SEAT BUS STUDY

FINAL REPORT

October 2015

SCCOG

SEAT

CONNECTICUT DEPARTMENT OF TRANSPORTATION

NELSON NYGAARD

ASG PLANNING

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ACKNOWLEDGEMENTS

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1 RECOMMENDATION

BACKGROUND

The Southeastern Connecticut Council of Governments (SCCOG), working closely with the Southeast Area Transit (SEAT) District, has undertaken a Comprehensive Operations Analysis (COA) of SEAT services. This COA, called the "SEAT Bus Study," was performed in order to identify cost neutral service improvements that would better serve existing riders, improve the overall efficiency of SEAT service, and attract more riders.

Today, SEAT provides service to 10 member communities, serving a number of key population and employment centers that are distributed (and often geographically isolated) across a service district that has a mix of urban and rural areas. Due to limited resources, about half of SEAT's routes offer service only every two hours, many end service before 7 p.m., and only four routes operate on Sundays. These limitations can make it challenging for many in the southeastern Connecticut region to access work, school, and needed services, particularly lower income individuals and those without access to other transportation. Increased transit frequency and additional weekend service are critically needed in the SEAT region.

Three alternative service plans were evaluated in depth and brought to the public and SEAT's Board of Directors for comment. This review included two plans that would be cost neutral on a systemwide basis, allowing SEAT to move forward with implementation within their existing operating budget. Given the need to more adequately serve the local population and enhance regional mobility, a third plan was also developed to identify priorities for system expansion if additional budget resources were to become available in the future.

RECOMMENDED SEAT IMPROVEMENT PLANS

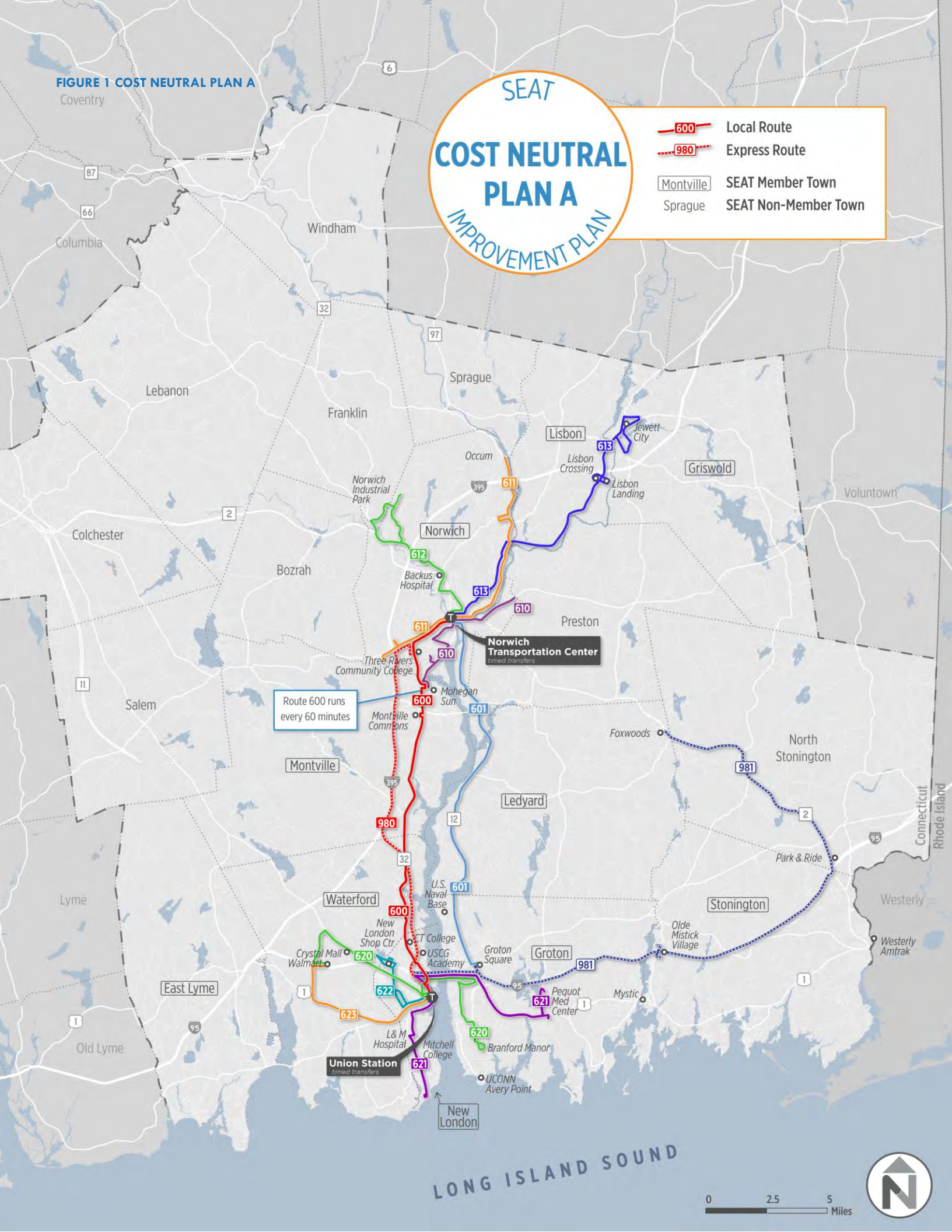
The **Recommended SEAT Improvement Plans** represent a set of service improvements that would be budget neutral when implemented on a systemwide basis. The plan would improve the overall efficiency of SEAT service, better meet customer needs and increase ridership by an estimated 13-16%. Increased fare revenues would make the service more efficient, possibly lowering overall annual operating costs on a net basis. These plans offer service design modifications on 16 of 17 existing SEAT routes to make service more efficient, more direct, faster, and more reliable. All SEAT routes would also be renumbered to correspond with new statewide transit route numbering.

Two SEAT Improvement Plans are presented as options for implementation: both plans are budget neutral when implemented on a systemwide basis, and each provides the service design benefits described above.

BENEFITS OF RECOMMENDED PLANS

- Easy to understand service
- Faster trips
- Fewer transfers
- Improved reliability
- Increased ridership
- Enhanced mobility

FIGURE 1 COST NEUTRAL PLAN A



The **Cost Neutral Improvement Plan A** (see Figure 1) provides increased frequency (from every two hours to hourly) on Route 600 between Norwich and New London, strengthening service in this corridor that serves as the "backbone" of SEAT's system. Route 980 express service would also be implemented in this corridor, replacing Three Rivers Community College trips, and taking 30 minutes as opposed to 60 minutes today. Plan A also calls for discontinuation of three existing routes, including two low ridership routes in East Lyme and Stonington. Evening service in New London (formerly called Run 15) would be replaced by extended service spans on existing daytime routes.

The **Cost Neutral Improvement Plan B** (see Figure 2) largely offers similar improvements to improve the efficiency of routes across the region. However, instead of discontinuing service along Route 1 in Stonington and along Flanders Road to Niantic, it maintains coverage in these lower ridership areas in lieu of increasing service levels in the New London-Norwich corridor. This plan was of interest to SEAT Board members and is further detailed in Chapter 3 below.

PRIORITY ACTIONS FOR SYSTEM EXPANSION

The Recommended SEAT Improvement Plans also include a series of priority actions for future system expansion, if and when additional resources are identified. These actions would extend service spans, add weekend service, and increase service frequency, particularly in the central urban cores of New London, Norwich, and Groton where ridership demand is strongest. These actions would respond to the strong calls for extended service on existing routes voiced by SEAT riders during the public outreach process conducted for this study.

The **System Expansion Plan C** is shown in Figure 3. More specifically, these expansion priorities include:

- Additional express service trips between New London and Norwich
- Sunday service on a total of eight routes, as compared to four today
- Extended service (earlier AM and/or later PM) on weekdays and Saturdays on nine routes
- A new route connecting Norwich with employment opportunities at the Foxwoods Resort Casino
- A new Groton local route, connecting major employers and residential populations in the City of Groton to Groton Square and the US Naval Base
- Restoring service in Stonington and East Lyme, including a new seasonal Mystic Shuttle operating from May to October each year

Collectively, if all expansion actions were pursued, the cost of service would increase by an estimated 25.7%. However, due to an anticipated increase in ridership as additional service is directed to core parts of the system, the net annual increase in SEAT operating costs would be less than 10%.

It is recommended that SEAT, working with SCCOG, take action to implement one of the **Cost Neutral Improvement Plans** for improved system efficiency over the near term. These partners should also pursue additional funding to implement the **System Expansion Plan** to better meet transit demand and mobility needs in the southeastern Connecticut region. Finally, SEAT should work with state and regional partners to advance another $6-$10 million in one-time capital improvements that would enhance the efficiency of transit service and better serve SEAT riders.

FIGURE 2 COST NEUTRAL PLAN B

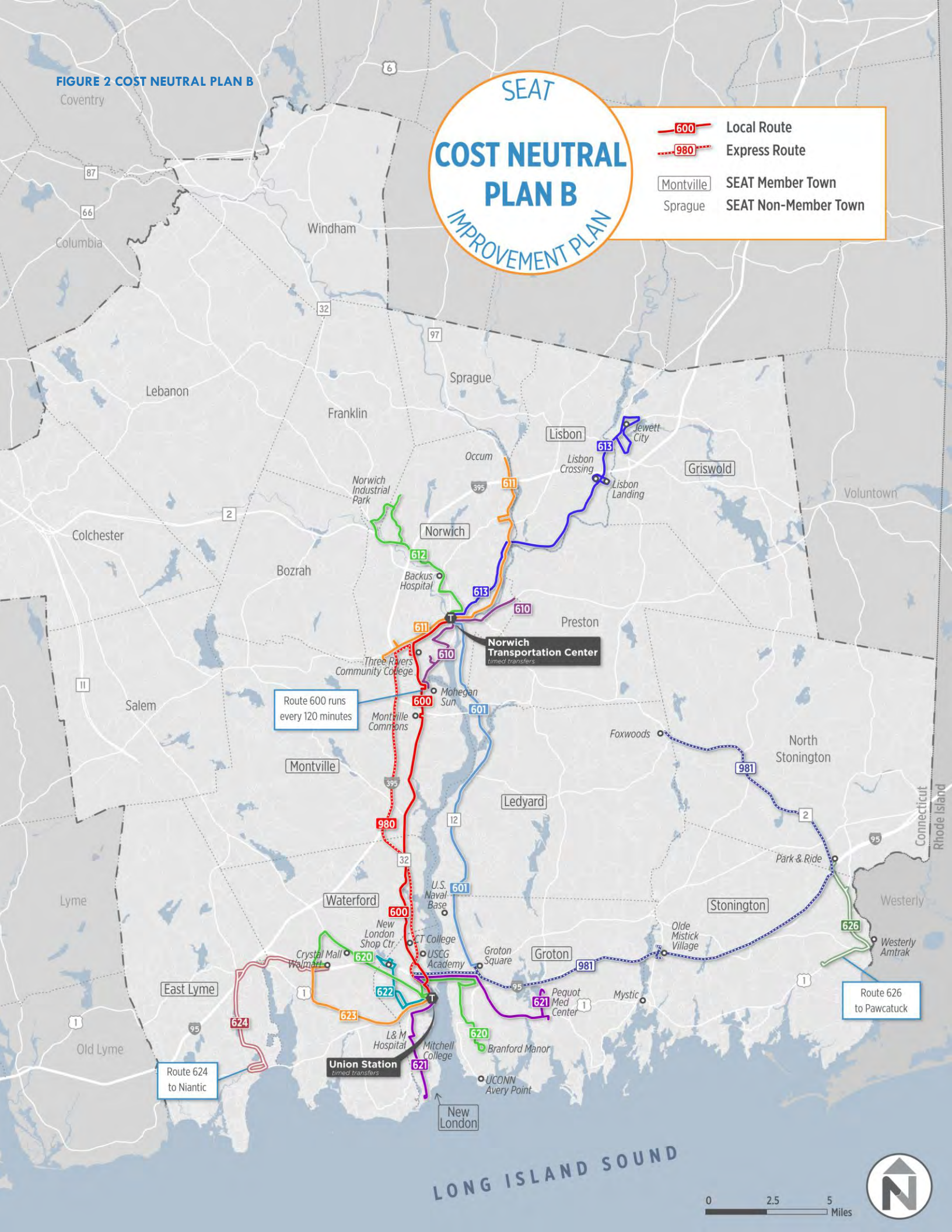
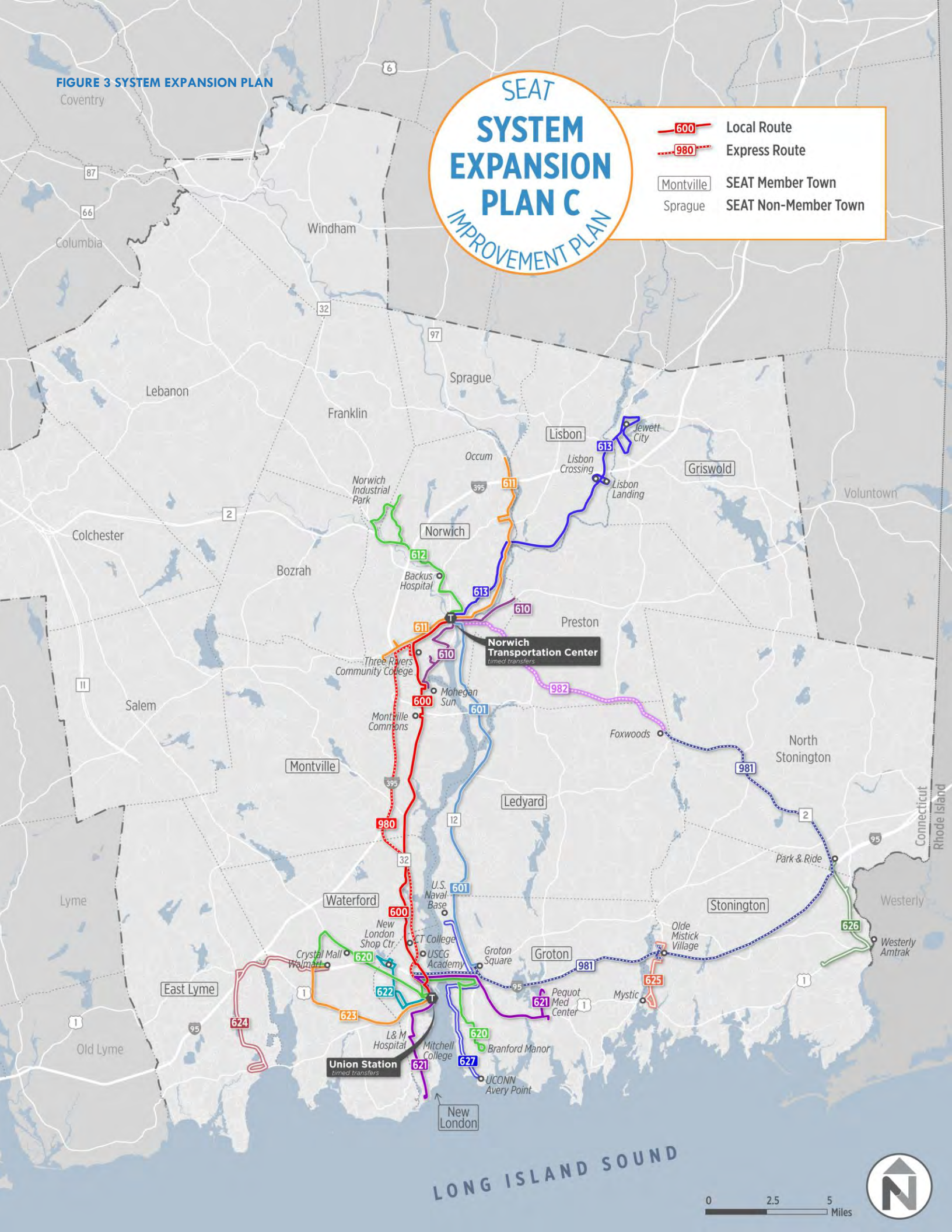


FIGURE 3 SYSTEM EXPANSION PLAN



2 THE SEAT TRANSIT SYSTEM TODAY

System Overview

The Southeast Area Transit District (SEAT) serves the 10 member municipalities of East Lyme, Griswold, Groton, Ledyard, Lisbon, Montville, New London, Norwich, Stonington, and Waterford in southeastern Connecticut (see Figure 4). SEAT provides service on 17 bus routes within these communities. SEAT also contracts with the Eastern Connecticut Transportation Consortium to provide complementary ADA paratransit service for those who live within ¾ of a mile of these routes but are unable to use fixed-route services.

