Existing Conditions Memorandum

Beyond Lechmere Northwest Corridor Project

Boston, Cambridge, Somerville, Medford, Massachusetts

Prepared for **Massachusetts Bay Transportation Authority**
Boston, MA

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Description of Study Area

The purpose of the Beyond Lechmere Northwest Corridor Project is to define the most appropriate transit strategy investment for improving mobility and regional access for residents in the northwest corridor communities of East Cambridge, Somerville and Medford. Traffic congestion, mode transfer, and service delays hamper access to downtown Boston and to employment and services. The Beyond Lechmere Northwest Corridor Project will investigate cost-effective transit solutions that will increase transit accessibility, improve corridor mobility, increase transit ridership, improve regional air quality and support opportunities for smart growth initiatives and sustainable development.

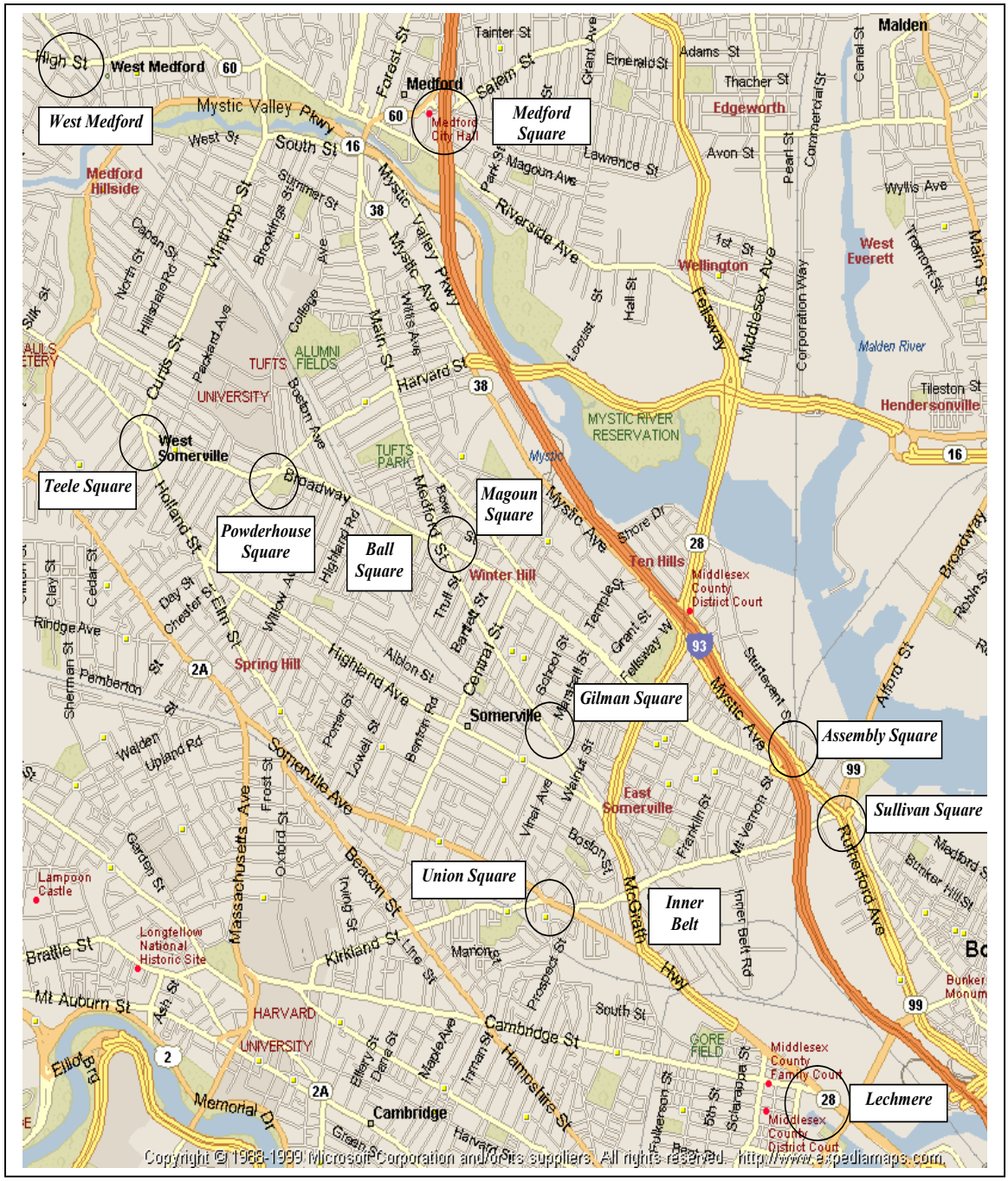
The study area for the "Beyond Lechmere" Project is generally bound by Interstate 93 and the Orange Line to the east, the Red Line and Fitchburg Commuter Rail Line to the west and south, and West Medford to the north. This area includes a small part of East Cambridge, a large segment of Somerville, and portions of Medford.

The geographic coverage of the study area includes primarily two communities – Somerville and Medford. Somerville is an urban city of approximately 4.1 square miles with a large industrial base. It is a city of neighborhoods, each with a distinct character. With a population of 76,210, its density is 18,543 people per square mile. Medford is a suburban city with a close proximity to Boston. With an area of approximately 8.1 miles and a population of 57,407, it has a density of 7,052 people per square mile. Both cities have a large base of commuters and transit users. In Somerville, over 25 percent of the residents use public transit services. In Medford, 18 percent of the residents use transit.

Many of the neighborhoods in Cambridge, Somerville, and Medford are focused on neighborhoods or "squares", where commercial activity serving surrounding residential areas is focused. Residents often walk to and from these commercial areas to meet their daily commerce needs. Examples of the neighborhoods within the study area are:

- Lechmere
- Inner Belt/Cobble Hill/Brickbottom
- Union Square

- Gilman Square
- Magoun Square
- Ball Square
- Powderhouse Square
- Teele Square
- West Medford



East and west of the study area, transit markets are effectively served by rapid transit facilities. The Red and Orange Lines provide high-capacity transit services that are well-utilized. The Orange Line offers parking facilities at Oak Grove, Wellington, and Sullivan Square Stations. The Red Line has a major parking structure available at Alewife Station in Cambridge. The Red Line also serves intermediate stations at Porter Square in Cambridge and Davis Square in Somerville.

Commuter rail service through the study area is provided via the MBTA's Fitchburg Commuter Rail Line at Porter Square. North of the study area, commuter rail service is provided via the MBTA's Lowell Line, also known as the New Hampshire Main Line. The closest commuter rail station on the Lowell Line to downtown Boston is located in West Medford. Guilford Rail System (GRS) operates freight service over both the Fitchburg and Lowell Lines.

The MBTA operates bus routes in or near the study area. The quality of bus service in the study area is good; however, schedule adherence is always a challenge. Heavy traffic congestion in Union Square and Davis Square causes delays, resulting in missed or late trips.

These rail and bus services provide each of their market areas with high quality and effective public transportation. Any transit improvements to be considered for this study will need to take each of these modes into consideration and not adversely impact the high quality and effectiveness of the service.

In addition to roadway and transit systems, walking and bicycling are important modes of transportation within the study area.

Source Documents

In compiling the information provided in this document a number of sources were utilized. The following is a brief summary of the source documents:

- Assembly Square Mixed-Use District, City of Somerville Office of Housing and Community Development , 2004
- Beyond Lechmere Alternatives Evaluation Report, MBTA/Lane, Frenchman, and Associates/Fay Spofford and Thorndike, Inc., 1984
- Boston Region MPO: Regional Transportation Plan 2004-2025, Boston Metropolitan Planning Organization Region, 2003
- Changes to Service Delivery Policy, Massachusetts Bay Transportation Authority, Adopted December 2002.
- Circumferential Transportation Improvements in the Urban Ring Corridor - Expanded Environmental Notification Form (ENF), Earth Tech, 2001

- Circumferential Transportation Improvements in the Urban Ring Corridor - Phase Two Draft Environmental Impact Report/Statement (DEIR/S) Scoping Summary Report, EarthTech, 2001
- Evaluation of Transit Alternatives Beyond Lechmere Station, MBTA, 1981
- Inner Belt Planning Study - Technical Memorandum I: Existing Conditions, City of Somerville Office of Housing and Community Development, 2001
- Load Profiles, MBTA Comprehensive Ridecheck Program, Winter 1997/1998 through Winter 2003.
- MassHighway Accident Database, 1998 - 2002
- MassHighway 2002 Traffic Volume Database
- MBTA Bus and Train Service Schedules, www.mbta.com, June 2004.
- MBTA Commuter Rail Train Audit, Massachusetts Bay Commuter Railroad Company, December 2003.
- MBTA Reverse Commuting Study, Central Transportation Planning Staff, 2001.
- McGrath Highway Corridor - Technical Memorandum 1: Existing Conditions, City of Somerville Office of Housing and Community Development, 2002
- North Point Somerville - Planning Study, ICON Architects/FMX Associates/Bruce Campbell and Associates/City of Somerville Office of Housing and Community Development, 2003
- Preliminary 2004 Service Plan: Proposed Bus Service and Service Policy Modifications, Massachusetts Bay Transportation Authority, 2004.
- Ridership and Service Statistics, Eighth Edition, Massachusetts Bay Transportation Authority, 2001.
- Service Delivery Policy, Massachusetts Bay Transportation Authority, Sept., 1996
- Somerville Community Path Feasibility Study, Rizzo Associates/ICON Architecture, 2001
- Streetcar Lines of the Hub, Clarke, Bradley H., Boston Street Railway Association, 2004
- Streetcar Suburbs, Warner, Samuel, Harvard University Press, 1962
- Transportation Element for the Somerville Community Development Plan: Crashes 1995-1999, Central Transportation Planning Staff.

- Truck Traffic Study in the City of Somerville for the Department of Traffic & Parking, Bayside Engineering, 2001
- Union Square Master Plan, Bluestone Planning Group, 2003
- Union Square Transportation Plan, Executive Summary City of Somerville Office of Housing and Community Development / Edwards and Kelcey

Demographics and Travel Behavior

Data from the 1990 and 2000 U.S. Census were reviewed to identify population, employment, and travel behavior within the study area. The data were gathered for Cambridge, Medford, and Somerville. Although Somerville forms the majority of the study area, data from Cambridge, Medford, and, in some instances, Boston are included since improved transit services are likely to connect to these cities.

Population and Health

Table 1-1 shows the relationship between population, land area and population density for the cities of Cambridge, Medford, and Somerville.

Table 1-1 – Population and Demographics

	Municipality of Residence		
Category	**Cambridge**	**Medford**	**Somerville**
Population	101,500	55,750	77,500
Percentage of Total Population			
Under 18 years	13.3%	17.9%	14.8%
18 to 24 years	21.2%	11.0%	15.9%
25 to 44 years	38.6%	32.6%	42.6%
45 to 64 years	17.8%	21.2%	16.2%
65 years and over	9.2%	17.3%	10.5%
Land Area (square mile)	6.4	8.1	4.1
Population Density (pop./sq. mile)	15,750	6,750	19,000
Median Resident Age (years)	30.4	37.5	31.1
Median Household Income	$47,979	$52,476	$46,315
Median House Value	$398,500	$226,800	$214,100

Sources:
* Data from 2000 Census

On the following page, Table 1-2 summarizes data gathered from the Massachusetts Department of Public Health's (DPH) Mass Community Health Information Profile (MassCHIP) for Cambridge, Medford, and Somerville, as well as statewide. Also included in the table are key chronic disease objectives (target rates) set forth by DPH. Each community's current rate can be compared to the target rate.

Table 1-2 – Population and Health Status Indicators

		Statewide Percent	Cambridge Percent	Medford Percent	Somerville Percent
Demographic Indicators*					
Per Capita Income		$25,952	$31,156	$24,707	$23,628
Population below 100% of poverty level		9.3	12.9	6.4	12.5
Population below 200% of poverty level		21.7	27.8	18.7	26.6
Children less than 18 years of age living below the 100% of poverty line.		12.0	15.6	6.1	15.2
Unemployed Person age 16 and older		5.3	3.8	4.6	4.5
White non-Hispanic persons		83.9	67.9	87.2	77.7
Black non-Hispanic persons		5.3	12.1	6.2	6.6
Hispanic persons		6.8	7.4	2.6	8.8
Asian persons		3.9	12.4	4.0	6.8
		Actual			
	Target Age-adjusted Rate**	**Statewide Age-adjusted Rate****	**Cambridge Age-adjusted Rate****	**Medford Age-adjusted Rate****	**Somerville Age-adjusted Rate****
Chronic Disease Indicators					
Total cancer deaths	------	202.4	186.4	215.4	233.9
Cardiovascular disease deaths	-----	284.2	270.8	259.3	253.5
Hospital Discharges for Primary Care Manageable Conditions					
Asthma	-----	130.8	123.1	126.6	137.7
Chronic Disease Objectives					
Reduce the overall cancer death rate. (All types of cancer)	44.9	202.4	186.4	215.4	233.9
Reduce asthma deaths - under 5 years of age ***	0.1	0.3	0.0	0.0	0.0
Reduce asthma deaths - ages 5 to 14 years .***	0.1	0.4	0.0	0.0	0.0
Reduce asthma deaths - ages 15 to 34 years.***	0.2	0.5	2.1	0.0	0.0
Reduce asthma deaths - ages 35 to 64 years.***	0.9	1.3	6.3	4.9	0.0
Reduce asthma deaths - ages 65 years or older.***	6.0	4.5	10.8	0.0	0.0
Reduce hospitalizations for asthma - under 5 years of age.****	250.0	346.1	290.3	404.7	400.7
Reduce hospitalizations for asthma - age 5 to 64 years.****	77.0	105.6	71.8	87.7	88.0
Reduce hospitalizations for asthma - 65 years and older.****	110.0	173.6	162.8	165.6	233.3
Chronic obstructive pulmonary diseases - ages 45 years and older.	60.0	121.7	95.3	116.5	116.1

Notes:

*2000 Census Counts or Sampling Data - most recent population estimates

Denominator for persons age less than 18 and living in poverty is all persons age less than 18.
Unemployment rate: all unemployed persons in labor force divided by all persons in labor force.
AFDC recipients percent denominator is persons age less than 65 (eligible population based on age)
Multiple Assistance Unit recipients percent denominator is persons less than age 25 (eligible population based on age)

**Age adjusted rates: A procedure for adjusting rates, designed to minimize the effects of age differences in age distributions when comparing rates for different populations. Age-adjusted rates are expressed per 100, 000 persons. For standardization within Mass Community Health Information Profile (MassCHIP) the standard population used is the 2000 US population.

