East End Transportation Study Final Report

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John A. Volpe National Transportation Systems Center

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Notes

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Executive Summary

This report is the final component of a multi-year transit feasibility study conducted by the Volpe National Transportation Systems Center on behalf of the five Towns of the East End. The initial transit concept under evaluation, a proposed Coordinated Rail-Bus Network, had its origins in the Sustainable East End Development Strategies (SEEDS) process as a means of improving local mobility. During the final stages of SEEDS, the concept was developed into a more comprehensive transit proposal by a local nonprofit advocacy group, Five Town Rural Transit, Inc. (5TRT). Using funds made available from a Shared Municipal Services Incentive Grant, the five Towns signed an agreement with the Volpe Center in 2007 for an external evaluation of this proposal.

In conducting its research and analysis, the Volpe Center team has been guided by a Technical Advisory Group (TAG), consisting of members of the East End Transportation Council and of 5TRT. Over the course of the study, the Volpe Center has (1) inventoried existing transportation conditions; (2) examined the basic technical feasibility and cost-effectiveness of the proposed East End rail-bus network, using the service parameters specified by the TAG; (3) worked jointly with the TAG to develop alternative transit concepts for comparison; (4) conducted additional service planning for the hybrid transit service concept that was ultimately selected; and (5) prepared a final report that focuses on the steps remaining on the path to implementation, particularly institutional and financial issues.

At a regional transportation forum held on April 17, 2009, staff from the Volpe Center presented interim findings to members of the TAG, local elected officials, and members of the public. In discussions at this Forum and in subsequent meetings with Town Boards, it became clear that differences in population density, travel patterns, and local priorities precluded the development of a single consensus transit concept that would apply to the entire East End region. Instead, the Towns on the South Fork generally preferred the Coordinated Rail-Bus Network, while the Towns on the North Fork generally preferred the alternative that had been developed for comparison, the Flexible Transit Network, which is focused on incremental bus and rail improvements. As such, this report is based on a so-called "Dual Concept" approach, with transit services along the lines of the Coordinated Rail-Bus Network concept on the South Fork and the Flexible Transit Network on the North Fork.

Details of the Dual Concept Transit Service

On the South Fork, most existing Long Island Rail Road train service and Suffolk County Transit bus service would be replaced by a coordinated rail-bus network. Small shuttle trains

would operate on the line between Speonk and Montauk, running roughly every 30 minutes during peak periods and every 60 minutes at other times. Four stations on the line would be re-opened: Quogue, Southampton College, Watermill, and Wainscott. Twelve bus routes would operate on coordinated timetables to bring passengers to and from the stations and to connect the train service with communities beyond the rail lines. In addition, seven smaller demand-response vehicles would be used to provide additional local mobility and station access. Depending on community needs, these demand-response services could encompass a range of service concepts, from door-to-door service by reservation to "flex" routes that operate on a defined route, but with the capacity to make deviations to pick up or drop off passengers. These more flexible services are designed to expand the reach of transit to people who are not able to use conventional public transportation. Service would run for approximately 18 hours per day in season, and 14 hours per day off-season, with the "seasons" each defined as roughly 182 days per year.

On the North Fork, the existing route structure and service concept would be kept largely intact, but there would be significant improvements to the frequency of service and expanded hours of operation, including Sunday/holiday service on all routes. The S-92 route would continue to be the primary route for much of the North Fork, and S-92 service would be expanded to run as often as every 15 minutes during peak periods, and as late as 12:30 AM during the summer. The 8A would serve downtown Riverhead and the S-58, S-62, and S-66 would connect Riverhead with points west. The S-96, a new route proposed by SCT as part of its recent service study, would connect Greenport to Riverhead and the Tanger Outlet Center.

Another important component of this concept is a set of flex and/or demand response services that would be added in Wading River, Southold, Cutchogue-Mattituck, Greenport, and Riverhead to provide connections to areas that are beyond the fixed-route buses. A new express bus service would also run roughly every 2 hours from Riverhead (or further east) to the Ronkonkoma train station and Islip-MacArthur airport. The North Fork concept also includes the potential for incremental improvements to rail service, such as converting an existing deadhead run to Greenport into revenue service and adjusting timetables to accommodate later-evening returns from New York City and intra-island commute patterns.

Costs and Ridership

The proposed Dual Concept system would be technically feasible provided that significant investment is made in upgrading the existing rail infrastructure, including the construction of new passing sidings and the installation of Centralized Traffic Control. Four rail stations would need to be rebuilt and made accessible. New bus and rail vehicles would also be needed, though it may be possible to use portions of the existing fleet on an interim basis as the service is phased in. Total upfront capital costs are estimated in the range of $117-$148

million. Beyond the upfront capital costs, annual costs of operations and maintenance are estimated at $44 million per year based on the proposed vehicle-hours of service. Depending on how the institutional arrangements are structured, part of the annual costs could be offset by savings through more effective coordination and consolidation of the many Human Services transportation programs in the region.

Ridership estimates for the system are inherently difficult to generate because of the substantial changes that are proposed not only for the level of transit service but also the overall route structure. An initial orders-of-magnitude estimate was produced using ridership on the current system in the East End (roughly 600,000 bus passengers and 400,000 rail passengers per year) and findings from the literature on the elasticity of transit demand to service provision. These estimates were cross-checked against the actual ridership figures from the South Fork Commuter Connection, a recent temporary service expansion that, while not considered a test of the rail-bus network concept, at least offers some insight into the public's likely response to additional transit service. Drawing on additional modeling work from SEEDS, a ridership range of 1.3 million to 3.1 million passengers per year was estimated for the coordinated rail-bus network (see Appendix B for further detail). The Dual Concept system has a comparable level of service and would be expected to have similar ridership levels. Ridership will depend strongly on the supporting strategies that are implemented by Towns and Villages, particularly pedestrian access to stations, transit-oriented development, and transportation demand management. These strategies are discussed in more detail in Section 5.

Next Steps

Sections 3 through 7 of this final report summarize the major steps toward implementation of the proposed East End transit system, including institutional and financial options, fare collection considerations, supporting strategies at the Town and Village level, and environmental issues. Overall, moving toward implementation means pursuing four main "tracks" of activity:

- Institutional and financial track: In order to move beyond the analytical stage, the East End region will need to come to a political consensus on the entity (or entities) that will build, operate, maintain, and manage the Dual Concept transit system, and on the financing mechanisms that will be used for its capital and operating costs. This report has identified a spectrum of options and the associated advantages and disadvantages of each, ranging from no institutional change through to the establishment of a new Regional Transportation Authority for the East End, with intermediate possibilities such as paid supplemental service or a regional council.

Options that involve more local control over transit services generally also entail more financial risk, while those closer to the status quo are unlikely, in the current fiscal and political environment, to lead to implementation of the desired transit service levels. Certain options, such as the creation of a new transit authority, will require state legislation and related actions such as designation as a federal-aid funding recipient. Section 3 summarizes the major Federal and State programs for which the East End system may be eligible. Although there are several potential sources of Federal funding, the relative size of the programs and the restrictions on their use mean that non-federal sources of funding must also be identified, particularly for annual operating costs.

- Environmental track: Environmental review is a requirement for most major transportation projects receiving Federal or State funding. This process ordinarily begins with scoping, identification of the purpose and need of the project, and the development of alternatives. Depending on the outcome of the initial analysis, more detailed review may be required.

- Technical track: More sophisticated travel demand modeling will be needed to estimate ridership and revenue with more precision and to identify broader effects on regional traffic and commuting patterns. Preliminary engineering work is also required to assess the state of existing track, stations, bridges, overpasses, and grade crossings; develop signaling and communication requirements; identify maintenance needs and potential facility locations; and assess vehicle options. Based on the outcomes from this work, the project could move forward with service planning, facility design and cost estimation, a procurement process, and ultimately with construction and the start of transit operations.

- Public outreach track: Extensive outreach will be needed to explain the purpose and need of the transit system, the institutional structures and financial mechanisms that are envisioned to support it, and the timeline for implementation. Existing transit riders will need information about how route and service changes (and any changes to fares or the fare collection system) will affect them, and non-riders will benefit from information about the new transit options that will be available. Residents of abutting properties and other areas potentially affected by construction activities should also receive information tailored to their concerns. Towns and Villages also need an opportunity to study and implement policy changes, such as updated parking regulations or TDM programs, that respond to the changes in the regional transit system.

Although each of these tracks can run in parallel for some period of time, they will ultimately need to become part of a coordinated planning process that begins with an Alternatives Analysis, moves through Preliminary Engineering and Final Design, and then to Construction and Operations. There continue to be several unknowns, particularly regarding the future

institutional structure for the Dual Concept transit system, that make it impossible to establish a precise timeline for implementation. As a guide, a typical transit project of this scale would require 1-2 years for further study of alternatives and incorporation into the regional long-range plan; then 2-3 years for engineering and environmental review; and finally 3-7 years for final design, procurement, and construction before the start of service. These phases are described in more detail in Section 7, along with some possibilities for interim transit service improvements such as extended hours for current bus services, improvements to rail timetables, and the implementation of supporting technologies such as transit signal priority. Given the time necessary for full implementation, these options for interim service should be given strong consideration as viable ways of improving service in the near-term and building the transit ridership base.

1. Introduction

Background

For several years now, residents and policymakers on the East End of Long Island have been pursuing options for improved public transportation, with the goal of implementing services that will improve mobility for residents and visitors, reduce traffic congestion and pollution, and help preserve the region's scenic beauty. This report is the final component of a multi-year study conducted by the Volpe National Transportation Systems Center on behalf of the five Towns of the East End: East Hampton, Riverhead, Shelter Island, Southampton, and Southold. The primary purpose of the study has been to analyze the technical feasibility and cost-effectiveness of a proposed "coordinated rail-bus network" that would replace most of the East End's current transit services with an integrated system of local shuttle trains and connecting bus services.

The early outlines of this transit concept emerged from a planning process on Sustainable East End Development Strategies (SEEDS), which began in 2001 and considered land use and transportation issues from a regional perspective. A local nonprofit advocacy group, Five Town Rural Transit, Inc., then developed the concept further and presented a formal proposal for a Coordinated Rail-Bus Network in 2005. Using funds made available from a Shared Municipal Services Incentive Grant, the five Towns signed an agreement with the Volpe Center in 2007 for an external evaluation of the concept.

In conducting its research and analysis, the Volpe Center has been guided by a Technical Advisory Group (TAG), consisting of members of the East End Transportation Council and of Five Town Rural Transit. The TAG has provided further details on the Coordinated Rail-Bus Network concept, guided the development of an alternative concept for analysis, and provided feedback on interim deliverables.

This study began with initial stakeholder contact and an analysis of existing transportation conditions on the East End. Findings from this stage were summarized in an Existing Conditions Report (see Appendix A), finalized in June 2008. In preparation for further analysis, the Volpe Center then worked with the TAG and Towns to define the Coordinated Rail-Bus Network concept more precisely, establishing key parameters such as the frequency of service, hours of operation, and locations of bus routes. Using this information, the Volpe Center then conducted railroad traffic modeling, service planning, and other analyses in order

to prepare a "concept of operations" for the proposed transit system that covered vehicle and infrastructure requirements, service characteristics, and information on cost-effectiveness.

To provide some basis for comparison, the TAG and the Volpe Center also worked together to define an alternative transit option, for which the Volpe Center likewise developed a concept of operations. A wide range of alternatives was initially considered, including a scaled-back version of the rail-bus network that could be achieved with more limited capital expenditure; a Bus Rapid Transit system operating on a mix of local roads and dedicated right-of-way; a revival of the South Fork Commuter Connection rail service with corresponding bus enhancements; and combinations of these approaches in conjunction with local mobility enhancements such as bicycle parking and carsharing.

The alternative option that was ultimately selected by the TAG for further analysis and later given the name "Flexible Transit Network," is based primarily on incremental improvements to existing bus services, with some options for targeted additional rail service. Findings from these analyses were summarized in two memoranda, which were finalized in April 2009 (see Appendix B for the Coordinated Rail-Bus Network and Appendix C for the Flexible Transit Network) and presented at a regional transportation forum held on April 17 at the Riverhead campus of Suffolk County Community College.

One of the goals of the forum was to select a single concept that would become the basis for analysis in this final phase of the study, which is geared toward identifying a "road map" to ultimate implementation, particularly on institutional and financial issues. However, in discussions at the Forum and in subsequent meetings with Town Boards, it became clear that differences in population density, travel patterns, and local priorities precluded the development of a single consensus concept that would apply to the entire East End region. Instead, the Towns on the South Fork generally preferred the Coordinated Rail-Bus Network, while the Towns on the North Fork generally preferred the alternative Flexible Transit Network concept. As such, this report is based on a so-called "Dual Concept" approach, with transit services along the lines of the Coordinated Rail-Bus Network concept on the South Fork and the Flexible Transit Network on the North Fork.

Structure of this Report

Section 2 presents an overview of the service characteristics and costs that would be associated with pursuing the "Dual Concept" system. It also provides additional detail on some specific operational issues identified in earlier work on the South Fork rail service component of the Coordinated Rail-Bus Network.

Sections 3 through 7 discuss issues related to the path to implementation for expanded East End transit services, making distinctions where relevant between the transit concepts. Section 3 analyzes the pros and cons of a spectrum of institutional structures that could be employed to operate and manage the transit service, and analyzes the finance mechanisms that are potentially available to fund capital and operating expenses. Section 4 identifies options for fare policy and collection procedures. Section 5 presents a summary of other policies and strategies that support and enhance the viability of public transportation systems, and Section 6 provides a brief overview of the environmental issues inherent in implementing the expanded transit service. An overall summary and conceptual roadmap to implementation are presented in Section 7.

Key deliverables from earlier phases of the project, including the Existing Conditions report and summary memos on the two transit concepts, are included in their entirety as appendices to this report.

2. Operational Issues

New Service Concept

As noted above, differences in circumstances and needs among the Towns of the East End led to the identification of a Dual Concept transit system, with a Rail-Bus Network operating on the South Fork and services modeled on the Flexible Transit Network operating on the North Fork. This section identifies the key service characteristics of a Dual Concept system and presents initial cost estimates.

South Fork

In the Dual Concept system, the portions of the Coordinated-Bus Rail Network that are located on the South Fork would be implemented as described in the concept of operations memo (see Appendix B). Namely, shuttle train service would run between Speonk and Montauk every 30 minutes during peak periods, and every 60 minutes off-peak. Train stations would be (re-)opened at Quogue, Southampton College, Watermill, and Wainscott. Twelve connecting bus routes would operate on coordinated timetables to bring passengers to and from the stations and to connect the train service with communities beyond the rail lines. In addition, seven demand-response vehicles would be used to provide additional local mobility and station access. Depending on community needs, these demand-response services could encompass a range of service concepts, from door-to-door service by reservation to "flex" routes that operate on a defined route, but with the capacity to make small deviations (typically up to three-fourths of a mile) to pick up or drop off passengers. These more flexible services are designed to expand the reach of transit to people who are not able to use conventional public transportation. (See Appendix E for an informal discussion paper on the various forms of flexible transit services.)

North Fork

On the North Fork, in keeping with the Flexible Transit Network concept, all existing Suffolk County Transit (SCT) bus routes would be retained, but with substantially improved frequencies and with expanded hours of operation, including Sunday service on all routes and more late-evening service. The S-92 route would continue to be the primary route for much of the North Fork, and S-92 service would be expanded to run as often as every 15 minutes during peak periods, and as late as 12:30 AM during the summer. The 8A would serve downtown Riverhead and the S-58, S-62, and S-66 would connect Riverhead with points west. The S-96, a new route proposed by SCT as part of its recent service study, would connect Greenport to Riverhead and the Tanger Outlet Center. (Because this route overlaps

the S-92 for much of its length, service could be coordinated between the two route to provide a combination of local and limited-stop or express service. The S-96 could also be extended eastward to Orient.)

Another important component of this concept is a set of flex and/or demand response services that would be added in Wading River, Southold, Cutchogue-Mattituck, Greenport, and Riverhead to provide connections to areas that are beyond the fixed-route buses. A new express bus service would also run roughly every 2 hours from Riverhead (or further east) to the Ronkonkoma train station and Islip-MacArthur airport. This would facilitate connections to New York City via the more frequent electric rail service from Ronkonkoma but is not intended to replace existing rail service. Indeed, the Flexible Transit Network also includes the potential for incremental improvements to rail service. On the North Fork, near-term rail options with minimal cost implications could include converting one of the existing deadhead runs to Greenport into revenue service and adjusting timetables to accommodate later-evening returns from New York City. Appendix C has additional details on the routes and services in this concept.

Shelter Island

Both the Coordinated Rail-Bus Network and the Flexible Transit Network envisioned some form of flexible transit service running on Shelter Island. Although there were slight differences in the service concept, both would require a single vehicle and involve some element of demand-response service. Either approach could be part of the Dual Concept system at roughly the same cost.

Links Between the Forks

To ensure seamless transportation within the East End, particularly for trips between the North and South Forks, some form of interface between the two service concepts will be required. One such linkage is the Westhampton-to-Riverhead bus route that is part of the Coordinated Rail-Bus Network. (Depending on the nature of the service, the Shelter Island bus route conceivably could serve this function to some extent as well, linking Greenport with the planned bus routes out of North Haven.) However, relying solely on this connection would require many passengers to take circuitous routes to travel between the Forks, and the planned frequency of service on this route would be inadequate for the volume of inter-Fork trips.

The other key transit connection between Forks is the current S-92 bus route. Instead of replacing the South Fork portion of this route with the Rail-Bus Network, it likely makes sense – at least initially – to continue the S-92 for much or all of its current length to ensure inter-Fork connectivity. This will entail some duplication of service, since the S-92 would then parallel the expanded rail service along much of the South Fork. However, as the new

transit system evolves, origin-destination travel patterns can be reviewed to determine whether it would be worthwhile to abbreviate the route to gain operating efficiencies. For example, the S-92's "southbound" (counter-clockwise) run could end at Hampton Bays, with passengers transferring to the Rail-Bus Network for any onward travel on the South Fork. Compared to the current route to East Hampton, this would save 50-55 minutes of one-way running time, allowing the service to be operated with significantly fewer vehicles. On-time performance would likely also be improved by eliminating the congested areas between Southampton and East Hampton. The operational efficiencies of a shorter route would, of course, need to be balanced against the passenger convenience of preserving a one-seat ride. Analysis of recent SCT ridership data suggests that the Riverhead-Southampton section of the route has the highest passenger volumes, meaning that a forced transfer at Hampton Bays would inconvenience many riders. To be conservative, the cost estimate below includes S-92 service for the full length of the current route from Orient Point to East Hampton. The overview map below illustrates the other options for the S-92 by showing the section from Hampton Bays to East Hampton as a dashed line.

Phasing in the New Service

The service concept outlined above represents the region's long-term vision for public transportation. Many aspects of the plan will require several years of additional analysis and environmental review before changes can be implemented. (See Section 7 for a fuller discussion of the overall path to implementation.) However, *nothing in this vision should be interpreted as precluding other near-term improvements in transit service that are consistent with the goal of improved local mobility*. As one example, direct negotiations between the Towns of the East End and the LIRR could result in modified train schedules that provide more service for East End residents, particularly for those whose travel needs do not align with the traditional Manhattan-centric service model. This would include intra-island trips from the East End to western Suffolk and Nassau counties as well as the "reverse" commute (west to east in the morning) into the East End. SCT, for its part, has recently conducted a service planning study and may introduce a number of enhancements on its own initiative that overlap with this vision, including Sunday service on key routes and the extension of some schedules later into the evening. The five Towns themselves can also pursue better coordination of their existing Human Services transportation programs, as the Towns of East Hampton and Southampton have done with their joint service to Stony Brook Medical Center.

Costs

For the Dual Concept system, capital and operating costs would be based on the cost elements of the Coordinated Rail-Bus Network that relate to the South Fork, plus those from the Flexible Transit Network that relate to the North Fork. Costs of the Dual Concept system can therefore be derived from the earlier cost estimates produced for each concept (see Appendices B and C for more details and unit costs) with the necessary adjustments as detailed below:

- Rail Infrastructure: Since the frequent shuttle train service would operate only on the South Fork in the Dual Concept system, only 4 of 7 sidings, 12 of 20 switches, and 4 of the 5 new stations originally planned for the Rail-Bus Network would be required. The upgrade to Centralized Traffic Control would likewise only be needed for the track mileage on the South Fork. A rail vehicle maintenance facility would still be required.
- Rail Vehicles: Seven railcars (6 plus a spare) would be required for the South Fork component of the service, compared to the 17 that had been estimated to be required for both Forks. Because the South Fork would tend to have higher passenger volumes, at least 4 additional unpowered passenger coaches would be recommended. As in previous cost analyses, there is uncertainty about the availability of federally compliant Diesel Multiple Units (DMUs), and differences in potential suppliers create a wide range of unit costs.
- Bus Purchase: The South Fork routes (including Shelter Island) from the Coordinated Rail-Bus Network require only 39 buses, not the 62 that had been previously estimated. However, implementing the North Fork components of the Flexible Transit Network, including the S-92 at its full route length, would require 37 full-size buses and 6 smaller demand-response vehicles. These figures include spares.
- Investments in Intelligent Transportation Systems and annual costs for service planning and management functions are assumed to be roughly the same for the Dual Concept service as in previous estimates.

Based on these adjustments, the upfront capital costs for the Dual Concept system would be approximately $117 million to $148 million. The low end of this range is based on using refurbished Budd cars for the rail vehicles, and the higher end is based on list prices for the former Colorado Railcar. This compares to a range of $132 to $201 million for the Coordinated Rail-Bus Network and therefore represents substantial savings. (Both sets of figures exclude any potential land acquisition costs or other ancillary investments, such as expanded parking areas.) Annual operating costs are projected to be only slightly lower, however, due to the intensity of service on both Forks and the cost of operating duplicative rail and bus service in some areas to ensure connectivity.

To put the $117-148 million capital cost figure for the Dual Concept system in perspective, this is very roughly equivalent to:

- Three times the cost of the recently announced project to widen a 3½-mile stretch of State Route 112 in the area between Coram and Port Jefferson Station, including resurfacing and the installation new landscaping and drainage ($43 million); or
- Roughly double the cost of the proposed project to create a grade-separated interchange at County Road 97 and State Route 347 ($68.5 million); or
- One-quarter of the cost of the Brooklyn Bridge rehabilitation project, which will repair and widen the approach ramps and repaint the bridge ($448 million).

Summary of Capital and Operating Costs by Transit Concept

	Concept 1: Coordinated Rail-Bus Network	**Concept 2: Flexible Transit Network**	**Dual Concept System**
Capital Costs	$132 M to $201 M	$84 M	$117 M to $148 M
Annual Operations & Maintenance	$46.1 M	$27.8 M	$43.6 M

Breakout of Major Capital Cost Items for the Dual Concept Transit System

	Unit Cost	Quantity	Total
Railcar	$2.0 m - $5.5 m	7	$14.0 m - $38.5 m
Unpowered rail coach	$2.0 m - $3.5 m	4	$8.0 - $14.0 m
Railroad siding	$500,000	4	$2.0 m
Centralized Traffic Control	$175,000 per track-mile	47	$8.2 m
Switches	$75,000	12	$0.9 m
Maintenance / repair facility	$35 m	1	$35.0 m
Accessibility for re-opened stations	$1.0 m	4	$4.0 m
Smaller buses (demand-response and station shuttle)	$300,000	45	$13.5 m
Larger buses (fixed route and express service)	$600,000	37	$22.2 m
Bus refueling and dispatch center	$7.0 m	1	$7.0 m
Intelligent Transportation Systems (e.g. signal priority)	Varied	Varied	$2.5 m
TOTAL CAPITAL COSTS			**$117.3 m to $147.8 m**

Notes:
Costs for the rail vehicles will depend on the choice of supplier and whether newly manufactured or refurbished vehicles are selected. Bus costs reflect hybrid-drive models.

Summary of Operating Cost Projections for the Dual Concept Transit System

	Avg. Cost per Vehicle-Hour of Service	Annual Vehicle-Hours of Service Proposed	Total Cost
Rail component of rail-bus network (South Fork)	$423.90	21,622	$9.2 m
Bus component of rail-bus network (South Fork)	$89.42	145,202	$13.0 m
Expanded bus service (North Fork)	$89.42	183,439	$16.4 m
General & administrative expenses – service planning, contract management, etc.			$5.0 m
TOTAL ANNUAL OPERATING EXPENSES			**$43.6 m**

Track Conflicts with High-Volume LIRR Service

The concept of operations memo for the Coordinated Rail-Bus Network (Appendix B) identified an important operational limitation of the concept, which is that, due to the capacity limits of the single track infrastructure, the 30- to 60-minute rail service frequencies on the South Fork may not be compatible with existing high-volume services, i.e. the summer season weekend trains run by the Long Island Rail Road (LIRR). The basic dilemma is this: allocating track space to the local shuttle trains would require LIRR passengers to disembark and transfer at Speonk, which would not only be inconvenient, but would also be essentially unworkable since the volume of passengers involved would vastly exceed the capacity of the envisioned DMUs or Budd cars. Conversely, allowing the high-volume trains through past Speonk would require altering the local train schedules or cancelling some local runs altogether, which would disrupt local mobility and require concomitant adjustments to each of the connecting bus schedules. The investments proposed in the Dual Transit system would also affect LIRR operations, since the addition of new passing sidings would allow for greater

service options, while the addition of new station stops would increase overall end-to-end run time.

To investigate potential options, the Volpe Center used railroad traffic modeling software to simulate a summer Friday, when as many as seven high-volume trains from New York would be operating in the East End in addition to the proposed East End shuttle trains. Using the software, iterative rounds of adjustments were made to the current and proposed service schedules in an attempt to find a workable schedule. One of the modeling assumptions, which could be re-visited as necessary, was that the high-volume trains would serve all stations, current and proposed, so that they would offer the greatest potential for local use *within* the East End. (Several LIRR trains skip certain stops, and of course none stop at now-closed stations such as Southampton College.) The modeling results summarized in the notional schedules in Appendix D indicate that some disruption to the orderly 30- and 60-minute intervals between local trains is inevitable due to the crossing movements of trains. With some adjustments to schedules, there could still be relatively frequent service, but with some schedule gaps of up to 60-75 minutes, particularly in the westbound direction, which is the predominant afternoon commuting direction for East End workers. For commuters accustomed to waiting no more than 30 minutes for a train, this is a significant reduction in frequency, and brings up the potential need for substitute bus service or broader mobility strategies such as transportation demand management (see Section 5).

These results are preliminary and need to be interpreted with caution since they reflect only the ability of trains to complete their runs and to pass each other at the sidings (existing and proposed). They do not reflect specific LIRR operating rules, equipment availability needs, or information about time-specific customer travel patterns. Moreover, there is no built-in allowance for the delays and disruptions that are part of everyday railroad operations; these are particularly problematic in single-track environments, where one breakdown affects trains in both directions. More detailed modeling of this issue should become part of subsequent stages of environmental and engineering review of the Dual Concept system.

3. Institutional and Financial Options

This section provides an overview of the current institutional structure, a range of institutional options to consider for implementing the Dual Concept transit system, and information on federal and state funding options.

Current Arrangements

The current set of institutional arrangements is discussed in the Existing Conditions report (Appendix A). As a brief recap, the East End's rail service is provided by the LIRR, which is an operating unit of the Metropolitan Transit Authority (MTA), a state-chartered corporation. In addition to transit fares and tolls, MTA is supported by a range of state-imposed taxes and fees within its service area. These include Mortgage Recording Taxes (MRT), the Dedicated Mass Transportation Trust Fund (MTTF), and Metropolitan Mass Transportation Operating Assistance Fund (MMTOA). MTTF and MMTOA, in turn, are supported by state taxes on petroleum businesses, a portion of motor fuel taxes, certain motor vehicle fees, as well as a regional sales tax and a temporary regional franchise tax surcharge. New York City and the State of Connecticut both provide some additional funding to MTA related to specific services.

The year-round population of the East End is just under 1 percent of the total MTA region population, but the portion of MTA subsidies that derives from taxes collected in the East End or paid by or on behalf of its residents cannot be readily determined from MTA's published financials, as they do not itemize revenues at the Town level. In 2005, 5TRT produced an informal estimate of $60 million per year, but this figure has not been independently verified, and in any event the economic downtown of the intervening years has greatly affected MTA receipts. Further research on this topic may be relevant to discussions of institutional options.

LIRR's operating budget in 2007 was $1.04 billion systemwide. Of this total, 46 percent was covered by fare revenues and 51 percent by state and local subsidies. LIRR receives federal funding for capital projects, but not for operations.

Local bus service in most of Suffolk County, including the East End, is provided by Suffolk County Transit, a division of the Suffolk County Department of Public Works. SCT's systemwide operating budget for transit and paratransit in 2007 was $45.7 million. Funding

for SCT's operations comes from fares (16 percent), state subsidies (43 percent), federal programs (6 percent), and the county's own general fund (34 percent).[1]

Spectrum of Options

There is a spectrum of operating structures that the East End's communities could choose from, ranging from the status quo to the formation of an entirely new regional transit authority (RTA). Decisions about the appropriate structure would depend on several factors including funding sources, the type of transit service to be provided, and a calculated tradeoff between local control and additional financial risk.

- ***No Institutional Change*:** This would preserve existing institutional structures and providers. Any new transit service enhancements in the East End would need to come via LIRR and SCT. In the case of the Dual Concept system, this would entail the LIRR restructuring its services to operate the South Fork shuttle trains and making improvements to North Fork service, while SCT would revise its route network to operate the envisioned bus components. The primary role for municipalities would be to enact transit-supportive local policies in areas such as zoning, transportation demand management, and pedestrian and bicycle facilities (see Section 5). This scenario could also encompass the possible takeover of SCT bus services by the MTA, which has been discussed locally. This approach has the advantages of not requiring any new legislation and maintaining the operating expertise of the current transit agencies, but fiscal constraints at these agencies make it extremely unlikely that they could implement anything approaching the scale of the Dual Concept system.

- ***Dedicated Operating Unit*:** This is a minor variant on the scenario above that includes the idea of each agency having a separate administrative unit focusing exclusively on the East End. Strong coordination between the units in each agency would, if effective, allow the Dual Concept system to operate as a coherent, integrated system despite being split across two agencies. More generally, this approach would ensure that the region's transit needs receive more attention and analytical focus than they currently do. Otherwise, its advantages and disadvantages are largely the same as above.

- ***Regional Transportation Council*:** Through a multilateral agreement or Memorandum of Understanding, the five Towns of the East End could provide funding for a regional transportation council to support full-time planning and analysis staff (and/or contractor support). As with the options listed above, the transit services of the Dual Concept

[1] All operating cost and funding data for LIRR and SCT are taken from the National Transit Database, 2007 agency profiles.

system would be implemented by LIRR or SCT, but this approach would give the East End a stronger voice in the oversight and management of the system and in service planning. The council would also conceivably have resources available to conduct traffic and transit studies; coordinate various federal, state, local, and private funding opportunities; engage with stakeholders; and take a regionally coordinated approach to transportation issues and analysis. With this regional focus, the council could provide analysis and service planning to promote further coordination and consolidation of the many private and Town-supported programs that provide human services transportation, potentially creating some economies of scale. It could also support the development of small-scale but useful tools for East End transit riders, such as an online trip planner.

