

The vehicle crash data for this signalized intersection are based on actual accident reports for the years 2002 through 2004, and were provided by the Salem Police Department.

Based on the data provided, 38 of the 69 crashes were rear end (55%), 18 were angle (26%), and 7 were sideswipes in the same direction (10%). Most of the rear end crashes occurred on the southbound (Canal Street) and eastbound (Jefferson Avenue) approaches. Of the angle crashes, there was an even distribution with 9 crashes involving left turns or broadsides within the intersection, and 9 crashes involving vehicles entering or exiting driveways and then conflicting with through traffic. See Figure D-8 for a collision diagram of the combined three-year data. The crash rate at this location is 1.91, more than twice the 2005 District 4 average rate for signalized intersections of 0.88.

LOS analyses reveal that the overall intersection operates at LOS F during both the AM and PM peak hours. Most of the individual approaches operate at either LOS E or F. Queuing is severe.

PUBLIC TRANSPORTATION⁷

Introduction

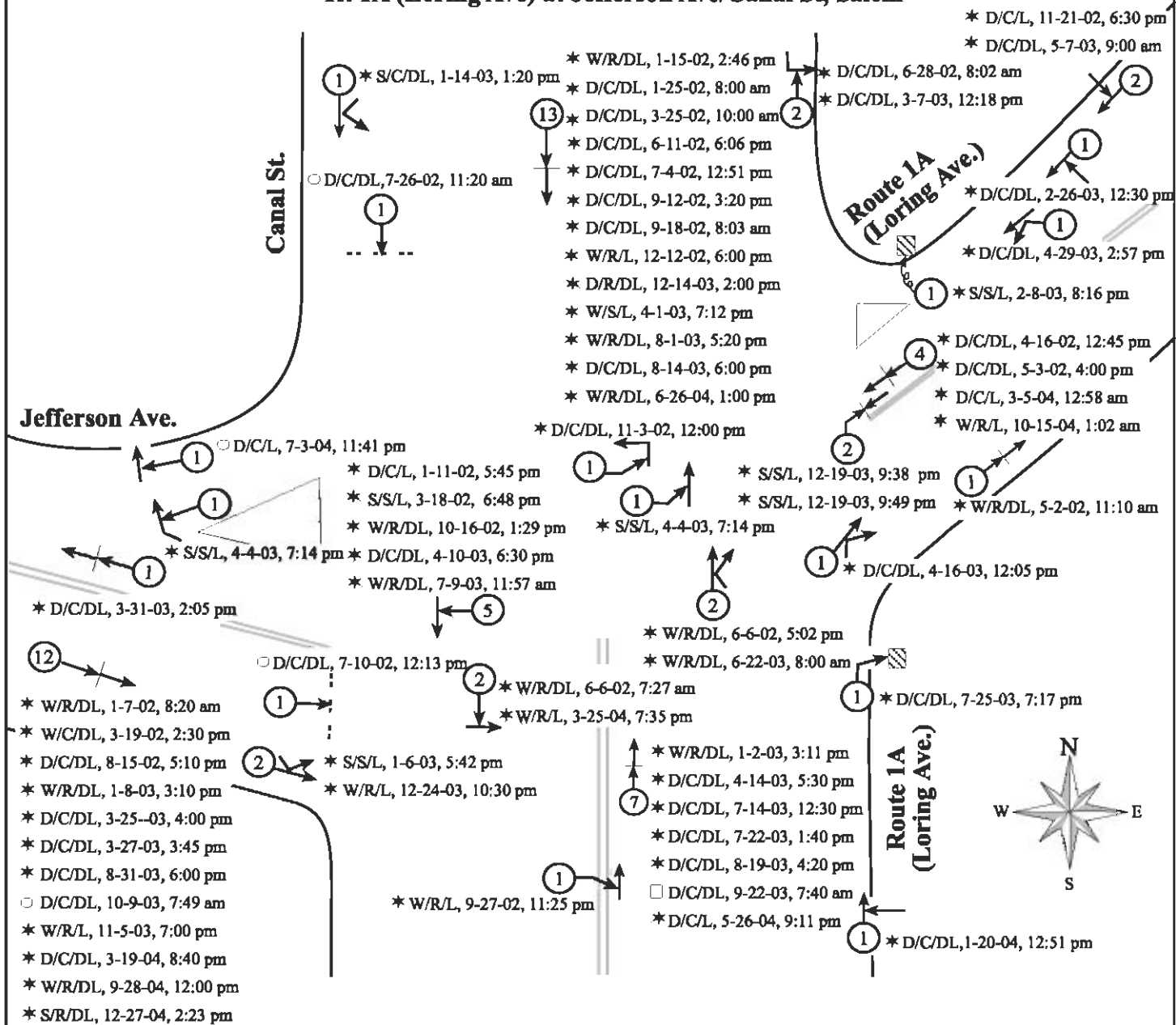
While the share of commuter trips from the greater Mid-North Shore area made by public transportation grew by just 1% between 1990 and 2000, there are several reasons to suggest that the demand for such services will grow, both for commuting and for other trip purposes. Lynn and Salem are the fastest growing towns in the region in terms of population. They also have the highest values, and greatest growth, of many other variables that are traditionally linked to transit usage. For example, they have two of the highest population densities in the area, as well as substantial growth in the number of employed residents. Also, moderately high poverty rates, and large numbers of immigrants and younger residents, are factors which are traditionally correlated with high transit usage. This high transit usage is also related to the lack of disposable income and access to private vehicles. As the local economy grows, however, a general increase in commuting can be expected, including increased demand for local public transportation services.

Growing job opportunities in Boston also suggest that the demand for public transportation will continue to remain strong for commuters from throughout the Mid-North Shore area. The speed and comfort of existing public transportation modes, as compared to the private automobile, will likely determine to what extent transit is used. In fact, between 1990 and 2000 many commuters switched to commuter rail, presumably partly as a result of the improvements made to the commuter rail system in the late 1980s and early 1990s.

Certain variables and trends, however, suggest the continuing difficulty that public transportation in general may have in the Mid-North Shore area. As more and more residents work outside the study area and in dispersed locations throughout the Boston metropolitan

⁷ This section is based on three Draft technical memoranda by CTPS Transit Service Planning staff: T. Humphrey, "Mid-North Shore Transit Service Connectivity," 27 July, 2005; R. Guptill, "Task 4: Mid-North Shore Subregional Transportation Study: Public Transportation," 3 February, 2006; and, R. Guptill, "Task 4: Mid-North Shore Subregional Transportation Study: Bus Service Demand," 7 February, 2006.