***Objective has been reworded, but it maintains its meaning. Objectives seek a rate of death per 1.0 million. The modified definition converts the rate of deaths per 100,000.

****MassCHIP can only approximately measure the objective. Hospital discharges data set does not includeemergency room visits, where many cases of asthma are seen. Objectives have been reworded, but maintain the same meaning. The objectives seek a rate of hospitalizations per 10,000. The modified definition converts the rate to deaths per 100,000.

Population and Employment

Table 1-3 shows the relationship between population and employment for the cities that will be served by improved transit in the study area. A resident to job ratio is also shown to give an indication of whether the city is a net-importer or exporter of workers. This relationship is important in terms of understanding how improved transit will serve the community. In other words:

- Will it help residents of city access employment opportunities elsewhere?
- Will it help workers reach the employment opportunities in a city?
- Will it do both?

These data consider only the existing flows of commuters between the cities. Improved transit service could change these patterns by opening up new opportunities for housing and employment in the study area.

Table 1-3 – Population and Employment

	Municipality of Residence			
Category	**Cambridge**	**Medford**	**Somerville**	**Boston**
Population*	101,500	55,750	77,500	589,000
Employment**	113,500	19,000	23,000	578,500
Resident to Job Ratio	0.89	2.93	3.37	1.02

Sources:
* Data from 2000 Census Minor Civil Division (MCD) Journey to Work Tables
** Data from the Mass Division of Employment and Training (DET) for 2001

From this table, the following is indicated:

- Boston's population and employment are over five times those of the other three cities. Boston is almost equal in number of residents and workers in the city.
- Cambridge is the second largest city in population and employment. Unlike Boston, Cambridge has more workers than residents, indicating that it is a net importer of workers.
- Somerville is the third largest of these cities; however, it has three times more residents than workers, indicating that it is a net exporter of workers.
- Medford is the smallest city in population and employment and, like Somerville, is a net exporter of workers.

Travel Behavior for Residents

Table 1-4 presents the travel characteristics of residents in each of the cities.

Table 1-4 –Travel Behavior for Residents

	Municipality of Residence			
Category	**Cambridge**	**Medford**	**Somerville**	**Boston**
Population*	101,500	55,750	77,500	589,000
Percent of Resident Labor Force in Cambridge*	46 %	11 %	20 %	6 %
Percent of Resident Labor Force in Medford*	1 %	17 %	4 %	0 %
Percent of Resident Labor Force in Somerville*	2 %	5 %	16 %	1 %
Percent of Resident Labor Force in Boston*	27 %	25 %	28 %	66 %
Percent of Residents who Work in Study Area	76 %	58 %	68 %	73 %
Percent of Residents who Work Beyond the Study Area	24 %	42 %	32 %	27 %
Mode to Work for Residents*				
Automobile	41 %	75 %	56 %	51 %
Public Transit	25 %	18 %	29 %	32 %
Walk/Bike/Other	29 %	5 %	13 %	15 %
Work at Home	5 %	2 %	2 %	2 %
Total	100 %	100 %	100 %	100 %

Sources:
* Data from 2000 Census Minor Civil Division (MCD) Journey to Work Tables

The table indicates the following travel behaviors for residents in the Study Area:

- **Cambridge –** 46% of Cambridge residents also work in Cambridge, while a small portion of Cambridge residents work in Medford (1 %) or Somerville (2 %). Overall, 76 percent of Cambridge residents work within the Study Area cities. In terms of mode split, only 41 percent of Cambridge residents drive to work, which is the lowest automobile mode share for the four cities. Walking and bicycling are very important modes, carrying 29 percent of commuting trips, which is the highest walk/bike mode share for the four cities. Transit is the third most prevalent mode, carrying 25 percent of commuting trips, which is the third-lowest transit mode share.
- **Medford** - Medford has the highest proportion of people who work outside the Study Area (42 %). Within the Study Area, the largest concentration of employment for Medford residents is in Boston (28 %). A modest number of Medford residents also work in Medford (17 %) and in Cambridge (11 %). The smallest work location percentage for Medford residents is Somerville (5 %). In terms of mode split, Medford residents have the highest reliance on the automobile for commuting trips (75 %) and the lowest walk/bike (5 %) and transit mode shares (18 %).
- **Somerville -** A large portion of Somerville residents work in Cambridge (20 %) and Boston (28 %). Interestingly, Somerville has the smallest percentage of residents who work in their city of residence (16 %). A small percentage of Somerville residents work in Medford (4 %). In terms of mode split, Somerville residents rely more heavily (29 %) on public transit for commuting trips than Cambridge (25 %) or Medford (18 %) residents. The most important commuting mode for Somerville residents is the automobile, which carries 56 percent of trips. Walking and bicycling also carry a large portion of commuting trips with 13 % compared with the other three cities.
- **Boston** - Data shows that a relatively small portion of Boston residents commute to Medford and Somerville (1 %), which will be the focus of improved transit. Employment for Boston residents is concentrated in Boston; although, a moderate portion of Boston residents commute to Cambridge (6 %). These commute patterns are consistent with the well-established transit services on the Green and Red Lines. In terms of mode share, public transit use is most significant in Boston (32 %) when compared to the other cities. While many residents rely on transit for commuting, many also rely on automobile travel. Boston residents' automobile mode share (51 %) is higher than Cambridge's (41 %) and similar to that of Somerville residents (56 %.).

Travel Behavior for Workers

The previous section evaluated the travel behavior of residents in the selected communities. This section enhances the travel pattern profile for the four cities by considering how those who work in these communities travel. The data show how the cities serve as regional employment centers, with travel characteristics more representative of the metropolitan region than the urban core. Table 1-5 presents the travel characteristics of workers in each of the cities.

Table 1-5 –Travel Behavior Data for Workers

	Municipality of Workplace			
Category	**Cambridge**	**Medford**	**Somerville**	**Boston**
Employment**	113,500	19,000	23,000	578,500
Percent of Workers who Live in Cambridge*	22 %	2 %	6 %	3 %
Percent of Workers who Live in Medford*	3 %	25 %	6 %	1 %
Percent of Workers who Live in Somerville*	8 %	8 %	31 %	2 %
Percent of Workers who Live in Boston*	14 %	7 %	9 %	36 %
Percent of Workers who Live in the Study Area	47 %	42 %	52 %	42 %
Percent of Workers who Live Beyond Study Area	53 %	58 %	48 %	58 %
Mode to Work for Workers***				
Automobile	63 %	83 %	73 %	56 %
Public Transit	21 %	8 %	11 %	34 %
Walk/Bike/Other	14 %	9 %	12 %	9 %
Work at Home	2 %	3 %	4 %	1 %
Total	100 %	100 %	100 %	100 %

Sources:
* Data from 2000 Census Minor Civil Division (MCD) Journey to Work Tables
** Data from the Mass Division of Employment and Training (DET) for 2001
*** Data from 1990 Census Transportation Planning Package (CTPP) Data (2000 Data Not Available at this Time)

The table indicates the following travel behaviors for workers in the Study Area:

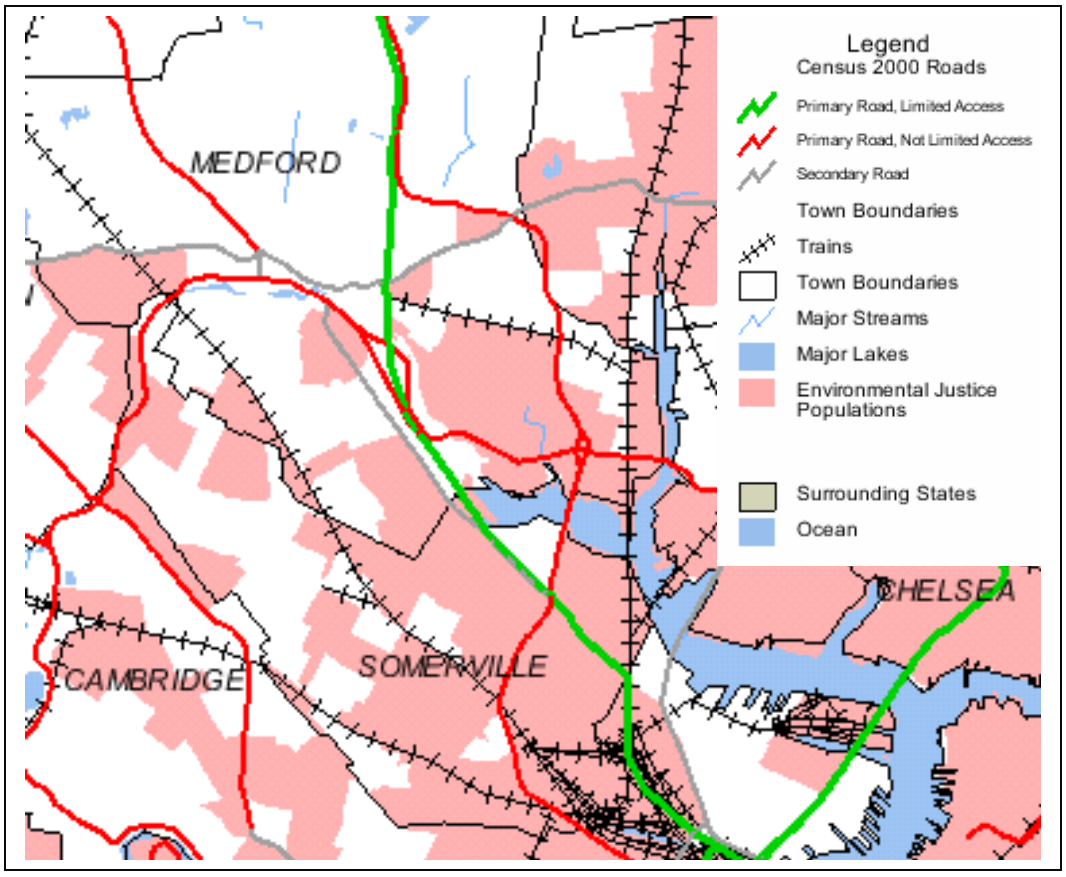
- **Cambridge –** A smaller portion of Cambridge workers live in Cambridge (22 %) than in any of the four Study Area cities. The table also shows that a small portion of Cambridge workers live in Medford (3 %). A modest number of Cambridge workers live in Somerville (8 %) and Boston (14 %). Overall, less than half (47 %) of Cambridge workers live in the four cities. In terms of mode split, 63 percent of Cambridge workers drive to work, which is the substantially higher than the commuting automobile mode share for Cambridge residents (41 %), but the second lowest of the four cities. Transit is the second most prevalent mode, carrying 21 percent of commuting trips, which is the second-highest transit mode share for workers. Walking and bicycling are very important modes, carrying 14 percent of commuting trips, which is the highest walk/bike mode share for workers in the four cities.
- **Medford** - Medford has highest proportion of workers who live beyond the Study Area cities (58 %). The largest concentration of residential locations for Medford workers is in their own community (25 %). A modest number of Medford workers live in Somerville (8 %) and in Boston (7 %). The smallest residential location percentage for Medford workers is Cambridge (2 %). In terms of mode split, Medford has the highest reliance on the automobile for workers' commuting trips (83 %) and the lowest walk/bike (9 %) and transit mode shares (8 %).
- **Somerville -** A large portion of those who work in Somerville also reside there (31 %). Moderate portions live in Medford (6 %), Cambridge (6 %), and Boston (9 %). In terms of mode split, Somerville workers rely more heavily (11 %) on public transit for commuting trips than Medford (8 %) workers. The most important mode commuting Somerville workers is the automobile, which carries 73 % of trips. Walking and bicycling also carry a large portion of commuting trips with 12 %, which is consistent with the walk/bike mode share for Somerville residents discussed in the previous section.
- **Boston** - A relatively small portion of Boston workers commute from Cambridge (3 %), Medford (1 %), and Somerville (2 %). Residence locations for Boston workers are concentrated in Boston with 36 percent. In terms of mode share, public transit use is most significant for Boston workers (34 %) when compared to the other cities. While many workers rely on transit for commuting, many also rely on automobile travel. Boston's automobile mode share for workers (56 %) is the lowest of the selected cities. However, the walk/bike mode share for employment in Boston is the lower than both Cambridge (14 %) and Somerville (12 %).