Overall, this approach is administratively more complex than the options above, and requires the Towns to commit some financial resources, but it also ensures a more holistic approach to regional transportation. As with any scenario involving the current transit providers, however, it is unlikely to yield significant service improvements in the current fiscal environment.

- ***Supplemental Service:*** In this model, the five Towns would collectively raise local funds (through property taxes, lodging taxes, or other revenue streams such as parking fees) to finance the transition from the current set of transit services to the more expansive Dual Concept system but would keep much of the other aspects of the current arrangements in place. This could entail a fee-for-service agreement with SCT and LIRR and/or direct provision of certain transit services (such as the demand-response and Ronkonkoma express buses) directly by a consortium of the Towns. Any agreement with SCT or LIRR would need to include detailed provisions regarding performance standards, reckoning and allocation of the incremental costs and revenues, and continuance of existing services. This scenario has the advantage of allowing for local control of the new service with manageable financial risks and the ability to maintain existing institutions. Its principal drawback is the high degree of administrative complexity that would be required both for the funding agreements among the Towns and for the contracts with the transit agencies.

- ***Establishment of a New Regional Transit Authority*:** Under this option, the five Towns would leave the MTA transit district and establish their own RTA to oversee public transportation on the East End. This option has several positive aspects because it gives the East End communities greater control over the transit provided to the region, but it also comes with greater financial and operating risk.

  The primary advantage of this arrangement is that it would provide East End Towns with maximum control over the type and quality of transit service provided, including the

direct implementation of the Dual Concept system and consolidation of existing human services transportation and paratransit. Under this arrangement, the new RTA would seek permission from New York State to retain the taxes and fees collected within the region that currently support the MTA and allow the RTA to apply for federal and state transit funding on its own (see below on federal and state funding sources).

The formation of a separate RTA carries financial, operational, and oversight risks. This option will present the greatest degree of financial risk for the Towns as they will be responsible for covering the cost of capital and operations of the new transit service. The financial risk stems from the fact that most revenue sources are subject to volatility. For example, the MTA has reported a 40 percent decline in MRT receipts over the past year, and nationally, there has been a decline in motor fuel tax receipts. The primary operational risk is being able to provide the desired level of transit service within the established budget. Depending on how the break with MTA is structured, it could also mean the end of most or all LIRR service to the region, an arrangement to pay LIRR for use of their rail right-of-way, and/or the need for the new RTA to purchase this right-of-way at some negotiated value. The new RTA would also be responsible for providing ADA-compliant paratransit to complement its fixed route service, though the inherent flexibility built into the demand-response services would mitigate this to some extent. Still, paratransit tends to be costly, with SCT's financials indicating an average cost of $38 per one-way paratransit trip.

One of the key decisions that a new RTA would face is whether to operate the transit services in-house using its own staff and equipment, or hire a contractor for these services. The pros and cons of the contracting approach have been discussed extensively in the transportation literature but are still debated. In general, contracted services are less costly on a per-vehicle hour basis, particularly in areas with restrictive union work rules and generous public sector pay and benefits. Private contractors are also generally able to make better use of part-time labor and other efficiencies. However, contracting involves a number of "hidden" costs, such as for contract oversight and administration, and cost savings can be minimal if there are not an adequate number of local firms to generate true competition, as may be the case in a rural area. The quality of the transit service can also suffer if the contracts do not include enforceable performance measures in areas such as on-time performance.

Roadmap to formation and establishment of a new RTA

If the communities of the East End come to a decision to establish a new RTA, the first step would generally be to agree on the governing structure for the transit service. Options for the governing structure include designating one of the member municipalities as the operating

authority or the establishment of a new authority with its own by-laws and board of directors. Included in this discussion should be the agreement on how the transit agency will be funded.

The New York State legislature would need to pass legislation authorizing the establishment of the new RTA. The new RTA would have to be listed as a "designated recipient" by the Governor of New York in order to be eligible for Federal Transit Administration (FTA) federal-aid transportation funds. These actions may be resisted by MTA, Suffolk County Transit, and NYMTC, as in large part the new RTA would be competing for an essentially fixed pool of federal funds.

The new RTA could participate in the New York Statewide Mass Transportation Operating Assistance (STOA) program. If a municipality or transit agency wishes to participate in the STOA program, a letter of intent about the proposed transit service must be submitted to the NYSDOT Transit Bureau. Once accepted, the operating agency must sign a "119r" agreement. Each agency that receives STOA funding must follow the rules and regulations contained in Part 975 of the New York State Code of Regulations. At a minimum, the agency must:

- Maintain accounting books and records in accordance with the Uniform System of Accounts by NYSDOT,
- Track revenue vehicle miles and individual passenger counts,
- Conduct bus inspections to NYSDOT standards,
- Submit a System Safety Plan within 180 days of service starting,
- Meet accessible service requirements contained within the Americans with Disabilities Act (ADA) for fixed route service, and
- File an annual report with NYSDOT.

Federal Funding Programs

Overview

FTA provides financial assistance to communities to support public transportation by issuing grants to eligible recipients for planning, purchase of vehicles, construction of service, operations, and other purposes. FTA administers this financial assistance according to authorization provided by federal transportation law, SAFETEA-LU. Each year, Congress provides an annual appropriation for each of the designated transit funding categories. Upon receiving this appropriation, FTA apportions and allocates these funds according to formulas and earmarks.

To be eligible to receive federal funds, the agency or governmental unit must be a federally designated recipient. Generally, this is a state, municipality, regional government, or transit authority. A recipient of these grants is responsible for managing its projects in accordance with federal requirements. Most of the federal funds are distributed based on a legislatively determined formula. This usually means that new additional transit service must compete for the existing amount federal dollars allocated to the state or urbanized area rather than seeing an inflow of new funds.

Current federal transit funds that may be available for transit improvements for the East End towns include:

Section 5303: Metropolitan Planning: This program funds planning studies for future transit investments. For New York state, these federal funds are distributed from FTA to NYSDOT, which then allocates the funding to each of the state's MPOs. The MPO then is responsible for programming the use of the funds. To access this funding, the East End towns would need to work with NYMTC on defining and programming a transit planning study into the regional Unified Planning Work Program (UPWP). This program provides 80 percent federal funding with a required local match of 20 percent.

Section 5307: Large Urban Cities: This program provides federal funding for capital investment for existing transit systems. Funds are distributed based on urbanized area population and other factors through a federally determined legislative formula. For areas with a population of less than 200,000, an agency can use a portion of this funding for operating assistance. The governor of New York has the responsibility to designate the recipient of these transit funds. This program provides 80 percent funding with a required local match of 20 percent. For fiscal year 2009, the New York City urbanized area, which includes some western portions of the East End, received $886 million in Section 5307 funding. Because the New York urbanized area receives a set amount of funding, any money that the East End would hope to receive would come at the expense of the MTA or Suffolk County Transit, each of which would be expected to fight any reallocation of Section 5307 funding.

Section 5309: Rail and Fixed Guideway Modernization: This program provides funding for capital investment for transit projects that use exclusive rights-of-way or rails, including commuter railroad services. These funds are allocated by a federal formula for urbanized areas with rail systems that have been in operation for at least seven years. This program provides 80 percent funding with a required local match of 20 percent. For fiscal year 2009, the New York City urbanized area received $460 million in Section 5309 funding. Similar to Section 5307 funding, the East End Towns would be in direct competition with the MTA for these funds.

Section 5310: Transportation for Elderly Persons and Persons with Disabilities: This program provides formula funding to assist private non-profit organizations in providing transit service for the two designated groups when existing transportation service provided is "unavailable, insufficient, or inappropriate to meet their needs." Projects using 5310 funding must be from a locally developed public transit and human services transportation plan. For fiscal year 2009, New York State received $9.3 million in 5310 funding.

Section 5311: Rural and Small Urban Areas: This program provides formula funding to states to provide transit assistance for areas with less than 50,000 residents. The funds can be used for capital, operating, and administrative purposes. The funds are distributed to the states based on a statutory formula. NYSDOT then distributes these funds based on applications. Most of the East End, with the exception of some western sections of Riverhead and Southampton, is outside the Census-defined New York urbanized area; as such, a new East End RTA would in principle be eligible for this grant program. Section 5311 guidelines also explicitly allow eligible rural transportation agencies to provide some service to and from urbanized areas, and for agencies to receive both urban and non-urban funds, as long as they are used as intended.[2] The legal guidance on this point appears to be complex and should be researched further, if considered relevant. A new RTA would still be competing for the limited pool of funds with other rural areas within New York State. For fiscal year 2009, New York State received a total of $17.5 million in Section 5311 funding. This implies that even if the East End were able to receive a substantial share of this funding at the expense of rural regions upstate, it would only cover a portion of projected operating costs.

Section 5316: Job Access and Reverse Commute (JARC): This program is designed to allow better access to employment, particularly for inner-city and rural residents traveling to jobs in the suburbs. The funds may be used for capital planning as well as operating costs to transport low-income residents to and from work. Funds are allocated by formula to states for areas with populations below 200,000 people, and to designated recipient areas for urbanized areas with a population above 200,000. The distribution formula is based on the number of low-income and welfare eligible recipients within the area. For Fiscal Year 2009, New York State received $688,000 for distribution among areas with a population below 200,000 and the New York urbanized area received $12.1 million. For the New York City

[2] From *FTA Circular 9040.1F* (April 1, 2007): "Since the goal of Section 5311 is to enhance the overall mobility of people living in nonurbanized areas, Section 5311 projects may include transportation to and from urbanized areas[…] In some localities, a subrecipient receives both Section 5307 and 5311 funding to provide public transportation to urbanized and surrounding nonurbanized areas. These subrecipients should use Section 5311 funds only to assist the nonurbanized portion of those localities. Because of the wide range of circumstances under which an operator may provide services in both urbanized and nonurbanized areas, FTA expects the subrecipient to develop a reasonable basis related to the service provided, for allocating operating costs between the two FTA funding sources."

region, NYMTC distributes its allocation of both JARC and New Freedom funds through an annual competitive grant process. Proposed projects are asked to address gaps or barriers that have been identified in the NYMTC Interim Area Wide Coordinated Public Transit-Human Services Transportation Plan.

Section 5317: New Freedom Program: This program is designed to support new transit services beyond what is required by the Americans with Disabilities Act (ADA). The funds may be spent on capital and operating expense for the new transit services. The funds are allocated by formula based on the population of persons with disabilities. Any New Freedom Program project must be included as part of a locally developed human service transportation coordination plan. For Fiscal Year 2009, New York State received $410,000 for distribution among areas with a population below 200,000 and the New York-Newark urbanized area received $7.1 million. As noted above in the JARC description, these funds are distributed by NYMTC through a competitive grant process.

FTA New Starts, Small Starts and Very Small Starts Program: FTA provides capital funding for new capital transit projects that meet certain criteria. Project evaluation criteria include: land use, cost-effectiveness, economic development, and local financial commitment. These programs are extremely competitive and it will be difficult for East End projects to compete well at the national level on the cost-effectiveness metric due to the region's limited population and low-to- moderate density. For both programs, incremental operations and maintenance costs of the proposed new service should not exceed 5 percent of the agency's annual budget. Small Starts projects are also limited to services operated on a fixed guideway (for at least 50 percent of the project length) or high-quality, BRT-like bus service,[3] with total costs under $250 million and federal share under $75 million. A Very Small Starts project must also be fixed-guideway or high-quality bus service, with total capital costs under $50 million exclusive of rolling stock. Existing corridor ridership should be in excess of 3,000 per weekday, which is higher than the ridership on the East End's busiest route, the S-92.

Congestion Mitigation and Air Quality (CMAQ): The Federal Highway Administration (FHWA) allocates CMAQ funds by formula to regions with air quality "non-attainment" or "maintenance" status as defined by the Environmental Protection Agency. In New York, the CMAQ funds are distributed from FHWA to NYSDOT, which in turn suballocates funds to those MPOs that have regional air quality conformity issues. A CMAQ project can encompass a wide variety of transit, highway, vehicle, and technology programs that yield improvements in air quality. Subject to certain conditions, CMAQ funds can be used for

[3] Defined as having all of the following: substantial transit stations; traffic signal priority or pre-emption; low-floor buses or level boarding; branding of the service; 10-min. peak headways (15-min. offpeak) or better; and service 14+ hours per weekday.

operations on new transit services for up to 3 years. (The intent is to allow experimentation with new services and build ridership while permanent funding options are established.) One example of successful use of CMAQ funds is the Island Explorer bus system in Bar Harbor, Maine.

Congressional Earmarks: As part of the annual appropriations process, individual legislators are able to secure earmarks for specific projects. To secure an earmark would require the East End communities working with their Congressional delegation on defining a project and estimating the cost. Often a federal earmark does not cover the full cost of constructing or implementing the proposed project, so it is crucial to identify other matching funds to cover the full cost of the proposal.

Developments in Federal Funding

The Federal government funds public transportation programs through the Mass Transit Account of the Highway Trust Fund. The Mass Transit Account receives 2.86 cents per gallon from the overall federal motor fuel tax of 18.4 cents per gallon. The Highway Trust Fund's gas tax receipts have declined in recent years due to a combination of more fuel efficient vehicles and a reduction in overall vehicles-miles traveled. The tax rate has also not been adjusted for inflation, meaning that the real value of the revenue declines each year. At the same time, Congress has increased its annual appropriations for transportation. The result of these two actions has been a spending down of the prior surplus of the Highway Trust Fund. The Trust Fund reached deficit status in 2008. To cover the gap in funding for fiscal year 2009, Congress appropriated $8 billion from the General Fund to the Highway Trust Fund. To maintain current spending levels for the remainder of fiscal year 2009, a similar transfer of funds into the Highway Trust Fund will be required.

The current transportation authorization (SAFETEA-LU) is due to expire on September 30, 2009. The Obama Administration has proposed an 18-month extension of the current legislation to allow time for Congress to revise the legislation and propose new funding sources. The Administration has not proposed any additional funding or new programs for transit for that 18-month period. The House Transportation and Infrastructure Committee believes that transportation reauthorization should occur this year and has proposed enacting new legislation before the current authorization expires in September. The proposed legislation calls for a spending level of approximately $450 billion over the six-year period, but it contains only $300 billion in identified revenues. The House Ways and Means Committee, which is in charge of proposing revenue-related legislation, has indicated that it will not act on reauthorization until next fiscal year.

Neither the Administration nor Congress has proposed any additional funding streams to cover the gap between current spending and fuel tax revenues and are relying on the transfer of general funds to cover the ongoing deficit. Therefore, except for any funds related to economic stimulus legislation, it should not be expected that the federal government will significantly increase the funds allocated to transit in the near term due to concerns over the size of the current and projected federal budget deficits.

New York State Funding Programs

Statewide Mass Transportation Operating Assistance (STOA)

The New York State Department of Transportation distributes about $3.0 billion annually in Statewide Mass Transportation Operating Assistance (STOA), and other transportation assistance, to approximately 130 transit operators, which can include municipalities. To be eligible for STOA funding, a transit operator or municipality must be:

- Open and available to the general public,
- Charge an "appropriate fare", and
- Provide service on a vehicle capable of carrying at least 15 passengers.

In the 1970s, the New York Legislature enacted the Statewide Mass Transportation Operating Assistance Program (STOA) with appropriations from the State's General Fund. During the early 1980s, the Legislature enacted a series of dedicated taxes to fund the Mass Transit Operating Assistance (MTOA) fund, which is divided into dedicated upstate and downstate fund accounts. The downstate account provides funding to transit systems in the 12-county New York metropolitan transportation commuter district and consists of revenues from the following sources: a portion of the Petroleum Business Tax; the MTA Corporate Tax Surcharge; a sales tax in the MTA region; and the Long Lines Tax. To cover the cost of providing local bus service, Suffolk County Transit received about $23 million in 2008 from New York state grants.

4. Fare Policy and Collection

Transit agencies face a number of choices about how much to charge for different types of trips, how fares should be collected, what technologies should be employed, and what discounts and options should be offered. Decisions about fare policy should be made with an eye not only to revenue potential, but also to other agency goals such as ridership and marketing, along with broader policy goals such as equity. Fare collection is thus a complex topic, and this section is intended only to provide an overview of the key issues and considerations.

For the Dual Concept system, fare collection approaches will vary sharply depending on the governance structure and the institution(s) that operate the service. For simplicity, this section describes fare collection under two scenarios: (1) with the current providers, LIRR and SCT, operating the rail and bus components of the network in lieu of their current East End services, and (2) with some form of new transportation authority operating the system.

With Existing Providers

The LIRR uses zoned fares on each branch. After the most recent fare increase, the basic cash fare for a one-way trip within the East End ranges from $2.50 (intra-zone) to $5.00, and $7.25 from the North Fork to Ronkonkoma. SCT bus fares are $1.50, plus $0.25 for a transfer (valid for up to 2 buses within 2 hours). LIRR offers multi-ride tickets and weekly/monthly passes, while SCT does not. There are no free or discounted transfers between rail and bus services.

An initial step toward a coordinated fare structure for the Dual Concept system would be to establish an agreement between LIRR and SCT to cross-honor each other's tickets and passes as partial or full payment within the East End. Just as an example, a passenger transferring from bus to train could present his SCT transfer slip to the LIRR conductor to receive a $1.50 or $1.75 credit toward the rail fare. Although these sorts of agreements are common across the country, they can be complex because of the need to define how transfers are counted and audited, and how fare revenue from transfer passengers is allocated between the agencies. Some existing fare collection policies might also need adjustment; for example, SCT's current transfer system does not envision bus-rail-bus transfers. In the absence of technological integration between the agencies, transfers would also have to be handled manually. This might mean that the LIRR would waive its usual surcharge for onboard ticket purchases for those connecting from buses, much as Metro-North does for passengers connecting from Shore Line East. Some LIRR ticket types would also need modification to show the time that payment was made so that the validity of a future transfer could be determined.

A second stage of integration would be to create a uniform tariff structure for the East End, with a defined fare for each origin-destination pair. For example, the fare from Hampton Bays to Greenport might be set at $3, regardless of the specific routes or modes of travel used. Again, this would require modification of the SCT and LIRR fare structures and policies, along with detailed agreements on revenue sharing. Over the longer term, technological integration of the actual fare media and sales outlets, and harmonization of collection procedures, would be needed to create a truly seamless regional system, possibly extending westward to include interoperability with the New York City transit system.

With a New Transportation Authority

A new authority would have more freedom to start with a blank slate and consider the fare structure in light of the broader goals of the rail-bus network. Some of the fundamental questions to consider are:

- What is the appropriate fare level?
- Should the fare vary by distance, time of day, or other factors, or is it preferable to have one flat fare for the East End?
- What sorts of discounts, if any, should be offered?
- What kind of fare medium (e.g. paper tickets, magnetic stripe cards, contactless smart cards) should be used? Where and how should they be sold? How will payment off fares be enforced?
- How should transfers be handled, both within the network and to other transit services (including connecting SCT buses and LIRR through-trains)?

These questions are discussed in the sections below.

Whether to Charge[4]

Perhaps the most fundamental aspect of fare policy is whether to charge a fare at all. Some members of the TAG indicated an interest in a fare-free system, as had been earlier proposed by Five Town Rural Transit in their initial development of the rail-bus concept. Fare-free transit services are relatively rare within the United States, but some examples include the Staten Island ferry and the bus transit systems in Park City, Utah; Island County, Washington; Summit County, Colorado; and Chapel Hill, North Carolina. Seattle, Portland, and a few other cities also have extensive fare-free zones in the downtown area. Some of these systems have been fare-free for decades while others have only more recently converted to fare-free operation.

[4] Most of the material in this section is drawn from Dillon, R.W., and J.A. Bailey, *Legal and Political Aspects of Free Transit in Major Metropolitan Areas*, Northwestern University Transportation Center, 1970, and from the Transportation Research Board, Transit Cooperative Research Program Report 94, *Fare Policies, Structures, and Technologies: Update, 2003*. http://onlinepubs.trb.org/Onlinepubs/tcrp/tcrp_rpt_94.pdf

Free systems experience cost savings as they do not require expensive fare collection equipment or the associated staff time for selling tickets, servicing machinery, sorting and counting currency, processing payments, accounting, and auditing. Depending on fare levels, ridership, and the type of fare collection system, these savings could potentially offset much of the foregone revenue – particularly for small, rural systems where farebox recovery would be low anyway. Unfortunately, there does not appear to be much empirical evidence on this point, as the available examples are limited, and most of the literature on fare-free transit focuses on the impacts on ridership rather than costs.

One recent analysis by Lane Transit District in Eugene, Oregon, indicated that going fare-free would cost the agency about $5 million annually in revenue, while producing only $100,000 to $500,000 in savings. The limited savings were attributed to a number of factors, including the agency's relatively simple fare collection system; the number of passengers already using pre-paid passes; and the fact that staffing levels could not be reduced substantially because fare collection is only one aspect of many employees' duties. These factors will not apply to the same extent at all agencies, but the fact that no major urban system operates entirely fare-free suggests that similar cost-benefit considerations do apply, at least for medium-sized and larger agencies.

Fare-free systems provide obvious marketing opportunities ("It's free!") and make it much easier for unfamiliar or first-time riders to try the service, since they do not need to worry about having exact change or deciphering the ticketing system. Almost all of the research on fare-free systems indicates that free systems do experience higher ridership. The size of the ridership gains vary, and there is evidence that most travelers are much more sensitive to the frequency of service than to its price. This means that for any given amount of money, greater ridership gains can generally be attained by adding service than by reducing fares.

The obvious drawback to the fare-free approach is that it does not produce revenue to fund the system, meaning that alternative funding sources must be developed. Fare-free transit could also be difficult to sustain in the political arena, because non-transit users may feel that they are unfairly subsidizing the system without adequate contributions from riders themselves. (The "user pays" principle is common in transportation and forms part of the philosophical basis for using federal gasoline tax proceeds exclusively for transportation purposes.)

Several cities that experimented with free transit in the 1970s, such as Austin, Texas, also found that free buses attracted disorderly persons and criminal activity, which had the effect of driving away some of their regular customers (due to security concerns) and lowering employee morale. Though this information is limited and partly anecdotal, it also helps to explain why these fare-free

experiments were not continued and why other agencies have not adopted a fare-free approach. Smaller and more rural systems, such as Island Transit in Washington, do not report any serious issues with "problem riders" on their free services.

If free service remains a strong local priority for the East End, the mixed empirical evidence suggests that a more thorough evaluation of the potential costs and benefits of a fare-free approach would be necessary. This evaluation would need to consider the equipment and labor costs associated with fare collection and estimated revenues as well as more qualitative issues such as the effects on public perceptions of the transit system. Without prejudging the outcomes of such an evaluation, the remainder of this section assumes that a fare of some sort will be charged for East End transit, in order to discuss options for fare structure and collection. This could be thought of as the baseline fare structure against which a fare-free option would be compared.

Fare Level and Structure

Current transit fares in the East End range from $1.50 to $7.25 per trip segment depending on the mode and route. Nationally, average "base fares" (i.e., the undiscounted rate for a single one-way trip) on urban transit have been edging up toward $2, with commuter rail fares typically higher due to the longer distance covered. In addition to the dollar value of the fare, one of the major decisions that transit agencies face is whether to make fare distinctions based on distance, time of day, and/or mode of travel, or whether instead to charge a flat fare. The latter has the distinct advantage of being easy for passengers to understand and remember, and simpler for the agency to collect. However, a flat fare may need to be relatively high in order to be financially viable, and this can discourage short trips. There are also equity considerations and a societal expectation that travelers who cover a longer distance should contribute to the higher cost of their trips.

Every commuter rail system in the country uses some form of distance-based pricing, often using concentric fare zones around the city center rather than setting a distinct fare for each origin-destination pair. Bus systems typically have a single fare for most local routes, with premium fares charged on longer-distance or express routes. Bus fare structures generally need to be kept simple since fares are collected by a driver who has many other responsibilities and since delays with fare payment affect on-time performance. However, there are ways of making a distance-based structure relatively straightforward. On Martha's Vineyard, for example, the transit authority charges $1 per town traveled in or through. (There are six towns on the island.) A similar approach could be used with the five towns of the East End, perhaps with some adjustments for short trips that happen to cross local boundaries. This would create a base fare of $1 and a maximum one-way fare of $4, or $5 for the rare trip that somehow passes through all of the towns.

The precise nature of the demand-response bus components has not yet been determined, though the TAG had discussed the possibility of using a "station shuttle" approach in some areas and "flex

routes" in others. Many, but not all, transit agencies that provide demand-response service charge more for this service than for conventional fixed-route service, in recognition of the inherently higher costs per passenger. For example, the Cape Cod flex, with a base fare of $2, charges $2 extra for a route deviation request; this is reduced to $1 extra for seniors and persons with disabilities.

It is less common for transit agencies to impose separate peak and off-peak fares; however, each of the three major commuter railroads in the New York region (LIRR, Metro-North, and New Jersey Transit) does have such a distinction, as does the Metrorail subway system in Washington, D.C. Peak-hour surcharges help to balance passenger loads across the day and ease overcrowding, but they also discourage transit use at precisely the times when roadway traffic is most congested.

Transit agencies must also determine whether passengers should pay a fare every time they board a vehicle, or whether there will be free or discounted transfers for passengers making multi-segment trips. Free transfers between lines are the norm for urban rail systems, and most bus systems offer discounted or free transfers between routes. The advent of more advanced fare media has allowed many agencies, such as those in Boston and New York, to move toward free or discounted rail-bus and bus-bus transfers (though these can also be implemented using low-tech paper transfer slips). In general, when free or discounted transfers are offered, they are valid only for a reasonable time period and are not valid for the return half of a round-trip.

The coordination of transfers across services provided by different transit agencies is an evolving area. In many cases (e.g., LIRR and the New York City subway), connecting passengers must simply pay twice, but there are a growing number of cross-honor agreements in place. A few multi-agency regions, such as Puget Sound, have even gone so far as to develop universal farecards and consolidated regional tariff schedules, so that travelers can move from one agency's services to another without needing separate tickets or familiarizing themselves with the intricacies of each agency's fare structure.

The TAG had earlier indicated a preference for a fare in the range of $2.50 that would be valid for all transfers on a one-way trip, in recognition of the fact that a rail-bus network can require multiple transfers. Since the East End covers a large area, in this case, transfers might need to be valid for a full 2 or even 3 hours from the initial purchase or boarding, to allow for some longer trips. A flat fare of this type might have marketing advantages in creating a strong sense of a coherent East End regional transportation system. Despite the complexities involved in administering distance- or zone-based fares, however, some consideration should be given to that approach, both for the revenue potential associated with longer trips and to address possible equity concerns. Many transit riders will make comparisons to the current fare system and, rightly or wrongly, perceive inequities with the proposed flat fare. For example, under a flat fare system, a bus trip from East Hampton to Sag Harbor would rise from $1.50 to $2.50, while a rail-to-bus trip from Speonk to Sag Harbor would drop from a combined $6.50 to $2.50.

Fare Offerings and Discounts

One way of addressing these sorts of concerns, as well as promoting other agency goals, is to offer customers discounted passes for multiple rides. Although SCT is an exception, most transit agencies (nationally, about 75% of bus systems and all commuter rail systems) offer some form of discounted pass that is valid for multiple one-way rides or for unlimited travel on a daily, weekly, or monthly basis. Passengers benefit from the pricing discount and the convenience of being able to travel without exact change or tickets, and the agency benefits from having a more stable, pre-paid revenue stream and the potential for ridership gains when customers are induced to take additional "free" trips. Pre-paid passes can also speed boarding and are an important component of transit marketing programs with large employers and universities.

Price points for monthly passes are typically pegged at the cost of 30 to 40 one-way trips.[5] For the East End's Dual Concept system, assuming a $2.50 base fare, this would translate into a monthly pass cost of $75 to $100. For multi-tickets, the most typical discount is in the range of 10 to 19 percent, which would equate to a 10-ride pass for around $22.

Shorter-term passes aimed at visitors and tourists have also become common. Boston's MBTA, for instance, sells a one-day pass (good for unlimited travel on the subway, buses, and inner harbor ferries) for $9 and a 7-day pass for $15. A similar option, or perhaps even a "Friday to Monday" pass, might be worth exploring for the East End given the prevalence of weekend visitors.

Aside from discounted passes, most transit agencies also offer reduced fares for children, students, senior citizens, persons with disabilities, and/or other groups. These discounts are usually conceived of as a policy tool to ensure adequate mobility for transportation-disadvantaged residents. The pros and cons of these discounts should be considered for the East End.

Fare Collection and Enforcement

Once the fare level and structure is established, there is a wide spectrum of choices regarding the fare medium used to process payments and the procedures to ensure that passengers have paid. Although every fare collection system is a little different, most transit agencies use some variation on the four main approaches:

Pay on boarding: Passengers deposit cash or tokens, swipe a pass, present a pass or transfer, or otherwise process their fare medium at a farebox near the vehicle's entry door as they board. This is the most common approach on buses and is sometimes also used for light rail (streetcar) systems

[5] Transportation Research Board, Transit Cooperative Research Program Report 10, *Fare Policies, Structures, and Technologies*, 1996, pp. 40-42.

when volumes are manageable.

Barrier: Passengers deposit cash or tokens, swipe a pass, or otherwise process their fare medium at a turnstile or fare-gate near the entrance to a station. When the turnstile opens, the passenger gains access to the fare-paid boarding area. In cases where distance-based fares are charged, the fare medium will be presented again on exit so that the appropriate fare can be charged. Barrier systems are most common on urban rail (subway/elevated and light rail) as well as on some Bus Rapid Transit systems with enclosed stations. Barriers are not used on commuter rail in the U.S. because the layout of most stations precludes the use of turnstiles.

Conductor: This approach is most commonly found in large commuter rail systems. Passengers board the vehicle and then have their fare medium checked by a conductor at some point during the trip. Passengers without a valid ticket or pass must purchase one from the conductor. There is often a surcharge or convenience fee for onboard purchases to encourage passengers to pre-pay when possible, since this is more cost-effective for the agency.

Proof of Payment (PoP): Sometimes called the "honor system," this approach does not use any barriers or regular conductor checks, but simply requires that all passengers have a valid fare instrument in their possession at all times while onboard. Compliance is enforced through periodic random checks by inspectors. To discourage passengers from taking advantage of the possibility of riding for free, heavy penalty fares (or even civil and criminal sanctions) are imposed on those found on inspection without a valid ticket.

Each of these approaches has its own set of advantages and disadvantages, which also vary according to the type of transit service, station layouts, and customer and travel patterns. For example, using conductors is labor-intensive and may be impractical when there are heavy passenger volumes and short distances between stations, whereas a PoP system requires many more ticket vending machines to ensure that riders are always able buy a ticket before boarding. Barrier and pay on boarding approaches are not used on commuter railroads, while conductors are seldom (if ever) used on buses in the U.S.

Fare Media

The specific fare instrument or medium to be used will also strongly influence the choice of overall fare collection approach. Numerous fare media have been developed over time, with many older transit systems evolving from traditional coin and token systems to electronic payment. Compared to conventional tickets and tokens, electronic fare collection (EFC) can offer numerous advantages, including lower cash management and auditing costs; reduced fare evasion; greater customer convenience; faster boarding; easier coordination of transfers; and opportunities for more accurate

data collection on passenger volumes and travel patterns. These benefits must be weighed against the substantial costs (and technological challenges) associated with an EFC deployment.