The 10 SEAT member communities are part of the Southeastern Connecticut Council of Governments (SCCOG), a regional planning coalition that also includes the non-SEAT member municipalities of Windham, Lebanon, Franklin, Sprague, Colchester, Bozrah, Salem, Preston, and North Stonington. SEAT bus routes do pass through Preston and North Stonington, but do not stop to pick up riders in these non-member communities.

The 17 fixed routes operated by SEAT include longer corridor-based services and shorter local routes operating within one municipality. The adult base fare is $1.50 per trip, with free transfers provided upon request. There are three separate fare zones, with a $0.50 surcharge applied to the base fare for each zone crossed by a passenger.

The New London Union Station Intermodal Center and the Norwich Intermodal Transportation Center serve as major hubs for the SEAT system. Each of these locations serves as a key transfer location, where six or seven routes come together and "pulse," arriving and leaving on the hour to facilitate passenger connections.

Over the past few years, SEAT has taken a number of steps to improve its service and system. Adjustments have been made to improve service reliability, new vehicles have been purchased, and real time information is now available at the Norwich Transportation Center. Mobile applications are under development, which will soon allow riders to use smart phones to see where buses are in real time.

The first step of the SEAT Bus Study involved an in-depth review of the regional market demand for transit, as well as the performance of existing routes. The results of these analyses are summarized below.

Market Analysis

A market analysis was performed to examine underlying demographic conditions in the SCCOG region as they relate to the demand for transit service. Collectively, SEAT member communities had a 2010 population of 216,000, as compared to 286,711 in the broader SCCOG region. This is one indication that SEAT is currently focusing much of its service within more densely populated parts of the region.

The full market analysis focused on factors that are strongly correlated with transit demand including population and employment densities; areas populated by older individuals, individuals with low incomes or with disabilities; households without access to automobiles; and overall regional travel flows. The full Transit Market Analysis report is included as Appendix A.

FIGURE 4 SEAT ROUTE MAP / SCCOG MEMBER COMMUNITIES

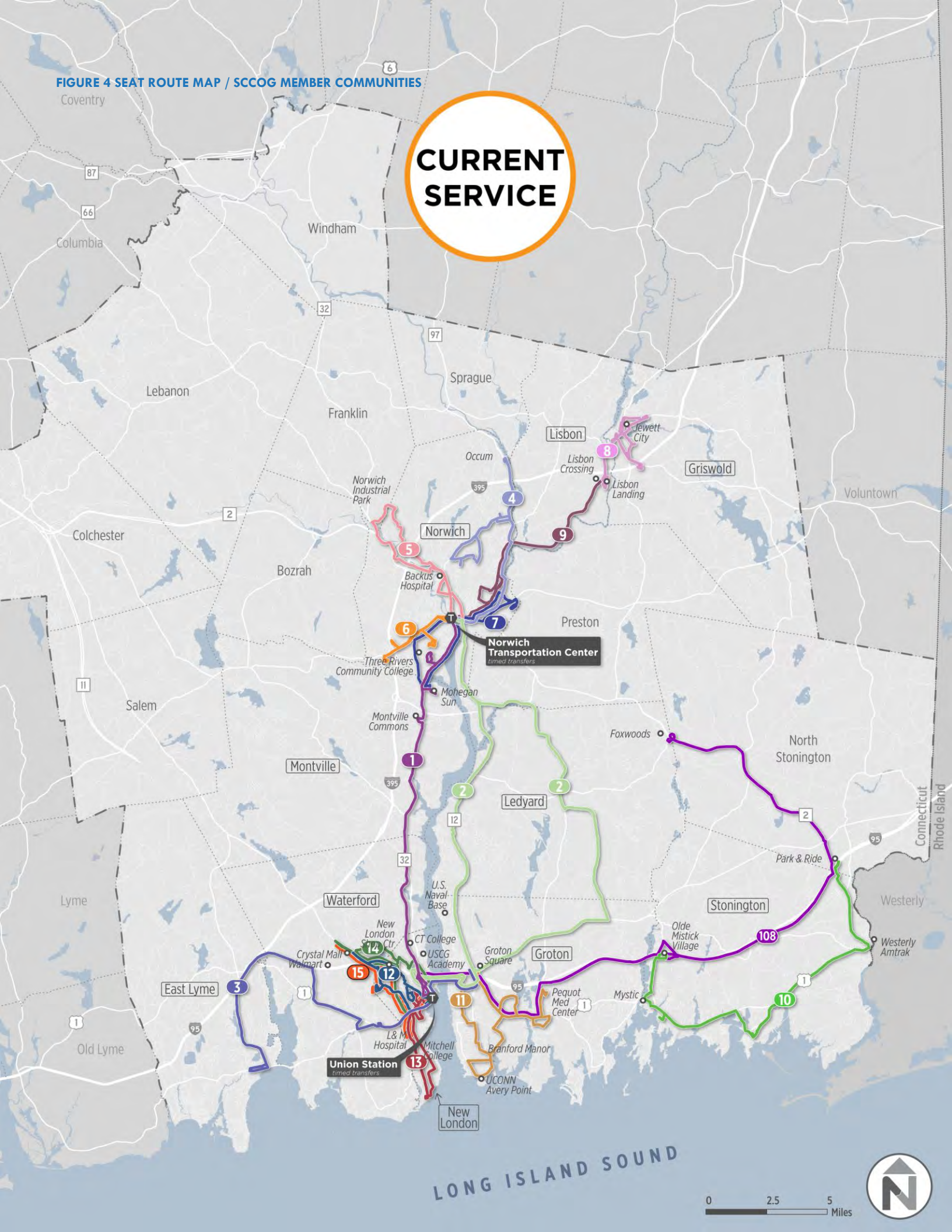


Figure 5 presents a "composite transit index" or a map of overall transit demand in the SCCOG region. This map indicates the likely level of transit service that could be effectively supported throughout the market area, based on existing population and employment densities. Key findings include:

- New London and parts of Norwich Groton are by far the most transit-supportive areas in the region, due to the clustering of jobs and population in close proximity. These communities represent the core of the SEAT service area, and can support the most significant and productive levels of transit service. Waterford also has areas with high or moderate demand.
- Several boroughs and key activity centers outside of these communities also demonstrate relatively high or moderate transit demand. However, these locations are geographically isolated from other areas of high demand, making them difficult for SEAT to serve effectively (e.g. Foxwoods Resort Casino, Mystic, Pawcatuck, Niantic, Lisbon Landing/Lisbon Crossing, and Jewett City). Linking these locations to the SEAT network requires routes to travel through areas with very low demand for transit. In these locations, alternative service strategies such as flex service, local circulator services or limited stop express service may be more appropriate transit service design models.
- The communities of Ledyard and Montville (with the exception of Mohegan Sun) have lower levels of density and transit demand, yet are well integrated into the SEAT network today as routes pass to connect to areas of higher demand.
- Three outlying communities – Windham, Colchester, and Westerly, RI – have moderate or high transit demand. While not currently SEAT members, there may be demand for improved regional transit connections with these locations, perhaps through coordination with other regional transit agencies serving these communities.
- Other outlying communities in the SCCOG region have a rural character and lack sufficient population and employment density to support fixed-route transit service (e.g. Bozrah, Franklin, Lebanon, North Stonington, Preston, Salem, and Sprague). SEAT should continue to follow their current strategy, directing resources to serve communities of higher density and demand.

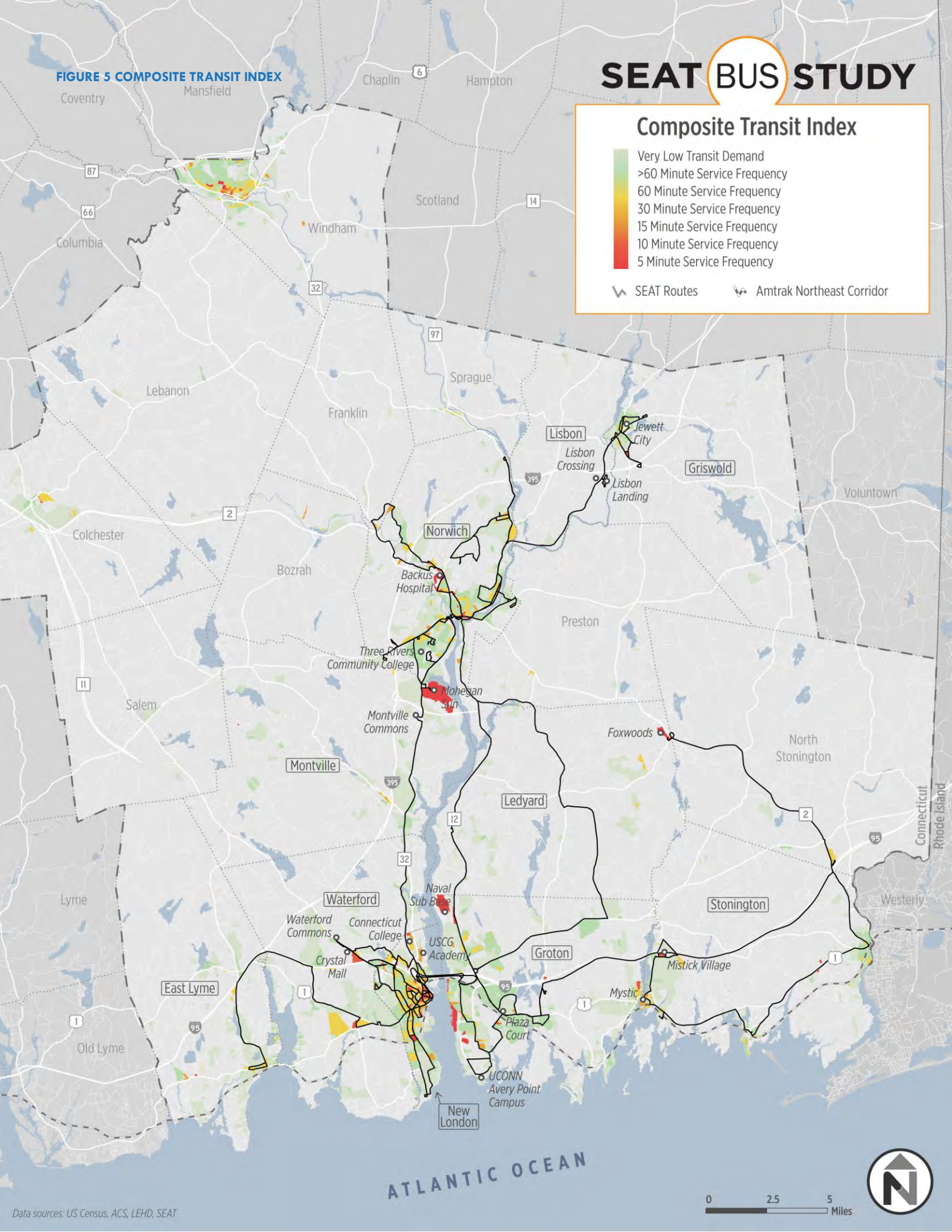
Evaluation of Existing Route Performance

SEAT service is operated seven days a week. On average, there are 4,000 weekday boardings on the system, or about 1.2 million trips per year.

The 17 scheduled routes include Run 15, which offers only evening service in New London, and the Three Rivers Community College Express, which offers seven trips per day. A total of 14 routes operate on Saturday and only four routes operate on Sunday.

In October 2014, a manual count of passengers boarding and alighting from all SEAT trips was performed. These "ride checks" were used to assess the individual markets served by each route, as well as overall performance by day of the week and time of day (trip). A summary of these ridership counts is shown in Table 1. (SEAT has since installed automated passenger counting devices and is now collecting ridership data on a daily basis.)

FIGURE 5 COMPOSITE TRANSIT INDEX



Data sources: US Census, ACS, LEHD, SEAT

TABLE 1 DAILY RIDERSHIP BY EXISTING SEAT RUN (OCTOBER 2014)

RUN	RUN DESCRIPTION	WEEKDAY RIDERSHIP	WEEKDAY RIDERS PER TRIP	SATURDAY RIDERSHIP	SATURDAY RIDERS PER TRIP	SUNDAY RIDERSHIP	SUNDAY RIDERS PER TRIP
1	Norwich/Mohegan Sun/NL	477	23.9	342	17.1	63	4.5
2	Norwich/Groton/New London	201	16.8	125	10.4		
3	Groton/NL/Niantic	154	12.8	-	-	-	-
4	Taftville/Occum/Greenville	338	26.0	207	17.3	-	-
5	Industrial Park/Backus Hosp.	349	15.9	171	10.7	-	-
6	West Side (Norwich)	457	19.0	219	13.7	-	-
7	Hamilton Ave./Mohegan Sun	593	34.9	369	28.4	154	10.3
8	Jewett City/Lisbon Landing	138	9.2	87	5.8	-	-
9	Norwich/Lisbon Landing	383	13.7	261	9.3	-	-
10	Pawcatuck/Mystic	22	2.2	-	-	-	-
11	Groton Local	283	10.5	170	6.8	98	5.8
12	Jefferson Ave./ Malls	256	11.6	260	11.8	-	-
13	L+M Hospital/Ocean Beach	228	9.5	145	6.6	-	-
14	Crystal Ave./Malls/Coleman	262	11.9	188	8.5	-	-
15	NL/Waterford evening service	31	5.1	37	4.6	-	-
108	NL/Groton/Mistick/Foxwoods	221	13.0	208	13.0	88	11.0
TR	Three Rivers Express	52	7.4	-	-	-	-
	System Average		**15.0**		**11.2**		**7.5**

Source: SEAT Ridecheck 2014

Figures 6 and 7 display the relative performance statistics for each run. Run 7, connecting Norwich with Mohegan Sun, and Run 1, connecting Norwich and New London, have the highest ridership. Other local Norwich bus runs (4, 5, 6, and 9) are also relatively productive. The Stonington (Run 10) and Jewett City (Run 8) services are the least productive runs with full weekday schedules.

FIGURE 6 - AVERAGE WEEKDAY RIDERSHIP

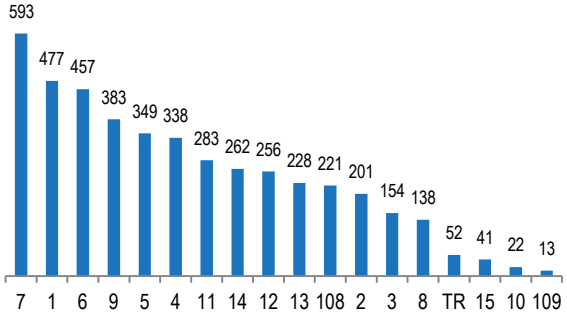
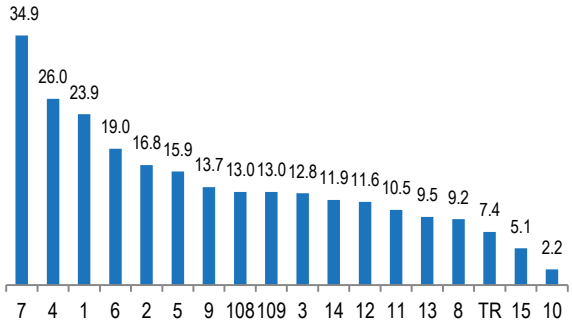


FIGURE 7 - AVERAGE WEEKDAY RIDERSHIP PER TRIP



Note: Run 109 operates supplemental service along the Run 1 corridor on State Route 32.

Stakeholder Outreach

Throughout the SEAT Bus Study, a high priority was to give everyone in the community an opportunity to participate. The project team provided as many ways as possible to interact, allowing people to share ideas and feedback in whatever way was most convenient and comfortable for them. Through a variety of online and in-person activities, there were multiple ways for SEAT bus riders and other community members to express their ideas and communicate their feedback. Summary reports of these efforts are provided in Appendix C.

OUTREACH BY THE NUMBERS

- ✓ 4 public meetings
- ✓ 9 outreach events, including workshop bus and tabling at key transit centers
- ✓ 144 written comments submitted at meetings and events
- ✓ 525 votes received through voting exercises at all events
- ✓ 22 interviews with stakeholders
- ✓ 316 completed tradeoff surveys
- ✓ 89 comments submitted through the SEAT Bus Study website

Stakeholder Interviews: A series of stakeholder interviews were conducted during the early phases of the study to better understand how members of the community perceive SEAT service. Interviews were conducted with 22 key stakeholders and representatives of organizations with clients that use SEAT.