FIGURE D-8
(pertains to Location 23 – see above, pp. D-27 and D-28)
Collision Diagram
Crashes from 1/1/2002 to 12/31/2004
Rt 1A (Loring Ave) at Jefferson Ave/Canal St, Salem



SYMBOLS	PAVEMENT/WEATHER/LIGHTING	TYPES OF COLLISIONS
Moving Vehicle Backing Vehicle Pedestrian/Bicycle Out of Control Vehicle Fixed Object Property Damage Only Injury Fatality No Damage/Injury Number of Accidents	D Dry W Wct S Snowy, Icy C Clear R Rainy/Foggy/Cloudy S Snow/Sleet O Other DL Daylight L Dark – Lights N Dark – No Lights	Head On Angle Rear End Sideswipe Broadside <p align="center">CTPS</p>

region, it will be increasingly difficult for public transportation to serve these varied suburb-to-suburb trip interchanges in a cost-efficient manner. Local transit service may also suffer as incomes rise and people make greater use of private vehicles for local trips. From growing congestion in general, and by Boston-bound commuters in particular, increased driving on local roads to nearby park-and-ride lots may negatively impact local transit service. See Appendix D-5 for a discussion on study area journey-to-work findings.

Figure D-9 depicts the public transportation system inside and outside the Mid-North Shore study area. No rapid transit or commuter boat services are found in the three-town study area. The closest rapid transit station is Wonderland Station on the Blue Line in Revere. A discussion on the extent of service and on performance issues for existing study area modes—commuter rail and bus, respectively—are described below.

Commuter Rail

Two MBTA commuter rail lines pass through the three study area towns. The Rockport Line has twelve trips inbound to North Station in Boston during weekdays, while the Newburyport Line also has twelve inbound trips to Boston. Combined with additional trips from intervening stations (Beverly Depot and Hamilton/Wenham stations), a total of 30 inbound trains to Boston stop in Salem, and 25 trains stop in Swampscott and Lynn on weekdays. Outbound, the corresponding totals are 25 trains stopping in Lynn and Swampscott, and 31 trains stopping in Salem. On weekends and holidays, 13 trains stop both inbound and outbound in all three towns.

Commuter rail ridership has grown steadily over the past thirty years. Table D-2 displays this growth in daily boardings at the three study area stations.

TABLE D-2
Average Estimated Daily Boardings (Inbound), Study Area Commuter Rail Stations
1975–2005

	1975	1980	1986	1990	1996	2000	2005
Lynn	50	70	220	170	470	570	660
Swampscott	230	340	320	520	780	830	800
Salem	390	540	800	930	1,630	1,900	1,910

Source: MBTA, 2005

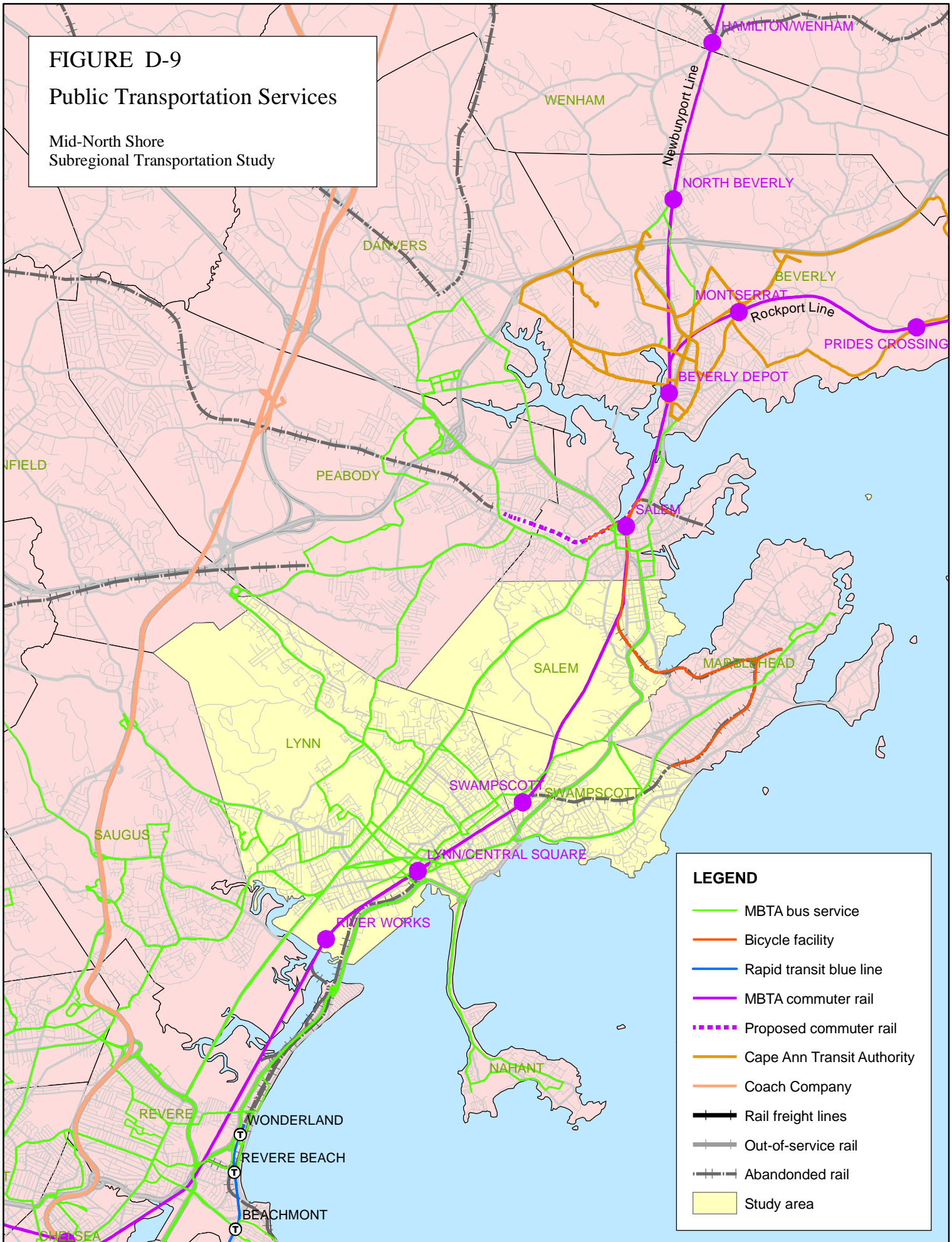
With respect to passenger load standards and on-time performance standards, it is seen that the Rockport and Newburyport Lines perform relatively well. Table D-3 below shows that both lines meet the peak period load standard of 1.1 passengers per seat. However, the two lines fall slightly below the standard of 95% of all trips departing and arriving on time.

Commuter rail and bus schedules for the study area have never been intentionally coordinated to facilitate transfers between the two modes. If schedules were coordinated, transfer passengers would have shorter wait times, and therefore shorter total trip times, than they do now. However, schedules of both modes are constrained by other considerations, such as a preponderance of single track layout limiting overall capacity, as well as the limited number of train sets available for service.

