Regional Bus Network Assessment for Massachusetts Department of Transportation (MassDOT) Rail and Transit Division (RTD)

Final Report

July 13, 2016

Prepared for
MassDOT RTD

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Executive Summary
MassDOT Regional Bus Network Assessment

INTRODUCTION

The primary goals of the Massachusetts Department of Transportation's (MassDOT) *Regional Bus Network Assessment* were to develop a list of potential improvements to the regional bus system serving the commonwealth and assess the feasibility for implementation. In addition to service recommendations, the study team identified issues and implications for MassDOT to consider for the regional bus program moving forward. These policy recommendations addressed the capital, operating, and information/technology components of the existing BusPlus program, potential funding sources, and the need to improve monitoring of the state's investment in the regional bus system.

MassDOT's definition of "regional bus" services includes both intercity and commuter bus services, and addresses both intrastate and interstate routes that serve Massachusetts. Following the 2013 *Massachusetts Regional Bus Study*, MassDOT's Rail and Transit Division (RTD) launched a program of support for improved regional bus services, called BusPlus. The overall goal of the BusPlus program is to improve statewide regional bus services to promote mobility and attract new ridership. BusPlus is an innovative public-private partnership between the state and the private bus industry to expand and improve services.

The KFH Group, Inc. conducted this study under direction and guidance from a Technical Advisory Committee including representatives of regional planning agencies, private carriers, and RTD staff.

THE BUSPLUS PROGRAM

MassDOT has historically worked with and supported its private carriers providing intercity and commuter bus services. This support included purchasing over-the-road coaches to lease to private operators and funding the operation of rural intercity bus service. In fall 2013 the state's regional bus program was branded as "BusPlus," with a new focus on improving customer service and expanding regional transportation.

BusPlus Program Goals

The following goals outline the intended impacts of the BusPlus program and guide improvements to Massachusetts' regional bus network:

- **Reduce Greenhouse Gas Emissions** – Support MassDOT's commitment to meet the commonwealth's greenhouse gas emissions reduction goal of 25% by the year 2020. Intercity

bus service is the most energy efficient passenger travel mode, and individuals that travel by motor coach instead of driving alone reduce their carbon dioxide emissions by an average of 85 percent.[1] Where individuals choose to take commuter bus instead of driving alone to work, they reduce their greenhouse gas emissions per passenger mile by more than half on average.[2]

- **Provide Basic Mobility for Transit-Dependent Populations** - Provide a means for long-distance trips and commutes by individuals who may not have access to a personal vehicle or cannot drive themselves due to age, disability, or income status. The passenger survey from the 2013 study indicated that on some existing routes up to 30 percent of riders used the regional bus because it was their only transportation option. The availability of regional bus service also provides a mobility option for seniors, who may wish to remain in their homes in rural and small town locations rather than having to move to be near adult children or medical services.

- **Improve the Customer Experience** - Provide a high level of customer service amenities to increase regional bus ridership. The BusPlus program aims to directly address passenger input during the 2013 study that identified the "comfort of seats" as a top area for improvement among service quality characteristics. Increasing the attractiveness of regional bus travel entails improving the availability of schedule information and making the purchase of tickets more convenient.

- **Form a Seamless Regional Network** - Ensure that regional bus is a convenient transportation option through routes, service times, and multi-modal connections that meet riders' needs. Regional service improvements implemented under BusPlus may include introducing new service, adding stops to existing routes, extending existing routes, and increasing route frequency. Keeping travel times comparable to automobile travel times can be achieved by implementing direct service between towns when possible, limiting the transfers required, and planning timed connections where transfers cannot be avoided.

BusPlus Program Elements

The BusPlus program currently includes three components:

- **Capital Assistance** - Provides bus capital (to maintain service quality and reduce operating costs) to the private operators in return for their operation of new or improved services. Some areas lacking intercity coverage, frequency, or connectivity have been addressed by new routes offered by the carriers as part of their service agreements for new buses. New buses improve the customer experience by providing the most comfortable ride possible, reducing operating costs, and decreasing emissions compared to the buses they are replacing.

[1] Union of Concerned Scientists. *Getting There Greener: The Guide to Your Lower-Carbon Vacation*. December 2008. http://www.ucsusa.org/sites/default/files/legacy/assets/documents/clean_vehicles/greentravel_report.pdf

[2] Federal Transit Administration. *Public Transportation's Role in Responding to Climate Change*. January 2010. http://www.fta.dot.gov/documents/PublicTransportationsRoleInRespondingToClimateChange2010.pdf

- **Operating Assistance** – Addresses needs for regional bus services identified in the 2013 study by providing operating assistance along with bus capital. MassDOT identified four (later reduced to three) corridors to address the primary unmet needs, and conducted a solicitation for operators to provide service on these corridors under contract to the state. Funding for the initial year of operation on these routes has been provided by MassDOT using state funds. The program will transition to the use of FTA Section 5311(f) rural intercity bus funds, but state policy regarding the use of operating assistance in the future is not certain.

- **Improved Information and Ticketing** – Promotes technology to provide good information to riders and facilitate easy ticket transactions. All BusPlus carriers are required to provide General Transit Feed Specification (GTFS) data to allow regional bus route information to be accessed through online mapping services. In addition MassDOT is developing universal smart phone ticketing applications that will be available to all BusPlus riders. The mobile and web based ticketing system will provide schedule information, a trip planner, and service advisories for all the private carriers in the BusPlus program in one convenient place.

METHODOLOGY FOR DEVELOPING SERVICE RECOMMENDATIONS

Figure ES-1 summarizes the study approach to developing regional bus service alternatives. The study team developed and applied standards to evaluate the services already funded (service standards) and the need for additional services (planning guidelines). The standards were also used to consider the performance of alternatives that could address unmet needs (performance metrics). In addition program performance measures were developed to assess the impact of BusPlus on statewide access over time.

Figure ES-1: Process for Alternatives Development

Service Standards Evaluation	• Identified service improvements to towns with existing service
Planning Guidelines Evaluation	• Identified candidate towns for new regional bus service
Review of Existing Studies and Stakeholder/Public Input	• Examined unmet needs and specific types of service improvements
Group Alternatives According to Potential Funding Sources	• Identified federal programs and other funding sources for the route alternatives
Refine List of Alternatives	• Developed cost, revenue, and ridership projections and applied performance metrics to prioritize alternatives

SERVICE RECOMMENDATIONS

The study's service recommendations were based on operating funding sources such as Section 5311(f) for rural intercity bus routes and CMAQ and Section 5307 for commuter bus routes, or carrier provision of services in return for capital funding for buses. The service prioritization was based on four factors: estimated annual ridership, subsidy per boarding, farebox recovery ratio, and existing level of service in the corridor. These factors were selected to reflect priorities to extend the regional bus network to places currently without service and to serve as many new riders as possible in a cost-effective manner.

Rural Intercity Bus Routes

Table ES-1 presents the study team's prioritization of the rural intercity bus routes, which are mapped in Figure ES-1. The currently funded 5311(f) and BusPlus routes were included in the prioritization process to determine how they compared with the proposed alternatives. Going forward, as RTD shifts the program to Section 5311(f) funding it should select the best projects that are likely to meet ridership and cost-effectiveness standards. In FY 2015 RTD's Section 5311(f) funding amounted to about $545,000. The study team recommended continuing to support existing routes, Hyannis-Provincetown and Albany-Springfield, which are anticipated to meet the performance standards developed as part of this project. However, if a qualified provider proposed an alternative to the existing routes that is likely to perform better, RTD should evaluate and compare all the alternatives.

These recommendations were based on the assumption that federal funds would be used to pay the entire net deficit using the in-kind funding method, which would require designing these services to make a meaningful connection with unsubsidized routes that are part of the national intercity network. To reflect this prioritization, RTD will need to include the use of in-kind match, and the related requirements, as part of its Section 5311(f) solicitation. While the proposed funding level will support only limited service, RTD could consider this as a first phase implementation, with subsequent implementation of other corridors, if Section 5311(f) funding increased or state funding for operating assistance became available.

Commuter Bus Routes

Under the FAST Act, Massachusetts' estimated FY 2016-FY 2020 apportionments for the CMAQ program total $328,935,103, or an average of $65.8M annually.[3] CMAQ projects are funded with 80% federal assistance and 20% state or local match. In Massachusetts the MPOs and regional planning commissions use part of the CMAQ apportionment for regional projects included in their Transportation Improvement Programs (TIPs). In addition MassDOT has a statewide CMAQ program, under which the recommended commuter bus routes would be eligible projects. Implementation of the recommended commuter routes will depend on the amount of funding available in MassDOT's statewide CMAQ program, or local selection of these projects for inclusion in regional TIPs.

[3] U.S. Department of Transportation, Federal Highway Administration. *Summary of Estimated FY 2016 – FY 2020 Apportionments under the Conference Report for H.R. 22 (FAST ACT).* 1 December 2015. Web. February 2016.

Table ES-1: Prioritization of Intercity Bus Routes in Massachusetts

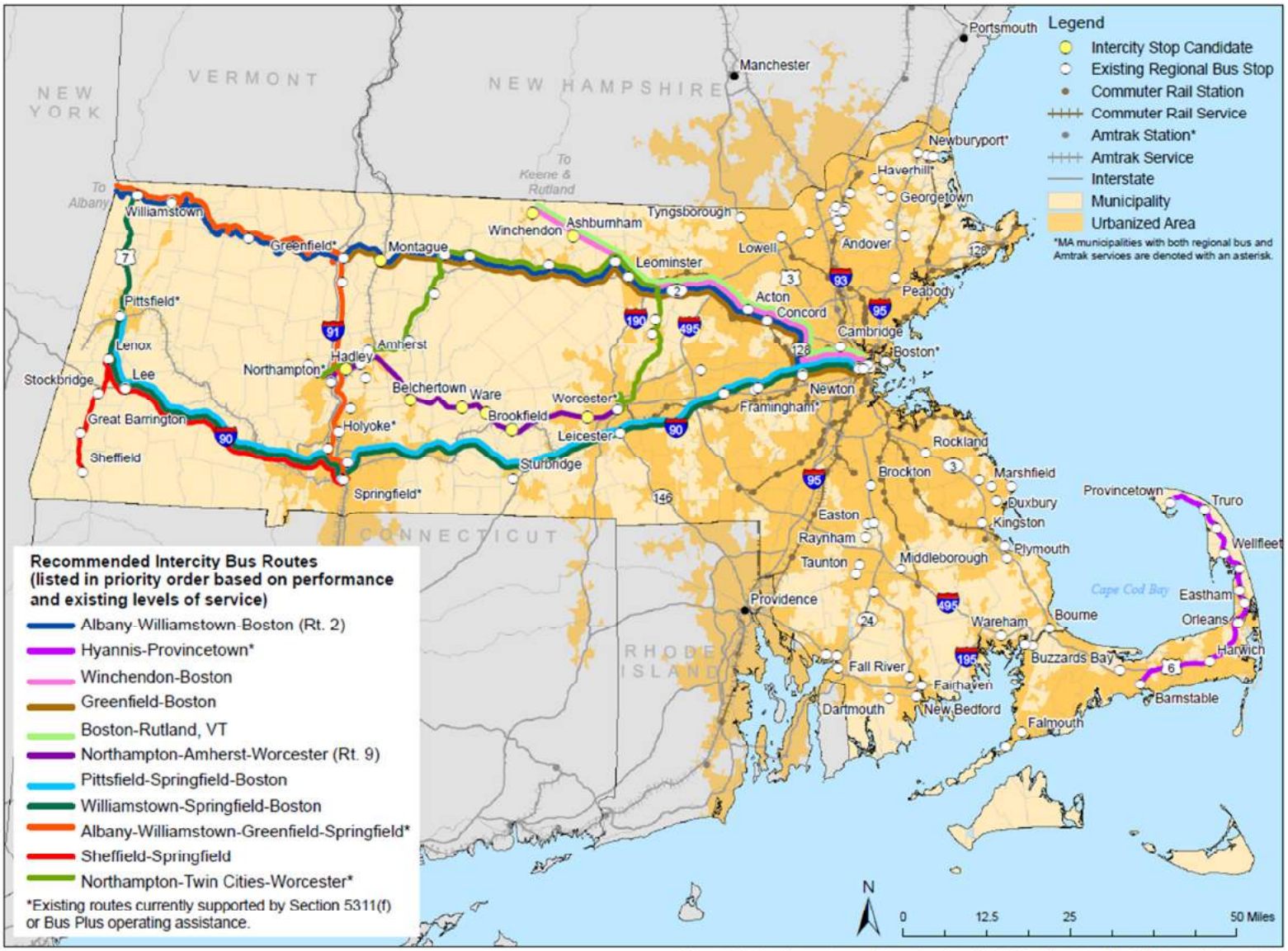
Route	Estimated Ridership	Ridership Points	Subsidy per Boarding	Subsidy per Boarding Points	Farebox Recovery	Farebox Recovery Points	Existing Level of Service (LOS)[1]	Existing LOS Points	Total Score	Overall Ranking
Albany-Williamstown-Boston (Rt. 2 Local)	13,450	10	$19	6	48%	11	3	3	30	1
Hyannis-Provincetown local*	16,020	11	$12	9	28%	6	4	4	30	1
Winchendon-Boston	10,700	7	$10	11	38%	8	3	3	29	3
Greenfield-Boston	11,150	8	$18	7	40%	9	3	3	27	4
Boston-Rutland, VT	11,700	9	$25	3	42%	10	4	4	26	5
Northampton-Amherst-Worcester (Rt. 9 Local)	9,200	6	$11	10	33%	7	2	2	25	6
Pittsfield-Springfield-Boston	7,800	4	$13	8	28%	6	1	1	19	7
Williamstown-Springfield-Boston	7,100	3	$21	5	25%	4	1	1	13	8
Albany-Williamstown-Greenfield-Springfield*	8,800	5	$67	2	14%	2	3	3	12	9
Sheffield-Springfield	5,800	2	$22	4	21%	3	1	1	10	10
Northampton-Twin Cities-Worcester*	2,500	1	$519	1	1%	1	4	4	7	11

[1]Existing Level of Service Categories: 4 = No current service over majority of route, 3 = No current service over portions of route, some towns have service, 2 = Minimal new coverage improves connectivity, 1 = Existing service requires two or more intercity transfers to Boston or NYC

*Routes currently supported by Section 5311(f) or Bus Plus operating assistance. These routes operate two roundtrips daily, so the costs are twice as high as the estimates for the alternatives, which were assumed to run one roundtrip daily. These higher costs resulted in a higher subsidy per boarding and a lower farebox recovery ratio in comparison to the projected performance for the alternatives.

Notes: The performance metrics in blue for the existing routes reflect actual operating data (from provider invoices to MassDOT). For the two routes that currently have BusPlus operating agreements, annualized performance was based on actual operating statistics for the first 5-8 months of service; however the existing LOS evaluation was conducted as if the service had not been implemented so the routes could be compared with the proposed alternatives. Also, several of these service options provide coverage to the same areas, and service to those areas would be provided by only one option. For example, the Albany-Williamstown-Boston (Route 2 Local) option provides coverage to the Williamstown-Greenfield segment, and includes points served by the Greenfield-Boston and Winchendon-Boston routes. As it serves more points that currently do not have service, its projected ridership is higher.

Figure ES-1: Recommended Intercity Bus Routes



Source: Existing bus routes and stops developed by CTPS and updated by KFH Group in June 2015.

The study team's prioritization of the commuter bus routes is shown in Table ES-2 and mapped in Figure ES-2. RTD should consider the Lowell-Waltham and Quincy-Waltham routes for initial implementation possibly with CMAQ or Section 5307 funding, if the private carriers provide their operating statistics to the FTA National Transit Database. The study team recommended discontinuing the existing Marlborough-Boston route in its current form, as it did not meet the 50% performance goals in its first year of operation—potentially its performance could be improved through alternative routing, additional parking capacity, or even extension to service additional markets (Shrewsbury), but such changes would require a new funding source.

Other Service Recommendations

In addition the study team recommended several routes for the private carriers and RTAs to consider based on potential markets and public and user input regarding desired service improvements. Since 2014 RTD has provided 46 coaches to Massachusetts carriers at no cost, in return for commitments from the carriers to provide specified service improvements—either new service to areas not previously served, or expansion of existing services in terms of frequency, span, or route coverage. Based on the analysis in this study, RTD could provide the following alternatives to private carriers to fulfill their service obligations in exchange for BusPlus coaches:

- I-91 additional service, Greenfield-Springfield express, with a possible stop in Northampton
- Sturbridge-Boston
    - Option A: Adjust existing schedule for earlier departure to provide full day trip to Boston
    - Option B: Add one roundtrip for day trip in Sturbridge (may be seasonal)
- Add second roundtrip to North Andover – Boston
- Add second roundtrip to Duxbury on Duxbury – Boston

The study team recommended several routes that the private carriers might consider implementing based on potential markets. These services would address various unmet needs identified through this study, and Section 5307 funding could be provided to the private carriers based on inclusion of their operating statistics in the FTA National Transit Database:

- Amherst/Northampton-Boston Logan express
- Provincetown-Hyannis-Boston Logan express
- Boston-New Hampshire local service (northbound)
- Worcester-New York City (no transfer in Hartford)
- I-91 corridor direct to New York City (no transfer in Springfield)

A large portion of the needs identified through this study were more local in nature, requesting services within one region or between adjacent RTA service areas. The study team identified several routes that were too short to be considered regional bus, as defined in this study. Table ES-3 lists regional routes that address unmet needs or requests for service improvements, while Table ES-4 outlines routes with good potential commuter demand[4] – both for RTA consideration.

[4] These origin-destination pairs met the planning guideline for potential demand to support two daily roundtrips at a 50% load. Based on 2006-2010 town-to-town commute flow data from the American Community Survey.

Table ES-2: Prioritization of Commuter Bus Routes in Massachusetts

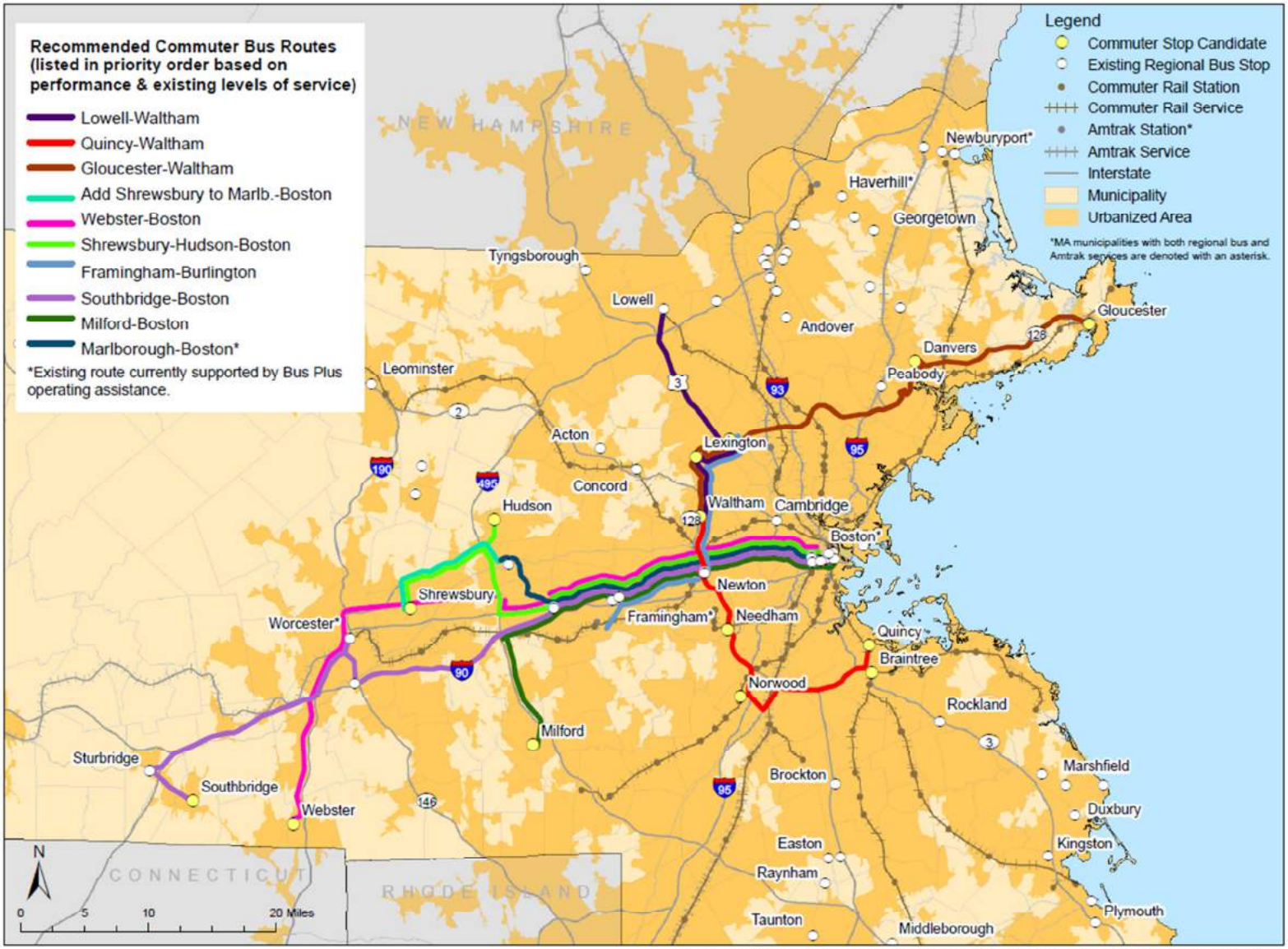
Route	Estimated Ridership	Ridership Points	Subsidy per Boarding	Subsidy per Boarding Points	Farebox Recovery	Farebox Recovery Points	Existing LOS[1]	Existing LOS Points	Total Score	Overall Ranking
Lowell-Waltham (Route 3 to Route 128 Central)	22,700	9	$9	10	26%	10	3	3	32	1
Quincy-Waltham (Route 128 South to Route 128 Central)	23,600	10	$17	8	17%	9	3	3	30	2
Gloucester-Waltham (Route 128 North to Route 128 Central)	17,600	8	$30	6	12%	8	2	2	24	3
Add Shrewsbury to Marlborough-Boston BusPlus rt.	13,500	6	$10	9	10%	5	2	2	22	4
Webster-Boston	17,300	7	$38	5	12%	8	1	1	21	5
Shrewsbury-Hudson-Boston	10,600	3	$52	4	12%	8	4	4	19	6
Framingham to Burlington (MA Turnpike West to Route 128 Central)	12,400	4	$26	7	9%	4	2	2	17	7
Southbridge-Boston	12,600	5	$61	3	9%	4	3	3	15	8
Milford-Boston	5,200	2	$83	2	7%	2	1	1	7	9
Marlborough-Boston*	4,900	1	$85	1	6%	1	1	1	4	10

[1]Existing Level of Service Categories: 4 = No current service over majority of route, 3 = No current service over portions of route, some towns have service, 2 = Existing service requires two or more transfers to destination, or requires significant out of direction travel, 1 = Existing service via local transit (RTA or transportation management association) or MBTA connections to regional bus or commuter rail

*Route currently supported by Bus Plus operating assistance.

Note: The performance metrics in blue for the existing route reflect actual operating data (from provider invoices to MassDOT). For the Marlborough-Boston route that currently has a BusPlus operating agreement, this evaluation was conducted as if the service had not been implemented so the route could be compared with the proposed alternatives.

Figure ES-2: Recommended Commuter Bus Routes



Source: Existing bus routes and stops developed by CTPS and updated by KFH Group in June 2015.

Table ES-3: Regional Routes for RTA Consideration

Geographic Area	Regional Route to Address Unmet Needs or Service Expansions/Improvements
Western Massachusetts	Amherst-Springfield express
	Ware-Holyoke Community College for day trip
Central Massachusetts	Hudson-Stow-Maynard-Acton
	Franklin-Bellingham-Milford
	Lowell-Springfield
	Westford-Littleton-Devens
	Fitchburg-Worcester-Springfield
	Worcester-Fall River-New Bedford
	Connections between WRTA and PVTA
Eastern Massachusetts	Route 114 corridor to North Shore
	Lowell-Newburyport
	Stoneham-Reading
	Taunton-Brockton
	Taunton-Fall River
	Wareham-New Bedford
	Plymouth/Wareham-Hyannis
	New Bedford-Taunton
	Connections between MVRTA and LRTA

Table ES-4: Commuter Routes for RTA Consideration

Employment Cluster	Origin	Destination
Boston/Cambridge	Foxborough	Boston/Cambridge
	Hanover	Boston/Cambridge
	Wayland	Boston/Cambridge
128 South	Brockton	Canton
Pioneer Valley	Belchertown	Springfield
I-495 Corridor	Shrewsbury	Westborough
	Worcester	Marlborough
	Worcester	Northborough
Worcester	Leominster	Worcester
	Rutland	Worcester
	Holden	Worcester
South Coast	Westport	Fall River
Providence, RI	Fall River	Providence
	Seekonk	Providence

Some connections requested through public input were already served by the RTAs or the private carriers. These routes could be candidates for service improvements including additional service, and would benefit from expanded marketing efforts to ensure the public is aware of them:

- Greenfield to Northampton express (Peter Pan and Greyhound)
- Greenfield to Amherst (Peter Pan)
- Northampton/Amherst to Springfield express (Peter Pan and Greyhound)
- Amherst to Holyoke (PVTA)
- Holyoke to Springfield express (PVTA)
- Lowell to Worcester (Peter Pan)
- Worcester to Providence, RI (Peter Pan)
- Taunton to Fall River (Peter Pan)
- Taunton to New Bedford (DATTCO)
- Lowell to Burlington (LRTA)
- Lowell to Westford (LRTA)
- Gardner to Fitchburg (MRTA)

POLICY RECOMMENDATIONS

The study team developed several policy recommendations for MassDOT to consider in moving forward with BusPlus implementation.

Continue the Bus Capital Program

Providing new buses for use by the private carriers is a continuation of state policies over the past 30 years, one that continues to be supported by current MassDOT project selection criteria favoring maintenance of the state's transportation infrastructure. New buses have public benefits in terms of quality of service for the user, reduced emissions and fuel use, and improved reliability. Providing capital also reduces carriers' costs per mile, making it more possible for carriers to serve marginal markets without operating subsidy. The study estimates that eight buses need to be replaced annually at an estimated cost of $4.8 million per year to continue the existing level of service.

There is potential to increase Section 5307 transit allocations in the state and fund capital replacement by having the BusPlus operators report their data to the National Transit Database (NTD). Section 5307 funding is provided on a formula basis to states and directly to Urbanized Areas (UZAs) based on factors such as population, bus revenue vehicle miles, and bus passenger-miles. Typically all public transit operators provide NTD data, but the private operators generally do not. If the BusPlus carriers provided their NTD data, expanded Section 5307 funding could be used for bus capital to replace BusPlus coaches in the future. The private carriers on the study's Technical Advisory Committee generally supported this concept *on the condition that any additional Section 5307 funding generated from their reporting benefits the BusPlus program*.

Enhance Oversight and Monitoring of BusPlus Vehicles

The interest of the state is to ensure that these vehicles (worth about $27 million) are being used for public transportation that primarily benefits the residents of Massachusetts, are in service, and are maintained. A periodic review of sample data is recommended to examine usage of the buses, including whether the buses are used in-state, are providing scheduled service, and ridership and utilization levels. The review should also ensure the vehicles are being maintained, and if vehicles are out of service due to damage or neglect the issue should be identified and corrected.

Continue to Require Service Improvements from Carriers Receiving BusPlus Vehicles

The benefits of continuing this requirement are expanded service and options for the public. The challenges of continuing the service obligations include 1) establishing a consistent approach to developing the service requirements, and 2) monitoring the services provided including documenting any changes to the service obligations negotiated with the carriers. Based on analysis of the current service obligations, the study team recommends that for every new BusPlus vehicle a carrier requests, they should propose a service improvement or expansion that has a value of $100,000 (or more) in annual operating costs, which is comparable to the average of the service obligations developed by the carriers for the last round of buses[5]. RTD staff should develop a database to track the service requirements, including reviewing provider schedules at least twice annually and renewing the Service and Maintenance Agreements at least every two years. This should involve a performance evaluation against the established metrics to determine whether the services should be continued or changed.

Use Alternative Funding Sources to Support a Limited Amount of New Regional Bus Service

Assuming continued constraints in state funding, three alternative funding options were identified to provide operating and capital support through BusPlus in the future.

Section 5311(f) program

The Section 5311(f) program provides funding for rural intercity bus services. Massachusetts' Section 5311(f) allocation was about $545,000 in FY 2015. In recent years about half this allocation has funded local service on the Cape, provided by Plymouth and Brockton. The study team recommends continuing to support existing routes as long as they are meeting performance standards. The Hyannis-Provincetown route was ranked first in the performance evaluation and is recommended for continued funding. The Albany-Springfield route, originally funded through BusPlus operating funds, also met the performance benchmarks and is recommended for Section 5311(f) support, albeit at a reduced service level to fit within the allocation amount. These recommendations assumed that federal funds would be used to pay the entire net deficit using the in-kind funding method, which

[5] Note that this metric (the dollar value of the service) is based on the cost of the service without netting the revenue—a carrier could potentially have the cost of these additional services offset by the resulting incremental revenue.

would require designing these services to make a meaningful connection with unsubsidized routes that are part of the national intercity network.

CMAQ Program

CMAQ is a potential funding source for commuter bus services. Projects must be transportation projects, generate an emissions reduction, and be located in or benefit a nonattainment maintenance area. CMAQ can fund capital in support of commuter bus services, both vehicles and terminal facilities (including park and ride lots), or be used for operating assistance for such services for a limited time. CMAQ used for operating assistance is limited to three years of funding, though the third year amount can be spread over two additional years to provide five years of operating assistance (with three years' worth of funding). After that period it is assumed that a successful project will transition to other funding sources as part of the baseline network. The federal share for most CMAQ projects is limited to 80%, with a 20% local share.

Section 5307 Program

Described previously, Section 5307 funding can be used for capital replacement, and in UZAs with populations less than 200,000 operating assistance is an eligible expense. If the private carriers participating in the BusPlus program provide their NTD data, there is potential to increase the Section 5307 transit allocations in Massachusetts. Currently Plymouth & Brockton is a reporting carrier, but the other BusPlus operators are not. Concord Coach Lines/Boston Express, DATTCO, and Peter Pan have the knowhow and capability to report their mileage to NTD, but would only find the effort worthwhile if RTD ensures that any additional Section 5307 funding generated from their reporting benefits the BusPlus program.

Promote Awareness of Regional Bus Services through Public Information and Mobile Ticketing

These efforts reflect MassDOT's strength in innovation. The New England Regional Transportation Maps, released in February 2015, were the first public transportation maps to outline all privately operated services across multiple modes and multiple states in one document. The BusPlus Mobile Ticketing program developed the first smartphone app in the country that allows individuals to purchase tickets for intercity or commuter bus services from several different private operators. Continuation of the ticketing application development needs to be tied to an ongoing effort to provide public information and market the available services. The significant input received from the public and users for this study revealed that many people are unaware of the available services.

The New England Regional Transportation Maps need to be updated periodically to maintain their usefulness. Information about the regional bus network also needs to be kept up to date on the MassDOT website, with linkages to the individual carriers and the ticketing application. All of the RTAs and MBTA provide GTFS to information sources such as Google Transit. (MassDOT funds the maintenance of GTFS files for 13 of the 15 RTAs, eight private bus carriers, and seven ferry operators.) Amtrak and Megabus do as well, allowing a user to quickly develop an itinerary for a multi-carrier trip. RTD should add the regional bus network to these online trip planners, which would allow users to

treat the RTAs, the intercity and commuter bus carriers, MBTA, and Amtrak as a statewide mobility network. This would not only complement the multi-carrier ticketing application, but could be the next step for expanding the mobile ticketing program.

Improve Facilities and Passenger Amenities to Enhance the Customer Experience

The recently enacted FAST Act encourages states and MPOs to consider intermodal facilities that support intercity buses when developing such facility plans. Going forward RTD should seek to ensure that privately operated intercity and commuter bus services are included in intermodal terminal plans wherever feasible. This is critical to the creation of a connected statewide mobility network. Input from both the public and the study's Technical Advisory Committee identified needs to improve park and ride lots and passenger amenities provided at regional bus stops. Additional capacity was identified as a need at park and ride lots in Barnstable (Route 6 lot), Bourne (Sagamore Bridge lot), Taunton (Galleria Mall lot), Andover (Lutheran Church lot), Kingston, Newburyport, Rockland, Plymouth, Newburyport (MA-113 Storey Avenue lot), and Falmouth (bus terminal). RTD should also establish prominent signage at all regional bus stops and improve passenger amenities, including shelters and restrooms, especially at higher ridership stops.

Account for Land Use when Planning Regional Bus Service and Stops

When implementing new regional bus service through the BusPlus program, MassDOT should consider a variety of factors including land use and development in determining the specific location of regional bus stops. There is no "one size fits all" approach. It is important to consider the regional bus markets and their specific characteristics such as level of car availability or transit dependency, the availability of local transit or other modes to access the regional bus stop, and the availability or capacity of park and ride lots. This study considered points of access to regional bus service and connectivity with other transportation modes in identifying candidates for new or expanded service.

CONCLUSION

Following extensive analysis of the existing regional bus services in Massachusetts, this study found that private carriers are providing a comprehensive network of services across the state. Most areas with regional bus needs and sufficient potential ridership are already served. New services were recommended to address unmet needs in rural and small town areas currently without direct access to the regional bus network, and for trips that are currently difficult due to existing schedules or the transfers required. Recommended strategies for the BusPlus program going forward include use of alternative funding sources to support a limited amount of new service, continuation of the bus capital program with oversight and monitoring of the state's capital investment, continuation of the development of the ticketing application, and expanded marketing and information to maximize the BusPlus program's benefits to the Massachusetts public.

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Chapter 1
Study Purpose and Policy Context

INTRODUCTION

The Massachusetts Department of Transportation's (MassDOT) Rail and Transit Division (RTD) has recently implemented a number of projects as part of an initiative to support and expand regional bus service in the commonwealth, including both intercity and commuter bus services. This initiative, branded as the BusPlus program, has included a statewide inventory of services, provision of a number of new coaches to private for-profit providers, development of a multi-carrier ticketing application, development of regional bus maps and guides, and some limited operating assistance to address rural and commuter service gaps. The purpose of this study was to evaluate the services to determine if there are any additional unmet service needs, and to develop standards for determining the feasibility of addressing any remaining service gaps.

This project built upon an earlier planning effort conducted by RTD together with the Central Transportation Planning Staff (CTPS) of the Boston Region Metropolitan Planning Organization (MPO). This earlier planning effort, the *Massachusetts Regional Bus Study*, redefined "regional bus" to include both intercity and commuter bus services, and addressed both intrastate and interstate services. This Regional Bus Network Assessment was conducted under RTD direction by the KFH Group, Inc.[1], together with input and review from a Technical Advisory Committee that included representatives of regional planning agencies, private carriers, and MassDOT staff from various divisions.[2] The committee members' breadth and depth of knowledge was instrumental in developing a common set of standards to evaluate the need for additional services as well as publicly funded existing services.

The *Massachusetts Regional Bus Study* included a historical review of private carrier regional bus services in Massachusetts, identified underserved areas, and suggested measures for improving services to meet the commonwealth's needs. Following the completion of the *Massachusetts Regional Bus Study* in June 2013, RTD launched a program of support for improved regional bus services, called BusPlus. The overall goal of the BusPlus program is to increase ridership on the regional services by maintaining and improving service quality. The program has several components including a bus capital program, an operating subsidy program, development of regional bus information (New England bus maps), and smartphone ticketing.

Funded by the Federal Transit Administration (FTA) and MassDOT and overseen by RTD, the BusPlus program defines regional bus service as, "regularly scheduled bus service for the general public that: operates with limited stops; connects two or more urban areas, or a rural and urban area; has the capacity for transporting baggage; provides reduced price multi-ride tickets for a portion of the route; makes meaningful connections with scheduled intercity bus and rail service to more distant points if

[1] The KFH Group was selected by RTD under a competitive procurement.
[2] A list of the Technical Advisory Committee members is included as Appendix A.

such service is available; and includes peak period service geared toward commuters." The BusPlus program includes a number of unique aspects:

- **Public-Private Partnership**: BusPlus is an innovative public-private partnership, in which the state works with the private bus industry to expand and improve services. MassDOT provides regional buses to private for-profit bus companies, who in return must implement a regional service improvement and are responsible for all capital maintenance and annual operating costs.

- **Regional Coordination**: Massachusetts understands that many of the services operated in the state are regional in nature, originating outside the state but serving residents of the commonwealth. Increased ridership on these services also improves air quality and mitigates traffic congestion in Massachusetts, so RTD is working with other states to improve the quality of services in the region.

- **Customer Service**: Projects under BusPlus focus on customer comfort and convenience including ways to improve the availability of information, ticketing, quality of the ride, and regional bus stops, which are essential to increasing ridership.

The *Massachusetts Regional Bus Study* and the new BusPlus program marked a significant investment in the regional bus system in Massachusetts (including linkages to other states in New England). The primary purpose of this Regional Bus Network Assessment was to develop a list of potential improvements to the regional bus system and assess the feasibility of addressing them, given existing funding and the federal and state policy context. This project 1) reviewed regional transportation needs identified in existing studies and collected through public and stakeholder engagement, 2) developed and evaluated alternatives to serve unserved and underserved areas, and 3) assessed potential projects including estimates of ridership, revenue, costs, and capital requirements. Depending on the level and types of unmet needs, this study addressed potential funding options and recommended changes in MassDOT policies regarding BusPlus program implementation.

POLICY CONTEXT

Under existing federal and state policy, intercity and commuter bus service is provided by private carriers in response to market demand. Since the private bus industry was deregulated in the early 1980's, the carriers have been able to choose their own routes, schedules, and fare structures without federal or state regulatory oversight. However, this has resulted in a significant reduction in the rural intercity bus and commuter services provided, as these services are often not profitable. The federal policy response to the loss of service has included the provision of funding specifically for rural intercity bus services under the FTA's Section 5311(f) program, and the ability to use FTA Congestion Mitigation and Air Quality Improvement (CMAQ) program funding for both intercity and commuter regional bus services. Depending on jurisdictional considerations and local/regional priorities, urban transit funding from federal and state sources may also be utilized for commuter bus services.

