TECHNICAL MEMORANDUM 2

Date: May 6, 2019

Subject: ALTERNATIVE ROUTE ANALYSIS AND
RECOMMENDATIONS

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INTRODUCTION

To ensure the implementation of the most efficient and optimal transit service possible, Salem must match its service to the community needs and the local transit market. This includes matching the level and type of service with the transit demand. It also includes providing convenient, direct, and easy to understand services.

This technical memorandum evaluates key market elements that specifically address the important question of what type of transit service is needed in Salem and how can that service be provided. This document provides a data point for these questions by examining:

- Major public transit trip generators
- Seasonal and special events
- Transit propensity and need for equitable distribution of transit
- Transit Demand
- Parking and bikeshare services
- Existing public transit services

Additionally, this document looks at how well past transit plans have addressed these key market elements and identifies the challenges that should be considered prior to service implementation. This document concludes with a list of alternative service options that can address the identified challenges and ensure the implementation of efficient and effective transit service in Salem.

MAJOR TRIP GENERATORS

Major employers, government facilities, schools, medical centers, shopping centers, and tourist destinations attract large numbers of people and can generate a significant number of transit trips.

In the City of Salem (Figure 1), there are several large employers. These include Salem State University, the North Shore Medical Center, Salem Five Bank, and the business and industry center at Shetland Park.

Important civic buildings include the Salem Public Library, newly opened Community Life Center, and the courthouses, including the Salem District Court, Essex County Superior Court, and Essex Family and Probate Courts.

Salem University and Salem High School both represent potential transit trip generators.

The southern part of the city includes major shopping destinations such as the Hawthorne Square area with Market Basket, Home Depot, and Target. Further down Route 107, there is a Walmart. Additionally, Vinnin Square is another popular shopping center, located to the southeast.

Tourist Attractions abound in Salem. Downtown locations such as the Essex Street pedestrian mall, Derby Street, and the waterfront are all important trip generators. In addition, the Peabody Essex Museum and Pickering Wharf are popular areas for visitors and locals, alike.

Most of the major trip generators are found in the northern part of the city, with Route 107 and Lafayette Street/Loring Avenue acting as important connections to destinations in the southern part of Salem.

Also of interest are two transportation hubs: the MBTA Commuter Rail Station on Bridge Street and the Salem Ferry Terminal located on Blaney Street.

Figure 1 | Major Trip Generators
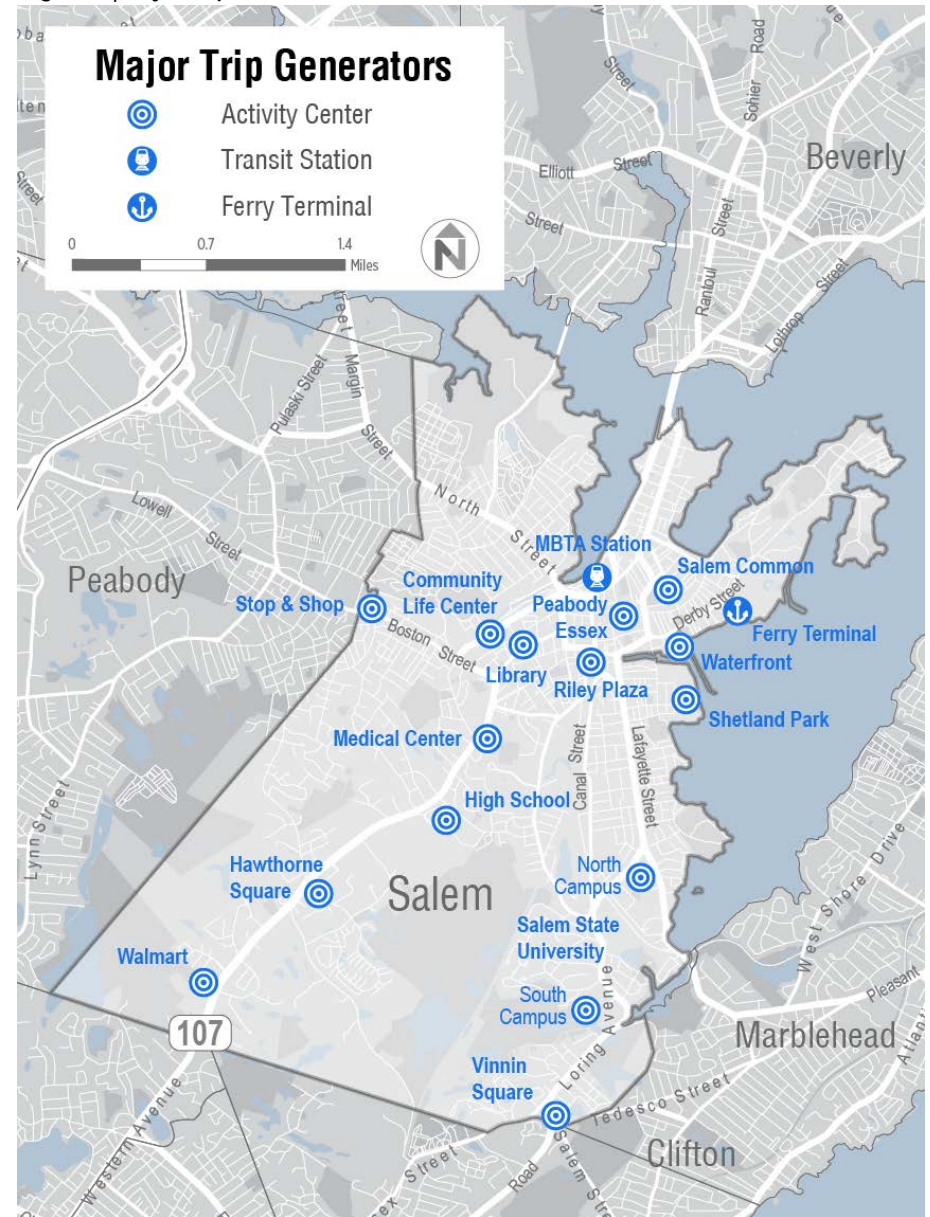
SEASONAL AND SPECIAL EVENTS

Because of its unique history and coastal charm, Salem is a community with many seasonal activities and events.