Public meetings and events: Four public meetings were held during the course of the study, with two each in Norwich and New London. In addition, the project team also visited major transit stops to speak with riders and hear feedback. Riders were encouraged to learn about the study, participate in interactive voting exercises, and talk one-on-one with members of the project team. A workshop bus was brought to several events, featuring a SEAT transit bus outfitted with uniquely branded banners outside the bus and workshop materials inside.

Website and online engagement: The SEAT Bus Study website (www.SEATBusStudy.com) provides easy access to information about the study and its progress, and served as a convenient way for people to share written comments and feedback. Announcements about public events were shared via email with people who signed up to receive project notices. A tradeoff survey was also administered online, which allowed respondents to quickly and easily identify the service priorities that are most important to them.

What we heard:

1. *Service is very slow. It takes forever to get anywhere.*
2. *There is not enough Sunday service.*
3. *Bus schedules are unreliable.*
4. *Service information is hard to find and read.*
5. *Weekday service ends too early.*
6. *We don't like flag stops.*
7. *Zone fare system is confusing.*
8. *Service should be more direct.*
9. *More New London-Groton service is needed.*
10. *Stronger Norwich-New London service needed.*

3 DEVELOPMENT OF ALTERNATIVES

METHODOLOGY

A number of different ideas for improving the effectiveness of each individual SEAT route were developed based on stakeholder outreach, the market analysis, and the ridership counts performed at the outset of the study. The different concepts for each route also followed a set of transit service principles established for SEAT. A detailed evaluation for each of the 17 existing SEAT runs, including a description of alternative service concepts considered, is included in Appendix B.

Alternative service proposals were brought to the public in February 2015; several ideas for new routes were also proposed. Based on rider feedback, preferred concepts were combined to create three systemwide service plans. Two of these plans were designed to be cost-neutral on a systemwide basis; the third plan identifies a number of priority actions that might be considered if additional budget resources are identified.

This chapter describes the established SEAT transit design principles, shows proposed changes by individual SEAT route, and describes the three alternative systemwide service plans:

- Cost Neutral Plan A
- Cost Neutral Plan B
- System Expansion Plan C

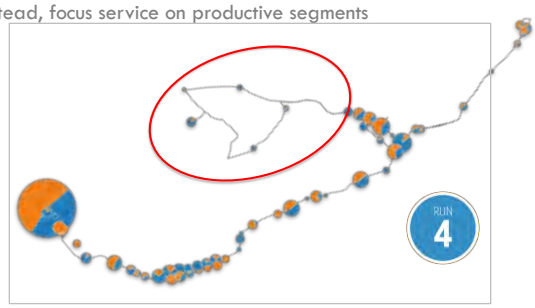
SERVICE DESIGN PRINCIPLES

A set of service design principles has been established as part of SEAT's new Service Guidelines (refer to Appendix D). Service elements that will attract one type of rider to transit can deter other riders, and SEAT must balance these types of competing demands. However, there are also certain service design principles that will improve service for nearly all riders. These principles are summarized below, and are also included in the Service Guidelines in Appendix E.

- **Service should be simple.** For people to use transit, service should be designed so that it is easy to understand. Many SEAT routes are complex. Improvements would make service intuitive, logical, and easy to understand.
- **Service should be fast and direct.** Service that meanders and repeats itself can be slow and hard to figure out. Many SEAT routes operate as loops, fo out-of-direction travel. Routes should operate alo major roadways and be as direct as possible.
- **Major routes should operate along arteria** Regional, express, and long distance routes shou offer fast service. Operating bus service along art makes transit service faster and easier for riders understand and use.
- **Routes should be symmetrical**. Many SEAT operate in loops, offering service in only one dire and forcing passengers to travel out of their way least one segment of their round trip. With bidirectional service (where runs serve the same in both directions), passengers benefit from more direct and convenient service.
- **Route deviations should be minimized.** Turning off major arterials to serve small roads with limited ridership wastes valuable resources and slows down through service for the majority of other riders. Service should be focused on productive segments.
- **Routes should serve well-defined markets.** Although urbanized areas in the SEAT system benefit from a number of transit runs, these runs often operate along the same corridors. Routes should be designed to serve distinct markets.
- **Most trips should be possible with one transfer.** Certain trips within the SEAT district require taking up to three buses, such as a trip from Groton to Waterford or from Jewett City to Three Rivers Community College. Services should be combined or modified to offer more one-seat rides where possible.

Strategy: Discontinue Unproductive Segments

- Unproductive segments waste valuable resources
- Unproductive deviations slow down thru-service
- ✓ Instead, focus service on productive segments



SEAT ROUTE RENUMBERING

At the request of the Connecticut Department of Transportation (CTDOT), any future service changes implemented by SEAT will also introduce a new statewide bus route numbering system. SEAT "Runs" will now be called "Routes" with numbers 600-630; express routes that utilize limited access highways for part of their route will be numbered 980-982. Figure 8 provides a map to help correlate existing SEAT run numbers with proposed new route numbers.

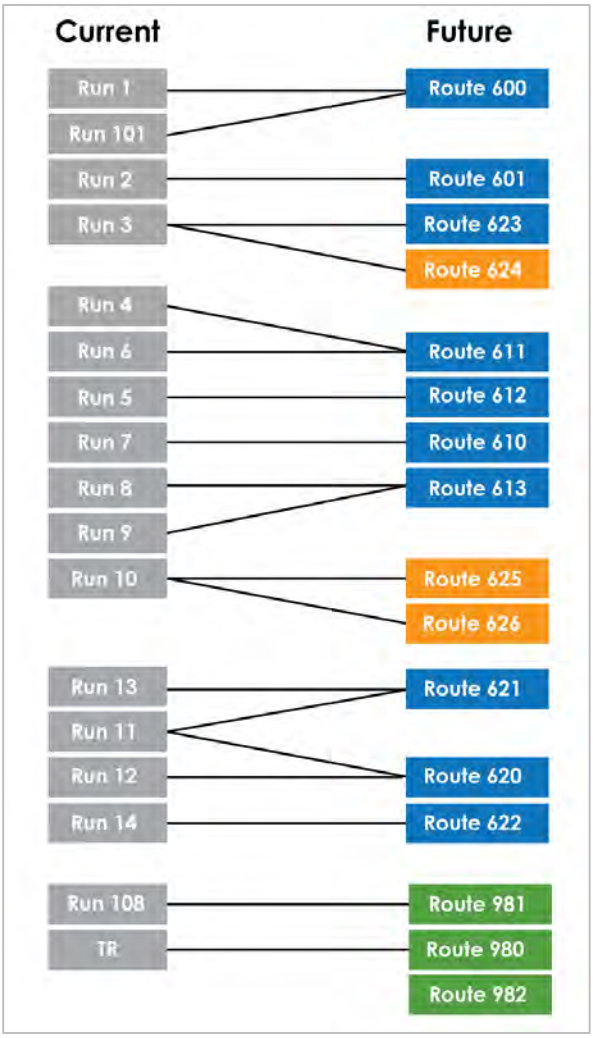
PROPOSED ALIGNMENT CHANGES BY ROUTE

Before creating alternative service plans, recommended alignment changes by route were developed.

Alignment changes are recommended for each route in the SEAT system. These improvements are intended to make each SEAT route more attractive to riders by adopting best practices in transit service design. A number of new routes are also proposed to serve areas with identified transit demand not well served today, or to connect key activity centers.

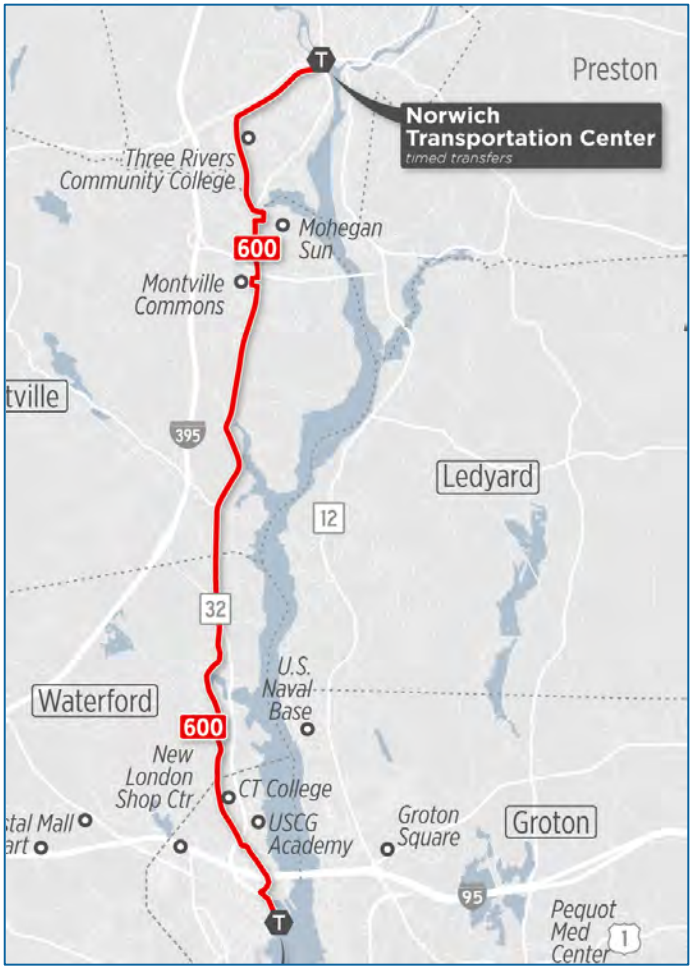
The following pages present a side-by-side comparison of existing SEAT routes with proposed alignment modifications and potential new routes.

FIGURE 8 PROPOSED ROUTE RENUMBERING



Run 1 Norwich-New London

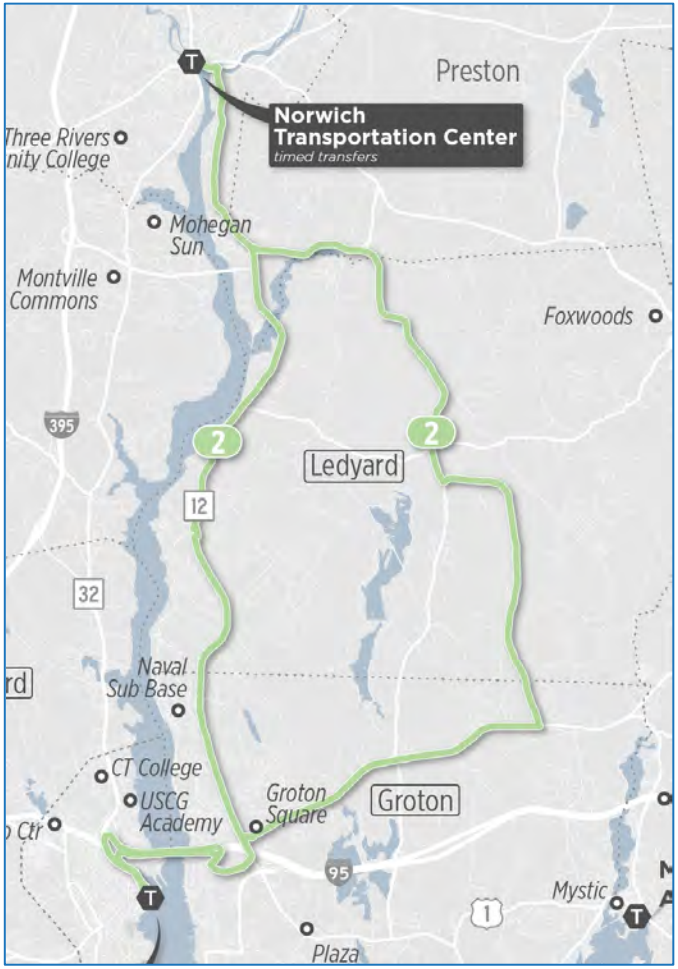
Proposed Route 600 Norwich-New London



Route 600

- Run 1 and 101 trips consolidated into one route.
- New London segment serves Crystal Avenue.
- Norwich segment uses New London Avenue and W. Main Road rather than Thames Street.
- Continues to operate locally along SR 32 and into Montville Commons and Mohegan Sun.
- Provides more frequent and direct service to Three Rivers Community College from both downtown Norwich and New London.
- Uncas on Thames now served by new Route 610.

Run 2 Norwich-Groton-New London

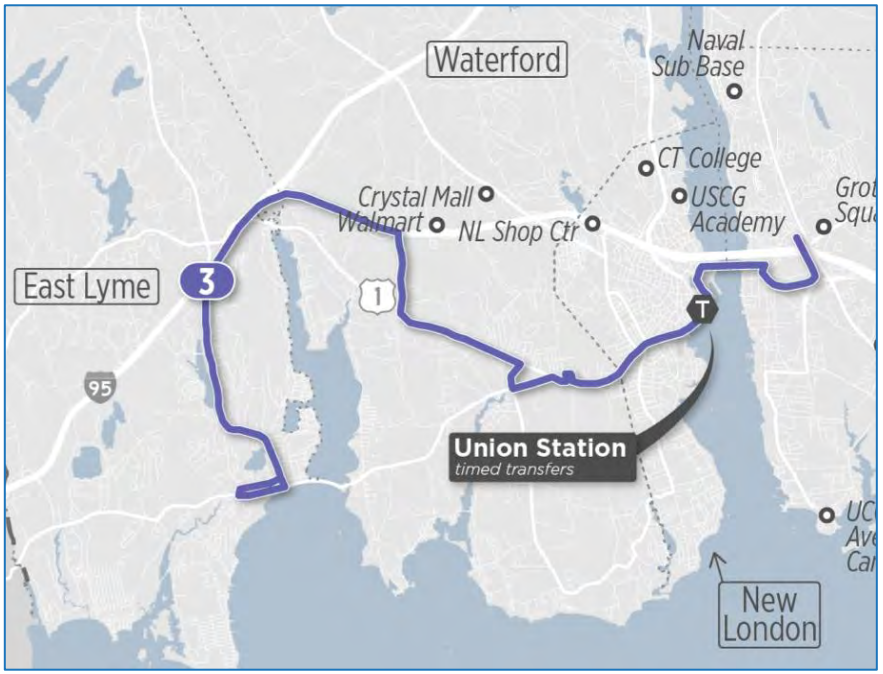


Proposed Route 601 Norwich-Groton

Route 601

- Operates along same alignment in both directions, rather than as a one-way loop.
- Ledyard Center segment has little ridership and would be discontinued.
- US Naval Base, Gales Ferry, and other locations along SR 12 would benefit from service in both directions.
- Route would terminate at Groton Square, where connections to New London, Foxwoods, and other Groton points could be made.
- Route would make short deviation onto Crystal Lake Road once SEAT and Naval Base find agreeable turnaround location.

Run 3 Groton-New London-Niantic



Proposed Route 623 Waterford Cancer Center
Proposed Route 624 Flanders-Niantic

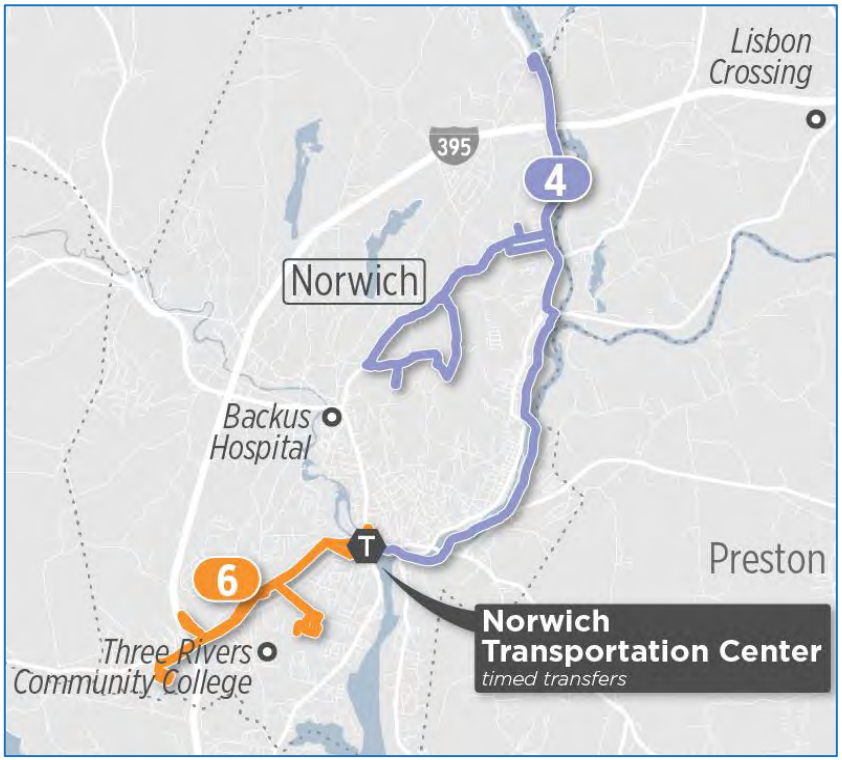
Route 623

- Route 623 provides a much faster connection between Union Station and Waterford Center, as opposed to current Run 3 which travels from Union Station to Groton prior to serving Waterford Center.
- End point would differ depending on whether Niantic service is retained.
  - If Niantic service is discontinued, Route 623 would operate New London-Waterford Center-Waterford Cancer Center.
  - If Niantic service is retained (as Route 624), Route 623 would terminate at Waterford Walmart, meeting Routes 624 and 621.