FIGURE D-9

Public Transportation Services

Mid-North Shore
Subregional Transportation Study



LEGEND

- MBTA bus service
- Bicycle facility
- Rapid transit blue line
- MBTA commuter rail
- Proposed commuter rail
- Cape Ann Transit Authority
- Coach Company
- Rail freight lines
- Out-of-service rail
- Abandoned rail
- Study area

TABLE D-3
Commuter Rail Load and On-Time Adherence Standards

Line	Load Standards		95% of all trips departing and arriving at both terminals must be within 5 min. late
	Peak period	Off-peak period	
	Max.: 1.1 passengers / seat	Max.: 1.0 passengers / seat	
Newburyport Line	AM and PM peak periods, 0.74 passengers / seat	Unavailable	92% of AM and PM peak period trips on time
Rockport Line	AM and PM peak periods, 0.97 passengers / seat	Unavailable	

Source: MBTA, 2000 and 2003–2004

Bus

Several MBTA express bus routes run through from the Mid–North Shore study area to Boston, either to Haymarket Station (connecting to the Orange/Green Lines) or to Downtown Crossing (connecting to the Orange/Red Lines). These express routes also provide local bus service in the study area. Several bus routes serve the Wonderland terminal in Revere, where passengers can transfer to Blue Line rapid transit trains for Boston.

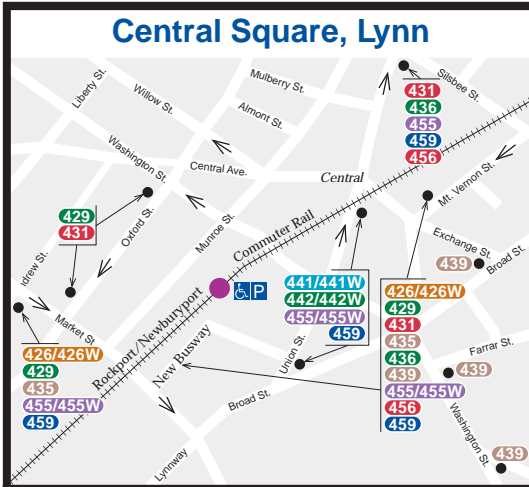
The majority of local bus routes that do not run through to Boston terminate at Central Square in Lynn. Central Square is also served by most of the express routes, and is the location of the Lynn Central Square commuter rail station. Several of the bus routes also intersect at the commuter rail station in Salem (see Figure D-10).

The use and performance of bus service in the greater Mid-North Shore area is examined next for each study area town—Lynn, Swampscott, and Salem. Following this, there is a discussion on general North Shore bus service demand. The public transportation section then concludes with a summary of park-and-ride facilities in the study area.

Lynn bus service

The following MBTA bus routes currently serve the City of Lynn:

- 424 (Eastern Avenue and Essex Street–Haymarket)
- 424W (Eastern Avenue and Essex Street–Wonderland)
- 426 (Central Square–Haymarket)
- 426W (Central Square–Wonderland)
- 429 (Central Square–Northgate Shopping Center)
- 431 (Central Square–Neptune Towers)
- 434 (Peabody Square–Haymarket via Goodwin Circle)
- 435 (Liberty Tree Mall–Central Square via Peabody Square)
- 436 (Liberty Tree Mall–Central Square via Goodwin Circle)
- 439 (Bass Point, Nahant–Central Square)
- 441 (Marblehead–Haymarket via Paradise Road)
- 441W (Marblehead–Wonderland via Paradise Road)
- 442 (Marblehead–Haymarket via Humphrey Street)



LEGEND

- Commuter Rail and station
- Accessible station
- Parking available at station

Bus Routes

- 000 - 000 - 000 - 000
- 000 - 000 - 000 - 000
- Colors are randomly assigned
- Dashed lines are route variations
- Express route
- Non-MBTA route/shuttle
- Details in beige box
- Bicycle rack at station

Water

Interstate 93

U.S. route 1

State route 3

Park

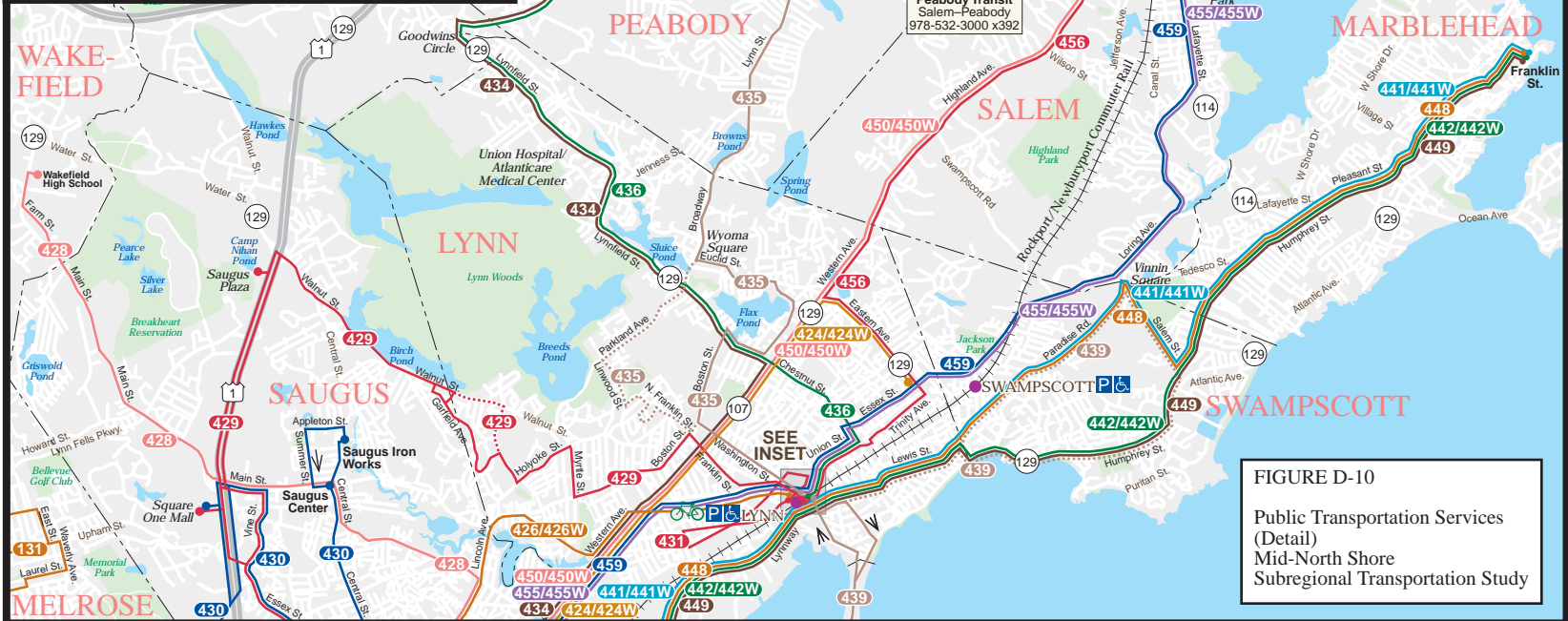


FIGURE D-10
Public Transportation Services
(Detail)
Mid-North Shore
Subregional Transportation Study