The entire month of October is dedicated to *Haunted Happenings*, with Halloween-themed activities and events taking place every day. The Biz Baz Street Fair is held October 6-7 along the Essex Street pedestrian mall. An annual carnival has also been held in past years. In 2018, the corner of Federal and Washington Streets was the site for the month-long carnival.

Salem Willows is a popular attraction during warmer months, with an arcade and amusement park open from April to September. An annual jazz festival is also held in August, attracting 6000 in recent years.

Many of these events include a transportation component to help transport tourists and locals to the activity centers and throughout Salem.

- The Haunted Happenings Shuttle operates from October 20-28 and provides a loop service from parking lots at Northshore Medical Center, Salem High School, and Salem State University to downtown.
- Salem Harbor Shuttle – the Boston Harbor Cruises-run shuttle loops between four stops, with an additional round-trip voyage to Marblehead once per day. Service operates from June to Labor Day.
- The Salem Trolley, which operates April 1-November 1, provides a tour with many stops in downtown and along Derby Street. Winter Island and Salem Willows are available as flag stops.

Figure 2 shows seasonal events and transportation in the city.

Figure 2 | Seasonal & Special Events
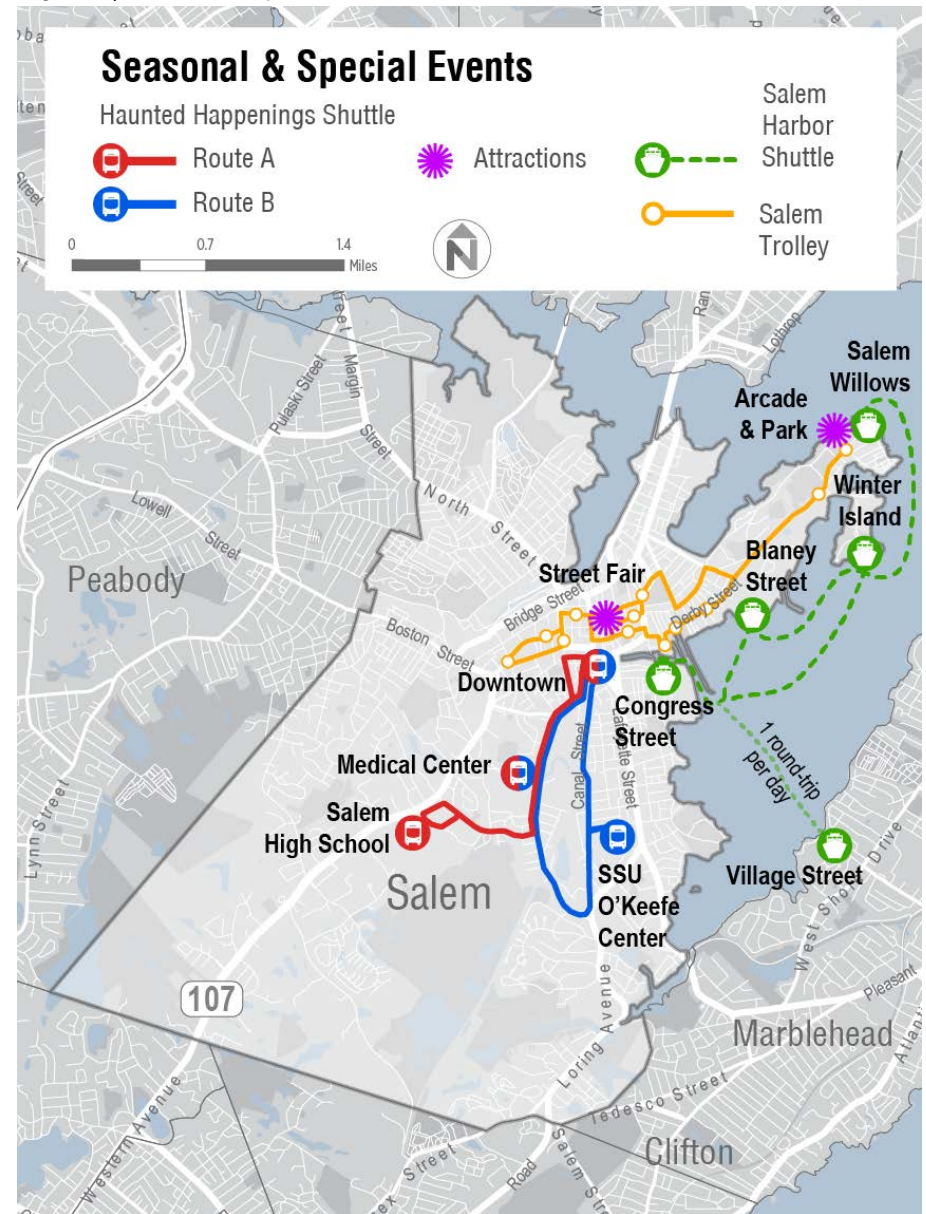
PROPENSITY AND EQUITABLE ACCESS

Public transit is designed to serve everyone and as such, it is important to consider the demographic characteristics of the population in a service area. Title VI of the civil rights act of 1964 requires public transit to ensure services are offered in an equitable manner.

In addition, data shows that economically disadvantaged residents, minority residents, and foreign-born residents are all more likely to use transit. Further, households that do not have access to a private vehicle are the most likely to use transit. This likelihood to use transit is referred to as transit propensity and is an indicator of where transit services will be the most successful. By design, it also provides a means of identifying populations who benefit the most from transit. Figure 3 shows this information for Salem.