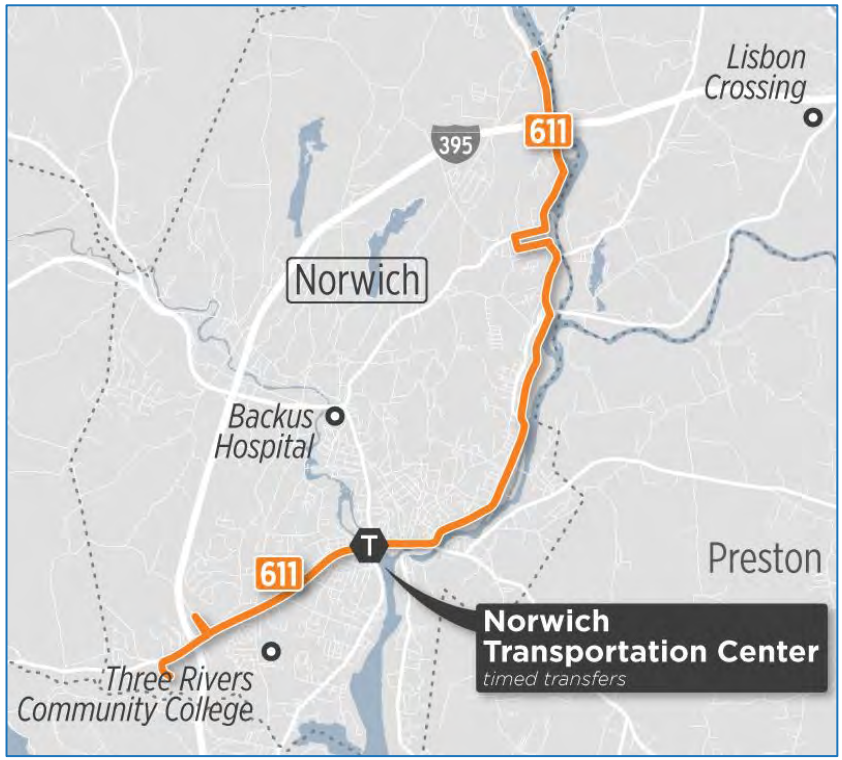
Route 624

- Service would operate directly between the Waterford Walmart-Flanders Four Corners-Niantic.

Run 4 Taftville-Occum-Greenville
Run 6 West Side



Proposed Route 611 West Main-Occum

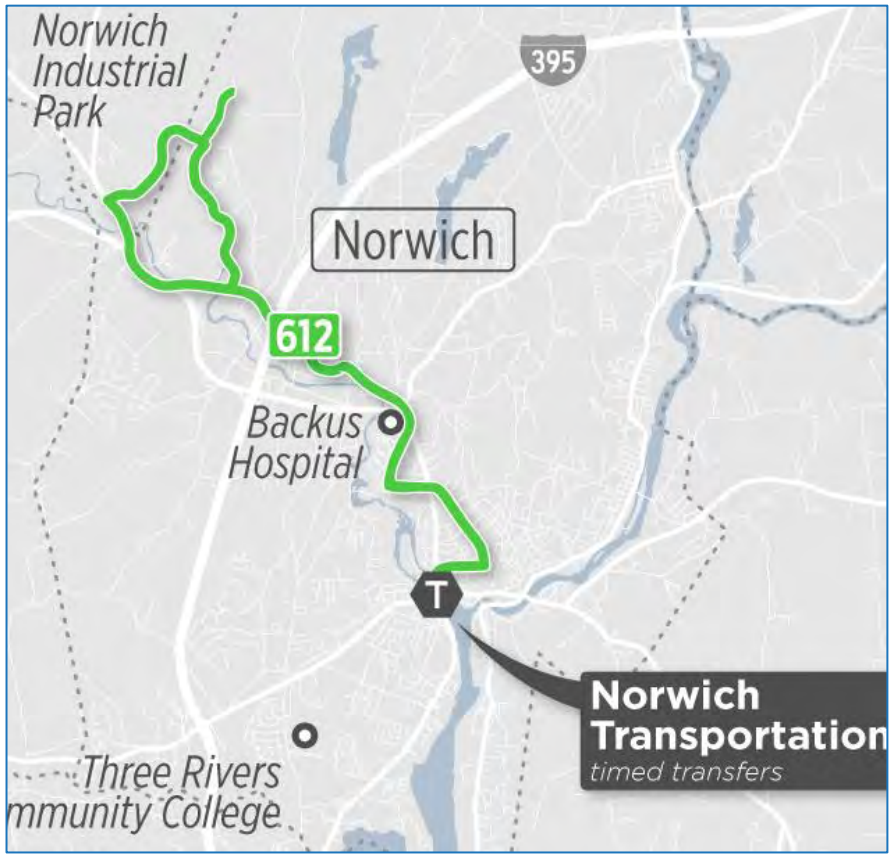


Route 611

- SEAT runs 4 and 6 would be combined to provide one-seat service between Occum, Taftville, Greenville, and Norwich's west side retail district.
- The Taftville deviation would be shortened, eliminating a long loop that carries very few riders. This allows for more frequent service to Occum.
- Wequonnec Village would no longer be directly served, riders would need to board the bus on Providence Street.
- All trips would operate via Boswell Avenue.
- On the west side, the Dunham Street Sunset Park area would be served by a new Route 610.

Run 5 Norwich Industrial Park

Proposed Run 612 Norwich Industrial Park

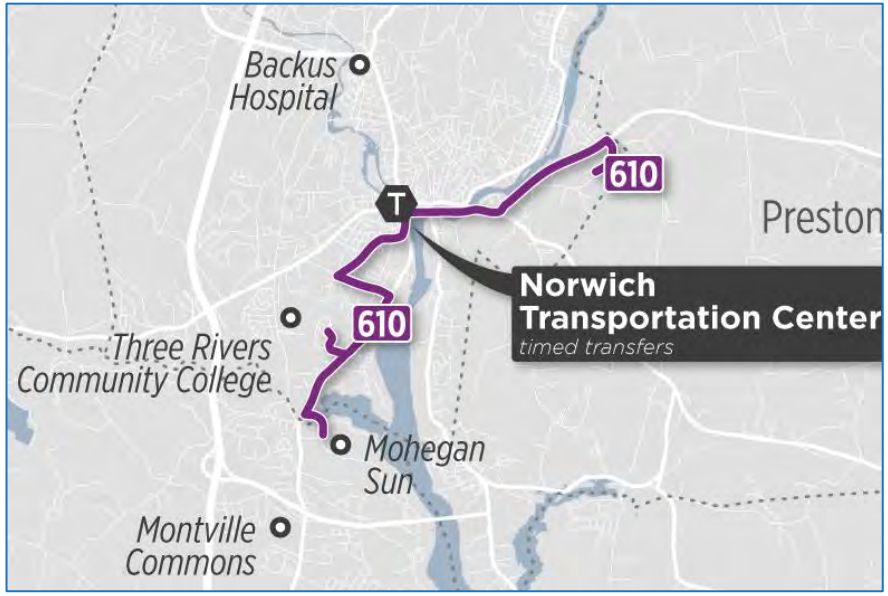


Route 612

- Service realigned to eliminate two of three one-way loops. The Industrial Park loop is shortened by bypassing unproductive segment on Otrobando Avenue.
- Service would operate northbound on Broadway and southbound on Union Street. Service would operate in both directions via Sachem Street and Lafayette Street.
- One or two daily trips would serve Wisconsin Avenue at the north end of the Industrial Park, rather than the Industrial Park loop.

Run 7 Hamilton Avenue-Mohegan Sun

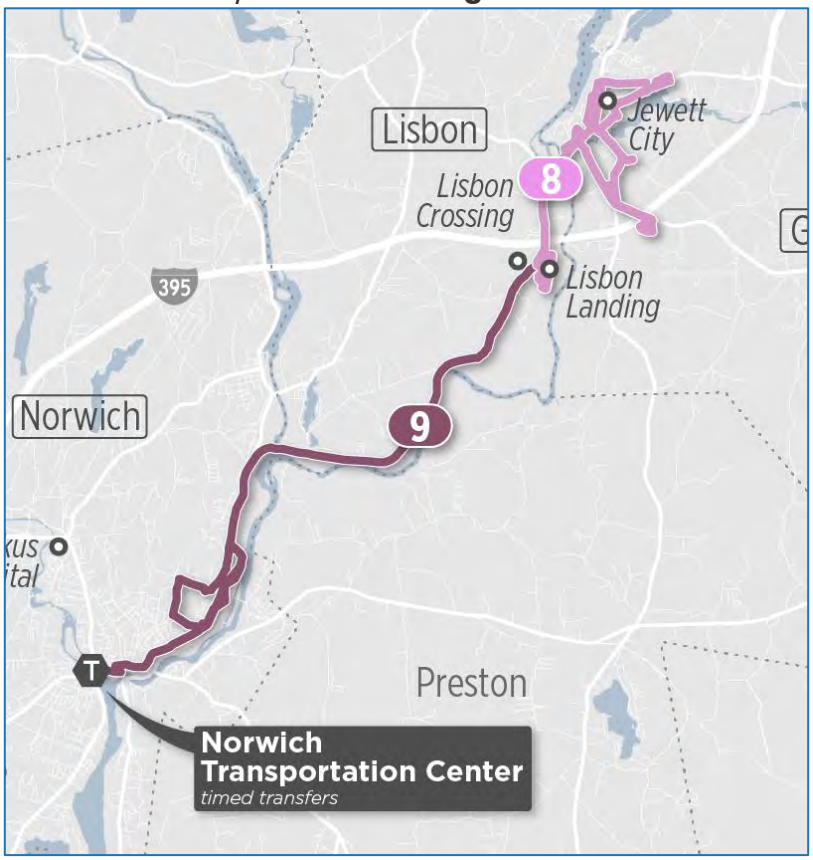
Proposed Run 610 Hamilton Avenue-Mohegan Sun



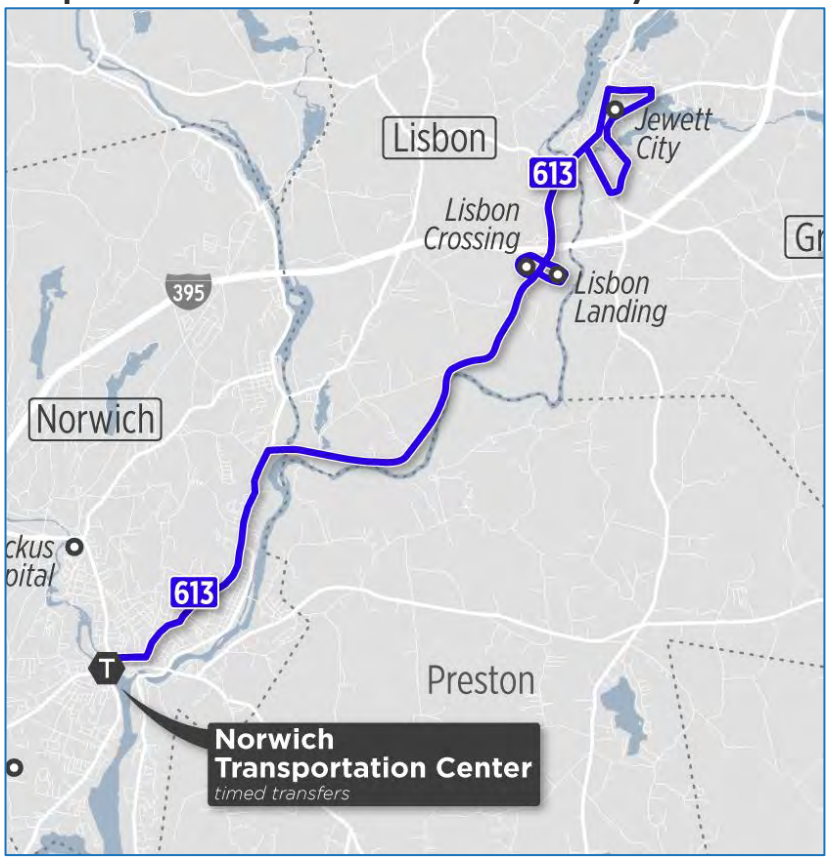
Route 610

- Service would operate between Mohegan Sun, Sunset Park area, West Main Road, downtown Norwich, and Hamilton Avenue. The Greenville area along Central Avenue and Boswell would be served by Routes 611 and 613.
- The Franklin Street deviation in downtown Norwich would be discontinued due to low ridership.
- Route 610 would provide service to Uncas on Thames complex.

Run 8 Jewett City/Lisbon Landing
Run 9 Norwich/Lisbon Landing



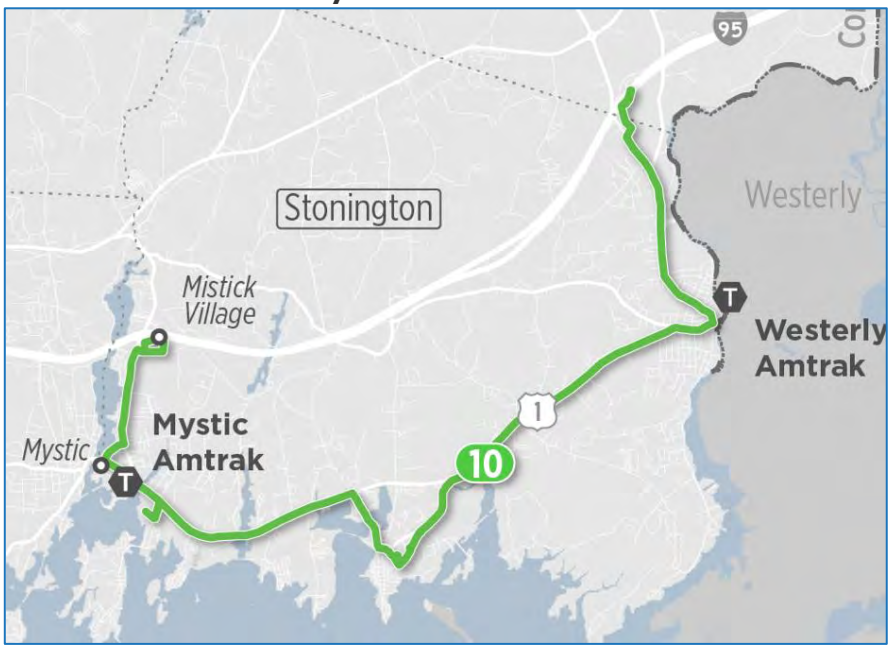
Proposed Route 613 Norwich-Jewett City



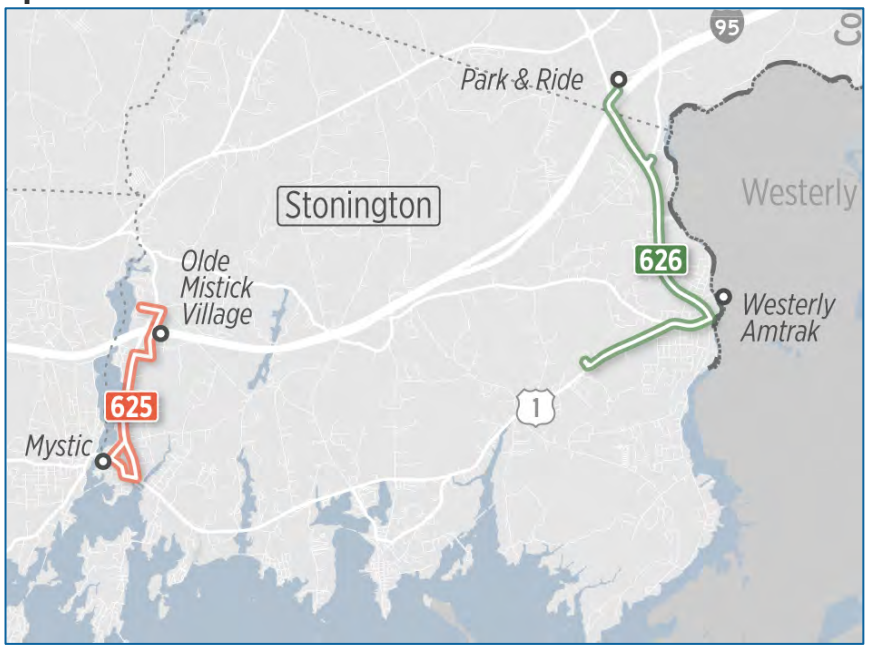
Route 613

- SEAT runs 8 and 9 would be combined to provide one-seat service between Norwich, Lisbon, and Jewett City.
- Route 613 would serve both Lisbon Landing and Lisbon Crossing.
- Meandering service in Jewett City would be straightened to make route faster and easier to understand.
- All trips would operate via Boswell Avenue in Norwich.