Environmental Justice Populations

Environmental Justice is an important element of policy making in transportation planning. Environmental Justice efforts focus on improving the environment in under served communities, specifically minority and low-income communities; addressing disproportionate adverse environmental impacts that may exist in those communities; and providing opportunities for racial and ethnic minorities to participate in the decision making process. The federal government has identified Environmental Justice as an important goal in transportation. Local and regional governments are also incorporating Environmental Justice into transportation programs.

The data used to analyze Environmental Justice compliance are generally based on 2000 U.S. Census data. The "Block Group level" is the smallest geographic area for which income, race, and ethnicity data are available from the U.S. Bureau of the Census. The characteristics of the population within the Study Area are compared to thresholds established by the state, municipality, or MPO. The analysis identifies minority population, Hispanic population and low-income populations.

The study area for the Beyond Lechmere Northwest Corridor Project includes a number of Environmental Justice Populations. MASSGIS mapping developed by the EOEA indicates that portions of Cambridge, Somerville and Medford include EJ populations.



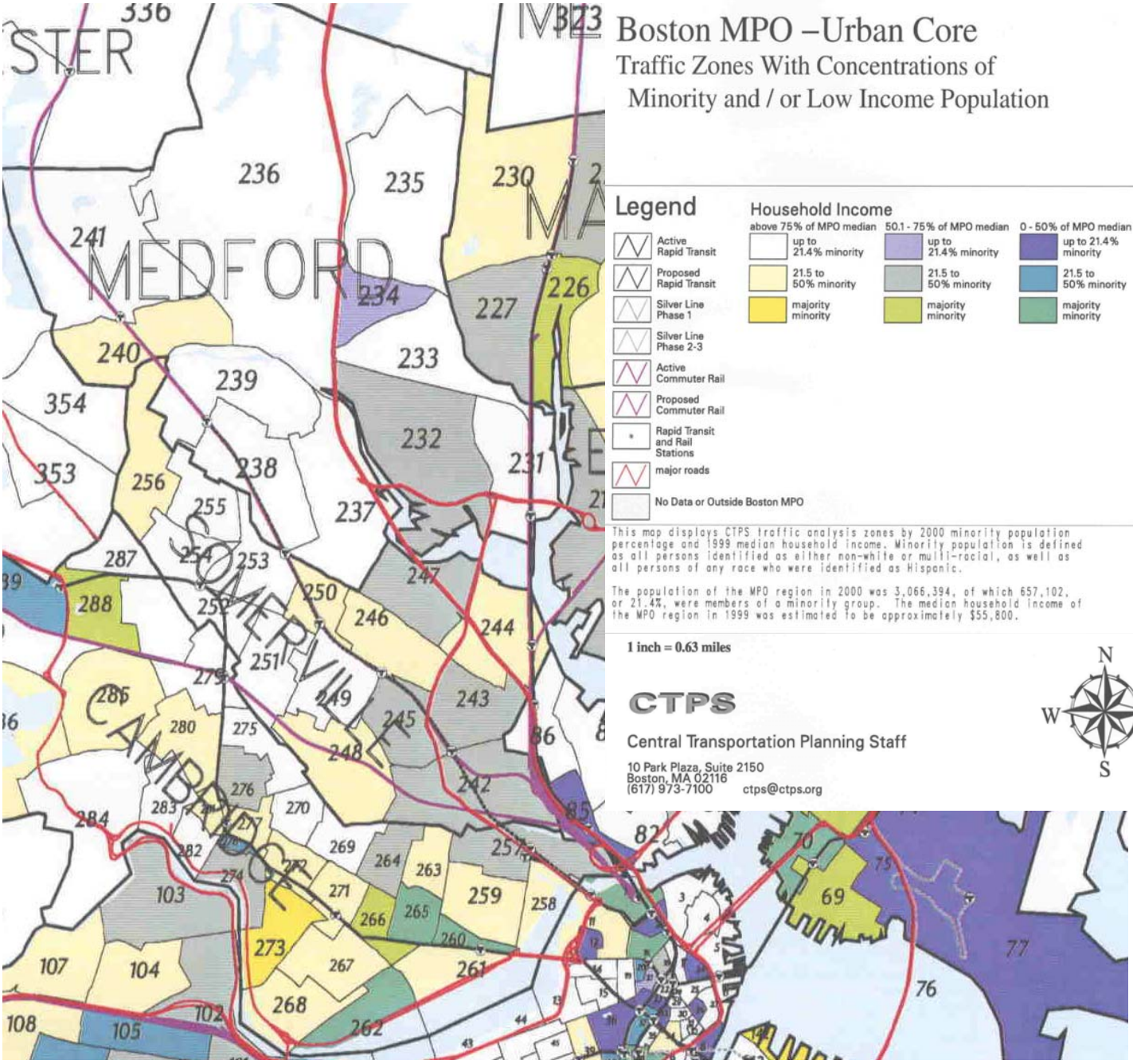
The Boston Region MPO has also compiled profiles of the Environmental Justice Communities of Concern as part of the Regional Transportation Plan 2004-2025. Cambridge and Somerville have been identified as populations of concern, or target populations. Medford was not identified as a target population. These target neighborhoods, identified in terms of their traffic analysis zones (TAZs), are shown on the graphic on the following page.

The Environmental Justice Community of Concern in Cambridge includes traffic analysis zones (TAZs) 265, 266 and 288. TAZ 265 and 266 are located east of the Central Square Red Line Station, north of Massachusetts Avenue and south of Hampshire Street. TAZ 288 is located east of the Alewife Red Line Station. Statistics on the population encompassing these TAZs include:

- Over 9,600 people live in these neighborhoods.
- Over 67% of the population consists of minorities.
- The median income within the individual TAZs ranges from $26,044 to $35,500.
- Approximately 60% of the households own one or more vehicles.
- Journey-to-work mode split for automobiles is 37%.
- The unemployment rate ranges from 5.8% to 7.9% in these TAZs.

The neighborhoods in Somerville that comprise the EJ Community of Concern include TAZ 242, 243 and 245. This area is bounded by I-93 on the east, Cambridge on the south, Union Square on the west and Broadway on the north. Statistics on the population encompassing these TAZs include:

- Over 15,000 people live in these neighborhoods.
- Over 40% of the population consists of minorities.
- The median income within the individual TAZs ranges from $34,466 to $37,036.
- Approximately 71% of the households own one or more vehicles.
- Journey-to-work mode split for automobiles is 62%.
- The unemployment rate ranges from 3.1% to 3.5% in these TAZs.


Boston MPO –Urban Core
Traffic Zones With Concentrations of
Minority and / or Low Income Population
Legend
Household Income
above 75% of MPO median
50.1 - 75% of MPO median
0 - 50% of MPO median
Active Rapid Transit
Proposed Rapid Transit
Silver Line Phase 1
Silver Line Phase 2-3
Active Commuter Rail
Proposed Commuter Rail
Rapid Transit and Rail Stations
major roads
No Data or Outside Boston MPO
up to 21.4% minority
21.5 to 50% minority
majority minority
This map displays CTPS traffic analysis zones by 2000 minority population percentage and 1999 median household income. Minority population is defined as all persons identified as either non-white or multi-racial, as well as all persons of any race who were identified as Hispanic.
The population of the MPO region in 2000 was 3,066,394, of which 657,102, or 21.4%, were members of a minority group. The median household income of the MPO region in 1999 was estimated to be approximately $55,800.
1 inch = 0.63 miles
CTPS
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N
W
E
S
MEDFORD
SOMERVILLE
CAMBRIDGE

Transportation needs and burdens in Somerville identified by the Boston MPO include:

- Commuter rail lines pass through the community without providing access to their service.
- Congestion exists on local streets, particularly on Route 28.
- There is a need to provide for and be sensitive to local languages in outreach efforts.
- There is a high transit usage in the area, despite the lack of rapid transit service around Union Square.
- There is a need for additional services, such as radial bus connections to employment centers.
- More off-peak bus service is needed.
- Protect low-cost housing stock to mitigate potential gentrification impacts of additional transit investment.

It is the goal of this project that improvements to transit services will provide benefits to these Environmental Justice populations in terms of air quality, mobility, and access to areas.

Roadways

As mentioned above, a network of arterial and local roadways serves the study area. In general, the arterial roadways provide connections between the key activity centers within and beyond the area. Many of these arterial roadways also serve as commuter routes between more distant suburbs and the core business districts of Cambridge and Somerville. Intersections of these major arterial roadways often form the major commercial centers. Local roadways link residential areas to the arterials, and sometimes serve as cut-through routes to avoid traffic congestion during peak periods. Major roadways and the connections they serve are described below.

- **Interstate 93** is the only interstate highway near the study area, running from the Massachusetts/New Hampshire border near Methuen to Canton where it terminates at I-95. I-93 forms the southeastern boundary of the study area and serves as a major commuting route from the northern suburbs to downtown Boston. The only access to I-93 inbound near the study area is at the Route 28/38 intersection, adjacent to the Assembly Square Mall. Access from I-93 northbound is also possible at the Route 28/38 intersection and at a recently completed exit ramp to Cambridge Street/Washington Street near Sullivan Square on the Boston/Somerville city line. Access to and from I-93 north of

the study area is available at the Mystic Avenue interchange on the Somerville/Medford city line. Supplemental connections between the study area and I-93 are also possible via Rutherford Avenue in Charlestown and via Leverett Circle in Boston. In the study area, I-93 carries nearly 150,000 vehicles per day with an average of 125 auto accidents per year.

- **Route 28/McGrath-O'Brien Highway** is a major multilane arterial that provides alternative connections from I-93 to Cambridge and downtown Boston. To the north of the study area, Route 28 is known as the Fellsway, which traverses Medford. To the south of the study area, Route 28 travels though Leverett Circle where connections are possible to the interstate system and Storrow Drive. Route 28 also provides important circulation functions within the study area linking Medford and the Assembly Square neighborhood to Winter Hill, East Somerville, and East Cambridge. Near Lechmere Station, Route 28 carries over 40,000 vehicles per day. Approximately 170 auto accidents occur along this corridor annually.
- **Route 38/Mystic Avenue** parallels I-93 offering access to commercial areas in Somerville and Medford and providing links to I-93 entrance and exit ramps. Mystic Avenue begins near Medford Square and ends near Sullivan Square in Charlestown. Mystic Avenue is generally a four-lane arterial carrying approximately 35,000 vehicles per day. Approximately 205 auto accidents occur annually along this corridor.
- **Route 16/Mystic Valley Parkway** travels through the northern section of the study area in an east-west direction linking Wellington Station and Alewife Station. Route 16 is generally a four-lane arterial roadway carrying approximately 20,000 vehicles per day. The corridor averages 236 auto accidents annually.
- **Route 60/High Street** travels through the northern section of the study area in an east-west direction linking Medford Square and Winthrop Square to West Medford. Route 60 is two-lane arterial roadway carrying approximately 18,000 vehicles per day with approximately 90 auto accidents a year.
- **Broadway** crosses the study area in a northwest-southeast direction linking Powderhouse Square near Tufts University to East Somerville and Sullivan Square via the Winter Hill neighborhood. Between Powderhouse Square and Sullivan Square, Broadway is generally a four-lane arterial roadway carrying between 20,000 and 30,000 vehicles per day. The corridor averages approximately 195 auto accidents a year.

- **Washington Street** runs in an east-west direction across the southern portion of the study area, linking Union Square to Sullivan Square. In general, Washington Street is two-lane arterial roadway carrying approximately 11,000 vehicles per day and averaging 120 auto accidents a year.
- **Medford Street** crosses the study area in a north-south direction beginning in Medford Square as Main Street and crosses Harvard Street where it becomes Medford Street. Medford Street then enters Somerville as it crosses Broadway at Magoun Square and continues behind the Somerville City Hall/High School complex where it crosses the MBTA's Lowell Line at Gilman Square. Medford Street continues to the south and runs parallel with Route 28 to the east of Union Square. South of Somerville Avenue, Medford Avenue separates from Route 28, crossing the MBTA's Fitchburg Line and the Grand Junction Branch where it enters Cambridge and becomes Gore Street behind the Twin City Shopping Plaza. Gore Street terminates at Route 28 and the northwest corner of the existing Lechmere Station. In general, Medford Street is a two-lane arterial roadway carrying approximately 21,000 vehicles per day. On an annual average, 80 auto accidents occur along the Medford Street corridor through the City of Somerville.
- **Highland Avenue** crosses the study area in an east-west direction, beginning at Davis Square, passing by Somerville Hospital and the Somerville City Hall/ High School complex and ending at Medford Street near its intersection with Route 28. Highland Avenue serves a critical function in connecting the primary commercial district of Somerville (Davis Square) with its government and medical centers. In many ways, Highland Avenue is a symbolic "Main Street" for Somerville. Highland Avenue is a two-lane roadway carrying approximately 13,000 vehicles per day, with approximately 90 auto accidents a year.
- **Somerville Avenue** runs in an east-west direction along the MBTA's Fitchburg Commuter Rail Line, beginning at Porter Square and continuing through Union Square. The land uses fronting Somerville Avenue are generally commercial or light industrial with residential neighborhoods located to the north of the roadway. Somerville Avenue ends at Route 28, approximately one mile west of Lechmere Station. Somerville Avenue is a two-lane roadway carrying approximately 8000 vehicles per day, with approximately 140 auto accidents annually.