In Salem, residents of the Point and Broad Street neighborhoods are the most likely to use transit. North River, McIntire District, Castle Hill, and Derby Street residents also have a high propensity. Additionally, there are 250 affordable housing units at Loring Towers in Vinnin Square.

Table 1 | Transit Propensity Factors

| Demographic Group[1]	Transit Propensity[2]
Race and Ethnicity	
White Alone (Not Hispanic or Latino)	0.69
Black or African-American	2.67
Asian (Not Hispanic or Latino)	1.10
Other Race (Not Hispanic or Latino)	1.42
Hispanic or Latino	1.19
Vehicle Ownership	
No Car	6.87
One or More Cars	0.39
Country of Origin	
Native	0.91
Foreign	1.24
Poverty Level	
Under the Poverty Line	1.55
At 100%-149% of the Poverty Line	1.42
At 150% of the Poverty Line or Above	0.96

Note: This analysis uses census data. It does not include new development.

Source: Calculations developed using 2012-2016 American Community Survey 5-Year Estimates

[1] While persons with disabilities, young adults, and older adults are also documented to use transit at higher rates, propensity for these demographics is not well captured by journey-to-work data, as these groups are employed at lower rates than the total population.

[2] These figures indicate the relative propensity of different groups to use transit. For example, a transit propensity factor of 1.50 means that the group is one and a half times more likely to use transit than the general population. Based on transit mode share of 21.5% for the Census Designated Places that comprise MBTA service area, and available demographic split on journey-to-work data.

Figure 3 | Transit Propensity Factor
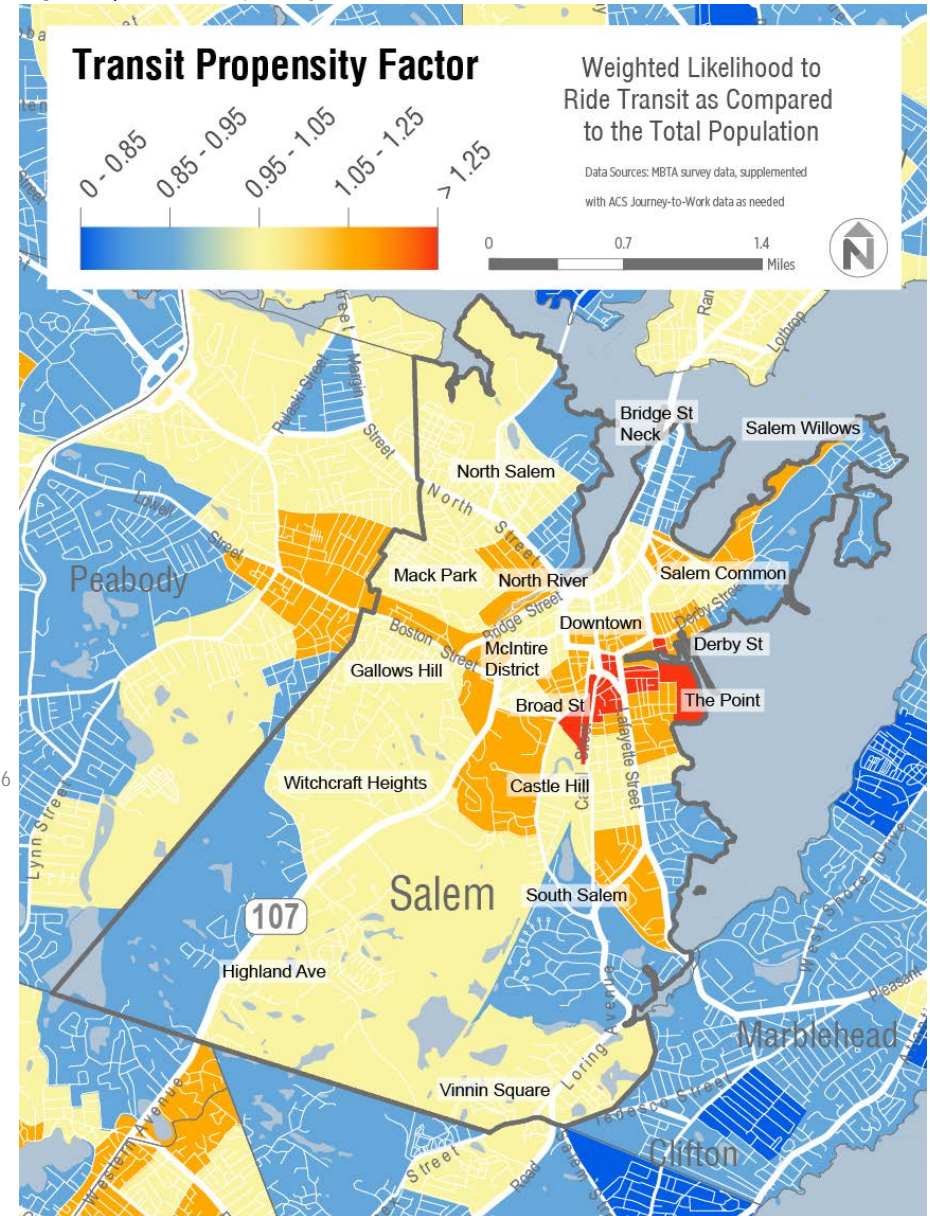
TRANSIT DEMAND

Population density and employment density are both indicators of potential demand for transit. When population and employment-based demand are considered together, it is possible to identify areas that can support higher levels or more frequent transit service.

In Salem, the highest levels of demand are in the most densely developed areas near Downtown. As you move further away from the city center, demand for transit decreases. The areas in Salem with the highest transit demand include:

- The Point
- Downtown
- South Salem
- McIntire District
- Derby Street
- North River
- Bridge Street Neck
- Salem Common
- Castle Hill

Figure 4 shows the composite demand for all neighborhoods.