Run 10 Pawcatuck Mystic



Proposed Route 625 Mystic Shuttle
Proposed Route 626 Pawcatuck Local



Route 625

- The Mystic portion of Run 10 would be redesigned as a seasonal shuttle operating between Olde Mistick Village and Mystic Center.
- The shuttle would operate more frequently (30 minutes versus every 2 hours).
- The shuttle would operate 7 days a week for 5 months, from mid-May to mid-October.
- Connections to New London and Foxwoods could be made at Olde Mistick Village.

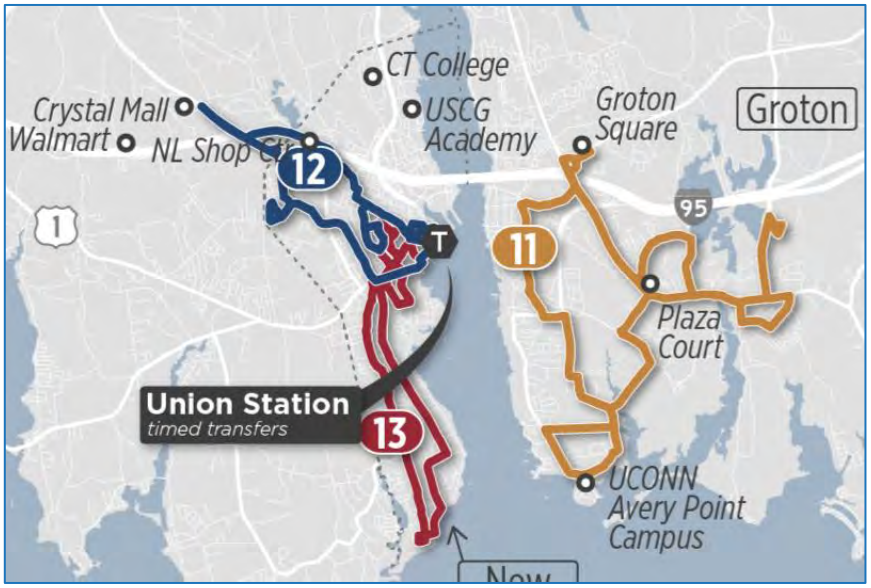
Route 626

- The Pawcatuck portion of Run 10 would operate between Brookside Apartments to the park-and-ride lot on SR 2 at I-95.
- Route 626 would serve the Voluntown Road Stop & Shop.
- Connections to Foxwoods, Olde Mistick Village, and New London could be made at the park-and-ride lot.

Run 11 Groton Local

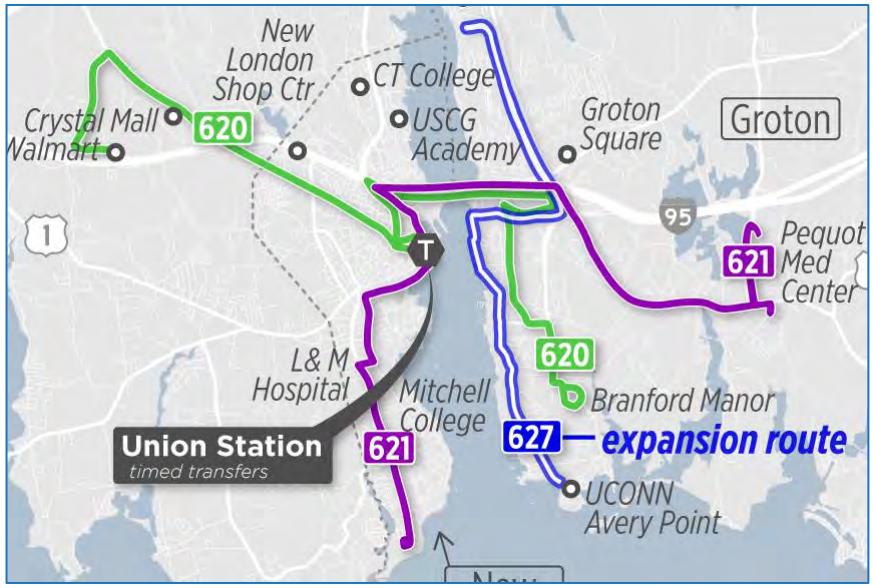
Run 12 Jefferson Ave/Malls

Run 13 L+M Hospital/Ocean Beach



Proposed Route 620 Waterford /Branford

Proposed Route 621 Ocean Beach/Pequot Medical



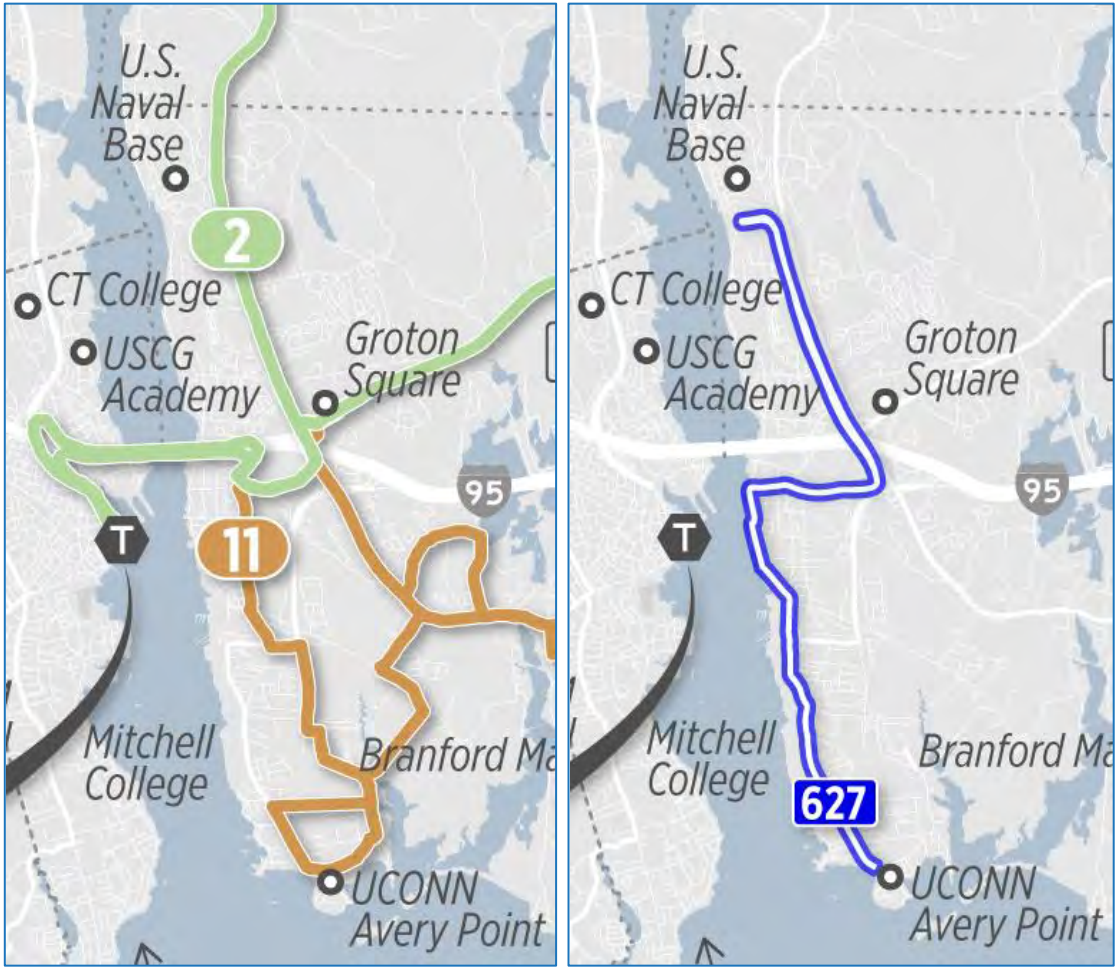
Route 620

- Runs 11 & 12 combined to offer one-seat service between Groton and Waterford.
- Waterford leg would extend to Walmart. Groton leg would end at Branford Manor.
- Local Groton connections could be made at a new Groton Square mini-hub.
- Service to Avery Point would be discontinued.

Route 621

- Runs 11 & 13 combined to offer one-seat service between Pequot Medical Center and Ocean Beach.
- Groton leg would serve Poquonnock Bridge area in one direction. Poquonnock Road south of Route 1 would be discontinued due to low ridership.
- Ocean Beach service would operate on Ocean Avenue in two directions.

Proposed New Route 627 Avery Point-US Naval Base



Route 627

- This new Groton local route would connect UCONN Avery Point, GD-Electric Boat, Groton Square, and the US Naval Base.
- Connections to other Groton locations, Norwich, Foxwoods, and New London could be made at Groton Square.

Run 14 Crystal Ave/Malls/Coleman

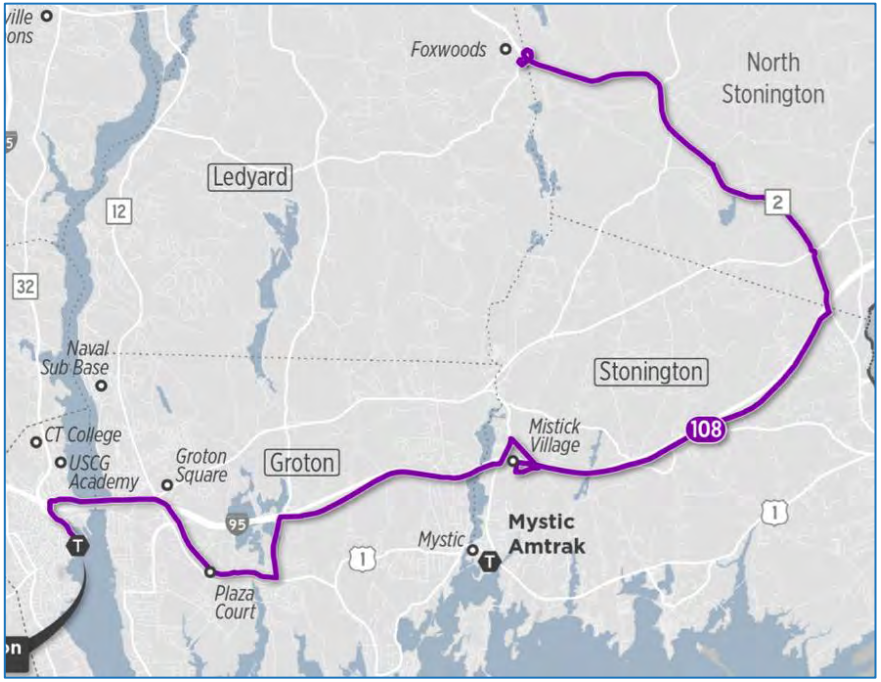
Run 15 New London/Waterford Evening Service

Proposed Route 622 New London

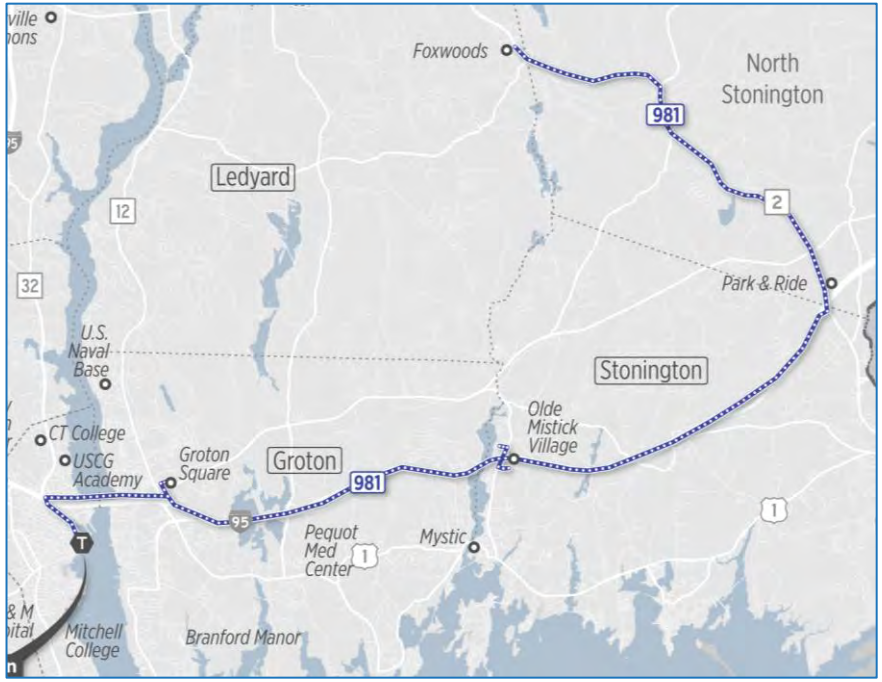
Route 622

- Existing Run 14 would be simplified to eliminate deviations and loops.
- Service would operate northbound on Jefferson and southbound on Coleman.
- Service would connect Bank Street and New London neighborhoods directly with the New London Mall and New London Shopping Center.

Run 108 New London/Foxwoods



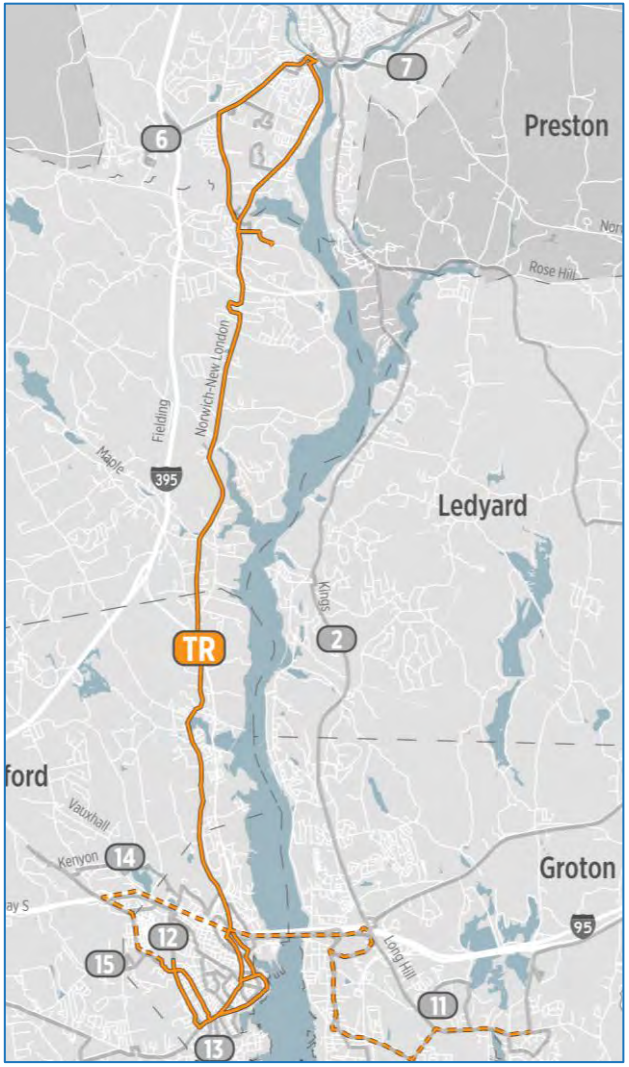
Proposed Route 981 New London/Foxwoods



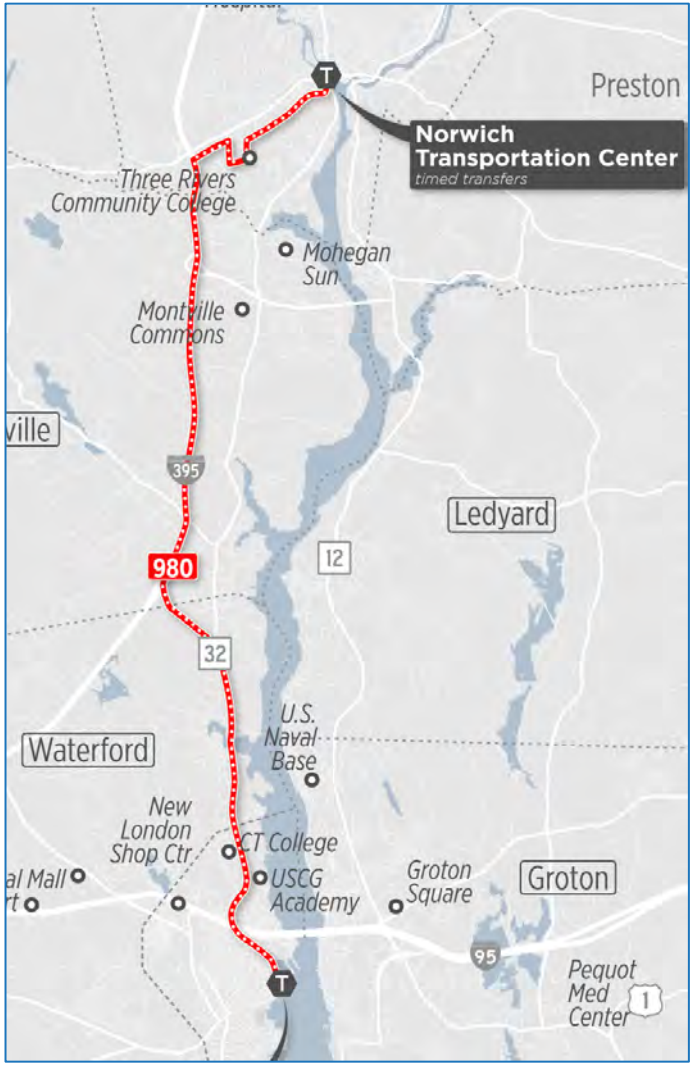
Route 981

- Existing Run 108 would be refocused on highway segments, providing faster travel between New London and Foxwoods.
- Travel between New London and Foxwoods would be 10 minutes faster.
- Groton residents can make connections at Groton Square.