- 442W (Marblehead–Wonderland via Humphrey Street)
- 448 (Marblehead–Logan Airport and Downtown Crossing via Paradise Road)
- 449 (Marblehead–Logan Airport and Downtown Crossing via Humphrey Street)
- 450 (Salem Depot–Downtown Crossing via Highland Avenue)
- 450W (Salem Depot–Wonderland via Highland Avenue)
- 455 (Salem Depot–Haymarket via Loring Avenue)
- 455W (Salem Depot–Wonderland via Loring Avenue)
- 456 (Salem Depot–Central Square via Highland Avenue)
- 459 (Salem Depot–Logan Airport and Downtown Crossing via Loring Avenue)

Currently, bus service between Central Square in Lynn and the Wonderland Blue Line terminal in Revere is provided by Routes 426W, 441, 442, 441W, 442W, and 455W. The 440-series routes use the fastest and most direct alignment, via the Lynnway and North Shore Road (Route 1A). Routes 426W and 455W use longer and slower alignments with more intermediate stops. For purposes of time comparisons with commuter rail, it is reasonable to assume that most passengers using a combination of bus and Blue Line to travel from Central Square to downtown Boston will ride one of the 440-series routes.

In downtown Boston, the Blue Line has four stations: Aquarium, State, Government Center, and Bowdoin. For passengers taking buses from Central Square to Wonderland and continuing to Boston on the Blue Line, average elapsed times from arrival in Central Square to arrival at these stations range from 44 to 48 minutes.

Several MBTA express bus routes run through from Lynn to Boston, but they have longer travel times than either commuter rail or a combination of bus and Blue Line. Furthermore, travel times on all of the express routes are subject to significant traffic delays.

With respect to headways, through buses to Boston on Routes 441 and 442 depart Central Square at a combined interval of every 30 minutes in the AM peak. Route 455 also provides through service from Central Square to Boston, but uses a slower alignment than Routes 441 and 442. On Route 455, the AM peak scheduled time from Central Square to Haymarket is 15 minutes longer than that of Routes 441 and 442, and Route 455 runs only once hourly. Route 459 provides service from Central Square to Downtown Crossing. During AM peak hours, the scheduled time between these points is 14 minutes longer than that of Routes 441 and 442 between Central Square and Haymarket. Like Route 455, Route 459 ran only once hourly in the AM peak in Spring 2005.

Passengers accessing transit services at Central Square by private transportation can plan their arrivals to minimize waiting times for bus or commuter rail departures. Passengers arriving by feeder bus can plan on connections only as close as those offered by the bus schedules. As scheduled in Spring 2005, most bus trips arriving in Central Square make closer connections with buses to Wonderland than with commuter rail trains to Boston.

Swampscott bus service

The following MBTA bus routes currently run through Swampscott. They originate in either Marblehead or Salem, and are destined for Wonderland Station or downtown Boston:

- 441 (Marblehead–Haymarket via Paradise Road)
- 441W (Marblehead–Wonderland via Paradise Road)
- 442 (Marblehead–Haymarket via Humphrey Street)
- 442W (Marblehead–Wonderland via Humphrey Street)
- 448 (Marblehead–Logan Airport and Downtown Crossing via Paradise Road)
- 449 (Marblehead–Logan Airport and Downtown Crossing via Humphrey Street)
- 455 (Salem Depot–Haymarket via Loring Avenue)
- 455W (Salem Depot–Wonderland via Loring Avenue)
- 459 (Salem Depot–Logan Airport and Downtown Crossing via Loring Avenue)

None of the routes serve the Swampscott commuter rail station directly. On Routes 455, 455W, and 459 the nearest point to Swampscott Station is about 750 feet away at Essex Street and Essex Avenue, about a three-minute walk. On Routes 441, 441W, and 448, the nearest point to Swampscott Station is about one-quarter mile away at Paradise Road and Pine Street, a five-minute walk.

Because of street layout, diverting buses to serve Swampscott Station directly would increase travel times slightly for passengers traveling past the station but not transferring to trains at Lynn. Swampscott Station is currently served by all of the same trains that stop at Lynn. The scheduled train time between the Lynn and Swampscott stations is three minutes on almost all trips.

Historically, bus routes running on Essex Street have never made a side diversion to bring them closer to Swampscott Station. From January to June 1989, most inbound AM peak trips and some outbound PM peak trips on Routes 441 and 442 did make a side diversion to Swampscott Station via Burrill Street, Railroad Avenue, and Pine Street. However, published bus schedules did not show bus or train times at the station, and published train schedules did not mention the bus service at all. Few, if any, riders took advantage of the diversion to transfer between trains and buses.

Because of winding roads and steep hills, few streets in Swampscott other than those currently included in MBTA bus routes would be suitable for operation of full-size buses.

Salem bus service

MBTA bus routes serving Salem Depot are:

- 450 (Salem Depot–Haymarket)
- 450W (Salem Depot–Wonderland)
- 451 (North Beverly–Salem Depot)
- 455 (Salem Depot–Haymarket via Central Square, Lynn)
- 455W (Salem Depot–Wonderland via Central Square, Lynn)
- 456 (Salem Depot–Central Square, Lynn via Highland Avenue)

- 459 (Salem Depot–Downtown Crossing via Logan Airport)
- 465 (Liberty Tree Mall–Salem Depot)
- 468 (Danvers Square–Salem Depot)

All of these routes can be used for local travel within Salem and adjoining communities that they run through. Routes 450, 455, and 459 run through to points in downtown Boston. Routes 450W and 455W provide connections with the Blue Line at Wonderland Station for Boston travel. Routes 451, 456, 465, and 468 require transfers either to other buses or to commuter rail for Boston trips.

For travel to Boston from the immediate vicinity of Salem Depot, commuter rail is faster than any of the bus routes. During AM peak hours, scheduled bus times on Route 450 from Salem Depot to Haymarket Station in Boston range from 47 to 59 minutes, and service runs on fixed 30-minute headways. Route 455 has only two inbound AM peak trips, one hour apart, with scheduled times of 77 and 82 minutes to Haymarket. Route 459 has three inbound AM peak trips at hourly intervals, alternating with Route 455 trips.

Another alternative for passengers starting from points on Route 455/459 in Salem is to take Route 455W to Wonderland and transfer to the Blue Line. Route 455W has six inbound AM peak trips, with scheduled times to Wonderland ranging from 46 to 60 minutes. For passengers transferring to the Blue Line, the additional time to reach State Station in downtown Boston would be about 21 minutes, making a total of about 74 minutes from Salem Depot. This is more than twice as long as the average scheduled commuter rail time of 32 minutes from Salem Depot to North Station. However, the locations of Blue Line stations in downtown Boston provide general egress time savings of about 10 minutes compared with those from commuter rail at North Station.