Figure 4 | Composite Transit Demand
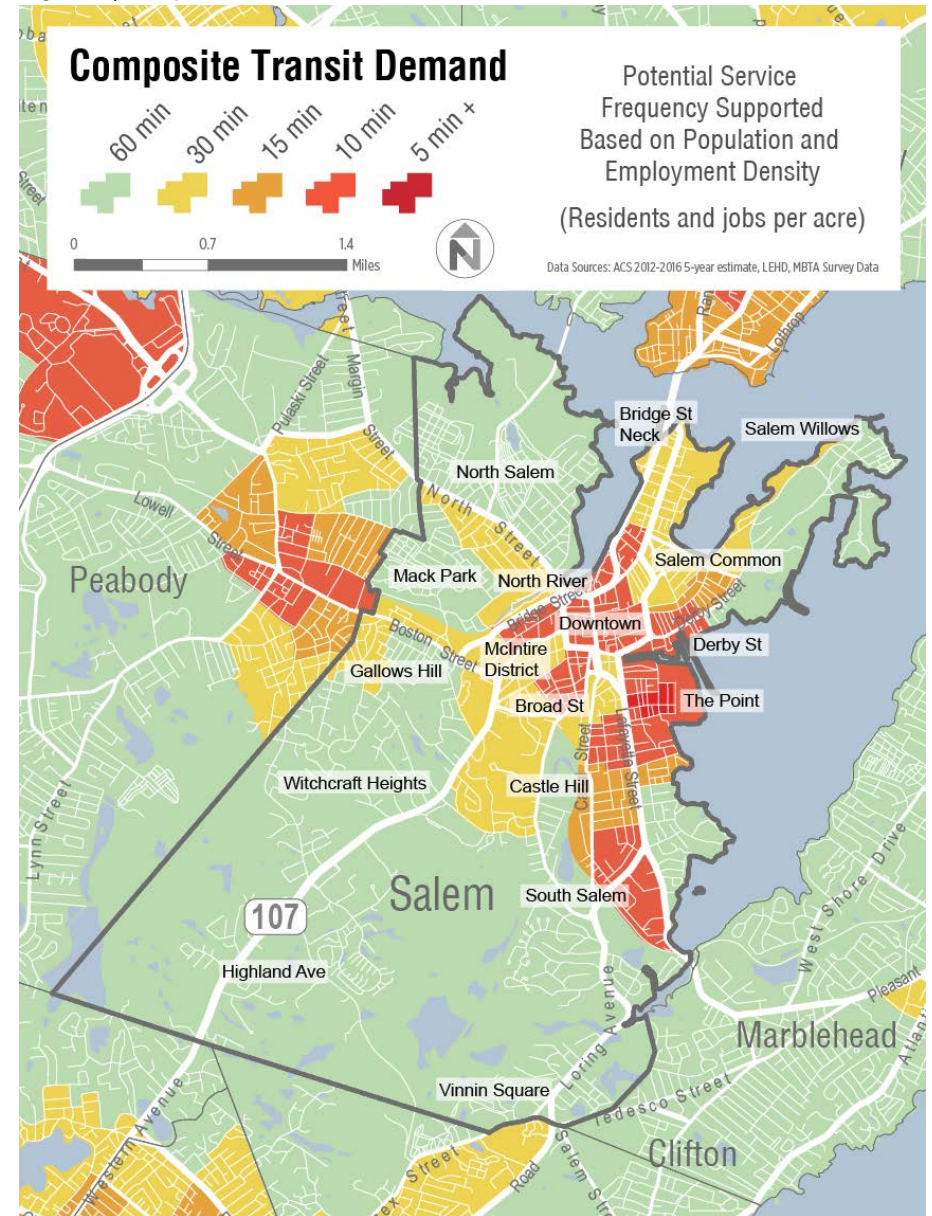
PARKING AND BIKESHARE

The cost and availability of parking can impact the demand for public transit. Areas with high parking cost and limited availability generate more demand for public transit, while the inverse is true in areas with cheap and abundant parking. Salem has metered parking on streets and lots throughout downtown. The city parking guide suggests using on-street meters for 1-2 hours, parking lots for 2-4 hours, and parking garages for 4+ hours. Lots allowing all day parking are also available.

Three hourly rates are enforced for street and lot parking meters: $1.50, $1.00, and $0.50. Enforcement is 8 a.m. - 6 p.m. Monday–Saturday. Parking is free on Sundays.

There are also three parking garages in Salem that allow public parking. They operate seven days per week.

- Museum Place/Downtown Garage- 910 spaces, $1.25 per hour Located at 1 New Liberty Street. At Museum Place monthly passes are available for $80 ($70 for residents).
- MBTA Garage – 712 spaces, $5 per day ($2 per day weekends) Located at 252 Bridge Street.
- South Harbor/Waterfront Garage – 287 spaces, $0.75 per hour on weekdays only ($1.50 per hour weekends). Located at 10 Congress Street.

In addition to parking, Salem offers a bikeshare program, Zagster, with 16 stations and 80 bicycles. Most of the stations are clustered in downtown, including two at the MBTA commuter rail station. Salem State University south campus, Salem Willows, and McGlew Park also feature stations (Figure 5). Bikeshare offers a potential complement to transit service and increase the "reach" of the travelers making first- and last-mile connections.