TR Three Rivers Express



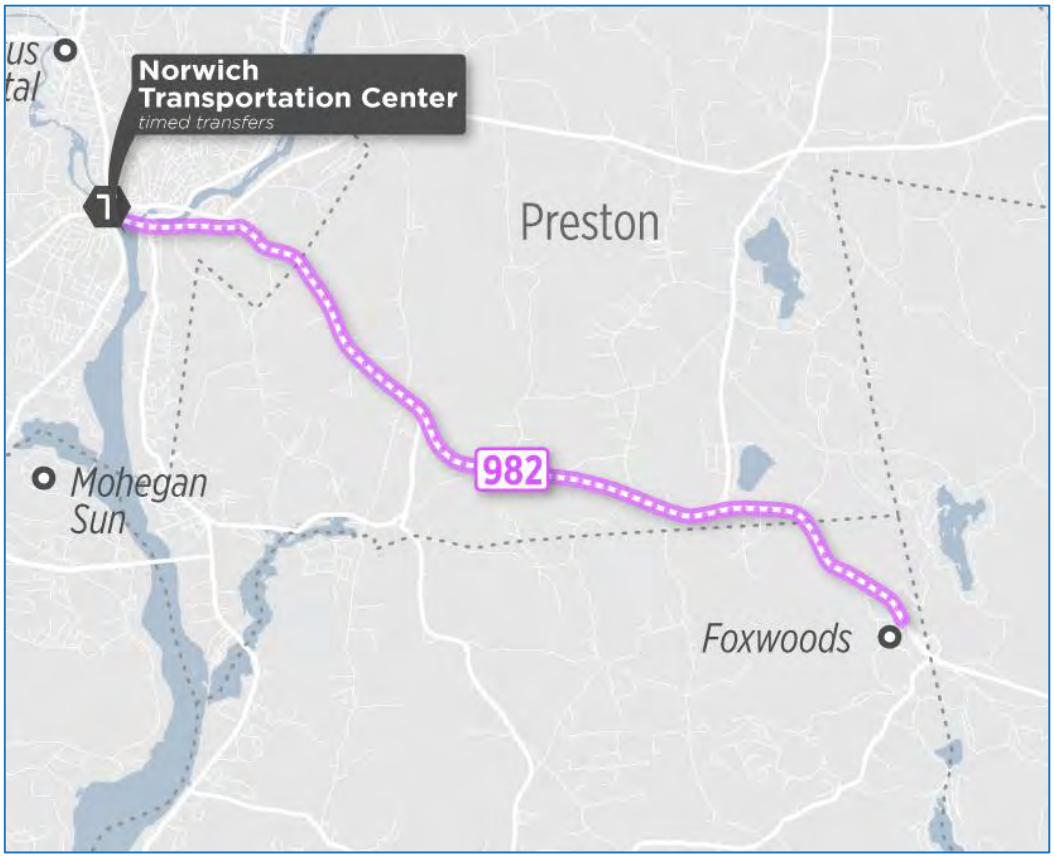
Proposed Route 980 New London/Norwich Express



Route 980

- Today SEAT operates 7 daily trips between New London and Three Rivers Community College.
- Route 600 (described earlier) would provide direct service between New London and TRCC all day.
- Route 980 would provide supplemental express trips, traveling via I-395 and arriving in 30 minutes rather than 60 minutes.
- Express service would be initiated between New London and TRCC, and would alternate with Norwich Transportation Center trips as more service can be added.
- Groton residents can use Routes 620, 621 or 981 to access TR trips at Union Station.

Proposed New Route 982 Norwich – Foxwoods Express



Route 982

- This new route would provide service between the Norwich Transportation Center and Foxwoods Resort Casino.
- The route would operate as an express on Route 2 in Preston, but would serve the Tanger Outlet Mall in Mashantucket.

DESCRIPTION OF PLANS

The improvement plans were created by combining the route design improvements described above with potential changes to service span (length of service day) and frequency. While alignment changes to existing routes were designed to be implemented without impact to operating costs, span and frequency changes would directly impact the cost of service. For this reason, three alternative plans have been developed:

- Two "Cost Neutral plans" that focus mainly on route and alignment changes
- A third "System Expansion plan" that also incorporates a range of span and frequency improvements to enhance the attractiveness and availability of transit

Finally, a number of related capital and operational improvements are proposed to enhance the system as a whole. These improvements are intended to improve service reliability and to make the system easier to understand and use, and may have associated capital or operating costs. However, they can be implemented as resources allow, and would support any of the three plans considered.

Cost Neutral Plan A

The first plan focuses SEAT resources on areas where ridership demand is the greatest. It is cost neutral on a systemwide basis.

Cost Neutral Plan A incorporates alignment changes on almost all existing SEAT runs, implementing transit design principles to make service faster, more reliable, and more efficient. It also discontinues two existing SEAT runs (in Stonington and East Lyme) that carry very few riders today. These resources would be redirected to frequency improvements in the Route 600/980 corridor between New London and Norwich, providing hourly service to better serve existing riders, improve regional mobility, and attract more riders.

Figure 9 provides a map of Cost Neutral Plan A. In addition, Figure 10 provides a list of services offered under this option and the associated span and frequency of each.

FIGURE 9 COST NEUTRAL PLAN A

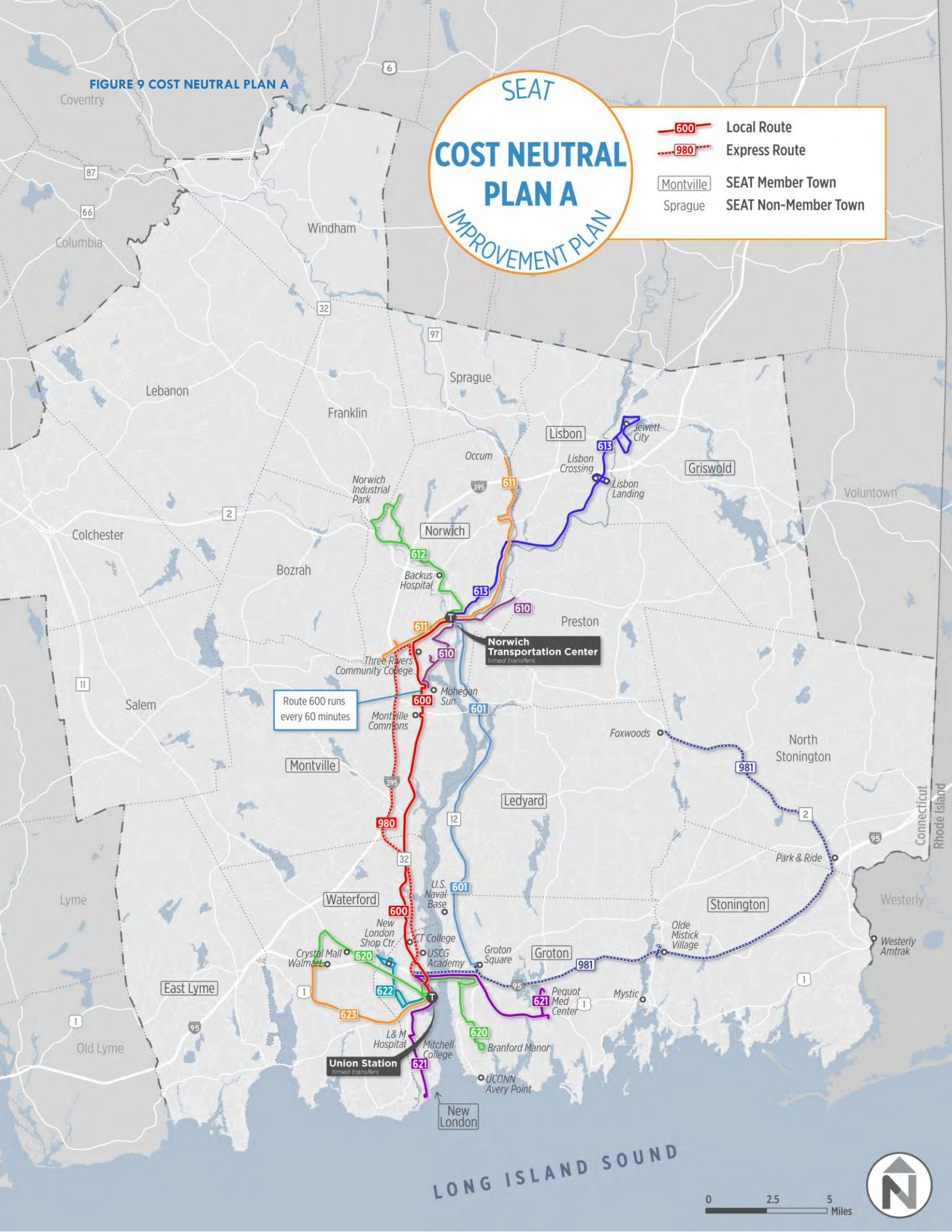


FIGURE 10 SPAN & FREQUENCY OF SERVICE UNDER COST NEUTRAL PLAN A

	WEEKDAY		SATURDAY		SUNDAY	
	Service Span	Frequency	Service Span	Frequency	Service Span	Frequency
600 Norwich–New London (previously Runs 1 & 101)	6AM – 5PM 5PM – 11PM	60 min 120 min	6AM – 11PM	120 min	7AM – 2PM	120 min
601 Norwich–Groton (former Run 2)	8AM – 5PM	120 min	no service		no service	
612 Industrial Park (former Run 5)	8AM – 6:30PM	60 min	9AM – 5:30PM	60 min	no service	
611 West Main–Occum (previously Runs 4 & 6)	6:30AM – 7PM	60 min	6:30AM – 7PM	60 min	no service	
610 Mohegan Sun–Hamilton (previously Run 7)	6AM – 11PM	60 min	6AM – 10PM	60 min	6AM – 2PM	60 min
613 Jewett City (previously Runs 8 & 9)	6AM – 10PM	60 min	6AM – 10PM	60 min	no service	
620 Broad Street–Groton (previously Runs 11 & 12 & 15)	7AM – 10:30PM (west side only after 8PM)	60 min	7AM – 10:30PM	120 min	6AM – 2PM (Groton only)	60 min
621 Ocean Beach–Groton/Pequot Med (previously Runs 11 & 13 & 15)	7AM – 7:30PM	60 min	7AM – 7:30PM	120 min	6AM – 2PM (Groton only)	60 min
622 New London (former Runs 14/15)	7:30AM – 10PM	60 min	7:30AM – 10PM	60 min	no service	
623 Waterford (former Run 3)	8AM – 5PM	120 min	no service		no service	
980 Norwich–New London Express (previously Three Rivers Shuttle)	6 one-way trips daily		no service		no service	
981 New London–Foxwoods Express (previously Run 108)	6AM – 11PM	120 min	6AM – 10PM	120 min	6AM – 2PM	120 min

Green = Better than today

Red = Worse than today

Cost Neutral Plan B

The second plan is designed to retain transit coverage in all SEAT member communities, providing access across a larger service area, including areas of lower density. It is cost neutral on a systemwide basis. Because it would not discontinue service to any existing SEAT communities, the SEAT Board of Directors has expressed their preference for this plan.

Cost Neutral Plan B incorporates alignment changes on all existing SEAT runs, implementing transit design principles to make service faster, more reliable, and more efficient. It does not include any span or frequency improvements. Modified services in Stonington (Route 626) and East Lyme (Route 624) would be retained to provide a minimal level of service to residents of these communities. The level of service within the Route 600/980 corridor between Norwich and New London would also continue to operate every two hours, as it does today.

Figure 11 provides a map of Cost Neutral Plan B. In addition, Figure 12 provides a list of services offered under this option and the associated span and frequency of each.