Salem Depot is located near the north side of the City of Salem, technically outside the study area for this study. Access to it from much of the city requires traveling in the opposite direction from Boston. This makes the buses more time-competitive with trains from points further away from Salem Depot. Bus and train arrival and departure times at Salem Depot are not intentionally coordinated at this time. Within Salem, Routes 455 and 459 follow the same alignment, so a passenger using either route for a connection to Salem Depot does not have to be concerned with which route the bus is on.

Route 451 connects directly with commuter rail both at Salem Depot and at North Beverly Depot, but does not run close enough to Beverly Depot to allow convenient transfers there. Only one inbound trip is scheduled to arrive at Salem Depot in time to connect with an AM peak commuter rail trip to Boston. Two outbound trips on Route 451 can be used to connect with inbound trains at North Beverly, with one requiring a wait there of 20 minutes and the other a wait of four minutes.

Both inbound AM peak trips on Route 468 can be used for commuter rail connections at Salem Depot, with scheduled wait times there of 15 and 12 minutes. Including the times on the connecting trains, total times from bus arrival at Salem Depot to train arrival at Boston would be 43 and 45 minutes. Even if bus connections to Boston are provided with no waiting time (which

they are not) none of the direct routings or Blue Line transfer routings would be as fast as the commuter rail transfers.

Summary of study area bus service

The study area bus routes have been reviewed in this memorandum with respect to established standards of service performance—frequency, passenger load, and on-time adherence. Data on bus service performance are from 2003–2005, and Table D-4 is a summary of which study area bus routes fail to meet the standards. Noteworthy from this table is that every bus route fails in at least one of the three performance standards, with none of the routes meeting the on-time adherence standard.

North Shore Bus Service Demand

Service demand indicators for each Mid–North Shore study area bus route are presented in Table D-5. They are expressed in terms of each route’s ridership totals for weekdays, Saturdays, and Sundays.

As the table shows, Routes 426, 429, 442, 450, 455, and 459 have the highest weekday ridership. Demand declines by about one-half to one-third on Saturday, with only the Saturday Route 455(W) actually exceeding its weekday ridership. Demand continues to decline slightly from Saturday to Sunday, with only Route 442(W) maintaining approximately the same level of ridership throughout the weekend.

In addition, Table D-5 shows that the average subsidy per passenger (the net cost, or total cost minus fare revenue divided by ridership) is generally lower on routes with greater ridership. About half of the routes serving the Mid-North Shore have subsidies at or below \$4.00 per passenger. The five most heavily traveled routes in the study area—Routes 426, 429, 442, 455, and 459—receive five of the six smallest subsidies. Only Route 434, with a subsidy per passenger of \$0.39, comes close to breaking even. Routes 439 and 468, the two routes with the smallest ridership totals, receive the two largest subsidies per passenger, \$15.13 and \$9.93, respectively.

Many riders on the bus network use it to connect to other buses or to the subway or commuter rail network. On express routes, such as Routes 424, 426, 434, 450, and 455 that serve downtown Boston, it is not surprising that the largest percentage of riders are either boarding or alighting at Haymarket Station as they transfer to or from the subway network. Wonderland Station also acts as a major transfer point between the bus and subway networks, as several routes originate or terminate directly at the Blue Line station. 71% of Route 424W inbound passengers alight at Wonderland Station; 53% of Route 449 outbound passengers board here. On the weekends, Wonderland attracts an even greater percentage of total riders. Another common location for riders to board or alight is the Lynn Central Square commuter rail station. For Route 436, 31% of inbound and 46% of outbound passengers board and alight, respectively, from the Lynn Central Square Station.

TABLE D-4
MID-NORTH SHORE SUBREGIONAL TRANSPORTATION STUDY
MBTA Bus Service: Summary of Failures to Meet Performance Standards

Bus Rte No.	Frequency Standards		Load Standards		Adherence Standard (all day)*
	Peak period headway: every 30 min.	Off-peak period headway: every 60 min.	Midday School/Peak period Max.: 1.4 passengers per seat	Off-peak period Max.: 1.0 passengers per seat	
424	---	---	---	---	20% inb., 25% outb.; FAILS weekdays
426	---	---	---	---	20% inb., 20% outb.; FAILS weekdays 18% inb., 21% outb.; FAILS Saturdays 44% inb., 21% outb.; FAILS Sundays
429	---	---	---	---	31% inb., 39% outb.; FAILS weekdays 20% inb., 20% outb.; FAILS Saturdays 22% inb., 11% outb.; FAILS Sundays
431	Every 104 mins.; FAILS AM pk Every 60 mins.; FAILS PM pk ---	---	---	---	15% inb., 11% outb.; FAILS weekdays 10% inb., 11% outb.; FAILS Saturdays 43% inb., 64% outb.; FAILS Sundays
434	---	---	---	---	0% inb., 0% outb.; FAILS weekdays
435	Every 45 mins.; FAILS AM pk Every 60 mins.; FAILS PM pk ---	Every 120 mins.; FAILS Sundays ---	---	1.1 pass./seat; FAILS Sat. eve. inb. 1.05 pass./seat; FAILS Sat. AM outb. 1.05 pass./seat; FAILS Sun. mid'y outb.	29% inb., 6% outb.; FAILS weekdays 60% inb., 7% outb.; FAILS Saturdays 50% inb., 25% outb.; FAILS Sundays
436	Every 60 mins.; FAILS PM pk ---	Every 120 mins.; FAILS Sundays ---	---	---	52% inb., 47% outb.; FAILS weekdays 36% inb., 45% outb.; FAILS Saturdays 50% inb., 17% outb.; FAILS Sundays
439	Every 41 mins.; FAILS AM pk	---	---	---	36% inb., 25% outb.; FAILS weekdays
441	---	---	---	1.08 pass./seat; FAILS Sat. mid'y inb. ---	25% inb., 33% outb.; FAILS weekdays 15% inb., 38% outb.; FAILS Saturdays 30% inb., 20% outb.; FAILS Sundays
442	---	---	1.63 pass./seat; FAILS PM peak outb. ---	---	29% inb., 28% outb.; FAILS weekdays 32% inb., 37% outb.; FAILS Saturdays
448	Every 60 mins.; FAILS AM pk Every 60 mins.; FAILS PM pk	---	---	---	0% inb., 0% outb.; FAILS weekdays ---

* Adherence Standard = 75% of all trips must (a) depart not less than 0 and not more than 3 minutes of scheduled departure, and (b) arrive not less than 3 and not more than 5 minutes of scheduled arrival

TABLE D-4 (cont.)
MID-NORTH SHORE SUBREGIONAL TRANSPORTATION STUDY
MBTA Bus Service: Summary of Failures to Meet Performance Standards (cont.)