Paper tickets and passes are still not uncommon in American commuter rail systems, since they are relatively simple and work well with the usual customer base, which consists largely of monthly pass-holders. Fare collection and verification can occur relatively quickly as long as the onboard staffing is adequate for the passenger volumes. As with coins and tokens, however, paper tickets also involve significant cash management and auditing costs since they are essentially bearer instruments with a cash value.

Many urban transit systems have long since moved to magnetic stripe cards, which are relatively inexpensive technologies that provide some additional security and data collection options, and are compatible with distance-based and variable fares. These cards do, however, wear out after repeated contact with electronic readers, and some types can also become demagnetized in wallets. More recently, in the past five to ten years, many agencies have adopted contactless smart cards, sometimes as part of a regional consortium. While more expensive to produce, these cards are longer-lived, and generally offer faster transaction times and greater customer convenience. By allowing customers to put large sums on the cards, they can also help to manage agency cash flow and reduce the amount of currency in the system that needs to be tracked. Smartcard approaches allow some marketing innovations, such as:

- "Guaranteed last ride," whereby the card can be used to purchase one last trip, even if it results in a small negative balance;
- "Guaranteed lowest fare" programs, which allow customers to pay trip-by-trip, but with their total fares for the day capped at the price of a all-day pass, so that riders get the benefit of the pass price without having to commit to it in advance;
- Balance protection, which protects customers against a loss of value if their card is lost or stolen.

Just in the last few years, some transit agencies have considered eliminating all of their dedicated fare media in favor of simply accepting debit/credit cards directly at the turnstile. This approach has had some successful trials and pilot programs, such as on the Lexington Avenue subway in New York. It simplifies payment for most passengers, by letting them pay for transit with the same card that they use for other purchases. The transit agency benefits from being able to essentially outsource much of its fare collection and payment processing functions to the banks, thus focusing on its core mission of providing transportation. This bankcard approach introduces new challenges about equipment needs, transaction fees, data security, and branding. In addition, there will always be cash-paying customers, particularly among the low-income population and other "un-banked" customers. One approach that has been tried for customers without bankcards is a pre-paid card that can function as a transit farecard and pre-paid debit card.

Sales Outlets

The range of outlets through which fares would be sold would depend on the type of fare collection system in use, transit staffing levels, and the level of ridership (since this affects operator workload). The most conventional approach would combine onboard fareboxes for bus services with onboard conductor sales for rail services, plus ticket vending machines (TVMs) at major stations selling all ticket and pass types. If desired, TVMs could be supplemented by traditional ticket windows at stations with sufficient space. If a proof-of-payment system is used, a near-ubiquitous complement of TVMs would likely be necessary to ensure that riders have an opportunity to pay their fare before boarding. Most large transit agencies now sell ticket and pass products via the Internet and through agreements with large employers and universities. These outlets should be considered for the East End system since they generally provide greater customer convenience at lower administrative cost. Some agencies also have successful partnerships with third-party vendors, allowing tickets and passes to be sold at supermarkets, convenience stores, and other retail outlets. Another innovative approach would be to allow customers to print their own barcoded tickets via the Internet, as the Rail Runner Express commuter rail service in Albuquerque does.

5. Supporting Strategies

This section provides an overview of the policies and strategies that can be implemented, often at the Town or Village level, to support public transit ridership and enhance the value of the service. Some of these policies may also have relevance for any new regional transportation council or transportation authority that is established.

Land Use and System Access

One of the inherent properties of public transportation is that it requires a certain level of population and employment density in order to generate the shared origin-destination patterns that make it cost-effective. Potential land-use changes in the East End were analyzed extensively in the SEEDS process, and some land-use changes have already been made. While this report is not intended to revisit the findings from SEEDS, the importance of land-use changes cannot be understated, particularly with regard to Transit-Oriented Development, i.e., concentrating employment and new housing growth in areas served by public transit. This is especially important for the rail components, since rail stations are fixed focal points.

Access to stations is also a key consideration, since almost all transit trips (aside from those on demand-response services) also involve a walk to or from the stops. Pedestrian access has been identified as an important determinant of transit ridership[6] and is particularly important in the East End context, where some areas lack sidewalks and where high-volume roadways can produce an environment that is not pedestrian-friendly. Improvements to pedestrian access (sidewalks or paths) are therefore an important supporting strategy, with a particular focus on the areas within one-half mile (roughly 10-minutes' walk) of rail stations, along bus corridors, and where there are opportunities to connect walk/bike paths and pedestrian corridors.

The East End's relatively dispersed population means that additional access improvements will be needed beyond pedestrian access, and indeed the Dual Concept transit model already includes substantial service on connecting shuttle bus routes and demand-response vehicles. Even so, there will still be residents who are either not served by those routes or who would prefer other options for accessing the transit system. To accommodate this demand, areas around stops and stations should be assessed for their potential to support bike parking, additional bike path connectivity, and park-and-ride lots.

The possibility of bringing car-sharing services to the East End could also be explored. Car-sharing is

[6] Ryan, Sherry, and Lawrence F. Frank. "Pedestrian Environments and Transit Ridership," *Journal of Public Transportation*, Vol. 12, No. 1 (2009).

a concept whereby businesses (for-profit or non-profit) sell memberships that provide access to a fleet of vehicles on a pay-per-hour basis. Typically, reservations are made via the Internet and access to the vehicles can be provided instantly through an electronic cardkey. The concept has proven popular in major cities because it gives urban residents access to automobiles on those few occasions when they are truly needed (e.g., major grocery store or hardware purchases, airport pick-ups) while avoiding the high costs of car ownership and the inconvenience of conventional car rentals. Vehicles are typically parked in highly accessible locations near transit stations. While there are currently no carsharing services on the East End, companies such as Zipcar have already expanded into semi-rural locations such as Hanover, N.H., and university towns in coastal Maine. It is conceivable that the East End, with its many second-homeowners and weekend visitors, could be a viable market for carsharing, particularly once the enhanced transit network is in operation and vehicles can be located at the rail stations. (For example, a family visiting Southampton could use bicycles and the rail-bus network for most of their basic travel to and from the village center and beaches, but then use a carsharing vehicle for occasional half-day excursions to farmstands on the North Fork.) The primary supporting strategy that can be implemented at the Town and Village level is the provision of dedicated parking for the carsharing vehicles at the curbside and/or in municipal lots. Some municipalities have also eliminated portions of their own light-duty vehicle fleet in favor of carsharing memberships; this can reduce the town's operational costs while also providing a critical mass of demand for the shared vehicles.

In addition to improving physical access to transit routes, public outreach and communication are also important means of improving the public's access to the transit system. At the Town and Village level, one proven strategy is to produce integrated maps of bicycle, pedestrian, and transit links and "how to ride" guides, which can help demystify the transportation system for residents and visitors alike. A related concept, which would need to be pursued at the regional level, is a "car-free guide to the East End," which would show visitors the ways in which they can travel to, from, and within the region without needing their own vehicle.[7] Though it is difficult to measure the ultimate effectiveness of these types of programs, they do appear to help shift attitudes over time in favor of non-automotive modes. Given their very low costs when compared to transit system expansion, they can also be very cost-effective in increasing ridership.

Parking Management

Enhancements to the region's public transit system are likely to create additional demand for parking near major transit stations. This can often lead to parking shortages in the adjoining neighborhoods and conflicts between commuters and local residents. In these cases, Towns and Villages may need to update their on-street parking regulations to reflect the new usage patterns and to ensure adequate turnover of vehicles. One common approach is a resident sticker program, which reserves certain

[7] See, e.g., Nantucket's "Wheels, Heels, and Pedals" campaign and the Cape Cod "Smart Guide." http://www.wheelsheelsandpedals.com and http://www.smartguide.org .

spaces for neighborhood residents and/or exempts their vehicles from posted time limits and meter fees. (In New York State, some aspects of these programs may require legislative approval.)

More broadly, active management of parking by Towns and Villages can be a key supporting strategy for encouraging transit ridership and transit-oriented development. One management tool is the development of shared parking arrangements, whereby a single parking facility can serve multiple businesses, instead of each requiring its own lot. One classic example would be shared parking among a bank, a movie theatre, and a church, each of which sees its peak parking demand at different times over the course of the week. Park-and-ride spaces that primarily serve transit commuters during the work-week can often be shared with parking for activities that peak on evenings and weekends.

Setting appropriate parking fees can also be an important management tool. As it stands now, most hamlet centers have free on-street and municipal parking, which encourages automobile trips and contributes to traffic congestion. Imposing modest parking fees – with the potential for variation by season, day, time, and location – would help reduce vehicle trips, demand for parking, and the congestion that is caused by drivers circling the block looking for parking during busy times. The meter fees would also create a major new source of revenue that could fund transit operations or other transportation improvements.

Municipalities are often leery of imposing parking fees because of the costs of implementation, streetscape aesthetics, and a concern about losing shoppers and diners to other areas, particularly "big box" stores and nearby towns with free parking. Motorists have also found it inconvenient to keep a constant supply of coins with which to feed the meter. However, modern multi-space meters can accept credit and debit cards and take up relatively little sidewalk space. Many models are solar-powered, and most can readily adjust their price levels by time of day. Areas such as downtown Pasadena, California, that have introduced paid parking have found it to contribute to, rather than detract from, the vibrancy and economic vitality of the area, particularly when the parking revenues are used for local improvements.

Replacing arbitrary parking time limits (e.g. one-hour parking) in favor of meter fees as the means of generating parking turnover is particularly beneficial for merchants and restaurant owners, since it allows customers to continue shopping or stay for dessert without the looming risk of a parking ticket. Paid parking is also much easier to enforce, as there is no need to chalk tires or to visit each vehicle twice. By increasing turnover of spaces, meter fees essentially allow the same number of spaces to serve more people, helping to remove downtown shoppers' anxieties about not being able to find a place to park.

Other Transportation Policies

Transportation Demand Management (TDM) is an umbrella term for a range of approaches, including both policy measures and voluntary programs, that can be employed to reduce private automobile travel and the environmental impacts of transportation. Parking management, as discussed above, is an important TDM tool. Many other strategies have been developed, often in partnership with large employers, such as:

- Subsidized transit pass programs, whereby employees receive a monthly transit pass at a substantial discount, or at least with pre-tax dollars
- Computerized carpool matching programs
- Parking cash-out, which allows employees to elect a small cash bonus in lieu of using free workplace parking
- Promotion of tele-work (tele-commuting), which helps to reduce overall peak-period travel
- Guaranteed ride home programs, which provide a taxi or rental car for transit commuters who need to return home in an emergency, addressing one of the key psychological barriers to transit use.

Each of these programs enables commuters to make smarter transportation choices, and most also directly enhance vitality of the public transit system. A number of communities around the country have made some or all of these measures a legal requirement for major new developments, while others have taken a more voluntary approach. Others, such as Cambridge, Massachusetts, have required new developments to file and implement a plan for achieving mode-split targets (i.e., the share of employees that arrive by single-occupant vehicle) without mandating the precise mix of strategies to be used in achieving those targets. In anticipation of expanded public transportation on the East End, the region's Towns and Villages can evaluate their current TDM programs and identify areas for expansion. Municipalities also have the opportunity to lead by example in establishing TDM programs for their own employees. This is particularly important for the East End, where Towns and school systems are among the largest employers.

Emergency Use

Expanded public transportation, with its ability to move large numbers of people relatively quickly, can play an important role in emergency management and response. Indeed, one of the most cited "lessons learned" from the experience of New Orleans after Hurricane Katrina in 2005 was that residents who cannot drive or who do not own private vehicles cannot readily evacuate the area without access to some form of transit. (Although vehicle ownership is generally widespread on the East End, nearly 6 percent of households have no vehicle.) Even where transit service is available, emergency plans need to be developed to ensure that vehicles, fuel, and maintenance facilities are available during emergencies. Employees also need to receive adequate training on the emergency

plan and to participate in regular drills on emergency operations. Integrating transit into local emergency plans also requires a great deal of inter-agency and inter-jurisdictional cooperation to ensure a coherent response at the regional level. This is an emerging area of research and practice, with relatively little in the emergency management literature on effective practices for using transit.[8]

Due to Long Island's geography, population density, and the limitations of the east-west road network, public officials have acknowledged that a full-scale evacuation of the island would generally be considered infeasible.[9] Instead, a network of emergency shelters has been established to allow coastal residents to move inland and to higher ground in the event of a hurricane or tidal surge, and/or to house evacuees in other emergency situations. On the East End, most of these shelters are in public schools and other buildings in village and hamlet centers that are served by both the current and proposed transit systems. Through coordination with the Suffolk County Office of Emergency Management, the expanded transit network could be more explicitly incorporated into overall emergency planning, perhaps using a combination of regularly scheduled service, demand-response vehicles, and special services to transport residents to and from emergency shelters.

[8] Scanlon, J. "Transportation in Emergencies: An Often Neglected Story," *Disaster Prevention and Management*, Vol. 12, No. 5 (2003). Cited in Schwartz, M.A., and T.A. Litman, "Evacuation Station: The Use of Public Transportation in Emergency Management Planning," *ITE Journal on the Web*, January 2008.

[9] See, for example, P. von Zielbauer, "A Fast Long Island Evacuation? Impossible," *New York Times*, September 24, 2005.

6. Environmental Issues

This section identifies some of the major environmental issues associated with the Dual Concept transit proposal. This is not part of the formal process under the National Environmental Policy Act (NEPA) or state environmental law, but merely an introduction to some of the salient issues that will need to be analyzed as the project moves forward.

Grade Crossings and Train Whistles

With rail service every 30 to 60 minutes, the rail-bus network would greatly increase the number of trains operating on the East End and passing through the region's highway-rail grade crossings. Train traffic on the South Fork would increase from as few as 4 or 5 trains per day now to nearly 50 trains per day. This raises issues related to safety, traffic delays during the time that gates are down, and quality-of-life impacts from train noise and whistles.

The use of smaller, self-propelled railcars can mitigate these issues to some extent, as these vehicles are quieter and pass through grade crossings more quickly than conventional locomotive-hauled trainsets. However, federal rail safety rules would still require train whistles to be sounded, at a volume between 96 and 110 decibels, 15-20 seconds in advance of all public grade crossings. Using methodologies such as the FRA's train horn noise model, the impacts of train engine and whistle noise on nearby homes and businesses could be assessed. FRA rules do allow for the establishment of local "quiet zones" in locations where additional safety measures, such as four-quadrant gates or roadway medians, can be installed to provide an equivalent safety level without whistles. Establishing quiet zones on the East End would require consultation with local and state governments and the development of safety plans for the areas in question that meet FRA guidelines. Studies could also identify locations where the elimination of grade crossings would be feasible and cost-effective in reducing congestion and improving safety.

Fuel Consumption and Emissions

Improved public transportation can draw travelers away from more energy-intensive modes, such as single-occupant vehicles, thereby reducing overall fuel consumption and emissions. However, travelers' mode choice decisions are complex, and involve not only objective factors such as travel time, but also subjective factors such as convenience and even the image of the service. As the experience of the past few years has shown, changes in fuel prices can also produce significant changes in traveler behavior. Environmental review of the proposed Dual Concept transit system will likely need to include detailed modeling of the energy and emissions implications of the service with a range of assumptions about future fuel prices, vehicle fuel economy, and other factors. Simply as an illustrative calculation, based on the reported fuel economy (one mile per gallon) of the Colorado

Railcar, the South Fork rail component, with service on the line every 30-60 minutes, will require approximately 750,000 gallons of diesel per year. This indicates that the Dual Concept transit system will need to achieve significant ridership and/or congestion mitigation to produce a net reduction in emissions.

Vehicle Maintenance and Storage Facilities

Although some bus maintenance facilities already exist on the East End, and third-party maintenance is available locally and up-island, the proposed expansion in bus service and the associated vehicle requirements are significant enough that additional storage and maintenance facilities will likely be needed. Similarly, the current LIRR maintenance facility in Hillside, Queens, does not appear to be a viable option for rail vehicle maintenance due to its distance from the East End and the differences in equipment. Environmental review will need to consider options for locating such facilities and the impacts that additional paved (impermeable) surface and on-site fuel storage may pose.

7. Summary

This project has focused on the basic technical feasibility and cost-effectiveness of expanded public transportation in the East End region, and this report has elaborated on the transit service planning discussion from earlier memos to include consideration of institutional issues, environmental concerns, and related policy matters. As those discussions indicate, the overall path to implementation will involve four major "tracks," which can initially proceed in parallel but will ultimately need to become part of a coordinated regional planning process.

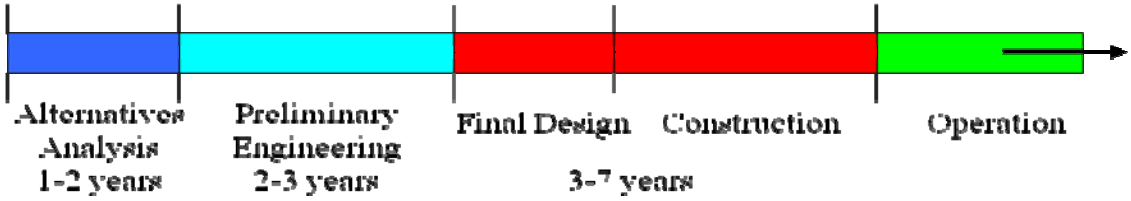
- Institutional and financial track: In order to move beyond the analytical stage, the East End region will need to come to a political consensus on the entity (or entities) that will build, operate, maintain, and manage the Dual Concept transit system and on the financing mechanisms that will be used for its capital and operating costs. This report has identified a spectrum of options and the associated advantages and disadvantages of each, but other options could emerge from the political process. As noted, certain options, such as the creation of a new transit authority, will require state legislation and related actions such as designation as a federal-aid funding recipient.

- Environmental track: NEPA review is a requirement for most major transportation projects receiving federal funding, and additional requirements may be imposed by state laws such as SEQRA. The NEPA process ordinarily begins with scoping, which is the identification of the specific areas of environmental impact (e.g., soil, wildlife, air quality, environmental justice) that will be included or excluded from analysis. Based on the purpose and need of the project, alternatives are then identified, including the proposed action, one or more alternative approaches, and a "no action" baseline. Environmental analysis is then conducted in each subject area for the alternatives and public comments are solicited and reviewed to produce a draft Environmental Assessment (EA) document. If the EA indicates the potential for serious adverse consequences, a more detailed Environmental Impact Statement (EIS) may be required. Once the EA or EIS has been finalized, the executive agency overseeing the project will issue a Record of Decision that selects an alternative to proceed.

- Technical track: More sophisticated travel demand modeling, likely using a regional four-step model, will be needed to estimate ridership and revenue with more precision and to identify broader effects on regional traffic and commuting patterns. Preliminary engineering work is also required to assess the state of existing track, stations, bridges, overpasses, and grade crossings; develop signaling and communication requirements; identify maintenance needs and potential facility locations; and assess vehicle options. Based on the outcomes from this work, the project could move forward with service planning, facility design and cost estimation, a procurement process, and ultimately with construction and the start of transit operations.

- Public outreach track: Although this study has included an outreach component, most members of the general public have limited information about the transportation improvements that are planned. Extensive outreach will be needed to explain the purpose and need of the Dual Concept system, the institutional structures and financial mechanisms that are envisioned to support it, and the timeline for implementation. Existing transit riders will need information about how route and service changes (and any changes to fares or the fare collection system) will affect them, and non-riders will benefit from information about the new transit options that will be available. Residents of abutting properties and other areas potentially affected by construction activities should also receive information tailored to their concerns. As noted in Section 5, Towns and Villages also need an opportunity to study and implement policy changes, such as updated parking regulations or TDM programs, that respond to the changes in the regional transit system.

Putting these four tracks together into a single timeline toward implementation will require regional cooperation and ultimately some form of consensus, particularly on the institutional and financial side. At this stage, there are still many unknowns that could affect the timeline. As a point of reference, however, the diagram below (adapted from a Federal Transit Administration publication) shows the typical phases and timeline for a medium- to large-scale transit project receiving FTA funds. The time ranges within each stage are rough estimates and will vary depending on the complexity of the project.



Source: FTA Office of Planning

Alternatives Analysis

The Alternatives Analysis is used to evaluate the options for improved transit service within a particular corridor for a community or region. Typically, during the alternatives analysis the following steps are begun:

- Identification of options, including a no-build alternative
- Estimation of benefits, costs and impacts of the various options
- Public outreach and involvement to educate the public about the options
- Preliminary determination of a preferred alternative

For projects that will use FTA funds, this phase is typically complete when local and regional decision makers select a locally preferred alternative, and the proposed project is adopted by the metropolitan planning organization (MPO) into the region's long-range transportation plan. As such, the current

East End transportation study has provided much of the raw material for the alternatives analysis but does not represent the end of even this stage.

Preliminary Engineering

During the preliminary engineering (PE) phase, the project sponsor considers design options to refine the locally preferred alternative. Steps include:

- Design work, including identification of right-of-way needs and systems requirements
- Development of possible operational plans and determination of capital needs to meet those plans
- Environmental review including completing, if necessary, the National Environmental Policy Act (NEPA) process
- Refinement of project costs, benefits and impacts for the alternative
- Identification of local, state, and federal funds for the project

At the end of Preliminary Engineering phase, a project sponsor has identified management and operations plans, demonstrated its technical capabilities to develop the project, and committed local funding to the project.

Final Design

Final design is the last phase of project development. During this phase the project sponsor will have completed all work necessary before moving to construction. This will include:

- Completion of final engineering and design plans
- Preparation of construction documents
- Development of bid documents with specification of materials and cost

Construction

The Construction phase begins with the awarding of a contract for work to build the project. During construction, the project sponsor must oversee the management plan and ensure that construction work is completed according to the design and engineering specifications.

Operation

Operation begins when construction is completed and the service is open to the traveling public. The sponsoring agency should have estimated annual operating costs and have identified funding sources to supplement farebox revenue. The agency should also have developed a life-cycle cost estimate for maintenance and rehabilitation of the system to ensure proper maintenance of the system over the life of the project.

Clearly, it will take some time for the East End region to work its way down this multi-year development path. Yet many portions of the Dual Concept system can also be readily phased-in as soon as political consensus is achieved and funding is available. On the North Fork, the most logical step would be to begin providing late-evening and Sunday service, since this can largely be done using existing vehicles. As more buses are acquired, additional frequency can be provided and the demand-response and/or Ronkonkoma express services could be added, based on the region's priorities.

The rail-bus network on the South Fork is more difficult to phase-in incrementally because its design relies on well-timed multimodal connections. However, as environmental and engineering work proceed, some service improvements could be made. For examples, buses acquired for the station shuttles could be used on an interim basis to improve frequency on existing routes such as the S-92. There are also several areas of project development that, provided certain conditions are met, could proceed without NEPA review requirements.[10] This includes the construction of connecting bicycle and pedestrian paths; acquisition of existing rail right-of-way; implementation of ITS, such as transit signal priority; station renovations to allow handicapped access; and track and railbed improvements within an existing right-of-way.

[10] See 23 CFR 771.117.

Technical Advisory Group

The Volpe Study was aided by a Technical Advisory Group consisting of the members of the East End Transportation Council (EETC) and of Five Town Rural Transit, Inc. (5TRT). The following members regularly attended the Technical Advisory Group meetings:

East Hampton Town:
JoAnne Pahwul, Assistant Planning Director, EETC Co-Chair
Kathy Cunningham Faraone, 5TRT President

Riverhead Town:
Councilwoman Barbara Blass
Karin Gluth, Town Planner, EETC representative
Vince Taldone, 5TRT representative
Jim Elwood, 5TRT representative

Shelter Island Town:
Patricia Shillingburg, EETC & 5TRT representative

Southampton Town:
Tom Neely, Transportation Director, EETC Chair

Southold Town:
Councilman Tom Wickham
Neboysha Brashich, EETC representative
John Rooney, 5TRT representative
Margaret Brown, 5TRT representative

Southampton Village:
Jennifer Mesiano, EETC representative

New York State Department of Transportation:
Tatyana Golikova, Deputy Director of Program Development and Management, EETC representative

Long Island Rail Road:
Scott Howell, Planner, EETC representative

Suffolk County Transit
John Murray and Chris Chatterton, Planners, EETC representative

New York Metropolitan Transportation Council
Nancy O'Connell, Nassau-Suffolk Transportation Coordinating Committee Staff Director, EETC representative

Local Project Coordinator
Glynis Berry

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Appendix A

Existing Conditions - Interim Report for the "Creation of a Coordinated Rail & Bus Network on Eastern Long Island"

This document has been prepared by the Volpe National Transportation Systems Center on behalf of the Towns of East Hampton, Riverhead, Shelter Island, Southampton, and Southold. Funding was provided through a New York State Department of State Shared Municipal Services Incentive Grant.

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1. Introduction

The East End of Long Island, defined here as the Towns of East Hampton, Riverhead, Shelter Island, Southampton, and Southold and located at the extreme eastern end of Long Island, has longstanding traffic congestion and internal circulation problems. The East End's location and geography limit its roadway network. As a popular location for tourists and second home owners, the East End experiences significant seasonal traffic congestion. At the same time, the emphasis on tourism in the local economy and the desire to maintain a rural quality heightens the importance of scenic views and preservation of open space and makes roadway capacity increases difficult to implement. A number of public and private transportation providers serve the area, but uncoordinated schedules and service limitations make internal circulation difficult for those who do not or choose not to drive. This is of concern to local governments and residents, especially as the population ages.

The Towns of East Hampton, Riverhead, Shelter Island, Southampton, and Southold jointly applied for a New York State Department of State Shared Municipal Services Incentive Grant, with the Town of Southampton as the lead municipality. The grant requested funding for "planning and assessment activities associated with the creation of a coordinated rail-bus network on Eastern Long Island". Upon award of the grant, the five Towns then contracted with the U.S. Department of Transportation Volpe National Transportation Systems Center (Volpe Center) for assistance in analyzing the feasibility of providing more and better coordinated public transportation services using the rail and bus infrastructure now in place, and, alternately, evaluating different transportation concepts for the region.

Several previous studies have examined transportation issues in the region. As agreed in the Town-Volpe Statement of Work, a review of existing research, reports and plans is to form the basis of the initial analysis of conditions. Although the primary focus of this project is not merely to identify issues, an assessment of existing conditions is a necessary first step in developing, evaluating, and refining alternatives for improving alternative transportation in the region. To prepare this report, Volpe Center staff reviewed numerous previous local and regional studies, conducted a series of site visits, and interviewed staff from the five towns, transportation and planning agencies, and stakeholder groups.

This report is an interim product, which summarizes existing conditions; findings will be used to appropriately scale and evaluate transportation alternatives. Future reports will examine the rail-bus concept in detail and provide alternative concept evaluation. After additional input from regional stakeholders, the financial and management aspects of the selected concept will be detailed in a "road map" to assist the region in moving forward on public transit initiatives.

2. Demographics

2.1. Resident Demographics

This section provides a demographic overview of the East End, defined here as the five easternmost towns of Suffolk County: East Hampton, Riverhead, Southampton, Southold, and Shelter Island. It is designed to ensure that analysis of the East End's transportation issues and evaluation of options proceeds from an understanding of the area's population and the underlying demographic factors that influence travel demand. This section makes use of data from the U.S. Census, supplemented by data from the local jurisdictions. Census data is widely used in transportation planning as it provides detailed information on demographics and travel behavior and allows for "apples-to-apples" comparisons both locally and nationwide.

2.1.1. Population Overview

According to the 2000 Census, the East End has just over 120,000 residents. These figures reflect the population as of April 1 of that year, and thus may be thought of as reflecting the year-round rather than seasonal population. The East End has experienced high population growth in the past thirty years, and projections indicate that the growth will continue. The growth consists of both second home owners and primary residents. Some observers have also noted a trend toward the transition of seasonal residents to full-time residents. During the period between the 1990 and 2000 Census, the year-round population of the East End grew by about 18 percent. More recent Census figures are not available at the town level, but at the county level, the population of Suffolk County grew by 3.5 percent during the period from 2000 to 2006.

Population density and a spatial concentration of activities are typically regarded as essential for the viability of a transit system, particularly one based on fixed routes. The overall population density runs from 184 persons per square mile on Shelter Island to 411 in Riverhead, with an overall average of 361 persons per square mile for the five-town East End area. This figure reflects the fact that much of the East End's acreage is farmland, protected open space, or wetlands. Residential densities are higher within the settled areas (land use is discussed in more detail in Section 4).

Table 1: Total Population and Population Density (persons per square mile)

	East Hampton	Riverhead	Shelter Island	Southampton	Southold
Total Population	19,719	27,680	2,228	54,712	20,599
Population Density (persons per square mile)	265	411	184	394	384
Source: U.S. Census 2000					

Figure 1: Eastern Long Island Population Density

As a point of comparison, the table below shows density statistics that are illustrative of different types of land-use patterns:

- Suffolk County as a whole, which includes the East End and the more thickly settled western towns
- Nassau County, a suburban area with generally denser development patterns
- Manhattan, a major urban center where over 80 percent of commuting trips are made on public transportation or on foot
- Martha's Vineyard and Barnstable County, Massachusetts, which like the East End have large seasonal populations and village centers separated by extensive areas of protected open space. Martha's Vineyard has a well-used, year-round bus transportation system. Barnstable County is served by several local transit routes, including the Flex, an innovative fixed-route line which may deviate by up to .75 miles.

Table 2: Population density comparisons (persons per square mile)

	East End: 5-Town Area	Suffolk County	Nassau County	Manhattan	Martha's Vineyard	Barnstable County
Total Population	123,938	1,419,369	1,334,544	1,537,195	14,987	222,230
Population Density (persons per square mile)	361	1,556	4,655	66,940	144	561.9
Source: U.S. Census 2000						

Age

The five towns of the East End have an older population than Suffolk County as a whole, with relatively smaller school-aged populations and relatively larger numbers of senior citizens. However, both the *Town of East Hampton Comprehensive Plan* and the *Sustainable East End Development Strategies (SEEDS) study* point to increases in the number of children and school enrollments, as well as moderating growth of the over-65 population. The latter trend is expected to reverse in a few years as large numbers of baby-boomers retire. Age distribution is an important variable for transportation planning because of the generally greater reliance on public transit among senior citizens and youth.

Table 3: Age Distribution (by percent of total population)

Age	East Hampton	Riverhead	Shelter Island	Southampton	Southold	Suffolk County
Under 18	14	23	18	21	22	26.1
18 to 24	4.5	6.1	4	7.7	5.2	7.6
25 to 44	23	28	20	29	24	31.2
45 to 65	31.3	24.2	29.1	26	26.5	23.3
65 and Over	27	19	29	17	23	11.8
Median Age	41.6	40.6	49.2	40.4	44.7	36.5
Source: U.S. Census 2000						

Income

Census data indicate that the median household income in 2000 in the five East End towns ranged from $46,195 to $53,887. This is higher than the national average ($41,944), but lower than that of Suffolk County ($65,288).[1] The median marks the point at which half the households earn more per year and half earn less. Income differences between the East End and the rest of the county are due to a number of factors, including the greater number of retirees in the East End. A demographic report by the Long Island Regional Planning Board also discusses a rising divide between the rich and poor on Long Island in recent years[2].