Figure 5 | Parking and Bikeshare
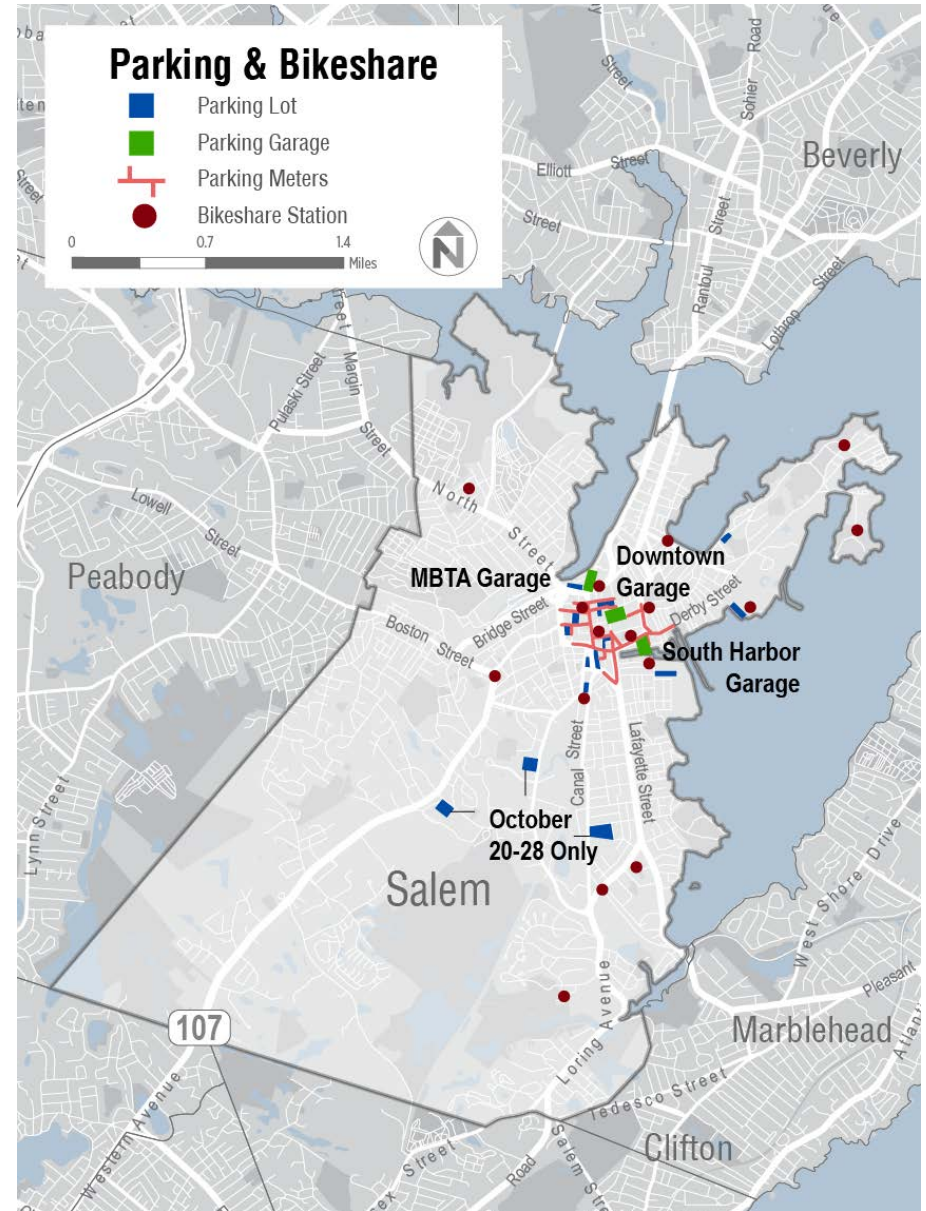
EXISTING PUBLIC TRANSIT SERVICE

When considering the demand for public transit services, it is important to complement existing transit services. This ensures that resources are not duplicated and works to provide a comprehensive transit network for customers, which can extend the reach of transit and capture more of the potential transit market.

The MBTA currently serves Salem with six bus routes, operating throughout the day. Service is available in Salem on weekdays and weekends (see Table 2).

Table 2 | Salem MBTA Service Spans

MBTA Route	Weekday Span	Saturday Span	Sunday Spam
450	5:00 am – 1:30 am	6:30 am – 12:00 am	8:15 am – 12:00 am
451	6:00 am – 7:10 pm	–	–
455	5:00 am – 12:30 am	6:00 am – 12:00 am	6:00 am – 12:00 am
456	5:00 am – 1:30 am	6:30 am – 12:00 am	8:15 am – 12:00 am
459	5:00 am – 12:30 am	–	–
465	7:00 am – 7:00 pm	9:30 am – 7:00 pm	–

An evaluation of the 2018 *Shuttle Bus Feasibility Study* and a *Qualitative Evaluation of Current Transit Services* shows a high degree of duplication with existing MBTA bus routes (Figure 6).

Any new shuttles services in Salem should not compete with MBTA buses but should instead complement them by connecting to the existing network while expanding service and offering new destinations for transit riders.