- **Elm Street** begins at Davis Square and connects to Somerville Avenue just to the east of Porter Square. Elm Street provides an important connection between Davis Square and Union Square via Somerville Avenue. Elm Street generally forms the southwestern edge of the study area and is a two-lane arterial carrying approximately 11,000 vehicles per day, with approximately 40 auto accidents a year.
- **College Avenue** begins at Davis Square and traverses the study area in a southwest-northeast direction. Approximately one-half mile northeast of Davis Square, College Avenue enters Powderhouse Square and turns to the north, traveling through the Tufts University campus crossing Boston Street and ending at Summer Street in the Medford Hillside neighborhood in Medford. College Avenue is generally a two-lane arterial carrying 11,000 vehicles per day. The auto accident rate along this corridor in Somerville is approximately 40 accidents per year.
- **Boston Avenue** enters the study area from West Medford and continues across Somerville and Medford in a northwest-southeast direction. Boston Avenue parallels the MBTA's Lowell Commuter Rail Line and passes near Tufts University at its intersection with College Avenue. Boston Avenue then continues to an intersection with Broadway at Ball Square, where its character changes to that of a neighborhood residential street. Boston Avenue is generally two lanes and carries between 11,000 and 18,000 vehicles per day. Approximately 20 auto accidents occur along the Boston Street corridor within the City of Somerville.
- **Curtis Street/Winthrop Street** begins with Curtis Street at Teele Square to the northwest of Davis Square in Somerville and continues in a north-south direction to the Somerville/Medford City Line on the west side of the Tufts University campus. In Medford the roadway is named Winthrop Street and continues across the Mystic River into West Medford. Curtis Street/Winthrop Street is a two-lane roadway that carries between 8,000 and 10,000 vehicles per day. Approximately 15 auto accidents occur along this corridor annually. Curtis and Winthrop Streets generally form the northwestern boundary of the study area.

Transit Services

The area encompassed by this study has a long history of transit usage and dependency. The Boston region's first street railway consisted of a single car, which began service between Harvard Square and Union Square in Somerville in 1852. Over the next 50 years, routes and services were continuously expanded, typically following existing paths and roadways. By the early 1900's, a network of streetcar lines had evolved that shaped the structural pattern of residential and commercial development throughout the area. The routes also evolved to provide connections to the Main Line Elevated at Sullivan Square As depicted on the accompanying Boston Elevated Railway map circa 1915, in Somerville these streetcar routes encompassed Broadway, Boston Avenue, College Avenue, Highland Avenue, Main Street, Medford Street, Pearl Street, Beacon Street, Summer Street, Washington Street, Somerville Avenue, Webster Avenue, Cross Street, Holland Street and Elm Street The routes also extended north into Medford Square along High Street, Main Street and the Fellsway Line.

Many of these streetcar routes continued in operation into the 1940's, when they were converted to trackless trolley operation. The Clarendon Hill – Lechmere routes on Highland and Somerville Avenues operated upwards of 110 trips per day in the 1940's. These routes are perpetuated today as part of the MBTA's local bus network.

In addition to the local transit services, the Boston & Maine Railroad furnished limited commuter service in Somerville. In Medford, trains on the B&M's New Hampshire Division and the Western Route stopped at several locations in the City.

This section provides an overview of the present-day routes, facilities, service patterns and ridership characteristics of the rapid transit, commuter rail and bus systems in the project area. Within the project study area, these facilities consist of three rapid transit lines, two commuter rail lines and many feeder bus routes.

Bus Service

The MBTA operates twelve bus routes in the project study area. The following is a listing and description of the various bus routes provided by the MBTA.

Route 80: Arlington Center – Lechmere via Powder House Square - The Route 80 is a local route connecting Arlington Center, Medford Hillside, Powder House Square, Magoun Square, Gilman Square and Lechmere Station. Most of this route is within the project study area, traveling along Boston Ave., College Ave., Broadway, Medford St., Pearl St., and the McGrath/O'Brien Hwy.

Route 85: Spring Hill – Kendall / MIT - Route 85 is a local route connecting Spring Hill, Summer Street, Union Square and Kendall / MIT. This route northern section, serving Spring Hill and Summer Street is within the project study area before traveling to Union Square where it runs along the same route as the CT2 to Kendall / MIT.

Route 86: Sullivan Square Station – Cleveland Circle via Harvard / Johnson Gate - This route connects Sullivan Square to Union Square, Harvard Square, Allston, Brighton and Cleveland Circle. The bus travels along Cambridge Street and Washington Street through the project study area providing service between Sullivan Square and Union Square. The MBTA's Preliminary 2004 Service Plan contains a recommendation to split this into two routes, each one starting or ending at Harvard Square to minimize schedule adherence problems. This change would not significantly affect the schedule of the route through the project study area.

No. 87: Arlington Center / Clarendon Hill – Lechmere Station via Somerville Avenue - This route connects Arlington Center, Clarendon Hill, Davis Square, Union Square, and Lechmere Station along Broadway, Elm Street and Somerville Avenue.

No. 88: Clarendon Hill – Lechmere Station via Highland Avenue - This route connects Clarendon Hill, Davis Square, Somerville High School, and Lechmere Station along Broadway, Holland and Highland.

No. 89: Clarendon Hill – Sullivan Square Station via Broadway - This route connects Clarendon Hill and Sullivan Station via Powder House Square and Winter Hill. The MBTA's Preliminary 2004 Service Plan contains a recommendation to split this route by alternating the northerly terminating stop between Davis Square and Clarendon Hill. The new diversion to Davis Square, called 89D, would travel between Sullivan Square and Powder House Square, as it currently does along Broadway, and then turn onto College Ave. to make the trip to Davis Square. This would improve the connection between Winter Hill and the Red Line.

No. 90: Davis Square – Wellington Station via Sullivan Square Station & Assembly Mall - This Route provides service between Davis Square and Wellington Station via Union Square and Sullivan Square.

No. 91: Sullivan Square Station – Central Square Cambridge via Washington Street - Route 91 connects Sullivan Square with Central Square (Cambridge) via Union Square and Inman Square.

No. 94: Medford Square – Davis Square Station via W, Medford & Medford Hillside - This route provides service from Medford Square to Davis Square. This route travels through the project study area along Boston Street and College Ave.

No. 96: Medford Square – Harvard Station via George Street & Davis Square Station - Route 86 operates between Medford Square and Harvard Square with an intermediate stop at Davis Square Station. This route utilizes Boston St. and College Ave. through the project study area just like Route 94, however the trip to Medford Square is much shorter since it travels along Winthrop Street and Main Street in Medford.

No. 101: Malden Station – Sullivan Sq. Station via Salem St., Main St. & Broadway - Route 101 connects Malden Center to Sullivan Square Station via Medford Square and Winter Hill. This route travels along Broadway and Main Street in the project study area.

No. CT2: Sullivan Square Station - Ruggles Station via Kendall / MIT - The CT2 Route is a limited stop, cross-town route that operates between Sullivan Square and Ruggles Station. This route utilizes Cambridge Street and Washington Street to travel between Union Square and Sullivan Square in the project study area.

Bus service frequencies and daily ridership on the project study area bus routes are shown in Table 1-6.

Table 1-6 Bus Service Frequency and Ridership

Route	Daily	Number of Weekday Inbound Bus Trips				
	Ridership	5-9:30am	9:30am-4pm	4-7pm	after 7pm	Total
No. 80	2,095	13	13	8	7	41
No. 85	402	7	9	4	0	20
No. 86	5,139	17	18	8	7	50
No. 87	3,720	14	15	11	11	51
No. 88	4,299	18	16	11	12	57
No. 89	3,586	21	17	6	9	53
No. 90	1,280	5	9	5	4	23
No. 91	1,482	11	15	6	6	38
No. 94	1,343	11	9	9	10	39
No. 96	1,458	12	10	9	10	41
No. 101	4,322	21	14	13	7	55
No. CT2	1,192	9	13	9	0	31

Medford Square Bus Services

In addition to the buses that travel through the Study Project Area utilizing the transit stations as hubs, many bus services use the Medford Square area as a hub to provide connections throughout Medford and to parts of Woburn, Winchester, Malden, Somerville, Cambridge and Boston. Bus routes that serve Medford Square also provide connections to the Red Line (at Davis Square Station and Harvard Station), the Orange Line (at Malden Station, Wellington Station, and Sullivan Square Station) and the Haverhill and Lowell Commuter Rail Lines at West Medford, Winchester Center and Malden Stations. In addition to the local routes, which provide local service and connections with rapid transit stations, there is an express bus service with a stop in Medford Square that provides service to Haymarket Station (Orange and Green Lines) in Boston with a travel time of less than 10 minutes. The bus routes that serve Medford Square include:

Table 1-7 Medford Square Bus Services

Route	Daily Route Ridership	Daily Bus Boardings in Medford Sq.*	Daily No. of Bus Trips through Medford Square
No. 94	1,343	101	78
No. 95	1,679	85	87
No. 96	1,458	189	82
No. 101	4,323	180	120
No. 134	1,605	129	78
No. 326	467	69	39
No. 710	N/A	N/A	32
Total		**750***	**516**

*Winter '02 counts (except Rtes. 95 and 136 are Winter '97 counts

Bus Safety and Comfort

The MBTA has a Service Delivery Policy that is a way to "ensure that the MBTA provides quality transit services that meet the needs of the riding public." A Draft Service Delivery Policy has been developed for 2004 that updates and revises the 1996 Service Delivery Policy and incorporates changes that were approved in 2002.

A portion of the Service Delivery Policy identifies Service Objectives and Standards used to evaluate the MBTA's service performance. The Service Standard for Safety and Comfort is vehicle loading. The average load standard for Bus Service is shown in Table 1-8. These standards are calculated using an average maximum vehicle load over any 30 to 60 minute period at the maximum load point of the service.

Table 1-8 MBTA Bus Load Standards

Time Period	Passengers/Seat
Early AM, AM Peak, Midday School & PM Peak	140%
Midday Base, Evening, Late Evening, Nigh/Sunrise &Weekends	
Surface portions of routes	100%
Tunnel portions of routes	140%

Loading Evaluation

Of all the bus services that are included in the study area only the Route 86 service does not meet the Bus Load standard. The traffic congestion along the entire route results in delay to the service and limits the ability to add significant capacity. In addition this route has one of the most frequent headways of those operating in the study area.

The Route 86 service also experiences significant problems regarding schedule adherence. It appears that the schedule adherence problem is a result of the route configuration and alignment, which travels through Harvard Square as a mid-point. The traffic congestion throughout the entire route, coupled with heavy ridership destined to the mid-point location results in significant delay problems. It has been recommended to split the single route into two routes both ending at Harvard Square. This would permit greater reliability since the service would be able to make schedule corrections at Harvard Station. Any capacity improvements on the two new services would first need to focus on the Harvard to Cleveland Circle route since that where the current maximum load point is located.

Reliability Service Standards

The portion of the Service Delivery Policy that deals with on-time performance or reliability includes a Schedule Adherence Standard that is used to quantify the performance of each service and how well it adheres to the published schedules. The goal is to identify services that do not meet the standard, identify the problem and to take some corrective action, where possible. The specific standards vary by the scheduled frequency of the route. Routes have been divided into walk-up service, where the service operates more frequently than every 10 minutes, and scheduled departure service, where headways are greater than 10 minutes. The summary of the Bus Schedule Adherence Standard is shown in Table 1-9.

Table 1-9 Summary of Bus Schedule Adherence Standard

Trip Test	Beginning of Route	Mid-Route Time Point(s)*	End of Route
Scheduled Departure Trips (Headways ≥10 min.)	Start 0 min. early to 3 min. late	Depart 0 min. early to 5 min. late	Arrive 3 min. early to 5 min. late
Walk-up Trips(Headways <10 min.)	Start within 25% of scheduled headway	Leave within 50% of scheduled headway	Running time within 20% of scheduled running time
Route Test	For any given bus route to be in compliance with a the Schedule Adherence Standard, 75% of all trips on must adhere to the above measures over the entire service day.		

*For Schedule Adherence, mid-route time points will be used only for routes on which the on-time performance data has been collected using CAD/AVL equipment.