[1] Reported in 1999 dollars.
[2] Long Island Regional Planning Board. Long Island Demographic Update: 2000-2006 Working Paper. September 2007.

Table 4: Household Income Distribution (by percent of total households)

Household Income	East Hampton	Riverhead	Shelter Island	Southampton	Southold	Suffolk County
Less than $10,000	6.7	6.6	5.7	6.5	5.8	4.5
$10,000 to $14,999	5.5	6.4	4.6	4.8	7.7	3.5
$15,000 to $24,999	10.7	13.2	11	9.1	11.2	7.3
$25,000 to $34,999	10.2	12.3	8.7	10.6	11.8	8.1
$35,000 to $49,999	15.1	15	17.3	14.4	13.7	12.9
$50,000 to $74,999	16.8	18.1	17.5	19.5	18.3	21.7
$75,000 to $99,000	13.5	12.8	17.1	12.9	13.4	16.5
$100,000 to $149,000	12	10.1	8.8	12.7	12.1	16.2
$150,000 or more	9.8	5.4	9.3	9.4	6.2	9.4
Source: U.S. Census 2000						

Race, Ethnicity, and Language

These variables influence transportation needs to the extent that they are correlated with housing and employment patterns. According to the 2000 Census, most of the East End's population (85 to 90 percent) self-identifies as non-Hispanic white and similar proportions speak only English at home. However, just over 8 percent identify as Hispanic or Latino, and nearly 8 percent speak Spanish as the primary language at home. The *East End Transit Survey,* a study commissioned by Five Town Rural Transit Inc., included a Spanish-language session and survey questions targeting the East End's Spanish-speaking population. The responses of this population were markedly different from those of other respondents, notably with regard to usage and familiarity with Suffolk County Transit services.

Spanish-Language Planning Workshops held as part of the SEEDS effort also identified different transportation characteristics of the Spanish-speaking population, such as low vehicle ownership and high reliance on public transportation[3].

The *Town of East Hampton Comprehensive Plan* also cites an increase in ethnic diversity, especially of the Hispanic/Latino population since 1990, both within the town and throughout the county. This is supported by county-level Census data, which show an increase of nearly 24 percent in the population described as "Hispanic or Latino of any race" between 2000 and 2006. The geographic distribution within this category ranges

[3] NYMTC. *Sustainable East End Development Strategies Summary Report*. June 2006

from 2.4 percent in Shelter Island, to 14.8 percent in East Hampton. The same variation appears with respect to language. In East Hampton, 20 percent of the population 5 years of age and older speak a language other than English as a primary language at home, three-quarters of whom are Spanish speakers. Of those, 8.1 percent are reported to speak English "less than well." Such language considerations are important, particularly if, as reported in the focus group, travel patterns vary by demographic group.

2.1.2. Seasonal Patterns

The Sustainable East End Development Strategies (SEEDS) Study highlights some of the seasonal demographic trends not easily captured with Census data of year-round residents. According to the analysis conducted by SEEDS, the East End's population is 2½ to 3 times higher during the peak summer season, with the breakout by town as shown below:

Table 5: Estimates of Year-Round vs. Seasonal Population

	Estimated Year-Round Population, 2003	Estimated Total Population in Season, 2003 (Year-Round plus Seasonal Residents)
East Hampton	20,275	93,756
Riverhead	31,203	44,294
Shelter Island	2,244	9,471
Southampton	56,760	160,230
Southold	20,945	49,466
East End Total	131,427	357,217
Source: SEEDS Inventory and Analysis, Tables 2-28 and 2-30		

This marked seasonal increase means that the overall population density in the East End rises to approximately 1040 persons per square mile during the peak of the summer. This suggests the potential for more favorable conditions for fixed-route transit during the season.

The SEEDS study also notes that second home ownership is rising, with approximately 38 percent of all homes classified as seasonal residences, roughly consistent with the 2000 Census data on seasonal use of housing units summarized in Table 8. This has been accompanied by a move toward larger seasonal homes and an extension of the season into the autumn and spring. The service economy related to these second homes – such as architecture and landscaping – is growing, which adds to demand for housing and traffic congestion. Under such development pressure, the study cites a loss of rural character and agricultural land, with development moving to the more rural North Fork.

Table 4: 2000 Census Data on East End Housing Stock

	Total Housing Units	Occupied Units (April 1)	Vacant as of April 1, but held for "seasonal, recreational, or occasional use"
East Hampton	19,640	8,101	10,693 (54%)
Riverhead	12479	10749	1,165 (9%)
Shelter Island	2,370	996	1,307 (55%)
Southampton	35836	21504	12,604 (35%)
Southold	13,769	8,461	4,689 (34%)
East End Total	84094	49811	30,458 (36%)

2.2. Visitor Demographics

In addition to year-long residents and seasonal inhabitants, Long Island attracts a number of leisure travelers, who contribute to the region's economy and transportation demands[4]. In 1999, there were approximately 14.3 million person-days spent on the island in connection with leisure trips, with total visitor expenditures totaling just under $1 billion. (The data do not permit an accounting of the East End's share of these totals.)

Compared to a group of other East Coast vacation destinations, Long Island stands out for its relatively high share of visitors who are visiting friends and relatives (50%) and who stay in private homes (46 percent) rather than in commercial accommodation. The average length of stay is also a bit lower, at 3.8 days.

Visitors to Long Island tend to come from the middle age ranges (50 percent are between 35 and 54) and have higher-than-average incomes and educational attainments. They are drawn largely from nearby markets: New York, Scranton, Washington, Philadelphia, Hartford-New Haven, Boston, Albany, and Rochester. Of those not arriving by rail, most (88 percent) arrive by car, though 12 percent arrive by air.

[4] The visitor statistics in this section are drawn from the *1999 Domestic Travel Report*, prepared by D.K. Shifflet & Associates Ltd. for Long Island Convention and Visitors Bureau and Sports Commission, October 2000.

3. Land Use

3.1. Overview

The natural and built environments of the East End are primary attractions for visitors and residents alike. Historically, the area was largely agricultural, with the cultivation of cauliflower and potatoes as major industries. Town, village, and hamlet centers were the commercial and community centers. Today, development patterns exhibit more suburban characteristics, but strong open space and agricultural protection programs have allowed the area to retain much of its rural character.

3.2. Development patterns

As noted in the demographic overview section, population densities today are still relatively low. Development controls also restrict significantly higher-density development. In addition, a review of the comprehensive planning documents and conversations with local planners suggests that preservation of open space and natural resources is a strong concern for local residents. For example, one of the three main land use recommendations of the SEEDS study was to reduce overall development potential, while focusing new development in already-developed areas.

Today, hamlet, village, and town centers still display traditional development patterns, with low-rise shops on small lots and residential areas within walking distance. Several of these areas are settled at densities of four to five dwelling units per residential acre, which is a common rule-of-thumb threshold for the viability of regular transit service.

While retail remains in many of these village and hamlet centers, many are almost exclusively dedicated to high-end retail, which contributes to the tendency of residents to drive to the major shopping destinations of Bridgehampton on the South Fork and Riverhead's CR 58 corridor, which have a wider variety of goods and services.

Residential development is largely single-family. Throughout the East End, 85 to 95 percent of the housing stock consists of detached single-family houses. (One exception is the Town of Riverhead, which has more multi-unit buildings and mobile homes, though even here detached single-family houses comprise 72 percent of residences.) Lot sizes in older neighborhoods tend to be smaller in acreage, while new developments are more typically on lots of one acre or more. Several studies have noted that newly built homes, particularly those intended as seasonal residences, have been growing larger in size and footprint. The increase in second-home ownership also means that many of these homes may be vacant much of the year.

Major employers are schools, hospitals, and local governments. There are relatively few other major generators aside from town, village, and hamlet centers and public beaches

(in season). As noted above, major shopping destinations, with a wider variety of goods and services, are in Bridgehampton on the South Fork and along Riverhead's Route 58 corridor.

Housing costs vary significantly by area within the East End but are generally high. By one common measure of housing affordability – the share of household income that goes to housing payments – many East End households are heavily burdened by their housing costs. Across the East End, fully one-quarter of homeowners and over a third of renters dedicate more than 35 percent of their income to housing costs. A lack of affordable housing means that many employees cannot afford to live near their jobs. Several reports have also noted that the East End's general lack of affordability increases demand for the reverse commute trip or so-called "trade parade" (i.e., traveling east in the morning and west in the evening).

3.3. Development controls

Aside from the normal zoning and subdivision development controls, many other regulations and programs impact development in the East End.

3.3.1. Wastewater

Much of the East End is served by septic systems. Article 6 of the Suffolk County Sanitary Code "established density limitations in unsewered areas to control nitrogen load from sewage disposal and the impact on ground surface water resources[5]." Article 6 acts as an effective cap on development density, as it sets both minimum lot sizes and maximum dwelling units per acre. In those areas with sewer systems, capacity limitations also pose a potential barrier to new development. On the East End there are three sewage treatment systems operated by municipalities-in Riverhead, Greenport and Sag Harbor; one operated by the Air National Guard/Suffolk County at Gabreski Airport and some privately operated systems at select locations.

Table 5: Article 6 Development Constraints

	Minimum lot sizes	Maximum dwelling units per acre
Areas with public water	20,000 s.f.	2
Areas with no public water	40,000 s.f.	1

3.3.2. Central Pine Barrens

The Central Pine Barrens is a natural region of Suffolk County notable for unique vegetation patterns and especially important for its role in providing fresh drinking water for county residents. The 1993 New York State Long Island Pine Barrens Protection Act

[5] AKRF. *SEEDS Inventory and Analysis*. 2004.

designates this area of 102,500 acres. Large portions of Southampton and some areas of Riverhead are included in the designated area.

The Pine Barrens Credit (PBC) Program is a transfer of development rights program intended to protect the area from development. The Pine Barrens Commission notes that "as of June 2006, 615 parcels totaling 1323 acres have been protected, with an average parcel size of 2.15 acres.[6]"

Protected open space
A variety of open space preservation tools is used by the county and the individual towns. For example, Southampton purchases open space property and preserves agricultural lands by buying development rights. This program is funded by the Community Preservation Fund, which draws from a 2% real estate transfer tax. All five study area towns participate in the Community Preservation Fund.

Table 6: Protected Open Space

Town	Farmland Preserved (acres)	Open Space Preserved (acres)	% of Town's Total Area
Riverhead	2,600	7,400	25%
Southold	2,300	2,600	13%
Shelter Island	N/A	2,600	33%
Southampton	2,400	14,800	19%
East Hampton	700	12,500	27%
Source: The New York Times, April 2001 (In AKRF. SEEDS Inventory and Analysis)			

3.4. Future development

As noted above, a goal created in the SEEDS process was to reduce future development potential. Since SEEDS was completed, "upzoning", or reducing the maximum allowable development in a zone, has been carried out in East Hampton and Riverhead. In the case of the latter, the population at buildout is projected to have been reduced from 51,000 to 43,000, as compared to a population of 27, 680 in 2000.

While SEEDS concluded that zoning changes were needed to concentrate new development in hamlet and village centers, with the goal of supporting future transit service and protecting open space, these have not yet been put into place. In general, increasing density increases the viability of transit service, as many people will share origins and destinations and the transportation times between them will be less. One obstacle are the density controls created by wastewater regulations, as noted in Section 3.3.1. Effecting land use change through zoning is a slow process; it may be many years after a zoning revision is complete that its effects begin to be felt.

The Calverton site
A 2900-acre site formerly home to the Grumman Corporation is now known as Enterprise Park at Calverton. The site has been the subject of various redevelopment plans and is currently rezoned for Light Industrial, Planned Industrial Park, Planned

[6] Central Pine Barrens Commission. http://pb.state.ny.us/pbc/pbc_program_fact_sheet.pdf

Recreational Park, and Calverton Office uses. At build-out, the site could add significantly to local employment and traffic.

4. Transportation Network

4.1. Travel Patterns

A number of studies and reports, including the SEEDS process, have noted worsening traffic congestion in eastern Long Island, fueled by population growth, sprawling development, a shortage of workforce housing, and an extension of the usual summer season into the spring and autumn. This is occurring side-by-side with a growing service economy related to second homes.

Tables 8 and 9 summarize some of the most important Census questions related to transportation: journey-to-work mode choice and vehicle availability, again with Suffolk and Nassau counties and Manhattan shown as points of comparison. Although the commuting mode shares vary somewhat across the five towns, the general pattern is one where automobile commuting is prevalent and public transit usage is limited. This pattern is similar to that of Suffolk County as a whole, albeit with slightly less transit usage and more walking and working from home. In fact, within the five towns, more commuters work from home than use public transportation.

Table 7: Primary Mode of Commute to Work (by percent of workers over 16)

Commute to Work	East Hampton	South Hampton	Riverhead	Southold	Shelter Island	East End: 5 towns	Suffolk County	Nassau County	Manhattan
Car, Truck, Van (alone)	70.5	75.2	80.9	78.5	69.1	75.8	78.1	69.4	7.6
Car, Truck, Van (carpool)	12.9	10.5	9.7	8.4	12.3	10.4	10	8.6	3.4
Public Transport	2.7	3.7	2.6	3.2	1.4	3.2	6.8	15.7	59.6
Walked	3.1	3.8	2.4	3.6	4.2	3.4	1.7	2.7	21.9
Other	2.4	1.1	1	1.4	0.4	1.3	0.8	0.7	1.7
Worked at home	8.4	5.6	3.3	4.9	12.7	5.6	2.7	3	5.5
Mean Travel Time (minutes)	21.2	26.2	27.4	26.8	19.7	—	31.8	34.3	30.5

Source: U.S. Census 2000

Household vehicle availability is a major predictor of transit usage. In particular, residents of zero-vehicle households commute via public transit and carpooling at much

higher rates than the population as a whole. Just under 6 percent of East End households have no vehicles available, while a small majority of households have two or more available. This is broadly similar to Suffolk County as a whole. In comparison, in Manhattan, a dense area of high transit usage, a strong majority of households – nearly 78 percent – have no vehicles available at all.

Table 8: Vehicle Availability by Household (percent of households)

Vehicles available	East Hampton	South Hampton	Riverhead	Southold	Shelter Island	East End: 5 Towns	Suffolk County	Nassau County	Manhattan
0	3.9	5.4	8.5	5.4	3	5.7	5.4	7.7	77.5
1	36.9	36.7	35.9	32.9	37.3	35.9	26.8	29.8	20.2
2	39.5	41.1	35.1	44.5	43.4	40.2	45.2	43.9	1.8
3 +	19.7	17.1	20.4	17.2	16.3	18.2	22.5	18.6	0.5
Source: U.S. Census 2000									

4.1.1. Journey-to-Work Flow

Work-related travel now represents a relatively small share of overall travel (just under 20 percent nationally), so commuting data should be regarded as only one component of the larger transportation picture. Still, the commute trip is important because it often takes place during peak periods and is still, for many people, the primary journey around which other activities are scheduled. Data from the 2000 Census were analyzed for patterns of travel between places of residence and places of work, both for those residing in the East End and for those commuting to work in the East End from elsewhere[7].

The journey-to-work data reveal a few key facts about commute travel to, from, and within the East End.

- First, most commuting trips are quite local: the majority of trips are entirely within the East End, and most often they start and end within the same town. This reinforces the importance of assessing *local* transportation options and mobility strategies.

- The next largest group of commuter flows are between the East End and western Suffolk County. The number of western Suffolk commuters traveling into the East End (21,160) is roughly double the number traveling the other way (11,516). This is consistent with experiences of peak traffic congestion for travel eastbound in the morning and westbound in the afternoon.

[7] The Census questionnaire is based on where the respondent worked most often in the previous week. There are some known methodological issues with this question, particularly in places such as the East End where workers in the building trades often visit multiple sites during a given week and do not have a fixed place of work in the conventional sense.

- There is a relatively small but significant number of regular long-distance commuters between the East End and New York City. About 4 percent of employed East End residents (2,500 people) commute to the city, while a smaller number (about 950) city residents regularly commute to the East End, largely to the Towns of Southampton and East Hampton.

More specifically, the Census 2000 Journey-to-Work data show that among residents of the five East End towns, the majority (55 percent) work within their town of residence. Another 16 percent work elsewhere within the East End, with Southampton-to-Riverhead constituting the largest single flow between towns. An additional 20 percent work elsewhere in Suffolk County.

Looking instead at the composition of the East End workforce, again most East End workers come from within the East End. But among those who live elsewhere and commute into the East End, these commuters overwhelmingly (88 percent) come from the western towns of Suffolk County.

The following tables summarize Journey-to-Work flows by town of residence and by town of employment.

Table 9: Journey to Work by Residence

Live in: / Work In:	East Hampton	Southampton	Shelter Island	Riverhead	Southold	East End Totals
East Hampton	6325	1305	52	100	101	7883
Southampton	1127	14538	59	1561	616	17901
Shelter Island	25	56	696	0	112	889
Riverhead	136	2032	17	4708	1015	7908
Southold	52	368	34	583	4979	6016
Rest of Suffolk Co.	885	4510	98	4493	1530	11516
Nassau Co.	195	660	4	396	258	1513
Manhattan	300	1144	21	199	140	1804
Rest of NYC	76	405	23	127	78	709
Connecticut	5	8	0	0	4	17
Other	114	337	7	62	84	604
Total	**9240**	**25363**	**1011**	**12229**	**8917**	**56760**

Source: U.S. Census 2000

Table 10: Journey to Work by Employment Location

Live In \ Work in	East Hampton	Southampton	Shelter Island	Riverhead	Southold	East End Totals
East Hampton	6325	1127	25	136	52	7665
Southampton	1305	14538	56	2032	368	18299
Shelter Island	52	59	696	17	34	858
Riverhead	100	1561	0	4708	583	6952
Southold	101	616	112	1015	4979	6823
Rest of Suffolk Co.	1996	10130	102	7132	1800	21160
Nassau Co.	230	851	5	268	218	1572
Manhattan	127	132	0	14	0	273
Rest of NYC	157	306	12	105	100	680
Connecticut	7	29	0	0	150	186
Other	87	172	46	42	102	449
Total	**10487**	**29521**	**1054**	**15469**	**8386**	**64917**

Source: U.S. Census 2000

4.1.2. SEEDS Origin-Destination Study

An origin-destination study was completed as part of the SEEDS study during the summer of 2002 by Eng-Wong, Taub & Associates. While the study had a very low 7% response rate, almost 1,800 surveys were received. It should be noted that the results were not weighted to represent the universe because of the low response rate. The survey was distributed at 10 locations on the South Fork to drivers and to local, express bus, LIRR, and ferry riders.

The following is a summary of major conclusions:

- 52% of auto drivers and 47% of local bus riders began and ended their trips in the South Fork while only 1% of LIRR and express bus riders and 6% of ferry riders had trips entirely within the South Fork.
- 64% of riders on the South Ferry had either an origin or destination outside of the South Fork; 31% had both origin and destination outside the South Fork.
- Most respondents (77%) stated home or second home as origin.
- Destinations were more varied (auto: 27% to shopping, 18% to social or recreation activities, 16% to home, 20% to other; local bus: 56% to work, 19% to shopping; express bus: 37% to home, 27% to summer home, 18% to social/recreation; LIRR: 42% to second home/vacation home, 39% to social/recreation; ferry: 33% to social/recreation, 16% to home, 23% to other)
- Most auto respondents were driving alone (42%) or had one passenger (30%)
- 21% of auto respondents make the same trip 5+ times per week, 21% 2-4 times per week. For bus riders 30% make the trip 5+ times per week and 30% 2-4 times per week. Other modes much less frequently (1-3 times per month or once per season).

- 52% of auto and 54% of local bus respondents were permanent residents of the South Fork.
- 60% of express bus, 80% of LIRR and 55% of ferry respondents were not a permanent or season resident of the South Fork.

Significantly, the survey revealed that most auto trips are shopping and recreation-oriented while local bus trips are work and shopping oriented. Furthermore, riders on the LIRR and express buses tended to be more likely traveling to second or vacation homes. This result may be skewed, however, since 85 surveys were returned from LIRR and 90% of those were heading eastbound, to the South Fork.

4.2. Roadway Conditions

Traffic congestion has been a long-standing concern in the East End. Geography and local opposition to roadway expansion restrict development of the roadway network and there is relatively little redundancy in the network. Congestion is driven by these physical capacity constraints, seasonal population fluctuations, dispersed land use patterns, and by physical bottlenecks such as the Shinnecock Canal on the South Fork.

I-495, the Long Island Expressway, terminates in Riverhead. Major roadways in the area include County Road (CR) 48 and State Route (SR) 25 on the North Fork; CR58 in Riverhead; and SR27 (Sunrise Highway), Montauk Highway, and CR39 on the South Fork. CR39 and SR27 run concurrently in sections.

Seasonal congestion along CR39 had led Suffolk County and the Town of Southampton to initiate the "Cops and Cones" program, wherein police manually placed traffic cones to create a second eastbound lane in the morning peak period. Construction on a second eastbound lane for almost the length of CR 39 began in the fall of 2007 and was completed in April 2008.

In order to better understand the seasonality in traffic volumes in the East End, several sources of data were considered. First, seasonal traffic patterns had been identified in the SEEDS study. These patterns reveal that traffic peaks during the summer months on both the North and South Forks, generally from June through September.

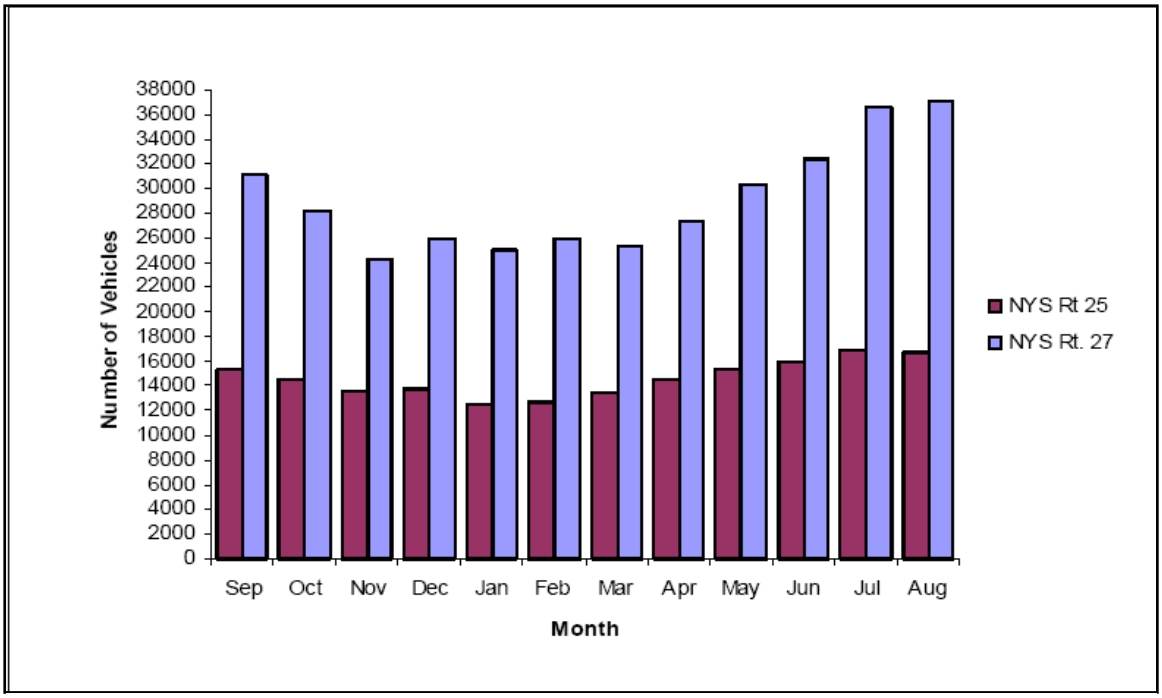

Figure 2: Comparison of Average Weekday Daily Traffic Volumes, NYS RT 25 (1998-1999) and NYS RT 27 (2000-2001), SEEDS Study

The traffic data from SEEDS were compared to more recent data available from the New York State Department of Transportation for 2006. Average daily traffic data for New York State Routes 25 and 27 was compiled and compared by month and is presented in the chart below[8].

[8] The traffic recorder for NYS 25 was located between Cross River Drive and South Jamesport Avenue and for NYS 27 between Peconic Drive and Tuckahoe Lane.

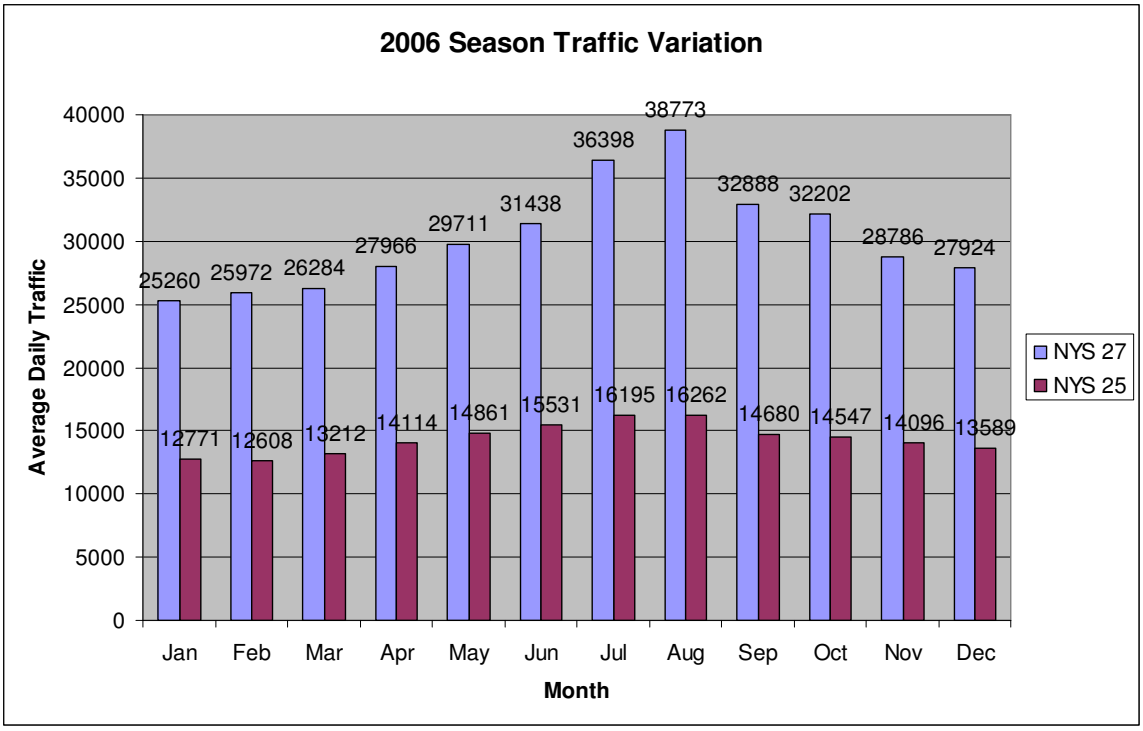

Figure 3: 2006 Average daily traffic by month

2006 monthly average daily traffic volumes closely match those recorded in 2000-2001, with a virtually identical seasonal pattern, indicating the traffic patterns in the East End have been consistent during this period.

In general, traffic congestion on the North Fork is less severe than on the South Fork. There is more redundancy in the roadway network and there is less demand, as the North Fork is less intensely developed than the South Fork. Interviewees noted that seasonal congestion on the North Fork is generally tied to special events, such as the Strawberry Festival, Maritime Festival, and pumpkin picking, concentrated on weekends during September through November. The vineyards along SR25 are also a major tourist attraction, especially in the fall. As noted in Section 3.2, big box and strip retail uses are concentrated along the CR58 corridor in Riverhead. The resultant traffic congestion on CR58 leads to secondary congestion along local roads.

On the South Fork, there is a degree of peak-hour traffic congestion year round. Traffic begins to noticeably increase around the end of March, as second homes are being prepared for occupancy during the summer season, and fall off in October.

4.3. Alternative Transportation

The study area is served by a number of public and private transportation providers, using three primary modes: local and intercity bus, commuter rail, and ferry. In general, local bus services account for most of the transit trips within the East End, while the commuter

rail and private intercity bus services are used for travel to and from New York City. Ferries provide connections to Shelter Island and New England. Unusually for an American city, private intercity bus service, operated by the Hampton Jitney and its main competitor, Hampton Luxury Liner, is a major component of transit service.

Each service will be briefly reviewed in this section.

4.3.1. Long Island Railroad

The Long Island Railroad (LIRR) operates commuter rail service between New York City and Long Island. It is a subsidiary of New York State's Metropolitan Transportation Authority, the MTA. The LIRR system consists of over 700 miles of track on 11 branches extending from Penn Station in Manhattan to Montauk on the eastern edge of Long Island. Within the East End, service is provided at 12 stations along two branches: the Ronkonkoma/Greenport Branch and the Montauk Branch.

Operations

The Long Island Railroad *Service Guidelines* sets the framework for its operations. These are goals, rather than guarantees, but generally guide the operation of the railroad. Stations are divided into four "level of service" categories (Level 1 being the highest and Level 4 the lowest) based on passenger boarding per day. Decisions about station amenities and frequency of service are linked to the station's level of service. Stations within the study area fall into "Level 4: Fewer than 1,000 customers a day".

The LIRR operates a fleet of bi-level commuter coaches with capacities of about 140 seats in the East End. The maximum length train is 12 cars, consisting of 3 locomotives and 9 passenger cars, for an effective capacity of 1,260 passengers. The "Cannonball," which offers non-stop express service from Jamaica to Westhampton on Fridays (year-round) and on Thursdays in summer months, is the only train that regularly reaches this level of ridership.

As seen in Table 11, frequency of service in the study area is relatively low. The LIRR's primary market is the commute trip to and from Manhattan. As described in the demographic summary above, relatively few East End residents work in Manhattan. Demand is somewhat greater in the summer months, due to the area's attraction for tourists and the high number of second homeowners. In addition, infrastructure constraints restrict rail capacity along both the North and South Forks.

The LIRR timetable varies seasonally and, in some cases, by day of the week. Table 11 provides a general summary of service to and from the study area. The North Fork refers to the Ronkonkoma/Greenport branch from Riverhead to Greenport. The South Fork refers to the Montauk branch from Speonk to Montauk. Note that not all trains serve all stations on the South Fork (i.e., some runs skip Hampton Bays, Amagansett, Montauk, and/or other stops).

Moreover, several trains each day terminate at or originate from Speonk and do not serve study area destinations further east. The totals below do not include these Speonk trains (generally 6 eastbound and 10 westbound on weekdays; 5-6 eastbound and 7-8 westbound on weekends).

All figures represent the typical number of daily arrivals and departures and are based on current and past LIRR printed schedules. The figures do not reflect all schedule adjustments for the spring and fall shoulder periods or for holiday weekends.