Massachusetts has benefited from its location at the center of New England, with routes from the rest of New England providing coverage in the state on their way to Boston or New York City, but there are still rural and small town areas of the state with either no service, or circuitous options involving

multiple transfers and long travel times. To help sustain the existing services and maintain service quality, MassDOT has historically worked with and supported its private carriers providing intercity and commuter bus services. Beginning in 1983 the Intercity Bus Capital Assistance Program (IBCAP) initially used bond funding to purchase over-the-road coaches, which were then leased to private operators at a savings of 50 percent or more over commercial lease rates. These vehicles were dedicated to particular service areas. Through this program Massachusetts became a leader in providing wheelchair accessibility on over-the-road coaches by requiring a portion of the state-funded fleet to be lift-equipped, well before the Americans with Disabilities Act (ADA) mandated the use of accessible coaches by private providers. This program has continued to replace vehicles over time with some changes in the structure.

However, the IBCAP program was not really designed to address gaps in service coverage or connectivity. MassDOT has made use of the FTA Section 5311(f) funding for rural intercity bus service to address such issues. Unfortunately, due to the fact that Massachusetts has a small rural population (as defined by the U.S. Census as a basis for federal transit funding), the amount of overall rural transit funding allocated to the state is limited, and the 15 percent share of that amount that is set aside for Section 5311(f) is smaller yet, limiting the ability of the state to address rural intercity needs through this program. For FY 2015 the state's overall Section 5311 allocation was $3,634,423, and the amount available for Section 5311(f) was $545,163. MassDOT Section 5311(f) awards for the past four years are summarized in Table 1-1.

Table 1-1: Massachusetts Section 5311(f) Awards

Award Year	Applicant	Project Description	Award Amount
FY 2013	Plymouth & Brockton Street Railway	Daily round-trip service between Hyannis and Provincetown, including additional trips during summer months	$246,028
FY 2013	Peter Pan Bus Lines	Rural service	$279,750
FY 2014	Plymouth & Brockton Street Railway	Daily round-trip service between Hyannis and Provincetown, including additional trips during summer months	$265,500
FY 2014	Peter Pan Bus Lines	Multi-component program to market multimodal services in Berkshire, Franklin, Hampshire, Hampden and Barnstable Counties	$160,000
FY 2015	Plymouth & Brockton Street Railway	Daily round-trip service between Hyannis and Provincetown	$271,731
FY 2015	Peter Pan Bus Lines	Replace obsolete or inoperable wheelchair lifts	$190,000
FY 2015	DATTCO	Procure stand up transmission jack to repair BusPlus coaches	$5,440
FY 2015	DATTCO	Procure lifts to service BusPlus coaches	$36,800
FY 2016	Plymouth & Brockton Street Railway	Daily round-trip service between Hyannis and Provincetown	$271,731

THE BUSPLUS PROGRAM

The BusPlus program has addressed the continuing need to support regional bus infrastructure and gaps in service identified by the previous study and the carriers. The goals implied by the previous IBCAP program and Section 5311(f) have been incorporated into a new, broader mission statement for MassDOT programs addressing regional bus services, based on results of the previous study. These goals have led to the current program implementation.

BusPlus Program Goals

A clear set of goals for the BusPlus program is essential to guide expansion of and improvements to Massachusetts' regional bus network. The goals are broad and long-term, intended to focus on the overall impact of the BusPlus program.

Reduce Greenhouse Gas Emissions

BusPlus is one of many initiatives that MassDOT developed as part of its commitment to meet the commonwealth's greenhouse gas emissions reduction goal of 25% by the year 2020. The BusPlus program aims to increase the number of regional transportation options available to encourage residents and visitors to shift from single occupancy vehicles (SOV) to healthier options including biking, walking, and transit. Regular-route, scheduled intercity bus service is the most energy efficient passenger travel mode, and individuals that travel by motor coach instead of driving alone reduce their carbon dioxide emissions by an average of 85 percent.[3] Where individuals choose to take transit including commuter bus instead of driving alone to work, they reduce their greenhouse gas emissions per passenger mile by more than half on average.[4] Commuting is the most significant market for roadway travel, accounting for about 28 percent of vehicle miles of travel, so it is important to provide attractive commuter bus options to help reduce the greenhouse gas emissions from private vehicle travel.[5]

Provide Basic Mobility for Transit-Dependent Populations

Regional bus service provides a means for long-distance trips and commutes by individuals who may not have access to a personal vehicle (or one considered reliable enough for a long trip) or cannot drive themselves due to age, disability, or income status. Data on intercity bus rider characteristics and trip purposes suggests that a substantial percentage of intercity bus riders are transit dependent, at least for that type of trip. The survey of intrastate regional bus passengers from the 2013 *Massachusetts Regional Bus Study* indicated that on some existing routes up to 30 percent of riders

[3] Union of Concerned Scientists. *Getting There Greener: The Guide to Your Lower-Carbon Vacation*. December 2008. http://www.ucsusa.org/sites/default/files/legacy/assets/documents/clean_vehicles/greentravel_report.pdf

[4] Federal Transit Administration. *Public Transportation's Role in Responding to Climate Change*. January 2010. http://www.fta.dot.gov/documents/PublicTransportationsRoleInRespondingToClimateChange2010.pdf

[5] American Association of State Highway and Transportation Officials. *Commuting in America 2013: The National Report on Commuting Patterns and Trends. Brief 2. The Role of Commuting in Overall Travel.* May 2013. http://traveltrends.transportation.org/Documents/B2_CIA_Role%20Overall%20Travel_web_2.pdf

used the regional bus because it was their only transportation option. In addition, the availability of regional bus service provides a mobility option for seniors, who may wish to remain in their homes in rural and small town locations rather than having to move to be near adult children or medical services.

Improve Customer Experience

MassDOT is focused on providing a high level of customer service amenities in its effort to increase regional bus ridership. Through the BusPlus program MassDOT aims to directly address passenger input during the 2013 *Massachusetts Regional Bus Study* that identified the "comfort of seats" as a top area for improvement among service quality characteristics. MassDOT also seeks to make regional bus travel more attractive by improving the availability of schedule information, and making the purchase of tickets more convenient.

Form Seamless Regional Network

MassDOT wants to ensure that regional bus is a convenient transportation option for the commonwealth's residents and visitors. Regional service improvements implemented under BusPlus may include introducing new service, adding stops to existing routes, extending existing routes, and increasing route frequency. The most common service improvement requested by riders during the 2013 *Massachusetts Regional Bus Study* was more frequent service, followed by preferences for more express service, earlier morning departures, and later evening departures. Keeping travel times comparable to automobile travel times is another key to making regional bus service attractive. This can be achieved by implementing direct service between towns when possible, limiting the transfers required, and planning timed connections where transfers cannot be avoided. For riders who do not have access to a car or may prefer to leave their car at home, the convenience of regional bus service relies heavily on connectivity to and from other modes including passenger rail and local transit. MassDOT also recognizes the need to create a data source to continually analyze potential regional service improvements.

BusPlus Program Elements

Capital Assistance

The BusPlus program addresses the need for additional frequency or improved connections to better serve all users, but particularly those who are transit dependent, by providing bus capital (to maintain service quality and reduce operating costs) to the private operators in return for their operation of new or improved services. Some areas lacking intercity coverage or connectivity have been addressed by new routes offered by the carriers as part of their service agreements for new buses. The provision of new buses has also allowed MassDOT to address the customer experience by providing the most comfortable ride possible including fully outfitted restrooms, increased leg room, Wi-Fi and power outlets, comfortable seating, and accessible vehicles. The new buses have reduced emissions (as compared to the buses they are replacing), and they are attractive. Under the BusPlus agreements the new buses are to be used on the expanded or improved services offered by the carriers. The BusPlus

awards and the services they support are presented in Table 1-2 (where SMA stands for "Service and Maintenance Agreement").

Operating and Capital Assistance

In addition, several areas identified in the previous study as lacking in regional bus connections have been addressed by providing operating assistance along with bus capital. MassDOT identified four (later reduced to three) corridors to address the primary unmet needs, and conducted a solicitation for operators to provide service on these corridors under contract to the state. Funding for these routes is being provided by MassDOT, but state policy regarding the use of operating assistance in the future is not certain. Table 1-3 presents summary information on the operating grants made under BusPlus.

Improved Information and Ticketing

MassDOT also recognizes the growing role of technology in providing good information to riders and facilitating easy ticket transactions. All BusPlus carriers are required to provide GTFS data to allow regional bus route information to be accessed through online mapping services such as Google Maps. In addition MassDOT is developing universal smart phone ticketing applications that will be available to all BusPlus riders. The mobile and web based ticketing system will also provide schedule information, a trip planner, and service advisories for all the private carriers in the BusPlus program in one convenient place.

ASSESSMENT METHODOLOGY

A major purpose of this study was to develop and apply a common set of standards to evaluate the need for additional services and as a basis for evaluating services already funded. The standards were also used to consider the performance of alternatives that could address unmet needs, whether funded with state or federal dollars.

Much of the state is already served by regional bus services provided by private carriers. Therefore the primary focus of potential state action was the identification of places (or routes) that may require some form of public investment in order to receive the appropriate level of service, and determination of whether or not public investment was warranted by the expected level of ridership. The concept of "appropriate level of service" could mean improvements in existing services such as additional connections or frequencies, or new service to places that do not have any regional connections. The initial step was the inventory of existing services, including comparing those services to defined minimum standards to determine if incremental improvements might be required.

A second step was intended to identify places that might have sufficient population and density to warrant a regional bus stop—but are not served by the existing network. The identification of unmet needs was informed by input from existing and potential users and the transportation providers, a third step in the identification of unmet regional bus need.

Table 1-2: Summary of BusPlus Lease Awards

Carrier	Date of Contract	End Date (Initial Term)	SMA* or Operating SMA	No. Buses	Route (New or Change)	Frequency Change	Days of Service	Change in Stop Locations
Bloom	12/13/13	1/19/16	SMA	2	Taunton-Raynham-Easton-West Bridgewater-Brockton-Boston	Taunton-Boston increase from 13 to 17 one-way trips, Boston-Taunton increase from 12 to 17 one-way trips	Mon-Fri Year Round	None
Coach Co.	12/13/13	1/5/16	SMA	2	Newburyport-Boston	Increase from 5 to 6 round-trips	Mon-Fri Year Round	None
	Same	Same	Same	Same	Haverhill-Groveland-Georgetown-Boxford-Topsfield-Peabody-Boston	Increase from 2 to 3 round-trips	Mon-Fri Year Round	None
DATTCO, Inc.	1/20/14	1/26/16	SMA	2	New Route: Providence-Uxbridge-Worcester Union Station-Worcester (UMass Medical)-Boston	Two round-trips daily	Mon-Fri Year Round	None
DATTCO, Inc.	1/20/14	1/26/16	SMA	5	Fairhaven-New Bedford Terminal-New Bedford Park & Ride-Taunton-Boston	Increase from 12 to 14 round-trips	Mon-Fri Year Round	Add stop at Dartmouth (UMass), will not stop at New Bedford Terminal and New Bedford Park & Ride.

Carrier	Date of Contract	End Date (Initial Term)	SMA* or Operating SMA	No. Buses	Route (New or Change)	Frequency Change	Days of Service	Change in Stop Locations
DATTCO, Inc.	4/2/15	No date-amendment to previous contract of 6/20/14	SMA Amendment		Fairhaven-Dartmouth-Fall-River-Providence-New York City	Increase from 3 to 4 round-trips (Megabus)	Monday-Sunday Year Round	Add Fall River as a new stop
Greyhound Lines, Inc.	2/19/14	2/23/16	SMA	2	Boston-Nashua (NH)-Keene (NH)-Brattleboro (VT)	New Route, one round-trip	Friday and Sunday Year Round	New Stops Keene, and Nashua, NH
	Same	Same	Same	Same	Springfield-Northampton-Greenfield-Brattleboro (VT)-Bellows Falls (VT)-White River Junction (VT)	Maintain existing service one round-trip per day	Year Round	
Peter Pan Bus Lines, Inc.	12/13/13	1/19/16	SMA	10	Fall River-Boston	Increase from 6 to 7 round-trips per day	Mon-Fri Year Round	New stops at Somerset and Providence
	Same	Same	Same	Same	Hartford-Worcester-Framingham-Boston	Increase from 7 to 8 round-trips per day	Monday to Sunday Year Round	
	Same	Same	Same	Same	Springfield-Worcester-Framingham-Boston	M-Th increase from 8 to 9 round trips, Fri from 10 to 11, Sat from 7 to 8 round-trips, Sunday Springfield-Boston from 7 to 8 one-way trips, and from 8 to 9 one-way trips Boston to Springfield	Monday-Sunday Year Round	New stop at Sturbridge, add stops at Chicopee and Palmer if able to find suitable stops

Carrier	Date of Contract	End Date (Initial Term)	SMA* or Operating SMA	No. Buses	Route (New or Change)	Frequency Change	Days of Service	Change in Stop Locations
Peter Pan Bus Lines, Inc.	6/24/14	6/30/14	SMA	5	New Route: Haverhill-Lawrence-Methuen-Worcester	One round-trip per day	Monday-Sunday Year Round	
	Same	Same	Same	Same	Sturbridge-Worcester-Framingham-Boston	M-Th-Sturbridge-Boston increase from 15 to 16 one-way trips, Fri from 16 to 17 one-way trips; M-Th Boston-Sturbridge 16 to 17 one-way trips, Fri 17 to 18 one-way trips	Mon-Fri Year Round	Two stops in Worcester, one stop in Framingham
	9/30/14	Amendment to 6/24/14 contract	SMA	Same	Providence-Worcester-Springfield-Lee-Lenox-Pittsfield-Williamstown-Albany	Increase from 2 to 3 round-trips per day	Monday-Sunday Year Round	Worcester on all west-bound trips, only 2x on eastbound
	9/30/14	Amendment to 6/24/14 contract	SMA	Same	Sturbridge-Worcester-Framingham-Boston	Increase from 12 to 13 round-trips	Mon-Fri Year Round	Two stops in Worcester, one stop in Framingham

Carrier	Date of Contract	End Date (Initial Term)	SMA* or Operating SMA	No. Buses	Route (New or Change)	Frequency Change	Days of Service	Change in Stop Locations
Peter Pan Bus Lines, Inc.	12/13/13	1/19/14	SMA	2	Boston-Wareham-Bourne-Falmouth-Woods Hole	Fall/Winter/Spring: M-F increase from 8 to 9 round-trips, Sat-Sun increase Boston-Woods Hole from 6 to 7 one-way trips, Woods Hole-Boston from 7 to 8 one-way trips; Summer: M-Sat increase Boston-Woods Hole from 12 to 13 one-way trips, Sun from 10 to 11 one-way trips; M-Sun Woods Hole-Boston increase from 11 to 12 one-way trips	Monday-Sunday Year Round, schedule varies seasonally	Add stop in Buzzards Bay, increase service to Wareham from one to two round-trips per day
Plymouth & Brockton Street Railway Co.	4/10/14	5/4/16	SMA	5	New Route: Plymouth-Middleborough-Taunton-Somerset-Providence	Two round-trips per day	Mon-Fri Year Round	
Yankee Line	2/3/14	2/3/16	SMA	1	Boston-Concord-Acton	Increase from 1 to 2 round-trips	Mon-Fri Year Round	
Total				**36**				

*SMA = Service and Maintenance Agreement

Table 1-3: BusPlus Capital and Operating Agreements

Carrier	Date of Contract	End Date (Initial Term)	SMA* or Operating SMA	No. Buses	Route (New or Change)	Frequency Change	Days of Service	Change in Stop Locations	Route Length	Incremental Annual Revenue-Miles
Peter Pan Bus Lines, Inc.	7/22/15	6/30/16	Operating and SMA	3	New Route: Springfield-Northampton-Greenfield-Shelburne Falls-Charlemont-North Adams-Williamstown-Troy (NY) 2 stops-Albany/Rensselaer	Two round-trips per day	Monday-Sunday Year Round	Shelburne Falls-Charlemont-North Adams	130	190,060
Peter Pan Bus Lines, Inc.	7/22/15	6/30/16	Operating and SMA	1	New Route: Marlborough-Framingham-Boston	Two round-trips per day	Mon-Fri Year Round	Marlborough	38	38,760
True North Transit Group LLC (dba MAXI)	7/27/15	6/30/16	Operating and SMA	3	New Route: Worcester-Boylston-Clinton-Lancaster-Sterling-Leominster-Fitchburg-Westminster-Gardner-Athol-Orange-New Salem-Pelham-Amherst-Northampton	Two round-trips per day	Monday-Sunday Year Round	Boylston-Clinton-Lancaster-Sterling-Westminster-Gardner-Athol-Orange-New Salem-Pelham	100	146,000
Total				**7**						

*SMA = Service and Maintenance Agreement

From the combination of needs identified from unmet service standards, the identification of places without service, and public input, the study team developed potential services as alternatives. Given that net costs of these potential services might exceed available funding, the alternatives were evaluated to determine if they met minimum standards of efficiency and effectiveness, and to prioritize any potential investments.

In order to accomplish this assessment, this study examined four types of standards as a basis for evaluating the need for additional regional bus services, developing potential regional bus service alternatives, and evaluating existing and proposed regional bus routes:

- **Service Standards** helped evaluate the existing regional bus network and develop potential routes. Service to a stop could be considered inadequate if it did not meet these standards, and service alternatives or improvements were developed to meet the standards.

- **Planning Guidelines** helped identify places in the commonwealth that should have regional bus service.

- **Performance Metrics** were used to examine the performance of existing routes and the anticipated performance of proposed routes. Moving forward the RTD will use these metrics to monitor regional bus services.

- **Program Performance Measures** were used to measure the impact of the program on statewide access over time. The availability of regional bus service has been in large part a result of the services provided by the private carriers, with the state program designed to complement services provided by the marketplace. For that reason changes in service availability included both private and state-supported services.

These standards differed for intercity bus and commuter bus services. For intercity bus service, the standards were comparable to those of peer rural intercity services in other states. For commuter bus service, the standards were based on major work trip flows statewide that could support the provision of commuter bus service. Many of these markets involved commutes to Boston and were already addressed by MBTA commuter rail or existing commuter bus services. The commuter shed for central Boston/Cambridge included a large area of the state, covering an area within a radius of approximately 70-miles from downtown Boston.[6] Within this area the study team used service standards to identify locations that have potential needs but are currently unserved by commuter rail or bus. This study also reviewed potential commuter bus service needs to non-Boston destinations, where warranted by demand.

Public input was taken into consideration in developing planning guidelines and service standards, particularly requests for regional bus stop locations to be walkable and transit accessible and to minimize transfers. The proposed service standards were reviewed by MassDOT RTD and the Technical Advisory Committee of RTD's Regional Bus Network Assessment.

[6] Metropolitan Area Planning Council, *Route 128 Corridor Plan*, Appendix D, Commutersheds in Massachusetts, p.2.

STRUCTURE OF THE REPORT

The remainder of this report documents the overall assessment by developing and applying appropriate measures to available data. Chapter 2 reviews the existing regional bus network in the commonwealth, and evaluates it against a set of defined service standards. Chapter 3 examines places in the state that are likely to warrant a regional bus stop, and compares that list of places to those served by the existing network to identify unserved places. Chapter 4 documents the input from existing users, potential users, and transportation planners and providers regarding unmet needs. Chapter 5 combines the results of these analyses to define potential service alternatives to address the unmet needs. Chapter 6 evaluates both currently funded services and alternatives in terms of their likely performance, and outlines service recommendations within the current funding and policy context.

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Chapter 2
Existing Services

INTRODUCTION

During the 2013 *Massachusetts Regional Bus Study*, MassDOT RTD and CTPS conducted an in-depth review of the regional transportation network, and evaluated the network's coverage to identify underserved areas in the state. This chapter provides an update to the inventory of regional bus services in Massachusetts and evaluates the network in terms of a set of service standards that was developed by the study team together with MassDOT staff and the study's Technical Advisory Committee.

2015 INVENTORY OF REGIONAL BUS SERVICE

A few changes have been made to regional bus services in Massachusetts since the last inventory in 2012, but on the whole network coverage remains similar. The primary changes included the addition or elimination of a few routes and changes in service frequency. In late 2015 MassDOT, in partnership with private carriers, implemented three new BusPlus routes under agreements that provided both operating assistance and vehicle capital:

- Northampton to Worcester via Twin Cities
- Albany to Springfield via Williamstown and Greenfield
- Marlborough to Boston with a stop in Framingham.

This 2015 inventory of regional bus service was based on route information as of June 2015. It included both intercity and commuter bus routes as well as the three new BusPlus routes.

Table 2-1 provides a 2015 update to the regional bus routes inventory by carrier. The routes are categorized as commuter bus, intercity bus, or both (serving both markets) to help MassDOT monitor the commuter and intercity bus networks against the BusPlus program performance measures discussed in Chapter 1. Figure 2-1 displays the regional bus routes serving Massachusetts by carrier.

Carriers

Eighteen private carriers and one regional transit authority, the Merrimack Valley Regional Transit Authority (MVRTA), currently operate regular, fixed route regional bus service in Massachusetts. The main changes in carriers from the last inventory were that Fung Wah's service between Boston and New York ended, but Yo! Bus became a new carrier that operates the same route (though at significantly less frequency). Jointly operated by Greyhound Lines and Peter Pan Bus Lines, Yo! Bus provides non-stop service from Boston South Station to Chinatown in New York City on weekends

Table 2-1: Intercity and Commuter Bus Routes Operating in Massachusetts (2015)

Commuter or Intercity	Carrier	Route Name	Towns Served	Days of Service	Roundtrips per Weekday	Weekday Frequency Change Since 2012	Roundtrips per Weekend Day	Notes
Both	Bloom	Boston-West Bridgewater-Raynham-Taunton*	Easton, Raynham, Taunton, West Bridgewater, Brockton, Boston	Daily	18	Increase	4	
Intercity	Bolt Bus	Boston-New York, NY	Boston, New York	Daily	8	Decrease	11.5	
Intercity	Bolt Bus	Boston-Newark, NJ-Philadelphia, PA	Boston, Newark NJ, Philadelphia PA	Daily	2	Same	3	
Both	Boston Express	Boston-Salem, NH-Londonderry, NH (I-93)	Boston, Logan Airport, Salem NH, Londonderry NH, North Londonderry NH, Manchester NH, Concord NH	Daily	29	Increase (small)	17	Fewer trips serve Logan Airport.
Both	Boston Express	Boston-Tyngsborough-Nashua, NH-Manchester, NH (Route 3)	Boston, Logan Airport, Tyngsborough, Nashua NH, Manchester NH	Daily	19	Increase	12.5	Fewer trips serve Logan Airport.
Both	C&J	Boston-Newburyport-Portsmouth, NH-Dover, NH	Boston, Logan Airport, Newburyport, Portsmouth NH, Dover NH	Daily	31	Similar	22	Fewer trips serve Logan Airport.
Intercity	C&J	NEW Portsmouth, NH-Tewksbury-New York, NY	Ogunqiot ME, Portsmouth NH, Tewksbury, New York NY	Daily	3	NEW	3	
Commuter	Coach Company	Boston-Newburyport*	Boston, Newburyport	M-F	6	Same	0	No longer serves Plaistow, NH.
Commuter	Coach Company	Boston-Peabody-Topsfield-Boxford-Georgetown-Groveland-Haverhill*	Boston, Peabody, Topsfield, Boxford, Georgetown, Groveland, Haverhill	M-F	3	Increase (2-3)	0	
Intercity	Concord Coach Lines	Boston-Concord, NH	Boston, Logan Airport, Concord NH	Daily	12	Similar	11.5	Nearly all trips stop at Logan.

Commuter or Intercity	Carrier	Route Name	Towns Served	Days of Service	Roundtrips per Weekday	Weekday Frequency Change Since 2012	Roundtrips per Weekend Day	Notes
Intercity	Concord Coach Lines	Boston-Portland, ME	Boston, Logan Airport, Portland ME	Daily	26	Increase (small)	26	15 trips stop at South Station, 15 trips stop at Logan Airport.
Intercity	Dartmouth Coach	Boston-Hanover NH	Boston, Logan Airport, New London NH, Lebanon NH, Hanover NH	Daily	8	Same	8	All trips serve Logan Airport.
Both	DATTCO	Boston-Taunton-New Bedford-Fairhaven*	Boston, Taunton, New Bedford, Fairhaven, Dartmouth (UMass)	Daily	13.5	Increase (small)	5	
Intercity	Go Buses	Cambridge-Newton-New York, NY	Cambridge, Newton, New York NY	Daily	6	Increase	13	
Intercity	Greyhound	Boston-Burlington, VT-Montreal, QE	Boston, Logan Airport (served by 2 trips), Manchester Airport NH, Manchester NH, Concord NH, Hanover NH, White River Junction VT, Montpelier VT, Burlington VT Downtown, Burlington VT UVM, Burlington VT airport, St. Jean PQ, Montreal PQ	Daily	4	Same	4	Only two trips serve Logan.
Intercity	Greyhound	Boston-New York, NY via RI/CT	Boston, Providence RI, Foxwoods Casino CT, Mohegan Sun CT, New London CT, New Haven CT, Bridgeport CT, Stamford CT, White Plains NY, New York	Daily	2	Decrease	4	Table 108
Intercity	Greyhound	Boston-Portsmouth, NH-Portland, ME-Bangor, ME	Boston, Portsmouth NH, Wells ME, Portland ME, Brunswick ME, Lewiston ME, Augusta ME, Waterville ME, Bangor ME	Daily	2	Decrease (small)	2	Table 60

Commuter or Intercity	Carrier	Route Name	Towns Served	Days of Service	Roundtrips per Weekday	Weekday Frequency Change Since 2012	Roundtrips per Weekend Day	Notes
Intercity	Greyhound	Boston-Worcester-Springfield-Albany, NY	Boston, Worcester, Springfield, Albany NY	Daily	4	Increase (small)	4.5	Of 4 roundtrips, only 1 serves Springfield.
Intercity	Greyhound	NEW Boston-Brattleboro, VT*	Boston, Nashua NH, Keene NH, Brattleboro VT	F, Sun	0	NEW	1	Table 64
Intercity	Greyhound	Springfield-Greenfield-White River Junction, VT*	Springfield, Northampton, Greenfield, Brattleboro VT, Keene NH, Bellows Falls VT, White River Junction VT	Daily	1	Same	1	Table 67
Intercity	Limoliner	Boston-Framingham-NYC	Boston, Framingham, NYC	Daily	3	Same	4	
Intercity	Lucky Star	Boston-NYC	Boston, NYC	Daily	12	Decrease	20	
Intercity	MAX	NEW Northampton-Twin Cities-Worcester*	Northampton, Amherst, Pelham, New Salem, Orange, Athol, Gardner, Fitchburg, North Leominster, Leominster, Lancaster, Clinton, Worcester	Daily	2	NEW	2	
Intercity	Megabus/ DATTCO	Boston-Burlington, VT	Boston, Burlington VT	Daily	1	Same	1	
Intercity	Megabus/ DATTCO	Boston-Hartford, CT-New Haven, CT	Boston, Hartford CT, New Haven CT	Daily	1	Decrease	2	
Intercity	Megabus/ DATTCO	Boston-New York	Boston, New York NY	Daily	10	Same	17	
Intercity	Megabus/ DATTCO	Boston-Philadelphia-Washington, D.C.	Boston, Secaucus NJ, Philadelphia PA, Baltimore MD, Washington, D.C.	Daily	2	Same	2	
Intercity	Megabus/ DATTCO	Burlington, VT-Amherst-Hartford, CT-New York	Amherst, Burlington VT, Hartford CT, New York NY	Daily	1	Decrease (2-1)	1.5	
Intercity	Megabus/ DATTCO	NEW Fairhaven/New Bedford-Fall River-Providence, RI-NYC	Fairhaven, Fall River, Providence RI, New York NY	Daily	3	NEW	3	

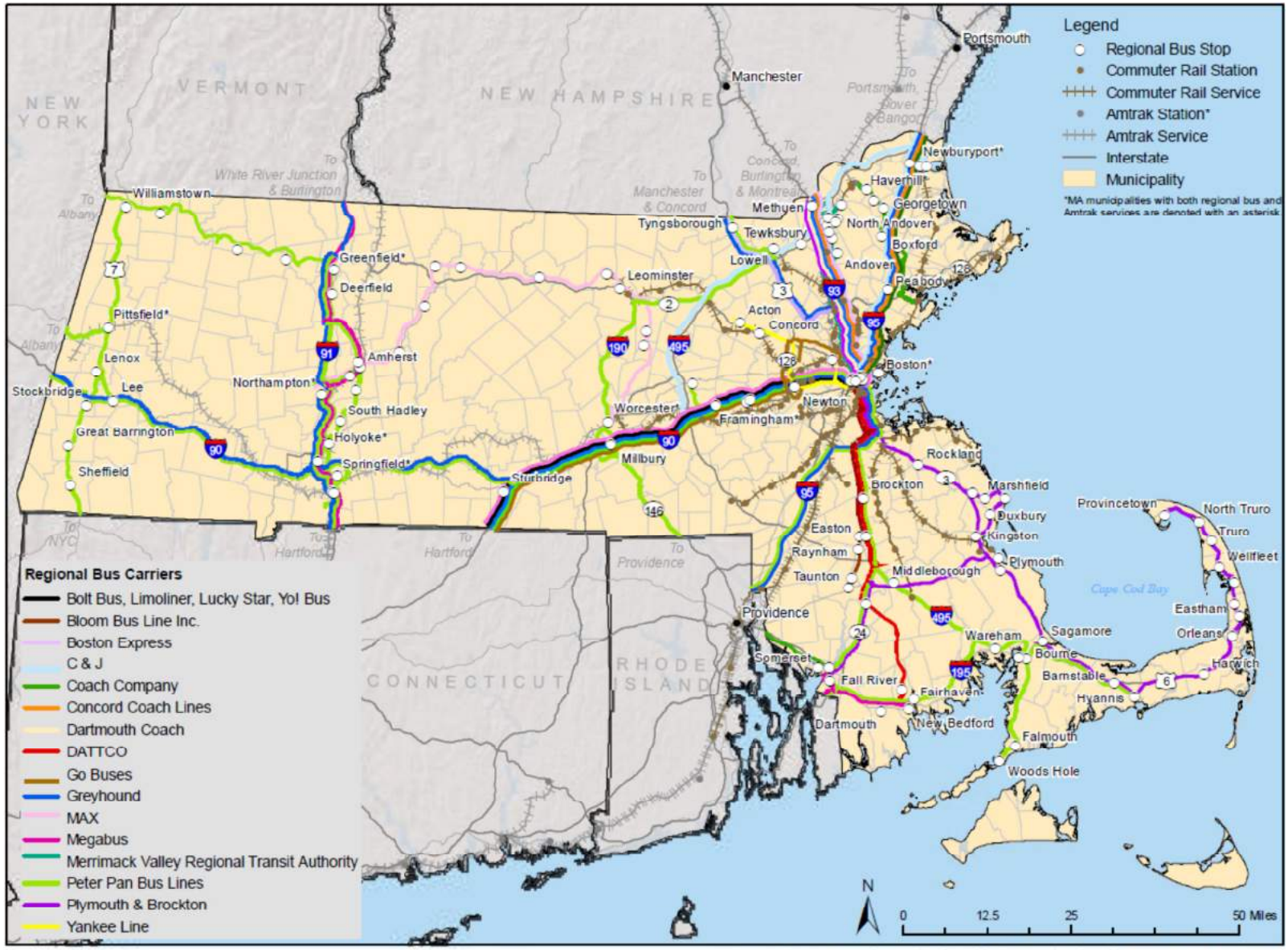
Commuter or Intercity	Carrier	Route Name	Towns Served	Days of Service	Roundtrips per Weekday	Weekday Frequency Change Since 2012	Roundtrips per Weekend Day	Notes
Intercity	Megabus/ DATTCO	NEW Fairhaven-Dartmouth UMass-Newport, RI-Kingston, RI-New York, NY*	Fairhaven, Dartmouth, Newport RI, Kingstown RI (U of RI), New York NY	F, Sun	1	NEW	1	
Commuter	MVRTA	Methuen-Lawrence-Andover-Boston	Methuen, Lawrence, Andover, Boston	M-F	4.5	Similar	0	
Commuter	MVRTA	NEW North Andover-Boston	North Andover, Boston	M-F	1	NEW	0	
Intercity	Peter Pan	Albany, NY-Pittsfield-Lenox-Lee-Springfield-Worcester-Providence RI*	Pittsfield, Lenox, Lee, Springfield, Worcester, Providence RI, Albany NY	Daily	2	Same	2	Table 2039
Intercity	Peter Pan	NEW Albany, NY-Berkshires-Springfield*	Springfield, Northampton, Deerfield, Greenfield, Shelburne Falls, Charlemont, North Adams, Williamstown, Troy NY, Albany NY	Daily	2	NEW	2	
Both	Peter Pan	Boston-Fall River-Newport RI*	Boston, Taunton, Fall River, Somerset, Portsmouth RI, Middletown RI, Newport RI	Daily	5.5	Similar	2.5	Table 2040
Intercity	Peter Pan	Boston-Framingham-Worcester-Springfield*	Boston, Framingham, Worcester, Sturbridge, Springfield	Daily	7 + 2 nonstop	Similar	6 + 2 nonstop	Table 2014
Intercity	Peter Pan	Boston-Providence, RI	Boston, Logan Airport, Providence RI, TF Green Airport RI (served by 5 roundtrips)	Daily	9	Similar	7	Table 2025
Both	Peter Pan	Boston-Wareham-Bourne-Falmouth-Woods Hole*	Boston, Logan Airport, Wareham, Buzzards Bay, Bourne, Falmouth, Woods Hole	Daily	10	Similar	7	Table 2030. New stop added at Buzzards Bay.
Intercity	Peter Pan	Concord, NH-Manchester, NH-Nashua, NH-Lowell-Leominster-Worcester-Foxwoods Casino, CT	Worcester, Leominster, Lowell, Nashua NH, Manchester NH, Concord NH, Foxwoods Casino Mashantucket CT	Daily	1	Same	1	Tables 2011 and 6B

Commuter or Intercity	Carrier	Route Name	Towns Served	Days of Service	Roundtrips per Weekday	Weekday Frequency Change Since 2012	Roundtrips per Weekend Day	Notes
Intercity	Peter Pan	Hyannis-New Bedford-Fall River-Providence RI	Hyannis, Barnstable, Bourne, New Bedford, Fall River, Providence RI	Daily	6	Same	6	Table 2037
Both	Peter Pan	NEW Boston-Framingham-Worcester-Sturbridge Commuter*	Boston, Framingham, Worcester, Millbury, Sturbridge	Daily	11	NEW	11	Table 2016 (includes some same trips as Table 2014)
Commuter	Peter Pan	NEW Marlborough-Boston*	Marlborough, Framingham, Boston	Week-days	2	NEW	n/a	
Intercity	Peter Pan	NEW Springfield-Enfield, CT-Foxwoods Casino, CT	Springfield, Enfield CT, Foxwoods Casino Mashantucket CT	Daily	1	NEW	2	Table 17A
Intercity	Peter Pan	New York, NY-Sheffield-Great Barrington-Lee-Lenox-Pittsfield-Williamstown	Sheffield, Great Barrington, Stockbridge, Lee, Lenox, Pittsfield, Williamstown, New York NY	Daily	2	Same	2	Table 2042
Intercity	Peter Pan	Springfield-Holyoke-Northampton-South Hadley-Amherst-Deerfield-Greenfield	Springfield, Holyoke, Northampton, South Hadley, Amherst, Deerfield, Greenfield	Daily	8	Similar	8	Tables 2018 and 2014. Not all stops are served on every trip.
Intercity	Peter Pan/ Greyhound	Boston-Framingham-Worcester-Hartford, CT*	Boston, Framingham (served by 4 trips), Worcester, Hartford CT	Daily	6	Increase (Table)	6	Greyhound Table 104, Peter Pan Table 2018. Only 4 trips serve Framingham.
Intercity	Peter Pan/ Greyhound	Boston-Hartford, CT nonstop	Boston, Hartford	Daily	2	Increase (Table)	4.5	Greyhound Table 104, Peter Pan Table 2018
Intercity	Peter Pan/ Greyhound	Boston-New York, NY nonstop	Boston, New York, 1 trip stops in Worcester	Daily	15	Increase	17	Greyhound Table 105

Commuter or Intercity	Carrier	Route Name	Towns Served	Days of Service	Roundtrips per Weekday	Weekday Frequency Change Since 2012	Roundtrips per Weekend Day	Notes
Intercity	Peter Pan/ Greyhound	Springfield-Hartford, CT-New York, NY	Springfield, Hartford CT, New Britain CT, New Haven CT, New York	Daily	11.5	Increase (Table)	13	Greyhound Table 104, Peter Pan Table 2018
Commuter	Plymouth & Brockton	Boston-Rockland-Kingston-Plymouth	Boston, Rockland, Kingston, Plymouth	M-F	8	Similar	0	Table 2455
Commuter	Plymouth & Brockton	Boston-Rockland-Marshfield-Duxbury	Boston, Rockland, Marshfield, Duxbury	M-F	1.5	Similar	0	Table 2455
Both	Plymouth & Brockton	Boston-Rockland-Plymouth-Sagamore-Barnstable-Hyannis	Boston, Logan Airport, Rockland, Plymouth, Sagamore, Barnstable, Hyannis	Daily	23	Similar	15	Table 2451. Plymouth and Rockland only served on 16 roundtrips on weekdays.
Intercity	Plymouth & Brockton	Hyannis-Provincetown local	Hyannis, Harwich, Orleans, Eastham, North Eastham, South Wellfleet, Wellfleet, Truro, North Truro, Provincetown	Daily	2	Same	2	Table 2461
Commuter	Plymouth & Brockton	NEW Plymouth-Middleborough-Taunton-Somerset-Providence, RI*	Plymouth, Middleborough, Taunton, Somerset, Providence RI	M-F	2	NEW	0	Table 2458
Commuter	Yankee Line	Boston-Concord-Acton*	Acton, Concord, Boston	M-F	2	Increase (1-2)	0	
Intercity	Yo! Bus	Boston-New York Chinatown	Boston, New York	F, Sat, Sun	0	Decrease (compared to Fung Wah)	4	Greyhound Table 106. Fung Wah previously provided 19 RTs weekdays & 27 roundtrips weekend days.