Schedule Adherence Evaluation

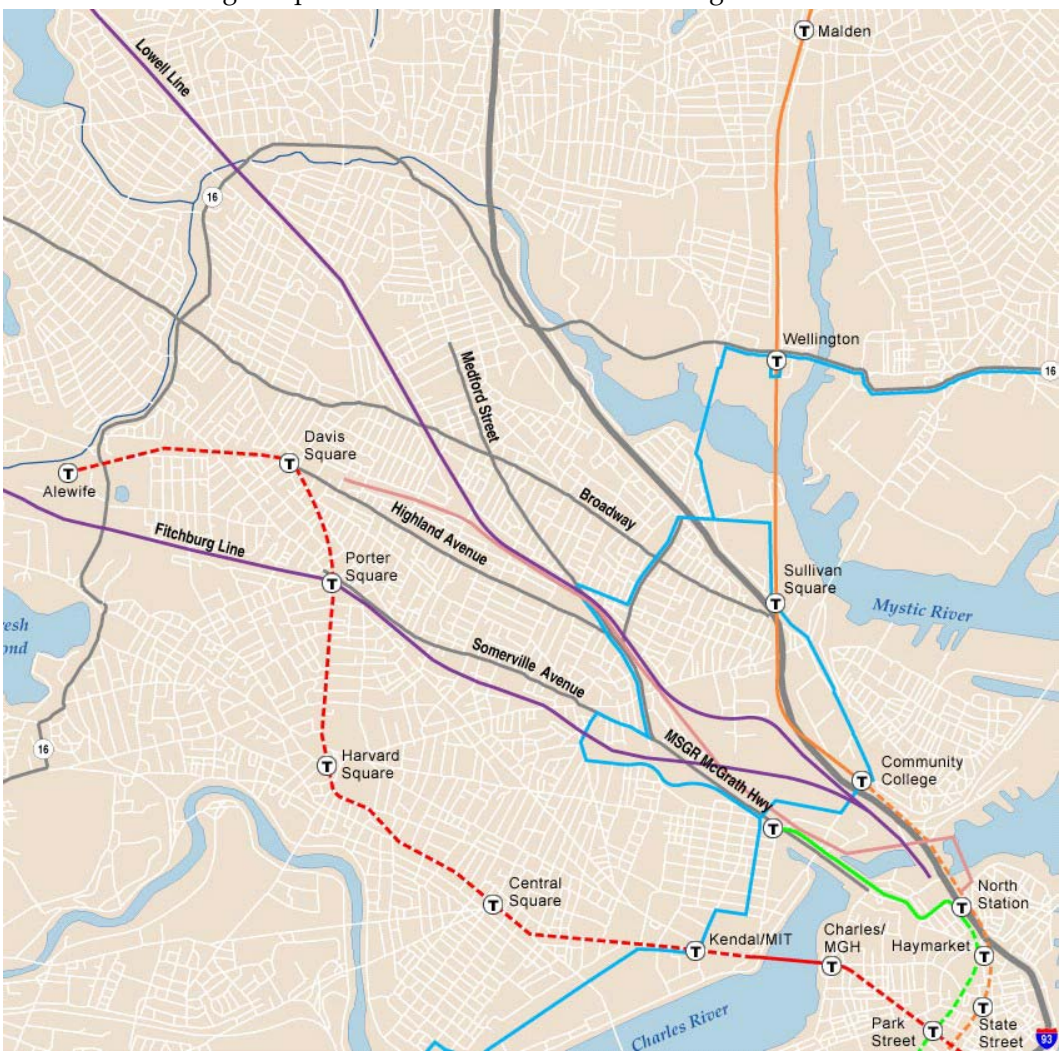
The MBTA bus fleet that operates in the project study area is composed mostly of vehicles that are 40 foot, high-floor, diesel powered transit buses from various manufacturers dating back to the mid 1980's. All of the bus routes in the Project Study Area, except for Route 85, do not meet the current Schedule Adherence Standards on weekdays. In fact only approximately 11% of the MBTA's weekday bus service routes meet the current Schedule Adherence Standard. The current Schedule Adherence Standards determine a bus trip to be noncompliant if it arrives at its destination one minute or more early. A change to this standard has been proposed so that the MBTA can focus on routes that have problems running significantly late.

The MBTA is committed to making improvements to its current bus system. Improvement initiatives currently underway include:

- A large scale upgrade of the MBTA bus fleet, with the procurement of approximately 500 new buses with either CNG or Emissions Controlled Diesl (ECD) engines. The new buses are of a low floor configuration.
- Many of these buses will automatically collect data that can be used to set better schedules and make route changes when congestion is a problem.
- Many of the existing buses manufactured since 1990 are being overhauled, including the installation of cleaner diesel engines.
- Many of the MBTA's bus maintenance garages have reached their capacity. The MBTA has plans to expand existing facilities and/or construct garages to provide additional capacity.

Green Line (Rapid Transit / Light Rail)

Lechmere Station, situated in Cambridge at the southern periphery of the project study area, serves as the northern terminus for the MBTA's Green Line light rail system. In its existing configuration Lechmere Station is an at-grade facility located immediately west of the Msgr. O'Brien Highway. This is essentially a "turnback" facility equipped with loop tracks, limited storage capacity for light rail cars and no maintenance facilities. Developers of the North Point complex, located east of the Msgr. O'Brien Highway, have committed to participate in the construction of a new Lechmere Station within the development complex. This would provide a modern terminus, well positioned to access the nearby commuter rail rights-of-way. The provision of a storage and maintenance facility has not been addressed by the development plans and remains an unresolved issue. South of existing Lechmere Station, the alignment of the Green Line crosses over to the east side of the Msgr. O'Brien Highway on an elevated causeway, extending south to Science Park and North Station. The MBTA is nearing completion of a new Green Line – Orange Line Station located



underground at North Station. This new station will result in the abandonment of the elevated structure between Science Park and North Station.

South of North Station, the Green Line operates through a series of downtown tunnels termed the "Central Subway." Once through the Central Subway, the Green Line branches into four separate routes that emerge from underground in the vicinity of Kenmore Square (Boston College, Cleveland Circle and Riverside Lines) and at Northeastern University on Huntington Avenue (Heath Street Line). These southern branches have been variously through-routed to terminal points at Park Street, Government Center, North Station and Lechmere. At present, the designated terminal points are:

- Route B Boston College – Government Center
- Route C Cleveland Circle – Government Center
- Route D Riverside – Lechmere
- Route E Heath Street – Lechmere

The Route A designation is vacant, having been assigned to the now-discontinued Oak Square / Watertown Line. The Boston College, Cleveland Circle and Heath Street branches operate at-grade in mid-street reservations and in mixed traffic. This results in the service being subjected to traffic-generated delays. Such delays are often mitigated by turning the northbound trains around prior to reaching their northern destinations (i.e. at Park Street or Government Center instead of Government Center or Lechmere, respectively). The Riverside – Lechmere route is the longest on the Green Line, encompassing 13.4 miles.

Daily ridership on the Green Line, as measured by passenger boardings, is 225,200 passengers. The morning peak hour load volume of 7,300 passengers per hour occurs between Arlington and Copley Stations.

Green Line trains are comprised of three types of equipment: Light Rail Vehicles (LRVs), Type 7 cars and Type 8 cars. LRV's were built by Boeing Vertol in 1976-1978. Presently, 40 of these cars remain in service, used primarily in peak periods. The bulk of the fleet consists of so-called Type 7 cars built in 1984-1988 by Kinki-Sharyo. This fleet consists of 111 active vehicles. The LRV and Type 7 cars require the use of multiple steps to board the vehicle, since the Green Line operates with low-level platforms. In an effort to improve passenger accessibility (and to permit retirement of the remaining Boeing LRV's) the MBTA is procuring so-called Type 8 cars manufactured by Breda. This procurement is for a total of 100 cars, with 36 in service as of June 2004. These vehicles have a low floor center section, which facilitates passenger boarding. Platform heights are being increased at key stations to enable wheelchair passengers to access the low floor section by means of a short ramp. The Green Line vehicles are powered by an overhead electrified trolley wire

and catenary system energized at 600 volts. The total active fleet is thus 184 cars, with 144 cars being required for the afternoon peak period. The Green Line's primary maintenance, repair and storage facility is located at Riverside. Additional storage yards and light maintenance facilities are located at Reservoir (end of the Cleveland Circle Line) and Lake Street (end of the Boston College Line). At the north end of the Green Line, Lechmere provides only limited storage space with no maintenance or repair capability, which results in an "unbalanced" distribution of such facilities.

Green Line trains typically consist of one and two cars, although a few three car trains have been operated during peak periods, subject to equipment availability. The three vehicle types are not interchangeable, and multiple car trains must be comprised of like equipment. As part of the Type 8 Breda car procurement, the MBTA is modifying propulsion and control systems on the Type 7 cars so that the two equipment types can operate together in multiple car trains.

Peak period schedules provide for service frequencies (headways) of five minutes on both the Boston College and Riverside Lines, six to seven minutes on the Cleveland Circle Line and seven minutes on the Riverside Line. As these services meet in the Central Subway, the result is a peak hour combined service volume of 43 trains per hour in each direction in the Central Subway, or a headway of approximately 90 seconds. Green Line car requirements and headways are summarized as follows (where **T** = Number of trains, L=Cars per train and *H* = headway in minutes):

Table 1-10 Green Line Car Requirements and Headways

Route	**AM Peak**			**Am Base**			**PM Base**			**PM Peak**			**Late**		
	T	L	*H*	**T**	L	*H*	**T**	L	*H*	**T**	L	*H*	**T**	L	*H*
Boston College	**20**	2	*5*	**12**	2	*8*	**12**	2	*8*	**20**	2	*5*	**11**	1	*8*
Cleveland Circle	**13**	2	*6/7*	**13**	1	*6*	**13**	1	*6*	**13**	2	*6/7*	**7**	1	*10*
Riverside	**24**	2	*5*	**12**	2	*10*	**12**	2	*10*	**25**	2	*5*	**11**	1	*10*
Heath Street	**12**	2	*7*	**8**	2	*9*	**8**	2	*9*	**12**	2	*7*	**8**	1	*10*
Run as Directed	**4**	1					**1**	1		**4**	1				
Total Cars Required	**142**			**77**			**78**			**144**			**37**		

Red Line (Rapid Transit / Heavy Rail)

From downtown Boston the Red Line extends northwest to a terminus at Alewife Station, passing through Cambridge and the western portion of Somerville. In the project study area, stations are located at Davis

Square and Porter Square. A station is also located nearby in Cambridge a Kendall Square. Daily boardings at each of these stations are as follows: Davis-10,695, Porter - 7,355, and Kendall – 11,218. The Porter Square station includes a commuter rail station for the Fitchburg Line. Davis Square includes a number of feeder bus routes and is located at the west end of a linear park / pedestrian path, which is intended to extend east towards Lechmere.

The Red Line is a heavy rail, high platform, grade separated operation, powered by a third rail system. Trains consist of multiple cars (six cars during peak periods and four cars during the off-peak). The active fleet consists of 218 cars. The oldest group of cars, totaling 74, was constructed in 1969-70 and was rebuilt in 1985-88. An additional 58 cars of similar design were constructed in 1987-89. A newly designed fleet of 86 cars was procured in 1993-94. South of downtown Boston, the line splits into two branches terminating at Braintree and Ashmont stations. The distance from Alewife to Braintree is 17.7 miles; from Alewife to Ashmont the distance is 11.9 miles. Service frequencies on each branch are approximately eight minutes during the peak periods and twelve minutes during the off-peak. From downtown Boston north to Cambridge and Somerville this results in a combined service frequency of four minutes during the peak period and six minutes during the off-peak. The line was extended north from Harvard Square through Porter and Davis Squares to Alewife during the early 1980's. The subsequent commercial and residential development in the areas surrounding these locales is considered indicative of the economic and social benefits that can accrue from such transit facilities.

Daily ridership on the Red Line is 214,200 passenger boardings. The morning peak hour passenger load volume is 9,500 passengers occurring between South Station - Broadway - Andrew Stations.

Orange Line (Rapid Transit / Heavy Rail)

The Orange Line extends from Forest Hills in Jamaica Plain to Oak Grove in Malden, a distance of 10.8 miles. Within downtown Boston, the line operates in a subway. South of downtown Boston, the line is located in an open cut alongside the commuter rail and Amtrak Northeast Corridor right-of-way. North of Boston, the line is located in a grade separated right-of-way alongside the MBTA's Haverhill/Reading commuter rail line. At the eastern periphery of the project area, the Orange Line provides service parallel to the Green Line between North Station and Sullivan Square Station. Wellington Station, the next station north beyond Sullivan Square, is a major park-and ride facility, with over 1,300 spaces. Although Wellington is located beyond the project area,

the parking facilities are large enough to serve a regional market, so that some project area residents may use them.

The Orange Line includes three tracks between Community College and Wellington stations. When the reconstruction of the northern portion of the Orange Line was designed in the late 1960's, it was intended that the two outside tracks would be the normal northbound and southbound tracks while the inside track would be a reverse express track. MBTA long-range planning at that time envisioned extension of the various rapid transit lines outwards to the Route 128 corridor, and this track configuration anticipated the eventual extension of the Orange Line to Reading. However, the line has never been operated with an express track service. Instead, the third track has been used for testing of vehicles, signals and train control equipment.

The City of Somerville is examining the feasibility of constructing a new Orange Line station at Assembly Square, located mid-way between Wellington and Sullivan Square Stations. The Assembly Square station is intended to serve as an important adjunct to the re-development of the Assembly Square by facilitating commercial and residential development at the site. The positioning of a new station at an intermediate location on the Orange Line raises issues pertaining to train travel times, passenger volumes and the impact on capacity at peak load points on the line. These issues are being investigated by the City of Somerville in consultation with the MBTA.

The Orange Line is a high platform, third rail operation that uses a fleet of 120 cars constructed in 1979-81. Service frequencies range from five minutes during the peak hour to a range of eight to thirteen minutes during off-peak periods. All trains are scheduled to operate the entire length of the line. Trains consist of six cars at all times. The MBTA is currently upgrading the signal system on the northern portion of the line, with the intent of improving service reliability. Daily ridership is 160,900 passengers with the morning peak hour load volume of 8,200 passengers occurring between North Station and Haymarket Station.

Commuter Rail Services

There are two railroad lines in operation that pass through the study area. These rail lines, owned and maintained by the MBTA, include the New Hampshire Main Line and the Fitchburg Division. Presently commuter rail service and freight rail service operate on both of these rail lines, with Amtrak intercity service also operating on the New Hampshire Main Line.

New Hampshire Main Line/Lowell Line

The New Hampshire Main Line extends northwesterly from Boston North Station through Somerville and Medford, to Lowell, which is the present terminal for commuter rail service on the line. The MBTA identifies the route as the "Lowell Line" in its published schedules. The route continues northwards into New Hampshire. The Boston – Portland intercity passenger rail service operated by Amtrak as the "Downeaster" also uses a portion of this route. Freight service along the line is operated by Guilford Transportation Industries. The State of New Hampshire, in cooperation with the Massachusetts Executive Office of Transportation & Construction, is proceeding with the initial design and operations planning for an extension of commuter rail service to Nashua, New Hampshire. From Boston through Lowell to the New Hampshire state line, the line is owned by the MBTA.