Table 11: LIRR Service to and from the East End

		Summer			Winter	
		Mon. – Thurs.	Friday	Sat. – Sun.	Mon.-Fri.	Sat. – Sun.
North Fork	Eastbound	2 [a]	3 [a]	2	2 [a]	2
	Westbound	3 [a]	3 [a]	2	3 [a]	2
South Fork	Eastbound	6 [b]	10	5	6 [c, e]	5
	Westbound	5 [d]	5	4 on Sat., 8 on Sun.	5 [e]	4

a – One additional train to/from Riverhead
b – One additional train on Thursdays
c – One additional train on Fridays
d – One additional train on Mondays
e – Plus 3 South Fork Commuter Connection local trains during duration of SFCC (see below)

Freight Operations

New York and Atlantic Railway (NY&A) has leased the freight operation from the LIRR, and in the study area they run approximately one train per day, although this will vary. LIRR cannot deny freight operations but has scheduling priority.

Infrastructure

Service limitations in the study area exist due to infrastructure constraints, including non-electrification, areas of single track, and a lack of signalization. While much of the LIRR is electrified, the Oyster Bay Branch, the Port Jefferson Branch, the Montauk Branch, and the portions of the Ronkonkoma Branch in the study area are not. Operating in the East End requires use of diesel or dual-mode locomotives operating in diesel mode. The LIRR maintains diesel railyards in the study area at Greenport, Montauk, and Speonk.

The right-of-way (ROW) between Ronkonkoma and Greenport and between Speonk and Montauk is single-tracked with passing sidings. The passing sidings have hand-thrown switches. The ROW is generally 40-60 feet in width; track placement varies from being in the center of the ROW to being offset. Additionally, bridges and underpasses are generally much narrower.

A further service restriction is the lack of signalization beyond Ronkonkoma on the Ronkonkoma Branch and Babylon on the Montauk Branch. Without signals, the ROW is divided into blocks of between one and 14 miles and only one train may occupy a block at any time. The LIRR's 5-year Capital Improvement Plan (CIP) call for installation of signal control as far as Speonk on the Montauk Branch, but there are no plans to install signals beyond Speonk. With or without signalization, operations today are close to capacity on the South Fork with the additional shuttle service provided for the South Fork Commuter Connection. The primary capacity issue is the single-track limitation and the ability for trains operating in opposite directions to pass each other.

Ridership

As noted above, ridership in the study area is low and represents only a small part of the LIRR's customer base. For example, in Spring 2006, passengers at study area stations represented only 0.08% of all system passengers[9]. Table 12 divides the study area's LIRR stations into groups based on passenger counts performed in Spring 2006. It should be stressed that these counts are "point in time" and do not represent peak ridership, which is generally summer Fridays.

Table 12: East End LIRR Station Utilization - Spring 2006

Boardings & Alightings / Day	North Fork Stations	South Fork Stations
1-15	Greenport, Mattituck, Southold	Amagansett, Bridgehampton, Hampton Bays, Westhampton,
16-50		East Hampton, Southampton, Montauk
50-100	Riverhead	
100-300		Speonk

Source: LIRR 2006 Weekday Passenger Station Counts

Park and Ride

Parking at East End LIRR stations is provided by the LIRR or the local municipalities at no charge. Interviewees indicated that park-and-ride facilities in the study area are sparsely used during the year but are utilized more heavily in the peak summer months. The most recent park-and-ride usage data available suggest that park-and-ride lots typically do not reach capacity. Relatively few data points were available for this

[9] LIRR 2006 Weekday Passenger Station Counts. Counts were performed between April and June 2006.

analysis and it should be understood to be illustrative rather than conclusive. Table 13 shows parking lot utilization rates for each East End LIRR station. It should be noted that several of the park-and-ride lots were expanded between the 1999 and 2005 surveys, so that results are not directly comparable. During the study team's site visits (January, mid-day), observed off-peak usage was even lighter, ranging from 0% to an estimated 30% occupancy.

Table 13: LIRR Commuter Parking, East End Stations.

Station	2005 Capacity	2005 Occupancy	1999 Capacity	1999 Occupancy
Amagansett	35	77%	35	57%
Bridgehampton	139	56%	85	59%
East Hampton	451	63%	373	28%
Greenport	103	91%	111	44%
Hampton Bays	147	14%	190	16%
Mattituck	73	42%	71	45%
Montauk	60	25%	60	5%
Riverhead	24	33%	22	77%
Southampton	101	81%	74	59%
Southold	22	23%	20	5%
Speonk	335	23%	180	54%
Westhampton	114	11%	38	21%

Sources: LIRR Parking Database; DEIS, East Side Access, December 1999.

Interviews suggest that East End residents traveling to Manhattan may prefer to drive to Ronkonkoma Station, which marks the beginning of electrified train service and offers much more frequent service than East End stations (some 30 departures daily, as compared to the 2-5 available at East End stations). Ronkonkoma Station is a major transportation hub on Long Island with approximately 6,000 paid and unpaid commuter parking spaces, which are well-used.

Participants in the SEEDS project listed "improve parking at train stations" as one way of improving public transportation[10]. Based on the parking utilization data above and input from local residents, it is possible that this sentiment is directed at Ronkonkoma rather than the East End stations themselves.

The seasonal nature of travel in the area may also increase demand in the peak season. Not only are there more trips, but, at some stations, long-term parking may be used to store vehicles for second homeowners for extended periods, which would have a disproportionate impact on lot utilization.

South Fork Commuter Connection

During the recent reconstruction of County Road 39, a major east-west connector on the South Fork, the LIRR and the Town of Southampton jointly initiated the South Fork

[10] NYMTC. SEEDS Final Report. June 2006. pp4-7

Commuter Connection (SFCC) as a congestion mitigation measure. The SFCC consisted of three additional eastbound trains from Speonk (6:11 am, 8:32 am, 2:44 pm), two terminating in Montauk and one in East Hampton. In addition, there are three additional westbound weekday trains – two originating from Montauk (12:28 pm and 4:22 pm) and one originating from East Hampton (7:26 am), all of which terminate at Speonk.), along with connecting shuttle bus service for some trains and supplementary "bus-in-lieu-of-rail" service. The pilot program began October 23, 2007 and was scheduled to operate weekdays through May 22, 2008. In April 2008, by mutual agreement of the parties, the service was extended to June 26th.

SFCC was promoted with major employers, particularly local school districts, and succeeded in garnering a few hundred riders per day. SFCC was also marked by an increase in the use of park-and-ride facilities on the South Fork (particularly Speonk, Westhampton and Hampton Bays). Anecdotally, many of these park-and-ride customers were commuters who live west of the Shinnecock Canal but work to the east of the Canal, and who used the train service as a way of avoiding the worst of the congestion. As noted in Section 4.1.1, local commuting patterns tend to flow west to east in the morning and east to west in the evening.

This pilot project offers an opportunity to assess the feasibility of increased transit and the affect of increased schedule coordination on transit usage on the South Fork. An evaluation of the service and considerations for implementation of similar service will be performed separately; findings are expected to inform development and evaluation of alternatives.

Figure 4: Long Island Railroad System Map (*Source: Long Island Railroad*)

4.3.2. Suffolk County Transit

Suffolk County Transit (SCT), managed by the Suffolk County Department of Public Works, provides local bus service throughout Suffolk County. SCT plans the service and owns the vehicles but contracts out the service to private companies. Contractors (primarily Hampton Jitney on the South Fork and Sunrise Coach on the North Fork) maintain staff and maintenance facilities. SCT operates six days a week with no Sunday or holiday service.

Service Overview

SCT service in the study area is concentrated in Riverhead. Southold, Southampton, and East Hampton are primarily served by the S92, 8A, and 10A/B/C/D/E routes. Shelter Island is not served by SCT, though SCT routes do serve the ferry terminals at Greenport and North Haven. On most routes, the frequency of service is generally in the range of one trip every 90 minutes and the span of service is generally 5AM or 6 AM to 8 PM or 9PM on weekdays and Saturdays, but this varies greatly by route.

Table 14: SCT East End Routes

Route #	Route	Approximate Headway	2006 total ridership
S-92	Orient Point – East Hampton	~30 min (peak); ~1 hour (offpeak)	403,296
S-66	Patchogue to Riverhead	~1 hour	235,579
S-58	East Northport – Riverhead	~1 hour	214,180
S-62	Hauppauge - Riverhead	~1 hour	141,691
8A	Riverhead – Calverton Hills	~1 hour	45,760
10C	East Hampton to Montauk	>1 hour (5-9 trips / day)	44,149
10B	Bridgehampton to East Hampton	>1 hour (7-8 trips / day)	42,917
S-90	Center Moriches – Riverhead	>1 hour (1-5 trips / day)	19,303
10A	Long Island University in Southampton to Sag Harbor to the North Haven South Ferry	>1 hour (2-5 trips / day)	11,114
10DE	East Quogue to Hampton Bays	>1 hour (5-6 trips / day)	3,797
10E	Hampton Bays local service	>1 hour (7 trips / day)	(included in above)
S-94	Montauk Village – Montauk Point Lighthouse (Summer only)	~1 hour (10AM - 5PM)	535

Within the study area, the major route is the S92, which provides line-haul service from Orient Point at the eastern end of the North Fork to East Hampton on the South Fork. Other routes provide limited feeder service or operate only seasonally. In recent years, SCT has seen an increase in travel by day laborers traveling from their homes along the North Fork to the South Fork, using the S92[11]. These workers begin using the route in mid-March and generally continue through late Fall. These trips typically originate on the western end of the North Fork, around Aquebogue and Jamesport and travelers tend to alight at Hampton Bays, Southampton and Bridgehampton. In the afternoon, workers are dropped off along the route by employers and catch the S92 to return home.

Ridership

The busiest route is S92, which is the second busiest route in the SCT system. As described above, S92 is a long route that connects most East End communities from Orient Point on the North Fork to East Hampton on the South Fork. Additional trips were added to the S92 route, which has experienced demand in excess of capacity, in Spring 2008[12].

Throughout the study area, there is a significant increase in ridership during the high season between June and September, with the lowest ridership occurring during the winter months. This is to be expected considering the seasonal nature of activity in the East End. Most "S" routes connect Riverhead to points west, while the 8A, 10A, 10B, 10C and 10D/E are internal to the East End. Route S94 is seasonal, operating only in the summer, connecting Montauk Village to Montauk Point Lighthouse. Seasonal trends in ridership are more pronounced when looking at routes that are internal to the East End. As shown in Figure 4, SCT routes that operate wholly within the East End show more seasonal variation than the SCT system as a whole.

[11] Bob Shinnick, SCT. Personal communication. February 2008
[12] Greenberg, Susan J. " Schedule Expanded For E. End Bus Riders" April 9, 2008. *Suffolk Life*.

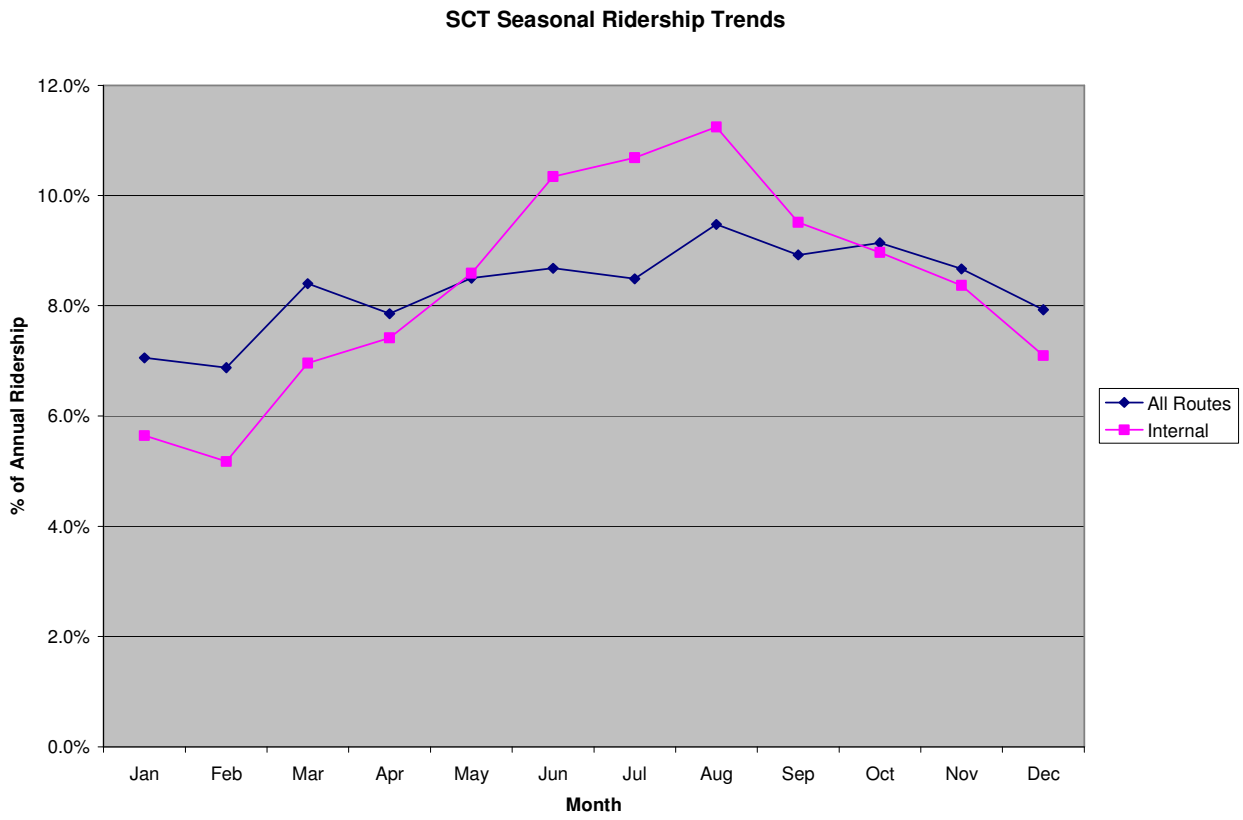

Figure 5: SCT seasonal ridership trends

Bus Route Configuration Study

SCT is currently working with a consultant team on a bus route configuration study, which should be substantially complete by summer 2008. The study will assess the fixed route system and consider changes or additions to service, including fare policy. New service standards may be an output of the study. They will include span of service and headways. Focus groups were held and a system-wide boarding count analysis has been done by a second consultant during fall 2007. The study will examine the impacts of land use and employment changes, such as the increasing popularity of the Tanger Outlets in Riverhead.

4.3.3. Intercity Bus

There are two intercity private bus operators that serve the East End: the Hampton Jitney and Hampton Luxury Liner. The former operates along both the North and South Forks while the latter serves the South Fork only. Both companies operate year-round with additional service in the summer.

Private bus operations play a large role in the East End – Manhattan travel market. Prices are higher than public transportation, but frequent departures, the comfort and amenities provided, convenient pick-up and drop-off locations, and express service to Manhattan make these services attractive to travelers in this market. Though much of the marketing is oriented to second home owners and vacationers, the bus services are also used by East End residents for their occasional trips to New York City, and in some cases for more regular commuting. Airport connections are available via Hampton Jitney's stop in Queens, where passengers can complete their journey by taxi to LaGuardia or Kennedy airports. Hampton Jitney also provides service from the East End to the Connecticut casinos and, during the academic year, to Boston.

4.3.4. Paratransit

Paratransit services are typically more flexible than conventional fixed-route, fixed-schedule public transportation services and are often targeted at particular populations. Programs are usually funded by a variety of Federal, State, and local programs. In the East End, paratransit service is provided by Suffolk County, the Towns of Shelter Island, Riverhead, Southold, Southampton, and East Hampton, and private organizations.

Suffolk County Accessible Transportation

Suffolk County provides public transportation for those people with disabilities who have special transportation needs with the Suffolk County Accessible Transportation (SCAT). SCAT was designed to increase mobility for people who cannot use the SCT transit buses. Riders must be registered as an "ADA Eligible Rider" to use the service.

SCAT provides curb-to-curb transportation between any two points in Suffolk County that are within three-quarters of a mile of a Suffolk County Transit or HART bus route. SCAT reservation times are based upon a 30-minute pickup window. Sunday service is not available on the East End for SCT so SCAT is also not available.

Town-operated Transportation Services

All five towns in the study area operate paratransit services, largely targeted at senior citizens, but also for the disabled, and some youth and other community programs. Although the programs differ by town, by population, and by funding source, clients typically must book transportation 2-5 days in advance, are picked up from their homes, and are dropped off at senior centers, medical appointments, and shopping centers. Most programs are free of charge, but may have a nominal suggested donation. Sedans, vans, and 20-passenger buses are used for most trips. The Town of Southampton has a relatively large fleet, with 13 20-passenger buses, 3 Jeep Grand Cherokees, and a few other smaller vehicles.

Stony Brook Transportation

Southampton and East Hampton cooperatively run a shuttle to Stony Brook Medical Center. East Hampton operates the shuttle on Tuesday and Southampton on Thursday. Ridership is below capacity, with approximately 3-5 passengers each day. The number may grow as the service becomes better known.

Southold Travel Training
Southold has done limited travel training with younger, more active seniors. A staff member will board SCT buses with seniors and show them how to use the services available to them. Participants have subsequently begun to use SCT buses on their own.

Southampton Beach Shuttle
Southampton operates a summer beach shuttle from Bridgehampton High School parking lots to town ocean beaches. The beach shuttle is $2 and 2 buses are used to provide service every 15 minutes.

4.3.5. Aviation

Within the five East End towns there are two airports which have limited commercial air service. Air transportation is not part of this study or future recommendations, but this information is included to round out the broad overview of the entire transportation network in the region.

Francis S. Gabreski Airport is a public, general aviation airport owned by Suffolk County. It is located in the western section of the Town of Southampton, near the villages of Westhampton, Westhampton Beach, and Quogue. It is used for a mixture of private, commercial, and air taxi services.

In 2007, working with Suffolk County and the community, the Town of Southampton adopted a Master Plan for the airport. This plan creates the framework for development of a high tech industrial park on the site; additional air services are not part of the long term plan. Hampton Jitney operates an intermodal park and ride facility on the property and taxis services are available. LIRR tracks cross through the south end of the property and the Westhampton LIRR station is about one-quarter mile west of the property grounds. The SEEDS study identified Gabreski as a potential future intermodal transportation hub.

East Hampton Airport is a Town-owned facility located just north of the Wainscott business and industrial center area. Both aviation and non-aviation uses, including an industrial park, are located on the property grounds. It is a general aviation airport utilized by corporate aircraft, private aviation, and air taxi services. Car rental and taxi services are available on site and the LIRR tracks are located just south of the airport grounds. The SEEDS study identified East Hampton Airport as a future potential intermodal transportation site; and included a draft rezoning plan for the airport area in support of the SEEDS concepts.

The Town of East Hampton is currently in the process of developing and adopting an updated Master Plan for the airport.

4.3.6. Ferry Service

Ferries provide an essential role in the transportation network in the East End of Long Island and additional ferry service has been proposed at varying locations in the area. However, transportation impacts of ferry service are controversial locally, as some residents are concerned about additional traffic congestion and parking spillover. For example, interviewees felt that the introduction of high-speed ferry service from Orient Point to New London, Connecticut, which largely serves the casinos in Connecticut, has dramatically increased ferry-related traffic congestion and the incidence of parking and pedestrian activity along State Route 25.

Orient Point

At Orient Point, ferry service is provided to New London, Connecticut, by the Cross Sound Ferry, a private operator. There are 10 to 15 roundtrips per day, 4 of which are high-speed "Sea Jet" passenger-only ferries. The Orient Point ferry terminal is located at the end of State Route 25 in Orient. Transit service is provided by SCT route S92 and the Hampton Jitney.

In New London, transit connections are available at the Multi-Modal Transportation Center located 200 yards from the New London Ferry Terminal. Service in New London includes Amtrak, Shoreline East commuter rail, local transit, and Greyhound[13].

Montauk

The Montauk Point ferry terminal is located about 2 miles from the Montauk LIRR Station and 3 miles from Montauk Village. Passenger-only ferry service is provided by Viking Fleet during the summer season. Ferry service is provided daily between Montauk and New London, Connecticut and Block Island, Rhode Island. Crossing time is about 1 hour 45 minutes.

Viking Fleet offers limited excursion service between Montauk and Martha's Vineyard, Massachusetts. In 2008, one trip to Martha's Vineyard is planned for August, though service has been slightly more frequent in the past.[14].

Montauk Point is served by SCT route 10C. Additionally, the Hampton Jitney connects with Block Island ferries to provide a connection between New York City and Block Island.

Shelter Island Ferries

[13] Long Island Rail Road East End Transportation Study, September 2000
[14] Vikingfleet.com

There are no bridges connecting Shelter Island with the rest of Long Island. The relatively short distance between the North and South Forks, however, enables a quick (less than 10 minute) ferry ride shore to shore. Both ferries provide year-round service from early morning until around midnight, often running later on busy summer nights.

The North Ferry Company provides service for passengers and vehicles between Greenport and Shelter Island. The Greenport terminal is directly adjacent the Greenport LIRR Station; SCT bus service is available along Main Street. The Hampton Jitney also stops at Greenport Station.

The South Ferry Company provides service for passengers and vehicles between North Haven on the South Forth and Shelter Island. SCT route 10A serves the North Haven terminal with twice daily trips Monday-Saturday.

4.3.7. Non-Motorized Transportation

Bicycling

Only about 1 percent of East End residents regularly commute to work via "other means," the Census category that includes bicycling. Nonetheless, bicycling is a popular way to get around the East End, particularly in summer, both as a form of recreation and for short local trips. Shelter Island is a popular spot for recreational bicycling among visitors, and there are several tour companies that bring visitors by bike through the North and South Forks.

There are some designated bike routes in the East End, most notably an 85-mile route from the Cold Spring Harbor LIRR station to Orient Point, running mostly along State Routes 25 and 25A. Separate bike lanes exist in a few locations around the East End, such as along Route 114 in North Haven (completed as part of a traffic calming project). There are also some off-road trails, including one at Orient Beach State Park, and numerous back roads whose low traffic volumes are conducive to cycling. Conversely, stakeholders noted that many main arteries are too heavily trafficked and lack the wide shoulders or bike lanes that would make them more suitable for bicycling.

The Town of Riverhead Comprehensive Plan noted that "in addition to recreational bike use, many of the seasonal farm workers and service industry employees (landscapers, nurserymen, etc.) in the Town utilize bicycles to travel to and from their places of employment. Many Town roadways lack even minimal shoulders for bike and pedestrian use."[15]. This concern for bicycle safety was echoed by interviewees, although no data on cycling or cycling safety were available.

Bicycles can extend the catchment area for transit services. Holders of the MTA's Cyc-n-Ride permit may bring their bicycles aboard LIRR trains during off-peak hours. (The permit costs $5 and is available by mail or at Pennsylvania Station in New York.) The

[15] Town of Riverhead Transportation Element Executive Summary (7).

LIRR also runs special "bicycle trains" on weekends, for which the usual limit of 8 bicycles per train is waived. SCT buses do not have bike racks.

Walking

According to the 2000 Census, just over 3 percent of the East End's year-round workers commute to their jobs on foot, with the highest rate in the Town of Shelter Island. The most heavily-used bus route in the study area, the S92, runs on major roads. While some stops, particularly those in village and town centers, are pedestrian-accessible, many stops are located in areas not served by sidewalk networks and require patrons to cross busy streets to reach them.

The New York Metropolitan Transportation Commission (NYMTC) is currently conducting the Long Island Non-Motorized Transportation Study; results from the study will be considered in the development of alternatives, should they be available.

4.3.8. Service Connectivity and Itinerary Planning

While there are numerous service providers in the study area, car-free travel is not a straightforward matter. Services are oriented to different market segments and, even if they overlap geographically, schedules are frequently not timed so as to allow transfers between modes.

Aside from the dedicated bus-rail coordination provided for the South Fork Commuter Connection service, there is currently no bus-rail coordination on the East End. In interviews, staff from both LIRR and SCT cited scheduling impacts on their networks as a whole as a concern in instituting coordinated schedules. LIRR staff indicated that their services are directed to different markets and they do not believe that coordinating service would significantly increase ridership.

There is limited coordination for ferry service. SCT uses Orient Point as a layover for the S92 route, so departures are timed to coordinate with ferry arrivals as possible. In addition, some ferry lines outside the study area, such as Patchogue and Bay Shore to Fire Island, coordinate their service with the LIRR.

To assess the feasibility of making transit connections today, the study team reviewed connectivity between services at main locations, primarily major transportation centers including all LIRR stations and ferry terminals, using Winter 2007 schedules as a basis of comparison. Figure 5 shows the wait time for connections between modes for weekdays and Saturdays, respectively.

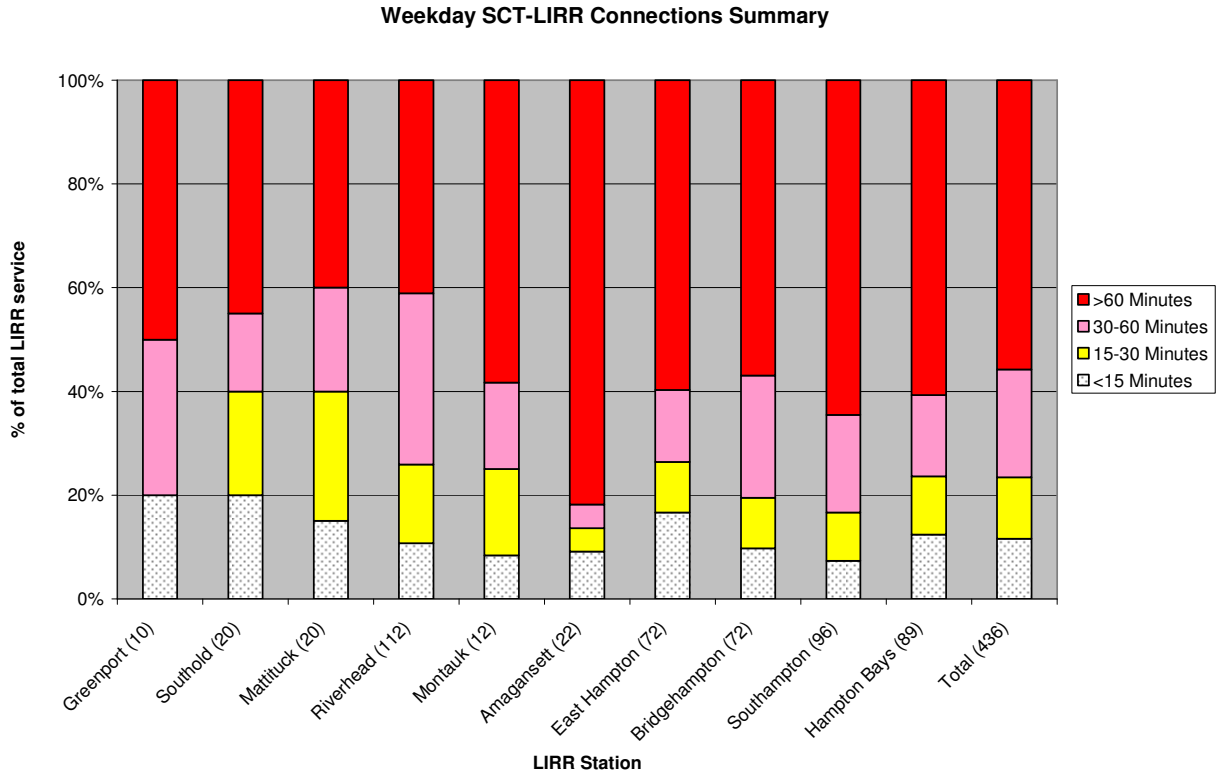

Figure 6: Bus / Rail connectivity, Winter 2007

As the figure indicates, transfers between Suffolk County Transit and Long Island Rail Road trains typically require lengthy waiting times. For example, at Greenport, of 10 possible transfers, 5 require more than 60 minutes' wait, 3 have a 30 to 60 minute wait, and 2 have a wait of less than 15 minutes.

Given the number of public and private operators, there is no single source of travel information for the East End. This makes it difficult for travelers unfamiliar with the area to learn about services provided and to plan transit trips, which tends to further encourage the use of private automobiles.

4.3.9. Issues Identified

The SEEDS study (2006), *Access to Transportation on Long Island* study (2007) and the *Long Island Transportation Plan* (2000), all sponsored by NYMTC, identified a number of key issues and shortcomings of the existing public transportation network on Long Island. One recurring theme in these studies is the lack of coordination between transit modes, which results not only service that is less convenient (e.g. due to long connection times, as discussed above), but also in high travel costs when multiple fares must be paid. The SEEDS study in particular also stressed connectivity between hamlets and village centers. Another common finding is that the system as currently structured has insufficient frequency and span of service, and often has a radial orientation that makes it

ill-suited for local and intra-county trips or for the sorts of "trip-chaining" activities associated with child care. Regional services, such as LIRR, are not designed to serve the predominant commuting patterns in the study area, traveling west in the morning and east in the evening. All studies also agree on a need for greater information and outreach to the public, and for identifying ways (such as feeder buses from residential communities) to provide better access to existing rail stations. Some specific geographic gaps in service were also identified; one example within the East End is Montauk to Southampton.

5. Community Goals and Public Opinion

The success of a transportation system rests not only on its operational characteristics and financial sustainability, but also on its political acceptability and the extent to which it aligns with the goals and values of the population it serves. This section presents some of the major goals that East End communities have expressed in relation to transportation and related issues. It also summarizes the public-opinion survey work that has been conducted on more specific attitudes toward transportation in the region, as well as themes from the interviews that the Volpe Center team has conducted to date with local officials and residents. This qualitative information is intended to complement the more formal data presented earlier on the East End's demographics, travel patterns, and existing transportation services.

5.1. Community Goals

Each of the East End's five towns has its own particular set of issues, priorities, and goals, as expressed in community documents such as Master Plans, Comprehensive Plans, and Vision Statements. A review of these town-level documents[16], as well those produced by regional efforts such as SEEDS, reveals a number of common themes in the region's goal statements as they relate to transportation, land use, and related issues.

Land Use
- Preserve open space and the existing rural character of the East End
- Preserve and enhance the built environment, particularly the historic villages and hamlets
- Protect the region's environmental resources: improve air quality and groundwater quality; protect sensitive areas such as shorelines and wetlands; promote biodiversity; and conserve energy
- Provide development opportunities to the extent that they are compatible with environmental and other goals

Transportation
- Create more multimodal and transit options, improve conditions for walking and bicycling, and generally reduce reliance on the automobile among both residents and visitors.
- Reduce traffic congestion and the intrusion of congestion onto local side roads
- Improve overall mobility and connectivity, especially for vulnerable populations
- Ensure the safety of the transportation system

[16] Town of Southold, Master Plan Update; Riverhead Vision 2020; Southampton Final Comprehensive Plan Update; East Hampton Vision Statement.

Social

- Ensure that affordable housing and human services are available to support a diverse population, including youth and the elderly
- Ensure a healthy and sustainable local economy, including traditional industries such as fishing, as well as the seasonal economy related to second homes
- Promote a mix of shopping and services that provides necessities for year-round residents and specialty shopping for seasonal visitors
- Ensure the availability of recreation opportunities

5.2. Public Opinion

Public opinion research provides more detailed information on the attitudes of East End residents toward traffic, public transportation, and related issues. This work sheds light on some qualitative concerns that are not necessarily covered in the Census or other formal data-collection efforts, or even in public planning documents.