Notes: *Supported by BusPlus program. Data based on route information as of June 2015. Three new BusPlus routes based on schedules in June 2016.

Figure 2-1: Regional Bus Routes by Carrier



Source: Bus routes and stops developed by CTPS and updated by KFH Group in June 2015.

only. Another minor change was World Wide Bus, which operated the Cambridge-Newton-New York route, and is now known as Go Buses. Go Buses is owned and operated by Academy Bus.

In addition to Fung Wah's service, one other route was eliminated since the 2012 inventory. Megabus/DATTCO is no longer operating the summer route between Hyannis and New York, NY.

Listed below are new regional bus routes that started operating since the 2012 inventory. The routes marked by an asterisk receive support from MassDOT through the BusPlus program.

- **Tewksbury to Portsmouth, NH and New York, NY** - C&J provides daily intercity service with some trips also serving Ogunquit, ME.
- **Boston to Brattleboro, VT*** – Greyhound provides intercity service twice a week (Fridays and Sundays) between Boston and Brattleboro with stops in Nashua and Keene in New Hampshire.
- **Fairhaven to New York, NY** – Megabus/DATTCO provides daily intercity service with stops in Fall River and Providence, RI. Additional service on Fridays and Sundays serve UMass Dartmouth, Newport, RI, and Kingstown, RI (the University of Rhode Island).
- **North Andover to Boston** – MVRTA provides commuter service.
- **Boston to Worcester*** – Peter Pan provides commuter service with a stop in Framingham. A few trips serve Sturbridge.
- **Springfield to Foxwoods Casino, CT** – Peter Pan provides daily intercity service to Foxwoods Casino in Mashantucket, CT with a stop in Enfield, CT.
- **Plymouth to Providence, RI*** – Plymouth & Brockton provides commuter service with stops in Middleborough, Taunton, and Somerset.
- **Northampton to Worcester*** - MAX provides daily intercity service with stops in Amherst, Pelham, New Salem, Orange, Athol, Gardner, Fitchburg, Leominster, Lancaster ,and Clinton.
- **Albany, NY to Springfield*** - Peter Pan provides daily intercity service with stops in Northampton, Greenfield, Shelburne Falls, Charlemont, North Adams, Williamstown, and Troy, NY
- **Marlborough to Boston*** - Peter Pan provides commuter service with a stop in Framingham.

The following changes were made to stops on specific routes:

- Coach Company's Boston-Newburyport route no longer connects to Plaistow, NH.
- Plymouth & Brockton's Boston-Rockland-Plymouth-Hyannis route now serves Sagamore and Barnstable.

The 2012 inventory included seasonal services that are still operating but were not included in the 2015 update given the limited service:

- Boston to Hamptons, NY – Hampton Jitney provides very limited service (only three days at Thanksgiving).

- Boston to Amherst – Peter Pan's College Express services connect Amherst, Northampton and South Hadley to Boston and New York City, primarily operating on weekends during the school year only.

- Boston and Springfield to Six Flags Agawam - Peter Pan's Go Six Flags New England services connect Boston, Framingham, Worcester, and Springfield to Six Flags, operating from Memorial Day to Labor Day.

The Massachusetts Port Authority (Massport) still operates the Logan Express bus routes which provide nonstop service to Logan Airport from Braintree, Framingham, Peabody and Woburn.[1]

Stops

The 2015 regional bus network served nearly 80 municipalities in the commonwealth, including Boston. Previously served by Peter Pan, Chicopee was the only town from the 2012 inventory that is no longer served by regional bus. Hyannis remains in the regional bus network, but the Megabus stop on Ocean Street is no longer served.

Several towns have since been added to the regional bus network, largely along the three new BusPlus routes receiving operating assistance from MassDOT (marked with an asterisk):

- Athol* – MART Intermodal terminal on South Street and Athol Common (flag stop), served by MAX
- Buzzards Bay – Buzzards Bay Train Depot, served by Peter Pan
- Charlemont* – Main Street near Avery General Store, served by Peter Pan
- Clinton* – Depot Square at Sterling Street, served by MAX
- Dartmouth – UMass Dartmouth, served by Megabus/DATTCO
- Fitchburg* – MART/MBTA Intermodal Terminal on Main Street, served by MAX
- Gardner* – MART stop at Connors Street and City Hall Avenue, served by MAX
- Lancaster* - Harvard Street, served by MAX
- Marlborough* – Granger Boulevard and Newton Street, served by Peter Pan
- Middleborough – Campanelli Business Park on Leona Drive, served by Peter Pan
- New Salem* – Route 202 near New Salem General Store (flag stop) , served by MAX
- North Adams* – BRTA bus shelter on Main Street, served by Peter Pan
- North Andover – Osgood Landing, High Street, and Massachusetts Avenue, served by MVRTA
- Orange* – Water Street/Monument Square, served by MAX
- Pelham* – Route 202 at Amherst Road (flag stop), served by MAX
- Shelburne Falls* – Main Street near Shelburne Senior Center, served by Peter Pan

[1] The Logan Express routes were not included in the analysis of statewide regional bus service frequency below.

- Somerset – Park and ride lot on Route 103, exit 4 off I-95, served by Peter Pan, and park and ride lot on Slades Ferry Avenue, served by Plymouth and Brockton
- Sturbridge – Old Sturbridge Village Visitor Center, served by Peter Pan
- Tewksbury – Highwood Drive, served by C&J

The following towns are still in the regional bus network and have had new stops added within the town since 2012:

- Amherst – New stop at Hampshire College, served by Peter Pan
- Framingham – New stop at Routes 9 and 30, exit 13 off I-90, served by Peter Pan
- Plymouth – New stop on Memorial Drive at the Waterfront Visitor's Center, served by Plymouth & Brockton
- Springfield – New stops at UMass Springfield and Rocky's Plaza/Ace Hardware, both served by Peter Pan

The stop locations in Fall River and Greenfield moved to new intermodal transportation centers. Served by Megabus and Peter Pan, the Fall River stop moved to the new Louis D. Pettine Transportation Center, completed in 2013, on 4th Street. Served by Peter Pan and Greyhound, the Greenfield stop moved to the new John Olver Transportation Center, completed in 2012, on Olive Street.

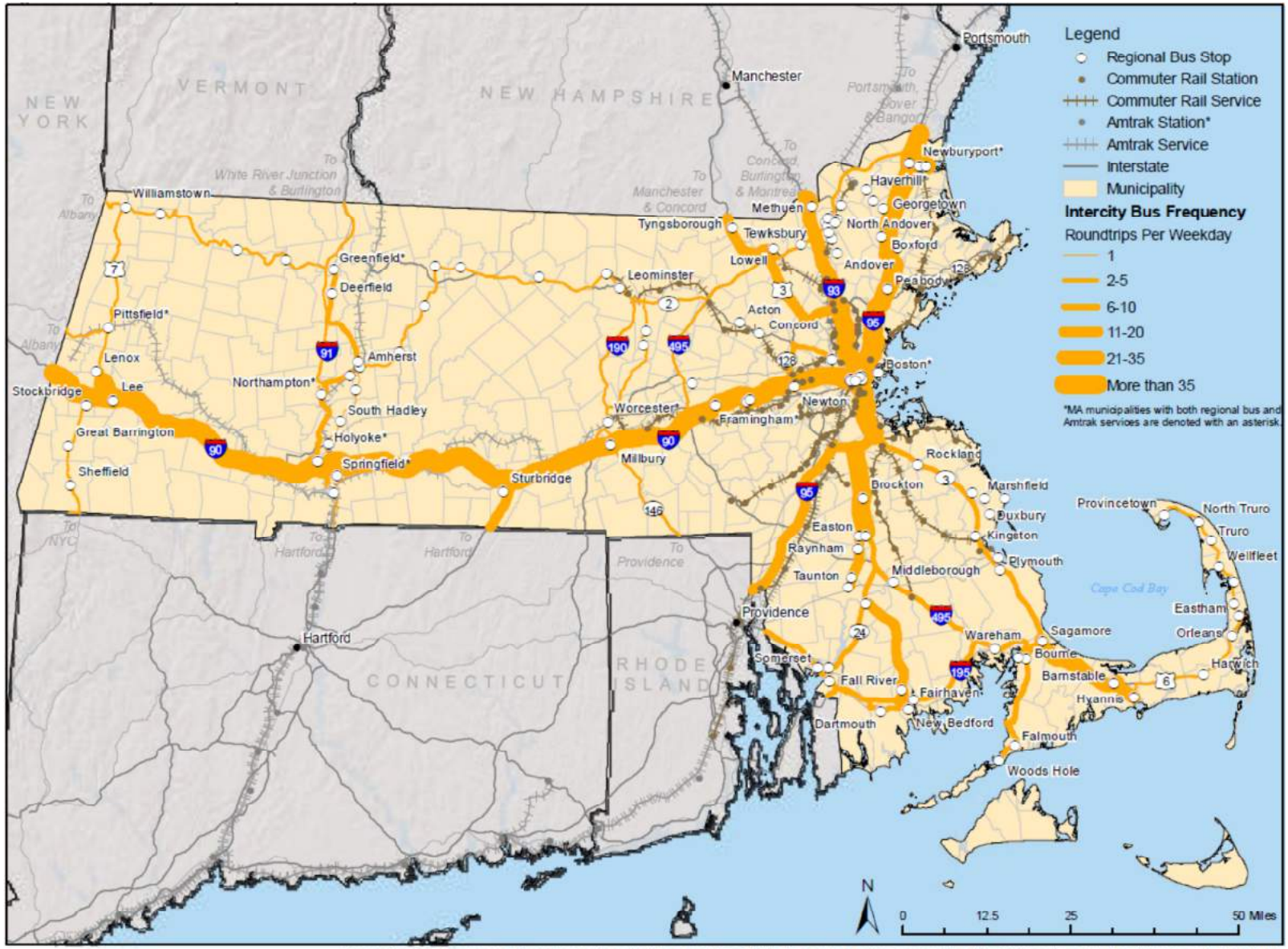
Service Frequency

Table 2-1 above included the service frequencies per route. Approximately half of the regional bus routes provided a similar level of service in 2015 as in 2012. Service frequency increased on approximately one-fourth of the routes, including intrastate service in Eastern Massachusetts and interstate service to New York, Connecticut and New Hampshire. A handful of routes, namely Boston to New York service, experienced frequency decreases.

Figures 2-2 and 2-3 display the weekday frequency by corridor for the intercity bus and commuter bus networks, respectively. In June 2015, 93% of the intercity bus network was served by two roundtrips per day or more, and 96% of the commuter bus network was served by two roundtrips per day or more. These percentages are even higher when taking into account the three new BusPlus routes that started in late 2015.

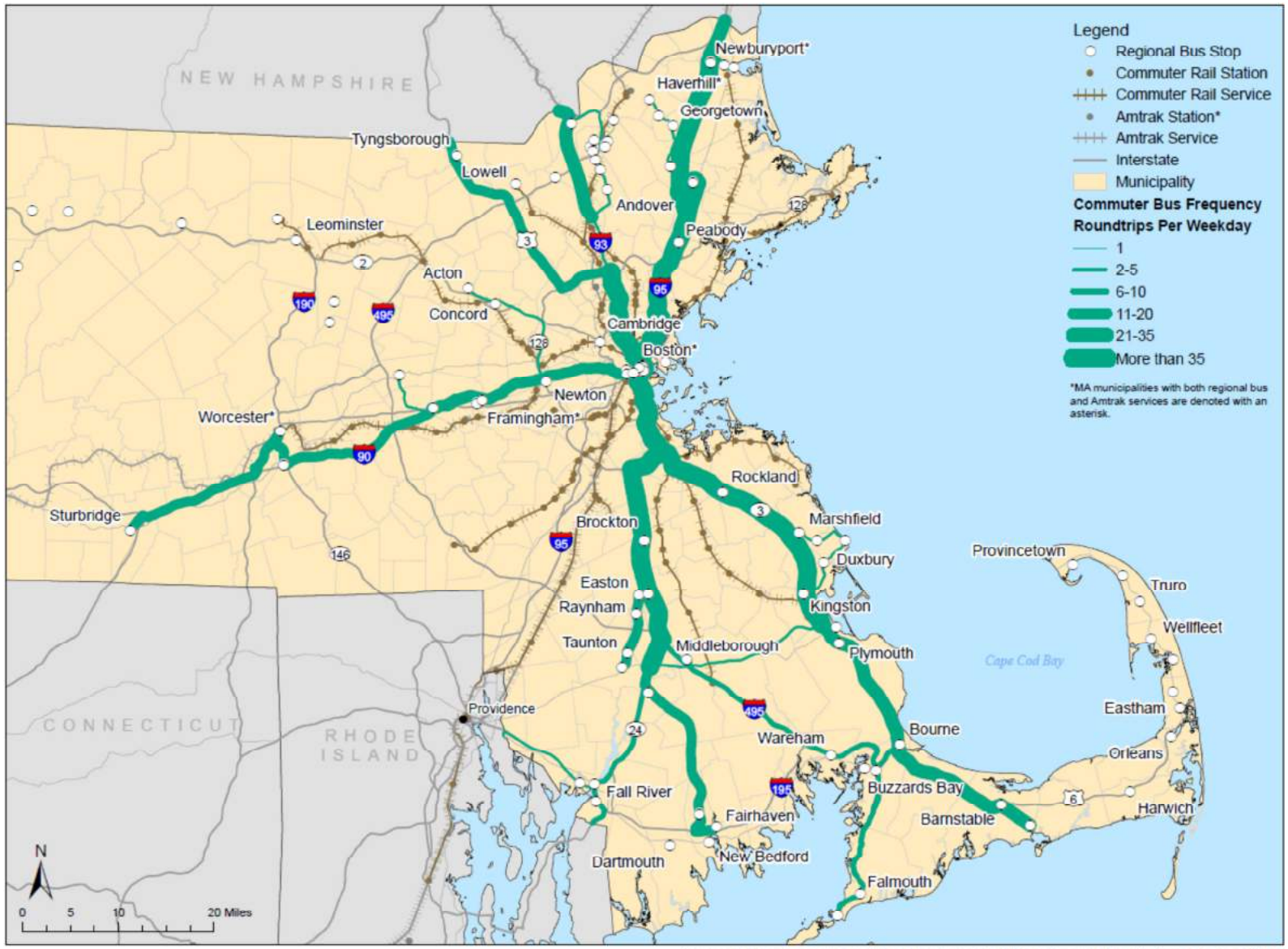
Figure 2-4 portrays the weekday frequency of regional bus service (both intercity and commuter) by town in Massachusetts; the frequency is listed in Table 2-2. The service frequency to villages is included in the town where the bus stop is located (e.g., Village of Hyannis is included in the Town of Barnstable).

Figure 2-2: Frequency of Intercity Bus Services by Corridor



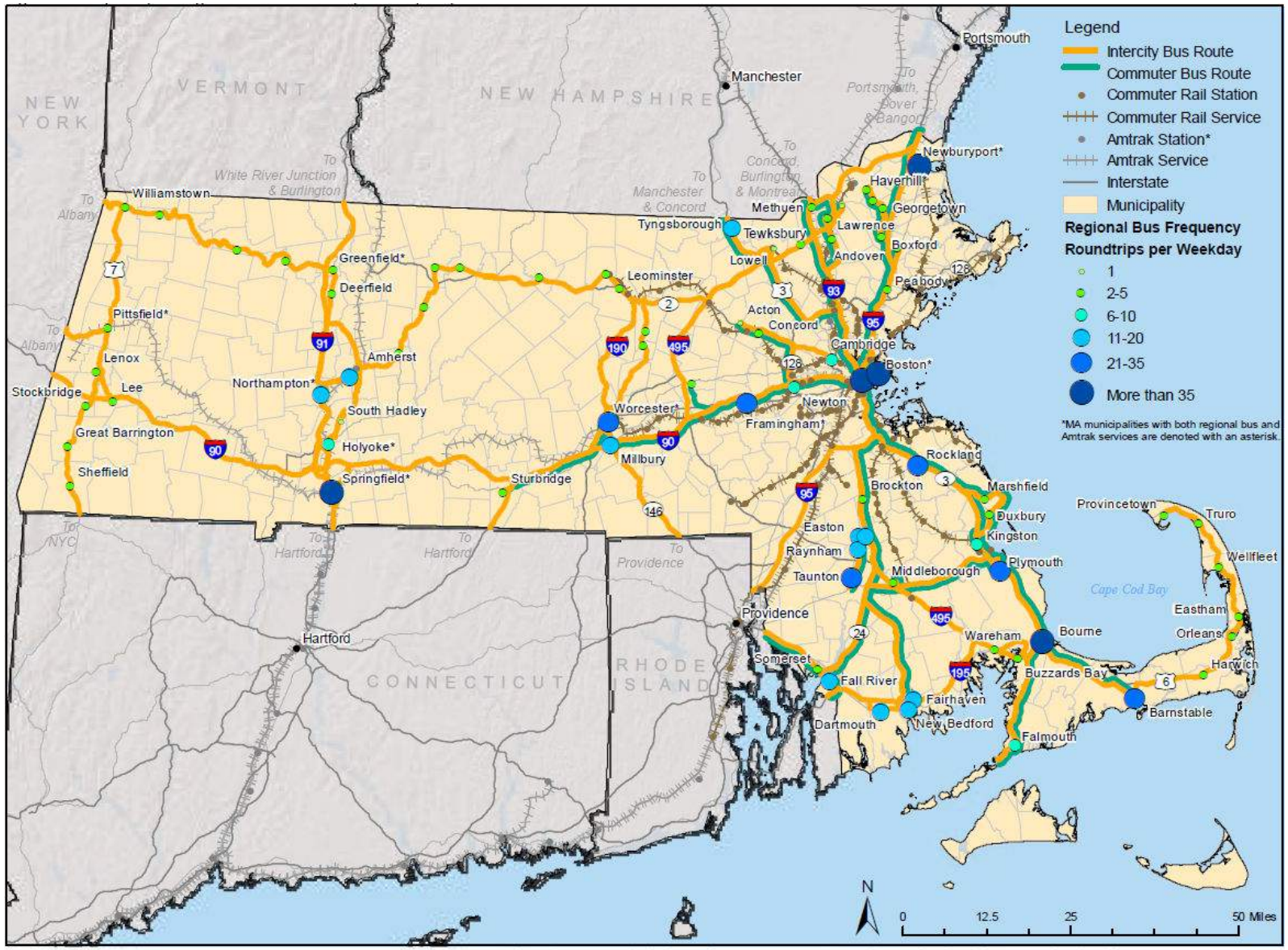
Source: Service frequencies based on carrier schedules as of June 2015. Bus routes and stops developed by CTPS and updated by KFH Group in June 2015.

Figure 2-3: Frequency of Commuter Bus Services by Corridor



Source: Existing bus routes and stops developed by CTPS and updated by KFH Group in June 2015.

Figure 2-4: Frequency of Regional Bus Services by Municipality



Source: Service frequencies based on carrier schedules as of June 2015. Bus routes and stops developed by CTPS and updated by KFH Group in June 2015.

Table 2-2: Frequency of Regional Bus Services by Municipality

Municipality with Regional Bus Service	Roundtrips per Weekday	Roundtrips per Weekend Day	Notes
Acton	1	0	
Amherst	10.5	11	
Andover	4.5	0	
Athol	2	2	
Barnstable	31	23	Includes Hyannis
Boston	326	264	
Boston Logan Airport	171	130	
Bourne	39	28	Includes Sagamore
Boxford	3	0	
Brockton	4	1	
Buzzards Bay	2	1	
Cambridge	6	13	
Charlemont	2	2	
Clinton	2	2	
Concord	2	0	
Dartmouth	13.5	6	
Deerfield	3	3	
Duxbury	1.5	0	
Eastham	2	2	Includes North Eastham
Easton	18	4	
Fairhaven	17.5	10	
Fall River	14.5	11.5	
Falmouth	10	7	Includes Woods Hole
Fitchburg	2	2	
Framingham	27	25	
Gardner	2	2	
Georgetown	2.5	0	
Great Barrington	2	2	
Greenfield	5	5	
Groveland	2.5	0	
Harwich	2	2	
Haverhill	2.5	0	
Holyoke	6.5	6.5	
Kingston	8	0	
Lancaster	2	2	
Lawrence	4.5	0	

Municipality with Regional Bus Service	Roundtrips per Weekday	Roundtrips per Weekend Day	Notes
Lee	4	4	
Lenox	4	4	
Leominster	3	3	
Lowell	1	1	
Marlborough	2	0	
Marshfield	2	0	
Methuen	4.5	0	
Middleborough	2	0	
Millbury	11	11	Route 146 park and ride lot (Worcester on schedule)
New Bedford	19.5	11	
New Salem	2	2	
Newburyport	37	22	
Newton	6	13	
North Adams	2	2	
North Andover	1	0	
Northampton	12	12	
Orange	2	2	
Orleans	2	2	
Peabody	3.5	0	
Pelham	2	2	
Pittsfield	4	4	
Plymouth	26.5	15	
Provincetown	2	2	
Raynham	18	4	
Rockland	26	15	
Sheffield	2	2	
Shelburne Falls	2	2	
Somerset	3	0	
South Hadley	1	1	
Springfield	37.5	43	
Stockbridge	2	2	
Sturbridge	1.5	1.5	
Taunton	33.5	9	
Tewksbury	3	3	
Topsfield	3.5	0	
Truro	2	2	Includes North Truro
Tyngsborough	13.5	9	

Municipality with Regional Bus Service	Roundtrips per Weekday	Roundtrips per Weekend Day	Notes
Wareham	2	1	
Wellfleet	2	2	Includes South Wellfleet
West Bridgewater	18	4	
Williamstown	4	4	
Worcester	32.5	32	Includes Millbury Route 146 Lot stop

Note: Frequencies based on route schedules as of June 2015, except for stops on the three new BusPlus routes, which were based on spring 2016 schedules.

SERVICE STANDARDS

The service standards outlined a minimum level of service that municipalities served by regional bus should receive. Service to a municipality was considered inadequate if it didn't meet these standards, and service improvements were developed to provide at least the minimum level of service. The service standards helped ensure that regional bus service is convenient for passengers, thereby encouraging ridership and forming a seamless regional network.

Intercity Bus

Intercity bus service to a municipality should:

- Allow a passenger to reach Boston or New York City with no more than one transfer (not including transfers on or from local transit services), including possible transfers at regional or national network connectivity points such as Worcester, Springfield, Hyannis, Albany, NY, Providence, RI, Hartford, CT, Rutland, VT, Manchester, NH, and Portsmouth, NH.
- Allow a passenger to make a day trip and spend five hours or more in Boston, Springfield, or Worcester.
- Provide daily service, preferably, though routes can be started as weekend-only routes to test ridership demand, and if successful, additional service can be added.
- Provide one roundtrip per day or more, preferably two roundtrips per day or more for places with higher demand (actual or projected).

Commuter Bus

Municipalities with commuter bus service should:

- Allow a passenger to reach a Massachusetts Employment Cluster[2] in a one-seat ride, not counting transfers from local transit

[2]As defined in the Route 128 Corridor Study, Metropolitan Area Planning Council, Appendix D, Commutersheds in Massachusetts. Employment clusters include Boston/Cambridge, 93 North/Merrimack, 128 South, Pioneer Valley, 495 Corridor, 128 North, 128 Central, Worcester, and South Coast.

- Allow a passenger to work a full business day, approximately 8 a.m. - 5 p.m.
- Have service every weekday, Monday-Friday
- Have two peak hour roundtrips per day or more

The study team applied all of these criteria to the existing services to identify locations that did not meet the standards, so a location was identified as having inadequate service if it did not meet any one of the criteria.

EVALUATION AGAINST SERVICE STANDARDS

Municipalities that received regional bus service in June 2015 were evaluated against the service standards, specific to intercity bus service and commuter bus service. As highlighted in Figure 2-5, some municipalities were considered to have inadequate service if their current level of regional bus service did not meet all the service standards. New services or service improvements were developed to ensure regional bus service to these municipalities met at least the minimum service level requirements. Municipalities that met all the service standards were still considered for service improvements if unmet needs were identified through the needs analysis documented later in this report.

Municipalities with Intercity Bus Service Only

Table 2-3 summarizes the results of the service standards assessment for towns with intercity bus service only. The following service standards were applied:

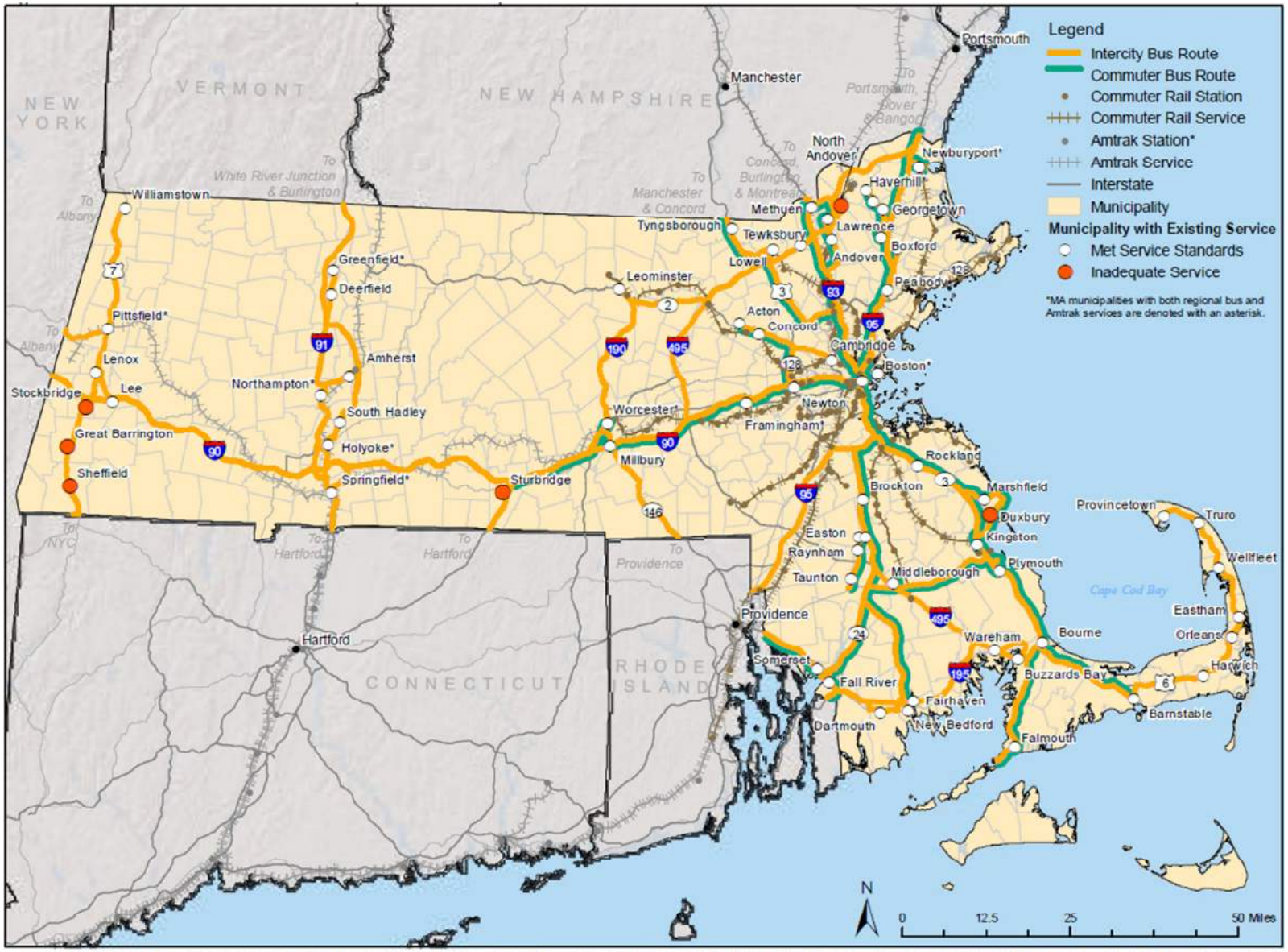
- Passenger can arrive in Boston or New York City with only one transfer after arriving at a major network connectivity point
- Passenger can make a day trip and spend 5 hours or more in Boston, Worcester, or Springfield
- Seven day per week service is preferred
- Minimum of one roundtrip per day; or two roundtrips per day for places with higher demand

Intercity bus services were deemed inadequate based on one of two issues related to passengers making day trips to Boston:

1. Passengers can make a roundtrip to Boston in one day, but may not have sufficient time to conduct their business (e.g., medical appointment, social visit), or
2. Passengers cannot make a day trip to Boston, Worcester, or Springfield.

Residents in the Berkshires have a direct trip to New York City (and also one trip from Pittsfield to Albany), but the existing service to reach Boston is inconvenient. Great Barrington, Sheffield and Stockbridge residents cannot make a day trip to Boston, Worcester, Springfield, or Albany. Their current intercity bus service requires a four-hour layover in Lenox, where one transfer allows riders to arrive in Springfield in the evening and another transfer provides the connection to Boston for a nighttime arrival. Sturbridge residents can make a day trip to Boston, but the earliest available arrival into Boston is 1:30 p.m., allowing only three hours to conduct their business in order to make a same day return trip.

Figure 2-5: Service Standards Evaluation



Note: The three new BusPlus routes that started in late 2015 were not included in the service standards evaluation. Source: Bus routes and stops developed by CTPS and updated by KFH Group in June 2015.

Table 2-3. Service Standards Evaluation of Municipalities with Intercity Bus Service Only

Municipality	Meeting All Service Standards (Yes/No)	Type of Inadequate Service
Amherst	Yes	
Cambridge	Yes	
Dartmouth	Yes	
Deerfield	Yes	
Eastham	Yes	
Great Barrington	No	Cannot make day trip to Boston, Worcester, or Springfield
Greenfield	Yes	
Harwich	Yes	
Holyoke	Yes	
Lee	Yes	
Lenox	Yes	
Leominster	Yes	
Lowell	Yes	
Newton	Yes	
Northampton	Yes	
Orleans	Yes	
Pittsfield	Yes	
Provincetown	Yes	
Sheffield	No	Cannot make day trip to Boston, Worcester, or Springfield
South Hadley	Yes	
Springfield	Yes	
Stockbridge	No	Cannot make day trip to Boston, Worcester, or Springfield
Sturbridge	No	Day trip only provides 3 hours in Boston
Tewksbury	Yes	
Truro	Yes	
Wellfleet	Yes	
Williamstown	Yes	

While residents in Lee, Lenox, Pittsfield, South Hadley and Williamstown are able to make day trips to Springfield, the existing service to Boston is inconvenient and does not provide sufficient time in Boston for a day trip. Alternatives may be considered to improve this connection. It is worth noting that Cape Cod residents are able to make a day trip to Boston, but the existing intercity bus service only allows four hours to conduct their business. From May to October, residents in Eastham, Harwich, Orleans, Provincetown, and Truro can take local transit and ferry service to Boston, which allows five hours to conduct their business in Boston.

Municipalities with Commuter Bus Service Only

The following service standards were applied to municipalities that currently receive commuter bus service only:

- Passengers within the commute shed of the following major employment destinations may reach the city without a transfer: Boston, Worcester, Springfield, Northampton/Amherst, Albany, NY, Hartford, CT, and Providence, RI
- Passenger is able to work a full business day (approximately 8am-5pm)
- Service every weekday (Monday-Friday)
- Minimum of two peak hour roundtrips per day

Table 2-4 summarizes the results of the service standards assessment for towns with commuter bus service only. Most of the municipalities served by commuter bus service received a level of service that met the service standards. Only services to Duxbury and North Andover were considered inadequate because these towns were served by less than two peak hour roundtrips per day.

Table 2-4. Service Standards Evaluation of Municipalities with Commuter Bus Service Only

Municipality	Meeting All Service Standards (Yes/No)	Type of Inadequate Service
Acton	Yes	
Andover	Yes	
Boxford	Yes	
Concord	Yes	
Duxbury	No	Less than two peak hour roundtrips per day
Georgetown	Yes	
Groveland	Yes	
Haverhill	Yes	
Kingston	Yes	
Lawrence	Yes	
Marshfield	Yes	
Methuen	Yes	
Middleborough	Yes	
Millbury	Yes	
North Andover	No	Less than two peak hour roundtrips per day
Peabody	Yes	
Somerset	Yes	
Topsfield	Yes	

Municipalities with Both Intercity and Commuter Bus Service

Some municipalities were served by both intercity and commuter bus services, and were evaluated against both sets of service standards. Table 2-5 summarizes the results. All of the municipalities that have both intercity and commuter bus service met the service standards, i.e., there were no deficiencies.

Table 2-5. Service Standards Evaluation of Municipalities with Both Intercity and Commuter Bus Service

Municipality	Meeting All Service Standards (Yes/No)	Type of Inadequate Service
Barnstable	Yes	
Bourne	Yes	
Brockton	Yes	
Buzzards Bay	Yes	
Easton	Yes	
Fairhaven	Yes	
Fall River	Yes	
Falmouth	Yes	
Framingham	Yes	
New Bedford	Yes	
Newburyport	Yes	
Plymouth	Yes	
Raynham	Yes	
Rockland	Yes	
Taunton	Yes	
Tyngsborough	Yes	
Wareham	Yes	
West Bridgewater	Yes	
Worcester	Yes	

CONCLUSION

Massachusetts is fortunate in having a comprehensive network of intercity and commuter bus services that largely meet the defined service standards. The major gaps arose in part from geography. Towns in the western part of the state did not have bus service to Boston that allowed for a one-day roundtrip with adequate time in the destination city. Passengers from Provincetown (at the end of the Cape) would have only four hours in Boston before a same-day return trip, potentially restricting appointment times (though summer ferry service would allow a full five hours in Boston). Although these issues concerned service from the extreme ends of the state, it is possible that alternative schedule and service designs could address issues caused by the need for transfers and long layover times. Options for these alternatives are presented in Chapter 5.

Chapter 3
Analysis of Unmet Regional Bus Need Based on Demographic Characteristics

INTRODUCTION

While the evaluation of service standards helped identify potential needed improvements to existing regional bus services, the second step involved examining areas of the commonwealth that do not currently have either intercity or commuter bus service. These areas might warrant regional bus service based on the population, density, and degree to which they demonstrate high transit need characteristics. This chapter outlines the results of the needs analysis using planning guidelines to identify places not currently served that are good candidates for regional bus service. Note this analysis was conducted prior to the implementation of the three new BusPlus routes in late 2015, but the maps include the new stops for reference.

PLANNING GUIDELINES

Planning guidelines helped identify places in the commonwealth that may have sufficient demand to warrant new or expanded regional bus service. High general population density, high densities of transit dependent populations, and major trip generators including employment centers served as indicators of potential demand for regional bus services. Places that are not currently served by regional bus or lack good local transit connections to nearby regional bus stops were candidates for new stops in the regional bus network. Increasing access to regional bus services by adding new stops contributes to the BusPlus program goals of providing basic mobility for transit dependent populations and increasing ridership. Serving downtown locations that are walkable and provide access to local transit services also meets the program goal of providing basic mobility for transit dependent populations. Where possible the study team considered serving Gateway Cities to support the commonwealth's commitment to invest in these 26 cities through economic and real estate development.[1]

These guidelines were developed with review and input by RTD staff and by the Technical Advisory Committee. The municipalities that met multiple planning guidelines were cross-referenced with the places with unmet needs, identified through the study's public engagement efforts, to determine good candidates for regional bus service improvements.

[1] The commonwealth defines Gateway Cities as municipalities outside Boston that have populations greater than 35,000, below-state-average household incomes, and below-average rates of educational attainment (https://malegislature.gov/Laws/GeneralLaws/PartI/TitleII/Chapter23A/Section3A).

Intercity Bus

A municipality could be a good candidate for intercity bus service if it:

- Has a population density of 5,000 people per square mile or above and has a total population of 7,500 or above.
- Has high or very high need based on transit dependent populations including older adults, autoless households, persons with disabilities, persons living below the poverty level, and young adults.
- Has major trip generators for intercity bus travel including major medical centers, universities or colleges, transit hubs or intermodal terminals, military installations, major tourist destinations, and correctional facilities.
- Is not currently served, or receives very limited service (less than two roundtrips per day), by existing regional bus services. A municipality was considered to have limited service if transit dependent populations are more than a mile walk or a 30-minute transit ride to a regional bus stop.
- Has a walkable downtown location with access to local transit services.
- Is a Gateway City.

These guidelines were applied in a sequential process. First locations meeting the density threshold were identified, and at the same time a statewide ranking of municipalities based on the numbers of transit dependent persons (a combined ranking of each category of transit dependence) helped identify communities that have a high or very high need for transit access. Municipalities meeting both the density and need criteria were then screened to see if they are the location of a major key trip generator, and evaluated to determine if they already have adequate regional transit access (based on the criteria listed above). Places with sufficiently high population and density, with high or very high need based on transit dependence, or with a key generator were then evaluated to see if they have a walkable downtown (that could be a link to regional transit services) or if they are a Gateway City.

Commuter Bus

A municipality could be a good candidate for commuter bus service if it:

- Has a population density of 5,000 people per square mile or above and has a total population of 20,000 or above.
- Is not currently served, or receives very limited service (less than two roundtrips per day), by existing regional bus or rail services. A municipality was considered to have limited service if the only access to regional service is through a local transit connection.

- Is a major employment center. The study team considered developing commuter service improvements to non-Boston destinations that are job centers. Job centers were defined as 1) municipalities where the ratio of the number of jobs to the size of the residential labor force is 10% above the state average[2], or 2) municipalities that are part of a major employment cluster, as defined by the Metropolitan Area Planning Council (MAPC).

- Is part of a work trip interchange (origin-destination pair) that is currently unserved and has potential demand to support two roundtrips per day at a 50% load factor.

- Has a downtown location with access to local transit services.

- Has a park and ride lot with available capacity.

These guidelines were also applied in a sequential process. First locations meeting the density and total population thresholds were identified. Municipalities meeting both the density and total population criteria were then screened to determine if they already have adequate regional transit access (based on the criteria listed above). Next the municipalities that are major employment centers were identified as candidates for new commuter bus service. At the same time, the towns were evaluated to determine if they are part of a work trip interchange currently unserved but with potential demand to support two roundtrips per day. Places with sufficiently high population and density that demonstrated potential demand for commuter service were evaluated to see if they have a walkable downtown (that could be a link to regional transit services) or a park and ride lot with capacity for new or expanded service.