FIGURE 11 COST NEUTRAL PLAN B

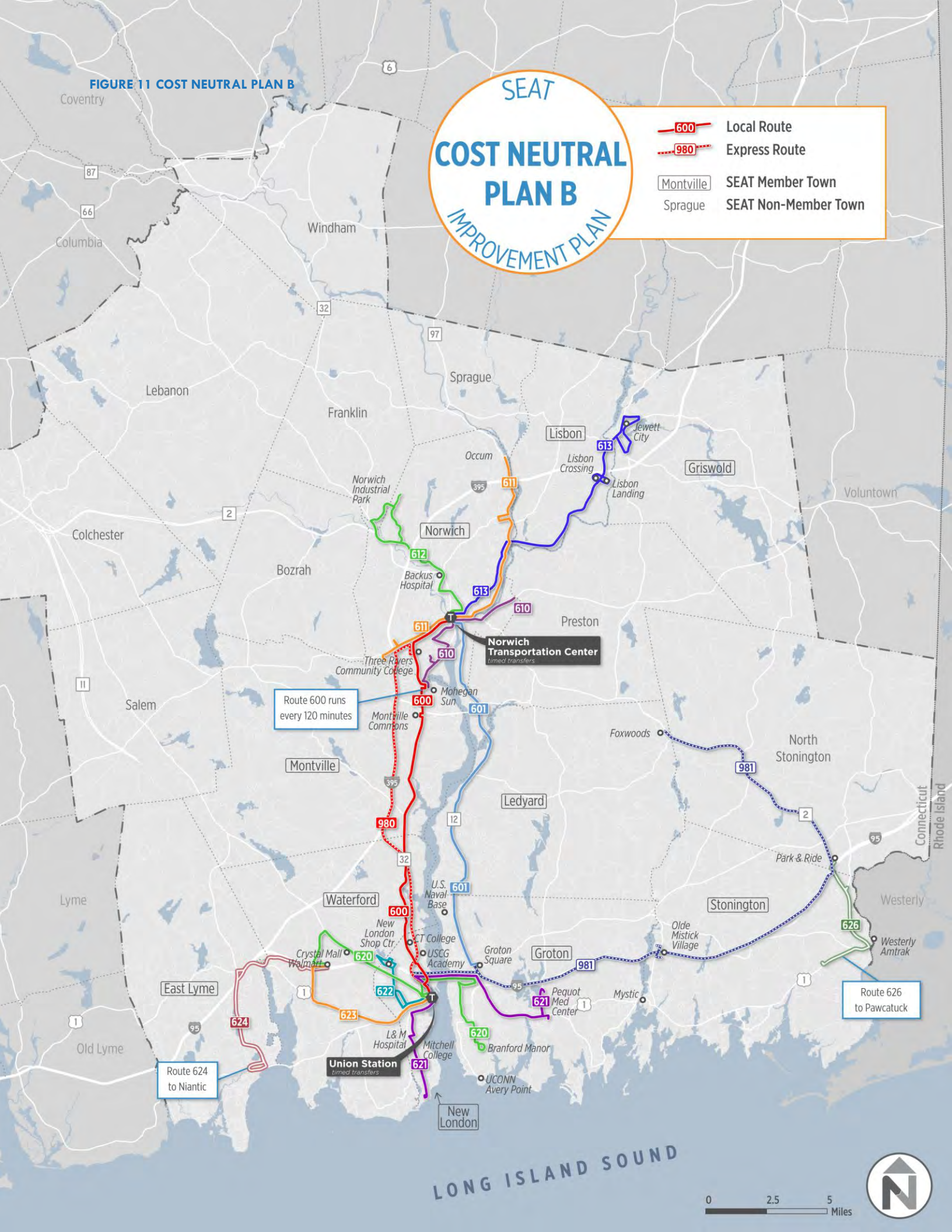


FIGURE 12 SPAN & FREQUENCY OF SERVICE UNDER COST NEUTRAL PLAN B

	WEEKDAY		SATURDAY		SUNDAY	
	Service Span	Frequency	Service Span	Frequency	Service Span	Frequency
600 Norwich–New London (previously Runs 1 & 101)	6AM – 11PM	120 min	6AM – 11PM	120 min	7AM – 2PM	120 min
601 Norwich–Groton (former Run 2)	8AM – 5PM	120 min	no service		no service	
612 Industrial Park (former Run 5)	8AM – 6:30PM	60 min	9AM – 5:30PM	60 min	no service	
611 West Main–Occum (previously Runs 4 & 6)	6:30AM – 7PM	60 min	6:30AM – 7PM	60 min	no service	
610 Mohegan Sun–Hamilton (previously Run 7)	6AM – 11PM	60 min	6AM – 10PM	60 min	6AM – 2PM	60 min
613 Jewett City (previously Runs 8 & 9)	6AM – 10PM	60 min	6AM – 10PM	60 min	no service	
620 Broad Street–Groton (previously Runs 11 & 12 & 15)	7AM – 10:30PM (west side only after 8 pm)	60 min	7AM – 10:30PM	120 min	6AM – 2PM (Groton only)	120
621 Ocean Beach–Groton/Pequot Med (previously Runs 11 & 13 & 15)	7AM – 7:30PM	60 min	7AM – 7:30PM	120 min	6AM – 2PM (Groton only)	120
622 New London (former Runs 14/15)	7:30AM – 9PM	60 min	7:30AM – 9PM	60 min	no service	
623 Waterford (former Run 3)	8AM – 5PM	120 min	no service		no service	
624 Niantic (previously Run 3)	8AM – 4:30PM	120 min	no service		no service	
626 Stonington (former Run 10)	8:30AM – 5PM	60 min	no service		no service	
980 Norwich–New London Express (previously Three Rivers Shuttle)	6 one-way trips daily		no service		no service	
981 New London–Foxwoods Express (previously Run 108)	6AM – 11PM	120 min	6AM – 10PM	120 min	7AM – 2PM	120 min

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System Expansion Plan C

This plan could be implemented only if additional operating resources were identified to support SEAT. It includes all improvements in Plan A and Plan B, and also incorporates a wide range of service span improvements and three new routes.

This plan was developed in response to stakeholder and rider feedback, as well as the study team's evaluation of existing service and transit demand. Today, SEAT resources are spread across the service district, with most areas receiving limited service frequency and no Sunday service. With many people relying on SEAT to access work, school, and medical and social services, increased frequency and service span are critically needed.

System Expansion Plan C includes all improvements listed in Plan A and Plan B, including hourly frequency on Route 600 between Norwich and New London, and local routes serving Pawcatuck (626) and Niantic (624). In addition, this plan includes:

- Additional trips on 980 Norwich–New London Express
- Three new routes:
  - 625 Mystic Shuttle (seasonal)
  - 627 Avery Point–US Naval Base
  - 982 Norwich–Foxwoods Express
- Sunday service on a total of eight routes, as compared to four today
- Extended service (earlier AM or later PM) on weekdays and Saturdays on nine routes

FIGURE 13 SYSTEM EXPANSION PLAN C

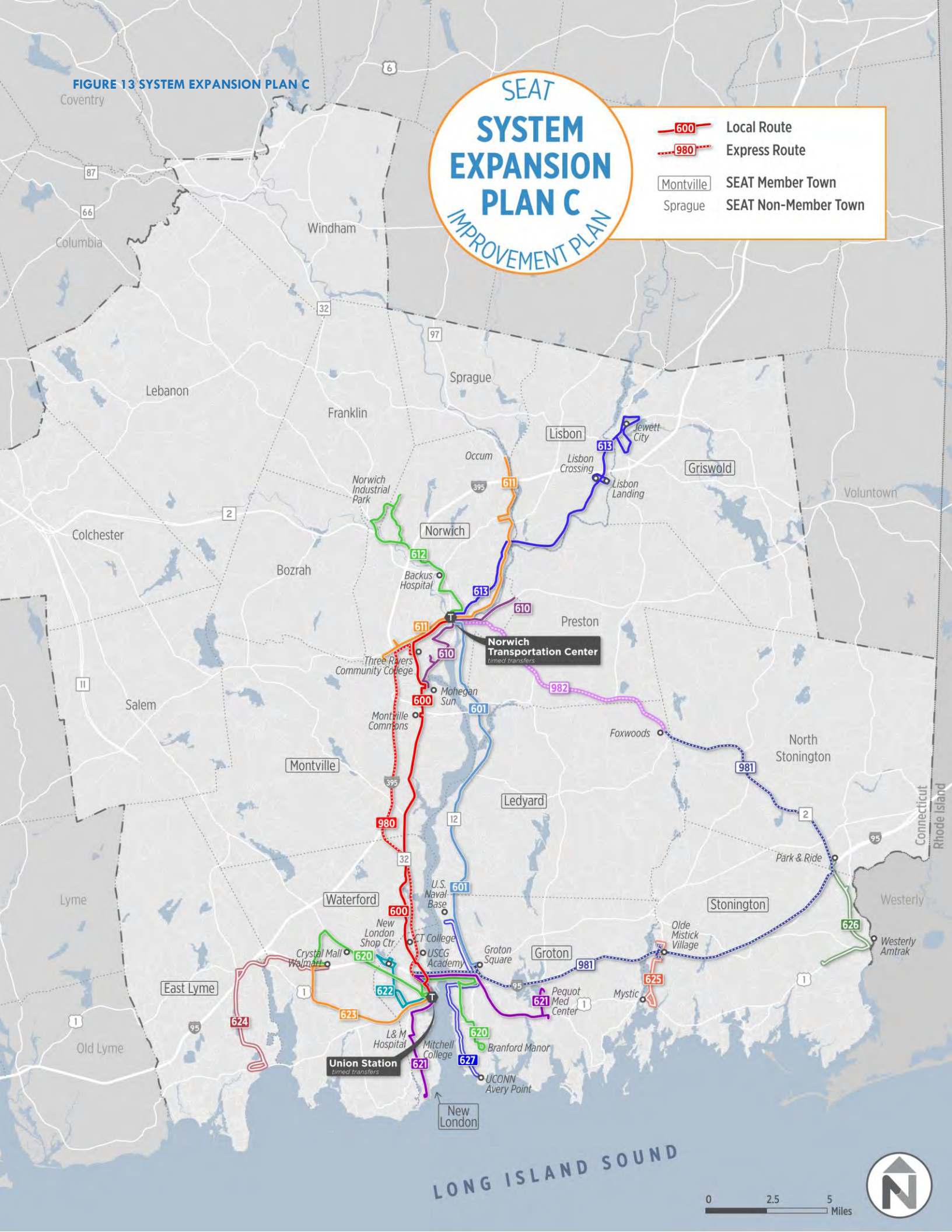

FIGURE 14 SPAN & FREQUENCY OF SERVICE UNDER SYSTEM EXPANSION PLAN C

	WEEKDAY		SATURDAY		SUNDAY	
	Service Span	Frequency	Service Span	Frequency	Service Span	Frequency
600 Norwich–New London (previously Runs 1 & 101)	6AM – 7PM 7PM – 11PM	60 min 120 min	6AM – 11PM	120 min	7AM – 5PM	120 min
601 Norwich–Groton (former Run 2)	7AM – 6PM	120 min	8AM – 5PM	120 min	no service	
612 Industrial Park (former Run 5)	7AM – 6:30PM	60 min	7AM – 5:30PM	60 min	no service	
611 West Main–Occum (previously Runs 4 & 6)	6:30AM – 8PM	60 min	6:30AM – 8PM	60 min	8AM – 4PM	120 min
610 Mohegan Sun–Hamilton (previously Run 7)	6AM – 11PM	60 min	6AM – 10PM	60 min	6AM – 5PM	60 min
613 Jewett City (previously Runs 8 & 9)	6AM – 10PM	60 min	6AM – 10PM	120 min	no service	
620 Broad Street–Groton (previously Runs 11 & 12 & 15)	7AM – 11PM (west side only after 8 pm)	60 min	7AM – 10:30PM	120 min	8AM – 4PM (Groton and New London)	120 min
621 Ocean Beach–Groton/Pequot Med (previously Runs 11 & 13 & 15)	7AM – 8PM	60 min	7AM – 8PM	60 min	8AM – 4PM (Groton and New London)	120 min
622 New London (former Runs 14/15)	7:30AM – 10PM	60 min	7:30AM – 10PM	60 min	8AM – 4PM	60 min
623 Waterford (former Run 3)	7AM – 6PM	120 min	8AM – 5PM	120 min	no service	
624 Niantic (previously Run 3)	7:30AM – 5:30PM	120 min	no service		no service	
625 Mystic Shuttle (former Run 10)	8AM – 6PM	30 min	8AM – 6PM	30 min	8AM – 4PM	30 min
626 Stonington (former Run 10)	6:30AM – 5PM	60 min	no service		no service	
627 Groton: Avery Point - Naval Base	7AM – 5PM	60 min	no service		no service	
980 Norwich–New London Express (previously Three Rivers Shuttle)	8 trips TRCC; 8 Trips NITC		no service		no service	
981 New London–Foxwoods Express (previously Run 108)	6AM – 11PM	120 min	6AM – 11PM	120 min	6AM – 4PM	120 min
982 Norwich–Foxwoods Express	7:30AM – 5:30PM	120 min	no service		no service	

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RELATED SYSTEMWIDE IMPROVEMENTS

A number of systemwide improvements have also been identified. These improvements work with any service improvement alternative and have the potential to further enhance SEAT operating performance, convenience, and customer satisfaction.

Create Bus Stops / Discontinue Flag Stop System

Many riders find the flag stop system confusing, and SEAT drivers have indicated that flag stops slow service and affect on-time performance. Discontinuing the flag stop system should improve the efficiency of service.

Using ridership data now collected through its Automated Passenger Count (APC) system, SEAT can identify locations for permanent bus stops and add specific timepoints to its schedules. Bus stop signs would need to be installed, and any rural route segments where SEAT might still operate under a flag stop system should be clearly identified on its route maps. Key locations with high ridership or where two routes intersect should be considered for bus shelters, seating, bus schedule information and/or signage highlighting the availability of transit.

Make Hub/Facility Improvements

Bus hubs are an important part of a local transit system, providing highly visible locations and a higher level of passenger amenities to attract customers, as well as a location to make connections and transfers. The following improvements to existing SEAT hubs are suggested:

- **Install berth signage at Norwich Intermodal Transportation Center (NITC).** Bus berths at NTC are unassigned and passengers are not always sure where to stand while waiting for buses to arrive/depart on each hourly pulse. General berth assignment and signage (e.g. three routes assigned to inner bay berths and three to outer bay berths) would improve this situation.
- **Work with New London to Improve Union Station Intermodal Hub.** Union Station is an important intermodal hub, yet SEAT bus berths have limited space and poor pedestrian access. SEAT should coordinate with local planners, SCCOG, and others involved in planning for the new National Coast Guard Museum to identify improvements to better accommodate local buses and riders in this area. Enhancements could include shelters, berth signage, real-time information displays, route maps, and seating.
- **Create a new Groton Square Mini-Hub.** Four SEAT routes are proposed to meet in the Groton Square area. Coordination with the shopping center owners is recommended to properly site a location for bus transfers and layover, as well as passenger amenities such as a shelter and real time information display.

Make BRT Type Improvements Between Norwich and New London

Route 600 would function as the primary route in SEAT's system, connecting the urban centers of New London and Norwich and providing access to regional services, schools, and employment opportunities. Improvements should be made to ensure fast, frequent service and to attract new riders. In particular, transit signal priority would help improve speed and reliability by maintaining green traffic signals for SEAT buses. Queue jump lanes at intersections would also help the flow of buses. Other BRT type improvements might include designating limited key stops along SR 82 with branded passenger shelters, as well as designated berths in New London and Norwich.

Construct Pedestrian Improvements at Key Stop Locations

Due to the rural nature of the study area, many SEAT bus routes operate on state highways with high speeds and busy traffic. SEAT passengers must often cross these roadways in at least one travel direction. Crosswalks, signals, pedestrian islands, and other enhancements should be considered at key locations such as the State Correctional Center on SR 32, St. Bernard's High School, Three Rivers College, and major shopping centers.

Pursue Other Roadway Modifications that Support SEAT Service Efficiency

A number of locations have been identified where minor roadway improvements would enhance the efficiency of SEAT service. These include:

- A bus turnaround by the Hamilton Avenue Playground in Norwich, where SEAT Run 7 currently terminates near the border of the SEAT service area.
- A small widening of the main entryway circle at the Department of Social Services in the Uncas on Thames complex. This would facilitate the turning of buses within the main circle entry rather than traversing the entire complex to pick up a limited number of riders.

Other Related Improvements

Eliminate Multi-Zone Fare Structure

Stakeholders and SEAT bus drivers have also indicated that the multi-zone fare structure is confusing to riders and can be difficult to properly enforce. Due to these difficulties, the revenue impact of transitioning to one systemwide base fare should be assessed and considered for implementation.

Provide More Fare Payment Options

Stakeholders and riders expressed interest in having more options for fare payment, including unlimited monthly passes, student U-Passes that could be used over a semester, and reloadable passes. Riders would also find it helpful if SEAT fare products were sold at more locations.

Improve Public Information (Website, Maps, and Route Schedules)

Many SEAT customers have commented on the need for route maps and schedules that are easier to understand. The implementation of upcoming SEAT service changes provides the opportunity to adopt a new style and user-friendly format in tandem with these changes. These updates can also be implemented in step with other SEAT improvements (bus stops, real-time bus tracking apps, etc.) as part of a coordinated and thoughtful update of the overall SEAT brand, including the website, schedules, and route maps.

Shift Systemwide Pulses

Today, buses meet at the Norwich Transportation Center and New London Union Station every hour, "on the hour" allowing customers to transfer between routes. If these connections were shifted to occur "on the half hour," it would give many workers time to get to jobs with shifts that begin "on the hour." Another consideration would be to shift only one of the pulses (e.g. Norwich) to "on the half hour" once 30-minute express service on Route 980 becomes more frequent. This would allow commuters to leave one hub and make a connection at the other 30 minutes later.

Work with CTDOT to Implement or Strengthen Regional Connections

Recent statewide studies and discussions have suggested improved regional transit connection. Riders are also interested in strengthening regional connections and specifically mentioned a number of communities that are currently served by other transit districts, including:

- New London–Old Saybrook (9 Town Transit)
- Norwich–Willimantic (Windham Region Transit)
- Norwich–Colchester (CT*transit* Hartford division)
- Stonington–Westerly, RI (RI Public Transit Authority)

4 EVALUATION OF IMPROVEMENT PLANS

Evaluation Criteria

Each alternative plan has been evaluated against a range of criteria to compare the relative costs and benefits of each option. These criteria include ridership, operating costs, capital costs and other factors. The results of this evaluation are summarized below, including the methodology and assumptions made as part of this analysis.

Ridership & Fare Revenue

A major focus of the SEAT Bus Study has been to identify more compelling service alternatives to attract more riders to the system. Ridership demand was estimated for each plan based on existing SEAT ridership, accounting for individual route changes, the amount of service that would be provided under each alternative, and the improvements that would be made to service design.