Bus Rte No.	Frequency Standards		Load Standards		Adherence Standard (all day)*
	Peak period headway: every 30 min.	Off-peak period headway: every 60 min.	Midday School/Peak period Max.: 1.4 passengers per seat	Off-peak period Max.: 1.0 passengers per seat	
449	Every 60 mins.; FAILS AM pk Every 60 mins.; FAILS PM pk	---	---	---	0% inb., 33% outb.; FAILS weekdays ---
450	---	---	1.45 pass./seat; FAILS PM peak outb.	---	23% inb., 13% outb.; FAILS weekdays 29% inb., 20% outb.; FAILS Saturdays
451	Every 60 mins.; FAILS AM pk ---	---	---	---	46% inb., 8% outb.; FAILS weekdays 20% inb., 40% outb.; FAILS Saturdays
455	---	---	---	1.15 pass./seat; FAILS Sat. PM inb.	0% inb., 6% outb.; FAILS weekdays 33% inb., 21% outb.; FAILS Saturdays
456	---	---	---	---	14% inb., 11% outb.; FAILS weekdays
459	Every 60 mins.; FAILS AM pk Every 60 mins.; FAILS PM pk	---	---	---	6% inb., 31% outb.; FAILS weekdays ---
465	---	---	---	---	45% inb., 60% outb.; FAILS weekdays 18% inb., 9% outb.; FAILS Saturdays
468	Every 61 mins.; FAILS AM pk Every 50 mins.; FAILS PM pk	---	---	---	50% inb.; FAILS weekdays ---

* Adherence Standard = 75% of all trips must (a) depart not less than 0 and not more than 3 minutes of scheduled departure, and (b) arrive not less than 3 and not more than 5 minutes of scheduled arrival

Source: MBTA, 2003-2005

TABLE D-5
MID-NORTH SHORE SUBREGIONAL TRANSPORTATION STUDY
MBTA Bus Service: Weekday, Saturday, and Sunday Service Demand

Bus Route No.	Direction	Total Weekday Ridership	Total Saturday Ridership	Total Sunday Ridership	Subsidy per Passenger	Date Last Ride-checked
424	Inbound	<i>Only Route 424W runs in inbound direction</i>				
424	Outbound	88	N.A.	N.A.	\$2.54	Fall03
424W	Inbound	72	N.A.	N.A.	\$2.54	Fall03
424W	Outbound	<i>Only Route 424 runs in outbound direction</i>				
426	Inbound	555	N.A.	N.A.	\$1.73	Fall03
426	Outbound	920	N.A.	N.A.	\$1.73	Fall03
426W	Inbound	143	224	213	\$1.73	Fall03
426W	Outbound	N.A.	280	173	\$1.73	Fall03
429	Inbound	566	313	141	\$4.00	Spring03
429	Outbound	599	375	179	\$4.00	Spring03
431	Inbound	60	3	1	\$2.78	Winter05
431	Outbound	32	0	7	\$2.78	Winter05
434	Inbound	63	N.A.	N.A.	\$0.39	Spring03
434	Outbound	17	N.A.	N.A.	\$0.39	Spring03
435	Inbound	241	232	71	\$5.64	Spring03
435	Outbound	296	281	87	\$5.64	Spring03
436	Inbound	363	124	87	\$4.80	Spring03
436	Outbound	323	163	82	\$4.80	Spring03
439	Inbound	39	N.A.	N.A.	\$15.13	Spring03
439	Outbound	27	N.A.	N.A.	\$15.13	Spring03
441	Inbound	407	N.A.	N.A.	\$2.19	Spring03
441	Outbound	465	N.A.	N.A.	\$2.19	Spring03
441W	Inbound	148	281	197	\$2.19	Spring03
441W	Outbound	N.A.	244	195	\$2.19	Spring03
442	Inbound	456	N.A.	N.A.	\$1.57	Spring03
442	Outbound	901	N.A.	N.A.	\$1.57	Spring03
442W	Inbound	163	301	342	\$1.57	Spring03
442W	Outbound	N.A.	302	293	\$1.57	Spring03

TABLE D-5 (cont.)
MID-NORTH SHORE SUBREGIONAL TRANSPORTATION STUDY
MBTA Bus Service: Weekday, Saturday, and Sunday Service Demand

Bus Route No.	Direction	Total Weekday Ridership	Total Saturday Ridership	Total Sunday Ridership	Subsidy per Passenger	Date Last Ride-checked
448	Inbound	62	N.A.	N.A.	\$4.55	Spring03
448	Outbound	57	N.A.	N.A.	\$4.55	Spring03
449	Inbound	78	N.A.	N.A.	\$5.01	Spring03
449	Outbound	60	N.A.	N.A.	\$5.01	Spring03
450	Inbound	630	N.A.	N.A.	\$1.82	Fall03
450	Outbound	773	N.A.	N.A.	\$1.82	Fall03
450W	Inbound	9	268	199	\$1.82	Fall03
450W	Outbound	N.A.	315	282	\$1.82	Fall03
451	Inbound	96	51	N.A.	\$7.52	Winter05
451	Outbound	131	18	N.A.	\$7.52	Winter05
455	Inbound	676	N.A.	N.A.	\$1.23	Fall03
455	Outbound	580	N.A.	N.A.	\$1.23	Fall03
455W	Inbound	222	886	381	\$1.23	Fall03
455W	Outbound	N.A.	818	407	\$1.23	Fall03
456	Inbound	51	N.A.	N.A.	\$4.99	Spring03
456	Outbound	105	N.A.	N.A.	\$4.99	Spring03
459	Inbound	525	N.A.	N.A.	\$2.27	Fall03
459	Outbound	495	N.A.	N.A.	\$2.27	Fall03
465	Inbound	115	93	N.A.	\$5.68	Winter05
465	Outbound	175	121	N.A.	\$5.68	Winter05
468	Inbound	10	N.A.	N.A.	\$9.93	Winter05
468	Outbound	7	N.A.	N.A.	\$9.93	Winter05

Source: CTPS

Park-and-Ride Facilities

Numerous facilities exist in the study area and throughout the North Shore where commuters may park their vehicles and transfer to another mode. These park-and-ride facilities are located at commuter rail stations, rapid transit stations, and key roadway locations such as near highway interchanges and along state-numbered highways. Figure D-11 depicts these facilities, along with available data on capacity, utilization rates, connecting transportation services, and towns of origin of parked vehicles.

License plate surveys were performed by CTPS during 2005 as part of this study at the MBTA Lynn Central Square, Swampscott, and Salem commuter rail stations, as well as at the Wonderland Blue Line rapid transit station in Revere. A summary of the results from the surveys is shown in Table D-6.