METHODOLOGY

All municipalities in Massachusetts were screened and compared against the planning guidelines for intercity and commuter bus service. Of 351 municipalities in the commonwealth, 124 municipalities met the thresholds for population density, total population, or need based on transit dependent populations. These planning guidelines were applied first to identify the municipalities most likely to have demand for new regional bus service. The results of the screening process for these 124 municipalities are shown in alphabetical order in Appendix B, Table B-1.

Ninety municipalities had at least one Census block group with 5,000 or more people per square mile. An additional 20 towns had had at least one block group with high need based on the density of transit dependent populations including older adults, young adults, individuals living below the poverty level, and autoless households. An additional 14 municipalities were added to the list having at least one block group with a high number of autoless households. This may be the strongest individual indicator of need, as these residents do not have access to a private automobile. These towns were also screened for need based on a high density of people with disabilities, another population group that often relies on public transportation.

[2] Goodman, Michael, Dana Ansel, and Robert A. Nakosteen. "The even long(er) commute." *Mass*Benchmarks 26 May 2015. Web. 26 June 2015.

Table B-1 also indicates if the municipalities are currently served by regional bus service, MBTA service, RTA service, or one of the new BusPlus routes that started in 2015. The last column in the table provides notes on whether the areas of density within each municipality currently have transit service.

Population Density

Figure 3-1 illustrates population density at the block group level for the entire state, based on American Community Survey (ACS) 2009-2013 data. Five-mile buffers around the existing bus stops, including those along the three new BusPlus routes, were included to indicate areas that currently have reasonable access to the regional bus network. Many of the state's most densely populated areas, with more than 5,000 persons per square mile, already have regional bus and/or MBTA commuter rail service. Areas with high population density that did not have regional transit services included the Route 9 corridor (Ware, North Brookfield and Spencer), I-395 south of Worcester (Oxford, Dudley and Webster), and the Blackstone Valley (Northbridge and Blackstone). The Route 2 corridor (e.g., Orange, Athol and Gardner) and the 495/MetroWest corridor (Clinton, Hudson and Marlborough) also had relatively high density areas, which were served by the new BusPlus routes starting in late 2015.

Total Population

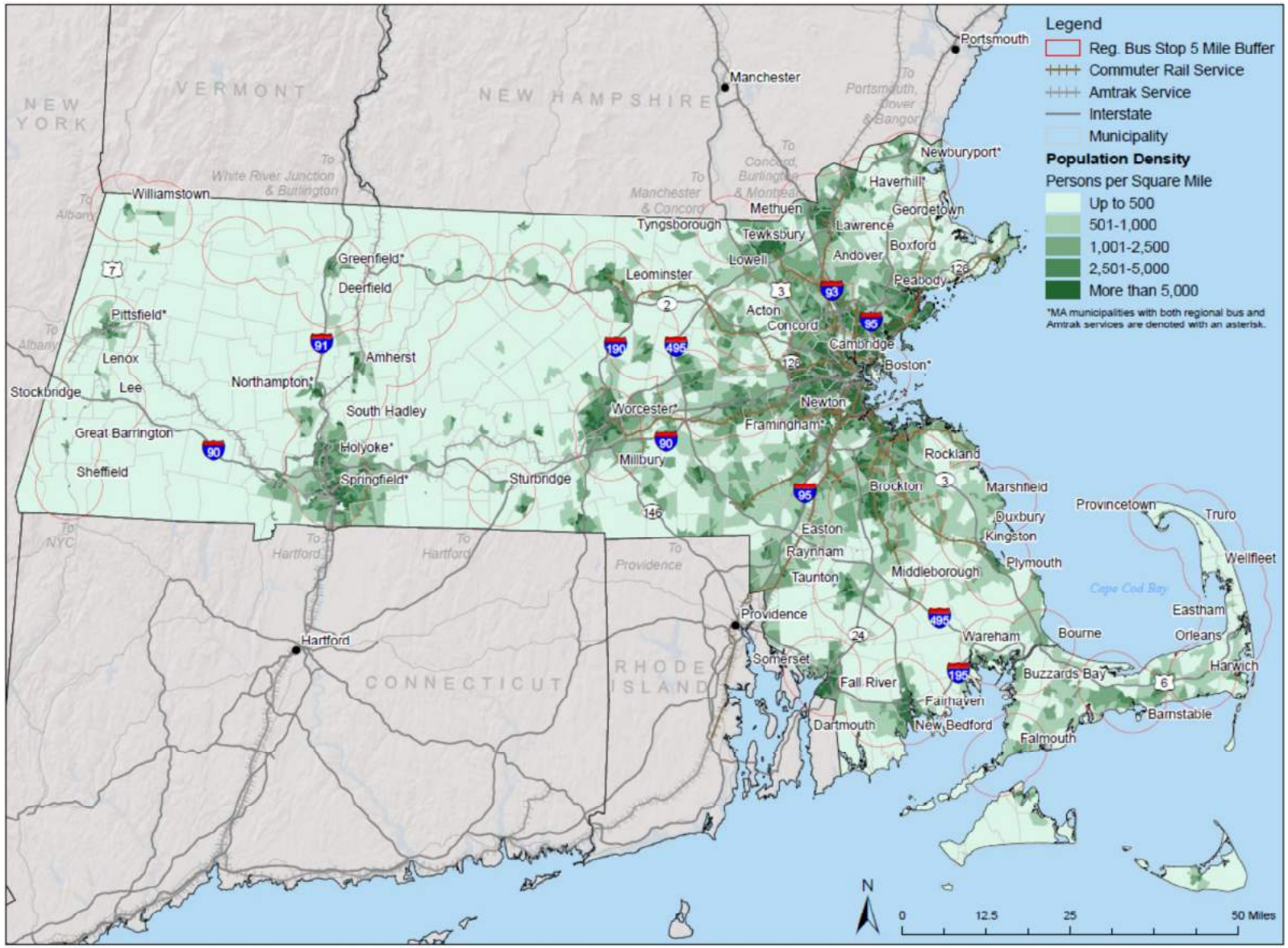
The study team also examined the total population of the candidate municipalities. Total population served as an indicator of the additional residents that would have access to the regional bus network if the municipality became a new regional bus stop. Municipalities with higher total populations were prioritized for new service to maximize the population with access to the regional bus network.

Existing Regional Transit Services

The list of municipalities was further screened for whether they are currently served by regional bus service or MBTA service, including commuter rail, rapid transit, or express bus. Towns that did not have existing service were considered good candidates for regional bus service improvements. In some cases where the towns had RTA service, the level of RTA service and feasible connections to regional bus or MBTA service were examined in more detail. Municipalities where residents could use an RTA route to directly reach a regional bus stop or commuter rail stop were considered to have decent access to the regional bus network. Municipalities where this RTA connection was limited, in terms of low frequency or short span of service, or a resident would be required to transfer between RTA routes in order to reach a regional bus or commuter rail stop could be prioritized for new, direct regional bus service.

The additional planning factors considered in identifying intercity and commuter bus stop candidates are described below.

Figure 3-1: Population Density by Census Block Group



Source: Demographic data from American Community Survey 2009-2013 five-year estimates. Bus routes and stops developed by CTPS and updated by KFH Group in June 2015.

INTERCITY BUS STOP CANDIDATES

Table 3-1 shows the results of further screening to identify municipalities that were good candidates for intercity bus service based on the intercity bus planning guidelines. Note the towns in bold have areas of high population density and/or high density of transit dependent populations, but have limited access to regional bus. The density areas may be more than 5 miles to the nearest regional bus stop; may be within 5 miles of the nearest regional bus stop, but farther than walking distance with no local transit connection available; or may be closer to a commuter rail stop, but with no local transit connection available or a poor local transit connection. Clinton, Gardner, Marlborough, and North Adams were served by new BusPlus service starting in late 2015. Arlington, Lexington, and Stoneham were screened out of this list as the municipalities are close to or have good MBTA bus connections to commuter rail stations. Easthampton was screened out because PVTA provides regular service to the Northampton regional bus stop, and it is possible to make a day trip to Boston via a transfer in Springfield.

Transit Need Based on Density of Transit Dependent Populations

Figure 3-2 portrays need based on the density of transit dependent populations at the block group level. The level of transit need per block group was determined through a combination of population density and numbers of the transit dependent populations. In this calculation, a population density of 2,000 persons/square mile was considered "high," so this analysis captured additional areas of need compared to those identified based on population density alone. High numbers of populations that are more likely to depend on transit, including young adults, older adults, individuals with disabilities, low-income individuals, and residents of autoless households, also served as an indicator of potential transit need. These populations are more likely to use intercity buses because they do not have access to a personal vehicle, cannot drive, or prefer not to drive.

The potential transit need based on the density of transit dependent populations was mapped on a scale of “very low” to “very high,” based on the state average, as outlined below.

Level of Transit Need	Density of Transit Dependent Populations
Very Low	< State Average
Low	> State Average and < 1.33 times the State Average
Medium	> 1.33 times the State Average and < 1.67 times the State Average
High	> 1.67 times the State Average and < 2.00 times the State Average
Very High	> 2.00 times the State Average

Many of the state’s areas with high transit need already have regional bus and/or MBTA commuter rail service. The areas with unmet need were similar to those identified in the population density map.

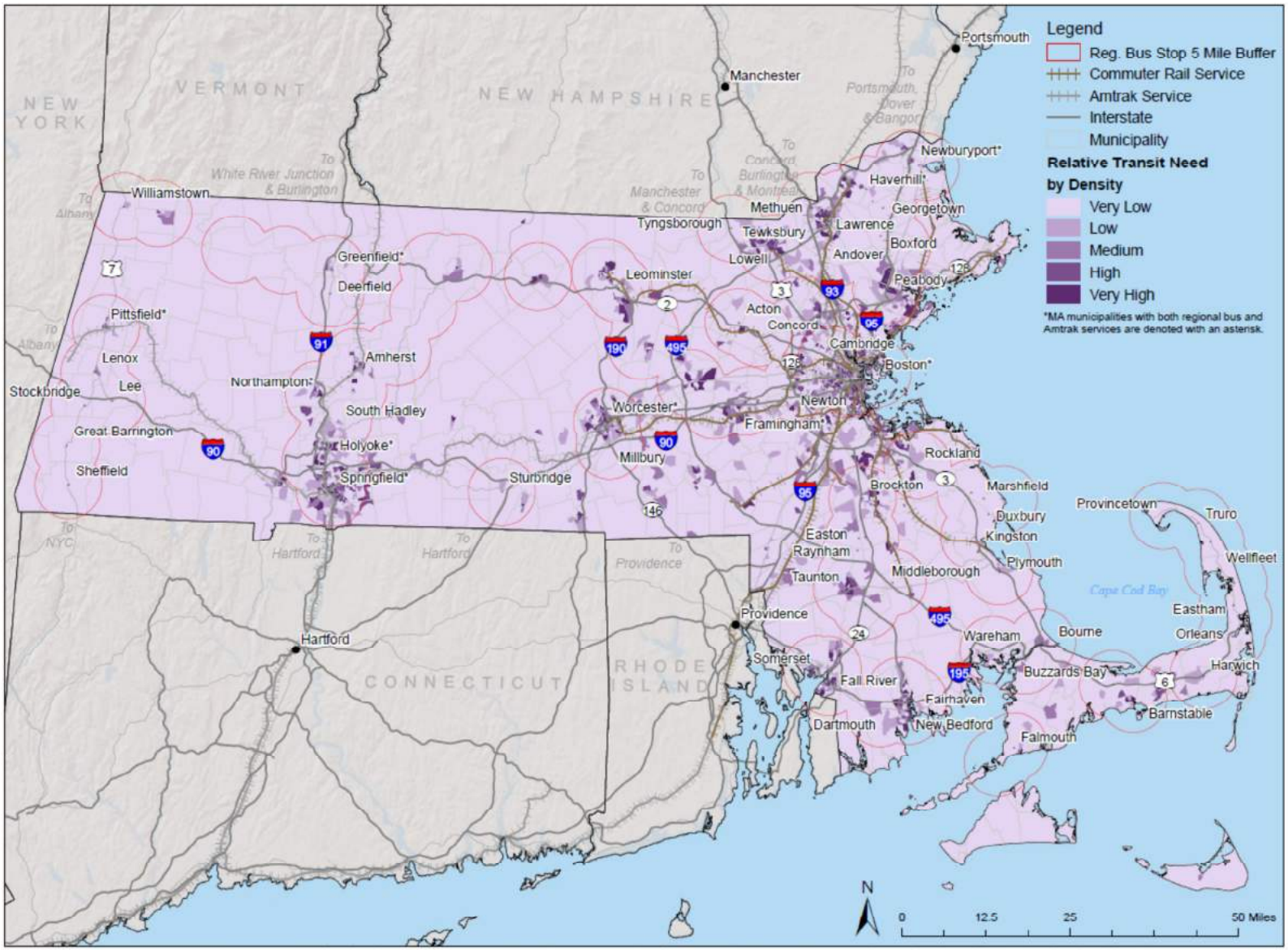
Table 3-1: Screening for Intercity Bus Stop Candidates Using Planning Guidelines

Municipality	5,000+ Population Density	2010 Population	High Density of Transit Dependent Populations	High Number of Autoless Households	High Density of People with Disabilities	MBTA Commuter Rail	MBTA Rapid Transit	MBTA Bus	MBTA Express Bus	Ferry
Agawam	1	28438	1	1	0	0	0	0	0	0
Amesbury	1	16283	1	1	0	0	0	0	0	0
Chicopee	1	55298	1	1	1	0	0	0	0	0
Clinton	1	13606	1	1	0	0	0	0	0	0
Danvers	1	26493	1	0	0	0	0	1	0	0
Gardner	1	20228	1	1	1	0	0	0	0	0
Hudson	1	19063	1	0	0	0	0	0	0	0
Hull	1	10293	1	1	1	0	0	1	0	1
Ludlow	1	21103	1	1	1	0	0	0	0	0
Marlborough	1	38499	1	1	1	0	0	0	0	0
Milford	1	27999	1	1	1	0	0	0	0	0
Montague	1	8437	1	1	0	0	0	0	0	0
North Adams	1	13708	1	1	1	0	0	0	0	0
North Attleborough	1	28712	1	0	1	0	0	0	0	0
Shrewsbury	1	35608	1	0	0	0	0	0	0	0
Southbridge	1	16719	1	1	1	0	0	0	0	0
Spencer	1	11688	1	1	0	0	0	0	0	0
Swansea	1	15865	1	0	0	0	0	0	0	0
Webster	1	16767	1	1	1	0	0	0	0	0
West Springfield	1	28391	1	1	1	0	0	0	0	0
Westfield	1	41094	1	1	1	0	0	0	0	0

Table 3-1: Screening for Intercity Bus Stop Candidates Using Planning Guidelines (continued)

Municipality	Private Intercity Bus	Private Commuter Bus	New 2015 BusPlus Route	RTA Service	Gateway City	Major Trip Generator Farther than 5 Miles from Stop	Major Tourism Destination
Agawam	0	0	0	1	0	0	0
Amesbury	0	0	0	1	0	0	0
Chicopee	0	0	0	1	1	0	0
Clinton	0	0	1	0	0	1	0
Danvers	0	0	0	1	0	0	0
Gardner	0	0	1	1	0	1	0
Hudson	0	0	0	0	0	0	0
Hull	0	0	0	0	0	0	0
Ludlow	0	0	0	1	0	0	0
Marlborough	0	0	1	1	0	1	1
Milford	0	0	0	1	0	1	1
Montague	0	0	0	1	0	0	0
North Adams	0	0	1	1	0	1	0
North Attleborough	0	0	0	1	0	0	0
Shrewsbury	0	0	0	1	0	0	0
Southbridge	0	0	0	1	0	0	0
Spencer	0	0	0	1	0	0	0
Swansea	0	0	0	1	0	0	0
Webster	0	0	0	1	0	0	0
West Springfield	0	0	0	1	0	0	1
Westfield	0	0	0	1	1	1	0

Figure 3-2: Density of Transit Dependent Populations by Census Block Group



Source: Demographic data from American Community Survey 2009-2013 five-year estimates. Bus routes and stops developed by CTPS and updated by KFH Group in June 2015.

Major Trip Generators

Typical trip generators for intercity travel include major medical centers, universities or colleges, military installations, correctional facilities, and major tourist destinations. Figure 3-3 portrays major trip generators across Massachusetts. Data on tourism expenditures by municipality in 2013 from the Massachusetts Office of Travel and Tourism was used as a proxy to determine towns that are tourist destinations. Using the same scale for need based on transit dependent populations, municipalities with "high" tourism expenditures (those that exceeded 1.67 times the state average) were considered major tourism destinations. Table 3-2 summarizes the major trip generators that are located outside a five mile radius from an existing regional bus stop. Note some of these trip generators are within the MBTA service area. With the addition of the three new BusPlus routes in late 2015, several major trip generators along the Route 2 corridor and the 495/MetroWest corridor became accessible by regional bus.

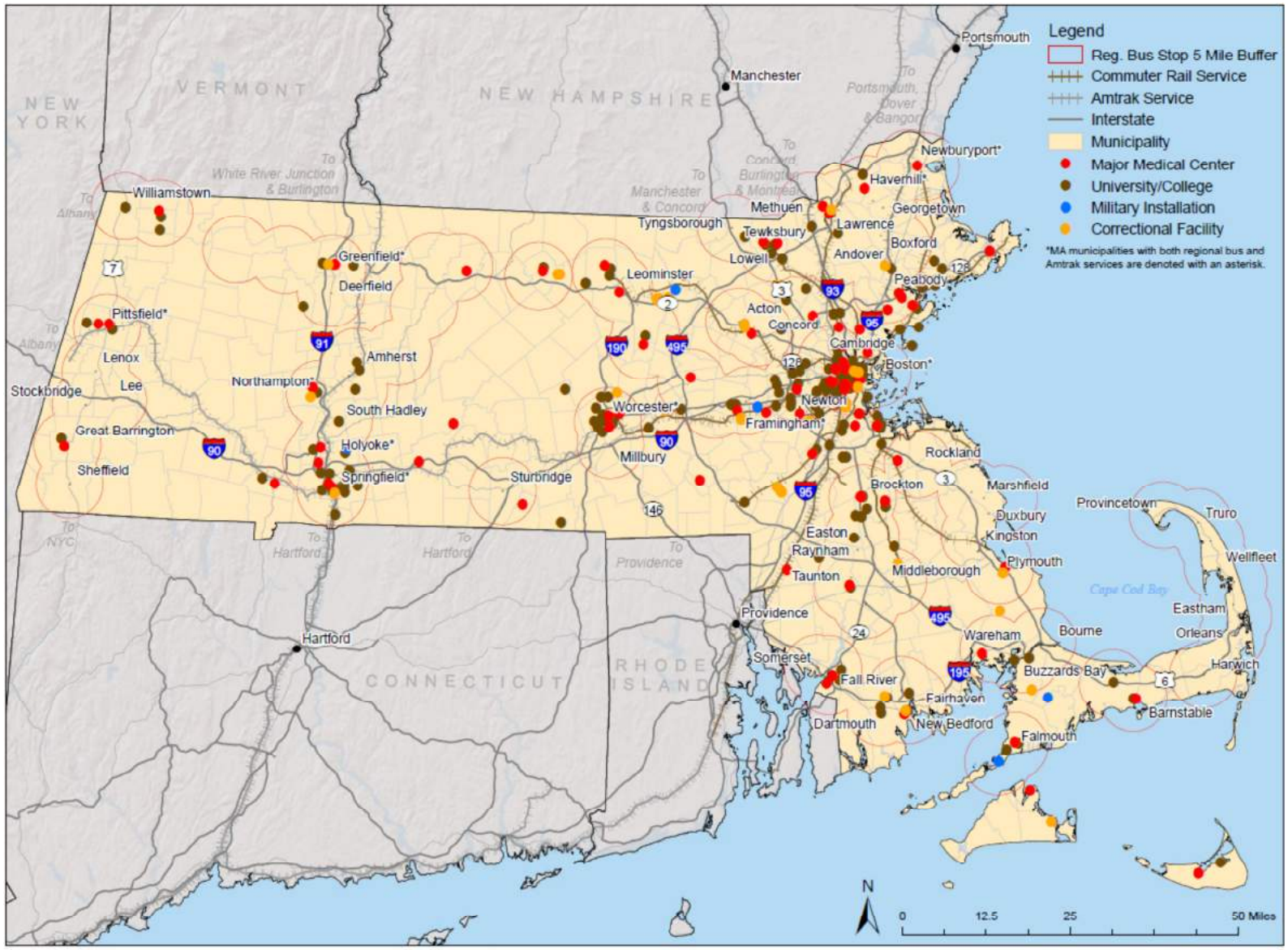
Gateway Cities

The commonwealth defines Gateway Cities as municipalities outside Boston that have populations greater than 35,000, below-state-average household incomes, and below-average rates of educational attainment.[3] Exhibit 3-1 includes a map of the commonwealth's Gateway Cities.

The other intercity bus planning guideline of serving transit oriented downtown locations was examined on a case by case basis when determining specific locations to serve in municipalities with unmet need.

[3] https://malegislature.gov/Laws/GeneralLaws/PartI/TitleII/Chapter23A/Section3A

Figure 3-3: Major Trip Generators in Massachusetts



Source: Trip generators from CTPS. Bus routes and stops developed by CTPS and updated by KFH Group in June 2015.

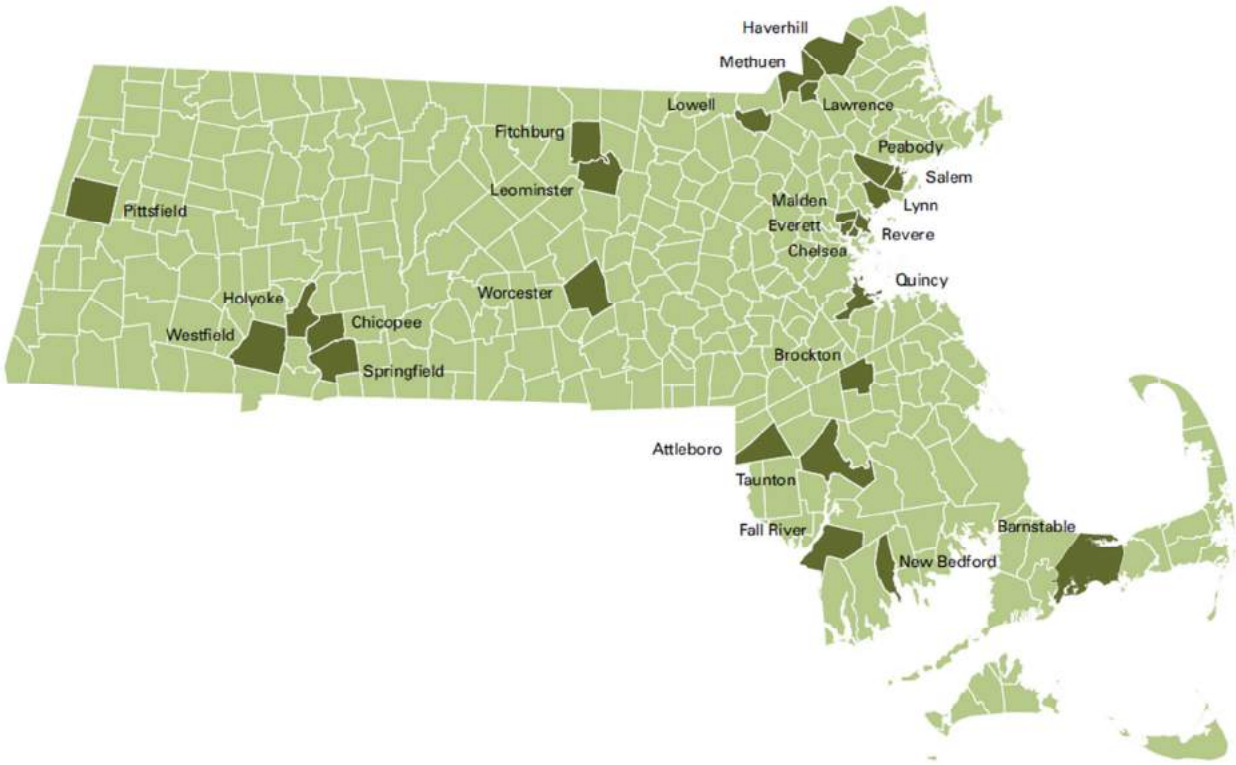
Table 3-2: Major Trip Generators Farther than Five Miles from Existing Regional Bus Stop

	Eastern Massachusetts	Western and Central Massachusetts
Major Medical Centers	Beverly Campus	Baystate Mary Lane Hospital
	Caritas Norwood Hospital	Nobel Hospital
	Hallmark Health System	
	Lahey Clinic Medical Center	
	Milford Regional Medical Center	
	Milton Hospital	
	Nashoba Valley	
	Northeast Hospital Corporation –	
	Quincy Medical Center	
	Ridgewood Court Nursing & Rehab Ctr.	
	Sturdy Memorial Hospital	
Higher Education Institutions	Gordon-Conwell Theological Seminary	Anna Maria College
	Anna Maria College	Nichols College
	Bay State School of Technology	Westfield State College
	Blue Hills Regional Technical School	
	Catherine Hinds Institute of Esthetics	
	Charles H. McCann Technical School	
	Dean College	
	Eastern Nazarene College	
	Endicott College	
	Gordon College	
	Gordon-Conwell Theological Seminary	
	ITT Technical Institute	
	Marian Court College	
	Massachusetts College of Liberal Arts	
	Middlesex Community College	
	Montserrat College of Art	
	Nichols College	
	North Eastern University	
	North Shore Community College	
	Quincy College	
	Salem State College	
Military Installations	Cape Cod Air Station/Otis National Guard	none
Correctional Facilities	Bay State Correctional Center	MCI-Shirley
	Bridgewater State Hospital	Souza-Baranowski Correctional Center
	Dukes County Jail and House of Correction	Women's and Children's Program (Westborough)
	Massachusetts Alcohol and Substance Abuse Center	
	Massachusetts Treatment Center	

	Eastern Massachusetts	Western and Central Massachusetts
	MCI-Cedar Junction	
	MCI-Norfolk	
	MCI-Plymouth	
	Middlesex County House of Correction (Billerica)	
	Norfolk County Sheriff's Office and Correctional Center	
	Old Colony Correctional Center	
	Pondville Correctional Center	

Source: GIS of trip generators from CTPS. Analysis by KFH Group in June 2015.

Exhibit 3-1: Massachusetts Gateway Cities



Source: Ash, Jay and Marty Jones. "Targeted Redevelopment Assistance to Strengthen Massachusetts Gateway Cities." MassBenchmarks 2015. Web. 26 June 2015.

COMMUTER BUS STOP CANDIDATES

Table 3-3 shows the results of further screening to identify municipalities that were good candidates for commuter bus service based on the commuter bus planning guidelines.[4]

Major Employment/Job Centers

Major employment centers in the commonwealth were identified through two approaches. First, municipalities were defined as job centers using a *Mass*Benchmarks definition: places where the ratio of the number of jobs to the size of the residential workforce is 10% or more above the state average. The analysis of job centers using this definition was first conducted as part of MassINC's 2004 *Mass.commuting* report. This analysis was updated using 2009-2013 ACS data on the residential workforce, ages 16 and over, by municipality (Table S2301) and data on the average monthly employment by municipality in 2013 from the Massachusetts Executive Office of Labor and Workforce Development.[5] Using this data the state average ratio of jobs to residential workforce was calculated at 0.89. Municipalities with ratios greater than 0.98 (10% above the state average) were considered job centers.

Figure 3-4 portrays the job centers defined using 2009-2013 data. The job centers across the commonwealth remain largely unchanged from the MassINC analysis using 2000 data. In western Massachusetts, clusters of job centers are found along Route 7 and I-91, and Lenox and Hadley have the highest job-to-worker ratios. In central Massachusetts, job centers are located in the Worcester area and along the I-495 corridor. Westborough has one of the highest job-to-worker ratios in the state. In eastern Massachusetts, clusters of job centers are found along Route 128 and I-90 with distinctive job centers in Bedford, Burlington, and Woburn, as well as Andover, Canton, and Avon.

The other approach was to determine if a municipality was part of a major employment cluster, as defined by the MAPC. If the municipality was included as a destination within the nine major employment clusters across the state, including Boston/Cambridge, 93 North/Merrimack, 128 South, Pioneer Valley, 495 Corridor, 128 North, 128 Central, Worcester, and South Coast, then it was considered a major employment center.[6]

[4] While high need based on transit dependent populations was not a planning guideline specific to commuter bus service, this factor is included in the table and shows that the municipalities that meet the commuter bus planning guidelines also have areas with high densities of transit dependent persons.

[5] Employment data was not available for four municipalities, Alford, Mount Washington, Peru, and Tyringham, which were excluded from the analysis.

[6] As defined in the *Route 128 Corridor Study*, Metropolitan Area Planning Council, Appendix D, Commutersheds in Massachusetts.

Table 3-3: Screening for Commuter Bus Stop Candidates Using Planning Guidelines

Municipality	5,000+ Population Density	2010 Population	High Density of Transit Dependent Populations	MBTA Commuter Rail	MBTA Rapid Transit	MBTA Bus	MBTA Express Bus	Ferry	Private Intercity Bus	Private Commuter Bus
Agawam	1	28438	1	0	0	0	0	0	0	0
Chicopee	1	55298	1	0	0	0	0	0	0	0
Danvers	1	26493	1	0	0	1	0	0	0	0
Ludlow	1	21103	1	0	0	0	0	0	0	0
Marlborough	1	38499	1	0	0	0	0	0	0	0
Milford	1	27999	1	0	0	0	0	0	0	0
North Attleborough	1	28712	1	0	0	0	0	0	0	0
Shrewsbury	1	35608	1	0	0	0	0	0	0	0
West Springfield	1	28391	1	0	0	0	0	0	0	0
Westfield	1	41094	1	0	0	0	0	0	0	0

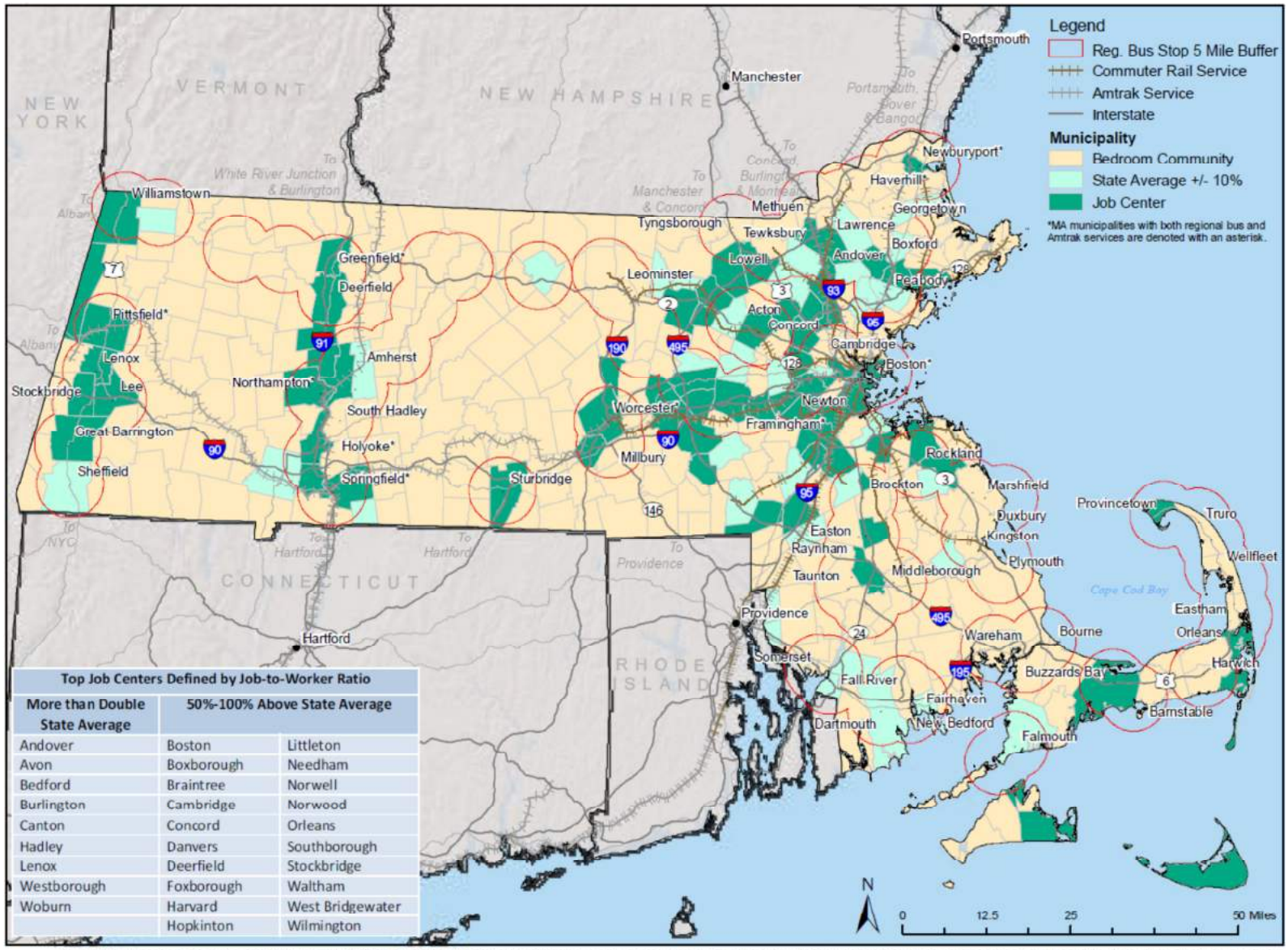
Notes: Towns in bold have areas of high population density and/or high density of transit dependent populations, but have limited access to regional bus. The density areas may be more than 5 miles to nearest regional bus stop; may be within 5 miles to nearest regional bus stop, but farther than walking distance and no local transit connection available; or may be closer to commuter rail stop, but no local transit connection available or poor local transit connection. Arlington, Lexington, and Stoneham were screened out of this list as the municipalities are close to or have good MBTA bus connections to commuter rail stations. Dracut and Gardner were also screened out of this list as the municipalities did not meet other planning guidelines of being a major employment center or being part of a work trip interchange with sufficient demand. North Attleborough is not a major employment center, but remains in the list because its work trip interchange to Boston/Cambridge has sufficient potential demand.

Table 3-3: Screening for Commuter Bus Stop Candidates Using Planning Guidelines (continued)

Municipality	New 2015 BusPlus Route	RTA Service	Job Center (2013 data)[1]	Destination within Major Employment Cluster	Work Trip Interchange to Boston/Cambridge >1040 Commuters	Other Work Trip Interchange >1040 Commuters
Agawam	0	1	0	1	0	0
Chicopee	0	1	0	1	0	0
Danvers	0	1	1	1	1	0
Ludlow	0	1	0	1	0	0
Marlborough	1	1	1	1	1	Shrewsbury & Worcester to Marlborough
Milford	0	1	1	1	0	0
North Attleborough	0	1	0	0	1	0
Shrewsbury	0	1	0	1	0	Shrewsbury to Marlborough & Westborough
West Springfield	0	1	1	1	0	0
Westfield	0	1	0	1	0	0

[1]Using a *Mass*Benchmarks definition, job centers are places where the ratio of the number of jobs to the size of the residential workforce is 10% or more above the state average.

Figure 3-4: Job Centers in Massachusetts



Top Job Centers Defined by Job-to-Worker Ratio		
More than Double State Average	50%-100% Above State Average	
Andover	Boston	Littleton
Avon	Boxborough	Needham
Bedford	Braintree	Norwell
Burlington	Cambridge	Norwood
Canton	Concord	Orleans
Hadley	Danvers	Southborough
Lenox	Deerfield	Stockbridge
Westborough	Foxborough	Waltham
Woburn	Harvard	West Bridgewater
	Hopkinton	Wilmington

Source: Municipal data on jobs from MA Executive Office of Labor & Worforce Development; data on residential workforce from ACS 2009-13. Analysis follows approach in MassINC's 2004 Mass.commuting report.

Work Trip Interchange

Table 3-3 also notes if the municipalities were part of a work trip interchange that is currently unserved, but has potential demand to support two commuter bus roundtrips per day at a 50% load factor. The study team examined the commute sheds for the nine major employment clusters, defined by MAPC, to identify work trip interchanges (origin town to destination town commute flows) that may warrant new commuter bus service. Most of the Massachusetts employment clusters include five or more municipalities as employment destinations, and some of the highest work trip interchanges occur between these towns or with adjacent towns. This makes sense given that working individuals often try to live close to work. This analysis focused on the longer distance work trip interchanges for which individuals might consider using a commuter bus, as opposed to the short distance commutes that are an easy drive or may already be served by local transit service.

Assuming a commuter bus has 52 seats, the guideline for potential demand to support two commuter bus roundtrips per day at a 50% load factor was calculated as 52 riders per day. Review of a statewide report on commuting trends and issues indicated that in municipalities with existing commuter bus service about 5% of commuters use public transit.[7] This mode split was used to identify the minimum number of commuters on a work trip interchange (1,040 commuters), where 5% or 52 riders could reasonably be expected to use commuter bus.

The study team used 2006-2010 Census Transportation Planning Products (CTPP) data to identify work trip interchanges that met the minimum threshold of 1,040 commuters to a major employment center in Massachusetts. Based on 2006-2010 ACS data, this CTPP data was the most recent commuting data available on specific origin to destination workflows. The study team first conducted this analysis using town level data. Across the nine Massachusetts employment clusters, only 13 town-to-town workflows were identified as meeting the minimum threshold, with no existing transit service or poor transit service available. In addition RTD identified Albany, NY, Hartford, CT, and Providence, RI as the top out of state employment destinations. The town-to-town commute flow data indicated that only two work trip interchanges from Massachusetts municipalities (Fall River and Seekonk) to Providence met the minimum threshold.

Only a few of the towns in these work trip interchanges that indicated potential demand to support commuter bus service also met the other planning guidelines for density, total population, and no or very limited existing service, and are noted in Table 3-3. The study team also conducted this analysis using CTPP Census tract level data provided by MAPC.[8] Examining data at the sub-municipal level helped determine if there may be commuter bus demand from individuals that could use local transit service or walk to/from the bus stops. However, when applying the same minimum threshold of 1,040 commuters between origin and destination tracts (in the "downtown" areas of the municipalities), none of the work trip interchanges had sufficient workflows to support two commuter bus roundtrips per day at a 50% load factor.