5.2.1. East End Transit Survey, 2005

The most comprehensive information available from recent years comes from a telephone survey[17] conducted on behalf of Five Town Rural Transit, Inc., in 2005. Based on a sample of 1200 East End residents, the survey yielded the following major findings about existing transportation:

Most East End residents have little direct experience with the local public transportation system. Ninety-five percent of survey respondents said that their travel in the region is primarily by car rather than via any form of public transportation. A majority (54 percent) of respondents never use the Long Island Rail Road, and only 11 percent take the LIRR with any frequency (i.e., anything more than just a few times a year). A slightly larger share of respondents reported using private coach services such as Hampton Jitney at least occasionally. There are some significant differences by town, with Riverhead residents most likely to use the LIRR and least likely to use private coach services, and vice versa in East Hampton. In each town and across different population groups, however, use of these services is primarily on an occasional rather than regular basis.

The figures are even more striking with regard to the Suffolk County Transit bus network. Fully 88 percent of respondents never use this service. Even among those respondents with no access to a private vehicle, only about 28 percent use SCT at least twice per week.

[17] "East End Transit Survey: Qualitative and Quantitative Transportation Surveys of the Five Towns on the East End of Long Island," prepared by Appel Research, LLC for Five Town Rural Transit, Inc., August 15, 2005.

Whether related to this lack of direct experience or not, opinions toward the current public transportation network in the East End are largely negative. On a 5-point scale (with 1 as "the worst it could be" and 5 as "the best it could be") East End survey respondents gave the current system an average score of 2.5. Unfavorable ratings exceeded favorable ones by a two-to-one margin, with only small differences across the towns. Interestingly, the most favorable ratings came from those without access to a car and from users of the current services. This suggests that opinions are more favorable when based on direct experience with the services rather than mere perception. There is also likely a degree of self-selection in that those who find the current services more convenient are more likely both to use them and to rate them favorably.

In informal focus group sessions that accompanied the 5TRT survey, the major drawbacks of the current public transportation services in the East End were identified by participants as including: the inconvenient scheduling of LIRR trains; the limited hours of SCT bus service and the lack of Sunday service; the lack of coordination between bus, train, and ferry schedules; and the fact that many homes and even some major destinations have no service within walking distance. A Spanish-language focus group session was conducted which included many frequent users of the SCT bus system. Although this group gave the current transit system a high numerical ranking (7.1 on a scale of 1 to 10), they also noted several major frustrations they encounter when using SCT: hours-long gaps in service; a route network that requires transfers for commonly made trips (e.g. Montauk to Riverhead); the lack of electronic fare collection and the "exact change only" rule; frequent exposure to weather while waiting for the bus; and an overall difficulty, as non-native speakers (or non-speakers) of English, to piece together all of the relevant schedule and connection information required to make a trip.

East End residents are open to, and indeed generally favor, many of the improvements to public transportation that have been discussed. The 5TRT-sponsored survey used some phrasing which arguably biased the results – for example, by using words like "sparkling new" and by describing the advantages of a proposed rail-bus system without presenting alternative viewpoints. The results are nevertheless illustrative of residents' general receptiveness to concepts such as greater frequencies, expanded hours of service, better rail-bus coordination, and more park-and-ride options. Each of these received average favorability ratings of 3.8 or greater on a scale of 1 to 5.

5.2.2. Other Recent Public Opinion Research

Other recent public opinion surveys have addressed related topics including land use and housing. A 2004 survey by the Rauch Foundation[18] found that ***residents of Long Island generally support efforts to preserve open space and ecologically sensitive areas, and to provide more affordable housing***. Of most relevance for transportation planning is the finding that 62 percent of respondents favored zoning changes that would permit a greater number of rental apartments in downtown areas and near train stations and bus

[18] "Where Do We Grow from Here? Land Use on Long Island: Regional Attitudes Toward Housing, Land Use, and Open Space," Rauch Foundation, Garden City, N.Y., 2004.

terminals. An earlier survey, also from the Rauch Foundation, found that 49 percent of Long Island residents consider a walkable, bikable community to be very important. When asked who was to blame for the region's traffic congestion, a plurality (36 percent) placed the blame on drivers themselves.[19] (For both Rauch surveys, the results are for Long Island as a whole; no cross-tabulations by town of residence were published.)

Finally, although the issue has not necessarily received much attention from major public opinion polls, it is worth noting that ***ferry service is a controversial issue in the East End***. Although most East End residents are generally receptive to expanded transit service, many residents have concerns about the impacts of ferry services on traffic congestion, parking, and overall quality of life. In the 5TRT telephone survey, 65 percent of respondents favored the idea of incorporating passenger-only, seasonal water taxi service (between and along the North and South Forks) into the overall transit concept. However, support was only 57 percent among East Hampton residents, where concerns about ferries have been longstanding. Zoning ordinances in the Town of East Hampton place restrictions on the type and speed of passenger ferries that may dock in the Town; ferry terminals for vehicle-carrying vessels are banned outright. These restrictions have been the subject of a legal challenge from the Towns of Southold and Shelter Island. In 2006, the Town of Southold also filed suit against Cross Sound Ferry in a dispute over the permitted uses of the Orient Point site and the use of a high-speed passenger ferry.

5.2.3. Summary of Interview Findings

Although the focus of this study is not new data collection, an understanding of current local priorities is critical to developing appropriate transportation alternatives. In telephone and in-person interviews, town staff members and local residents were asked for their perception of transportation issues and priorities[20]. Input was also gathered at meetings of the East End Supervisors' and Mayors' Association and the Nassau-Suffolk Transportation Coordinating Committee. Responses are summarized below. It should be understood that this summary is not exhaustive. Information received is qualitative in nature and the number of interviews was limited. As additional information is received throughout the study, these findings may be revised.

Major findings

There is a widespread belief that something needs to be done about local transportation. While specific priorities and emphases differed, interviewees shared a general sense that the East End's transportation system is not working as well as it could. Many interviewees feel that it is now time to begin taking practical steps to implement the transportation vision articulated in SEEDS.

[19] "Long Islanders: Who Are We? A Quality of Life Survey of Long Island and the New York Metropolitan Region," Rauch Foundation, Garden City, N.Y., 2003

[20] A full list of interviewees may be found in Appendix III.

Traffic congestion impacts quality of life. Although congestion impacts are not felt uniformly across the East End, several interviewees stressed that congestion complicates internal circulation and negatively impacts quality of life. Congestion affects the main east-west routes and is increasingly spilling over into smaller local roads. Hamlet centers also experience congestion and parking shortages.

Local mobility and connectivity are key. While traffic congestion was frequently cited as an issue, it appears that internal mobility and connectivity for local residents are the primary goals for alternative transportation in the East End. The Town of Southampton plans to circulate a questionnaire to local stakeholders on alternative transportation priorities; results from this questionnaire should inform alternatives development.

Transportation issues and needs differ across the East End. Each of the five communities has its particular transportation issues and preferences, and differences are also apparent within each community. To a large extent these differences are driven by different geographic situations and demographics. For example, residents of one town felt that connectivity between the North and South Forks was a major issue; residents of another town felt that it was not a significant issue. Shelter Island, as an island community, has its own unique set of concerns while also sharing in the some of the region-wide issues. Balancing needs across communities will be an important factor in developing and evaluating alternatives.

Interviewees are concerned about spillover parking impacts associated with ferries and beaches. Interviewees felt that ferry terminals and public beaches lack sufficient parking for peak demand, causing parking to spillover, often onto neighborhood streets. This contributes to local controversy over the provision of existing or additional ferry service.

Other common themes

- Open space preservation and scenic views are highly valued by local residents.
- Residents of the East End feel that their communities are different from the rest of the New York metropolitan area, and many believe that their needs are not a priority for the large regional agencies.
- A number of interviewees mentioned that link between housing affordability and congestion, citing the "trade parade" of domestic workers, members of the building trades, and others who work in the East End but cannot afford to live there. (This impression is largely borne out by the 2000 Census data on housing costs and journey-to-work data flows, as summarized above).

6. Next Steps

An understanding of existing conditions lays the foundation for development of alternatives. For this project, the five Towns Boards are asked to serve in and Oversight and Advisory role; and the East End Transportation Council (EETC) and 5TRT as Technical Advisory Group to review findings and provide feedback. Feedback from these groups will be solicited before advancing to the next stage of the project, alternatives development.

Once feedback on this report is reviewed, working with the Technical Advisory Group, a range of alternatives will be developed and evaluated. Previous work, such as the transportation scenario proposed by SEEDS and 5TRT's coordinated rail-bus network proposal, will be integrated into the range of alternatives developed. Based on the results of the evaluation, an alternative will be selected for further development. A concept of operations for that alternative will be developed. The alternative selected for further development will influence the parameters of the concept of operations, but it is anticipated to include institutional issues and constraints, access and intermodal opportunities, operations and management considerations, and financial sustainability.

7. Appendix I: Previous Studies

Over the past decade, many organizations have studied transportation and development on Long Island in general and in the East End in particular. The results of these projects set the stage for the current study and are briefly reviewed below.

New York MTC, Access to Transportation on Long Island, April 2007: Assessed the extent to which residents of Long Island have "adequate access to transportation" and presented recommendations for addressing outstanding needs and service gaps.

New York MTC, New York Region Area-Wide Interim Coordination Public Transit – Human Service Transportation Plan, November 2006: A regional plan for coordinating mobility services for residents with limited private transportation options. For the East End, the following were identified as the top-ranked service enhancements: extended transit service hours and improved service frequencies; subsidized jitney/taxi service and childcare transportation; transportation cooperative services and marketing; and promotion of carpools as a TDM strategy.

New York MTC, Long Island Sound Waterborne Transportation Plan, 2005: Examined the role of water transportation in improving regional mobility. Within the East End, the report suggested further study on landside enhancements at Orient Point and Montauk and on the potential for service between New Haven and the north shore of Long Island. A proposed seasonal "Inner Forks" water taxi service was analyzed but deemed to be non-viable due to excessive travel times, though a Sag Harbor-Orient ("Shelter Island bypass") route was suggested as meriting further study.

New York MTC, Regional Transportation Plan 2005-2030: Includes a Long Island Gateway concept with the following projects of relevance to the East End: Long Island Truck Intermodal facility in central Suffolk County; a Long Island Rapid Commute System (bus rapid transit with priority lanes); the SEEDS planning effort (see above); and the LISWTP (see below). (2005).

Town of East Hampton Comprehensive Plan. May 2005.

Five Town Rural Transit, Inc., survey and focus groups (June 2005): Gauged local public opinion on public transportation in the region and options for enhanced service. Measured opinions on the East End Shuttle concept.

Long Island Rail Road. ***Service Guidelines*****. November 2005.**

Update to the Town of Southampton Comprehensive Plan – Transportation Element – November 30, 2004

Town of Southold. ***Local Waterfront Revitalization Plan.*** **November 2004.**

Town of Riverhead Comprehensive Plan, November 2003

Long Island Rail Road, East End Transportation Study (2000): Analyzed existing conditions, issues with transportation in the East End, options and constraints for improving service. Recommendations included wayfinding signage, improved connections to SCT, service adjustments, supportive land use policies, marketing/promotion, and some medium- to long-term investments (e.g. new signal system and switches).

New York MTC, Long Island Transportation Plan 2000: Stakeholder-based process to develop mobility options for Long Island, with recommendations folded into the regional transportation plan (see below). Main components are LIRC, a bus rapid transit system with priority lanes; investments in LIRR and local bus improvements; selected roadway widening (including CR 39 in Southampton); intermodal freight center; bike and pedestrian amenities; travel demand management and traffic calming.

Sustainable East End Development Strategies, NYMTC report prepared by AKRF for the East End Supervisors & Mayors Association: **March 2002 (rev. March 2004)**: Strategy document for the year 2025, examining options for sustainable development and transportation in the region. Recommendations focus on changing land use policies to emphasize compact, transit-oriented infill development in village/hamlet centers; and investing in the transportation system, with an emphasis on improved transit and multimodal connections between hamlets, traffic calming, intersection improvement and access management, and improvements to pedestrian/bicycle facilities.

Town of Southold. DGEIS done for the Comprehensive Implementation Study

Shelter Island Comprehensive Plan. December 1993.

8. Appendix II: List of Interviewees

East End Transportation Council (EETC)
Neboysha Brashich (Southold-Town Transportation Commission Chair & EETC representative)

NYMTC
Kevin Wolford
Gerry Bogacz
Nancy O'Connell (EETC representative)

Long Island Rail Road
PamelaBurford
Scott Howell (EETC representative)
Gus Da Silva

Suffolk County Transportation
Robert Shinnick
John Murray (EETC representative)

Town of East Hampton
Marguerite Wolffsohn
JoAnne Pahwul (EETC Vice-Chair)
Brian Frank
Tara Burke

Town of Southold
Heather Lanza (EETC representative)
Karen McLaughlin

Town of Riverhead
Karin Gluth (EETC representative)

Town of Shelter Island
Kathy Petersen

Town of Southampton
Thomas Neely (EETC Chair)
William C. Jones

Town of Shelter Island
Jim Dougherty

Five Towns Rural Transit, Inc
Patricia Shillingburg
Vince Taldone

James Ellwood
Margaret Brown
Hank de Cillia
Kathy Cunningham Faraone
Tom Ruhle

Members of the Nassau-Suffolk Transportation Coordinating Committee and East End Supervisors' and Mayors' Association

Appendix B

Memorandum

U.S. Department
of Transportation

**Research and
Innovative Technology
Administration**

Subject: East End Coordinated Rail-Bus Network

Date: April 9, 2009

From: Sean Peirce, Volpe National Transportation Systems Center

Reply to Attn. of:

To: Tom Neely, Town of Southampton, and
Members of the Technical Advisory Group

This memo is an updated version of the analysis produced for the December 2008 meetings of the Technical Advisory Group. It is intended to provide a summary of the Volpe Center's initial feasibility analysis for the proposed coordinated rail-bus network, covering the following topics:

1. Service concept and assumptions
2. Rail service scenario, infrastructure and vehicle investments, operating costs
3. Bus service scenario, infrastructure and vehicle investments, operating costs
4. System-wide service characteristics
5. Ridership estimates
6. Overall summary

Information in this memo on infrastructure needs, vehicles, costs and ridership are initial, order-of-magnitude estimates produced by the Volpe Center's modeling work. Though a number of revisions have been made since December in response to feedback received and recent developments, these estimates should not be regarded as definitive. They are intended to support further planning and stakeholder discussion.

1. Service Concept and Assumptions

For the purposes of this analysis, the coordinated rail-bus network was assumed to include the following elements, based on the consensus of the TAG. The service parameters were listed in our memo of October 16, 2008, and are briefly summarized here:

- The existing public transit (rail and local bus) services in the five towns of the East End would largely be replaced by a coordinated rail-bus network. Some high-volume trains such as the Cannonball would continue, as would certain SCT bus routes running from Riverhead into western Suffolk County. Rail shuttle service would operate on the Ronkonkoma-Greenport and Speonk-Montauk lines, with onward connections to existing LIRR service. Bus services would be used to link the two rail lines, to provide service to areas beyond the rail network, and to provide "feeder" service from neighborhoods and major destinations into the closest rail stations. Bus lines would include a mixture of conventional fixed-route service, "flex" (route deviation) services, and/or flexible station shuttles.

- Bus and rail schedules would be structured to allow relatively short connections between services, ideally less than 10 minutes between each bus arrival/departure and rail arrival/departure, subject to the constraints of the overall bus service levels and scheduling.

- Service would run 7 days per week throughout the year. Bus and rail services would run every 60 minutes during off-peak hours and every 30 minutes during the peak hours of roughly 6-10 AM and 3-7 PM. The span of service would be 18 hours per day for about half the days of the year and 14 hours per day the rest of the year.

- Neither expanded park-and-ride facilities nor waterborne transportation would be part of the concept.

- Standard base fare would be $2.50 per trip, including free transfers between vehicles. A more detailed analysis of fare policies and options for fare media and collection will come later in the project.

2. Rail Service Scenario

Background

The rail component of the proposed rail-bus network includes a number of new (or re-opened) stations, and service every 30 to 60 minutes, for 14-18 hours per day, on both the Ronkonkoma-Greenport and Speonk-Montauk rail lines. As a first step in modeling this proposed service, the Volpe Center gathered data from the LIRR, including wayside layout diagrams showing the location and condition of tracks, stations, sidings, and other infrastructure.

Both the proposed service parameters and the LIRR infrastructure information were entered into Railroad Traffic Planner, a software package jointly developed by the Volpe Center and MIT for the Federal Railroad Administration. Railroad Traffic Planner allows service scenarios to be modeled and evaluated. Outputs from the software are intended for planning purposes only, not for implementation, but are sufficient for this initial modeling effort.

One of the main infrastructure limitations of the existing rail lines is that they are single track, so trains traveling in opposite directions can pass each other only at sidings. As more train service is added, this problem becomes more complex. The limited number of sidings must be used more intensively, creating delays in service as trains spend time waiting to pass rather than moving between stations.

Signaling, Communications, and Dispatch

These sections of track also lack the sort of signaling system that is necessary to ensure safety when multiple trains are operating in proximity to each other in both directions. At present, these rail lines have only a Manual Block System in place, with no active signaling. The current arrangements were not designed or intended to handle the dense two-way traffic that is envisioned for the rail-bus network, particularly the way single-tracked segments would be used for bi-directional operations.

There are several options for communications and train dispatching. In our view, Centralized Traffic Control (CTC) would be the most cost-effective options for safely controlling the trains. CTC uses a centralized train dispatcher's office that controls railroad switches and the signals that the operators must obey. The dispatcher has a map that identifies where all the trains are located in real-time. The system used for dispatching may contain some or all of the following attributes: track bulletins, track warrants, archive of information, playback and simulation capabilities, train describer, timetable generation, train

management and cab signaling, track data management, real-time and optimizing movements, interlocking and tower control.

The Volpe Center team spoke with staff members from the Utah Transit Agency (UTA), where a form of CTC is being used for a new commuter rail line that shares some characteristics with the Montauk and Greenport lines (single track with sidings, 30-minute peak service). CTC has worked well in this environment. CTC allows signals to be "interlocked," which is a means of ensuring that opposing trains cannot make unsafe movements. Another advantage of CTC is that it can readily be adapted to include Positive Train Control (PTC), a system that enhances safety through the use of onboard equipment that prevents unauthorized train movements. The federal Rail Safety Improvement Act of 2008 mandated the use of PTC on most U.S. railroads by 2015, though there are some exceptions and further analysis would be needed on specific requirements along the East End rail corridors.

Based on discussions with a vendor of CTC systems (GE Transportation), costs for installation of a CTC-based wayside signal system would be on the order of $100,000 per track mile for equipment and $75,000 per track mile for installation. This is equivalent to a total of $15.8 million for the two East End rail lines. This estimate includes the accompanying hardware and software for that would be needed for dispatch.

Electrification

LIRR electric service ends at Ronkonkoma and Babylon. Extending electrification eastward to Greenport and Montauk would potentially create a number of service advantages and long-term cost savings. Electric-powered vehicles have better acceleration properties and thus can make service runs more quickly; they do not need to stop for refueling; they are generally quieter and (depending on the source of the electricity) produce fewer emissions; and their operational costs tend to be lower over the long term. However, electrification is an expensive undertaking and initial modeling did not show a net cost savings compared to diesel operation over a 20-year payback period. The consensus of the TAG was also that planning for the rail component of the rail-bus network should assume diesel operation.

Additional Modeling Assumptions

The Volpe Center's model is based on the speeds and acceleration/deceleration characteristics of a typical passenger train. Modeling also assumed end-of-the-line turnaround times of at least 20 minutes and (to be conservative) dwell times of 2 minutes per station, though 60-90 seconds would typically be sufficient. Refueling stops were not built into the service schedule, because the rail vehicle that was chosen for modeling (see below) has a 600-gallon tank, which would ordinarily be sufficient for a day's operations. Therefore refueling was assumed to take place before or after the hours of revenue service.

Modeling Results

Software modeling results indicated that the current single-track rail configuration has sufficient capacity to handle the proposed level of service, provided that: (1) a total of seven sidings are added: at Medford, Quogue, Southampton College, Water Mill, and Wainscott stations, plus intermediate sidings between Yaphank and Calverton and in the Jamesport area; (2) rail services are carefully timetabled to allow trains to pass at the sidings, in some cases waiting longer than normal at stations so that the opposing train can clear, (3) CTC/PTC is used to manage overall traffic flow; (4) the sidings are upgraded with signal control and interlocking as discussed above; (5) freight movements are scheduled at off-peak times.

Additional sidings beyond those noted above would provide a greater safety margin and would increase operational flexibility, for example in allowing rail services to get back on schedule after a disruption. Otherwise, even small disruptions in service can create ripple effects throughout the day, as trains must wait at sidings for others to pass. When trains break down along sections of single track, major disruptions ensue that require cancelling service altogether and/or using buses to provide substitute transportation to the nearest unaffected station.

The model results also show that, given the travel and turnaround times involved, 6 trainsets would be needed on the Montauk line, and 9 on the Greenport line, in order to provide the intended level of rail service. The primary constraint driving the vehicle requirements is the need to provide 30-minute service during peak hours, and the greater requirement on the Greenport line reflects differences in the spacing of stations and the track speed restrictions in place.

Travel times would be comparable to existing LIRR service, except that some runs are slightly longer because of the way timetables need to be adjusted to prevent trains from meeting at places other than sidings. The modeled schedules are reproduced in Figure 1 for reference, though these should not be regarded as anything other than conceptual at this point. Times can be adjusted based on input from the TAG, though some changes would require an extra train on the line.

Rail Vehicle Options

Light rail vehicles are often considered when rail services are marked by frequent departures and modest passenger volumes. However, light rail cannot be used in this case due to federal railroad safety rules that prohibit light rail vehicles from sharing tracks with heavy rail – namely, the LIRR service and freight trains that would continue to use the lines east of Speonk and Ronkonkoma. (Although it is possible to obtain waivers from the Federal Railroad Administration, that appears unlikely in this case due to the high rail traffic volumes and single track.) Light rail is also more typically associated with electric power, though there are some examples of diesel-powered systems.

Diesel multiple units (DMUs), also known as railcars, are self-propelled rail vehicles that do not require a separate locomotive. DMUs are in service in Portland, Oregon's Westside Express line and the South Florida Tri-Rail system, and have been under consideration by other rail agencies. DMUs were identified as a vehicle option by the TAG, and in our opinion, they are a logical choice for the East End rail service given the mileage and expected passenger volumes. DMUs allow flexible configurations and typically have lower costs on a per-seat basis than conventional trainsets that use a locomotive to pull coaches. Operating at about one mile per gallon, DMUs are roughly twice as fuel-efficient as conventional locomotive operation.

DMUs can operate on their own or pull multiple passenger coaches, though acceleration can suffer when more than one coach is added. DMUs and coaches both come in single- and bi-level versions; however, most bi-level cars are too high for some of the highway bridges on the East End rail lines. Typical seating capacities are 94 passengers for a single-level DMU and 102 for a single-level coach. At the outset of service, the recommended trainset configuration is a single DMU for low-volume runs and a consist of one DMU pulling one coach on higher-volume runs. (Additional coaches could be added over time if needed to accommodate ridership.)

Selection of a particular vehicle model or vendor is beyond the scope of the current analysis, but there are a number of relevant factors and recent developments to consider even at this initial phase. Until recently, Colorado Railcar Manufacturing LLC was the only manufacturer of DMUs that are FRA-

compliant, that is, that meet crashworthiness guidelines allowing them to share track with conventional heavy rail vehicles. This company halted business operations in late December 2008, creating significant uncertainties about the availability of DMUs. Since a number of transit systems around the country are seeking DMUs for planned system expansions, there is some expectation in the passenger rail community that another manufacturer may step in with an FRA-compliant design. Indeed, some manufacturers are already at work on this, though it may be several years before any such vehicles are available.

The TAG has noted that another option that could be explored is refurbished Budd cars (RDCs). These are self-propelled diesel railcars that were commonly used in the 1950s and 1960s for regional rail service. They are still in use on a handful of services in North America, including the Trinity Railway Express (TRE) commuter rail line in Dallas-Ft. Worth, where they are typically used for lower-volume mid-day trains. Fully refurbished cars are taken down to the steel shell and fitted with new engines, transmissions, electrical systems, climate control, and interiors. These refurbished vehicles have seating capacities comparable to the single-level Colorado Railcar DMU, are FRA-compliant, and should have service lifetimes that are comparable to other rail vehicles. While not originally designed with the Americans with Disabilities Act (ADA) in mind, it is possible to refurbish the cars with an accessible design. In some cases this may require other modifications, such as to station platforms. For example, the TRE provides wheelchair access to its Budd cars using a metal bridgeplate that is manually lowered to cover the gap between the train and a section of raised platform.

Based on the schedule modeling results above, it is assumed that 6 railcars would be needed on the South Fork line and 9 on the North Fork line, plus two spares that can be used during periods of repair, for a total of 17. Six additional coaches are assumed for the purpose of accommodating passengers during high-demand periods. For rough cost estimation, we used Colorado Railcar's list prices as of December 2008: $6.5 million per DMU and $3.5 million per coach. For the Budd car option, we used a figure of $2.0 million per refurbished vehicle, based on prior published estimates[1], which were consistent with an informal cost estimate received by the TAG from a prospective vendor.[2] These figures yield total rail vehicle acquisition costs in the range of $46.0 million to $114.5 million. Both figures should be used with some caution given the lead times associated with acquiring either type of rail vehicle and the potential uncertainties about availability and unit costs. It is worth noting that a conventional locomotive-plus-coach arrangement could also be used, and that often rail vehicles can be leased rather than purchased if that better aligns with the transit agency's institutional and financial framework.

Operational Costs

Operational costs include fuel and maintenance and the labor costs associated with operating and dispatching vehicles and collecting fares. According to the National Transit Database, the average cost of operating commuter rail is $424 per vehicle-hour of revenue service. (For the LIRR, the average is $490.) Since the proposed rail service is equal to approximately 45,000 annual vehicle-hours of service, an initial rough estimate of operational costs is $19.0 million per year, using the lower national average figure. In light of the fuel-efficiency of DMUs, actual costs could be slightly lower than the national average, though this would also tend to be offset by the relatively high labor costs in the New York metropolitan area.

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[1] See, e.g., the *Marin County Commuter Rail Implementation Plan* (http://www.co.marin.ca.us/depts/pw/main/rail/rail.cfm), 2004. These estimates, in turn, were based on an approximate cost of $1.8 million per vehicle for refurbished Budd cars acquired in 1995 by the Trinity Railway Express (TRE) system in Dallas-Ft. Worth.

[2] To be clear, this vendor is not the only potential source of refurbished Budd cars. One complicating factor is that several of the firms in this business, including the one contacted by the TAG and the one used in 1995 by TRE, are located in Canada. The Buy America Act requires that transit rolling stock, if acquired using any federal funding, must have 60 percent U.S. content and must have final assembly in the U.S.

Based on the mileage of the proposed service, the fuel economy of the DMUs, and the current price of diesel, the fuel component would only be about one-fourth of the total cost, or around $4.5 million per year, and most of the rest would be labor for operations, maintenance, dispatching, and fare collection. As recent experience has shown, fuel costs are also subject to substantial fluctuation based on the price of diesel. Conventional locomotive-drawn service would typically have slightly higher fuel costs.

Rail Investment and Costs

As discussed above, a total of seven passing sidings would be required to maintain safe bi-directional operation. Relatively short sidings will suffice due to the small size of the trainsets and the limited freight movements. Each siding would be approximately one-quarter mile in length and cost about $500,000. This is based on Utah Transit Authority's recent costs of roughly $350 per foot of track, though UTA notes that recent increases in the price of steel might translate into higher prices.

Each existing and new siding would also require an electronic switch (rather than manual) to ensure safety and compatibility with the CTC operating environment. Costs are estimated at $75,000 per switch (again based on discussions with a vendor, GE Transportation) for each of 20 sidings, for a total of $1.5 million.

The rail vehicles would also require arrangements for storage, maintenance, and repair work and a means (fixed or mobile) of refueling. Depending on the institutional arrangements for the service, it may be possible to use existing LIRR facilities for these functions, though their distance from the East End would mean a longer time out of service, and the railcars (whether Colorado Railcar or Budd) represent a different vehicle type from all existing LIRR rolling stock. The LIRR has also noted that storage space at Ronkonkoma and Speonk is fully subscribed. One potential alternative, at least in the near term, would be to store vehicles overnight at the passing sidings on each line, and to use a "mobile rail shop" (a truck equipped to conduct repairs on rail vehicles) for maintenance. The current practice of mobile fueling could also be continued.

Over the longer term, at least one dedicated storage and maintenance facility (and possibly two, one for each line) would likely be required, with the costs dependent on the size and mix of functions. Based on recent Volpe Center experience with rail projects for the U.S. Army, construction costs for a rail maintenance facility would be on the order of $15 million. However, other TAG members cited figures closer to $35 million for recent LIRR facilities of similar scope. The $35 million figure will be used for cost estimation purposes here in order to conservatively reflect the potentially high land, labor, and materials costs that prevail in the New York area (as well as the possible need for a second facility). Further precision will require additional analysis and consultation with the LIRR.

New and Re-Opened Stations

This initial analysis assumes that infrastructure investments will be made to (re-)open the following stations: Calverton, Quogue, Southampton College, Water Mill, and Wainscott. This work would include, at a minimum, the construction of ADA-compliant boarding platforms and space for passenger waiting and/or ticket vending machines. Based on similar projects at other commuter rail agencies, typical costs for new stations range from $250,000 for a very basic platform to $2 million or more for a station with a covered waiting area, lighting, and other amenities. (Recently opened stations along the UTA line were in the range of $1.5 million, though this included 10-car platforms, canopies, and a snowmelt system.) Additional costs would be incurred for parking lot resurfacing or other site improvements, and the actual cost could vary substantially based on current site conditions. For modeling purposes, fairly basic stations at $1,000,000 each are assumed. This represents a modest investment for

accessible platforms and shelters. It excludes costs for the construction or renovation of a station building and any land acquisition costs. Land ownership around former and existing LIRR stations is divided among numerous public and private entities, and it is possible that some land purchases could be required for expanded rail service and/or connecting bus operations.

Issues Identified in Modeling

The effects of running the Cannonball service (and other high-volume seasonal trains) on the South Fork have not yet been specifically modeled in the Railroad Traffic Planner software. However, since these seasonal trains can carry in excess of 1,000 passengers, it is clear that the smaller-capacity railcars envisioned in this scenario would be insufficient for the passenger volumes, making a transfer at Speonk impractical. Indeed, on a busy summer Friday, as many as seven eastbound trains arrive on the South Fork carrying more than 500 passengers each. To allow the Cannonball and other high-volume trains to continue past Speonk on the single track, several of the proposed local train runs would need to be cancelled during these periods (Thursdays, Fridays, and Sundays roughly from May to September).

The Cannonball would presumably still be available for local travel between South Fork hamlets, and/or substitute bus service could be implemented as necessary. Further analysis of this issue can be pursued in the next phase if desired. Freight train movements, though limited, would also need to be scheduled at off-peak times to ensure separation from passenger trains. Further modeling would also be needed to assess the impacts of the expanded passenger service on grade crossings and noise.