The route is also used by a few trains operating on the MBTA's Haverhill / Reading Line. Due to track capacity considerations on the Haverhill Line, these trains are routed over the New Hampshire Main Line between North Station and Wilmington as non-stop trains.

Current train operations on the New Hampshire Mainline through the project study area consist of the following:

MBTA Lowell Line

- 21 inbound and 21 outbound trains on weekdays
- 8 inbound and 8 outbound trains on weekends and holidays

MBTA Haverhill/Reading Line

- 3 inbound and 2 outbound trains on weekdays

Amtrak *Downeaster*

- 4 inbound and 4 outbound trips daily

Freight

- 1 to 2 trips per day in each direction

Travel time from Lowell to Boston is approximately 50 minutes. One of the most recent changes to operations on the line was the opening of a large intermodal station in Woburn, the Anderson Regional Transportation Center, which provides parking and Logan Express Bus connections for passengers in the vicinity of the Route 128 / I-93 interchange. There are no existing commuter rail stations along the Lowell Line within the project area. However, at the northern end of the project area, the West Medford station is served by all of the scheduled commuter rail trains. Daily ridership generated by the West Medford Station is approximately 478 passenger boardings. Travel time between West Medford Station and Boston is approximately 12 minutes. A

passenger station at Tufts University was once served by train but was closed in the early 1980's due to low passenger volume and the desire to reduce travel time to Boston for passenger from outlying areas.

Daily weekday ridership on the Lowell Line service is approximately 10,000 passenger boardings, based on December 2003 ridership counts. Table 1-11 includes typical weekday inbound boardings at each Lowell Line Station.

Table 1-11 - Lowell Line Daily Weekday Boardings by Station

Station	Daily Weekday Inbound Boardings
Lowell	1,341
North Billerica	737
Wilmington	450
Anderson	832
Mishawum	22
Winchester	677
Wedgemere	454
West Medford	478

Source: MBCR 12/03

Although the focus of the MBTA's commuter rail service is toward Boston as an employment center, the Lowell Line experiences some reverse commuting. The primary destination for any reverse commuter on the Lowell line is Woburn. In the Spring of 2000, approximately 80 riders used the commuter rail service to travel on the 4 peak period trains to the Mishawum station. In addition, 10 passengers utilized the Lowell Line to travel between North Station and West Medford.

Lowell Line Service Standards

There are four components of the MBTA's Service Standards, which are included in the Service Delivery Policy, that apply to commuter rail service. These include Span of Service, Frequency of Service, Schedule Adherence and Vehicle Load.

Span of Service

The Span of Service standard provides a minimum period that any given service will operate. This provides MBTA customers the confidence that particular types of services will be available though out the day. The minimum span of service for commuter rail services is to operate between 7:00 AM and 10:00 PM on weekdays and 8:00 AM and 6:30 PM on Saturdays. The Span of Service standard does not include service on Sundays and Holidays.

The Span of Service on the Lowell Line exceeds the minimum Span of Service standard both on weekdays and weekends. The first weekday train is scheduled to arrive at North Station at 6:22 AM and the last train

is scheduled to depart North Station at 11:59 PM. On weekends, both Saturday and Sunday, the first train arrives at North Station at 7:43 AM and the last train departs North Station at 11:30 PM.

Frequency of Service

The Frequency of Service Standard establishes the minimum service frequency for each mode by time of day. This standard establishes the minimum frequency on services where demand does not dictate more frequent service. The Frequency of Service Standard for commuter rail is for three trips in the peak direction during peak periods (7:00 AM to 8:59 AM and 4:00 PM to 5:59 PM on weekdays) and 180 minute headway, or time between trains, in each direction during all other periods.

The Lowell Line service exceeds the Frequency of Service Standard with five trains during each weekday peak period and with no headways exceeding 130 minutes and typical weekday headways not greater than one hour.

Schedule Adherence

The Schedule Adherence Standard establishes a way to measure the reliability of a service and when action needs to be taken to correct problems effecting reliability. The Schedule Adherence Standard for commuter rail states that 95% of all trips departing and arriving at terminals within five minutes of scheduled departure and arrival times.

Specific schedule adherence information is not available at this time for the Lowell Line. However, in past years all commuter rail services operating on the Lowell Line met the 95% on-time performance standard. Any year to year deviation from this standard on the Lowell Line is likely due to dispatching or equipment problems and not due to any infrastructure constraints.

Vehicle Load

The Vehicle Load Standard is a way to measure passenger comfort by establishing a maximum acceptable number of passengers per vehicle. The vehicle load is calculated as an average maximum load for each time period. Time periods include Early AM (start of service to 6:59 AM), AM Peak (7:00 AM to 8:59 AM), Base (9:00 AM to 1:59 PM), School (2:00 PM to 3:59 PM), PM Peak (4:00 PM to 5:59 PM) and Evening (6:00 PM to end of service). Currently, the Vehicle Load Standard for commuter rail should not exceed 110% of the seated capacity for all time periods. The seated capacity per commuter rail coach can range from 94 to 185 depending on the type of coaches used. It should be noted that customers may experience some trains or some coaches within trains with loading greater than 110% on a regular basis, however the standard measures an average over the entire period, with maximum loads for

commuter rail services typically experienced only during the peak periods.

The Vehicle Load for the Lowell Line meets the standard established by the MBTA. In fact, even the vehicle load for the inbound train with the highest ridership (Train No. 308) does not exceed the 110% standard. Train capacity, based on the use of a six single-level coach train, is 730 seated passengers. Train number 308 has a ridership or approximately 795 passengers representing 109% percent of seated train capacity. The Vehicle Load for the AM Peak Period is approximately 99% of seated capacity.

Lowell Line Capacity

Potential capacity of a commuter rail line can generally be determined by the number of trains that can operate along the line during a peak period and the capacity of those trains. Although there are other components that go into the potential capacity of a commuter rail line, such as terminal capacity, passenger peaking characteristics, volume of intermediate station passenger alightings, and freight rail operations, the calculation of potential capacity identifies the upper limit of passenger throughput that could be achieved without substantial infrastructure changes.

In keeping with MBTA operating standards for its "northside" commuter rail lines, all Lowell Line trains currently consist of single level commuter rail coaches operated in push –pull configuration with the locomotive typically located at the outbound (or northern) end of the train. Maximum train lengths typically include six coaches. This results in passenger capacity per train of approximately 730 seated passengers. Additional train capacity could be achieved by increasing train lengths to nine cars, subject to equipment availability. Long-term MBTA capital improvement plans call for the replacement of the single level coaches with higher capacity bi-level coaches, which would increase capacity per train to approximately 1,640 seated passengers, a 225% increase.

In addition to vehicle capacity, the capacity of the line depends upon the number of trains operated. There are approximately 29 trains operating along the line each direction, each weekday in the project area. Currently the Lowell Line operates with peak period headways of approximately 30 minutes. Average trip speed on the Lowell Line, calculated as the scheduled trip time over the terminal to terminal mileage, is similar to the other services operating out of North Station, with an average trip speed of approximately 32.5 miles per hour.

There is a potential for service frequency improvements along this line since there are few capacity constraints on the line, unlike the other

routes operating out of North Station. From Boston through Somerville the line remains as originally constructed with multiple tracks (three and four tracks in some locations). Reconstruction of the trackage by the MBTA has resulted in a double track route, with sufficient right-of-way available for the installation of additional trackage or other transit services. Recent overhead highway bridge construction at some locations has resulted in some side clearance limitations due to bridge abutments, and these will need to be investigated in conjunction with the project's proposed alternatives. In Somerville, all roadways, which cross the right-of-way, are grade separated from the tracks. Within the study area in Medford, only two at-grade crossings exist at Canal Street and at High Street adjacent to the West Medford Commuter Rail Station.

Fitchburg Division

The Fitchburg Division extends from North Station through Cambridge, Somerville and then west to Fitchburg. Within the project area the line passes along the west side of the MBTA's Commuter Rail Maintenance Facility in Somerville and proceeds west through Union Square, paralleling Somerville Avenue. The line then continues through Porter Square in Cambridge, Waltham, Concord and South Acton with a terminus in Fitchburg.

Current train operations on the Fitchburg Division through the project study area consist of the following:

MBTA Fitchburg Line

- 18 inbound and 18 outbound trains on weekdays
- 8 inbound and 8 outbound trains on Saturdays
- 7 inbound and 7 outbound trains on Sundays and holidays

Freight

- 1 train each day in each direction

Travel time between Boston and Fitchburg is approximately 1 hour and 20 minutes. Travel time between Boston North Station and Porter Square is 11 minutes. The MBTA recently inaugurated express service on this route, with trains operating non-stop between South Acton and Porter Square, thereby reducing travel time by approximately 10 minutes.

Daily weekday ridership is approximately 8,000 passenger boardings, based on December 2003 ridership counts. Table 1-12 includes typical weekday inbound boardings at each Fitchburg Line Station.

Table 1-12 – Fitchburg Line Daily Weekday Boardings by Station

Station	Daily Weekday Inbound Boardings
Fitchburg	155
North Leominster	172
Shirley	139
Ayer	233
Littleton/495	154
South Acton	560
West Concord	437
Concord	426
Lincoln	262
Silver Hill	5
Hastings	55
Kendal Green	111
Brandeis/Roberts	449
Waltham	488
Waverley	131
Belmont Center	113
Porter Square	143

Source: MBCR 12/03

Although the focus of the MBTA's commuter rail service is toward Boston as an employment center, the Fitchburg Line does experience some reverse commuting. The primary destination for any reverse commuter on the Fitchburg line is Waltham. In the Spring of 2000, approximately 75 riders used the commuter rail service to travel on the three peak period trains to the Waltham and/or Brandeis/Roberts stations. In addition, 25 passengers utilized the Fitchburg Line to travel between North Station and Porter Square.

Fitchburg Line Service Standards

An analysis of the four components of the MBTA's Service Standards that apply to commuter rail service is included in the following sections.

Span of Service

The Span of Service on the Fitchburg Line does not technically meet the Span of Service standard on weekdays since the first train does not arrive at North Station until 7:12 AM. This first train does not arrive until after 7:00 because of the duration of the trip, the longest on the MBTA's commuter rail system at 87 minutes. The evening weekday service does meet the standard with the last train leaving North Station departing at 12:10 AM. Similarly weekend service (operated on both Saturday and Sunday) does not arrive at North Station before the 8:00 AM time established in the standard, with the first Saturday train arriving at 8:16 AM. Again the evening train does meet the Span of Service standard with a train departing well after the 6:30 PM standard, departing at 11:30 PM.

Frequency of Service

The Fitchburg Line service also does not meet the Frequency of Service Standard. Although it has five trains during each weekday peak period there are some gaps in service that exceed the 180 minute headway standard. There are two weekday headways of 187 minutes and multiple weekend headways in excess of 180 minutes. All of these service gaps occur at the stations on the western end of the line, between South Acton and Fitchburg.

Schedule Adherence

Specific schedule adherence information is not available at this time for the Fitchburg Line. However, in past years all commuter rail services operating on the Fitchburg Line met the 95% on-time performance standard. Although any year to year deviation from this standard on the Fitchburg Line is likely due to dispatching or equipment problems there are some schedule limitations due to a single track section of the line and freight service along the line. Any deviation from the 95% standard would need to be closely analyzed to determine the root cause of the problem.

Vehicle Load

The Vehicle Load for the Fitchburg Line meets the standard established by the MBTA. In fact, even the Vehicle Load for the inbound train with the highest ridership (Train No. 410) does not exceed the 110% standard. Train capacity, based on the use of a six single-level coach train, is typically 730 seated passengers. Train number 308 has a ridership of approximately 778 passengers representing 107% percent of seated train capacity. The Vehicle Load for the AM Peak Period is approximately 90% of seated capacity.

Fitchburg Line Capacity

As previously stated the potential capacity of a commuter rail line can be generally determined by the number of trains that can operate along the line during a peak period and the capacity of those trains. In the project area there are approximately 18 to 19 trains operating each direction each weekday.

The service along the line has the same ability as the Lowell Line to increase capacity through the use of longer trains or bi-level coaches. However there exist some other limitations to increasing capacity on the line. There is an eight mile section of single track between South Acton and the Littleton/Ayer border. Additionally, the track west of the Littleton/Ayer border, where there is a junction with the Stony Brook Line named "Willow", is heavily used by freight traffic traveling from Maine and New Hampshire to points west. In addition to the frequent

freight service west of Willow, there is approximately one freight train each direction per day that operates between Willow and Boston. This freight traffic, in conjunction with the single track segment limits the capacity of the line for passenger service. A study is currently being conducted by the MBTA to examine ways to improve service along the Fitchburg Line.

Within the project area, the Fitchburg Division was constructed as a multiple track right-of-way, with many freight sidings in the industrial area of Union Square. Many of the sidings have been removed and the line operates as a double track rail corridor with sufficient right-of-way available for additional track or other transit services.

Within the project area the tracks are grade separated. Freight service on this MBTA-owned route is operated by Guilford Transportation Industries. Train configuration and equipment is the same as for the New Hampshire Main Line.

Congestion Management Areas

There are several locations within the study area that exhibit recurrent peak hour traffic congestion. In many cases, this traffic negatively impacts mobility for automobile traffic, truck traffic, and public transit operations. These locations are described qualitatively in the following sections. In many cases, these congestion management areas also correspond to locations with a high frequency of vehicle/pedestrian conflicts. Although the locations listed below are congestion points, many of the roadways within the study are characterized by narrow cross-sections, on-street parking, and high traffic volumes. All of these factors can contribute to traffic congestion.