The analysis results indicated that residents making the same commute are spread more widely through their town of residence, therefore serving a nearby park and ride lot may be a feasible approach for new commuter bus service. Also, the work trip interchanges across the state that did

[7] Goodman, Michael, Dana Ansel, and Robert Nakosteen. *Mass.commuting*. October 2004. Web. 26 June 2015.
[8] M. Hari, Data Services Group, MAPC, personal communication, September 15, 2015.

meet the minimum threshold already have some level of transit service providing that commute trip. While the analysis of work trip interchanges only identified a few commutes that may warrant new commuter bus service, the public input process also identified possible commuter bus route alternatives and service improvements.

The other commuter bus planning guidelines of serving transit oriented downtowns or park and ride locations were examined on a case by case basis when determining specific locations to serve in municipalities with unmet need.

Planning Guidelines Evaluation Results

The municipalities identified as good candidates for new intercity bus and commuter bus service are outlined in Table 3-4 and highlighted in Figure 3-5. Note some towns were candidates for both types of regional bus service. Clinton, Gardner, Marlborough, and North Adams started receiving service in late 2015 with the start of the new BusPlus routes. Following review and input from the study's Technical Advisory Committee, service alternatives were developed to directly address the remaining needs for new service coverage. Additional alternatives were developed to address service improvements and other needs identified through public input, discussed in the next chapter.

Conclusion

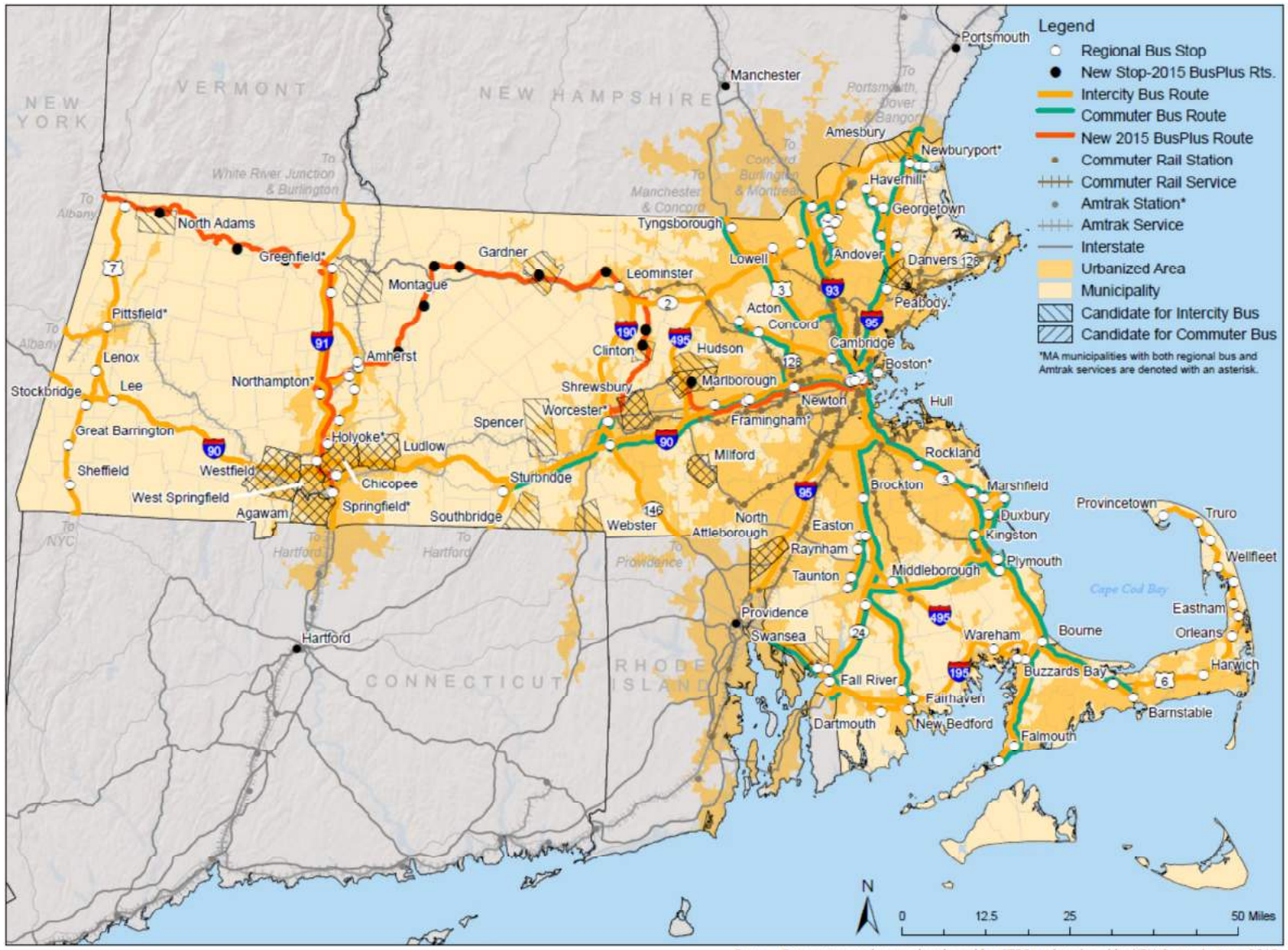
Many places that met the planning guidelines criteria to potentially warrant intercity or commuter bus services are already served by RTA services, which provide a link to the nearest regional bus or commuter rail stop—in many cases with enough frequency to allow for day trips. A number of the remaining points are now served by the 2015 BusPlus operating demonstration program routes. They have been left in this analysis to show that they met these thresholds, but would likely not have any service if the funded routes were to be discontinued. If one considers the places that have an RTA link and those served by the new BusPlus routes, there is essentially full coverage of potential regional bus stops based on total population, density, and needs characteristics.

Table 3-4: Regional Bus Stop Candidates Based on Planning Guidelines

Type Service	Municipality	Service Notes
Both	Agawam	PVTA connection to Springfield allows transfer to Boston for day trip
Intercity	Amesbury	MVRTA connections to Haverhill and Newburyport commuter rail
Both	Chicopee	PVTA connection to Springfield allows transfer to Boston for day trip
Intercity	Clinton*	Served by new 2015 BusPlus route
Both	Danvers#	Good potential demand for commuter bus service to Boston/Cambridge
Intercity	Gardner*	Served by new 2015 BusPlus route, MRTA connection to Fitchburg commuter rail
Intercity	Hudson	No parking
Intercity	Hull	Ferry service to Boston year round
Both	Ludlow	PVTA connection to Springfield allows transfer to Boston for day trip
Both	Marlborough*#^	Served by new 2015 BusPlus route, good potential demand for commuter bus service to Boston/Cambridge
Both	Milford	New MWRTA connection to Framingham started October 2015
Intercity	Montague	Limited FRTA service to Amherst, requires 2 transfers to reach Boston
Intercity	North Adams*	Served by new 2015 BusPlus route
Both	North Attleborough#	Good potential demand for commuter bus service to Boston, GATRA provides hourly connection to Attleboro commuter rail
Both	Shrewsbury^	WRTA connection to Worcester
Intercity	Southbridge	WRTA connection to Worcester
Intercity	Spencer	WRTA connection to Worcester allows transfer to Boston for day trip
Intercity	Swansea	SRTA connection to Fall River allows day trip to Boston, but not commute trip
Intercity	Webster	WRTA connection to Worcester
Both	West Springfield	PVTA connection to Springfield allows transfer to Boston for day trip
Both	Westfield	PVTA connection to Springfield allows transfer to Boston for day trip

*Served by new BusPlus route starting in 2015.
#Good potential demand for commuter bus service to Boston/Cambridge.
^Good potential demand for commuter bus service to one of the major employment clusters outside of Boston.

Figure 3-5: Planning Guidelines Evaluation - Candidates for Regional Bus Service



Source: Bus routes and stops developed by CTPS and updated by KFH Group in June 2015.

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Chapter 4
Regional Bus Service Needs as Identified in Previous Studies, by Stakeholders, and by the Public

NEEDS IDENTIFIED THROUGH EXISTING STUDIES

A number of existing studies, conducted by MassDOT and the regional planning agencies, provided insights into regional bus needs in the commonwealth and New England. The studies identified specific corridors with intercity and commuter travel needs, which were considered in developing the regional bus service alternatives.

Massachusetts Regional Bus Study

CTPS performed an extensive needs analysis for regional bus services in 2012, examining underserved areas as well as limited connectivity between urban areas in the commonwealth. The following regional bus services were identified for further examination of potential demand and feasibility.

For intercity bus service:

- Southbridge, Palmer, and Ware connections to Springfield, Worcester, and Boston
- Clinton to Worcester and Boston
- Adams, Athol, Gardner, and North Adams to Fitchburg and Boston
- Pittsfield to Boston

For commuter bus service:

- Northbridge and Uxbridge to Boston
- Hudson and Milford to Boston

CTPS conducted a survey of intrastate regional bus passengers, who identified their preferences for service improvements (listed in priority order from high to low):

- More frequent service – high request on all surveyed intrastate routes
- More express service – high request on:
    - Boston-Framingham-Worcester-Springfield
    - Boston-Worcester
    - Springfield-Amherst
    - Boston-Rockland-Plymouth-Bourne-Hyannis
    - Boston-Rockland-Marshfield-Kingston-Plymouth
    - Providence-Worcester-Springfield-Pittsfield-Albany

  - Boston-Newburyport
- Earlier morning departures – high request on:
  - Boston-Topsfield-Boxford-Georgetown-Groveland-Haverhill
  - Boston-Fall River-Newport
- Later evening departures – high request on:
  - Boston-Andover-Lawrence-Methuen
  - Boston-Bourne-Falmouth-Woods Hole
  - Boston-West Bridgewater-Raynham-Taunton
  - Boston-Taunton-New Bedford-Fairhaven

In addition CTPS analyzed the available amenities and conditions at park and ride locations with regional bus service. Several towns had highly utilized park and ride lots, at least 90% occupied, including Barnstable, Bourne, Taunton, Andover, Kingston, Newburyport, Rockland, and Plymouth. These possible capacity constraints were considered in developing commuter bus improvements.

Massachusetts State Rail Plan

Completed by MassDOT in 2010, the Massachusetts State Rail Plan serves as the commonwealth's 20-year plan for improvements to freight and passenger rail transportation. Massachusetts partnered with other New England states to present the *Vision for the New England High Speed and Intercity Rail Network*[1]. Planning efforts to improve intercity passenger rail are ongoing in several corridors in this network. Pending further review of potential demand, these corridors could be candidates for regional bus service to serve as a precursor to the rail service improvements and help build the transit market in the corridor, or to complement rail services on the ground if warranted by demand.

- Boston to Springfield, continuing to New Haven, CT
  - Inland Route with stops in Framingham, Worcester, and Palmer
- Boston to Montreal, Quebec
- Lowell to Manchester, NH or Concord, NH
  - Capitol Corridor will extend the MBTA Lowell Commuter Rail Line into New Hampshire; projected ridership of more than one million annually will relieve congestion on I-93 and serve Manchester-Boston Regional Airport
- Springfield to East Northfield, continuing to White River Junction, VT and New Haven, CT
  - Identified as a near-term project to return Amtrak Vermonter to its original route in the I-91 Knowledge Corridor with stops in Greenfield, Northampton, and Holyoke; estimated travel time savings of 30-45 minutes and projected 24% increase in ridership; rail service to Greenfield and Northampton began at the end of 2014[2] and the Holyoke station was scheduled to open in summer 2015[3]
- Boston to Westerly, RI
  - Rhode Island DOT is studying the restoration of South County Rhode Island commuter rail service
- Boston to Fall River and New Bedford

[1] http://www.massdot.state.ma.us/portals/20/docs/NewEngland_HSR_Vision.pdf
[2] Amtrak. *Amtrak Vermonter Service to the Knowledge Corridor Starts December 29*. 12 December 2014.
[3] Amtrak. *Ethan Allen Express and Vermonter* (schedule). 13 July 2015.

  - South Coast Rail identified as a near-term commuter rail project with stops planned in Canton, Stoughton, Easton, Raynham, Taunton, and Freetown; in the design and permitting phase[4], but some funding uncertainty remained in 2015[5]
- Boston to Portland, ME
  - Increase Amtrak Downeaster service by two roundtrips to seven daily roundtrips, reduce the travel time between Boston and Portland, and expand service to Brunswick, ME; projected ridership increase by more than 15%[6]
- Boston to New York, NY and Washington, D.C.
  - Improvements to the Northeast Corridor Amtrak service, which serves Providence, RI, New Haven, CT, Trenton, NJ, Philadelphia, PA, Wilmington, DE, and Baltimore, MD; note the NextGen high speed rail alignment slated for 2030-2040 includes a stop at Route 128 south of Boston[7].

Coordinated Human Services Transportation Plans

Developed by the regional planning agencies, the Coordinated Human Services Transportation (CHST) Plans identified the transportation needs of older adults, people with disabilities, and individuals with low incomes. These populations are often more dependent on public transit services than the general public. The CHST Plans reflected input from representatives of human service agencies and local transportation providers, who identified the needs and helped develop strategies to address the needs including service priorities.

The CHST Plans found that the needs of these underserved populations were primarily local or regional in nature, with destinations concentrated within one urban area or county. A higher percentage of older adults and people with low incomes, including people with disabilities who are disproportionately under-employed, live in rural areas where housing is less expensive. They often need to travel to urban areas for medical care, education, and employment. Most of these travel needs would fall under the purview of the RTA serving the region. The transportation needs relevant to regional bus services as defined in the BusPlus program are summarized below.[8] More detailed descriptions of the findings identified in each region's CHST Plan are included in Appendix C.

- **Berkshire Region** – The region's population is concentrated in Great Barrington, Pittsfield, and North Adams. Common destinations for residents are Springfield, Worcester, and Boston.

- **Boston Region** – Several municipalities in the Boston Region MPO area have no local MBTA or RTA bus service including Hamilton, Hanover, Manchester, Milford, Millis, North Reading, and Norwell. While the region is rich in transit and health and human services, the needs to coordinate services across the state and increase long distance medical trips were identified as areas for improvement. Other relevant needs included affordable transportation to access

[4] MBTA. *MBTA Assumes Leadership of South Coast Rail Design*. Fall 2014.
[5] Laidler, John. "South Coast Rail project chugs ahead, but uncertainty lingers." *The Boston Globe* 15 February 2015. Online.
[6] MassDOT. *Strengthening Rail in Massachusetts* (presentation). 2009.
[7] Amtrak. *The Amtrak Vision for the Northeast Corridor, 2012 Update Report*. July 2012.
[8] CHST Plans for all 13 regions in Massachusetts were reviewed. No regional needs are noted for the Nantucket Region CHST Plan, which focused on local transportation improvements.

employment corridors, limiting transfers required for transit trips, and better amenities and information at transit stops.

- **Central MA Region** – Unmet needs included transportation to rural and suburban employment, transportation to towns outside Worcester including Leicester and Spencer, transit connections between Worcester and Boston/MetroWest, and same day service to medical appointments outside of Worcester.

- **Cape Cod Region** – With a high senior population, unmet needs included increased access to long distance medical facilities, particularly from Nantucket and Martha's Vineyard, and additional service to Cape Cod Community College from outside the region.

- **Franklin Region** – Primary needs were improving links between transportation modes and providing transportation services to the rural areas of Franklin County not currently served by fixed route transit services.

- **Lowell Region** – Stakeholders identified needs for service expansion to multiple destinations:
  - Employment on Route 3A in Tyngsborough and Hudson, NH
  - Medical services in Concord, Littleton, and Bedford
  - VA in Lowell and Jamaica Plain/Boston
  - Chelmsford
  - Hanscom Air Force Base
  - Nashua, NH

- **Merrimack Region** – Commuter needs included additional MVRTA commuter bus service, more frequent MBTA commuter rail service on the Haverhill and Newburyport lines, restoring passenger rail service north of Newburyport, and implementing I-93 bus on shoulder or HOV lanes. Improved transit connections to adjoining regions were also requested:
  - Southern New Hampshire including Salem, Plaistow, Seabrook
  - Greater Boston educational institutions (Salem State College)
  - Employment sites in Peabody, Burlington, and Manchester, NH
  - Medical centers in Burlington, Beverly, Danvers, Peabody, and Portsmouth, NH

- **Martha's Vineyard Region** – Community needs included coordination of off-island connections for medical and veterans' trips, faster travel times, and more accessible vehicles.

- **Montachusett Region** – The CHST Plan identified specific intercity and commuter transportation needs.
  - Intercity needs included expanding service into rural communities such as Lunenburg, Shirley, Devens, Westminster, Clinton, and Worcester to provide residents with additional access to employment, education, and shopping in Fitchburg, Leominster and Gardner; increasing service to Worcester; improving service frequency and times to serve Mount Wachusett Community College and Fitchburg State University; and providing out of town transportation to medical services and employment centers.
  - Commuter needs included increased parking at commuter rail stations in Shirley, Ayer, and Littleton; extending service to Gardner; providing return service from Boston to Fitchburg in the early afternoon; offering reverse commute service from Boston to

Fitchburg, arriving by 8:00 a.m.; and developing a regional commuter facility in the Devens Enterprise Zone.

- **Old Colony Region** – Unmet needs included transportation to employment and education centers within the region, such as South Weymouth Naval Air Station Redevelopment and Massasoit Community College, and to VA hospitals and clinics in Brockton, West Roxbury, and Jamaica Plain. Another challenge was poor intermodal connectivity at commuter bus stops, particularly park and ride lots, which limits the feasibility of using private carrier commuter bus routes to residents who have a car.

- **Pioneer Valley Region** – Unmet needs included express service from Amherst to Springfield, improving the north-south connection between Amherst and Holyoke, and connecting Greenfield and UMass Amherst, possibly by expanding and coordinating PVTA and FRTA services. The communities with strong markets for transit include Northampton, Amherst, and Westfield, and to a lesser degree Easthampton and South Hadley. Employment clusters are located in Springfield, Holyoke, Northampton, and UMass Amherst.

- **Southeastern Region** - Stakeholders identified the need for more direct routes between cities in Southeastern Massachusetts including Taunton and Brockton, Taunton and Fall River, Wareham and New Bedford, New Bedford and Taunton, and Plymouth/Wareham to Hyannis. Specific medical, educational, and employment destinations included Boston hospitals and VA hospitals, Massasoit Community College, Bristol Community College, Cape Cod Community College, Bridgewater State University, Wrentham Outlets and Patriot Place in Foxborough for employment, and New Bedford seafood processing plants. Improved connections between RTAs including GATRA with SRTA, BAT, and RIPTA in Rhode Island were also identified as needs.

Regional Planning Agency Studies

In addition, a number of transit corridor studies developed by the regional planning agencies and MPOs were reviewed. These studies provided an in-depth examination of corridors across the state, which could be candidates for regional bus service improvements:

- **Route 128 Central Corridor Plan** (2011) – MAPC examined opportunities to reduce traffic congestion in the Route 128 Central Corridor by facilitating alternative transportation, particularly public and private transit services. One strategy specified seeking state involvement to implement a north-south express bus service on the shoulder of Route 128. The recommended express bus routes included one from the north on Route 3 and one from Route 128 north, with stops at park and ride lots and large commercial centers such as Middlesex Turnpike, Hartwell Ave, and Winter Street. A similar service could be operated on Route 128 south to Riverside. In studying corridor travel patterns, MAPC found that workers commute long distances to reach the high-technology jobs located in the Route 128 Central Corridor with concentrations traveling from the north and residing within the 495 belt.

- **North Suburban Commuter-Oriented Transit Opportunities Study, Phase II** (2005) – CTPS examined the feasibility of new commuter transit services to major employment

destinations along Route 128. The Phase I study suggested rail feeder services and inter-suburban circulator services, though most were improvements to MBTA or LRTA bus routes. One possibility for private carrier service was identified between Stoneham and Reading. The following were identified as high density employment areas in the corridor, which may warrant enhanced commuter transit service: Burlington Mall Road including Burlington Mall, The Lahey Clinic, and New England Executive Park; the Mishawum area of Woburn including Commerce Way, Rehabilitation Way, and Presidential Way; Edgewater Place/Edgewater Drive in Wakefield; and the town centers in Stoneham, Wilmington, and Reading.

- **MAGIC Suburban Mobility Transit Study** (2011) – MAPC developed recommendations to improve suburban transit services in the Minuteman Advisory Group on Inter-local Coordination (MAGIC) sub-region of the MAPC region. While the recommendations centered on MBTA service and feeder service to commuter rail stations, the study identified transit needs in the Town of Hudson to serve suburb-to-suburb commute trips. Connections could be provided to adjacent towns including Stow, Acton, and Maynard.

- **Southwest Advisory Planning Committee (SWAP) Regional Public Transit Feasibility Study** (2013) – CTPS analyzed the region's existing public transportation network to identify opportunities to increase ridership and improve transit connections. While most potential new transit services were recommended for MBTA or the RTAs, a recommended commuter service was a connection between Franklin, Bellingham, and Milford. A significant number of commuter trips occurred between these towns. Planners identified the Milford Regional Medical Center, the Milford Courthouse, and shopping areas in Bellingham as regional trip generators.

- **Knowledge Corridor Passenger Rail Feasibility Study** (2009) – The Pioneer Valley Planning Commission led a study to examine passenger rail improvements within the Knowledge Corridor. In 2015 the first recommendation to realign the Amtrak Vermonter to the "Conn River Line" route was nearly complete. The other recommendations may be considered in developing regional bus alternatives: add round trips in the corridor to increase ridership and promote economic development, and examine commuter rail service that would connect to the New Haven-Springfield commuter rail service, planned to begin in late 2016[9].

Other studies that did not identify specific corridors for regional bus alternatives, but provided valuable information on trip generators, potential transit markets, and planned development were referenced when developing service alternatives. These studies included the Route 9 MetroWest Smart Growth Plan, conducted by the MetroWest Regional Collaborative and MAPC in 2013; the Central Massachusetts Joint Trail/Busway Right of Way Study, conducted by MAPC in 2011; and the I-495 Transit Study, conducted by CTPS in 2007.

[9] Kinney, Jim. "Connecticut pits Springfield-New Haven commuter rail service out to bid." *MassLive.com* 31 December 2014.

NEEDS IDENTIFIED THROUGH STAKEHOLDER INPUT

Consultation with community stakeholders was a vital component of the public engagement process as MassDOT considered the future of its regional bus program. Both public and private stakeholders were surveyed and interviewed to identify unmet needs and desired improvements for regional bus service. Surveys of the following stakeholders were conducted in May and June 2015: regional planning agencies (RPAs), metropolitan planning organizations (MPOs), regional coordinating councils (RCCs), regional transit authorities (RTAs), and private regional bus operators.

Overall, the stakeholder outreach identified numerous stops, connections, and corridors needing service improvements. Most of the unmet need was characterized as regional, either connecting rural or suburban areas to regional activity centers or employment sites, often in suburban locations. These types of needs were typically candidates for RTA service, but were considered for portions of new longer distance intercity or commuter bus service. The traditional intercity travel needs included more service to rural areas, the ability to make day trips to Boston or New York from outlying areas in the commonwealth, and more express and direct service. Stakeholders requested improvements to some commuter routes to Boston, to suburban employment centers such as Route 128, and to employment in the I-91 corridor. The stakeholder input on regional bus needs is summarized below.

Unmet Needs Identified by Planning Agencies and RTAs

The MPOs, RPAs, RCCs, and RTAs shared their observations about unmet regional and commuter transit needs in each of their regions. In addition to identifying improvements to regional and commuter routes and amenities, planning agencies expressed concern for underserved populations who are transit dependent. Individuals with low and moderate incomes, people with disabilities, and older adults are disproportionally dependent on public transportation. Medical transportation and extending service hours for low income employees working shift and retail hours were needs identified by several RTAs and RCCs.

Another common request was to increase transportation in rural and suburban areas. The rural populations in Massachusetts would benefit greatly by additional and improved transportation to regional activity centers and metropolitan hubs. For example, many people from the North Central and North Western regions would like to be able to travel south to employment centers, services, and educational institutions within their regions. For residents in isolated rural towns, this transportation serves as a lifeline to work and education opportunities and social services. Increasing access to employment through regional bus services presents an opportunity to enhance the economic wealth of rural areas in Massachusetts.

The unmet service needs identified by the planning agencies and RTAs are summarized below, and additional details are included in Appendix D.

- Intercity Bus Service
  - Berkshires to Boston and New York City (allow same day trip)
  - Pittsfield to Albany
  - Pioneer Valley – connect rural towns to urban centers
  - Blackstone Valley to Providence

  - Lowell to Worcester and Springfield
  - Fitchburg to Worcester and Springfield
  - Route 114 corridor to North Shore
  - Southeast Region – intraregional connections to Taunton, New Bedford, and Fall River

- Commuter Service
  - Greenfield to Northampton, Holyoke, and Springfield
  - Blackstone Valley to Providence
  - Merrimack Valley to Route 128 (suburb-to-suburb)
  - Northeast region to New Hampshire
  - Gloucester/Cape Ann to Boston
  - Fall River and New Bedford to Boston
  - South Coast to Route 128

- Direct Service
  - Franklin County/Greenfield to Boston
  - Ware to Holyoke Community College (allow same day trip)
  - Lowell to Newburyport
  - Lowell to Boston commuter service

- Express Service
  - Greenfield to Northampton and Amherst
  - Holyoke to Springfield
  - Provincetown to Boston commuter service

- Improve Service
  - Framingham to Boston
  - Hyannis to Boston, New York City, and Providence
  - Woods Hole to Boston and Providence
  - Woods Hole to Plymouth and Cape Cod

- Service Gaps
  - Route 9 – Pittsfield to Northampton/Amherst, Ware to Worcester and Framingham
  - Route 2 – Fitchburg to Greenfield, serve Devens Business Park
  - Route 20 – Marlborough to Weston and Boston
  - Route 109 – Milford to Boston
  - Connect RTAs – WRTA and PVTA, MVRTA and LRTA

- Medical Transportation
  - Northeast to regional hospitals in Concord, Bedford, and Burlington
  - Southeast (Fall River and New Bedford) to Boston hospitals

The planning agencies and RTAs also identified needs related to facilities, fares, and marketing:

- **Increased parking capacity** – Requested in Newbury (MA-113 Storey Avenue lot), Plymouth (Exit 5 park and ride), Sagamore (Sagamore Bridge lot), Barnstable (lot at Routes 6 & 132), and Falmouth (bus terminal)

- **New parking facilities** – Requested in Newbury (off I-95, exits 54 or 56) and Boston (layover location for buses)
- **Additional passenger amenities** – Enclosed buildings and public restrooms were requested at stops between Hyannis and Boston. Shelters were also requested for RTA stops. Providing wireless internet services onboard vehicles and making sure vehicles are accessible were additional requests.
- **Signage** – Improvements to signage and route information to increase awareness about the availability of regional bus services was requested at RTA stops and Boston curbside stops for commuter bus service
- **Affordable fares** – Reduce fares on Hyannis to Boston, Woods Hole to Boston, Hyannis to Providence routes
- **Joint ticket/pass** – Explore joint ticketing between RTAs, MBTA, and private carriers to provide passengers with flexibility in using services and to facilitate connections between providers and regions
- **Marketing and outreach** – Actively promote existing services in a range of formats (brochures, direct mail, etc.), especially to older adults who may not access information online

Unmet Needs Identified by Private Operators

The private regional bus operators identified concerns about access to services, amenities, and travel time. Facility and capital improvements were the top requests, particularly increased parking capacity at park and ride lots and transit terminals to support new and additional services. The same issues that encourage riders to use regional bus service, traffic congestion and a lack of parking at the destination, present challenges to the operation of regional bus service. The private carriers requested additional parking facilities outside of major cities to increase customer access to their routes and eliminate the need for all customers to travel into the city center. Identifying good locations for bus stops, elsewhere in Boston than South Station and in Springfield for example, would also facilitate new services. Bus structures were requested at park and ride lots (e.g., Route 3, exit 35 in Tyngsborough) and non-terminal sites.

The private operators also identified the need for dedicated bus lanes to mitigate congestion and improve travel time. Suggestions included using HOV lanes, bus on shoulder lanes, and breakdown lanes. These infrastructure improvements were specifically requested on I-90, between I-495 and Boston, and on I-93. An operator also suggested using smaller 35' buses on routes that serve areas with lower population densities. Improved connectivity between rural transit providers and intercity bus services would also enhance rural access to the national intercity bus network.

The private carriers identified unmet needs and potential markets for the following services:

- **Growing job market areas** – Commuter services to areas such as Boston's Seaport Innovation District and Cambridge's Kendall Square
- **Route 128** – Circumferential commuter service between Gloucester, Burlington, Newton, and Braintree; and reverse commute service from Cambridge to MetroWest region and Route 128
- **South Shore to North Quincy** – Commuter service via Route 3
- **Braintree to Providence, RI** – Commuter service
- **Boston to Montreal, Quebec** – Intercity service

- **Boston to Albany, NY** – Local intercity service and early morning westbound service
- **Southeast to airports** – Intercity service from southeastern Massachusetts to Logan Airport and T.F. Green Airport
- **Seasonal service** – I-495 and Route 128 corridors to Cape Cod and Martha's Vineyard and Nantucket ferries
- **I-395 and I-90** – Thompson, CT, Webster, Worcester, and Boston
- **Route 9** – Palmer, Ware, Brookfield, Leicester, and Worcester
- **Routes 7 and 57** – Lenox, Great Barrington, and Springfield
- **Route 20** – Albany, NY, Pittsfield, Becket, Westfield, Springfield
- **Increase connectivity to national network** – Provide day trips from smaller communities, especially rural areas not currently served by rail, to major metropolitan areas
- **Medical transportation** – Service to major medical centers and VA hospitals

NEEDS IDENTIFIED THROUGH PUBLIC INPUT

This study conducted a significant public outreach effort to obtain input on needs and priority service improvements from the general public including both users and non-users. This input from everyday travelers and commuters was invaluable to identify additional areas with unmet needs and specific service improvements to existing routes.

Two online surveys were conducted in June and July 2015 to obtain public input on needs and desired service improvements for intercity bus and commuter bus, respectively. The surveys were provided in English, Spanish, Portuguese, and Traditional Chinese. The survey links were promoted to both community organizations and individuals interested in transportation issues through several avenues including MassDOT's project website, MPOs, RPAs, RCCs, and Massachusetts' transportation management associations (TMAs). In addition, the study team also handed out bookmarks with links to the surveys, in all four languages, at South Station Bus Station, the Silver Line South Station, and the Blue Line Airport Station. More details about the public outreach activities and copies of the surveys are included in Appendix E.

Intercity Bus Needs

Of the 580 responses collected on the intercity bus survey, half the respondents had used intercity bus service in the past year. Respondents indicated that they primarily make long distance trips for social visits and recreational activities, in addition to work related travel and shopping. Those who have not used intercity bus service recently provided input that they are willing to drive or ride with someone five to ten miles to reach an intercity bus stop, though nearly 40% prefer not to drive or cannot drive. Many of these respondents indicated preferences to walk or take local transit to reach the intercity bus stop. Of the respondents who have used intercity bus service in the past year, the largest majority used public transit to reach the stop, followed by driving (self or dropped off) and walking to the stop. Current intercity bus riders mainly obtain information on services through the bus company websites, as well as through printed timetables at bus stations or onboard the bus and the MassDOT website. Nine out of ten respondents who currently use intercity bus service said there is a need for additional routes or schedules.

Table 4-1 summarizes the top origins, destinations, and corridors (listed in order starting with the most common requests) identified by survey respondents. Note that high responses from some of these places may be a result of good survey promotion on certain routes or by certain community organizations. Nonetheless this public input was an important factor among several need indicators analyzed in the process of developing service alternatives.

Table 4-1: Top Intercity Trip Origins, Destinations, and Corridors Identified through Public Surveys

Top Intercity Trip Origins	Top Intercity Trip Destinations	Top Intercity Corridors Requested for Additional Service
• Boston • Westford • Ayer • Fitchburg • Gardner • Sharon • Cambridge • Somerville • Lowell • Lexington • Northampton/Amherst • Worcester • Medford • Pepperell	• Boston • New York, NY • Worcester • Lowell • Cambridge • Fitchburg • Leominster • Springfield • Gardner • Greenfield • Cape Cod • Providence, RI • Marlborough • Somerville • Westford	• Route 2 - Greenfield to Boston; Gardner to Fitchburg; service to Ayer & Westminster • I-91 - Greenfield to Northampton, Northampton/Amherst to Springfield • Route 3/3A - Cape Cod to Boston & Logan Airport; South Shore to Boston; Westford to Woburn, Boston & Cambridge • I-90 – Berkshires to Boston, Northampton/Amherst to Boston, Springfield to Boston, Worcester to Boston, Boston and Worcester to New York City • I-495 - Lowell to Andover, Westford, Ayer, Worcester, Framingham & Boston • I-190 - Fitchburg to Worcester • I-93 - Boston to Concord, NH • I-195 - Cape Cod to T.F. Green Airport & New York City • Route 146 - Worcester to Providence, Fall River & New Bedford • Route 24 - Fall River to Taunton

Survey respondents identified their top recreational and tourism destinations, listed below starting with the most popular:

- Boston
- Montreal, Quebec
- Cape Cod
- North Shore (Salem, Newburyport, Gloucester, Ipswich)
- Portland, ME
- Providence, RI
- New York, NY
- Portsmouth, NH
- Burlington, VT

- Northampton/Amherst
- Berkshires
- Newport, RI
- Hampton Beach, NH
- Toronto, Ontario
- Quebec City, Quebec
- White Mountains, NH

In addition, current intercity bus riders identified the types of service improvements needed on existing services with priorities for 1) more express service and 2) additional trips later in the day. The following were examples of specific routes that respondents identified under each type of service improvement:

- **Increased express service** – Boston to Springfield, Amherst, Newburyport & New York City; Northampton/Amherst to Springfield; Northampton to Greenfield
- **Increased seasonal service** – Boston/Cambridge to Cape Cod; Boston to New York City and Montreal; service to New Hampshire, Vermont, and Maine including ski resorts
- **Additional trips earlier in the day** – Boston to Plymouth and Hyannis; Newburyport to Boston; Worcester to Boston, Providence, and Albany
- **Additional trips during midday** – Gardner to Fitchburg; New Bedford to Boston; Springfield to Northampton/Amherst
- **Additional trips later in the day** – Boston to Springfield and Northampton; Northampton to Greenfield; Southeastern Massachusetts to Boston
- **Additional trips late night** – Boston to Amherst and Worcester; Northampton to Springfield; Boston to Vermont
- **Better connection to national intercity bus or rail network** – Berkshires, Pioneer Valley, Ayer, Westford, Townsend, Pepperell, Westminster

Other improvements that intercity bus respondents suggested were suburban connections, more frequent services, serving town centers, providing real time information to passengers, bike racks on buses, and dedicated bus lanes.

Commuter Bus Needs

Of the 400 responses collected on the commuter bus survey, the majority did not currently use commuter bus service (64%), but would be willing to if a commuter route met their needs (68%). More than half of respondents who do not currently use commuter bus indicated that they are willing to drive or ride with someone five to ten miles to reach a commuter bus stop, but nearly 40% preferred not to drive or cannot drive. Most of the latter respondents preferred to walk to commuter bus service, and some were willing to take local transit.

Table 4-2 summarizes the top origins and destinations identified by respondents who currently do not use commuter bus service. The table also includes the top corridors requested for additional or improved commuter bus service, identified by all survey respondents. The places and corridors are listed starting with the most common requests.

Table 4-2: Top Commuter Trip Origins, Destinations, and Corridors Identified through Public Surveys

Top Commuter Trip Origins	Top Commuter Trip Destinations	Top Commuter Corridors Requested for Additional Service
• Westford • Ayer • Fitchburg • Lexington • Boston • Arlington • Leominster • Medford	• Boston • Devens • Cambridge • Fitchburg • Lowell • Worcester • Leominster • Waltham • Westford	• Route 2 – Fitchburg, Ayer, Devens, Gardner, Leominster, Lexington to Cambridge • I-495 – Lowell to Westford, Littleton to Westford & Devens • I-91 – Greenfield to Springfield, Northampton/Amherst to Springfield, Greenfield to Brattleboro, VT • Route 128 – loop, Salem, Burlington • I-190 - Fitchburg to Worcester • Route 3/3A - Cape Cod to Boston/Cambridge, Westford to Boston, Nashua, NH to Boston, Lowell to Burlington • I-93 – New Hampshire to Boston

In addition to the above areas, Winchendon, Clinton, Woburn, and Watertown were identified as needing additional commuter service. Service improvements to connect North Station to Fort Point Channel and the Seaport District were also requested by several respondents.

Current commuter bus riders identified the types of service improvements needed on existing services with priorities for 1) more express service and 2) additional trips during the peak periods. The following were examples of specific routes that respondents identified under each type of service improvement:

- **Increased express service** – Plymouth and Hyannis to Boston, Newburyport to Boston, Lexington to Boston/Cambridge, Nashua, NH to Boston, Greenfield to Amherst
- **Schedule changes for earlier service** – Westford to Boston, Fitchburg
- **Schedule changes for later service** – Boston to Plymouth and Hyannis
- **Additional trips during AM and PM peak periods** – South Shore to Boston, Newburyport to Boston, Taunton to Boston, Gardner to Fitchburg and Leominster
- **Additional trips during midday** – Andover to Boston, South Shore to Boston, Greenfield to Amherst
- **Additional stops in Boston** – Back Bay, Quincy Market, the Seaport District, and the Blue Line Airport Station. Kendall Square was requested as an additional stop in Cambridge.

Other improvements that commuter bus respondents suggested were better on time performance, providing dedicated bus lanes, expanding park and ride capacity, improving first and last mile connections between commuter rail stations and employment, and communicating to riders when buses are late or canceled.

The top trip generators that the public identified in both the intercity and commuter bus surveys are highlighted in Figure 4-1.

Figure 4-1: Top Trip Origins and Destinations Identified through Public Surveys

Top Trip Generators Identified in Public Surveys

Intercity Bus	Commuter Bus	Both Types of Service
Cape Cod	Arlington	Ayer
Gardner	Waltham	Boston
Greenfield		Cambridge
Marlborough		Fitchburg
New York, NY		Leominster
Northampton/Amherst		Lexington
Pepperell		Lowell
Providence, RI		Medford
Sharon		Westford
Somerville		Worcester
Springfield		

Source: Bus routes and stops developed by CTPS and updated by KFH Group in June 2015.