Rail Cost Summary

Item	Unit Cost	Quantity	Total
Rail Vehicles			
DMU Railcar Single-level	$ 6,500,000	17	$ 93.5 million
DMU Coach Single-level	$ 3,500,000	6	$ 21.0 million
-- OR --			
Rebuilt Budd RDC	$2,000,000	23	$46.0 million
Infrastructure			
Railroad siding (1/4 mile)	$ 500,000	7	$ 3.5 million
CTC	$ 175,000	90	$ 15.75 million
Switches	$ 75,000	20	$ 1.5 million
Maintenance / repair facility	$15 – $35 million	1-2	$35.0 million
ADA retrofit -- New / reopened stations	$ 1,000,000	5	$ 5.0 million
Total Rail Capital Costs			**$106.75 million to $175.25 million**
Annual Operating Costs	$ 424 per vehicle-hour	45,000	**$ 19.0 million**

3. Bus Service Scenario

Background
Compared to current SCT bus services, the bus component of the rail-bus network represents a change in approach: many of the proposed bus routes are designed to feed into the rail system (with coordinated transfers) rather than provide end-to-end transportation. Several of the proposed routes have also been assumed to incorporate elements of demand-response or "flex" service.

Modeling Assumptions
The Volpe Center modeled the proposed bus routes using the service parameters noted above (hourly service for 14-18 hours per day, with half-hourly service during morning and afternoon peak periods). Travel times were estimated using existing SCT route travel times, where applicable, as well as posted roadway speeds. Additional recovery time of approximately 20 percent (a figure commonly used in bus transit planning) was built into the schedule to allow for variations in traffic congestion and the number of passengers boarding and alighting. Travel times and schedules will need to be updated based on actual travel conditions, and in some cases, it may be desirable to have the scheduled travel times vary by time of day or season based on ridership and traffic conditions.

Route Descriptions
The table below summarizes the modeling of the proposed bus routes, including travel characteristics, the recommended number of peak and off-peak vehicles, and the frequency of service that can be provided with those vehicles. (For fixed-route services, "average" wait time is one-half of the scheduled frequency, based on randomly timed arrivals at the bus stop; in practice many riders will time their trip based on the schedule so as to wait less.)

The Volpe team also made initial assumptions about whether each route should be structured as a conventional fixed-route service, a fixed route with an option for "flex" (deviation), or a demand-response

service. These initial determinations were based on the characteristics of the service area, likely passenger origins and destinations, running times and mileage, and vehicle availability.

In general, bus services that are envisioned as "feeders" to rail stations were designed as flexible, demand-response shuttles that serve points within a 3-mile radius from the station on request. The 3-mile radius reflects the approximate area that a single bus can serve for both dropping passengers off and picking passengers up from the train station during periods of half-hourly train service. (These service areas can be expanded geographically by meeting a train in only one direction or by providing hourly service during off-peak periods.) This form of on-demand service was chosen for modeling because it aligns well with the fact that many trips will start or end at the train station but are otherwise geographically dispersed. Several transit agencies around the country have also found that introducing new services as demand-response helps to identify the areas of greatest demand, which can then be converted into a fixed route later.

Most of the other bus routes provide service to areas beyond the rail lines, such as to Orient Point, Sag Harbor, and Wading River, and generally have been modeled as conventional fixed-route services. The Shelter Island route is recommended for flex service during the off-peak periods, as the island's layout allows broad coverage without additional vehicle requirements. Other routes, including those serving East Hampton, may be good candidates for flex service; however, this could increase waiting times for passengers who are connecting with the rail service. On the route map in Figure 2, fixed route service is shown as colored lines, with each color representing a different route. Demand-response shuttles are shown as circles around rail stations with approximate service radii. The shaded area on Shelter Island represents the approximate area for off-peak flex service.

The number of buses identified as necessary for each route is generally a function of the number required to provide service with wait times of no more than 30 minutes during peak periods and 60 minutes off-peak (except Hither Hills to Montauk, which is scheduled every 65 minutes in the off-peak). Schedules and vehicle requirements can be adjusted so as to minimize the wait time for passengers connecting between bus and rail. However, for most bus routes, establishing bus service with tight connections for boarding *and* alighting rail passengers, eastbound *and* westbound, would have required more than three times as many vehicles as listed in the table. The Volpe team therefore used its judgment in assigning vehicles to routes so as to strike a balance between rail-bus coordination and overall cost-effectiveness, typically selecting a number of vehicles that will allow good connections in the "peak" or predominant travel direction only. For example, the demand-response shuttles are modeled using only one vehicle; these would typically be timed to bring passengers to peak-direction trains in the morning and collect returning passengers from peak-direction trains in the afternoon. Travelers going in the off-peak direction would face longer wait times. Note also that extra vehicles have been assigned to the Riverhead-Hampton Bays route during peak periods to reduce waiting times on this important link between the two rail lines. In this case, tight timetabling with both the North and South Fork train connections was not feasible, so extra service was added so that bus wait times do not exceed 15 minutes.

Table 1. Bus Route Summary

Route	Round Trip/ Loop Distance *miles*	Time allowed for Round Trip *min.*	Off-Peak Buses	Off-Peak best frequency *min.*	Peak Buses	Peak best frequency *min.*	Service Notes (services are fixed-route unless noted)
Greenport RR - Orient Pt via Hospital	19.2	50	2	25	2	25	
Shelter Island	8.8	25	1	25	1	25	Flex during off-peak
Riverhead – Jamesport	12.8	50	1	50	2	25	
Riverhead RR -Wading River	24.0	65	2	33	3	22	
Riverhead RR - Hampton Bays RR	18.0	70	3	24	5	14	
Riverhead -Westhampton RR	17.5	55	1	55	2	28	
Riverhead Circulator A	11.6	60	1	60	2	30	Flex during off-peak
Riverhead Circulator B	8.4	45	1	45	2	23	Flex during off-peak
Bridgehampton RR - Sag Harbor - North Haven	16.2	50	1	50	2	25	
East Hampton - Sag Harbor - North Haven	22.2	60	1	60	2	30	
Noyak – Bridgehampton	25.8	85	2	43	3	29	
Southampton - North Sea	10.2	45	1	45	2	23	
East Hampton – Wainscott	8.8	25	1	25	1	25	
East Hampton - Cedar St, Stephen Hands Path, Springy Banks Rd	8.7	30	1	30	1	30	
East Hampton - Springs Fireplace Road, Three Mile Harbor Rd	12.6	40	1	40	2	20	
East Hampton - Accobonac Road	11.3	40	1	40	2	20	
Montauk RR to dock & village	10.0	55	1	55	2	28	
Amagansett - Napeague via Montauk Hwy (seas.)	12.6	40	1	40	2	20	
Hither Hills to Montauk light via village (seasonal)	21.2	65	1	65	3	22	
Southold shuttle A	6.0	20	1		1		Demand response
Southold shuttle B	6.0	20	1		1		Demand response
Mattituck shuttle A	6.0	20	1		1		Demand response
Mattituck shuttle B	6.0	20	1		1		Demand response
Speonk station-village shuttle	6.0	20	1		1		Demand response
Westhampton station-village shuttle	6.0	20	1		1		Demand response
Quogue station-village shuttle	6.0	20	1		1		Demand response
Southampton station-village shuttle	6.0	20	1		1		Demand response
Bridgehampton station-village shuttle	6.0	20	1		1		Demand response
Wainscott station-village shuttle	6.0	20	1		1		Demand response
Hampton Bays Shuttle	6.0	20	1		1		Demand response

The Greenport – Orient Point bus route provides a good example of the trade-offs involved in determining bus requirements and setting schedules. It is estimated that it will take a bus 20 minutes to travel between Greenport and Orient Point. On the schedule below, an extra 5 minutes has been added each way in order to provide some slack time in the schedule in case of traffic congestion or extra time needed to board passengers.

The Greenport-Orient Point route is unusual in that the bus has transfer points on both ends – the ferry terminal on the eastern end and the Greenport rail station on the western end. Connecting with a terminal rail station like Greenport is more straightforward than with an intermediate station, since all passengers will be alighting from the eastbound service and boarding the westbound trains. Ideally at a minimum of five minutes would be provided between the boarding and alighting of each leg of the trip, to allow even the slowest passengers to transfer without rushing. In some cases in the example below, however, only two minutes is scheduled between some eastbound trains and the bus' departure from Greenport due to the interactions between the train, bus, and ferry schedules.

This schedule provides half-hourly service through the off-peak midday hours. This is more than the service requirements laid out by the TAG. However, without the second bus, connections could be made in only one direction. In other words, if the second bus (shaded rows in the table) were removed, westbound passengers could not make either the ferry to bus connection or the bus to rail connection. In this case, with a 50-minute round-trip travel requirement, the bus has an extra 10 minutes each trip in which it waits at the Greenport rail station. This extra time allows a single vehicle to drop off passengers for the westbound train and then wait for passengers alighting the eastbound train. Not all routes will be amenable to such coordination. Had the route required an extra five or ten minutes, an entirely different solution to the schedule would have to be developed, likely missing more connections or adding significantly more vehicles.

Table 2. Sample Schedule for Greenport – Orient Point Route

Train Arrives Green-port	Time to catch bus from train	Bus Departs Greenport	Bus Arrives Orient Point	Time to catch ferry from bus	Ferry Leaves Orient Point	Ferry Approx Arrival Orient Point	Time to catch bus from ferry	Bus Departs Orient Point	Bus Arrives Green-port	Time to catch train from bus	Train Departs Green-port
											4:00
											5:00
											5:28
		6:00	6:25				6:25	6:25	6:50	0:10	7:00
6:28	0:02	6:30	6:55	0:05	7:00			6:55	7:20	0:10	7:30
6:58	0:02	7:00	7:25				7:25	7:25	7:50	0:10	8:00
7:28	0:02	7:30	7:55	0:05	8:00			7:55	8:20	0:10	8:30
7:58	0:02	8:00	8:25			8:20	0:05	8:25	8:50	0:10	9:00
8:28	0:02	8:30	8:55	0:05	9:00	8:50	0:05	8:55	9:20	0:10	9:30
8:58	0:02	9:00	9:25	0:05	9:30	9:20	0:05	9:25	9:50	0:10	10:00
9:28	0:02	9:30	9:55	0:05	10:00			9:55	10:20	0:10	10:30
9:58	0:02	10:00	10:25			10:20	0:05	10:25	10:50	0:10	11:00
10:28	0:02	10:30	10:55	0:05	11:00			10:55	11:20		
		11:00	11:25			11:20	0:05	11:25	11:50	0:10	12:00
11:24	0:06	11:30	11:55	0:05	12:00			11:55	12:20		
		12:00	12:25			12:20	0:05	12:25	12:50	0:05	12:55
12:24	0:06	12:30	12:55	0:05	13:00	12:50	0:05	12:55	13:20		
		13:00	13:25	0:05	13:30	13:20	0:05	13:25	13:50	0:10	14:00
13:24	0:06	13:30	13:55	0:05	14:00			13:55	14:20		
		14:00	14:25			14:20	0:05	14:25	14:50	0:10	15:00
14:24	0:06	14:30	14:55	0:05	15:00			14:55	15:20		
		15:00	15:25			15:20	0:05	15:25	15:50	0:10	16:00
15:24	0:06	15:30	15:55	0:05	16:00			15:55	16:20		
		16:00	16:25			16:20	0:05	16:25	16:50	0:10	17:00
16:24	0:06	16:30	16:55	0:05	17:00			16:55	17:20	0:10	17:30
16:58	0:02	17:00	17:25	0:05	17:30	17:20	0:05	17:25	17:50	0:10	18:00
17:28	0:02	17:30	17:55	0:05	18:00			17:55	18:20	0:10	18:30
17:58	0:02	18:00	18:25			18:20	0:05	18:25	18:50	0:10	19:00
18:28	0:02	18:30	18:55	0:05	19:00			18:55	19:20	0:10	19:30
18:58	0:02	*19:00*	*19:25*			*19:20*	0:05	*19:25*	*19:50*	0:10	*20:00*
19:28	0:02	*19:30*	*19:55*	0:05	*20:00*			*19:55*	*20:20*	0:10	*20:30*
19:58	0:07	*20:05*	*20:30*	0:15	*20:45*	*20:20*	0:10	*20:30*	*20:55*	0:05	*21:00*
20:28	0:07	*20:35*	*21:00*	0:15	*21:15*	*21:20*	0:10	*21:30*	*21:55*		
20:58											
21:28	0:27	*21:55*	*22:20*					*22:20*	*22:45*		
22:28	0:17	*22:45*	*23:10*					*23:10*	*23:35*		
23:28											
Bus 1		*trips and connections in italics do not run on during the low-season.*									
Bus 2		**connections in bold are not met by bus**									

A second example of scheduling complexity can be seen in the services provided to North Haven via Sag Harbor from Bridgehampton and East Hampton. It is estimated that the round trip to North Haven will require 60 minutes from East Hampton but only 50 minutes from Bridgehampton. A schedule that used all vehicles as efficiently as possible would provide 30-minute service on the East Hampton route and 25-minute service on the Bridgehampton route. While this provides the best possible service to the train stations, it provides erratic service between North Haven and Sag Harbor, where waits could range from 5 to 25 minutes during the peak period and as long as 50 minutes mid-day. If instead, the Bridgehampton buses wait an extra 10 minutes at the Bridgehampton Station on each run, the timing of the two services would be harmonized, and could alternate evenly to provide much more regular service between North Haven and Sag Harbor.. This would reduce the number of trips provided on the Bridgehampton route by 5 trips per day, or 17%, but with only minor cost savings since the driver would still work the same number of hours.

Bus Investment and Costs

Modeling results indicate that 52 buses would be needed to provide the proposed service. This reflects a minimum of one bus per route plus additional vehicles as necessary to achieve the desired 30-minute headways during peak periods. Spare vehicles are also needed to allow for replacements while buses undergo repair or routine maintenance. Typical rules of thumb are that routine maintenance is needed every 5,000 miles and that 15 to 20 percent of vehicles should be kept as spares. Spare vehicles at SCT and MTA Long Island Bus are in the 18 to 19 percent range according to the National Transit Database. This analysis assumes that 10 buses would be kept as spares, for a total of 62 buses.

Compared to the current SCT bus service, buses on the rail-bus network would largely travel on shorter routes that are focused on the rail stations. As such, and given the relatively low expected passenger volumes per trip and the need to negotiate smaller streets in village centers and residential neighborhoods, the Volpe team recommends using smaller, "cutaway" vehicles that seat 20 to 30 passengers. These vehicles are generally built as bus frames mounted on a truck chassis, and are available from numerous manufacturers with many different configurations and options. Further analysis of specific vehicle options can be part of the next phase of research. At this stage, the vehicle used for cost-estimation purposes is a 28-passenger, medium-duty, ADA-compliant shuttle bus with a hybrid-electric motor. Using prices available through the federal General Services Administration, the vehicle cost including a standard array of options is approximately $300,000. Total bus purchase costs would thus be $18.6 million including spares.

The bus service would also require an operations center, including a call center to take reservations for the on-demand and flex services, a bus refueling center, and a bus storage yard. Based on cost figures from USDOT's Intelligent Transportation Systems Cost Database, and recent experience with the Cape Cod RTA, a call center and refueling station is estimated at roughly $7 million, plus land acquisition costs (if applicable). The exact facility requirements would depend on the institutional arrangements used for providing the service. For example, a contractor might provide some of these services as part of the contract for service, in which case the capital costs would be lower but the costs would be included in the contract fee. For cost estimation purposes, this center can be assumed to double as the dispatching center for the rail operations and the home of the CTC hardware.

Upfront costs related to fare collection will also depend on institutional arrangements, the fare policy that is implemented, and the fare media used. For example, a self-service "proof of payment" system involves higher upfront costs for ticket vending machines, but can reduce the labor costs of enforcement. Regional integration (i.e., a single farecard that is valid both on the East End and in the New York City area) would be convenient for customers, but would likely require fare collection hardware and software that are

compliant with the MTA's systems. At this stage, no specific costs for fare collection hardware are included, but this issue can be addressed in the next phase of research.

Turning to operational costs, SCT's average operating cost per vehicle-hour is $89.42, compared to an average of $122.70 for the nation's 50 largest transit agencies. Operating costs for the bus portion of the rail-bus network are estimated using the lower SCT figure and the number of vehicle-hours of proposed service: 247,372 vehicle-hours per year. This produces an estimated $22.1 million in bus operating costs.

The cost estimate also needs to include non-direct costs for contract administration and oversight, service planning, accounting, auditing, legal services, property management, public affairs, marketing, and related activities. These costs will vary depending on the institution that manages the service. As a point of comparison, the Transportation Division of the Suffolk County Department of Public Works, which oversees SCT bus service, has roughly 17 staff positions at an annual cost of around $1.5 million, plus $2 million for insurance and other items. Although SCT has a larger service area than just the East End, managing the rail-bus network could be more resource-intensive due to its multi-modal nature and the need for close coordination of timetables. As a rough estimate, $5 million per year has been assumed for the rail-bus network's administrative costs, including a small office staff, insurance, and other expenses. These costs would be higher if the service is provided directly rather than contracted out, because additional functions such as human resources would be required.

Other Issues Identified in Modeling

The need for buses to meet fixed railroad timetables means that additional time must be built into their schedules to allow for transfers, plus schedule-recovery time to ensure that traffic delays on the route do not result in a missed train connection. As a result, the bus fleet would be used less intensively than under a conventional bus system, and more vehicles are needed for a given level of service. In meeting a half-hour train service, each bus might spend 20 or even 30 minutes out of each service hour waiting at the train station for passengers going to and from the train.

Bus Cost Summary

Item	Unit Cost	Quantity	Total
Medium-Duty Bus	$ 300,000	62	$ 18.6 million
Call center / refueling station / rail control center	$ 7,000,000	1	$ 7.0 million
Total Bus Capital Costs			**$ 25.6 million**
Annual Operating Costs	$ 89.42 per vehicle-hour	247,372	**$ 22.1 million**

4. System-wide service characteristics

The proposed rail and bus services have been laid out on the map in Figure 2 to allow for a more holistic view of service in the region. Table 3 shows the differences in travel characteristics between the current and proposed systems for a number of sample itineraries within the East End. The map and table highlight some of the key ways in which the proposed rail-bus network differs from the existing public transportation system:

- **Most obviously, both the geographic extent of transit coverage and the frequency of service are greatly increased.** Overall service frequencies are similar to the existing S-92 bus route, with departures every 30 to 60 minutes, but with a longer window of peak service, peak service in both directions, and a greater overall daily span of service. Most transit trips in the region would be faster and more frequent. Each area of the East End with existing transit service would continue to have service (possibly under a different form, such as an on-demand station shuttle). For areas off the S-92 route, such as Montauk, Springs, Noyac, North Sea, and Westhampton, the level of transit access would be greatly increased – from as little as 4-5 buses per day (or none, in the case of Shelter Island) to service every 30-60 minutes.

- **It is expressly designed as a multi-modal system, with timed connections between services, rather than rail and bus modes operating more or less independently.** In addition to connectivity, the advantage to this approach is that it allows much of the trip mileage to take place by rail rather than by bus, which means more reliable travel times, particularly during peak congested periods. However, the hub-and-spoke orientation means that transfers are required for almost all longer trips other than hamlet-to-hamlet trips along the same rail line. A trip between Sag Harbor and Greenport is currently a two-hour but one-seat ride on the S-92; this trip would become much faster (45-minute) with the rail-bus network, but would require four vehicles: a bus to North Haven, the South Ferry, the Shelter Island bus, and the North Ferry. Even with well-coordinated connections between bus and rail services, some transfer time and waiting is inevitable, which means that some trips will take longer than with the current system. For example, a trip from the Mattituck area to Eastern Long Island Hospital, both of which are currently on the S-92, would require taking a train to Greenport and then connecting to a bus for the last mile of the trip, adding at least 5-10 minutes to the journey even if the rail-bus coordination is fairly precise. The emphasis on limited-stop rail service also means that major employment destinations that are located outside of hamlet centers may not be as accessible as with the current bus route structure.

- **The bus-rail network improves access to New York City and other areas beyond the East End, but does not address many of the existing LIRR schedule issues.** The network would provide frequent service to the LIRR stations at Speonk and Ronkonkoma, where onward connections could be made. This would also help ease the parking crunch at Ronkonkoma. However, significant gaps in the train schedules would continue, particularly at Speonk. Although East End trains may arrive in Speonk every 30-60 minutes, there could still be a space of several hours in the LIRR schedule for onward travel to New York. The situation is somewhat better at Ronkonkoma, but even here, the East End's schedule (regular 30-60 minute service) does not always align well with the LIRR service, which has many trains clustered tightly in the AM peak, but then larger schedule gaps during the rest of the day. As summarized in the table below, existing North Fork train commuters may find that the more frequent service to Ronkonkoma brings with it the trade-off of longer layovers there.

Summary of Ronkonkoma Connections – Weekday Mornings Westbound

Based on Draft Rail Schedules in Figure 1 and Current LIRR Schedule

East End Train Departs Greenport	East End Train Arrives Ronkonkoma	Layover to next LIRR	LIRR Departs Ronkonkoma
4:00	5:52	0:16	6:08
5:00	6:52	0:04	6:56
5:28	7:17	0:02	7:19
7:00	8:52	0:19	9:11
7:30	9:22	0:49	10:11
8:00	9:52	0:19	10:11
8:30	10:22	0:49	11:11
9:00	10:52	0:19	11:11
9:30	11:22	0:49	12:11
10:00	11:52	0:19	12:11

Table 3. Comparison of travel times and connections for selected East End trips.
All travel times are approximate and are based on current and proposed schedules and average connection times.

	Current Transit System				Proposed Rail-Bus Network			
Trip	Service/ Route	Service Level	Travel Time	Trans-fers	Service/ Route	Service Level	Travel Time	Trans-fers
Jamesport to South-ampton	S-92	17 trips/ day	0:55	none	bus to Riverhead, bus to Hampton Bays, train to South-ampton	Approx. 25 trips/ day	1:20	2
Hampton Bays to East Hampton	S-92 or LIRR	17 buses & 3-4 trains per day offpeak	39-55 min.	none	train	24 trips / day	39 min.	none
Sag Harbor to Greenport	S-92	Every 30-60 minutes	1:50 to 2:00	none	Bus to North Haven, South Ferry, Shelter Is. bus, North Ferry	Every 30-60 minutes	45 min.	3
Orient Point to downtown Riverhead	S-92	Every 30-60 minutes	1:05	none	bus to Greenport, train to Riverhead	Every 30-60 minutes	1:10	1
Noyac to Amagan-sett	10A to S-92 to 10C, or 10A to LIRR	5 buses/ day from Noyac	2 to 3+ hrs	1 - 2	bus to Bridge-hampton RR, train to Amagansett	Every 30-60 minutes	1 hour	1
Springs to S'hampton College	10B to S-92, or connect to 10A	8 buses/ day from Springs	1:10 to 1:40	1-2	bus to EH RR, train to College	Every 30-60 minutes	50-60 minutes	1
Montauk Village to Tanger Outlets	10C to S-92 to 8A	4 buses/ day on 10C btw Montauk & East Hampton	4 hours	2	Bus to Montauk RR, train to H. Bays, bus to Riverhead, bus to Tanger	Every 30-60 minutes	2:15 to 2:30	3

5. Ridership Estimation

Ridership for the proposed rail-bus network as a whole is estimated below using a combination of analytical methods. This is intended only as an initial rough estimate range that can be used to enable stakeholder evaluation of the system's potential usage and cost-effectiveness.

The primary estimation approach is based on the relationship between public transit ridership and service provision. As common sense would dictate, ridership generally increases as the level of transit service increases: more service means shorter average waiting times, and potentially a greater number of destinations served by the transit system, both of which make transit more attractive relative to driving or other alternatives (or forgoing the trip altogether). By comparing current ridership and current service levels to the level of transit service envisioned in the rail-bus network, an estimate of ridership for that proposed transit system is produced. As a check on this method, the results are compared against other sources of information, including findings from the South Fork Commuter Connection; Census journey-to-work data on transit mode share and travel patterns in the region; and estimates of potential transit ridership increases from the modeling effort pursued as part of the SEEDS process. Results from a telephone survey on transit sponsored Five Town Rural Transit (5TRT) are also discussed to provide further context.

Baseline: Current East End Transit Ridership

Current transit ridership in the East End is split across agencies and modes (SCT and LIRR), with different ridership counting procedures and little information about the number of passengers transferring between modes. For some services (e.g. westward bus routes from Riverhead), the ridership figures also include some non-East East travelers. A reasonable estimate of current ridership can nonetheless be generated by applying some basic assumptions to the reported ridership figures from SCT and the LIRR.

Ridership counts conducted by SCT in 2006 yielded estimates of annual ridership as follows:

Route(s)	Estimated Annual Ridership
S-92	403,296
S-94	535
8A	45,760
10A	11,114
10B	42,917
10C	44,149
10DE	3,797
S-90	19,303
S-62	141,691

In building an estimate of current East End Ridership, ridership figures on the S-90 and S-62 routes were adjusted for the fact that these buses go beyond the five East End towns and therefore transport passengers who have neither an origin nor a destination within the East End. As a simplifying assumption, 80 percent of the S-90 ridership and 20 percent S-62 ridership was considered local to the East End. Including the effects of this adjustment, SCT bus ridership within the East End is estimated at approximately **600,000** one-way trips per year. Fully two-thirds of this total comes from the S-92 route. (Note that these counts represent "unlinked" trips; in other words, someone who rode the 10C and then transferred to the S-92 would be counted on both routes. This is the most common way to measure transit ridership, but can present difficulties when trying to measure complete itineraries.)

Estimates of LIRR ridership are based on "station counts" conducted in 2006 of passengers boarding and alighting at each East End station. These counts were mostly conducted between April and June, and showed a total of 480 boardings and alightings per day, equivalent to 240 round-trip passengers. Translating these figures into annual totals requires a number of assumptions. First, the 240 passengers can be viewed as regular commuters who travel 245 days per year (i.e., 49 work-weeks). This yields an annual total of 464,600 one-way trips. (This could overstate ridership if these riders are not actually regular rail commuters, but it could also understate ridership since the station counts did not capture the July-August peak.)

The rail ridership total also needs to account for those East End residents who drive to Ronkonkoma to take advantage of the more frequent LIRR service available there. These travelers should be considered part of the current East End ridership base because Ronkonkoma, as the western terminus of the proposed rail shuttle system on the North Fork, would be part of the proposed rail-bus network. Station counts at Ronkonkoma show about 6900 daily travelers; anecdotally about a third of these travelers come from east of the station, but the exact share from the five East End towns is unknown. This analysis will assume that the figure is about 10 percent, and again that these travelers make the equivalent of 245 round trips per year.

All told, these assumptions produce an estimated annual total of around **460,000** one-way trips to or from the East End on the LIRR. When combined with the bus estimate, total local transit ridership is **1,050,000** rides per year. Although this estimate is based on a number of assumptions, it is within 10 percent of the estimate produced by the Five Town Rural Transit group in 2005 of total bus and rail ridership in the East End of **940,000** per year. Given that 5TRT's estimate is now a few years old and that ridership on the S-92 has been rising noticeably in recent years, the two figures should be considered roughly comparable. Moreover, extreme precision is not warranted on this point, since even the "hard data" points are actually the product of fairly limited samples and counts. As a rough estimate for modeling purposes, therefore, this section uses an estimated annual total of **1 million** one-way transit trips as the baseline.

Elasticity of Transit Demand with Respect to Service Provision

Transportation planners seeking to understand the demand for public transportation have studied the influence of a number of factors on ridership, including transit fares, the level of service provided, and the cost of driving. *Elasticity* is defined as the percentage change in transit ridership for a given percentage change in one of these factors. In this case, where a significant expansion of transit service on the East End is envisioned, the variable of interest is service provision, which is usually expressed in terms of the number of vehicle-hours or vehicle-miles of transit service. How much would ridership be expected to increase for each 1 percent increase in service?

A review of the literature by Litman (2007)[3] noted that the elasticity value is typically less than one. In other words, increases in service levels produce increases in ridership, but on a less than one-to-one basis. This reflects the fact that there are diminishing returns to additional transit service: many automobile commuters will continue to drive in spite of the extra service, while transit riders can only take so many extra trips per day to take advantage of it. However, there have been exceptions, where well-crafted transit services (such as new express transit lines) have achieved ridership increases that exceed the proportional increase in the amount of service. Overall, based on findings from prior research, Litman recommends using a range of 0.5 to 1.1. This means that for each 10% increase in transit service with the proposed rail-bus network over the current service, ridership would be expected to increase about 5% to

[3] Litman, Todd (2007). Transit Price Elasticities and Cross-Elasticities. Victoria Transport Policy Institute, Victoria, B.C., Canada.

11% over current levels. (The increase is usually greater in the long run, because commuters need time to adjust their travel choices to the new circumstances.)

It should be noted that these elasticities have been empirically derived from changes in transit service that are relatively small, such as reduced headways on existing routes or the introduction of a new route or set of routes. By contrast, the proposed rail-bus network would constitute a very large increase in the amount of service provided on the East End. As Section 4 describes, it would also represent a change in the *way the transit network is organized*. Many trips would be faster and some new destinations would be reachable, but transfers – which are perceived as an inconvenience and are known to be a drag on ridership – would be much more common.

Current and Proposed Service Levels

For this analysis, service provision was measured using the common metric of vehicle-hours. (One transit vehicle traveling for 10 hours, or 10 transit vehicles traveling for one hour apiece, would each be equal to 10 vehicle-hours.) Current run times, hours of service, and the number of departures were based on published LIRR and SCT schedules. Only periods in which vehicles were in revenue service were included; that is, the figures do not include layover or turnaround time or vehicles deadheading to storage yards. For rail service, "vehicle" refers to a trainset rather than the number of individual coaches.

As described in the Existing Conditions report, the frequency of LIRR service to and from the East End varies by day, season, and line. In calculating current service levels, a composite figure (approximate weighted average across days and seasons) was used for each line. SCT service in the East End, with a few exceptions, does not vary by season. Service also does not vary by day, except that there is no Sunday service. For SCT routes that leave the East End, hours of service were based on the approximate portion of the running time that was within the East End, based on the printed timetable. In all, the East End's current transit network produces approximately 8,000 vehicle-hours of rail service and 48,000 hours of bus service annually, for a total of 56,000 vehicle-hours.

The proposed rail-bus network would have service 18 hours per day during half the days of the year, and 14 hours per day during the other half of the year. The two shuttle-train lines and most of the 30 bus routes would run on roughly hourly schedules, with half-hour service during the morning and afternoon peak periods. Based on these assumptions and the estimated running times associated with each route, the rail-bus network would offer approximately 45,000 vehicle-hours of rail service and 247,000 hours of bus service per year, for a total of 292,0000 vehicle-hours of transit service. This is an increase of 420 percent over the current transit system.

The lower end of the elasticity range appears to be most appropriate here because of the very large increase in the amount of service and the principle of diminishing returns. Thus, with an assumed elasticity of 0.5, the rail-bus network would be estimated to have 3.1 million total riders per year. (The number of boardings would be somewhat higher, since the rail-bus network has a hub-and-spoke orientation that requires transfers.)

This estimate is substantially lower than the 4.7 to 5.7 million annual riders that 5TRT estimated based on the telephone survey that it commissioned. However, the survey appears to reflect a well-known tendency for survey respondents to overstate their propensity to take transit. One source of error is "social desirability bias" – respondents know that using public transportation instead of driving is viewed favorably by others, and are thus more likely to respond in a way that conforms to that view. Simple optimism and good intentions also play a role, especially since the survey did not describe the routes,

stops, and timetables of the proposed transit service in enough detail for respondents to make informed judgments. The survey results should thus receive very little weight in developing a ridership estimate, though they might be viewed as a "best case scenario."