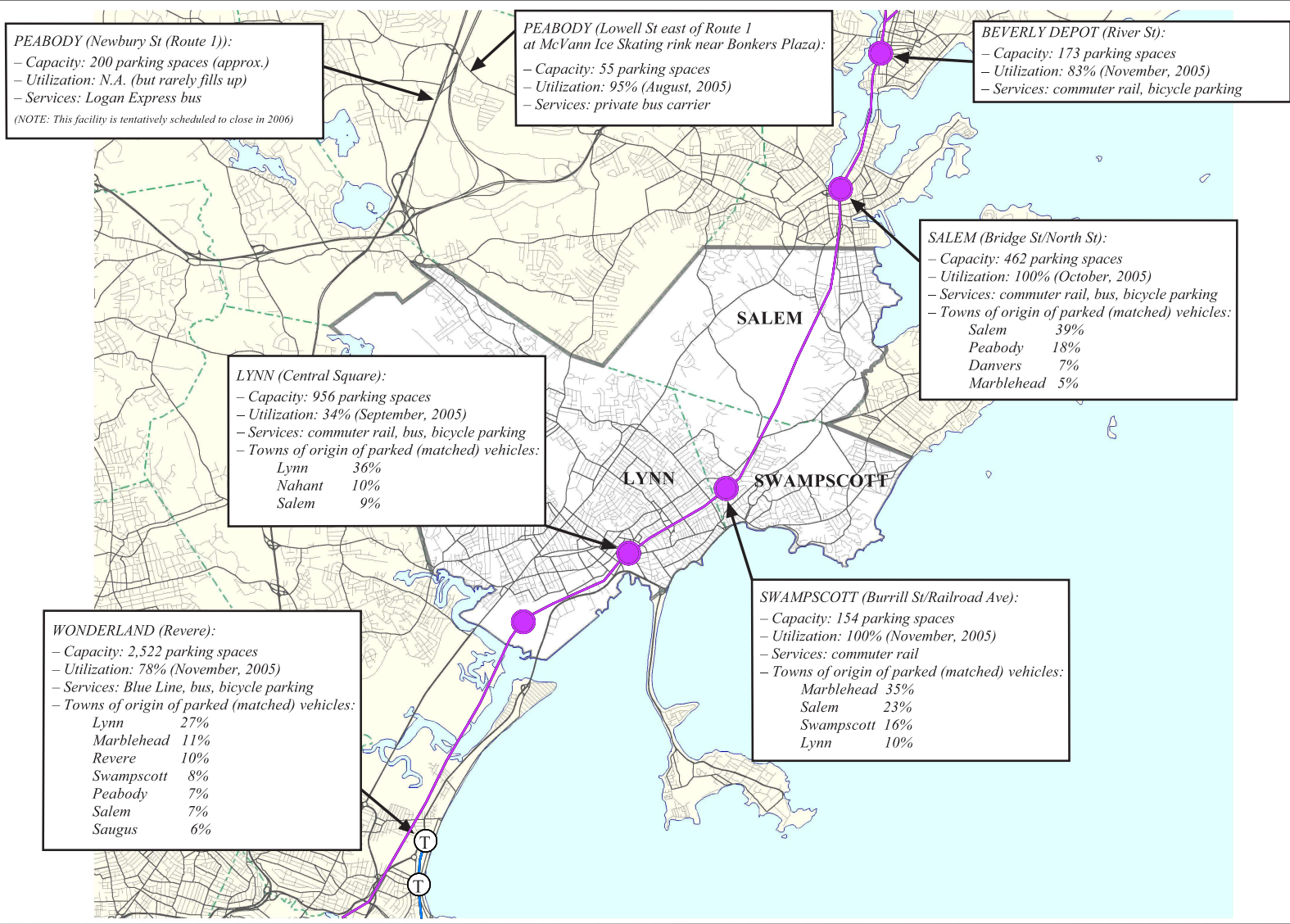
TABLE D-6
Results of License Plate Surveys at MBTA Park-and-Ride Facilities
Percent of Matched Vehicles (Number of Matched Vehicles) by Town of Origin

Town of Origin	Lynn Central Square Station	Swampscott Station	Salem Station	Wonderland Station
Lynn	36% (58 vehs)	10% (8 vehs)	< 5%	27% (238 vehs)
Nahant	10% (16 vehs)	< 5%	< 5%	< 5%
Salem	9% (14 vehs)	23% (18 vehs)	39% (106 vehs)	7% (64 vehs)
Marblehead	< 5%	35% (28 vehs)	5% (13 vehs)	11% (99 vehs)
Swampscott	< 5%	16% (13 vehs)	< 5%	8% (75 vehs)
Danvers	< 5%	< 5%	7% (19 vehs)	< 5%
Peabody	< 5%	< 5%	18% (50 vehs)	7% (61 vehs)
Revere	< 5%	< 5%	< 5%	10% (88 vehs)
Saugus	< 5%	< 5%	< 5%	6% (50 vehs)
Matched Vehicles:	163 (Match	79 (Match	272 (Match	883 (Match
Parked Vehicles:	250 rate: 65%)	132 rate: 60%)	413 rate: 66%)	1,195 rate: 74%)

Source: CTPS, 2005

From this table, it is noteworthy that just over one-third of matched vehicles at Lynn Central Square Station and Salem Station originate in Lynn (36%) and Salem (39%), respectively. However, at Swampscott Station it was observed that about one-third of the vehicles originate in Marblehead (35%), and only 16% originate in Swampscott (13 vehicles). In fact, it is seen that far more vehicles from Swampscott park at Wonderland Station (75 vehicles) than at Swampscott Station. This is also true of vehicles from Lynn, with 238 vehicles parked at Wonderland Station and only 58 at Lynn Central Square Station.

Additional information pertaining to the license plate surveys is found in Appendix D-4.



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**Mid-North Shore Subregional
Transportation Study**



**FIGURE D-11
Park-and-Ride Facilities
Study Area and Environs**

BICYCLES AND PEDESTRIANS

Bicycles

The only active off-road bicycle/pedestrian facility in the study area is the Salem–Marblehead Rail Trail between Salem State College and the center of Marblehead, crossing Route 114 near the town line at Forest River. In Salem, the trail extends southeastward about 0.5 miles along a former railbed from Canal Street, just north of Kimball Road, across Loring Avenue and the College campus to Route 114 (Lafayette Street) and the Marblehead line. See Figure D-12 for constructed and proposed bicycle/pedestrian facilities in and surrounding the study area.

There are bicycle parking facilities at most of the park-and-ride locations shown above in Figure D-11. In the study area, there are seven bicycle parking spaces at the Lynn Central Square Station and ten spaces at the Salem commuter rail station.

Pedestrians

The study area is a typical urban/suburban area in terms of pedestrian facilities. Most of the streets and arterials in the three towns have sidewalks on at least one side of the roadway. Most of the major intersections which CTPS was asked to study have crosswalks and are generally pedestrian-friendly, based on field observations. Table D-7 below lists the studied intersections, including current pedestrian signal phasings and timings.