SUMMARY

Practicing good stewardship of public funds requires a deep assessment of public needs in order to determine how federal and state dollars may be best invested to meet those needs. MassDOT used a multi-pronged approach to evaluate needs for regional bus service, including assessing existing services and stops against service standards and planning guidelines, reviewing existing studies and plans, and collecting input from stakeholders and the general public. These efforts demonstrated that overall Massachusetts has good coverage by existing regional bus services, but some communities need better access to the national intercity bus and rail network and some trips would be vastly improved through more direct service. Community stakeholders and individual residents identified a diverse set of unmet needs for travel within the commonwealth as well as connections to New England and Canada. The results of this needs evaluation informed the development of regional bus service recommendations.

The following themes emerged from this review of existing services and unmet needs:

- Interregional connections including new, direct services are needed between RTA service areas.
- Residents in isolated rural towns need lifeline services to regional urban centers to access employment, higher education, and medical services.
- Commuter service is needed to access suburban employment centers along Route 128 and I-495.
- The Berkshires need intercity bus service that allows for a day trip (five hours) in Boston and New York City.
- Circumferential commuter service is needed along major corridors such as Route 128, I-495, and I-190 so that riders do not need to go into Boston.
- The public's priorities for service improvements are more express service, more trips later in the day, and more commuter trips during the peak periods.
- In addition to service improvements, facility improvements, increased marketing and public information, and more passenger amenities would greatly enhance passenger experiences using regional buses.
- Improvements to intraregional connections are needed in some parts of the state including the Northeast and Southeast. While these needs would mainly fall under the purview of the RTAs, they could also be addressed as part of longer intercity bus routes.
- Many unmet needs identified during this study were more local in nature, indicative of outstanding needs to improve and expand RTA service, which would also facilitate good first and last mile connections to the regional bus network.

It is worth noting that a large portion of the needs identified through the existing studies and the public input pertained to services that are more local in nature, connecting origins and destinations within one region or within an RTA service area. It was important to document these needs as service improvements for consideration by the RTAs. However the BusPlus program focuses on meeting service gaps in the private carrier network, where public needs have been identified, and bridging needed connections between RTA service areas.

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Chapter 5
Service Alternatives

INTRODUCTION

This chapter provides an assessment of potential regional bus routes that would address the needs identified in the previous analysis. Alternatives were developed based on an inventory of existing service in Chapter 2, the demographic needs analysis presented in Chapter 3, and previous studies and input from the public and stakeholders documented in Chapter 4.

Following the identification of potential stops and corridors in the preceding chapters, the study team developed hypothetical routes and services that could potentially serve these places. These alternatives provided a basis for assessing the likely operating cost of service that would address these needs, the potential demand, and the likely revenue. The calculations helped determine the potential cost to the public of addressing these needs. In the next chapter, these service alternatives are assessed in productivity and cost-effectiveness to determine if any warrant public investments in regional bus service.

Although the previous analysis applied separate criteria for intercity or commuter bus needs (or both), the alternatives were categorized in terms of potential funding sources. The following funding sources were considered when developing the service alternatives:

- The Massachusetts Section 5311(f) rural intercity funding allocation,
- Possible Congestion Mitigation and Air Quality (CMAQ) program funding,
- Possible changes in the services provided by BusPlus bus lease carriers in return for the use buses, and
- Potential funding provided to private carriers based on inclusion of their operating statistics in the FTA National Transit Database, used to allocate Section 5307 funding for urbanized areas.

Each funding source has different conditions and requirements regarding the type of service that might be eligible, so the proposed alternatives have been developed and categorized to better fit with the characteristics of the funding sources. The tables in this chapter outline the service alternatives by funding source, along with the unmet needs identified in the previous analysis that each alternative addresses.

POTENTIAL RURAL INTERCITY ROUTES

The services listed in Table 5-1 as potential rural alternatives have been developed in response to identified gaps in the intercity network, and are potentially eligible for Section 5311(f) funding as rural intercity services. Massachusetts is unusual among states in that many of its small towns have been included in Census-designated urbanized areas that cover large regions, so in terms of transit funding allocations the state has a relatively small rural (non-urbanized) population, and there are relatively few non-urbanized (under 50,000 population) places that might warrant an intercity bus stop. Because the service alternatives link non-urbanized areas with urbanized areas, they would be eligible for rural intercity funding. The three existing intercity bus routes, currently supported by Section 5311(f) or BusPlus operating assistance, and eight intercity bus service alternatives, are shown in Figure 5-1.

Several options have been designed to address the service standard calling for a one-transfer trip to Boston (or New York City), with schedules allowing passengers to make a round-trip in a day—which is not met by existing services from the Berkshires. The other major rural areas lacking intercity service that are addressed by these options include the Route 2 corridor across the northern part of the state, the Route 9 corridor between Amherst and Worcester, and the southwest corner of the state.

The potential intercity routes would stop in communities such as North Adams, Athol, Gardner, Ware and others that have key destinations identified in Chapter 3, but no or limited existing service. These potential routes would improve intercity bus service to medical centers, colleges, correctional facilities, and intermodal stations across the state.

Some alternatives travel in the same corridor and serve similar stops, so one or the other would be selected for implementation, perhaps in different phases. For example, the Williamstown-Springfield-Boston and Pittsfield-Springfield-Boston alternatives are essentially the same route except that the first extends to Williamstown. Therefore, if RTD implements service in this corridor, buses might operate the Pittsfield-Springfield-Boston route first with consideration to extend the route to Williamstown at a later date. A similar scenario could apply to the Winchendon-Boston and Boston-Rutland, VT alternatives. The routes are similar except the latter extends service into Vermont. The Route 2 alternatives could be implemented as different types of service and could potentially be implemented at the same time. The Albany, NY-Williamstown-Boston alternative could provide express service between Greenfield and Boston, while the Greenfield-Boston alternative could serve several intermediate towns along Route 2.

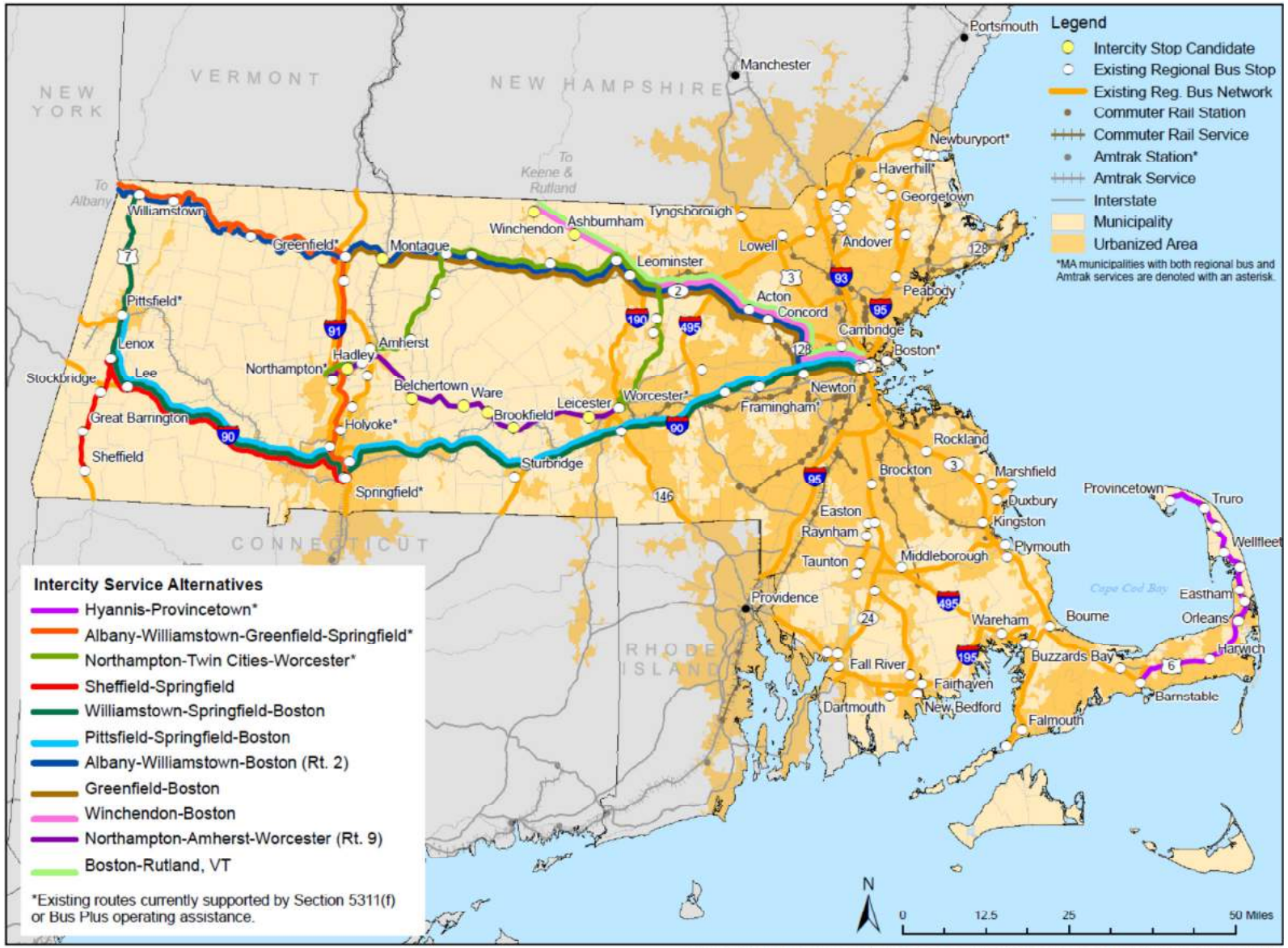
Table 5-1: Rural Intercity Service Alternatives Eligible for Section 5311(f) Funding

Rural Intercity Service Alternative	Stops	Unmet Needs Served
Sheffield-Springfield	Sheffield, Great Barrington, Stockbridge, Lenox, Lee, Springfield	• Allows passengers from Sheffield, Great Barrington & Stockbridge to make daytrip to Springfield & Boston, need identified in service standards evaluation • Serves Route 7, need identified in stakeholder input • Serves top intercity trip destination (Springfield) identified in public input • Serves top tourism destination (Berkshires) identified in public input
Williamstown-Springfield-Boston	Williamstown, Pittsfield, Lenox, Lee, Springfield, Boston	• Allows passengers from Williamstown, Pittsfield, Lenox & Lee to make daytrip to Springfield (new for Williamstown & Pittsfield) & Boston, need identified in service standards evaluation • Provides intercity service from Pittsfield to Boston, need identified in 2013 MA Regional Bus Study • Adds express service between Springfield & Boston, top request in 2011 CTPS survey & need identified in 2015 public input • Provides intercity service from Berkshires to Boston that allows same day trip, need identified in stakeholder & public input • Serves top intercity trip destinations (Boston & Springfield) identified in public input • Serves top tourism destinations (Berkshires & Boston) identified in public input
Pittsfield-Springfield-Boston	Pittsfield, Lenox, Lee, Springfield, Boston	• Allows passengers from Pittsfield, Lenox & Lee to make daytrip to Springfield (new for Pittsfield) & Boston, need identified in service standards evaluation • Provides intercity service from Pittsfield to Boston, need identified in 2013 MA Regional Bus Study • Adds express service between Springfield & Boston, top request in 2011 CTPS survey & need identified in 2015 public input • Provides intercity service from Berkshires to Boston that allows same day trip, need identified in stakeholder & public input • Serves top intercity trip destinations (Boston & Springfield) identified in public input • Serves top tourism destinations (Berkshires & Boston) identified in public input

Rural Intercity Service Alternative	Stops	Unmet Needs Served
Albany, NY-Williamstown-Boston (Rt. 2)	Albany (NY), Troy (NY), Williamstown, North Adams, Charlemont, Shelburne, Greenfield, Montague, Orange, Athol, Gardner, Fitchburg, N. Leominster, Acton, Concord, Boston	• Allows passengers from Williamstown to make daytrip to Boston, need identified in service standards evaluation • Serves intercity stop candidates (North Adams, Montague & Gardner) based on planning guidelines • Provides intercity service from North Adams to Boston, need identified in 2013 MA Regional Bus Study • Provides intercity service from Berkshires to Boston that allows same day trip, need identified in stakeholder input • Provides direct service from Franklin County/Greenfield to Boston, need identified in stakeholder input • Fills service gap on Route 2, need identified in stakeholder & public input • Provides local intercity service between Boston & Albany, need identified in stakeholder input • Serves top intercity trip destinations (Boston & Greenfield) identified in public input • Serves top tourism destinations (Berkshires & Boston) identified in public input
Greenfield-Boston (Rt. 2)	Greenfield, Montague, Orange, Athol, Gardner, Fitchburg, N. Leominster, Acton, Concord, Boston	• Serves intercity stop candidates (Montague & Gardner) based on planning guidelines • Provides intercity service from Athol & Gardner to Fitchburg & Boston, needs identified in 2013 MA Regional Bus Study • Could serve medical destinations in Concord, need identified in Lowell Region Coordinated Public Transit Human Services Plan • Provides direct service from Franklin County/Greenfield to Boston, need identified in stakeholder input • Fills service gap on Route 2 (Greenfield-Gardner-Fitchburg-Boston), need identified in stakeholder & public input • Serves top intercity trip origins (Boston, Fitchburg & Gardner) identified in public input • Serves top intercity trip destinations (Boston, Gardner, Greenfield, Fitchburg & Leominster) identified in public input • Serves top tourism destination (Boston) identified in public input

Rural Intercity Service Alternative	Stops	Unmet Needs Served
Winchendon-Boston (Rt. 2)	Winchendon, Ashburnham, Fitchburg, N. Leominster, Acton, Concord, Boston	• Fills service gap on Route 2, need identified in stakeholder & public input • Serves top intercity trip origins (Boston & Fitchburg) identified in public input • Serves top intercity trip destinations (Boston, Fitchburg & Leominster) identified in public input • Serves top tourism destination (Boston) identified in public input
Northampton-Amherst-Worcester (Rt. 9)	Northampton, Hadley, Amherst, Belchertown, Ware, West Brookfield, Brookfield, Leicester, Worcester	• Provides intercity service from Ware to Worcester, need identified in 2013 MA Regional Bus Study • Adds service to Leicester, a need identified in the Central MA Coordinated Public Transit-Human Services Transportation Plan • Provides intercity service connecting rural towns to urban centers in Pioneer Valley, need identified in stakeholder input • Fills service gap on Route 9 (Ware to Worcester), need identified in stakeholder input • Serves top intercity trip origins (Northampton, Amherst & Worcester) identified in public input • Serves top intercity trip destination (Worcester) identified in public input • Serves top tourism destination (Northampton/Amherst) identified in public input
Boston-Rutland, VT	Boston, Concord, Acton, N. Leominster, Fitchburg, Ashburnham, Winchendon, Jaffrey (NH), Keene (NH), Bellows Falls (VT), Springfield (VT), Chester (VT), Proctorsville (VT), Ludlow (VT), Rutland (VT)	• Serves top intercity trip origins (Boston & Fitchburg) identified in public input • Serves top intercity trip destinations (Boston, Fitchburg & Leominster) identified in public input • Serves top tourism destination (Boston) identified in public input • Could be scheduled to provide additional trips late night (Boston to VT), need identified in public input

Figure 5-1: Rural Intercity Bus Alternatives



POTENTIAL COMMUTER ROUTES

The services listed in Table 5-2 as potential commuter alternatives have been developed based on identified gaps in the commuter network and areas with potential demand for commuter bus service. These alternatives are potentially eligible for CMAQ program funding, which supports projects that improve air quality and relieve congestion. States may use CMAQ funding to provide capital investment or operating assistance for new transit routes. States may provide CMAQ operating assistance for a demonstration period, up to five years, which gives operators time to build ridership through marketing and service improvements, as needed. Another potential funding source is Section 5307 funding for urbanized areas, if the private carriers provide their operating statistics to the FTA National Transit Database to be used for funding allocation.

The existing commuter bus route, supported through BusPlus operating assistance, and nine commuter service alternatives are shown in Figure 5-2. These alternatives focus on serving markets for new commuter routes, where commuters currently have no feasible transit option. These alternatives have been screened to identify those with potential demand to support two roundtrips per day at a 50% load factor, a commuter bus planning guideline described in Chapter 3. While stakeholder and public input identified additional commuter service needs, including improvements to existing service, the study team identified these alternatives as potential CMAQ projects that have substantial markets and may effectively reduce the number of vehicles on the road.

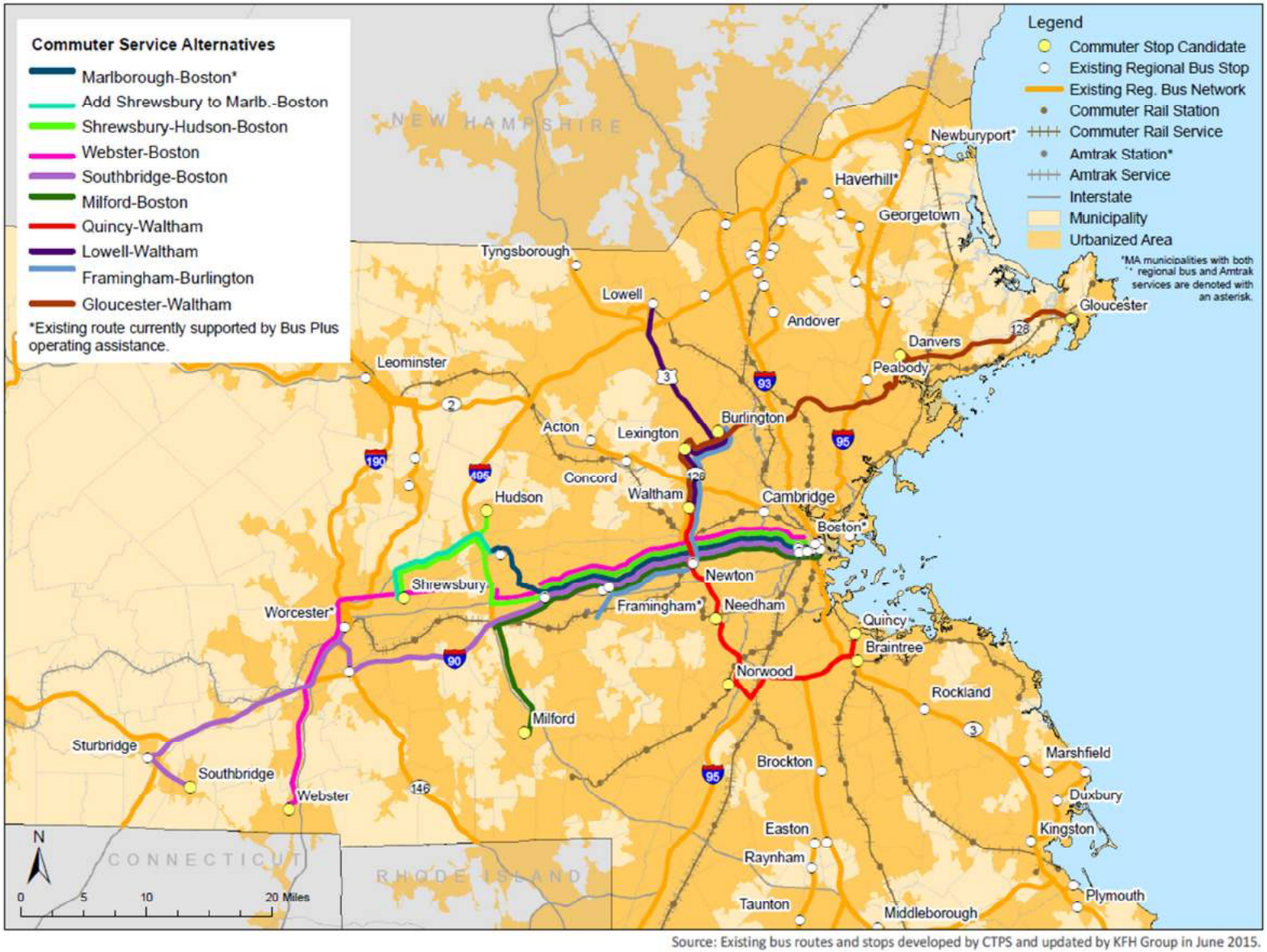
The service options address gaps in the commuter network (including existing commuter bus service and MBTA service) that have been identified in the Central Massachusetts region, the 495/MetroWest corridor, and the Route 128 corridor. While these alternatives primarily serve commuter markets, some also meet needs for intercity bus identified in the previous analysis. For example, the main commuter markets that the Southbridge-Boston alternative would serve are Southbridge and Sturbridge to Worcester. In addition this alternative would provide intercity service from Southbridge and Sturbridge to Boston, needs identified in the 2013 *Massachusetts Regional Bus Study* and the service standards evaluation. The Webster-Boston alternative is a similar scenario, where the main commuter markets would be Webster to Worcester and Shrewsbury to Worcester (reverse commute), with the additional benefit of providing intercity service options to Webster and Shrewsbury.

Table 5-2: Commuter Service Alternatives Eligible for CMAQ Funding

Commuter Service Alternative	Stops	Unmet Needs Served
Add Shrewsbury to Marlborough-Framingham-Boston BusPlus route	Shrewsbury (new), Marlborough, Framingham, Boston	• Serves intercity and commuter stop candidate (Shrewsbury) based on planning guidelines
Shrewsbury-Hudson-Boston	Shrewsbury, Hudson, Boston	• Provides commuter service from Hudson to Boston, need identified in 2013 MA Regional Bus Study • Serves intercity stop candidates (Shrewsbury & Hudson) based on planning guidelines • Serves commuter stop candidate (Shrewsbury) based on planning guidelines
Webster-Boston	Webster, Worcester, Shrewsbury, Boston	• Serves I-395 and I-90 (Webster to Worcester and Boston), need identified in stakeholder input • Serves intercity stop candidates (Shrewsbury & Webster) based on planning guidelines • Serves commuter stop candidate (Shrewsbury) based on planning guidelines
Southbridge-Boston	Southbridge, Sturbridge, Worcester, Boston	• Provides intercity service from Southbridge to Worcester and Boston, need identified in 2013 MA Regional Bus Study • Could be scheduled to allow full five hours for daytrip from Sturbridge to Boston, need identified in service standards evaluation • Serves intercity stop candidate (Southbridge) based on planning guidelines
Milford-Boston	Milford, Boston	• Provides commuter service from Milford to Boston, need identified in 2013 MA Regional Bus Study • Serves Milford, which has no local transit service (Boston Region CHST Plan) • Could serve Milford Regional Medical Center and Courthouse, identified as regional trip generators in SWAP Regional Public Transit Feasibility Study • Fills service gap on Route 109, need identified in stakeholder input • Serves intercity and commuter stop candidate (Milford) based on planning guidelines

Commuter Service Alternative	Stops	Unmet Needs Served
Quincy-Waltham (Route 128 South to Route 128 Central)	Quincy, Braintree, Norwood, Needham, Newton (Riverside-MBTA Green Line), Waltham	• Provides circumferential commuter service on Route 128 (serving Braintree & Newton), need identified in stakeholder input • Could provide express bus on shoulder service on Route 128 from Route 128 south, need identified in Route 128 Central Corridor Plan • Serves several job centers: Braintree, Norwood & Waltham
Lowell-Waltham (Route 3 to Route 128 Central)	Lowell, Burlington, Lexington, Waltham	• Provides express bus on shoulder service on Route 128 from Route 3, need identified in Route 128 Central Corridor Plan • Providers commuter service from Merrimack Valley to Route 128, need identified in stakeholder input • Serves job centers: Burlington & Waltham
Framingham to Burlington (MA Turnpike West to Route 128 Central)	Framingham, Burlington, Lexington, Waltham	• Provides service from MA Turnpike West to Route 128, potential demand identified in Route 128 Central Corridor Plan • Serves job centers: Burlington & Waltham
Gloucester-Waltham (Route 128 North to Route 128 Central)	Gloucester, Danvers, Peabody, Burlington, Lexington, Waltham	• Provides circumferential commuter service on Route 128 (serving Gloucester & Burlington), need identified in stakeholder input • Could provide express bus on shoulder service on Route 128 from Route 128 north, need identified in Route 128 Central Corridor Plan • Serves job centers: Burlington, Danvers & Waltham

Figure 5-2: Commuter Bus Alternatives



Source: Existing bus routes and stops developed by CTPS and updated by KFH Group in June 2015.

Potential Service Changes Provided by BusPlus Carriers

The services listed in Table 5-3 are possible changes that RTD may request of the BusPlus bus lease carriers in return for the use of the buses. Discussed in Chapter 1, one of the stipulations of private operators receiving capital assistance through the BusPlus program is that they operate new or improved regional bus service. These service projects often add frequencies to existing routes or establish new routes where the private operators see an emerging market.

In its implementation of the BusPlus capital assistance program to date, RTD has worked with the private operators to identify the service projects and any changes once the projects have been implemented for a period of time. These service alternatives are additional options for RTD and the private operators to consider as part of the agreement for capital support under BusPlus. Some alternatives address needs identified in the service standards evaluation to ensure that existing services meet the minimum acceptable service levels.

Routes for Private Carriers Based on Potential Markets

The services listed in Table 5-4 are alternatives that the private carriers may consider implementing based on potential markets. Potential funding could be provided to the private carriers based on inclusion of their operating statistics in the FTA National Transit Database, used to allocate Section 5307 funding for urbanized areas. The alternatives address service improvements requested through stakeholder and public input, namely for more direct and express regional bus service to Boston and New York City. Many projects represent potential service improvements or changes to services that are already provided without state or federal assistance. Decisions regarding implementation should reflect market demand and so they have been included for consideration by the private carriers.

Summary

Some alternatives provide new intercity connections, enhance existing connections with additional service, or make the transit option more attractive by reducing transfers and making travel times more comparable to those of automobiles. Between MBTA and the private carriers, the regional transit network is already quite extensive, with major metropolitan centers served at high frequencies and small urban and rural locations provided some level of service that allows residents to connect to the larger intercity network. The main areas for improvement are adding rural and suburban locations to the regional transit network, expanding service in corridors with minimal existing service, and providing more direct and convenient connections for daytrips and commutes.

The policy issues for RTD to consider include 1) whether to prioritize coverage of the regional transit network (i.e., adding new regional bus stops) or to improve existing connections and services (i.e., additional frequencies, fewer transfers), and 2) whether some these alternatives (or portions of them) might be more appropriate as local transit service operated by the RTAs. The next chapter evaluates the service alternatives against performance measures for intercity and commuter bus services, the results of which are used to prioritize service recommendations.

Table 5-3: Potential Service Changes Provided by BusPlus Carriers

Potential Service Changes by BusPlus Carriers	Stops	Unmet Needs Served
I-91 additional service, Greenfield-Springfield express	Greenfield, Springfield, possibly Northampton	• Provides commuter service from Greenfield to Northampton and Springfield, need identified in stakeholder input • Provides express service between Greenfield and Northampton and between Northampton and Springfield, needs identified in stakeholder and public input • Could be scheduled to provide additional trips midday from Springfield to Northampton, need identified in public input • Could be scheduled to provide additional trips later in the day from Northampton to Greenfield and late night from Northampton to Springfield, needs identified in public input • Serves I-91, top corridor requested for additional intercity and commuter service in public input • Serves top intercity trip origins (Northampton) identified in public input • Serves top intercity trip destinations (Greenfield & Springfield) identified in public input • Serves top tourism destination (Berkshires) identified in public input
Sturbridge-Boston, Option A: Adjust existing schedule for earlier departure to provide full daytrip to Boston	Boston, Framingham, Worcester, Millbury, Sturbridge	• Allows passengers from Sturbridge to make daytrip to Boston, need identified in service standards evaluation • Serves top intercity trip destinations (Boston & Worcester) identified in public input • Serves top tourism destination (Boston) identified in public input • Serves top tourism destination in Central Massachusetts (Sturbridge) based on Massachusetts Office of Travel and Tourism data
Sturbridge-Boston, Option B: Add one roundtrip for daytrip in Sturbridge (may be seasonal)	Boston, Framingham, Worcester, Millbury, Sturbridge	• Serves top intercity trip origins (Boston & Worcester) identified in public input • Serves top tourism destination in Central Massachusetts (Sturbridge) based on Massachusetts Office of Travel and Tourism data

Potential Service Changes by BusPlus Carriers	Stops	Unmet Needs Served
Add second roundtrip to North Andover – Boston	North Andover, Boston	• Increases service in North Andover to minimum acceptable level for commuter bus service, need identified in service standards evaluation
Add second roundtrip to Duxbury on Duxbury – Boston	Duxbury, Marshfield, Rockland, Boston	• Increases service in Duxbury to minimum acceptable level for commuter bus service, need identified in service standards evaluation

Table 5-4: Service Alternatives Provided by Private Carriers Based on Potential Markets

Routes for Private Carriers Based on Potential Markets	Stops	Unmet Needs Served
Amherst/Northampton-Boston/Logan express	Amherst, Northampton, Boston, Logan Airport	• Provides more express service between Boston & Amherst, need identified in public input • Could be scheduled to provide additional trips later in the day from Boston to Northampton & Amherst, need identified in public input • Serves I-90, top corridor requested for additional intercity service in public input • Serves top intercity trip origins (Northampton & Amherst) identified in public input • Serves top intercity trip origins (Boston, Northampton/Amherst) identified in public input • Serves top intercity trip destination (Boston) identified in public input • Serves top tourism destinations (Boston, Northampton/Amherst) identified in public input
Provincetown-Hyannis-Boston/Logan express	Provincetown, Hyannis, Boston, Logan Airport	• Serves Route 3, top corridor requested for additional intercity and commuter service in public input • Provides more seasonal service between Boston & Cape Cod, need identified in public input • Serves top intercity trip destinations (Boston & Cape Cod) identified in public input • Serves top tourism destinations (Boston & Cape Cod) identified in public input • Serves top tourism destinations in Cape Cod (Barnstable & Provincetown) based on Massachusetts Office of Travel and Tourism data
Boston-New Hampshire local service (northbound)	Boston, Burlington, Lowell, Nashua (NH), Manchester (NH), Manchester-Boston Regional Airport (NH)	• Bus service would serve as a precursor to Capitol Corridor rail service (extension of MBTA Lowell Commuter Rail Line to Manchester, NH), which has projected ridership > 1 million annually, as identified in Massachusetts State Rail Plan • Provides additional service from Lowell Region to Nashua, NH, need identified in Lowell Region Coordinated Public Transit Human Services Plan • Provides direct commuter service from Lowell to Boston, need identified in stakeholder input

Routes for Private Carriers Based on Potential Markets	Stops	Unmet Needs Served
		• Serves Route 3, top corridor requested for additional commuter service (Lowell to Burlington & Nashua, NH to Boston) in public input • Serves job center (Burlington) • Serves top intercity trip origins/destinations and top commuter trip destinations (Boston & Lowell) identified in public input
Worcester-New York City (no transfer in Hartford)	Boston, Framingham, Worcester, New York (NY)	• Serves I-90, top corridor requested for additional intercity service (Worcester to New York City) in public input • Serves top intercity trip origin (Worcester) identified in public input • Serves top intercity trip destinations (Worcester & New York City) identified in public input • Serves top tourism destination (New York City) identified in public input
I-91 corridor direct to New York City (no transfer in Springfield)	Greenfield, Deerfield, Amherst, South Hadley, Northampton, Holyoke, Springfield, New York (NY)	• Provides intercity bus service that allows daytrip from Berkshires to New York City, need identified in stakeholder input • Provides commuter service from Greenfield to Northampton, Holyoke & Springfield, need identified in stakeholder input • Provides express service from Holyoke to Springfield, need identified in stakeholder input • Could be scheduled to provide additional trips later in the day from Northampton to Greenfield, need identified in public input • Could be scheduled to provide additional trips during midday from Greenfield to Amherst, need identified in public input • Serves I-91, top corridor requested for additional intercity and commuter service in public input • Serves top intercity trip origin (Worcester) identified in public input • Serves top intercity trip destinations (Greenfield & New York City) identified in public input • Serves top tourism destinations (Berkshires & New York City) identified in public input

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Chapter 6
Service Recommendations and Program Considerations

INTRODUCTION

While the previous chapters sought to determine the extent of unmet regional bus needs in Massachusetts, this chapter identifies the potential costs of addressing these needs and whether the service alternatives are anticipated to meet performance criteria. The study team used the results of this performance evaluation to develop service recommendations under the potential funding sources discussed in Chapter 5. In addition to service recommendations, this chapter also identifies issues and implications for RTD to consider for Massachusetts' regional bus program moving forward. These issues include if and how the BusPlus Program should continue, considering both the capital and operating support programs, and improving monitoring of the state's investment in the regional bus system.

EVALUATION OF CURRENT & POTENTIAL PUBLICLY-FUNDED SERVICES

In order to determine the potential feasibility of investing state and federal funds to address the unmet needs and potential markets identified in the previous chapters, it was necessary to develop appropriate performance metrics to assess the currently funded BusPlus regional bus routes and to project the performance of service alternatives to address unmet needs. Although all the identified service needs could be met with unlimited funding, not all potential options would be cost-effective, and evaluation of the potential services is useful in identifying the most cost-effective options to be the focus of limited public funding.

It was assumed that all services provided by the private carriers without subsidy are covering their operating costs (and capital costs if not using a BusPlus-funded vehicle) from fares, and they are not included in this analysis. While it is possible that the private carriers have missed potential markets that could be served by them at their current fare levels, it is likely that unserved markets would need a subsidy to receive service. Most states utilize available Section 5311(f) and CMAQ funding to address these needs, and some also provide state funding either as match for those programs or in addition. The three routes funded by MassDOT under the BusPlus operating assistance program and the single route funded by MassDOT with Section 5311(f) federal funds are examples of current efforts to address service gaps in Massachusetts. This analysis included those services as well as the service alternatives developed in the previous chapter.

The performance metrics developed for this study evaluated the regional bus services in productivity, subsidy levels, farebox recovery, cost-effectiveness, and revenue generation. Many of the performance metrics were related. For example, the number of passengers per trip and the revenue per passenger mile determined the farebox revenue per trip. The numeric benchmarks represented the minimum acceptable level of performance. Higher ridership, longer trips for the average rider, and lower

operating costs would all result in better performance of the benchmarks identified below. For future evaluations performance metrics with dollar values need to be adjusted periodically to reflect inflation.

For services that it has funded, RTD should monitor performance over time, and review any service that operates for a prolonged period at lower performance than the benchmarks to see if either performance can be improved, or the funding reinvested to achieve a higher benefit. For new routes, some of the performance metrics are targets following the second year of implementation. New subsidized regional bus routes generally require two years, assuming good marketing efforts are conducted, to establish their ridership. RTD should evaluate new routes (however funded) at the end of the first year to determine if the routes are meeting at least 50% of the goals for productivity (boardings per trip), farebox recovery, and revenue per passenger mile, with the goal of meeting the full performance benchmarks by the end of the second year. Where new routes do not meet the first year standards, RTD may work with the operator to make changes designed to improve performance, or consider reinvesting state funds in different regional bus services.

The performance projections for the regional bus alternatives should be taken as sketch planning estimates. The projections were based on several assumptions, described below, and incorporated actual data from existing services where possible. A comparison of projections for the existing routes with the actual data reported in provider invoices found a range in accuracy. The study team's assumptions used to estimate revenue, operating costs, farebox recovery, and subsidy per boarding resulted in projections that were relatively accurate. However the accuracy of the ridership projections varied. The actual ridership data for the existing Northampton-Worcester and Marlborough-Boston routes were notably lower (by 70-80%) than the initial projections based on the study team's approach. The Albany-Springfield route, on the other hand, saw higher actual ridership (by 35%) than the study team's original projection. These results indicated the difficulty of accurately estimating ridership for route alternatives. Ongoing monitoring of state supported services following implementation is critical to ensure that services are meeting performance metrics and merit continued funding.

It should be noted that in a number of cases different route alternatives serve the same corridor with variations in stops, so it may not make sense to implement multiple alternatives serving the same general corridor. For the service recommendations the study team highlighted the option that provided the highest ridership and revenue at reasonable cost, while offering attractive service. However the bus operators on the study's Technical Advisory Committee did provide input that in some corridors it may be worthwhile to operate multiple routes targeted toward different markets. Commuters, for example, find service with more stops to be less attractive, whereas intercity riders traveling for leisure may accept multiple stops for the convenience of a one-seat ride.

Rural Intercity Bus Routes

The study team evaluated three existing intercity bus routes and eight intercity service alternatives against the performance metrics. In FY 2016 Plymouth & Brockton's Hyannis to Provincetown route was in its fourth year as a 5311(f) supported service, and the Northampton-Twin Cities-Worcester and Albany-Williamstown-Greenfield-Springfield routes were in their first year of service, with operating

and capital support from the BusPlus program. Actual ridership and operating data[1] for these existing routes was used in the performance evaluation where possible. The projected performance of the service alternatives was based on the following assumptions:

- Cost of $3.70 per revenue bus mile[2], which was multiplied by the number of roundtrip miles for the route.
- Service 365 days per year.
- 2 roundtrips per day for the existing routes, and 1 roundtrip per day for the service alternatives. This assumption resulted in higher operating costs, higher subsidies per boarding, and lower farebox recovery for some of the existing routes when compared to the service alternatives.
- Average passenger trip length of 80% of the route length, as passengers tend to use intercity bus for long trip distances but some passengers will not ride the entire length of the route.
- Revenue of $0.12 per passenger mile.[3]

The study team developed the ridership estimates for the intercity route alternatives using the TCRP 147 Rural Intercity Demand Toolkit.[4] The Toolkit includes two models that generate estimates of annual ridership based on user inputs. The regression model is a statistical equation based on the length of the route and the average population of the stops served (excluding the largest population stop, which is assumed to be the destination). The trip rate model is a different approach using National Household Travel Survey data. It accounts for regional variation in long-distance trip rates made by rural residents using public transportation. Because of differences between the regression and trip rate models' results in many of the intercity corridors, the two demand estimates were averaged to provide a single demand number. It should be noted that neither demand model is sensitive to frequency, as most of the rural intercity routes used in calibrating the models operate one or two roundtrips per day. There was not enough variation for frequency to appear as a significant variable. Further details on how the two models work are included in Appendix F.