Potential ridership was estimated based on current average weekday ridership, and then applying changes to route mileage, travel time, hours of service, and route simplification. This yielded a percentage increase under each plan, which was then applied to SEAT's actual FY14 ridership (1,165,424) t0 determine estimated annual ridership. An estimate of potential fare revenue was also made for each plan, calculated by applying the percentage increase in ridership to SEAT's total FY14 fare revenue ($951,167). The final estimates are presented in Table 2.

Based on improvements to the directness of route alignments, travel time, and the amount of service provided, Cost Neutral Plan A has the potential increase ridership by 16% without increasing operating costs. Cost Neutral Plan B would yield a smaller but still significant increase of 13%. System Expansion Plan C has the potential to yield even greater increases in ridership, due to the increased amount of service on existing routes as well as the addition of new routes. The potential for growth in ridership also translates to increased fare revenue under all three plans.

TABLE 2 ESTIMATED RIDERSHIP & FARE REVENUE

RIDERSHIP AND FARE REVENUE	EXISTING SEAT (FY14)	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
% Increase in Ridership	-	16%	13%	28%
Estimated Annual Ridership	**1,165,424**	**1,350,118**	**1,316,212**	**1,496,458**
Estimated Annual Fare Revenue	**$0.95 M**	**$1.10 M**	**$1.07 M**	**$1.22 M**

Annual Operating Cost Impacts

Revenue Hours of Service

The cost of providing SEAT services is a function of the number of revenue vehicle hours (RVH) and revenue vehicle miles (RVM) operated each day, as well as other factors such as administrative functions and ADA service. An operating cost model was developed based on the total RVH for each plan, as this is

the most significant factor related to the cost of service. The percentage increase was then applied to SEAT's FY16 approved operating budget of $6.26M to estimate the increased budget needed to support each alternative.

As shown in Table 3, the Cost Neutral A and B plans would involve minor increases in overall hours of service when compared to the 64,439 hours of service to be operated by SEAT in FY16. The System Expansion Plan C would involve an increase of 25.7% for full implementation.

TABLE 3 ESTIMATED COST OF PROVIDING SERVICE

COST OF SERVICE	EXISTING SEAT (FY16)	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
Annual RVH	64,439	64,541	64,587	81,005
Increase in RVH	-	102	148	16,566
% Increase in Cost of Service	**-**	**0.2%**	**0.2%**	**25.7%**
Est. Increase in Cost of Service[1]		**$10,000**	**$14,000**	**$1.61M**

1. Increase in Operating Cost is an order of magnitude estimate based on ratio of existing RVH to total operating costs, and includes non-service costs such as administration and vehicle maintenance.

ADA Paratransit Service Impacts

SEAT contracts with the Eastern Connecticut Transportation Consortium (ECTC) to provide complementary paratransit to those who are unable to ride fixed-route services. ADA paratransit service is provided to eligible individuals living within ¾ of a mile of SEAT fixed-route services during the same times of day. Changes to fixed-route alignments and service hours will impact the number of complementary paratransit trips provided.

Based on an interview with ECTC in December 2014, there are about 140 individuals living within ¾ of a mile from SEAT routes that are eligible for ADA service. This works out to about one individual per route mile of existing service. ECTC provides about 500 ADA rides per month, or an average of 3.5 per individual, with an average cost of about $30 per trip. The number of potential new ADA riders and trips was estimated based on these averages.

Due to the proposed discontinuation of routes and/or route segments in the Cost Neutral Plans, the table below shows there could potentially be a savings in ADA service costs under these alternatives. However, SEAT has indicated it may consider "grandfathering" clients in these areas to ensure no loss of service. If this policy were enacted, there would be no cost savings under the cost neutral options.

TABLE 4 ESTIMATED IMPACT ON ADA PARATRANSIT SERVICE

ADA IMPACT	EXISTING SEAT	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
Total Route Miles[1]	169	136	149	185
Est. ADA Customers[2]	140	113	124	154
Total Annual ADA Trips[2]	5,880	4,746	5,208	6,468
Change in Annual ADA Service [4]	**--**	**($0.04M)**	**($0.02M)**	**$0.02M**
ADA Impacts w/ "Grandfathering"		**--**	**--**	**$0.02M**

1. One-way route miles based on length of each route; includes double counting where routes overlap.
2. Based on existing system, assumes less than one (0.83) ADA customer per route mile.
3. Assumes each customer takes 3.5 rides per month, or 42 rides per year.
4. Based on 2014 average of $30/trip.

Additional Maintenance Costs

As described below under Capital Cost Impacts, the number of buses needed would increase from 17 to 22 vehicles under the System Expansion Plan C, necessitating an increase in the size of SEAT's fleet and an increase in vehicle maintenance. However, the cost to cover additional maintenance technicians is included in the overall increased cost of service shown in Table 3.

Installation of bus stop signs and shelters throughout the system is also discussed below. This would add new tasks to maintenance and is not factored into the overall increased cost of service. It is assumed that two new maintenance staff, at a fully loaded annual rate of $60,000 each would be brought on to cover these duties.

TABLE 5 SUMMARY OF OPERATING & MAINTENANCE COSTS

OPERATING & MAINTENANCE ITEM	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
Increased Cost of Service	$0.01M	$0.01M	$1.61M
ADA Service Costs[1]	--	--	$0.02M
Bus Stop Maintenance	$0.12M	$0.12M	$0.12M
Subtotal Increased Operating Cost	$0.13M	$0.13M	$1.75M
Less Estimated Fare Revenue	$1.10 M	$1.07 M	$1.22 M
Net Increase Operating Costs	**($0.97M)**	**($0.94M)**	**$0.53M**

1. Assumes existing ADA customers would be grandfathered in, negating savings under Cost Neutral Plans.

Capital Cost Impacts

Acquire Needed Fleet for Expansion

Currently SEAT has a peak period vehicle requirement of 17 buses. The two cost neutral alternatives are designed to operate the same number of vehicles and keep operating costs consistent with today. Additional fleet would only be needed for system expansion. Future fleet procurement to support expansion would likely be for 35-foot diesel-electric hybrid vehicles, as currently programmed in the Statewide Transportation Improvement Program at a cost of $620,000 per bus.

TABLE 6 ESTIMATED FLEET EXPANSION COSTS

CAPITAL ITEM	UNIT COST	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
New Buses Needed		0	0	5
Fleet Expansion Costs	**$0.62 M/bus**	**$0**	**$0**	**$3.10M**

Create Bus Stops / Discontinue Flag Stop System

Designated bus stops should be spaced at consistent intervals and identified with SEAT bus stop signs. For the purposes of this analysis, it is assumed that bus stops would be placed, on average, every 880 feet across the system or an average of six stops per mile. It is likely that spacing might be closer in some urban areas and greater in rural areas. The flag system may also continue to be appropriate along certain rural stretches of road (such as SR 12 in Lisbon or parts of Ledyard).

Additionally, certain key stops would merit a passenger shelter with bench. These should be stops with higher levels of daily boardings (e.g. shopping centers, hospitals, and town centers) or locations where two bus routes intersect (e.g. Broad Street and Colman Street in New London). It is assumed there would be an average of two locations on each route where enhanced bus stops would be provided.

TABLE 7 ESTIMATED BUS STOP COSTS

CAPITAL ITEM	UNIT COST	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
Total Route Miles[1]	-	136 mi.	149 mi.	185 mi.
# of routes		12	14	17
Est. # New Bus Stops[2]	-	1,000	1,100	1,400
Cost for bus stop signs[2]	$500[3]	$0.50M	$0.55M	$0.70M
Cost for stops w/ shelter and bench	$15,000[4]	$0.36M	$0.42M	$0.51M
Bus Stop Implementation Costs	-	**$0.86M**	**$0.96M**	**$1.21M**

1. Represents total one-way mileage for all routes. Includes double-counting where routes overlap.
2. Assume 6 signs per mile, on both sides of each route. Estimate rounded down due to route overlap and rural areas.
3. Includes sign, pole and installation located, on average, every 1/6 mile throughout system.
4. Includes small shelter, bench and installation, on average, at 2 locations on every route in system

Make Hub/Facility Improvements

Improvements are suggested at two existing hubs, the Norwich Intermodal Transportation Center (NITC) and the New London Union Station Intermodal Hub. Cost for new berth signage at NITC and a new Groton Square mini-hub, with a large shelter and real time display, are included below. However, no costs are included for New London's Union Station since municipal coordination would be required to site and design bus facility improvements as part of the planned future National Coast Guard Museum.

TABLE 8 ESTIMATED COSTS TO IMPROVE TRANSIT HUBS

CAPITAL ITEM	UNIT COST	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
Berth Signage at NITC[1]	$20,000	$0.02M	$0.02M	$0.02M
Groton Square Mini-Hub[2]	$40,000	$0.04M	$0.04M	$0.04M
New London Union Station	*Facility planning required in order to develop cost estimate.*			
Hub Improvement Costs	-	**$0.06M**	**$0.06M**	**$0.06M**

1. Lump sum assumes 10 berth signs at $1,500/each, plus an overall facility berth map and wayfinding signage.
2. Lump sum based on Bus Rapid Transit stops in the Providence, RI area. Includes shelter, real time display, enhanced signage, bench and trash can.

Make BRT Type Improvements Between Norwich and New London

Extending green lights for transit buses approaching traffic signals along SR 82, SR 32, and in downtown New London could be achieved using a variety of technologies. It is assumed that transponders would be installed on both buses and in traffic signals; that transponders would be installed on all buses in the fleet to maintain operational flexibility; and that 40 intersections would be upgraded.

To further promote a higher level of service along Routes 600 and 980, it is assumed that 20 branded shelters would be installed and minor intersection improvements would be pursued to help the flow of buses.

TABLE 9 ESTIMATED COST OF BRT IMPROVEMENTS

CAPITAL ITEM	UNIT COST	ALL PLANS
Transit Signal Priority[1]		
- per vehicle (25)	$1,000	$0.03M
- per intersection[2] (40)	$30,000	$1.20M
Branded shelters/stops (20)	$30,000	$0.60M
Road/Intersection Improvements (LS)	$1.50 M	$1.50M
Design/Admin/Contingency (35%)	$0.75M	$1.20M
BRT Improvement Costs	-	**$4.50M**

1. TCRP Synthesis 83, Bus & Rail Transit Preferential Treatment (2010); NCHRP Research Digest 352 Cost Benefit Analysis on Converting a Lane to BRT (2011); and actual installation costs in Providence, RI (2013).
2. Assume 20 intersections along SR82 in Norwich, plus 20 along SR32 and in New London.

Construct Pedestrian Improvements at Key Stops

Crosswalks, signals, pedestrian islands, and other enhancements should be considered at key locations such as the State Correctional Center on SR 32, St. Bernard's High School, Three Rivers College, and major shopping centers. This could be achieved through the use of painted crosswalks, small island medians, pedestrian phases in the traffic signals, and other treatments. A lump sum of $750,000 has been included for these efforts.

Make Roadway Modifications to Support SEAT Service Efficiency

Two locations have been identified where minor roadway improvements would enhance the efficiency of SEAT service. A lump sum cost of $500,000 has been included to construct:

- A bus turnaround by the Hamilton Avenue Playground in Norwich, allowing Route 610 to terminate in this location.
- A small widening of the main entryway circle at the Department of Social Services in the Uncas on Thames complex. This would allow buses to turn within the main circle entry rather than traversing the entire complex to pick up a limited number of riders.

TABLE 10 SUMMARY OF CAPITAL COSTS

CAPITAL ITEM	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
Fleet Expansion	--	--	$3.10M
Bus Stop Implementation	$0.86M	$0.96M	$1.21M
Hub/Facility Improvements[1]	$0.06M	$0.06M	$0.06M
BRT Improvements: Norwich to NL	$4.50M	$4.50M	$4.50M
Pedestrian Improvements	$0.75M	$0.75M	$0.75M
Roadway Modifications	$0.50M	$0.50M	$0.50M
Est. Total Capital Cost Impact	**$6.70M**	**$6.80M**	**$10.12M**

1. Does not include the potential cost of future bus transit facility improvements at New London's Union Station.

Other Benefits

The number of passenger trips that are carried per bus service hour provides a measure of productivity in terms of how well existing service is used and, in many respects, how well it is designed. By providing

more direct and efficient service, SEAT's ridership per service hour is estimated to increase, particularly under the Cost Neutral Plans A and B. This indicates that the system will carry higher ridership within the same number of hours, making more productive use of the service that is already on the ground. In addition, SEAT can realize cost efficiency benefits under each plan: as ridership grows without a commensurate increase in operating cost, the system's cost per passenger will decline.

TABLE 11 SUMMARY OF PRODUCTIVITY METRICS

	EXISTING SEAT (FY14)	COST NEUTRAL A	COST NEUTRAL B	SYSTEM EXPANSION C
Annual Ridership	1,165,424	1,350,118	1,316,212	1,496,458
Annual Operating Cost	$6,262,788	$6,262,788	$6,262,788	$7,872,828
Annual Hours of Service	64,439	64,541	64,587	81,005
Passengers per Service Hour	**18.1**	**20.9**	**20.4**	**18.5**
Cost per Service Hour	**$97.19**	**$97.04**	**$96.97**	**$97.19**
Cost per Passenger	**$5.37**	**$4.64**	**$4.76**	**$5.26**

Finally, the improvements presented under all three plans provide additional benefits to the SEAT system and its users, including:

- **More Reliable Service.** In 2014, the average on-time performance of all SEAT routes was 58%, as compared to SEAT's established goal of achieving 90% on-time performance. Across all plans, improvements to service design that make routes more simple and direct will increase the likelihood that buses arrive on time and meet timed transfers ("pulses") at transfer centers, improve the reliability of service. Improved on-time performance and fewer missed connections will also make service more attractive to potential riders.
- **Stronger Regional Connections.** SEAT provides critical connections to major employers and regional activity centers. The recommendations in each plan strengthen these connections by providing more direct, consistent, and convenient service for riders to reach these employment, educational, and institutional centers.
  - **Plan A** will improve the frequency of service to Norwich, New London, Mohegan Sun, and Three Rivers Community College. It will also provide improved bi-directional service to the US Naval Base in Groton.
  - **Plan B** will continue to provide regional service to Pawcatuck and Niantic.
  - **Plan C** will provide the improved connections identified above, as well as new service between Norwich and Foxwoods Resort Casino, new service between Groton City and the US Naval Submarine Base, and a seasonal Mystic Village Shuttle.
- **Serving Minority and Low-Income Riders.** Under each plan, improvement options provide more and better service in many areas that have minority and low-income populations above the SEAT service area averages.

5 SUMMARY

Cost Neutral Plan A, as shown in Figure 1, best meets the established objectives of the SEAT Bus Study, which were to identify budget neutral service improvements that would better serve existing riders, improve the overall efficiency of SEAT operations, and attract more riders.

Improvements made under Plan A have the potential to increase ridership by 16%, leading to increased fare revenues and an overall anticipated net decrease in operating cost. Plan A also presents the lowest cost of associated capital improvements. Cost Neutral Plan B reduces these benefits somewhat, but may be preferred because it will maintain service to all SEAT communities.

TABLE 12 SUMMARY OF ALTERNATIVES EVALUATION

CRITERIA	COST NEUTRAL PLAN A	COST NEUTRAL PLAN B	SYSTEM EXPANSION PLAN C
Annual Increase Ridership	184,694 (16%)	150,788 (13%)	331,034 (28%)
Annual Increase Fare Revenue	$1.10 M	$1.07 M	$1.22 M
Net Annual Increase O&M Costs	($0.97M)	($0.94M)	$0.53M
Capital Cost Impact	$6.70 M	$6.80 M	$10.12 M
Passengers per Service Hour	20.9	20.4	18.5
Cost per Passenger	$4.64	$4.76	$5.26

In addition to the improvements that would result from implementing either Plan A or Plan B, it is clear that Plan C would have even more significant ridership benefits, with the potential to increase ridership by 28%. Although this alternative would result in somewhat lower overall passengers per service hour and cost per passenger, this is reflective of the additional late evening and weekend service that would be provided to increase overall rider mobility and access.

It is recommended that SEAT, working with SCCOG, take action to implement one of the **Cost Neutral Improvement Plans** for improved system efficiency over the near term. These partners should also pursue additional funding to implement the **System Expansion Plan** to better meet transit demand and mobility needs in the southeastern Connecticut region.

BENEFITS OF RECOMMENDED PLANS

- Easy to understand service
- Faster trips
- Fewer transfers
- Improved reliability
- Increased ridership
- Enhanced mobility