Figure 6 | Salem MBTA Service
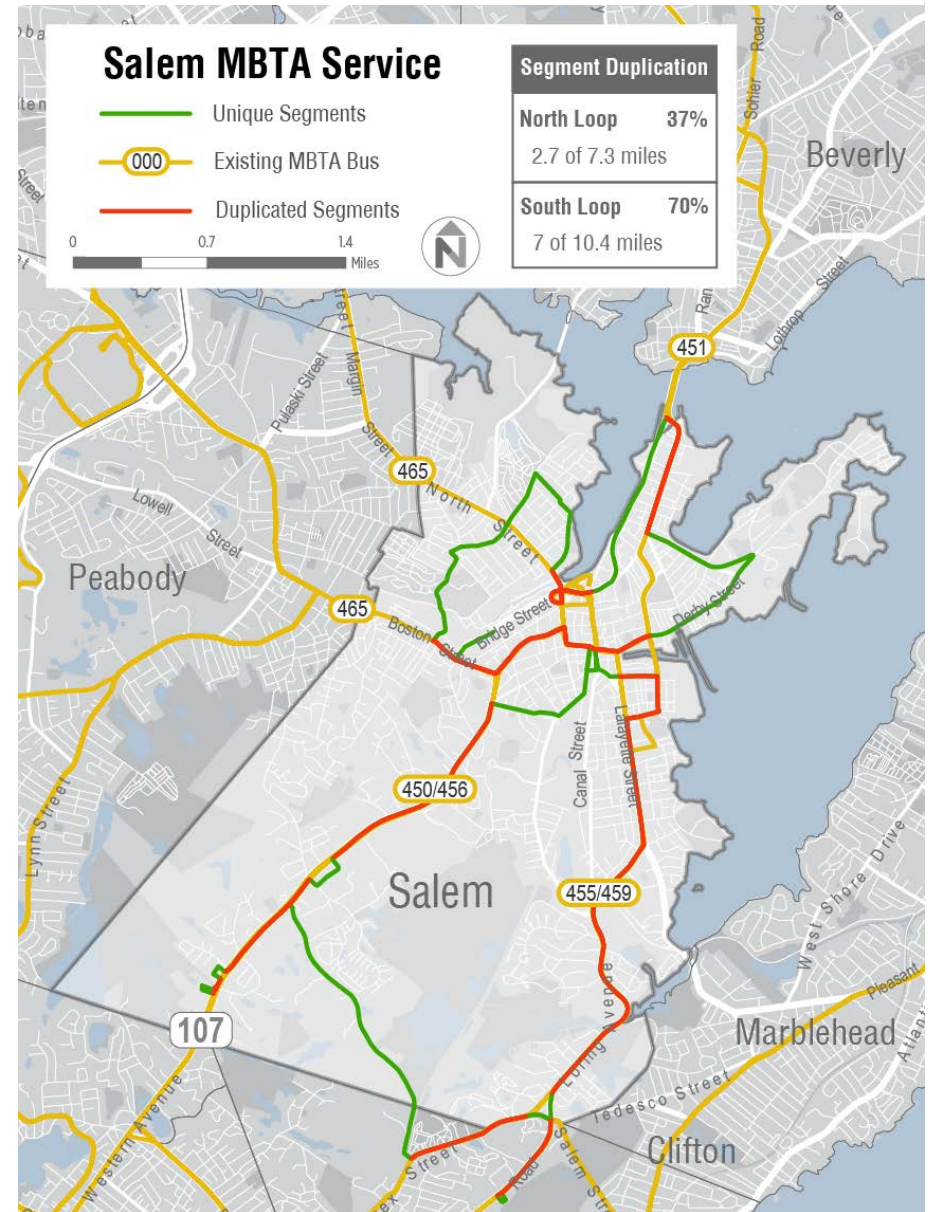
PROPOSED ROUTE EFFICIENCY AND OPTIMIZATION ASSESSMENT

This technical memorandum outlines the key transit market elements within Salem, including major trip generators, seasonal and special events, transit propensity, transit demand, parking and bikeshare, and other public transit services. For new transit service in Salem to be successful, the proposed service must leverage these market elements and develop a service design that efficiently utilizes resources and optimizes transit for the community.

An evaluation of the proposed shuttle service developed during the 2018 *Shuttle Bus Feasibility Study and a Qualitative Evaluation of Current Transit Services* presents several challenges related to key market elements and efficiency and optimization of transit service in Salem (Figure 7).

Proposed service challenges:

Service is designed as a one-way loop. This type of service is designed to provide more geographical coverage at the cost of customer travel time and service directness. Customers utilizing loop services are required to go around the entire loop to complete a round trip. On the proposed southerly loop, this would take 30 minutes to arrive back at your origin.

Out of direction travel. Service alignments that double back force customers to travel out of direction and extend travel times. The proposed service has several examples of this, including the service to the Highland Avenue Walmart, Paradise Road Whole Foods, Salem Willows service, and the Salem Council on Aging on Bridge Street.

Limited connections across Salem. As designed, the service does not provide connections between north and south Salem. Customers wishing to access shopping areas in south Salem from areas north of Downtown would be required to transfer.

Figure 7 | Proposed Routes
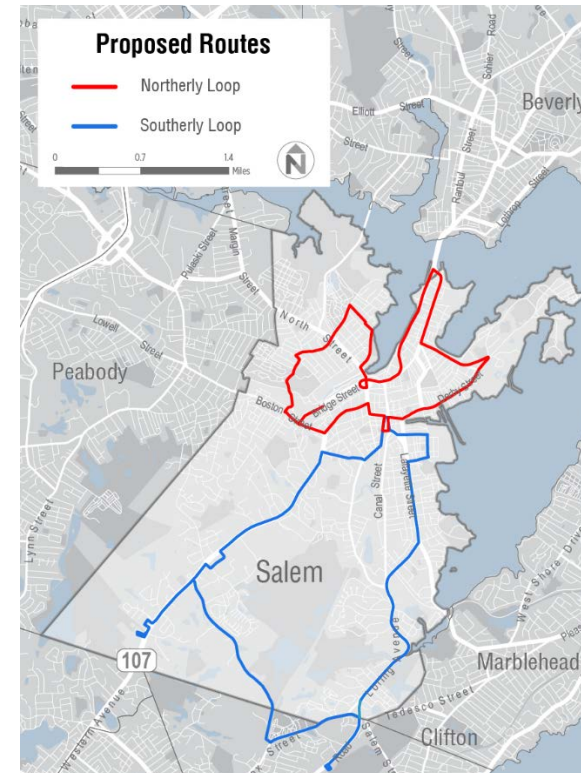
Service duplicates existing MBTA routes. Over half of the proposed service is duplicated by an existing MBTA route. Further, there are no direct transfer opportunities from the southerly loop to MBTA commuter rail or ferry service.