Winthrop Square

Winthrop Square is the intersection of High Street (Route 60/Route 38) and Winthrop Street (Route 38) and it is located along the northern edge of the study area. This intersection is controlled by a small rotary with all approaches yielding when entering the intersection. Moderate traffic congestion in this area can delay traffic flow along Winthrop Street, which connects to the Mystic River Parkway (Route 16).

Medford Square

Medford Square is a commercial center located along the northern edge of the study area. The square is formed by the intersection of Main Street to the south, High Street to the west, Forest Street to the north, Salem Street entering from the east, and Riverside Avenue exiting to the east. The intersection is controlled by a traffic signal. Moderate traffic congestion in this area can often delay traffic flow and bus operations

along Salem Street and High Street. Medford Square can also be accessed from a nearby I-93 interchange.

West Medford Square

West Medford Square is the intersection of High Street (Route 60), Playstead Road, and Harvard Avenue and it is located along the northern edge of the study area. This intersection is controlled by stop signs on the approaches from Playstead Road and Harvard Avenue. The MBTA Lowell Line railroad crossing is also located at the intersection. The railroad crosses High Street between Playstead Road and Harvard Avenue. The railroad crossing in this area can delay traffic flow along High Street, Playstead Road, and Harvard Avenue. Turns from the stop-controlled approaches on Playstead Road and Harvard Avenue can also be difficult during peak hours.

Main Street at South Street

South Street carries traffic from Winthrop Street and Mystic Valley Parkway (Route 16) eastbound. South Street is a one-way roadway connecting to Main Street (Route 38) at a flashing signal. Directly across from South Street is the on-ramp to Route 16 eastbound. Moderate traffic congestion in this area can often delay traffic flow along South Street.

Mystic Avenue at Main Street

Mystic Avenue (Route 38) intersects Main Street under stop control. The intersection is also controlled by a flashing traffic signal with pre-emption for the fire department located at the intersection. Moderate traffic congestion in this area can often delay traffic flow and bus operations along Main Street and impact emergency response vehicles.

Magoun Square

Magoun Square is located on the northwestern edge of the study area and is formed by the intersection of Broadway, Medford Street, and Dexter Street. The intersection is controlled by a traffic signal with two-lane approaches along Broadway and one-lane approaches along Medford Street. Moderate traffic congestion in this area can often delay traffic flow and bus operations along Broadway and along Medford Street.

Teele Square

Teele Square is the intersection of Broadway, Holland Street, and Curtis Street and is located along the western edge of the study area. This intersection is controlled by a traffic signal with pre-emption for the fire department located in the square. Moderate traffic congestion in this area can often delay traffic flow and bus operations along Broadway and along Holland Street.

Powder House Square

Powder House Square is a complicated intersection of Broadway, College Avenue, Powder House Boulevard, and Warner Street near Tufts University. The intersection operates as a rotary with occasional traffic signal control on some approaches. Other approaches are controlled by STOP signs. Moderate traffic congestion is experienced in Powder House Square with delays to the Broadway approaches generally being more substantial than the other, lower volume approaches. Traffic flow and bus operations are often delayed at this intersection due to the unusual geometrics and traffic control, and high traffic volumes.

Davis Square

Davis Square is the principal commercial center in Somerville. The square is characterized by a one-way circulation pattern along Elm Street (eastbound), Cutter Avenue (northbound), and Highland Avenue (westbound). Highland Avenue and Elm Street intersect with Holland Street, College Avenue, Dover Street, and Day Street at a signalized intersection. The MBTA Red Line Station is also located adjacent to this intersection. Traffic congestion in Davis Square is often moderate to severe during peak periods. Generally, the longest delays are along Elm Street westbound during the evening peak hour and on College Avenue southbound, entering Davis Square. These delays can influence transit connections to the Davis Square Red Line Station.

Temple Street and School Street at Broadway

Temple Street and School Streets intersect Broadway at two closely spaced traffic signals. Temple Street carries traffic from the Mystic Avenue interchange along I-93 into Somerville. Much of this traffic then uses School Street to continue in a southerly direction across the City. The interaction of these two traffic signals, coupled with higher traffic volumes along Broadway and short queue storage distances can lead to some traffic congestion along this segment of Broadway.

McGrath Highway/Fellsway (Route 28) at I-93

Traffic congestion is common at this complicated interchange along I-93. The most common point of congestion is the Fellsway southbound approaching the intersection.

McGrath Highway at Broadway

Although the traffic signals at this intersection along McGrath Highway are currently being reconstructed, the intersection can lead to traffic congestion on these major travel corridors. Congestion is especially prevalent when an incident on I-93 causes traffic diversions to the McGrath Highway. Similar conditions can occur many of the intersections along McGrath Highway such as the Pearl Street intersection located just to the south.

McGrath Highway at Medford Street/Highland Avenue

Medford Street and Highland Avenue intersect McGrath Highway at a traffic signal. The geometric conditions at this intersection are complex given the acute intersecting angles of these roadways. In most cases, traffic congestion is more pronounced on Medford Street and Highland Avenue than on McGrath Highway. Much like the previous intersections along McGrath Highway, increased congestion can occur when traffic congestion on I-93 results in diversions to McGrath Highway.

Union Square

Many roadways intersect to form the Union Square area. These roadways include Washington Street, Prospect Street, Somerville Avenue, Webster Street, Newtown Street, Stone Avenue, Warren Avenue, and Bow Street. On the west side of Union Square, Bow Street (westbound) and Somerville Avenue (eastbound) form a one-way loop. The eastern end of this one-way loop is a signalized intersection with Washington Street and Webster Avenue, which is one way southbound. East of this signalized intersection, Somerville Avenue intersections Washington Street and Prospect Street at another signalized intersection. Both of these signalized intersections can be severely congested during peak periods. This congestion is most prevalent on Washington Street eastbound and westbound and Prospect Street northbound approaching the square. At many times of the day, Somerville Avenue is also very congested between the two traffic signals.

McGrath Highway at Washington Street

Although the mainline of McGrath Highway passes over Washington Street, the surface intersection of ramps leading to and from Washington Street can be severely congested. The intersection is controlled by a system of traffic signals and has a very complicated geometry due to the space limitations imposed by the McGrath Highway overpass. Connections to several other roadways such as Medford Street, Linwood Street, and Somerville Avenue further contribute to traffic congestion at this location. Additionally, traffic congestion from Union Square sometimes contributes to congestion at this location.

Sullivan Square

Sullivan Square is located in Charlestown and is the intersection of Broadway, Mystic Avenue, Route 99, Main Street, Rutherford Avenue, and Cambridge Street (Washington Street). The square operates as a large rotary for most approaches although a traffic signal controls the westernmost intersection where Cambridge Street enters the rotary. Sullivan Station on the Orange Line is located adjacent to this intersection and an off-ramp from I-93 northbound provides access to Cambridge Street just to the west of the intersection. Until recently, an overpass provided expedited access I-93 from Sullivan Square. Recently

this overpass was demolished, increasing the number of traffic movements made via the rotary. Traffic congestion at Sullivan Square is especially prevalent along Cambridge Street as it approaches Sullivan Station and the rotary. This congestion is influenced by the coordination of traffic signals at the I-93 ramp and at the eastern end of the rotary and can result in delays to traffic and transit operations. Congestion in this area could influence the viability of potential connections to the Orange Line and Commuter Rail at Sullivan Square.

O'Brien Highway at Land Boulevard/Charestown Avenue (Gilmore Bridge)

This intersection is located to the east of Lechmere Station on Route 28. Traffic congestion at this intersection is common, often resulting in substantial traffic delays on the Gilmore Bridge and Land Boulevard northbound. Traffic congestion is less frequent on O'Brien Highway and generally is associated with severe congestion on I-93 resulting in diversions to Route 28. Currently, this congestion management area does not impact transit operations since no bus routes travel beyond Lechmere Station on Route 28 or on Land Boulevard and the Gilmore Bridge. Travel through this area may be necessary if improved connections to North Station or Community College Station are developed as alternatives for this study.

Leverett Circle

Although improvements are under construction by the Central Artery/Tunnel Project, recurrent congestion is expected to remain at this location and could impact the viability of bus route extensions to downtown that may be considered as part of this study.

Development Patterns

There are many opportunities to improve transit services in the study area. At the same time, constraints limit some of these opportunities. The following sections examine these opportunities and constraints.

Economic Development/Land Use

Understanding the urban setting in which the transit system functions beyond Lechmere is crucial in defining the goals and the realistic alternatives to consider. Any extension would need (1) to fit into/accommodate an established street network and defined open spaces, with real dimensions and physical constraints, (2) serve activity areas and (3) provide connections to riders' origination points.

Existing Land Use Patterns

The geography of the study area is hilly (Prospect Hill, Central Hill, Winter Hill, Medford Hills). The area also features a ridge that is oriented approximately west-east and runs along Highland Avenue. Street alignments roll down to the north and to the south from the ridge. The high ground areas around Prospect and Central Hills offer glimpses of Downtown Boston's high-rise structures, which emphasize the proximity to the City of Boston, making the lack of transit options even more evident.

The City of Somerville stretches in a northwest-southeast direction for approximately three miles. The City features unusual differences from one end to the other. An area like Clarendon Hills has a different character and is considerably more suburban, bordered by parkways and parkland than, for example, East Somerville, which is land-locked between highways.

While physical barriers like the McGrath Highway and Route I-93 are outside this project's immediate study area, the MBTA right-of-way, which divides the city into a northern district and a southern district, constitutes one of this project's main elements. The street pattern in parts of Somerville has developed along this existing railroad right-of-way. The depressed track alignment has generated the need for a number of bridge crossings (at Willow, Cedar, Lowell, Central, and School Streets, etc.).

The area of the City of Medford that would participate in this project features primarily the Tufts University campus, which, with its predominantly student population, is a potential heavy user of public transportation to and from Downtown Boston.

The study area is a typical dense early 20th-century urban setting. Double and triple-deckers distributed around urban centers that attract city activities, and a number of main avenues collect and funnel the vehicular traffic. The urban centers or activity areas that must be considered in their proper context are:

- **Davis Square** was declared one of the 15 "hippest" neighborhoods in the US in 1997. This only happened due to the 1984 arrival of MBTA's Red Line. While this square resides outside the study area of this project (even though previous studies have considered ending the Lechmere extension at Davis Square), it is an example of the turnaround that any rapid transit extension might bring to Somerville and Medford.
- **Union Square** bears striking similarities to and has the potential to become if served by transit another Davis Square. While presently appearing to be underdeveloped, it has considerable potential in the eyes of the City of Somerville officials to become

an economic catalyst, given its proximity to Inman Square in Cambridge. Union Square plays the role of a hinge between a light industrial area that lies along the eastern end of Somerville Avenue, the commercial establishments at the intersection of Prospect, Bow and Washington Streets, and the residential areas north of Bow and Summer Streets. Union Square connects with the Central Hill area via Walnut Street.

- **City Hall Square/Gilman Square** is the heart of Somerville which seems to reside at the intersection of Highland Avenue and School Street, extend along Highland Avenue to Walnut Street and then wrap around the high school complex to, and on, Medford Street across the bridge over the MBTA right-of-way to Gilman Square, behind City Hall. Just as Union Square bears similarities to Davis Square in terms of character (and even physical layout, as it features streets a sharp angled intersection), this area bears similarities to Cambridge's Central Square. It appears that, for reasons of location and importance to the city, this site could be a prime candidate for a transit station.
- **Ball Square** is located at the important intersection of Broadway and the Lowell Line right-of-way. Ball Square would be well suited as a stop on any transit service from Lechmere to Medford Hills.
- **Powder House Square** is a gateway to Tufts University, hence its importance to the study area. It is also the connection between the cities of Somerville and Medford, as well as a tie to the more suburban landscapes that occur beyond Mystic River and Alewife Brook and Mystic River parkways.

Economic Development Initiatives

As alluded to above, the introduction of public transit has resulted in substantial economic development in the Davis Square area. Although the majority of the study area is densely developed, expansion of public transit to new areas could have similar positive effects on economic development elsewhere in the study area. This economic development could result from redevelopment of underutilized parcels, such as underutilized industrial properties and surface parking lots, or from renovation and reuse of existing buildings.

In terms of constraints, the existing density of the study area limits the ability for large-scale economic development opportunities. As a result, much of the impact of increased transit investment is likely to be improvement to existing properties and improved access for area residents.

Two key areas hold the highest potential for increased economic development. These areas include:

- **Union Square**. Substantial development opportunities exist near Union Square. Underutilized industrial properties are located on the southeast side of the square adjacent to the Fitchburg Branch railroad corridor. Additional development opportunities exist in the square itself through renovation of existing buildings, renovation of existing buildings. Similar potential exists both to the east and west of the square along Somerville Avenue.
- **Inner Belt Industrial Park/Cobble Hill/Brickbottom**. To the east of Union Square, the mixed-use district along Washington Street could exhibit substantial economic development with the addition of improved transit service. The Inner Belt Industrial Park could be transformed into a prime location for additional light industrial, research & development, office, or mixed use development. The Industrial Park is accessible only from Washington Street via an underpass below the Mystic Piers Branch Railroad. This connection does not provide easy roadway, pedestrian or transit access to this development area. The Industrial Park is also separated from the emerging North Point District of Cambridge by the Fitchburg Line and the Grand Junction Branch. The area is further separated from the Hood Industrial Park and Sullivan Square Orange Line in Charlestown by the elevated I-93 structure and the surface-running Orange Line and Commuter Rail tracks. Depending upon the location of transit services, additional development opportunities are also possible in the Brickbottom area on the south side of the Lowell Line or in the Cobble Hill area located on the west side of the Mystic Piers Branch Railroad.