TABLE D-7
Pedestrian Signal Phasings and Timings, Selected Intersections

Town, Intersection	Signalized (S) or Unsignalized (U)	Exclusive (E) or Concurrent (C) Pedestrian Phase	Extent of Pedestrian Phase (secs)
<u>Lynn</u>			
1. Route 129 (Lynnfield St) at Broadway/Parkland	S	C (Parkland Ave)	17
2. Route 129 (Broadway) at Magnolia /Springvale	S	E	23
3. Route 129 (Broadway) at Boston /Chestnut/Carter	S	E	20
4. Route 1A (Broad St) at Market	S	E	28
5. Route 1A (Broad St) at Washington/Spring	S	E	26
6. Route 1A (Broad St) at Route 129 (Exchange)	S	C (all phases)	46 NB-SB, 21 EB
7. Routes 1A/129 (Broad St) at Silsbee/Newhall	S	C (all phases)	43 NB-SB 26 EB-WB
8. Routes 1A/129 (Broad St/Lewis St) at Chestnut/Atlantic	S	C (all phases)	41 NB-SB 34EB-WB
9. Routes 1A/129 (Lewis St) at Chatham/Aubrey	U (flng beacon)	—	—
10. Routes 1A/129 (Lewis St) at Ocean St/Ocean Cir	S	C (Ocean St)	19
11. Routes 1A/129 (New Ocean St) at Route 129A (Eastern)	S	E	15
12. Lynn Shore Dr at Nahant/Beach	S	E	24
<u>Swampscott</u>			
13. Route 1A (Paradise Rd) at Farragut/Norfolk	U	—	—
14. Route 1A (Paradise Rd) at Walker	U	—	—
15. Essex St at Danvers	S	E	21

FIGURE D-12

Bicycle & Pedestrian Facilities

Mid-North Shore
Subregional Transportation Study

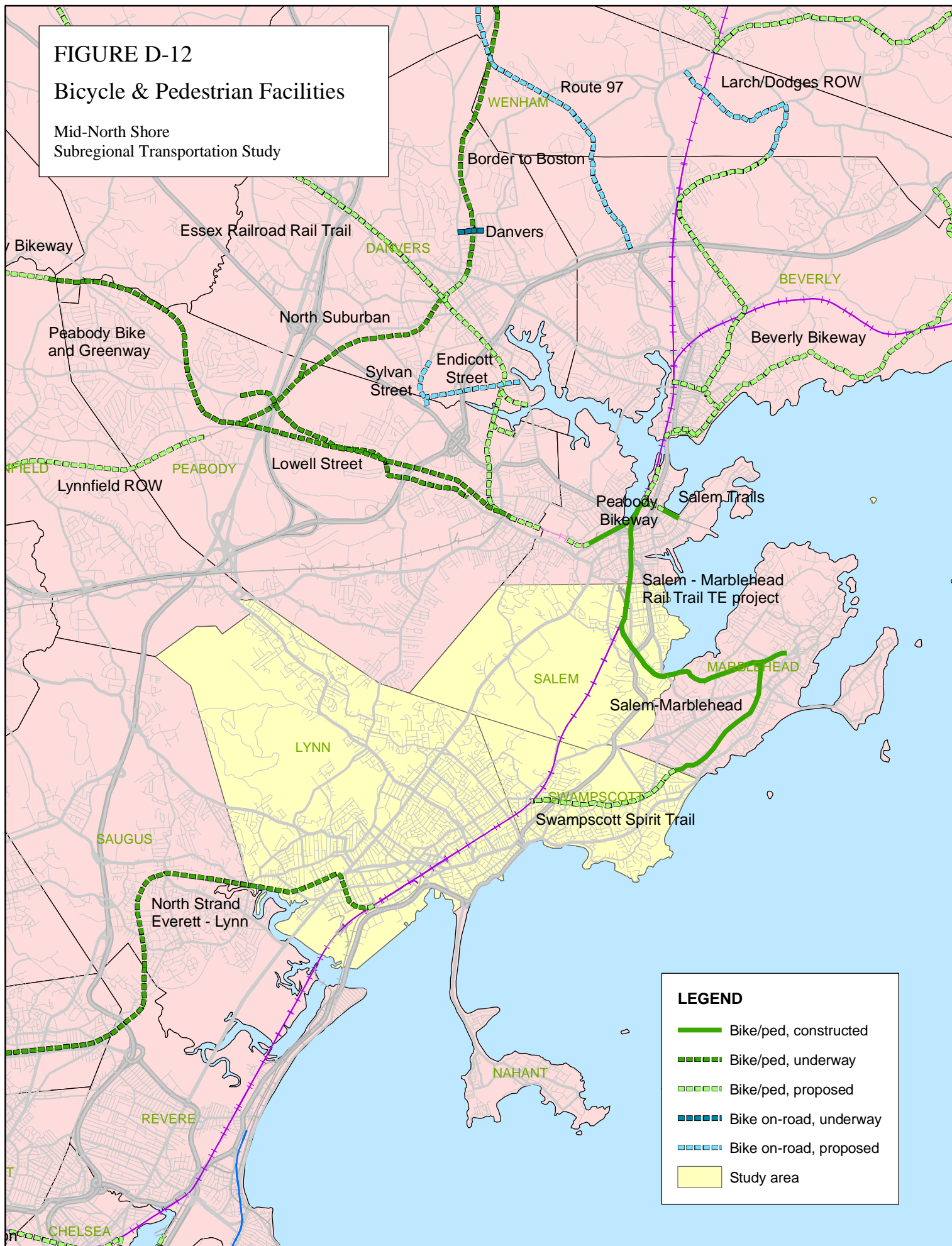


TABLE D-7 (cont.)
Pedestrian Signal Phasings and Timings, Selected Intersections

Town, Intersection	Signalized (S) or Unsignalized (U)	Exclusive (E) or Concurrent (C) Pedestrian Phase	Extent of Pedestrian Phase (secs)
<u>Salem</u>			
16. Route 1A (Loring Ave) at Route 114 (Lafayette)/West	S	E	19
17. Jefferson Ave at Willson St/Cloutman St	U (flng beacon)	E	15
18. Swampscott Rd at Aggregate Industries driveway	U	—	—
19. Route 1A (Paradise Rd) at Vinnin St (Vinnin Square)	S	E	18
20. Vinnin St at Salem St/plaza driveway (Vinnin Square)	S	E	19
21. Vinnin St at Loring Ave (Vinnin Square)	S	E	22
22. Route 1A (Paradise Rd) at Loring Ave (Vinnin Square)	S	E	19
23. Route 1A (Loring Ave) at Canal St/Jefferson Ave	S	E	19

In Task 5, it is expected that there will be recommendations to enhance conditions for pedestrians, such as replacing malfunctioning pedestrian buttons, improving crosswalk striping, and replacing concurrent pedestrian phases with exclusive phases (if warranted).