Table 6-1 presents the estimated annual ridership, revenue, and costs for the rural intercity alternatives that are potentially eligible for Section 5311(f) funding, along with the performance of the currently funded intercity routes. The intercity alternatives ranged in length from about 50 miles to 180 miles, with the longer distance alternatives connecting Massachusetts towns to Albany, NY and Rutland, VT. Estimated annual ridership ranged from 5,800 on the Sheffield to Springfield route to 13,500 on the Albany to Boston alternative via Route 2. These distances and projected ridership were comparable to those of the existing 5311(f) and BusPlus operating supported intercity routes.

[1] Ridership on the Hyannis-Provincetown route was 16,018 in 2015, per RTD, and the total operating cost was about $270,000 (the amount of the FY 2015 5311(f) award) for a cost per mile of $3.70.

[2] Based on the actual costs for the existing Albany-Springfield and Hyannis-Provincetown routes, which are receiving operating assistance from MassDOT.

[3] Based on current fares for the existing intercity bus routes. This revenue of $0.12 per passenger mile, less than the performance standard of $0.25, was used to develop a conservative estimate of revenue projections for the service alternatives. It is anticipated that new services are able meet the full performance standard by the end of their second year of operation.

[4] TCRP Report 147: Toolkit for Estimating Demand for Rural Intercity Bus Services. Transportation Research Board. Washington, D.C. 2011. http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_147.pdf.

Table 6-1: Annual Ridership, Revenue, and Cost for Existing and Potential Intercity Bus Routes

Route	Stops	One-Way Miles	Ridership	Revenue	Operating Cost[1]	Farebox Recovery	Net Operating Deficit	Subsidy per Boarding
Existing Intercity Route								
Northampton-Twin Cities-Worcester	Northampton, Amherst, New Salem, Orange, Athol, Gardner, Fitchburg, Leominster, Clinton, Worcester	100	2,500	$12,100	$1,274,100	1%	$1,262,000	$519
Albany-Williamstown-Greenfield-Springfield	Albany (NY), Williamstown, North Adams, Charlemont, Shelburne Falls, Greenfield, Northampton, Springfield	130	8,800	$97,400	$686,800	14%	$589,400	$67
Hyannis-Provincetown local	Hyannis, Harwich, Orleans, Eastham, North Eastham, South Wellfleet, Wellfleet, Truro, North Truro, Provincetown	50	16,020	$76,900	$270,100	28%	$193,200	$12
Potential Intercity Route								
Sheffield-Springfield	Sheffield, Great Barrington, Stockbridge, Lenox, Lee, Springfield	60	5,800	$33,400	$162,060	21%	$128,660	$22
Williamstown-Springfield-Boston	Williamstown, Pittsfield, Lenox, Lee, Springfield, Boston	74	7,100	$50,400	$199,900	25%	$149,500	$21
Pittsfield-Springfield-Boston	Pittsfield, Lenox, Lee, Springfield, Boston	53	7,800	$39,700	$143,200	28%	$103,500	$13
Albany-Williamstown-Boston (Rt. 2)	Albany (NY), Troy (NY), Williamstown, North Adams, Charlemont, Shelburne, Greenfield, South Deerfield, Montague, Orange, Athol, Gardner, Fitchburg, N. Leominster, Acton, Concord, Boston	177	13,450	$228,500	$478,100	48%	$249,600	$19
Greenfield-Boston	Greenfield, South Deerfield, Montague, Orange, Athol, Gardner, Fitchburg, N. Leominster, Acton, Concord, Boston	122	11,150	$130,600	$329,500	40%	$198,900	$18
Winchendon-Boston	Winchendon, Ashburnham, Fitchburg, N. Leominster, Acton	64	10,700	$65,700	$172,900	38%	$107,200	$10
Northampton-Amherst-Worcester (Rt. 9)	Northampton, Hadley, Amherst, Belchertown, Ware, West Brookfield, Brookfield, Leicester, Worcester	56	9,200	$49,500	$151,300	33%	$101,800	$11
Boston-Rutland, VT	Boston, Concord, Acton, N. Leominster, Fitchburg, Ashburnham, Winchendon, Jaffrey (NH), Keene (NH), Bellows Falls (VT), Springfield (VT), Chester (VT), Proctorsville (VT), Ludlow (VT), Rutland (VT)	183	11,700	$205,500	$494,300	42%	$288,800	$25

[1]The existing routes operate two roundtrips daily, so the costs were twice as high as the estimates for the alternatives, which were assumed to run one roundtrip daily. These higher costs generally resulted in a higher net operating deficit, a higher subsidy per boarding, and a lower farebox recovery ratio in comparison to the projected performance for the potential routes.

Note: The performance metrics in blue for the existing routes reflect annual estimates based on provider invoices (actual operating data) to MassDOT in late 2015 to Spring 2016. The projected performance of the intercity alternatives was based on the actual costs of the existing routes ($3.70 per revenue bus mile) and other assumptions (365 service days per year, 1 roundtrip daily, average passenger trip length of 80% of route, and revenue of $0.12 per passenger mile).

The average operating cost of the intercity alternatives that operate wholly within Massachusetts was $193,000 per year, while those that travel out of state cost approximately $486,000 per year. The difference was due to the length of the route—but in many cases the route will perform better if it connects to a larger population center with more connections to other places. The projected farebox recovery levels ranged from 21% to 48%, while the estimated subsidy per boarding ranged from $10 to $25. The cost, farebox recovery, and subsidy per boarding estimates for the alternatives were comparable to the metrics of the existing 5311(f) route from Hyannis to Provincetown.

When compared to the two new BusPlus routes, the intercity alternatives appeared to have lower operating costs, a higher farebox recovery, and a lower subsidy per boarding. However in FY 2016 the BusPlus routes operated two roundtrips per day, as opposed to one daily roundtrip assumed for the service alternatives. Also the existing Northampton-Worcester route had a much higher operating cost per mile ($9.31) than the $3.70 assumption used to estimate the alternatives' costs. The existing Albany-Springfield route provides a more direct connection between several Massachusetts towns that already have regional bus service. Therefore its original ridership estimate was on the low end to reflect the incremental ridership that would be drawn to more convenient service. However data from its first six months of service indicated that actual annual ridership may be 35% higher than originally anticipated, which boosted the route's performance in several benchmarks. The original estimate was based on a single daily round-trip, so the higher ridership may reflect the fact that twice as much service is being offered.

Intercity Bus Performance Metrics

The study team developed the following performance metrics based on peer intercity bus indicators from other states and input from the study's Technical Advisory Committee. These benchmarks were developed to reflect the likely demand and service characteristics of low frequency rural intercity bus routes that have relatively few riders traveling longer distances. Under the proposed metrics, RTD would consider an intercity bus route successful if it achieves:

- 10 boardings per trip or more on average (initial year 50% of goal, with full achievement by end of year two).
- $75 subsidy per boarding or less (for operating cost only).
- 25% farebox recovery or more (considering all farebox revenue, initial year 50% of goal, with full achievement by end of year two).
- $5.00 operating cost per bus-mile or less (for operating cost only).
- $0.25 revenue per passenger mile or more (initial year 50% of goal, with full achievement by end of year two).
- On-time performance of 90% or more of all scheduled trips departing the route origin within 15 minutes of the time shown in the published timetable.

The study team applied these benchmarks (except the on-time performance measure) to evaluate the existing 5311(f) and BusPlus operating funded services. The performance thresholds were also used to determine the feasibility of potential service options that have been proposed to meet unmet service needs. This performance evaluation was valuable to determine the productivity and cost-effectiveness of the service alternatives and help prioritize the alternatives for potential public investment in regional bus services. For example if a rural route was proposed to serve municipalities that have no current service, but its performance was not projected to meet the above thresholds, then it was considered infeasible to provide regional bus service because the costs were too high or the ridership too low.

Intercity Bus Performance Evaluation

Table 6-2 summarizes the results of the performance evaluation of the existing intercity routes and rural intercity alternatives. The figures that met the performance thresholds are shown in bold. As new routes require time to establish ridership, RTD should consider the new Northampton-Worcester and Albany-Springfield routes successful if they meet 50% of the goal for productivity (boardings per trip), farebox recovery, and revenue per passenger mile.

The performance of the existing BusPlus routes was based on actual operating data reported in the provider invoices to MassDOT in the first several months of operation, except for revenue per passenger mile as the MassDOT invoices currently do not collect passenger miles. On-time performance could not be evaluated at this time because data was not available for the existing routes. RTD will evaluate this measure in the future for any proposed service options following implementation.

Of the three existing intercity bus routes, Hyannis-Provincetown had the best performance, meeting all the performance standards for which there is available data. Currently RTD does not collect passenger-mile or revenue passenger-mile data, or on-time performance. It was expected that this route would perform well because it is the only established route, whereas the other two existing routes were in their first year of operation at the time of evaluation.

Taking into account the 50% goal for the initial year of service, the Albany-Springfield route met all performance benchmarks. RTD should monitor the Albany-Springfield route to ensure it keeps working toward the full performance goals by the end of year two. Potential strategies to improve performance include reducing service to a single daily roundtrip timed to offer good connections, or raising fares to levels more typical of market-based services, which should improve farebox recovery. The Northampton-Worcester route did not meet any performance thresholds based on the reported data, except possibly for revenue per passenger mile, which was based on MassDOT policy. With limited Section 5311(f) funding for future rural intercity projects, this route is likely to be discontinued at the end of the current contract.

The projections for the potential intercity routes indicated that nearly all the alternatives met the performance benchmarks, based on the assumed service level of a single round-trip per day. The Sheffield-Springfield route was the exception, namely because it had the lowest projected ridership. Part of this alternative, from Lenox to Springfield, is already served by regional bus so the incremental ridership is expected to come from new stops in Sheffield, Great Barrington, and Stockbridge, all of which have relatively small populations.

Table 6-2: Performance Evaluation of Existing and Potential Intercity Bus Routes

Route	Boardings per Trip (>= 10)	Subsidy per Boarding (<= $75)	Farebox Recovery (>= 25%)	Operating Cost per Bus-Mile[1] (<= $5.00)	Revenue per Passenger Mile[2] (>= $0.25)	On-time Performance (>= 90%)
Existing Intercity Route						
Northampton-Twin Cities-Worcester	2	$519	1%	$9.31	**$0.12**	TBD
Albany-Williamstown-Greenfield-Springfield	**6**	**$67**	**14%**	**$3.74**	**$0.12**	TBD
Hyannis-Provincetown local	**11**	**$12**	**28%**	**$3.70**	$0.12	TBD
Potential Intercity Route						
Sheffield-Springfield	8	**$22**	21%	**$3.70**	$0.12	TBD
Williamstown-Springfield-Boston	**10**	**$21**	**25%**	**$3.70**	$0.12	TBD
Pittsfield-Springfield-Boston	**11**	**$13**	**28%**	**$3.70**	$0.12	TBD
Albany-Williamstown-Boston (Rt. 2)	**18**	**$19**	**48%**	**$3.70**	$0.12	TBD
Greenfield-Boston	**15**	**$18**	**40%**	**$3.70**	$0.12	TBD
Winchendon-Boston	**15**	**$10**	**38%**	**$3.70**	$0.12	TBD
Northampton-Amherst-Worcester	**13**	**$11**	**33%**	**$3.70**	$0.12	TBD
Boston-Rutland, VT	**16**	**$25**	**42%**	**$3.70**	$0.12	TBD

[1]The operating cost per bus-mile for the existing Northampton-Worcester and Albany-Springfield routes was based on actual costs in the first 5-8 months of operation; the cost for the existing Hyannis-Provincetown route was based on the proposed cost in the operator's grant agreement with MassDOT. The existing costs of the Albany-Springfield and

[2]The revenue per passenger mile for the existing routes was based on existing fares. The same revenue per passenger mile was used to estimate the revenue and subsidies for the intercity alternatives.

Notes: The performance metrics in blue for the existing routes reflect annual estimates based on provider invoices (actual operating data) to MassDOT in late 2015 to Spring 2016. Figures in bold meet the performance thresholds. Shown in italics, the new BusPlus routes in their first year of operation (Northampton-Worcester and Albany-Springfield) were considered successful if they met 50% of the performance standard for boardings per trip, farebox recovery, and revenue per passenger mile. Aside from the operating cost per mile and the revenue per mile, the other performance measures are estimates based on several assumptions. The on-time performance of the routes is "to be determined" (TBD) when data becomes available to RTD.

Commuter Bus Routes

The study team evaluated one currently funded commuter bus route and nine commuter service alternatives against the commuter bus performance metrics. The performance of the existing Marlborough-Boston route and the projected performance of the service alternatives were based on the following assumptions:

- Cost of $11.80 per revenue bus mile[5], which was multiplied by the number of roundtrip miles for the route.
- Service 254 days per year, assuming weekday service only.
- 2 roundtrips per day.
- Average passenger trip length of 50% of the route length, as most of the routes have intermediate stops and passengers may only ride for a portion of the route. For the Milford-Boston alternative, it was assumed that passengers would ride the entire length of the route (no proposed intermediate stops). For the Shrewsbury-Hudson-Boston and Lowell-Waltham alternatives, an average passenger trip length of 80% of the route length was used.[6]
- Revenue of $0.17 per passenger mile.[7]

Actual operating data from the provider invoices to MassDOT were available for the Marlborough-Boston route. For the commuter alternatives, the study team developed the ridership estimates using commuting and employment data[8] available from the U.S. Census Bureau. The 2006-2010 American Community Survey provided the most recent town-to-town commute flow data available for Massachusetts. The study team first summed the total commuters traveling between origin and destination pairs along the commuter route. Then an estimated transit mode share of 3% was applied to the total number of commuters in the corridor to estimate the number of daily commuters that would likely use commuter bus. This assumption was based on data on commute mode splits by town in Massachusetts, which found that transit mode shares ranged from 2% to 5%.[9] The number of daily commuters that would use transit was then multiplied by 254 service days to estimate annual ridership. Note that commute flows where direct commuter rail service exists, such as from Worcester to Boston, were excluded from the ridership estimate assuming these commuters would continue to use rail service.

Table 6-3 presents the estimated annual ridership, revenue, and costs for the commuter bus alternatives that are potentially eligible for CMAQ funding, in comparison to the performance of the existing commuter route that is receiving operating assistance through the BusPlus program.

[5] Based on the actual cost for the existing Marlborough-Boston route, which receives operating and capital assistance through the BusPlus program.

[6] Average passenger trip length, used to estimate total revenue, was based on commute flow data along the route. For example, if the largest commute flows traveled only a portion of the route rather than end to end, an estimated 50% of the total route length was used. Most alternatives fell in this category. Some alternatives had significant commute flows for the whole of the route, along with notable commute flows for a portion of the route, so an estimated 80% of the total route length was used.

[7] Calculated using current fares for existing commuter bus routes, including the BusPlus supported routes and non-subsidized routes. This revenue of $0.17 per passenger mile was the average fare per mile based on the cost of 10-ride passes where available. This revenue per passenger mile, less than the performance standard of $0.25, was used to develop a conservative estimate of revenue projections for the service alternatives. It is anticipated that new services are able meet the full performance standard by the end of their second year of operation.

[8] *Table 3. Residence MCD/County to Workplace MCD/County Flows for the United States and Puerto Rico Sorted by Residence Geography: 2006-2010*, retrieved from http://www.census.gov/population/metro/data/other.html.

[9] Goodman, Michael, Dana Ansel, and Robert Nakosteen. *Mass.Commuting.* October 2004. Web. September 2015. Appendix C of the report provided Census 2000 data on the share of workers taking public transportation to work, by town of residence. The study team reviewed the transit mode share for all towns that currently have commuter bus service and found the transit mode split ranged from 2% to 5%.

Table 6-3: Annual Ridership, Revenue, and Cost for Existing and Potential Commuter Bus Routes

Route	Stops	One-Way Miles	Ridership[1]	Revenue	Operating Cost	Farebox Recovery	Net Operating Deficit	Subsidy Per Boarding
Existing Commuter Route								
Marlborough-Boston	Marlborough, Framingham, Boston	38	4,900	$28,800	$448,200	6%	$419,400	$85
Potential Commuter Route								
Add Shrewsbury to Marlborough-Boston BusPlus route	Shrewsbury (new), Marlborough, Framingham, Boston	13	13,500	$14,900	$155,900	10%	$141,000	$10
Shrewsbury-Hudson-Boston	Shrewsbury, Hudson, Boston	52	10,600	$75,000	$623,400	12%	$548,400	$52
Webster-Boston	Webster, Worcester, Shrewsbury, Boston	63	17,300	$92,600	$755,300	12%	$662,700	$38
Southbridge-Boston	Southbridge, Sturbridge, Worcester, Boston	70	12,600	$75,000	$839,200	9%	$764,200	$61
Milford-Boston	Milford, Boston	39	5,200	$34,500	$467,600	7%	$433,100	$83
Quincy-Waltham (Route 128 South to Route 128 Central)	Quincy, Braintree, Norwood, Needham, Newton (Riverside), Waltham	40	23,600	$80,200	$479,600	17%	$399,400	$17
Lowell-Waltham (Route 3 to Route 128 Central)	Lowell, Burlington, Lexington, Waltham	23	22,700	$71,000	$275,700	26%	$204,700	$9
Framingham to Burlington (MA Turnpike West to Route 128 Central)	Framingham, Burlington, Lexington, Waltham	29	12,400	$30,600	$347,700	9%	$317,100	$26
Gloucester-Waltham (Route 128 North to Route 128 Central)	Gloucester, Danvers, Peabody, Burlington, Lexington, Waltham	50	17,600	$74,800	$599,400	12%	$524,600	$30

[1]Estimate based on 3% transit mode share. *Mass.Commuting* report indicated towns that have existing commuter bus service have transit mode shares ranging from 2% to 5% for commute trips. Commuters who currently have direct commuter rail service were excluded from the ridership estimates, assuming these commuters would continue to use rail service.

Note: The performance metrics in blue for the existing route reflect annual estimates based on provider invoices (actual operating data) to MassDOT in late 2015 to Spring 2016. The projected performance of the commuter alternatives was based on the actual costs of the existing route ($11.80 per revenue bus mile) and other assumptions (254 service days per year, 2 roundtrips daily, average passenger trip length of 50% of route, and revenue of $0.17 per passenger mile).

The commuter alternatives ranged in length from 13 miles to 70 miles, where the shortest alternative extended the existing Marlborough-Boston route to Shrewsbury and the longest alternative connected Central Massachusetts (Southbridge and Sturbridge) to Boston. Estimated annual ridership ranged from about 5,200 on the Milford-Boston route to 23,600 on the Quincy-Waltham alternative serving Route 128. Excluding the incremental cost to extend commuter service to Shrewsbury, the commuter alternatives had an average annual operating cost of $548,000. The projected farebox recovery levels for the commuter alternatives ranged from 7% to 26%, while the estimated subsidy per boarding ranged from $9 to $83. On average the commuter alternatives performed better than the existing Marlborough-Boston route in most categories because the actual ridership reported on the Marlborough-Boston route was less than one-third of the original projection, and the actual costs were slightly higher than originally proposed.

Commuter Bus Performance Metrics

The study team developed the following benchmarks in part to provide comparability to the performance of Massachusetts Bay Transportation Authority (MBTA) commuter rail services. The study's Technical Advisory Committee also provided input on the commuter bus performance metrics. RTD would consider a commuter bus route successful if it achieves:

- 20 boardings per trip or more on average (initial year 50% of goal, with full achievement by end of year two).
- $15 subsidy per boarding or less (for operating cost only).
- 40% farebox recovery or more (considering all farebox revenue, initial year 50% of goal, with full achievement by end of year two).
- $12.00 operating cost per revenue-mile or less.[10]
- $0.25 revenue per passenger mile or more (initial year 50% of goal, with full achievement by end of year two).
- On-time performance of 90% or more of all scheduled trips arriving at the route terminal within 10 minutes of the time shown in the published timetable.
- 75% or more of passengers who would otherwise drive single occupancy vehicles (ridership diverted to bus).

The study team applied these benchmarks to evaluate the existing Marlborough-Boston route receiving BusPlus operating assistance, recognizing that new subsidized services typically require two years of operation to establish their market. The performance thresholds were also used to determine

[10] It is expected that most projects will have a lower operating cost per revenue-mile, but the peak-only nature of commuter service combined with potentially long deadhead trips to reach pick up points can result in high costs per mile.

if the service alternatives, developed in response to unmet service needs, would be feasible for RTD support in terms of productivity and cost-effectiveness.

Commuter Bus Performance Evaluation

Table 6-4 summarizes the results of the performance evaluation of the existing commuter route and the commuter bus alternatives. The figures that met the performance thresholds are shown in bold. RTD should consider the new Marlborough-Boston route successful if it meets 50% of the goal for productivity (boardings per trip), farebox recovery, and revenue per passenger mile.

On-time performance and the percentage of riders that switch from single occupancy vehicles (SOV) could not be evaluated at this time because data was not available. RTD will evaluate these measures in the future for any proposed routes following implementation.

Still in its first year of operation, the existing Marlborough-Boston route only met the benchmarks for operating cost per revenue mile and revenue per passenger mile. In productivity, subsidy per boarding, and farebox recovery, the Marlborough-Boston route did not meet the 50% first year goals. RTD will no longer be providing state funding for BusPlus operating projects, and the low performance of this route means that it is unlikely that it will be continued by the carrier, or by another transportation agency with different funding sources.

The projections for the potential commuter routes indicated that two alternatives met multiple performance benchmarks. The Route 128 commuter options from Lowell to Waltham and from Quincy to Waltham had the highest projected boardings per trip and among the lowest subsidies per boarding.

A few different issues affected the relatively low performance of several commuter bus alternatives. Some of the alternatives sought to provide a direct connection from origins with relatively small populations such as Webster and Southbridge to Boston, which translated to smaller potential markets to begin with. Some alternatives had strong commute demand but only for portions of the route, serving more local/regional commutes rather than long-distance commutes, which would generate more revenue. Some alternatives were also developed to meet needs for suburb to suburb commutes, which are difficult to serve while providing attractive (direct and fast) service because the origins and destinations are dispersed. The Lowell-Waltham and Quincy-Waltham alternatives performed well mainly because their ridership projections were high despite these factors, and the routes were not too long. Therefore the anticipated revenues could offset the projected operating costs, resulting in lower subsidies per boarding.

It should be noted that if any of these alternatives is selected for further consideration, more detailed service planning could result in significantly different cost or ridership estimates. Some of the commuter service options also provide coverage to the same areas, and it is recommended that service to those areas be provided by only one option.

Table 6-4: Performance Evaluation of Existing and Potential Commuter Bus Routes

Route	Stops	Boardings per Trip (>= 20)	Subsidy per Boarding (<= $15)	Farebox Recovery (>= 40%)	Operating Cost per Revenue-Mile (<= $12.00)[1]	Revenue per Passenger Mile (>= $0.25)[2]	On-time Performance (>= 90%)	Passengers shifted from SOV (>= 75%)
Existing Commuter Route								
Marlborough-Boston	Marlborough, Framingham, Boston	5	$85	6%	**$11.80**	**$0.17**	TBD	TBD
Potential Commuter Routes								
Add Shrewsbury to Marlborough-Boston BusPlus route	Shrewsbury (new), Marlborough, Framingham, Boston	13	**$10**	10%	**$11.80**	$0.17	TBD	TBD
Shrewsbury-Hudson-Boston	Shrewsbury, Hudson, Boston	11	$52	12%	**$11.80**	$0.17	TBD	TBD
Webster-Boston	Webster, Worcester, Shrewsbury, Boston	17	$38	12%	**$11.80**	$0.17	TBD	TBD
Southbridge-Boston	Southbridge, Sturbridge, Worcester, Boston	13	$61	9%	**$11.80**	$0.17	TBD	TBD
Milford-Boston	Milford, Boston	5	$83	7%	**$11.80**	$0.17	TBD	TBD
Quincy-Waltham (Route 128 South to Route 128 Central)	Quincy, Braintree, Norwood, Needham, Newton (Riverside), Waltham	**23**	$17	17%	**$11.80**	$0.17	TBD	TBD
Lowell-Waltham (Route 3 to Route 128 Central)	Lowell, Burlington, Lexington, Waltham	**23**	**$9**	26%	**$11.80**	$0.17	TBD	TBD
Framingham to Burlington (MA Turnpike West to Route 128 Central)	Framingham, Burlington, Lexington, Waltham	12	$26	9%	**$11.80**	$0.17	TBD	TBD
Gloucester-Waltham (Route 128 North to Route 128 Central)	Gloucester, Danvers, Peabody, Burlington, Lexington, Waltham	17	$30	12%	**$11.80**	$0.17	TBD	TBD

[1]The operating cost per bus-mile for the potential routes was based on the actual cost for the existing Marlborough-Boston route.

[2]The revenue per passenger mile for the routes was based on current fares for existing commuter bus routes in Massachusetts (mostly non-subsidized routes). This revenue of $0.17 per passenger mile was the average fare per mile based on the cost of 10-ride passes where available.

Notes: The performance metrics in blue for the existing route reflect annual estimates based on provider invoices (actual operating data) to MassDOT in late 2015 to Spring 2016. Figures in bold meet the performance thresholds. The Marlborough-Boston route was considered successful (shown in italics) in its first year of operation if it met 50% of the performance standard for boardings per trip, farebox recovery, or revenue per passenger mile. Aside from the operating cost per mile and the revenue per mile, the other performance measures were estimates based on several assumptions. The on-time performance and the percentage of passengers shifted from single occupancy vehicles (SOV) are "to be determined" (TBD) when data becomes available to RTD.

SERVICE RECOMMENDATIONS

The study's service recommendations were based on operating funding sources such as Section 5311(f) for rural intercity bus routes and CMAQ and Section 5307 for commuter bus routes. The service prioritization was based on four factors: estimated annual ridership, subsidy per boarding, farebox recovery ratio, and existing level of service in the corridor. These factors were selected to reflect priorities to extend the regional bus network to places currently without service and to serve as many new riders as possible in a cost-effective manner.

This section also outlines several service recommendations that met needs identified through the service standards evaluation, the planning guidelines evaluation, and public input. These additional recommendations include service changes that RTD may request of the BusPlus lease carriers in return for the use of the buses, routes that the private carriers might consider given potential markets, and routes for the RTAs to consider based on unmet needs.

Rural Intercity Bus Routes

Table 6-5 presents the study team's prioritization of the rural intercity bus routes, which are mapped in Figure 6-1. The currently funded BusPlus intercity routes were included in the prioritization process to determine how they compared with the proposed alternatives. The routes are shown in order of priority from high to low based on their overall score, which was the sum of their scores for each of the four factors, with equal weighting on each factor. Going forward, as RTD shifts the program to Section 5311(f) funding it should select the best projects that are likely to meet ridership and cost-effectiveness standards. In FY 2015 the amount of the 15% set aside for the FTA allocation ($3.6 million) was $545,163.

The evaluation of proposed projects may consider the positive aspects of continuing to support existing routes as long as they are meeting performance standards, as they have had some time to build ridership. This includes continuing to fund the Hyannis-Provincetown local route, which has an estimated net operating deficit of $193,000.

RTD should also consider supporting the existing Albany-Springfield route through Section 5311(f). While this route ranked lower than other alternatives, it did meet the performance standards for its initial year of service. However if RTD elects to support the Albany-Springfield route through Section 5311(f), the operating costs will need to be reduced to fit the funding constraint (about $352,000, if the Hyannis-Provincetown route is funded). Since the route's actual ridership was higher than initial projections, the study team anticipates that the route will still meet the full performance goals by the end of year two, even with service cuts (e.g., decreasing to one roundtrip per day).

Table 6-5: Prioritization of Intercity Bus Routes in Massachusetts

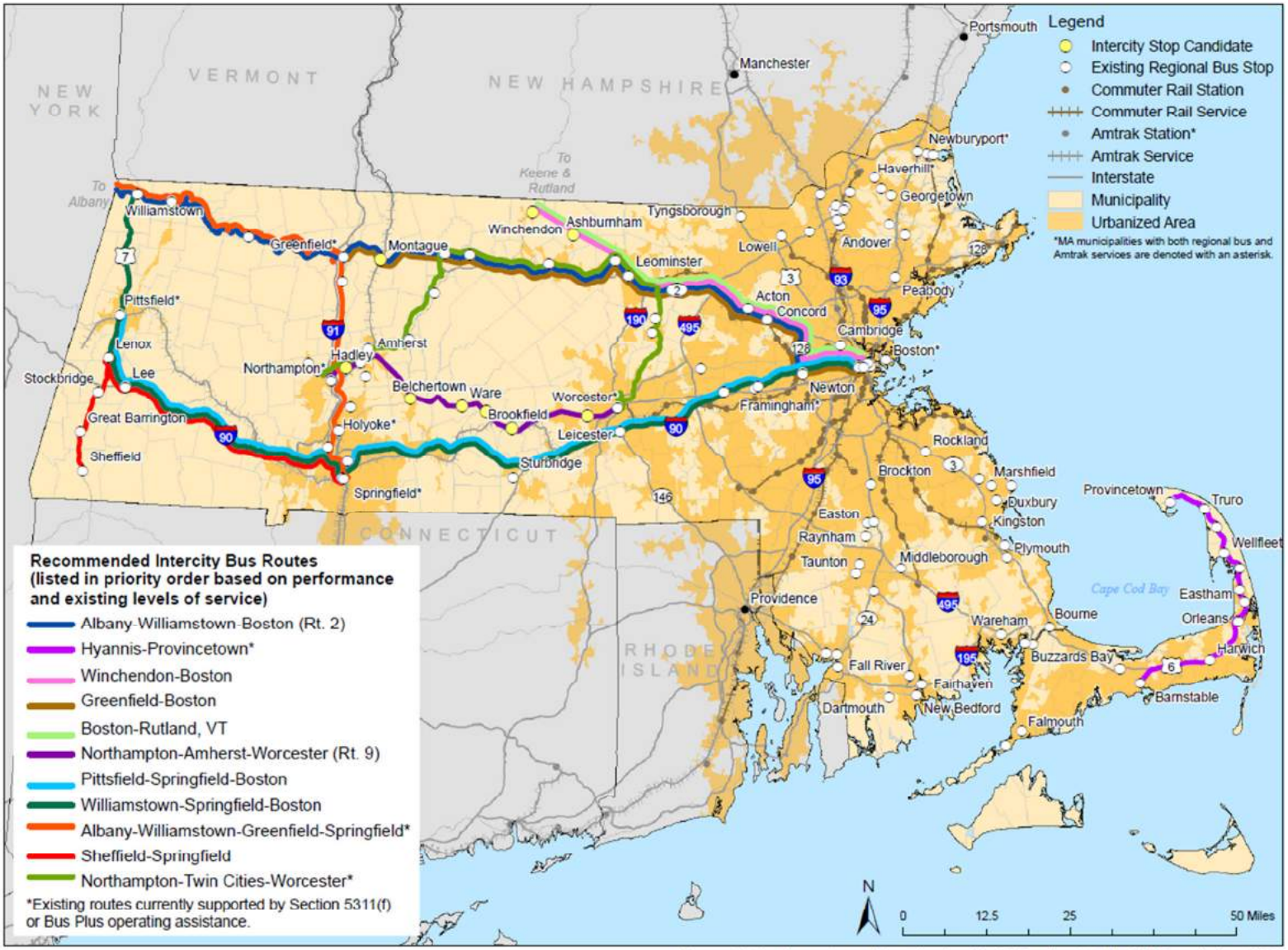
Route	Estimated Ridership	Ridership Points	Subsidy per Boarding	Subsidy per Boarding Points	Farebox Recovery	Farebox Recovery Points	Existing Level of Service (LOS)[1]	Existing LOS Points	Total Score	Overall Ranking
Albany-Williamstown-Boston (Rt. 2 Local)	13,450	10	$19	6	48%	11	3	3	30	1
Hyannis-Provincetown local*	16,020	11	$12	9	28%	6	4	4	30	1
Winchendon-Boston	10,700	7	$10	11	38%	8	3	3	29	3
Greenfield-Boston	11,150	8	$18	7	40%	9	3	3	27	4
Boston-Rutland, VT	11,700	9	$25	3	42%	10	4	4	26	5
Northampton-Amherst-Worcester (Rt. 9 Local)	9,200	6	$11	10	33%	7	2	2	25	6
Pittsfield-Springfield-Boston	7,800	4	$13	8	28%	6	1	1	19	7
Williamstown-Springfield-Boston	7,100	3	$21	5	25%	4	1	1	13	8
Albany-Williamstown-Greenfield-Springfield*	8,800	5	$67	2	14%	2	3	3	12	9
Sheffield-Springfield	5,800	2	$22	4	21%	3	1	1	10	10
Northampton-Twin Cities-Worcester*	2,500	1	$519	1	1%	1	4	4	7	11

[1]Existing Level of Service Categories: 4 = No current service over majority of route, 3 = No current service over portions of route, some towns have service, 2 = Minimal new coverage improves connectivity, 1 = Existing service requires two or more intercity transfers to Boston or NYC

*Routes currently supported by Section 5311(f) or Bus Plus operating assistance. These routes operate two roundtrips daily, so the costs are twice as high as the estimates for the alternatives, which were assumed to run one roundtrip daily. These higher costs resulted in a higher subsidy per boarding and a lower farebox recovery ratio in comparison to the projected performance for the alternatives.

Notes: The performance metrics in blue for the existing routes reflect actual operating data (from provider invoices to MassDOT). For the two routes that currently have BusPlus operating agreements, annualized performance was based on actual operating statistics for the first 5-8 months of service; however the existing LOS evaluation was conducted as if the service had not been implemented so the routes could be compared with the proposed alternatives. Also, several of these service options provide coverage to the same areas, and service to those areas would be provided by only one option. For example, the Albany-Williamstown-Boston (Route 2 Local) option provides coverage to the Williamstown-Greenfield segment, and includes points served by the Greenfield-Boston and Winchendon-Boston routes. As it serves more points that currently do not have service, its projected ridership is higher.

Figure 6-1: Recommended Intercity Bus Routes



Source: Existing bus routes and stops developed by CTPS and updated by KFH Group in June 2015.

The advantage of funding the existing service is that ridership has already had some time to develop, and higher net operating deficits of new routes in the first years of service may be avoidable. However, if there are proposals to operate other services with a higher priority and anticipated higher performance, MassDOT may well consider them as alternatives to the two existing routes. Note MassDOT will need to conduct more detailed service planning (e.g., turn by turn routing, exact stop locations) if it moves forward with implementing new routes.

The recommendations were based on the assumption that federal funds would be used to pay the entire net deficit using the in-kind funding method, which would require designing these services to make a meaningful connection with unsubsidized routes that are part of the national intercity network. RTD will need to include the use of in-kind match, and the related requirements, as part of its Section 5311(f) solicitation. While the proposed funding level will support only limited service, RTD could consider this as a first phase implementation, with subsequent implementation of other corridors, if Section 5311(f) funding increased (as a result of the Fixing America's Surface Transportation Act, or FAST Act), or state funding for operating assistance (either as match for 5311(f) operating or for 100% state-funded service) became available.

Subsequent phases of implementation, if the initial routes are successful, could include other corridors with lower priorities based on the factors used in the prioritization process. If MassDOT's Section 5311(f) funding increases slightly, or state funding for match became available, the third ranked Winchendon-Boston route, with a projected net operating deficit of $107,000, could be funded. If New Hampshire and/or Vermont provided funding this route could be extended to Rutland, Vermont via Keene, New Hampshire. Alternatively, the Route 9 local between Northampton, Amherst, and Worcester, currently unserved between the endpoints, could potentially be funded as it has a relatively low projected net operating deficit of $102,000. Another lower ranked option, the Pittsfield-Springfield-Boston service, would eliminate one transfer and a long wait on service between the Berkshires and Boston.

Commuter Bus

The study team's prioritization of the commuter bus routes, based on the same four factors, is shown in Table 6-6 and mapped in Figure 6-2. The routes are shown in order of priority from high to low based on their overall score. The existing Marlborough-Boston route was included in the prioritization process to determine how it compared with the proposed alternatives.

The top ranked commuter routes were those in the Route 128 corridor. The Lowell-Waltham (Route 3 to Route 128 Central) and Quincy-Waltham (Route 128 South to Route 128 Central) routes merit consideration for initial implementation possibly with CMAQ or Section 5307 funding, if the private carriers provide their operating statistics to the FTA National Transit Database. Again, MassDOT will need to complete more detailed service planning, including identifying specific stop locations, if it moves forward with implementation.