Service does not match market demand. The proposed service does not completely match the local transit demand. For example, demand along Swampscott Road is very low, primarily saving Salem Woods where no trip generators exist. Alternatively, areas along Jefferson Avenue and Canal Street have high transit demand, but little access to the proposed service.

Proposed Service Statistics

The proposed northern loop is 7.3 miles long, which would take one bus 40 minutes to complete, including layover time. Adding service to Salem Willows lengthens this route to 8.8 miles, adding 5 minutes (45 minutes) to complete a full loop. The proposed southern loop is 10.4 miles long, which would mean one bus, could complete the proposed alignment once per hour (Table 3).

The 2018 plan also included an option to double the service frequency of each proposed route by utilizing two vehicles. This would increase the frequency to around 20 minutes for the northerly loop (23 minutes with Salem Willows), and around 30 minutes for the southerly loop.

Table 3 | Proposed Service Statistics

Proposed Route	Span of Service	Frequency in Minutes (1 bus)	Total Revenue Miles (1 bus)	Total Revenue Hours (1 bus)	Frequency in Minutes (2 buses)	Total Revenue Miles (2 buses)	Total Revenue Hours (2 buses)
North Loop (no Willows)	7 AM-7 PM (10 hours)	40	7.3	10	20	14.6	20
North Loop (with Willows)	7 AM-7 PM (10 hours)	45	8.8	10	23	17.6	20
South Loop	7 AM-7 PM (10 hours)	60	10.4	10	30	20.8	20

Service Design Principals

To address the service challenges identified in the 2018 plan there are several service design principles that must be considered by Salem in order to best serve residents, workers, and visitors:
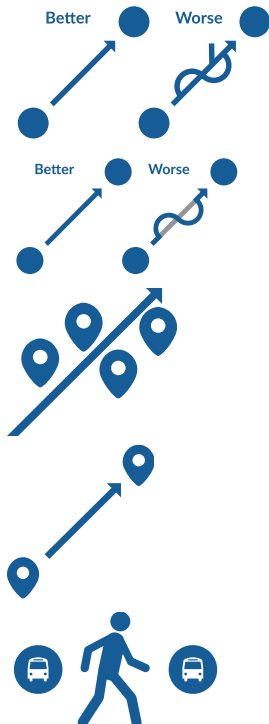
Simple Is Better than Complicated: A simple route structure and simple schedules will attract more riders than a complex system. First and foremost, for people to use transit, they must be able to understand it, and simpler services are easier for riders to understand. Simpler systems also help ensure that they get where they want to go when they want to without experiencing frustration and problems.

Routes Should Operate Along a Direct Path: The fewer turns a route makes, the easier it is to understand. Conversely, circuitous alignments are disorienting and difficult to remember. Routes should not deviate from the most direct alignment unless there is a compelling reason.

Routes Should Serve Well Defined Markets: The reconfiguration of service around more clearly defined markets can help to make service easy to understand, provide a basis for developing premium bus services, and minimize service duplication.

Transit Service Should be Focused Around Landmarks: Most potential transit users have a basic knowledge of major landmarks (and are often traveling to them). When transit service is focused around landmarks, they can also become transit hubs. Travelers traveling in unfamiliar area can more easily find their way to a landmark to make a transfer than to a lesser known area.
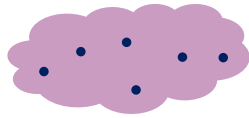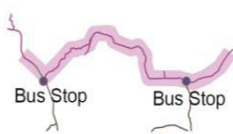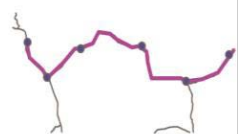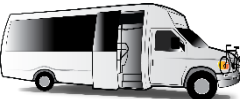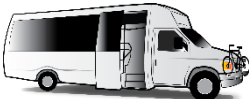
Services Should be Well Coordinated: Where different routes connect or operate along the same alignment, schedules should be coordinated to the greatest extent possible to provide short connection times.

Service Type

These service designs can be achieved through a range of service types that the City of Salem can choose from when designing new transit service. Demand-responsive, anchored flex route, microtransit, deviated fixed-route, and fixed-route are all options with their own benefits and challenges (see Table 4). The city must balance coverage, convenience, and cost when selecting a service type. Each service type represented below was considered when developing alternative recommendations, which are presented in the following section.