In addition to these primary redevelopment areas, additional opportunities exist throughout the city and could enjoy improved potential through the addition of transit services. Some of these additional sites include:

- Gilman Square could provide mixed-use development opportunities near a potential transit station. Such development could help to address the topographic challenges of the area and improve access to the City Hall/ High School complex from the potential station area are points to the north.
- The area between the Lowell Line and the former railroad right of way to Alewife (Somerville Community Path Alignment) contains abandoned industrial properties which could serve as prime residential development sites.

- The area along Boston Avenue between Ball Square and Tufts University could hold some redevelopment potential for institutional, residential, or mixed uses.
- Air-rights development over railroad corridors in the study area could provide economic development opportunities near planned stations or maintenance facilities.
- Increased residential and commercial activity is possible near the terminal points of the potential alignments, which could include Medford Hillside, West Medford, Winthrop Square, or Medford Square.

Transportation Corridors

As described earlier in this document, a variety of roadway corridors provide vehicular circulation. For the most part, however, these corridors have limited capacity to accommodate a large volume of additional bus service, or to provide improved service reliability and quality due to their narrow right-of-way, high traffic volumes, and on-street parking. Notable exceptions to this condition are the McGrath Highway, Somerville Avenue between McGrath Highway and Union Square, and Broadway between Ball Square and Sullivan Square.

Railroad corridors in the study area include the Fitchburg Line, the Lowell Line, and the Somerville Community Path right-of-way (among others in East Somerville). These rights-of-way provide the opportunity for off-road transit service and access to the main economic development areas described in the previous section. There are constraints on the ability of these rights-of-way to provide increased transit service. These constraints include:

- They are used for commuter rail and freight service,
- Some segments are narrow and may not be able to accommodate new facilities,
- Some building encroachments exist,
- Some bridges are narrow,
- A Community Path that is proposed along a portion of the Lowell Line,
- Joint-shared use requirements within railroad corridors,
- Operations at the Boston Engine Terminal Maintenance Facility, and
- Inadequate layover space.

Even though these issues are constraints, design solutions can be examined to take advantage of the available right-of-way. The extent to which they are possibilities needs to be analyzed. For example, one of

these constraints, the community path, could be an opportunity to improve pedestrian and bicycle access to the proposed transit systems and may help leverage multimodal/intermodal funding for transit development.

Environmental Considerations

Environmental considerations for the development of new transit facilities in the study area are both opportunities and constraints. There are several key environmental opportunities associated with the potential project. These include:

- Improved Mobility to existing urban neighborhoods,
- Opportunity for Smart-Growth, Transit-Oriented Development,
- Reduced traffic congestion,
- Reduced automobile emissions, and
- Opportunity for cleanup and reuse of contaminated urban land.

Although there are many environmental opportunities, there are also many issues associated with improved transit operation that may serve as constraints. These include:

- Additional noise in residential areas from construction and transit operations.
- Vibration caused by construction and transit operations.
- Wetland/Resource Area impacts associated with expanded infrastructure.
- Layover facilities.
- Transit vehicle emissions from fossil-fuel powered vehicles.
- Traffic impacts for in-road operations and at station sites.

Coordination with Other Projects

The MBTA and the City of Somerville are pursuing a number of transportation and development projects that are of importance to the project study area. Descriptions of the key features of these undertakings are provided as follows.

Urban Ring

The Urban Ring Project, currently in the planning stages, consists of a three-phase, staged implementation of transit services in a circumferential corridor located approximately two miles outside of the center of downtown Boston. The project includes segments within the

municipalities of Boston, Cambridge, Somerville, Brookline, Everett, Medford and Chelsea. The initial phase has consisted of implementation of three "Crosstown" bus routes by the MBTA, designated CT-1, CT-2 and CT-3. Presently, the MBTA is completing the preparation of a Draft Environmental Impact Statement (DEIS) for Phase 2 of the project, which primarily entails the implementation of various Bus Rapid Transit (BRT) routes. These services would provide connections from the existing Silver Line / Dudley Street terminal in Boston extending north and then east through the Longwood Medical Area, Kenmore Square, MIT, Kendall Square Lechmere, Union Square, Assembly Square, Orange Line stations between Community College and Wellington and east to Chelsea and Logan Airport.

In addition to the proposed BRT routes, Phase 2 of the Urban Ring Project provides for new commuter rail stations at Union Square, Gilman Square and Sullivan Square.

Phase 3 of the Urban Ring Project envisions conversion of some Phase 2 BRT routes and services to light rail and heavy rail rapid transit operations. Phase 3 has been developed as part of a Major Investment Study by the MBTA. However, an implementation schedule and plans for preparing an EIS for Phase 3 have yet to be formulated.

Assembly Square

Immediately south of the Mystic River and directly west of the MBTA's Orange Line and Commuter Rail right-of-way is the City of Somerville's Assembly Square Planning District, a large triangular area bounded on the east by the MBTA right-of-way, on the north by the Mystic River, on the west by Route 28 and on the southwest by the I-93 on viaduct. The District has large retail facilities such as Home Depot, K-Mart and Circuit City as well as a Tage Hotel, a "99" Restaurant, a Loews Cinema complex, the Somerville District Court House and other retail, commercial and industrial facilities. Despite this mix of uses, the site appears underused and run down due to large vacant parcels, vast paved parking lots and vacant buildings.

The City has studied the redevelopment of Assembly Square since 1994. These studies were followed by four more specific studies through its Office of Housing and Community Development. Their collective purpose is to provide a plan to redevelop the District as an "Urban Village" with an urban street grid and high development densities to support an Orange Line Station in Assembly Square. These studies include the following:

1. *Assembly Square Planning Study: A Vision and Implementation Plan for the Future*, prepared by the Cecil Group, Inc. with others, October 2000;

2. *Assembly Square: Unifying Design Guidelines for the Public Realm* by Von Grossman & Company, March 2002
3. *Assembly Square Revitalization Plan: 2002 Major Plan Change*, prepared by OHCD, May 2002
4. *Assembly Square Transportation Plan*, prepared by Rizzo Associates, May 13, 2003

Also during this period, two specific and significant development proposals were submitted to the City:

- *Assembly Square: Proposal for the Redevelopment of Yard 21 and Neighboring Parcels*, *Design Concept*, submitted by The Sturtevant Partnership, August 15, 2001; and
- *IKEA at Assembly Square, A Mixed Use Development, Preliminary Master Plan, Planned Unit Development*, prepared by Arrowstreet and Vanasse Hangen Brustlin, Inc., submitted by IKEA Property, Inc., May 3, 2002

Yard 21

The Sturtevant Partnership Proposal proposes creation of a significant mixed-use district on Yard 21 and adjacent parcels. The Partnership controls approximately 10 acres adjacent to the MBTA right-of-way. The development program includes a mix of office (2,039,800 square feet), retail (327,800 square feet) and 860 residential units. Of specific interest is the Partnership's plan to physically connect the station access with the mixed-use development by means of a "Draw 7 Park Arcade." Equally of interest is its development density objective of generating sufficient ridership to justify a new Orange Line station.

Within the Assembly Square District, Yard 21 is directly west and adjacent to the MBTA ROW between Foley Street Extension on the north and Tenney Court Extension on the south. The Somerville Redevelopment Authority owns the 9.79-acre triangular shaped parcel, having acquired it in September 2000 from the MBTA for redevelopment purposes. The eastern portion of the parcel nearest to the MBTA ROW was a former railroad yard and is currently unused, overgrown with weeds and unsightly. The western portion of the Parcel is occupied by Central Steel, Spaulding Brick Company and Petrolane Company.

In 1997, Rizzo Associates, Inc. performed a Phase 1, Initial Site Investigation for the MBTA. Petroleum related compounds were detected in the soil and groundwater by the MA Department of Environmental Protection. The City has plans to redevelop the parcel and adjacent parcels into a mixed-use residential urban village centered on a new Orange Line Station. The Sturtevant Partnership has been designated by the City as developer of the parcel. Yard 21 is the most

critical parcel for station siting purposes since access to the station will be through the parcel or adjacent to it.

Winter Hill Yacht Club

Directly west of the MBTA ROW is a thin sliver of land owned by the MDC and occupied by the private Winter Hill Yacht Club. The Winter Hill site and the Draw 7 Park are linked by the two-lane roadway, described above, under the Dana Bridge.

IKEA Site

Directly west of the Winter Hill Parcel is a parcel owned by IKEA, the Swedish furniture retailer. The parcel is bounded by the Winter Hill parcel (MDC) and a thin sliver of riverfront land owned by the MDC. IKEA plans a major retail furniture store with underground parking. Additional planned uses include a riverside park, office space, and ground floor restaurants and retail. Currently the site is vacant. The development site is within walking distance of the potential site for the Orange Line Station. The IKEA project is permitted and the developer is ready to go forward as soon as certain legal issues are resolved.

Several alternative configurations have been developed for the proposed Assembly Square Orange Line Station. All of the alternatives seek to minimize any encroachment on the development parcels at the western side of the proposed station, while also seeking to minimize the need for re-alignment of the Orange Line tracks and the Haverhill / Reading Line commuter rail tracks situated east oft the Orange Line. The station configuration is ultimately intended to consist of three tracks serving two center platforms, thereby taking full advantage of the three-track Orange Line configuration at this location.

Operational issues are also being addressed, notably the impact on existing Orange Line operations due to the implementation of a new station. Issues include effects on travel times, headways, passenger capacity and the possible need for additional cars.

Somerville Community Path

The City of Somerville is pursuing the construction of a bicycle / pedestrian facility linking the existing linear park at Davis Square to Lechmere. The project envisions the use of the abandoned segment of the Lexington & Arlington Railroad between Cedar and Lowell Streets. Heading southeast, it would extend along the MBTA's New Hampshire Main Line railroad right-of-way from Somerville Junction (near Lowell Street) to Washington Street. The alignment would then extend south to

Lechmere area. The City completed a Feasibility Study in May 2001 and is presently undertaking initial design on the segment from Cedar Street to Central Street. Conceptual planning continues on the project.

Where located at-grade along the MBTA's railroad right-of-way, the 14 foot wide path would be offset from the adjacent rapid transit service corridor by a minimum of 15 feet as measured from fence line to fence line.

In addition to coordinating the physical arrangements of the project, there is also an opportunity to integrate the Community Path's neighborhood connections into the transit stations, particularly where the path will cross local streets at grade. The alignments under consideration for the Beyond Lechmere Project will be coordinated with the community path for compatibility.

Union Square Master Plan / Phase II

The City of Somerville is undertaking a multi-phase plan for the revitalization of Union Square. The Square is a commercial business district and an historic crossroads where several major city arterials converge. The Fitchburg Division tracks also pass just south of the Square. Rail service represented an important feature in the development of the various industrial activities that once dominated the southern portions of the Square. This industrial activity has declined, and some of these remaining activities are viewed as being incompatible with plans for commercial and residential development of the area.

Presently, Union Square is considered to be viable but not as flourishing or vital as it once was. The Square is not served by rapid transit or commuter rail lines, and it is thus perceived to be at a competitive disadvantage as compared to other nearby neighborhood, community and office commercial centers – such as Davis Square, Porter Square, Central Square, Kendall Square and Harvard Square – all of which are served by the Red Line. The Master Plan's statement of goals and objectives identifies a need to "*maintain an efficient and thorough system of transportation that balances public transportation, private and commercial vehicles, bicycles, and pedestrians that is consistent with Union Square's image as a commercial center.*"

Specific activities include:

- Work with the MBTA to establish the commuter rail stops to utilize multiple lines that already pass through Union Square
- Work with the MBTA to establish a transit stop via the Green Line and the proposed Urban Ring
- Work with the MBTA to coordinate bus service within Union Square

One of the key elements in the revitalization plan is the need to locate all new major development sites within an easy walking distance (1,200 to 1,500 feet) of a proposed new multi-modal transit station planned along the Fitchburg Division right-of-way at the intersection of Prospect Street and Webster Avenue. The development in the vicinity of this transit facility may shift the "center of gravity' of Union Square slightly east towards Prospect Street, serving to enhance Prospect Street as the southern gateway to the Square.

Tufts University Master Plan

Tufts University is in the early stages of initiating a master plan for the area. The goal of the study is to conduct a full assessment of the present and future needs of Tufts University.

Medford Planning Efforts

There are a number of planning efforts that have been conducted in the City of Medford. These efforts include:

- **The Vision of Medford Square** - Coordinated by the City's Office of Community Development, this study examined economic opportunities associated with redevelopment particularly in the Medford Square area. Recommendations of the study will be considered for future comprehensive planning efforts for the entire City and to create a specific master plan for the Medford Square area.
- **Medford Open Space Plan –** Major goals of the Open Space Plan are to serve the specific recreation needs of Medford residents and to use the open space system to strengthen the community. The Medford Recovery Action Plan (RAP) is a supplement to the Medford Open Space Plan, which provides a framework for applying the Federal Urban Parks and Recreation Recovery Action Program to Medford's open space and recreation system.

Additional Private Developments

There are a number of private development initiatives that occur within the project study area. One example of this type of development is K.S.S. Realty Partners, Inc. plan for a residential development at 56 and 61 Clyde Street. The parcels are adjacent to the Lowell Line and the Lowell Street Bridge. Coordination with private developments along potential alternative alignments, such as this one, will need to be coordinated with throughout the project.