Lowell	Lowell Regional Transit Authority Route 1 - Christian Hill	$1.00 Local, $1.50 two or more communties; transfers $0.50. Senior and Disabled discount 50%	Christian Hill Neighborhood via Bridge Street	14	15	6:42 AM 6:50 PM	6:00 AM 7:15 PM	10	10	8:00 AM 5:00 PM	8:15 AM 5:15 PM	120	75	-
	Lowell Regional Transit Authority Route 2 - Bevidere		Belvidere Neighborhood via Rogers Street	28	29	6:15 AM 8:20 PM	6:20 AM 8:50 PM	11	11	7:45 AM 5:45 PM	8:20 AM 6:20 PM	430	125	-
	Lowell Regional Transit Authority Route 3 - South Lowell		South Lowell Neighborhood via Lawrence Street	16	17	5:55 AM 6:30 PM	6:15 AM 7:05 PM	10	10	8:00 AM 5:00 PM	8:25 AM 5:25 PM	100	40	-
	Lowell Regional Transit Authority Route 4 - Highlands		Highlands Neighborhood via Stevens Street	19	20	6:10 AM 6:30 PM	5:55 AM 6:55 PM	0	0	Combined with Route 3	Combined with Route 3	305	-	-
	Lowell Regional Transit Authority Route 5 - Westford St.		Wesford Street and Drum Hill	30	30	6:10 AM 8:20 PM	6:00 AM 8:36 PM	11	11	7:45 AM 5:55 PM	8:05 AM 6:15 PM	665	145	-
	Lowell Regional Transit Authority Route 6 - Broadway		Broadway - Umass South Campus	21	21	6:05 AM 5:45 PM	6:20 AM 6:00 PM	10	10	8:00 AM 5:00 PM	8:20 AM 5:20 PM	135	45	-
	Lowell Regional Transit Authority Route 7 - Pawtucketville		Pawtucket Neighborhood - Umass North Campus	28	29	5:55 AM 8:20 PM	5:50 AM 9:00 PM	11	11	7:45 AM 5:50 PM	8:20 AM 6:25 PM	775	175	-
	Lowell Regional Transit Authority Route 8 - Centralville		Centralville Neighborhood via Bridge Street & West 6th	18	19	6:05 AM 7:40 PM	6:10 AM 8:00 PM	0	0	Combined with Route 1	Combined with Route 1	290	-	-
	Lowell Regional Transit Authority Route 9 - Downtown Circulator		Downtown Lowell	22	Loop Route	6:10 AM 8:20 PM	N/A	0	0	Combined with Route 6	Combined with Route 6	130	-	-
	Lowell Regional Transit Authority Route 10 - Dracut/Tyngsborough		Christian Hill Neighborhood and Centralville Neighborhood	13	14	6:35AM 7:00 PM	6:10 AM 7:35 PM	10	10	8:30 AM 5:30 PM	9:15 AM 6:15 PM	165	50	-
	Lowell Regional Transit Authority Route 11 - Tewksbury/IRS		Belvidere Neighborhood via Andover Street	4	4	6:00 AM 4:00 PM	6:30 AM 4:30 PM	0	0	N/A	N/A	25	-	-
	Lowell Regional Transit Authority Route 12 - Tewksbury via Rte38		Belvidere Neighborhood, Lowell General Hospital (Saint's Campus)	13	14	7:00 AM 7:10 PM	6:45 AM 8:00 PM	11	11	7:00 AM 5:00 PM	7:45 AM 5:45 PM	355	195	-

Municipality	Provider / Route	Fares (One Way)*	Major Stops/Service Areas (within Municipality)	Number of Weekday Bus Trips within Community		Weekday Bus Scheduled Departure Times		Number of Saturday Bus Trips within Community		Saturday Bus Scheduled Departure Times		Average Daily Ridership by Route (entire route)		
				Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Weekday	Saturday	Sunday
Lowell (cont)	Lowell Regional Transit Authority Route 13 - Billerica	$1.00 Local, $1.50 two or more communties; transfers $0.50. Senior and Disabled discount 50%	Edson Cemetery Neighborhood	14	16	6:30 AM 6:30 PM	5:50 AM 7:10 PM	10	10	7:30 AM 4:30 PM	8:10 AM 5:10 PM	320	105	-