Table 4 | Service Types

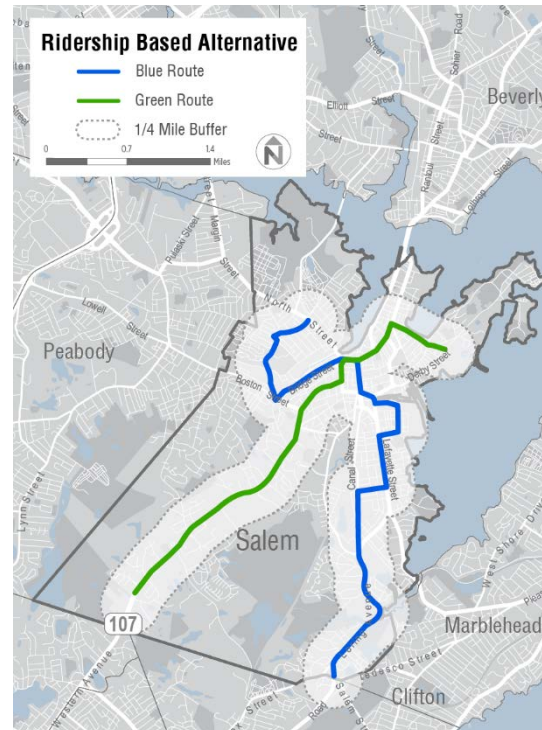|	Demand-Responsive	Anchored Flex Route	Microtransit	Deviated Fixed-Route	Fixed-Route
Description	Customers within a certain geographic area may call to schedule a curb-to-curb trip.	Anchored Flex routes have two fixed time points (usually at major activity centers or connection points to other transit services). Customers who live between the time points may call to request a curbside pick-up. The operator takes the most direct route between time points to pick up the passenger.	Personal or shared transit service with designated pick-up and drop-off locations that does not run a fixed schedule. Trips are set up by customers ahead of time by contacting the service provider to arrange travel times and origin-destination locations. Requests can be made over the phone, by way of the internet, or via applications.	Service runs along a published alignment. Customers within a certain distance from this route may call to request a curbside pick-up. Since the route is specified, the bus must return to the point where it left the route after a deviation.	A set route and schedule that operates along a fixed path.
Passengers per Revenue Hour	2-3	3-5	4-7	5-8	8-10
Benefits	In rural areas with dispersed destinations, demand-response service provides the ability to serve a large geographic area.	Anchored Flex service combines the accessibility features of demand-response with the scheduled reliability of fixed-route service.	Flexible service type can be adapted to community needs. Use of new technology offers convenience and can result in reliable and cost-effective service.	In lower-demand areas where deviations can be accommodated, the agency effectively provides both fixed and ADA service with one vehicle.	This type of service typically provides the fastest travel times between points, which makes service attractive to choice riders.
Challenge	Demand-response has high cost per trip as clients are typically traveling long distances. Wait times for pick-ups can be very long as can time onboard the vehicle, depending on additional pickups.	To accommodate flex pick-ups, the travel time between time points must be a factor longer than direct travel.	Has high cost per trip as clients are typically traveling long distances. This can also lead to long wait times for pick-ups.	In areas with sparse road networks, accommodating out-and-back deviations may add significant travel time.	Geographic coverage of the service is limited to the route alignments and stop locations.
Vehicle Type					

ALTERNATIVE SERVICE RECOMMENDATIONS

Many of the identified challenges associated with the 2018 study can be addressed through utilizing alternative service design. To best meet the needs of Salem and leverage the key transit market elements in the most efficient and optimal way alternative service recommendations should be considered (Figure 8, Figure 9, Figure 10). It is important to note that MBTA The RIDE provides complementary paratransit to the entire City of Salem. The Council on Aging vans also cover the transportation needs of seniors in the community.
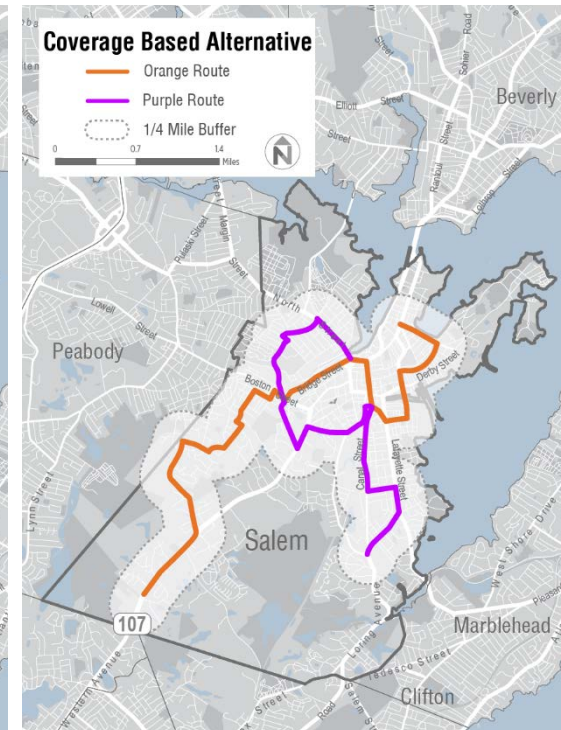
Figure 8 | Node Based Alternative

Figure 9 | Ridership Based Alternative

Figure 10 | Coverage Based Alternative
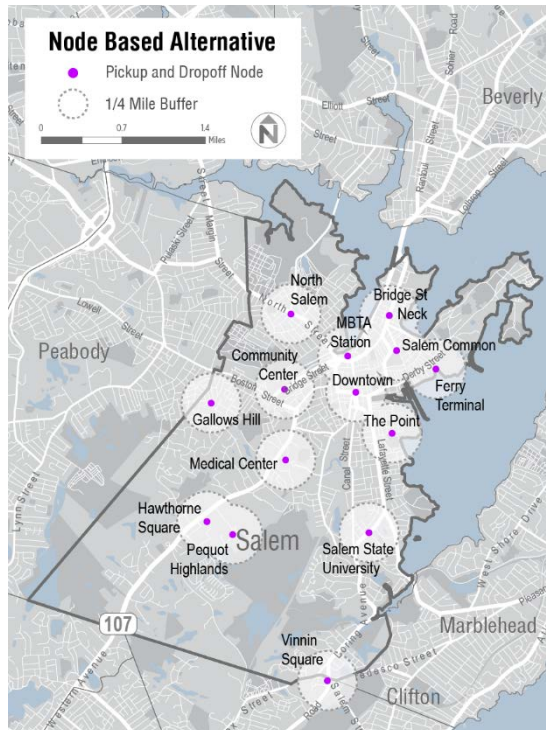
This mictotransit service operates as a shared shuttle which serves customers via designated pick-up and drop-off locations that are not served on a fixed schedule. Trips are provided at request, which can be made over the phone, by way of the internet, or via a smartphone application.

This fixed route alignment largely mirrors that of the existing MBTA service, serving the areas of highest ridership demand in Salem. Routes provide bidirectional service and add key east and west connections, not currently served by existing transit options.

This fixed route alignment focuses on providing neighborhood-based service where there is no or limited existing transit. Routes provide bidirectional service and add key east and west connections, not currently served by existing transit options.

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