Table 6-6: Prioritization of Commuter Bus Routes in Massachusetts

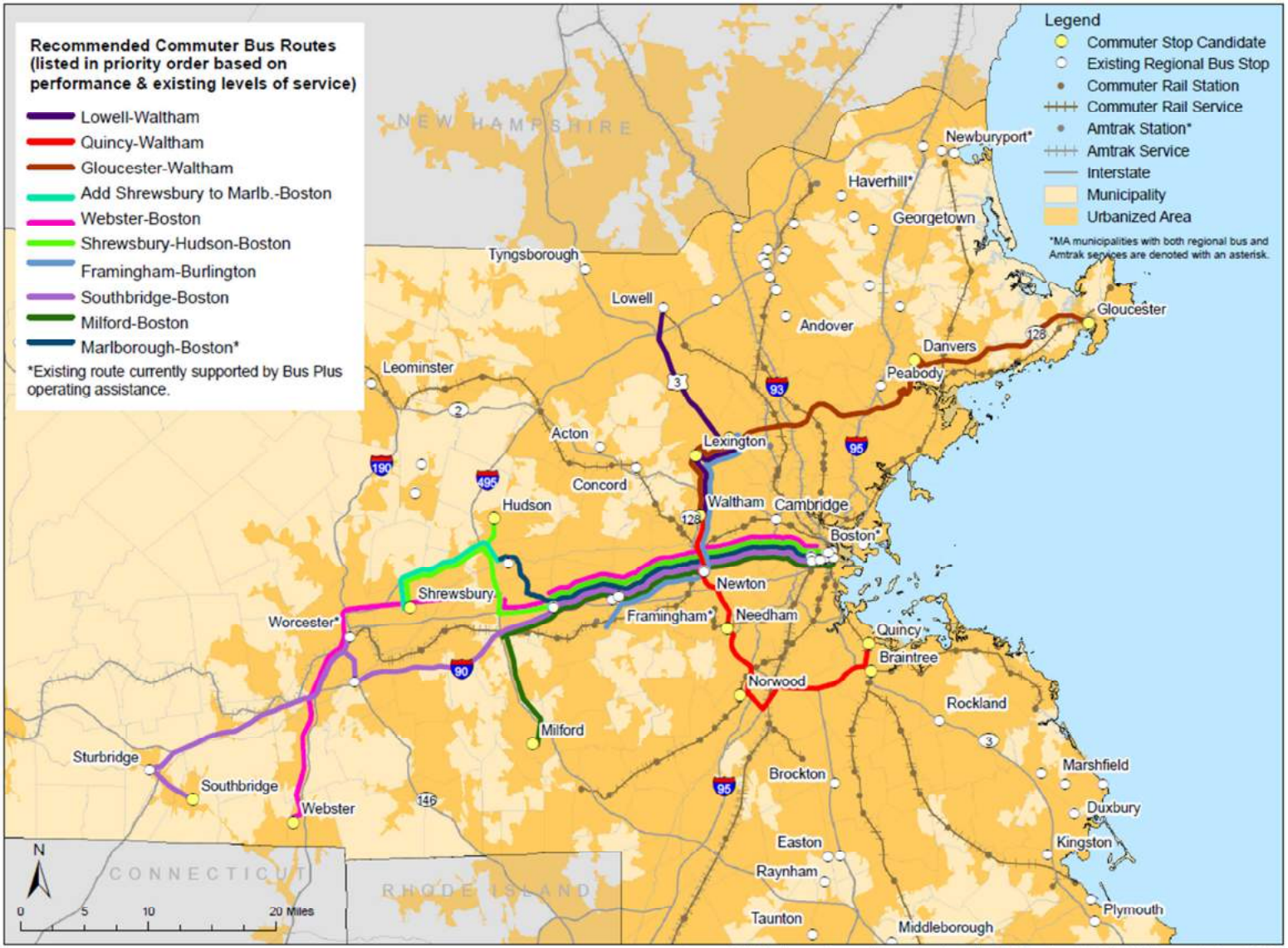
Route	Estimated Ridership	Ridership Points	Subsidy per Boarding	Subsidy per Boarding Points	Farebox Recovery	Farebox Recovery Points	Existing LOS[1]	Existing LOS Points	Total Score	Overall Ranking
Lowell-Waltham (Route 3 to Route 128 Central)	22,700	9	$9	10	26%	10	3	3	32	1
Quincy-Waltham (Route 128 South to Route 128 Central)	23,600	10	$17	8	17%	9	3	3	30	2
Gloucester-Waltham (Route 128 North to Route 128 Central)	17,600	8	$30	6	12%	8	2	2	24	3
Add Shrewsbury to Marlborough-Boston BusPlus rt.	13,500	6	$10	9	10%	5	2	2	22	4
Webster-Boston	17,300	7	$38	5	12%	8	1	1	21	5
Shrewsbury-Hudson-Boston	10,600	3	$52	4	12%	8	4	4	19	6
Framingham to Burlington (MA Turnpike West to Route 128 Central)	12,400	4	$26	7	9%	4	2	2	17	7
Southbridge-Boston	12,600	5	$61	3	9%	4	3	3	15	8
Milford-Boston	5,200	2	$83	2	7%	2	1	1	7	9
Marlborough-Boston*	4,900	1	$85	1	6%	1	1	1	4	10

[1]Existing Level of Service Categories: 4 = No current service over majority of route, 3 = No current service over portions of route, some towns have service, 2 = Existing service requires two or more transfers to destination, or requires significant out of direction travel, 1 = Existing service via local transit (RTA or transportation management association) or MBTA connections to regional bus or commuter rail

*Route currently supported by Bus Plus operating assistance.

Note: The performance metrics in blue for the existing route reflect actual operating data (from provider invoices to MassDOT). For the Marlborough-Boston route that currently has a BusPlus operating agreement, this evaluation was conducted as if the service had not been implemented so the routes could be compared with the proposed alternatives.

Figure 6-2: Recommended Commuter Bus Routes



Source: Existing bus routes and stops developed by CTPS and updated by KFH Group in June 2015.

The Marlborough-Boston route did not meet the 50% performance goals in its first year of operation. Based on its performance, MassDOT should discontinue the existing route in its current form—potentially its performance could be improved through alternative routing, additional parking capacity, or even extension to service additional markets (Shrewsbury), but such changes would require a new funding source.

Under the FAST Act, Massachusetts' estimated FY 2016-FY 2020 apportionments for the CMAQ program total $328,935,103, or an average of $65.8M annually.[11] CMAQ projects are funded with 80% federal assistance and 20% state or local match. In Massachusetts the MPOs and regional commissions use part of the CMAQ apportionment for regional projects included in their Transportation Improvement Programs (TIPs). In addition MassDOT has a statewide CMAQ program, under which the recommended commuter bus routes would be eligible projects. Implementation of the recommended commuter routes will depend on the amount of funding available in MassDOT's statewide CMAQ program, or local selection of these projects for inclusion in regional TIPs.

Potential Alternative Service Obligations for Carriers Operating BusPlus Vehicles

Since 2014 RTD has provided 46 coaches to Massachusetts carriers at no cost, in return for commitments from the carriers to provide specified service improvements—either new service to areas not previously served, or expansion of existing services in terms of frequency, span, or route coverage. The service and maintenance agreements between MassDOT and the carriers have a two year term, with MassDOT renewal anticipated unless other terms of the agreement are not met. Carriers can apply to seek an amended agreement with alternative services if they feel that there is not sufficient ridership/revenue and another alternative would be more productive. Based on the analysis in this study, RTD could direct any carrier seeking to amend its service obligations to consider choosing from among the following service alternatives:

- I-91 additional service, Greenfield-Springfield express, with a possible stop in Northampton[12]
- Sturbridge-Boston[13]
    - Option A: Adjust existing schedule for earlier departure to provide full day trip to Boston
    - Option B: Add one roundtrip for day trip in Sturbridge (may be seasonal)
- Add second roundtrip to North Andover – Boston[14]
- Add second roundtrip to Duxbury on Duxbury – Boston[15]

[11] U.S. Department of Transportation, Federal Highway Administration. *Summary of Estimated FY 2016 – FY 2020 Apportionments under the Conference Report for H.R. 22 (FAST ACT).* 1 December 2015. Web. February 2016.
[12] Greyhound currently provides service in this corridor as part of the BusPlus program. Peter Pan also operates service in the corridor and is a BusPlus carrier.
[13] Peter Pan currently provides service in this corridor as part of the BusPlus program.
[14] The Merrimack Valley Regional Transit Authority currently operates this route outside of the BusPlus program.
[15] Plymouth & Brockton currently operates this route and is a BusPlus carrier.

MassDOT has not required the carriers to report ridership and fare revenue data for the existing service obligations under the BusPlus capital assistance program. However the study team developed operating cost estimates for the existing service obligations (see Appendix G, Table G-1), which ranged from $88,000 to $583,000 annually, and the recommended service changes.[16] The analysis found that the above service changes are comparable in cost ($105,000-$192,000 annually[17]) to the existing service obligations. The exception is the option to adjust the schedule for the existing Sturbridge-Boston service, which is not anticipated to incur additional operating expenses. These recommendations would address several unmet needs, as described in the previous chapter.

Routes for Private Carriers Based on Potential Markets

The study team recommends several routes for the private carriers to consider based on public and user input regarding desired service improvements. These services would address various unmet needs identified through this study, described in the last chapter. Potential Section 5307 funding could be provided to the private carriers based on inclusion of their operating statistics in the FTA National Transit Database, though many of the projects represent potential service improvements or changes to services that are already provided without state or federal assistance. The recommended routes for the private carriers to consider include:

- Amherst/Northampton-Boston Logan express
- Provincetown-Hyannis-Boston Logan express
- Boston-New Hampshire local service (northbound)
- Worcester-New York City (no transfer in Hartford)
- I-91 corridor direct to New York City (no transfer in Springfield)

Some private carriers already serve these corridors, but may consider expanding or modifying services to meet the needs identified through this study. For example, Peter Pan operates college express service from Amherst and Northampton to Boston South Station (and New York City), but the service only operates on Fridays and Sundays during the school year. Based on study input, there may be a market for daily service throughout the year.

As another example, Boston Express currently serves the Route 3 corridor, connecting Boston and Manchester, NH. While the current route stops in Tyngsborough, the recommended route serves Burlington, a job center, and Lowell, a common trip generator identified in public surveys. As riders traveling from New Hampshire to Boston would not likely accept additional stops on the existing route (southbound), implementation of local service to destinations north of Boston, or reverse commute trips from Boston route may require additional service.

[16] The cost estimates were developed using the same costs per revenue bus mile used to estimate costs for the intercity and commuter route alternatives and the days and frequency of service outlined in each BusPlus agreement. The new recommended service changes were assumed to operate one roundtrip daily.

[17] Based on same assumptions used to develop the cost estimates for the service alternatives. The I-91 and Sturbridge services were considered intercity, while the North Andover and Duxbury services were considered commuter.

Routes for RTAs Based on Unmet Needs

A large portion of the needs identified through the existing studies, the stakeholder input, and the public input were more local in nature, requesting services within one region or between adjacent RTA service areas. When developing service alternatives, the study team identified several routes that were too short to be considered regional bus, as defined in this study. However, these routes address various unmet needs or public requests for additional service and may be considered for implementation by the RTAs. Table 6-7 lists the routes that were identified in existing studies and stakeholder and public input.

Table 6-7: Regional Routes for RTA Consideration

Geographic Area	Regional Route to Address Unmet Needs or Service Expansions/Improvements
Western Massachusetts	Amherst-Springfield express
	Ware-Holyoke Community College for day trip
Central Massachusetts	Hudson-Stow-Maynard-Acton
	Franklin-Bellingham-Milford
	Lowell-Springfield
	Westford-Littleton-Devens
	Fitchburg-Worcester-Springfield
	Worcester-Fall River-New Bedford
	Connections between WRTA and PVTA
Eastern Massachusetts	Route 114 corridor to North Shore
	Lowell-Newburyport
	Stoneham-Reading
	Taunton-Brockton
	Taunton-Fall River
	Wareham-New Bedford
	Plymouth/Wareham-Hyannis
	New Bedford-Taunton
	Connections between MVRTA and LRTA

Table 6-8 summarizes possible routes with good potential commuter demand[18] by employment cluster.

[18] These origin-destination pairs had a total number of commute trips that met the planning guideline for potential demand to support two roundtrips per day at a 50% load factor. Number of commuter trips based on 2006-2010 town-to-town commute flow data from the American Community Survey.

Table 6-8: Commuter Routes for RTA Consideration

Employment Cluster	Origin	Destination
Boston/Cambridge	Foxborough	Boston/Cambridge
	Hanover	Boston/Cambridge
	Wayland	Boston/Cambridge
128 South	Brockton	Canton
Pioneer Valley	Belchertown	Springfield
I-495 Corridor	Shrewsbury	Westborough
	Worcester	Marlborough
	Worcester	Northborough
Worcester	Leominster	Worcester
	Rutland	Worcester
	Holden	Worcester
South Coast	Westport	Fall River
Providence, RI	Fall River	Providence
	Seekonk	Providence

The private carriers are already serving a few of these corridors, but the existing service may serve a different purpose, with different schedules or fare levels than service that would meet the needs identified by the public. With more narrow service areas than the private carriers, the RTAs may be able to tailor services to better meet local needs.

Some connections requested through public input were already served by the RTAs or the private carriers. These routes could be candidates for service improvements including additional service, and would benefit from expanded marketing efforts to ensure the public is aware of them:

- Greenfield to Northampton express (Peter Pan and Greyhound)
- Greenfield to Amherst (Peter Pan)
- Northampton/Amherst to Springfield express (Peter Pan and Greyhound)
- Amherst to Holyoke (PVTA)
- Holyoke to Springfield express (PVTA)
- Lowell to Worcester (Peter Pan)
- Worcester to Providence, RI (Peter Pan)
- Taunton to Fall River (Peter Pan)
- Taunton to New Bedford (DATTCO)
- Lowell to Burlington (LRTA)
- Lowell to Westford (LRTA)
- Gardner to Fitchburg (MRTA)

OTHER POLICY CONSIDERATIONS FOR BUSPLUS GOING FORWARD

The Case for Continuing BusPlus

Given a recent change in leadership and funding priorities, MassDOT is at a crossroads regarding the BusPlus program. The argument for continuing the BusPlus program has been well articulated in the program's goals: to reduce greenhouse gas emissions, to provide basic mobility for transit-dependent populations, to improve the customer experience, and to form a seamless regional transportation network. These ideals reflect MassDOT's goals to increase the non-automobile mode share[19], to provide excellent customer service, to maintain a safe transportation network, and contribute to other state goals to reduce greenhouse gas emissions and promote economic development. The BusPlus program also exemplifies a unique public-private partnership between a state department of transportation and private bus companies that aims to improve both transportation services and the customer experience.

At a minimum RTD should continue the BusPlus capital program. Providing new buses for use by the private carriers is a continuation of state policies over the past 30 years, one that continues to be supported by current MassDOT project selection criteria favoring maintenance of the state's transportation infrastructure. New buses have public benefits in terms of quality of service for the user, reduced emissions and fuel use, and improved reliability—even if operated by private carriers without operating assistance. Providing capital also reduces carriers' costs per mile, making it more possible for carriers to serve marginal markets without operating subsidy—allowing operation of service on a thin route, or an additional frequency that might have lower ridership. In sum the BusPlus capital program incentivizes private operators to provide scheduled service in Massachusetts, which benefits residents, commuters, and travelers in the commonwealth.

The 2013 *Massachusetts Regional Bus Study* found that a total of 95 buses currently serve the Massachusetts regional bus network. Following the industry standard that an over-the-road coach has a useful life of 12 years, about eight buses need to be replaced annually to continue the existing level of regional bus service in the state. Given the $600,000 cost for each BusPlus coach in 2015, this equates to a state investment of approximately $4.8 million annually. Providing vehicles for any regional bus service improvements or expansions would require additional capital investment. FTA funding, specifically additional Section 5307 funding as described below, and state funding are potential sources to support the BusPlus capital program long-term.

It is also recommended that the public information and the mobile ticketing components of the BusPlus program continue. These efforts reflect MassDOT's strength in innovation. The New England Regional Transportation Maps, released in February 2015, were the first public transportation maps to outline all privately operated services across multiple modes and multiple states in one document. This is an invaluable resource to the public, which required significant coordination with other state departments of transportation and private carriers. The BusPlus Mobile Ticketing program developed the first smartphone app in the country that allows individuals to purchase tickets for intercity or commuter bus services from several different private operators. Continuing these efforts will help raise

[19] In 2012 MassDOT announced a statewide mode shift goal to triple the share of travel by transit, bicycling, and walking. (Source: MassDOT press release. 9 October 2012. Web. Accessed March 2016.)

awareness of regional bus services as part of the statewide mobility network, and make regional bus services easier to use.

MassDOT plans to end the state-funded operating assistance program in September 2016. While the potential benefits of expanding the regional transit network – improved mobility, shifting automobile users to transit, and reducing greenhouse gas emissions – were clear, the extent of these impacts was likely marginal given the wide coverage that Massachusetts' existing regional bus network already provides. Ideally BusPlus would have provided operating support to new routes for a few years to allow the carriers to build ridership, with the goal of achieving a sufficiently large ridership base to no longer require public support.

In reality some regional bus routes would require ongoing public support. Given the deregulation of the private bus industry, carriers now implement the regional bus routes that are profitable. Massachusetts currently benefits from wide coverage of these profitable routes across the state and New England. The routes recommended in this study expand that coverage to the rural and small town areas of the state that would benefit from direct access to the statewide (and national) transit network, but have smaller market demands (small enough that the routes may have difficulty ever becoming profitable). Given its funding constraints, RTD decided that it was not feasible to provide ongoing, and potentially long-term, state funding for new routes that do not have sufficient markets for private carriers to operate independently.

These BusPlus program components and the related policy considerations are discussed in further detail below.

Funding for New Services

Section 5311(f) and the CMAQ program are potential funding sources for the recommended regional bus routes. However the parameters of these funding programs present possible challenges. The in-kind funding method for the Section 5311(f) program requires a private firm, potentially different than the carrier implementing the new service, to commit to providing the value of its unsubsidized miles as in-kind match (more details below). CMAQ funding, by design, is only meant to provide operating support to new transit services for a maximum of five years. Furthermore the project selection process for Massachusetts' CMAQ program is also very competitive. The commuter bus projects would need to be included in an MPO transportation plan and transportation improvement program, and would need to demonstrate greater impacts on the attainment or maintenance of an air quality standard than other projects proposed by the MPO.[20]

Section 5311(f) Funding for Rural Intercity Services

As discussed in Chapter 1 Massachusetts has used its limited Section 5311(f) allocation to provide operating assistance in the past, and is currently funding Plymouth and Brockton to provide local service on the Cape. This project uses approximately half of the available funding. The study team recommends continuing to support existing routes as long as they are meeting performance

[20] USDOT Federal Highway Administration. *Congestion Mitigation and Air Quality Improvement Program (CMAQ)*. 12 September 2013. Web. Accessed March 2016.

standards. The Hyannis-Provincetown route was ranked first in the performance evaluation and is recommended for continued funding. The Albany-Springfield route, originally funded through BusPlus operating funds, also met the performance benchmarks and is recommended for consideration for Section 5311(f) support, albeit at a reduced service level to fit within the allocation amount. Alternatively, other proposals addressing the priority service areas may also be considered by MassDOT.

It has been assumed that the entire net operating cost of these rural intercity routes would be funded with the available federal dollars, using the in-kind match provisions of the Section 5311(f) program. Each of these services would need to be paired with an unsubsidized route with sufficient in-kind value to match the full net operating cost. Massachusetts has not utilized the in-kind match previously, and MassDOT would need to modify its policy and application to allow for this funding option. Alternatively, MassDOT could use state funds to supply the 50% of the net operating deficit match required under the conventional Section 5311(f) funding option, which would effectively double the amount of service that could be provided, allowing for additional projects (or higher frequencies). If MassDOT discontinues the BusPlus operating program, RTD could move any or all of the seven buses currently used on the three BusPlus routes to the capital program.

CMAQ Funding for Commuter or Intercity Services

Another potential source of funding, particularly for commuter bus services, is the Congestion Mitigation and Air Quality program. CMAQ provides funding for projects that contribute to the attainment or maintenance of the National Ambient Air Quality Standards. Projects must be transportation projects, generate an emissions reduction, and be located in or benefit a nonattainment maintenance area. CMAQ funding has been utilized in a number of states to fund capital in support of commuter bus services, both vehicles and terminal facilities (including park and ride lots), and can be used for operating assistance for such services for a limited time. CMAQ used for operating assistance is limited to three years of funding, though the third year amount can be spread over two additional years to provide five years of operating assistance (with three years' worth of funding). After that period it is assumed that a successful project will transition to other funding sources as part of the baseline network. The federal share for most CMAQ projects is limited to 80%, with a 20% local share.

New Hampshire has used CMAQ to fund coaches for commuter service into Boston, and for park and ride/intermodal terminal facilities that support these commute options. Vermont uses CMAQ to fund operation of new transit services, including commuter services, for an initial period of three years, and performance measures are applied to determine if the services need to be modified or continued after that period. Vermont also has transferred CMAQ to its Section 5311(f) program, where the program requirements associated with it also are applied.

The potential exists to use CMAQ funding for operating assistance for services identified in this report as priority commuter bus services, as well as for coaches to provide these services. Two proposed commuter routes, Quincy-Waltham and Lowell-Waltham, are projected to meet the performance thresholds and could be considered eligible for CMAQ funding. In the case of the existing Marlborough-Boston route, it could be shifted to CMAQ at the end of the state funding, but the route in its current form does not meet the performance criteria proposed in this study. A modified service might be considered for future funding through CMAQ.

The Marlborough-Boston and Quincy-Waltham routes are within the Boston region, and would need to be included in the regional process for evaluating potential CMAQ projects and including them in the regional Transportation Improvement Program. The Lowell-Waltham route crosses between the Northern Middlesex Council of Governments area and Boston, and would likely need to be considered by both, or as a MassDOT statewide CMAQ project.

BusPlus Vehicle Capital Monitoring and Section 5307 Funding

Another major element of the BusPlus program is the provision of buses to private carriers for operation on regional routes that primarily service Massachusetts. Carriers can apply for new vehicles, either to replace vehicles provided by MassDOT under the previous Intercity Bus Capital Assistance Program (IBCAP), or as expansion vehicles. MassDOT asks applicant carriers to submit proposals for new or improved service that they will operate, without subsidy, in return for use of the new buses. The BusPlus program guidance has guided the award of buses based on a prioritization scheme that favors new services to points not previously served as the highest priority, with improvements to existing service (either additional frequencies or route extensions) as a second priority, and three other levels of lesser priority. The available buses have been allocated based on their potential role as replacements for IBCAP buses or in terms of the service priorities.

Carriers awarded buses under the program sign lease agreements, called Service and Maintenance Agreements, which specify the service obligation associated with the vehicles and the related requirements for maintenance and insurance, etc. The buses are equipped with Automatic Vehicle Location (AVL) devices and Automatic Passenger Counters (APC) that provide data to the state's contractor regarding use of the bus including ridership. Appendix G, Table G-2 presents a summary of the service obligation by firm, along with the apparent current services on the route.

Monitoring and Oversight

The interest of the state is to ensure that these vehicles are being used for public transportation that primarily benefits the residents of Massachusetts, are in service, and are maintained. Data is automatically collected on the use of the buses, but currently there is no systematic, periodic review of these reports to monitor appropriate usage. It also appears that in some cases public information about the services promised under the service obligations is not being provided, and there are few lease amendments that document MassDOT's consent to changes.

Because this fleet represents a significant asset, MassDOT needs to continue a monitoring and oversight program that examines the usage of the buses—are they in–state (or leave the state only as permitted)? Are they providing scheduled service? Do they have riders? Is the utilization reasonable? (If they are parked a great deal of the time they are not providing public benefits.) A periodic review of sample data is recommended to check on these factors. MassDOT has equipped these vehicles with AVL and APC to collect very detailed data on usage in terms of service and ridership. This produces a great deal of data, and reviewing all of it is probably not possible.

However, MassDOT needs to staff a periodic check on each vehicle. A one-hour review of data on each vehicle quarterly as a screening would require approximately 180 person-hours per year. If issues are detected a larger sample could be drawn for that vehicle and that firm. Given the FTA and MassDOT interest in these vehicles ($27.1 million, with 46 vehicles costing about $600,000 each) a structured monitoring and oversight program is recommended. The review should also ensure the vehicles are being maintained, and if vehicles are out of service due to damage or neglect the issue should be identified and corrected.

Service Obligations

Another consideration for MassDOT moving forward is whether service obligations should continue to be a requirement for carriers receiving new or replacement buses through BusPlus. The benefits of continuing this requirement are expanded service and options for the public. The capital program can provide a mechanism for implementing new or incremental service, where funding would otherwise be limited or unavailable.

The challenges of continuing the service obligations include 1) establishing a consistent approach to developing the service requirements, and 2) monitoring the services provided including documenting any changes to the service obligations negotiated with the carriers. To date the service requirements have been determined based on the carriers' proposals in their applications for BusPlus vehicles. The MassDOT BusPlus manager reviewed the proposals in relation to the service priorities outlined in the program guidance. The carriers negotiated with the BusPlus manager directly regarding any changes to the service obligations. This process was somewhat subjective and did not consider the value of the service obligations in relation to the number of vehicles each private carrier received.

This study developed operating cost estimates for the existing service obligations (see Appendix G, Table G-1) based on similar assumptions to those used for the regional bus alternatives' projections. The analysis estimated that the current service obligations, in exchange for 36 vehicles[21], cost about $4.0 million to operate annually. This translates to a $114,000 average value per BusPlus vehicle. Moving forward the study team recommends using this guideline (rounded to $100,000 per bus) as a quantitative benchmark when evaluating proposed services. In other words, for every new BusPlus vehicle a carrier requests, they should propose a service improvement or expansion that has a value of $100,000 (or more) in annual operating costs. If a carrier requests multiple vehicles, the service proposal may reflect the combined values of multiple vehicles (rather than one service improvement per vehicle). This benchmark should be used in conjunction with the service priorities outlined in the program guidance.

If the service requirements continue, a second aspect of the BusPlus monitoring should include periodic reviews to compare scheduled base service, additional service required by the lease, and current services. Based on this study's review of services being operated by carriers as compared to those required in the Service Agreements (Appendix G, Table G-2), the actual service provided may be different. Some variance may be due to seasonal schedule adjustments, but if a carrier requests an amendment or other relief MassDOT currently has no way to know whether the carrier has tried to

[21] Did not include the three routes that receive BusPlus operating support, or the service obligations for the most recent three BusPlus vehicles that were awarded in early 2016.

meet the service obligation. If a carrier requests an amendment proposing a suggested alternative, it should be reviewed per the BusPlus program priority definitions. MassDOT can also evaluate proposed options in terms of the cost to operate the proposed service to determine if it is generally equivalent to the originally agreed upon service.

MassDOT staff should create a database to track the service requirements. It is recommended that provider schedules and services are reviewed at least twice annually (winter and summer seasons) to account for seasonal schedule adjustments. This review and ongoing communications with the carriers to monitor the service obligations and occasionally negotiate service changes are estimated to require approximately 100 person-hours per year.

In addition staff will be responsible for reviewing and renewing the Service and Maintenance Agreements at least every two years. This may involve analyzing service performance against established metrics, in order to determine whether the services should be continued or changed. RTD may consider convening a small committee of staff to review the lease agreements, with the goal of reaching consensus on whether the proposed services are reasonable or may require modification. The carriers have typically been forthright in communicating to MassDOT how the services are performing, and will often offer suggestions for modifications or new services that may perform better. The service recommendations identified in this study may also be candidates for the service requirements (estimated annual operating costs provided in Tables 6-1 and 6-3), though most of the alternatives would be appropriate for carriers receiving two or more buses.

All these monitoring efforts require MassDOT staff resources, which are limited for BusPlus. Multiple MassDOT staff members are currently working on the program part-time, tackling different components. A more structured organizational approach, and likely additional staff time, will be required if MassDOT chooses to continue the service requirement as part of the BusPlus capital program and strengthen its monitoring efforts.

The bus operators on the study's Technical Advisory Committee provided an argument for discontinuing the service requirements. They perceive the BusPlus service obligations as disrupting supply and demand and "forcing" extra trips where the carriers already make service adjustments to meet demand. The bus operators want to use the buses to run "productive miles" on Massachusetts services with good ridership, rather than running additional miles on less productive services that have been promised to the state.

Potential for Funding Capital Replacement with FTA Section 5307 Funding

Federal transit funding for Urbanized Areas (UZA) over 50,000 in population is provided on a formula basis to states and directly to UZAs. Funding for UZAs between 50,000 and 199,999 in population is provided to the governors of the states; for areas with greater populations the funding is provided directly to the UZA. While there are numerous population and weighting factors, for UZAs with 200,000 people or more, 66.71% of the funding nationwide is provided to bus systems, 73.39% is provided to UZAs over one million based on a formula that is 50% based on bus revenue vehicle miles, and 26.61% is provided to UZAs under one million using a formula that is also 50% bus miles. There is also a 9.2% incentive that is calculated based on bus passenger-miles times bus passenger-miles

divided by the operating cost.[22] The bus-miles and passenger-miles for each UZA are established by requiring recipient operators to report their data to the National Transit Database (NTD).

Typically all public transit operators provide NTD data (there is a waiver provision). However, the private operators generally do not. In Massachusetts Plymouth & Brockton is a reporting carrier, but the other BusPlus bus operators are not. There is at least potential to increase transit allocations in the state by having the BusPlus operators provide NTD data. In New Jersey the private commuter bus operators (that receive buses from the state) provide NTD reporting. It may be worthwhile to consider that if NTD data was provided by the BusPlus carriers, expanded Section 5307 funding could be used for bus capital to replace BusPlus coaches in the future.

The private carriers on the study's Technical Advisory Committee generally supported this concept *on the condition that any additional Section 5307 funding generated from their reporting benefits the BusPlus program*. Some of the private operators already have the knowhow and capability to report their mileage to NTD. Concord Coach Lines/Boston Express currently reports to NTD on behalf of the New Hampshire Department of Transportation, and DATTCO currently completes NTD reporting for its Connecticut services. Peter Pan voluntarily reported a Massachusetts route to NTD about seven years ago, but did not view any benefits in continuing to do so. The carriers estimate that the NTD reporting requires about one week's worth of work per year. Another challenge of the NTD system is that it was designed for public operators, not private carriers, and sometimes flags data issues incorrectly.

The most effective action for MassDOT to take to encourage the BusPlus carriers to complete NTD reporting is to establish a policy and mechanism for any additional Section 5307 funding, as a result of their efforts, to be allocated to the BusPlus program. This additional funding could be used to support continuation of the BusPlus capital program.

Information, Ticketing, and Marketing

One of the significant initiatives of the BusPlus program has been the development of a multi-carrier ticketing application that would allow all the carriers to sell tickets through a single portal. This is an innovative effort that has taken time to develop, and so its usefulness has not been apparent. Once BusPlus Mobile Ticketing is operational it is likely that more carriers will agree to participate, which will enhance its value. Continuation of the ticketing application development needs to be tied to a continued effort to provide public information and market the available services. The significant input received from the public and users for this study revealed that many people are unaware of the available services. BusPlus included the development of high quality, comprehensive bus service maps for all of New England, and they need to be updated periodically to maintain their usefulness. Information about the network of services also needs to be kept up to date on the MassDOT website, with linkages to the individual carriers and the ticketing application.

Users increasingly rely on applications on their smartphones for transit information, and all of the RTAs and MBTA provide General Transit Feed Specification (GTFS) to information sources such as Google Transit. (MassDOT funds the maintenance of GTFS files for 13 of the 15 RTAs, eight private bus

[22] Federal Transit Administration. *Table 4: Section 5307 Apportionment Formula*. 18 March 2016. Web. February 2016.

carriers, and seven ferry operators.) Amtrak and Megabus do as well, allowing a user to quickly develop an itinerary for a multi-carrier trip—for example using an RTA service to reach an Amtrak train. State support for adding the overall intercity bus network to these online trip planners would allow users to treat the RTAs, the intercity and commuter bus carriers, MBTA, and Amtrak as a statewide mobility network. This would not only complement the multi-carrier ticketing application, but could be the next step for expanding the mobile ticketing program.

The public and stakeholder input identified the need to explore joint ticketing between all public and private transit modes to provide passengers with flexibility in using services (e.g., being able to ride the commuter rail or commuter bus, whichever arrives first) and to facilitate connections between providers and regions. Although it might seem that the private carriers would provide such data, some view it as an additional expense beyond the ticketing systems they have to develop themselves, and some view the service data as proprietary. However a BusPlus vision should include development of improved multimodal information and ticketing that includes regional bus services.

Marketing is needed to achieve ridership goals, particularly for the new services provided by the carriers under their service obligations and the three routes receiving operating assistance under BusPlus. The contracts with the operating carriers include marketing elements, but promotion has been limited—even free rides will not draw new riders to a service if they do not know it exists. For these reasons a continued marketing and information element to BusPlus is recommended.

Facilities and Passenger Amenities

Intermodal terminals, parking facilities, and passenger amenities present additional opportunities for RTD to improve the customer experience, one of the goals of the BusPlus program. The recently enacted FAST Act encourages states and MPOs to consider intermodal facilities that support intercity buses when developing such facility plans. Going forward MassDOT should seek to ensure that privately operated intercity and commuter bus services are included in intermodal terminal plans wherever feasible. This is critical to the creation of a connected statewide mobility network. The private carriers and RTAs already share facilities in the urban areas that they both serve. These intermodal terminals tend to be the best equipped with passenger amenities and facilitate transfers for passengers between routes and modes.[23]

Input from both the public and the study's Technical Advisory Committee identified needs to improve park and ride lots and passenger amenities provided at regional bus stops. The 2013 *Massachusetts Regional Bus Study* made similar recommendations following a detailed review of existing park and ride facilities with regional bus service. That review, conducted in 2012, found that eight of 36 parking facilities with existing regional bus service were at or near capacity. These facilities located in Barnstable (Route 6 lot), Bourne (Sagamore Bridge lot), Taunton (Galleria Mall lot), Andover (Lutheran Church lot), Kingston, Newburyport, Rockland, and Plymouth should be candidates for park and ride expansions. In addition public input identified needs for increased parking capacity at stops in Newburyport (MA-113 Storey Avenue lot) and Falmouth (bus terminal). MassDOT owns all these park and ride lots identified for improvements, except for the Kingston and Falmouth stops.[24]

[23] 2013 *Massachusetts Regional Bus Study*.
[24] 2013 *Massachusetts Regional Bus Study,* see analysis of parking facilities starting on page 76.

The 2013 study also recommended establishing prominent signage at all regional bus stops and improving passenger amenities including shelters and restrooms, needs echoed in the public and stakeholder input collected through this study. The results of the public outreach process indicated that awareness of regional bus services is relatively limited. Observations conducted in the last study found that very few regional bus stops, including those at park and ride lots and curbside stops in downtown Boston, have clear signage indicating available regional bus services, much less route information. MassDOT's efforts to ensure such signage and amenities are in place at all regional bus stops (where the amenities provided would relate to the level of ridership at a stop) would be an important step toward encouraging the use of services. In increasing regional bus ridership, MassDOT maximizes the public benefits of the state's investment in the regional bus network, and complements existing efforts such as the New England Regional Transportation Map and the mobile ticketing app.

Regional Bus Service and Land Use

The planning guidelines described in Chapter 3 were developed to identify municipal candidates for regional bus service that may have sufficient demand and need for regional bus service. Among the planning guidelines was the consideration of points of access to regional bus service and connectivity with other transportation modes. A municipality with a walkable downtown location with access to local transit services was considered a good candidate for intercity or commuter bus service. This guideline reflected a national and statewide trend in development – the increasing popularity of walkable urban places. Supporting and further developing walkable urban areas not only meets the underserved demand from Millennials, retiring Baby Boomers, and the Creative Class, but also presents an opportunity for economic growth. In comparing walkable urban areas to drivable suburban areas, research has found that real estate values are nearly 40% higher and tax revenues generated from development per acre are 12 times higher in walkable urban places.[25]

Good transportation options beyond the automobile are vital to the success and appeal of walkable urban areas. Transit options in particular provide access to work and education opportunities and promote social equity.[26] Regional bus service should be among the transit options that support the development and expansion of walkable urban places. Commuter bus service may support municipalities' current efforts to rezone or redevelop their downtowns, and draw Millennials who are looking to buy housing in a walkable urban setting with convenient commute options to major employment areas such as Boston and the I-495/Route 128 corridors. Marlborough, Framingham, Quincy, and Lowell are examples of such municipalities.[27] MassDOT's implementation of commuter bus service to these areas would meet not only the BusPlus program goals of reducing greenhouse gas emissions and providing mobility, but would also support local and regional economic development efforts.

[25] Leinberger, Christopher and Patrick Lynch. "The WalkUP Wake-Up Call: Boston." The George Washington University School of Business. 2015. Web. March 2016.
[26] Ibid.
[27] Per input from the study's Technical Advisory Committee. Recent municipal efforts to promote downtowns areas are described in local news articles: http://www.metrowestdailynews.com/article/20150312/News/150318729, http://www.metrowestdailynews.com/article/20151022/NEWS/151028437, and http://www.patriotledger.com/article/20150611/NEWS/150619024.

However this is not to say that all new regional bus stops should be located only in walkable downtowns. Areas with notable demand but lower densities or more sprawling development patterns could be better served by a stop at a park and ride lot. These commuter markets cover a large geographic area given existing development patterns. A park and ride lot serves as a convenient place to convene drivers and possibly transit riders traveling from different parts of the catchment area. Therefore municipalities that have a park and ride lot with available capacity were also considered good candidates for commuter bus service in the planning guideline analysis. Boston Express is an example of existing commuter bus service that performs well, with strong ridership, by serving multiple park and ride lots along the route.

When implementing new regional bus service through the BusPlus program, MassDOT should consider a variety of factors including land use and development in determining the specific location of regional bus stops. There is no "one size fits all" approach. Coach Company's existing commuter bus services demonstrate a mix of serving downtown and park and ride locations along the same route. It is important to consider the regional bus markets and their specific characteristics such as level of car availability or transit dependency, the availability of local transit or other modes to access the regional bus stop, and the availability or capacity of park and ride lots. Similar to the rationale behind the intercity bus planning guideline of serving Gateway Cities, to support the commonwealth's economic development goals, MassDOT should consider local economic development efforts when planning the location of new regional bus stops. Bus operators on the study's Technical Advisory Committee also highlighted the need to consider operational issues, in that detouring off the highway to serve a downtown location could be potentially time consuming, more costly, and less attractive to riders already on the bus.

CONCLUSION

Over the past three years MassDOT has combined its previous program of providing bus capital to the private carriers with efforts to improve public information, identify and fill gaps in the network through service obligations in return for capital and operating assistance, and develop multi-carrier smartphone/internet ticketing options—all with the goal of improving statewide bus services to promote mobility and attract new ridership. This expanded program has been branded as BusPlus.

This study conducted extensive analysis of the existing regional (commuter and intercity) bus services in Massachusetts, and compared them to the most likely potential needs and markets for such service for consideration as potential future BusPlus projects. The network of services provided by these private carriers is comprehensive, providing connectivity across the state to both regional centers and the major urban areas. Using a consistent analysis process to identify areas of need with enough potential ridership, the study found that most of the state is served. Applying minimum service standards to the existing services revealed that for the most part, the level of service is commensurate with the demand.

New services designed to address the unmet needs and service deficiencies were developed, and then assessed to determine if they could be operated cost-effectively as subsidized service. Several services appear to offer that possibility, including intercity service in the Route 2 corridor and commuter service in the Route 128 corridor. Fortunately the unmet need is limited, and potential funding sources are available.

Funding for this program includes both federal grant funding (for capital) and state funding. Recent changes in funding availability have meant that expansion of state funding for operating assistance is unlikely for the foreseeable future. Yet the overall BusPlus program framework and brand continues to make sense, and merits continued support as an element of MassDOT's statewide mission. Recommended strategies for the program going forward include use of alternative funding sources to support a limited amount of new service, continuation of the bus capital program with oversight and monitoring of the state's capital investment, continuation of the development of the ticketing application, and expanded marketing and information to maximize the BusPlus program's benefits to the Massachusetts public.