	Lowell Regional Transit Authority Route 14 - Burlington Mall and Lahey Clinic		Meadow Brook Plaza - Edson Cemetery	14	14	6:00 AM 7:00 PM	7:00 AM 8:00 PM	10	10	8:00 AM 5:00 PM	8:55 AM 5:55 PM	510	265	-
	Lowell Regional Transit Authority Route 15 - Chelmsford / Westford		Edson Cemetery Neighborhood	10	11	6:30 AM 6:30 PM	6:00 AM 8:36 PM	7	7	7:30 AM 4:30 PM	8:10 AM 5:10 PM	185	40	-
	Lowell Regional Transit Authority Route 16 - Chelmsford Center		Meadow Brook Plaza - Chelmsford Street	12	12	6:45 AM 7:15 PM	6:00 AM 8:00 PM	10	10	8:00 AM 5:00 PM	8:45 AM 5:45 PM	230	120	-
	Lowell Regional Transit Authority Route 17 - N. Chelmsford		Middlesex Street - Drum Hill	14	15	6:20 AM 6:45 PM	6:00 AM 7:10 PM	10	11	8:00 AM 5:00 PM	7:55 AM 5:55 PM	310	100	-
	Lowell Regional Transit Authority Route 18 - Downtown Shuttle		Downtown Lowell	64	65	5:30 AM 9:15 PM	5:30 AM 9:30 PM	24	24	7:30 AM 7:00 PM	7:30 AM 7:00 PM	570	120	-
	Merrimack Valley Transit Authority Route 41 Lowell/Lawrence bus	$1.00 CharlieCard, $1.25 Cash. Senior and Disabled discount 50%	Kennedy Center, UML Inn and Conference Center	28	29	5:00 AM 6:00 PM	5:40 AM 7:40 PM	11	12	7:40 AM 6:40 PM	7:00 AM 6:00 PM			
	MBTA Commuter Rail	$10.00 - Zone 6 to Boston $2.75 - 1 Interzone to North Billerica	Gallagher Terminal / Kennedy Bus Hub	24	25	5:35 AM 12:15 AM	5:35 AM 11:05 PM	24	24	8:00 AM 11:30 PM	7:00 AM 9:00 PM	11,965	3,789	2,597
Tewksbury	Lowell Regional Transit Authority Route 11	$1.00 Local, $1.50 two or more communties; transfers $0.50. Senior and Disabled discount 50%	495 Business Center, Residence Inn, Holiday Inn	4	4	6:00 AM 4:00 PM	6:30 AM 4:30 PM	0	0	N/A	N/A	25	-	-
	Lowell Regional Transit Authority Route 12		Walmart Plaza, Town Center, State Hospital, Market Basket Plaza	13	14	7:00 AM 7:10 PM	6:45 AM 8:00 PM	11	11	7:00 AM 5:00 PM	7:45 AM 5:45 PM	355	195	-

Municipality	Provider / Route	Fares (One Way)*	Major Stops/Service Areas (within Municipality)	Number of Weekday Bus Trips within Community		Weekday Bus Scheduled Departure Times		Number of Saturday Bus Trips within Community		Saturday Bus Scheduled Departure Times		Average Daily Ridership by Route (entire route)		
				Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Weekday	Saturday	Sunday
Tyngsborough	Boston Express	$12.00 to South Station $17.00 to Logan Airport	Rte 3 - Exit 35 Park & Ride Lot	15		8:10 AM 10:25PM	5:20 AM 8:30 PM	10	10	8:10 AM 10:25PM	5:30 AM 8:30 PM	N/A	N/A	N/A
	Lowell Regional Transit Authority Route 7	$1.00 Local, $1.50 two or more communties; transfers $0.50. Senior and Disabled discount 50%	Greater Lowell Vocational High School	28	29	5:55 AM 8:20 PM	5:50 AM 9:00 PM	11	11	7:45 AM 5:50 PM	8:20 AM 6:25 PM	780	180	-
	Lowell Regional Transit Authority Route 10		Lakeview Apts, Duke's Pub, Ayott's	12	15	6:45 AM 7:15 PM	6:00 AM 8:00 PM	10	10	8:00 AM 5:00 PM	8:45 AM 5:45 PM	230	120	-
	Lowell Regional Transit Authority Route 17		Innovation Academy Charter School	14	15	6:20 AM 6:45 PM	6:00 AM 7:10 PM	10	11	8:00 AM 5:00 PM	7:55 AM 5:55 PM	310	100	-