Evidence from the South Fork Commuter Connection (SFCC)

From late October 2007 to late June 2008, the SFCC operated as a congestion mitigation measure during reconstruction of County Road 39. The SFCC included six additional local trains on the South Fork on weekdays – three in each direction. There were also shuttle bus services to connect the rail stations with villages, schools, and major workplaces, as well as two bus-in-lieu-of-rail services (the "school teachers' special" and "last chance" buses, both one-way westbound) that filled in gaps in the afternoon rail schedule.

Though the SFCC included some unique circumstances, it is also a useful "natural experiment" in assessing the response of East End residents to expanded transit service. Put another way, experience gained from the SFCC provides insight into how well the elasticity figures reported in the literature might apply to the East End.

The SFCC attracted about 8,000 one-way trips per month in November 2007, which is equivalent to about 200 round-trip riders per day. An intercept survey of riders showed that only 1 percent were existing LIRR commuters and 3 percent had been bus commuters, so the SFCC counts do reflect new transit ridership rather than existing transit commuters who simply switched departure times or modes. SFCC ridership remained relatively strong through the winter, but fell off sharply in May 2008 after CR 39 was fully re-opened. May ridership was about 3,200 one-way trips, or roughly 76 round-trip riders per day.

SFCC's three additional round-trip trains represented an increase in weekday LIRR service on the East End of approximately 54 percent, compared to the post-Columbus Day autumn schedule. The service increase was about 71 percent when the two bus-in-lieu-of-rail services are included as if they were rail.

The ridership-to-service level elasticity range mentioned above (0.5 to 1.1), when applied to the service increases associated with SFCC, would suggest that SFCC's new ridership would be in the range of 73 to 161 daily riders. This is indeed very close to the actual ridership numbers, though SFCC's peak was a bit higher. This provides some confirmation that the East End's population is likely to respond to additional transit service provision in a way that is roughly consistent with the elasticities derived from service expansions elsewhere as reported in the literature.

However, SFCC's relatively robust ridership results must be considered in conjunction with the fact that unusual conditions prevailed: the service was heavily promoted and marketed, connecting bus service was provided (particularly in the Town of Southampton), and construction delays on a major east-west artery created an environment that strongly discouraged travel by private automobile. SFCC's ridership levels after the re-opening of CR 39, which reflect an elasticity of about 0.5 – the same parameter used above – are probably a better reflection of the likely response to expanded public transportation. This would be particularly true in the absence of any supporting policies that would strongly discourage automobile travel (such as road-user charging, parking taxation, or mandatory trip-reduction targets for employers) and/or create clusters of higher-density housing and employment.

Journey-to-Work Mode Shares

The plausibility of the ridership estimates above can also be assessed by viewing them in light of the East End's existing mode choices for commute trips. As described in Section 4.1 of the Volpe Center's Existing Conditions report, data from the 2000 Census can be used to identify the Town-to-Town commuting patterns of East End residents and non-resident workers, as well as the share of commuters who use public transportation. According to this data, 55 percent of East End residents work in the Town of their residence, with many of the rest working in another East End Town, while the non-resident workforce comes primarily from the western part of Suffolk County. Just over 3 percent of the East End's resident commuters use transit as their primary means of travel for the journey to work, although this varies by Town, from a low of 1.4 percent on Shelter Island to 3.7 percent for residents of Southampton.

The proposed rail-bus network would offer more service to more East End residents (and in-commuters) and would make transit more attractive relative to driving or other modes. At the margin, some commuters would be expected to switch to transit. The effects would not necessarily be uniform across the East End towns[4] or between work and non-work trips. However, because trips to and from work constitute a large share of transit ridership, increases in ridership from the rail-bus network would translate into increased transit mode share. As a first approximation, the above-noted estimate of 3.1 million annual transit trips on the rail-bus network would be roughly equivalent to a transit mode share of around 9.5 percent for the East End. This is comparable to the levels that prevail in the westernmost Towns of Suffolk County (Huntington, at 10.6 percent, and Babylon, and 9.6 percent), which are much more densely populated and are home to many Manhattan-bound commuters.

Thus, this level of mode share might be considered potentially achievable, but in the near- to medium-term is probably unrealistically high for an area that is still largely rural. Indeed, areas that share some characteristics to the East End, such as Cape Cod (Barnstable County, Mass.) have transit mode shares in the 1-3 percent range, though their transit services are not as expansive as the proposed rail-bus network.

SEEDS Transit Ridership Forecast

Another point of comparison on ridership forecasts is the 2006 SEEDS (Sustainable East End Development Strategies) report. The proposed-rail bus network is similar to Transportation Scenario 3 from SEEDS, in that both are based on an intermodal network of expanded rail service and inter-hamlet bus connections, running at approximately 30-minute headways during peak periods. The SEEDS scenario is not an exact match, as there are a number of differences in the specific routes and service frequencies. Moreover, SEEDS also included Peconic Bay ferry service, which is not part of the current rail-bus concept, and assumed an accompanying set of land-use policy changes, not all of which have been implemented in the five Towns.

The SEEDS results are nonetheless useful because they are based on a more fine-grained and sophisticated model of mode choice and travel demand, using small Traffic Analysis Zones and the conventional four-step modeling process used by metropolitan planning organizations. The SEEDS modeling process yielded an estimated increase of 5 to 47 percent in the number of transit trips under Transportation Scenario 3, depending on the nature of the accompanying land-use changes (i.e., the overall change in development buildout and the change in density within hamlet centers). The 47 percent figure was associated with an increase in densities in hamlet centers; without such density changes, the increase in transit trips was estimated at 32 percent. Very roughly, these estimates imply an annual

[4] For example, Shelter Island currently has no scheduled local transit service, but with the rail-bus network it would have frequent transit for on-island trips with onward connections to both the North and South Forks.

ridership total of between 1.3 million and 1.5 million trips, again depending on the nature of any accompanying land-use policies.

Summary

Initial system-level estimates of ridership for the proposed rail-bus network range from 1.3 to 3.1 million one-way trips per year. The estimates derived from SEEDS, which are at the lower end of this range, are arguably the most realistic, inasmuch as they are based on an well-established travel demand model, using small geographic units and established models of mode choice. At the same time, the measured ridership response to the South Fork Commuter Connection provides some support for the idea that East End travelers may respond to expanded transit service in a more robust way, particularly if the service is accompanied by supportive policies. Given the uncertainty, the range of 1.3 to 3.1 million one-way trips can be used for modeling purposes as the lower and upper bounds of the ridership estimate. Based on the outcomes from the TAG's deliberations on the current concept, a more refined estimate can be produced as the analysis proceeds using the NYMTC model and/or boarding and alighting data from SCT.

It is important to keep in mind that ridership on the transit system would also be influenced by the effectiveness of any transit marketing campaigns promoting the new service, as well as by certain "intangible" elements related to the customer experience. Attributes such as clean and comfortable vehicles, friendly drivers, and fareboxes that accept credit cards (or, at least, ones that do not require exact change) are believed to be important in building a loyal ridership base, particularly among "choice" riders – those who have a private vehicle available but prefer public transportation for some trips.

Transit demand is also responsive to changes in fare. The TAG has proposed a flat fare of $2.50, including all transfers. This is more than the current SCT fares ($1.50 plus $0.25 for a transfer), while LIRR fares range from $2.25 to $6.50 depending on the distance. In other words, the proposed fare is generally higher for current bus riders, and either around the same level or somewhat less expensive for local rail riders. A direct apples-to-apples comparison is difficult because of the way in which the proposed rail-bus network reorganizes service into a multimodal system. Still, the difference in fares could be significant for lower-income bus riders, and if necessary, further analysis of the likely ridership response to a new fare level could be conducted. At this stage, however, the focus is on creating an initial ridership estimate, and no fine-tuning has been done for fare effects.

The ultimate level of ridership over the longer term will also be strongly affected by region-wide and external variables that are not directly related to the transit service itself, notably:

- Population growth, demographic shifts, and employment levels
- Gas prices
- Land-use policies and real estate development
- Parking policies and TDM measures
- Traffic congestion.

6. Overall Summary

This memo has summarized the results of initial modeling and analysis for the proposed rail-bus network. While more detailed work will be needed to support specific deployment decisions, the current analysis did not reveal any issues that would make the rail-bus network technically or operationally infeasible, provided that certain infrastructure improvements are made. The intensive use of single-track rail does, however, make the system somewhat less robust and flexible, limiting its ability to adjust to vehicle breakdowns, service disruptions, and unusual travel patterns (e.g. from special events).

The proposed routes and services represent a very substantial increase in both the geographic spread of transit service on the East End and in their frequency and intermodal connectivity. Most residents would have access to frequent service, many transit trips would become faster and more reliable, and demand-response services would provide additional flexibility. East End transit ridership, which has been growing in recent years, would be expected to grow even further in response to the new service. At the same time, the reorganization of the transit network into something closer to a hub-and-spoke model, with one or more transfers required for most trips, would be viewed as an inconvenience for those accustomed to one-seat rides on the current routes, and could seriously hinder the ability of the service to draw patronage away from automobile commuters.

The other major drawback of the proposed transit system is its cost: roughly $130 to $200 million in upfront capital costs for infrastructure upgrades and vehicle purchases, plus costs (not yet estimated) for fare collection equipment; then approximately $46 million per year in direct operating costs. Depreciation, although a non-cash item, must also be considered: typical service lifetimes are 12 years for a transit bus and 20 years for a railcar, so the system will need funds for re-capitalization within a relatively short period.

Based on the estimated ridership range and an effective average fare of $2 (i.e., a base fare of $2.50, but with the usual discounts for multi-ride passes, seniors and students), this translates into a cost-per-ride of between $15 and $35, even when looking only at direct operating costs. The farebox recovery ratio – the share of operating expenses covered by fares – would be in the range of 6 to 13 percent. Although this recovery ratio is comparable to that for existing SCT bus routes with lower ridership, such as the S-90 and 8A, the sheer size and scale of the rail-bus network would mean that substantially higher transit subsidies would be required annually. The high per-rider costs would also make it difficult for the system to compete effectively for federal funds under programs such as Small Starts.

Overall Cost Summary

Capital Costs – Rail	$ 106.75 to $ 175.25 million
Capital Costs – Bus	$ 25.6 million
Total Capital	$ 132.35 million to $ 200.85 million
O&M – Rail	$ 19.0 million
O&M – Bus	$ 22.1 million
General & Admin Costs	$ 5.0 million
Total Direct Annual Costs	$ 46.1 million

Table 1. Modeling Outputs: Draft Rail Schedules

Proposed Rail-Bus Network
South Fork Rail – Eastbound

* extra trips during high season only

Speonk	5:00	5:30	6:00	6:30	7:03	7:33	8:05	8:39	9:09	10:00	11:00	12:00	13:00	14:00
Westhampton	5:05	5:35	6:05	6:35	7:09	7:39	8:10	8:44	9:14	10:05	11:05	12:05	13:05	14:05
Quoque	5:09	5:39	6:10	6:40	7:13	7:44	8:15	8:49	9:18	10:10	11:10	12:10	13:09	14:10
Hampton Bays	5:16	5:46	6:17	6:47	7:20	7:51	8:22	8:56	9:25	10:17	11:17	12:17	13:16	14:17
Southampton College	5:23	5:53	6:24	6:54	7:27	7:58	8:29	9:03	9:32	10:24	11:24	12:24	13:23	14:24
Southampton	5:28	5:58	6:30	7:00	7:32	8:04	8:35	9:09	9:37	10:30	11:30	12:30	13:28	14:30
Watermill	5:32	6:02	6:34	7:04	7:36	8:08	8:39	9:13	9:41	10:34	11:34	12:34	13:32	14:34
Bridgehampton	5:39	6:09	6:42	7:12	7:43	8:16	8:47	9:21	9:48	10:42	11:42	12:42	13:39	14:42
Wainscott	5:43	6:13	6:47	7:17	7:47	8:21	8:52	9:26	9:52	10:47	11:47	12:47	13:43	14:47
East Hampton	5:50	6:20	6:54	7:24	7:54	8:28	8:59	9:33	9:59	10:54	11:54	12:54	13:50	14:54
Amagansett	5:55	6:25	7:00	7:30	7:59	8:34	9:05	9:39	10:04	11:00	12:00	13:00	13:55	15:00
Montauk	6:13	6:43	7:18	7:48	8:17	8:52	9:23	9:57	10:22	11:19	12:18	13:18	14:13	15:18

										*	*	*	*	
Speonk	15:20	15:50	16:19	16:49	17:18	17:48	18:22	18:52	19:22	20:00	21:00	22:00	23:10	
Westhampton	15:25	15:55	16:25	16:55	17:24	17:54	18:27	18:57	19:27	20:05	21:05	22:05	23:15	
Quoque	15:29	15:59	16:29	16:59	17:28	17:58	18:31	19:01	19:31	20:09	21:09	22:09	23:19	
Hampton Bays	15:36	16:06	16:36	17:06	17:35	18:05	18:38	19:08	19:38	20:16	21:16	22:16	23:26	
Southampton College	15:43	16:13	16:43	17:13	17:42	18:12	18:45	19:15	19:45	20:23	21:23	22:23	23:33	
Southampton	15:48	16:18	16:48	17:18	17:47	18:17	18:50	19:20	19:50	20:28	21:28	22:28	23:38	
Watermill	15:52	16:22	16:52	17:22	17:51	18:21	18:54	19:24	19:54	20:32	21:32	22:32	23:42	
Bridgehampton	15:59	16:29	16:59	17:29	17:58	18:28	19:01	19:31	20:01	20:39	21:39	22:39	23:49	
Wainscott	16:03	16:33	17:03	17:33	18:02	18:32	19:05	19:35	20:05	20:43	21:43	22:43	23:53	
East Hampton	16:10	16:40	17:10	17:40	18:09	18:39	19:12	19:42	20:12	20:50	21:50	22:50	0:00	
Amagansett	16:15	16:45	17:15	17:45	18:14	18:44	19:17	19:47	20:17	20:55	21:55	22:55	0:05	
Montauk	16:33	17:03	17:33	18:03	18:32	19:02	19:35	20:05	20:35	21:13	22:13	23:13	0:23	

These are conceptual timetables and are intended only to show the potential service levels of the rail-bus network, based on the modeling assumptions employed.

Proposed Rail-Bus Network
South Fork Rail - Westbound

* extra trips during high season only

Montauk	6:33	7:04	7:37	8:01	8:37	9:07	9:36	10:16	10:43	11:37	12:37	13:37	14:37	15:37
Amagansett	6:56	7:27	7:59	8:24	9:00	9:29	9:59	10:39	11:05	12:00	13:00	14:00	14:59	15:59
East Hampton	7:01	7:32	8:04	8:30	9:06	9:35	10:05	10:45	11:11	12:06	13:06	14:05	15:04	16:04
Wainscott	7:08	7:39	8:11	8:37	9:13	9:42	10:12	10:52	11:18	12:13	13:13	14:12	15:11	16:11
Bridgehampton	7:12	7:43	8:15	8:42	9:18	9:47	10:16	10:57	11:23	12:18	13:18	14:16	15:15	16:15
Watermill	7:19	7:50	8:22	8:51	9:27	9:56	10:26	11:06	11:32	12:27	13:27	14:23	15:22	16:22
Southampton	7:23	7:54	8:26	8:56	9:32	10:01	10:30	11:11	11:37	12:32	13:32	14:27	15:26	16:26
Southampton College	7:28	7:59	8:31	9:01	9:37	10:06	10:36	11:16	11:42	12:37	13:37	14:32	15:31	16:31
Hampton Bays	7:35	8:06	8:35	9:09	9:45	10:14	10:43	11:24	11:50	12:45	13:45	14:39	15:38	16:38
Quoque	7:42	8:13	8:42	9:17	9:53	10:22	10:51	11:32	11:58	12:53	13:53	14:46	15:45	16:45
Westhampton	7:46	8:17	8:46	9:22	9:58	10:27	10:57	11:37	12:03	12:58	13:58	14:50	15:49	16:49
Speonk	7:49	8:20	8:49	9:25	10:05	10:30	11:00	11:40	12:06	13:01	14:01	14:53	15:52	16:52

								*	*	*	*			
Montauk	16:52	17:22	17:52	18:22	18:52	19:22	19:52	20:22	20:52	21:33	22:33			
Amagansett	17:15	17:44	18:15	18:44	19:14	19:44	20:14	20:44	21:14	21:55	22:55			
East Hampton	17:20	17:49	18:20	18:49	19:19	19:49	20:19	20:49	21:19	22:00	23:00			
Wainscott	17:27	17:56	18:27	18:56	19:26	19:56	20:26	20:56	21:26	22:07	23:07			
Bridgehampton	17:31	18:00	18:31	19:00	19:30	20:00	20:30	21:00	21:30	22:11	23:11			
Watermill	17:38	18:07	18:38	19:07	19:37	20:07	20:37	21:07	21:37	22:18	23:18			
Southampton	17:42	18:11	18:42	19:11	19:41	20:11	20:41	21:11	21:41	22:22	23:22			
Southampton College	17:47	18:16	18:47	19:16	19:46	20:16	20:46	21:16	21:46	22:27	23:27			
Hampton Bays	17:54	18:23	18:54	19:23	19:53	20:23	20:53	21:23	21:53	22:34	23:34			
Quoque	18:01	18:30	19:01	19:30	20:00	20:30	21:00	21:30	22:00	22:41	23:41			
Westhampton	18:05	18:34	19:05	19:34	20:04	20:34	21:04	21:34	22:04	22:45	23:45			
Speonk	18:08	18:37	19:08	19:37	20:07	20:37	21:07	21:37	22:07	22:48	23:48			

These are conceptual timetables and are intended only to show the potential service levels of the rail-bus network, based on the modeling assumptions employed.

Proposed Rail-Bus Network
North Fork Rail - Eastbound

* extra trips during high season only

Ronkonkoma	5:00	5:30	6:00	6:30	7:00	7:30	8:00	8:30	9:00	10:00	11:00	12:00	13:00	14:00	15:00
Medford	5:12	5:42	6:12	6:42	7:12	7:42	8:12	8:42	9:12	10:12	11:12	12:12	13:12	14:12	15:12
Yaphank	5:21	5:51	6:21	6:51	7:21	7:51	8:21	8:51	9:21	10:20	11:20	12:20	13:20	14:20	15:20
Calverton	5:38	6:08	6:38	7:08	7:38	8:08	8:38	9:08	9:38	10:37	11:37	12:37	13:37	14:37	15:37
Riverhead	5:48	6:18	6:48	7:18	7:48	8:18	8:48	9:18	9:48	10:46	11:46	12:46	13:46	14:46	15:46
Mattituck	6:05	6:35	7:05	7:35	8:05	8:35	9:05	9:35	10:05	11:02	12:02	13:02	14:02	15:02	16:02
Southold	6:19	6:49	7:19	7:49	8:19	8:49	9:19	9:49	10:19	11:15	12:15	13:15	14:15	15:15	16:15
Greenport	6:28	6:58	7:28	7:58	8:28	8:58	9:28	9:58	10:28	11:24	12:24	13:24	14:24	15:24	16:24

									*	*	*	*			
Ronkonkoma	15:30	16:00	16:30	17:00	17:30	18:00	18:30	19:00	19:30	20:00	21:00	22:00			
Medford	15:42	16:12	16:42	17:12	17:42	18:12	18:42	19:12	19:42	20:12	21:12	22:12			
Yaphank	15:51	16:21	16:51	17:21	17:51	18:21	18:51	19:21	19:51	20:21	21:21	22:21			
Calverton	16:08	16:38	17:08	17:38	18:08	18:38	19:08	19:38	20:08	20:38	21:38	22:38			
Riverhead	16:18	16:48	17:18	17:48	18:18	18:48	19:18	19:48	20:18	20:48	21:48	22:48			
Mattituck	16:35	17:05	17:35	18:05	18:35	19:05	19:35	20:05	20:35	21:05	22:05	23:05			
Southold	16:49	17:19	17:49	18:19	18:49	19:19	19:49	20:19	20:49	21:19	22:19	23:19			
Greenport	16:58	17:28	17:58	18:28	18:58	19:28	19:58	20:28	20:58	21:28	22:28	23:28			

These are conceptual timetables and are intended only to show the potential service levels of the rail-bus network, based on the modeling assumptions employed.

Proposed Rail-Bus Network
North Fork Rail - Westbound

* extra trips during high season only

Greenport	4:00	5:00	5:28	7:00	7:30	8:00	8:30	9:00	9:30	10:00	10:30	11:00	12:00	13:00	14:00
Southold	4:19	5:19	5:47	7:19	7:49	8:19	8:49	9:19	9:49	10:19	10:49	11:19	12:15	13:15	14:15
Mattituck	4:33	5:33	6:01	7:33	8:03	8:33	9:03	9:33	10:03	10:33	11:03	11:33	12:29	13:29	14:29
Riverhead	4:49	5:49	6:18	7:49	8:19	8:49	9:19	9:49	10:19	10:49	11:19	11:49	12:45	13:45	14:45
Calverton	5:09	6:09	6:38	8:09	8:39	9:09	9:39	10:09	10:39	11:09	11:39	12:09	13:05	14:05	15:05
Yaphank	5:22	6:22	6:50	8:22	8:52	9:22	9:52	10:22	10:52	11:22	11:52	12:22	13:18	14:18	15:18
Medford	5:42	6:42	7:11	8:42	9:12	9:42	10:12	10:42	11:12	11:42	12:12	12:42	13:38	14:38	15:38
Ronkonkoma	5:52	6:52	7:17	8:52	9:22	9:52	10:22	10:52	11:22	11:52	12:22	12:52	13:48	14:48	15:48

								*	*	*	*				
Greenport	15:00	16:00	17:00	17:30	18:00	18:30	19:00	19:30	20:00	20:30	21:00				
Southold	15:15	16:15	17:15	17:45	18:15	18:45	19:15	19:45	20:15	20:45	21:15				
Mattituck	15:29	16:33	17:33	18:03	18:33	19:03	19:33	20:03	20:33	21:03	21:33				
Riverhead	15:45	16:49	17:49	18:19	18:49	19:19	19:49	20:19	20:49	21:19	21:49				
Calverton	16:05	17:09	18:09	18:39	19:09	19:39	20:09	20:39	21:09	21:39	22:09				
Yaphank	16:18	17:22	18:22	18:52	19:22	19:52	20:22	20:52	21:22	21:52	22:22				
Medford	16:38	17:42	18:42	19:12	19:42	20:12	20:42	21:12	21:42	22:12	22:42				
Ronkonkoma	16:48	17:52	18:52	19:22	19:52	20:22	20:52	21:22	21:52	22:22	22:52				

These are conceptual timetables and are intended only to show the potential service levels of the rail-bus network, based on the modeling assumptions employed.

Figure 2. Route Map

Eastern Long Island Transportation Study
Alternative 1 - Rail-Bus Network

Colored lines denote bus routes

Existing Railroad Station

Proposed Railroad Station

3 mile buffer representing coverage areas for the Demand Response services

N
W E
S

0 2.5 5 10 15 20
Miles

Appendix C

Memorandum

U.S. Department
of Transportation

**Research and
Innovative Technology
Administration**

Subject: East End Coordinated Rail-Bus Network Study:
Summary of Alternative 2, Flexible Transit Network

Date: April 9, 2009

From: Sean Peirce, Volpe National Transportation Systems Center

Reply to
Attn. of:

To: Tom Neely, Town of Southampton, and
Members of the Technical Advisory Group

At the January 7 meeting, members of the TAG requested that the Volpe Center develop an additional public transportation alternative that could be evaluated alongside the rail-bus network. The alternative presented below is an initial concept that has been prepared by the Volpe Center based on our understanding of the East End's transportation needs, priorities, and constraints. It has been refined based on successive rounds of feedback received from the TAG at subsequent meetings and via e-mail. Additional analysis of SCT ridership data, financial resources, institutional options, and other topics will be pursued if this scenario is selected for further study.

Overview

This potential alternative differs from the proposed rail-bus network in three major respects:

- First, rather than replacing almost all existing public transportation in the region with an entirely new service concept, the alternative discussed below would focus on incremental changes to the existing system. This would ensure that the ridership base of existing transit users would not be adversely affected by service changes. It also places the emphasis on improvements that are attainable in the near term with relatively modest expenditure.
- Second, instead of a hub-and-spoke approach centered on the rail lines, this alternative would rely primarily on buses, allowing more flexible point-to-point transportation (without transfers) and avoiding most of the costs of rail infrastructure upgrades.
- Third, instead of a single, all-in-one concept, this alternative is designed to allow for multiple future phases of transit improvements, as funding opportunities permit and as appropriate to meet ridership growth. The alternative is therefore structured as a flexible, tiered set of transit system improvements that can be implemented incrementally over time, with a focus on bus service in the near term and some concepts for rail service enhancements that could be considered if warranted by future transit demand.

Assumptions
In the absence of a strong consensus from the TAG about the appropriate scale of transportation improvements, the Volpe Center team made certain assumptions that are grounded in existing conditions.

- *Operational costs:* Based on current schedules and average operating costs, SCT bus services in the East End (including routes that leave the East End for western Suffolk County) are very roughly estimated to cost $9.5 million per year. The rail-bus network proposal was estimated to cost about $46 million per year. Between these two values, the Volpe Center team focused on transit alternatives with incremental operational costs in the $10-20 million per year range, particularly those with limited capital costs.

- *Cost-Effectiveness:* The East End SCT routes (again including routes leaving the region) carried approximately 1.1 million riders in 2006. SCT's average effective fare – i.e. the base fare minus the effects of discounts – is around $1 per ride. All told, the East End SCT routes have estimated farebox recovery ratios in the range of 10% to 25%. The study team focused on alternatives that would be at least as cost-effective as current services and comparable to those of smaller transit agencies.

Context
Compared to bus transportation, rail travel requires higher upfront capital investment for rolling stock and wayside infrastructure, and entails higher operating costs per vehicle-hour of service. Yet rail vehicles also have much higher passenger capacities, meaning that rail service can become cost-advantageous once relatively high passenger volumes are achieved. The East End does not have land-use patterns that are typically conducive to public transportation or that would bring passenger counts up this level. Specifically, because rail transportation involves fixed routes and stations, successful services require that land-use patterns reflect a highly "nodal" orientation, with clusters of residential and commercial development around the stations. This orientation is present to some extent in the East End in the village and hamlet centers. However, the density of these areas is limited compared to urban (and even some suburban) areas, and many of the East End's housing and employment destinations are far from the rail lines. This argues for the inherent flexibility of bus transportation.

Ridership figures from the South Fork Commuter Connection do not appear to demonstrate a latent demand for transit that would bring passenger counts up to level where rail would be cost-advantageous. That is, although SFCC ridership was nearly 400 passengers per day during the worst of the construction and roadway congestion, it fell to about 150 per day once the construction project ended and more typical conditions prevailed. This lower figure is roughly what would be expected for ridership using national averages of the ridership response to new service provision (see discussion of elasticity-based model below, and in the Rail-Bus memo).

Some caution must be used in viewing SFCC ridership as representative of the region's propensity to use transit, because several unique factors – particularly the temporary nature of the service, but also the limited schedules and the lack of connecting bus service at some stations

– may have acted as a drag on ridership. Looking at the figures a different way, however, SFCC's busiest trains carried about 165 passengers. Due to the lower operating costs for buses compared to rail (and assuming that CR 39 were operating under normal conditions) it would ordinarily be more cost-effective to serve those 165 passengers with four 40-seat buses rather than a single train. An additional advantage of that approach would be that the numerous bus departures could be staggered to offer more frequent service (every 15-25 minutes) instead of a more limited number of train trips that may or may not meet a particular commuter's schedule.

Proposed "Flexible Transit Network" Alternative: Bus System Improvements with Options for Subsequent Phase-In of Enhanced Rail Service

This alternative would focus on improving the East End's public transportation through revised bus routes that more efficiently connect origins and destinations, along with enhanced frequency of service and advanced technologies to improve the quality of service. The bus services would differ from those laid out in the TAG rail-bus proposal, because they would serve as point-to-point transportation rather than feeders to a rail line, and would be more strongly tied to the current route network.

This concept includes four sets of bus service enhancements:

- Service changes developed as part of the ongoing SCT service plan study
- Additional changes to the current route network developed by the Volpe Center team in response to TAG priorities, primarily increased frequencies
- New express bus service to Ronkonkoma station
- New demand-response service and flex routes.

Near- and Medium-Term Improvements: Bus Route and Service Detail

SCT Proposals

As noted above, SCT is currently conducting a detailed service plan, in which they have tentatively made a number of suggestions to improve bus service, including some changes within the East End, based on analysis of operational and ridership data. These recommendations have been used as the first component in the development of a wider set of improvements to the region's bus service. (It should be noted, however, that these recommendations have not yet been formally ratified and that some communities disagree with certain recommendations, particularly those that involve cuts in service.)

SCT proposes increasing peak service on the S-92 and adding two new hourly routes: one from Greenport (S-96) and one from Bridgehampton (S-98), both paralleling the S-92 as far as Riverhead, and then terminating at the Tanger Outlets. Because these routes would partially overlap the S-92, they would provide additional frequency on core sections of the route and alleviate some of the overcrowding that the S-92 experiences between Riverhead and the Hamptons.

SCT also recommends expanding the travel loop of the 10B eastward to Amagansett RR and westward to the Stony Brook Southampton campus. Other recommendations include streamlining route 8A service in Riverhead, and creating a new variation of the 10A to travel via Water Mill-Towd Rd. They have also recommended streamlining service to eliminate some of the minor routing variations on the 8A, S-62, and S-90, and to eliminate entirely routes 10D, 10E and S-94. (Note that although these fixed-route services would be eliminated, the same geographic areas would be covered by some of the proposed demand-response services described below.)

In addition to the route changes, SCT proposed adding Sunday service to routes 10C, S-58, S-66, and S-92 and extending the hours of service of routes 10B, 10C, S-58, S-66 and S-92 until 10pm.

In a section on possible longer-term enhancements, the SCT report also identified a potential bus route connecting Southampton, Speonk, and Patchogue via Montauk Highway, which could in turn be combined or coordinated with other service along the south shore. Because this service was described only in general terms as a future service, it has not been included in this alternative. (However, see below for a proposed service to Ronkonkoma station that could also potentially be combined, in whole or in part, with this proposed south shore service.)

SCT's interim report is largely conceptual and generally does not provide quantification of the specific additional resources that would be needed to implement the service enhancements (nor the magnitude of any cost savings from the few proposed cutbacks). The Volpe Center has attempted to produce a rough estimate of these changes using simplified modeling of the routes and data on SCT's average costs per vehicle-hour of service. Using this simplified modeling, it is estimated that the East End portion of these service adjustments (including portions of routes that leave the five Towns) would represent just over 55,000 additional vehicle-hours of service per year, at a cost of approximately $5 million.

Additional Service Enhancements to the Existing Network

Along with the recommendations made by SCT, the Volpe Center team proposes extending the route 10C to Bridgehampton so that residents of Montauk could have a coordinated, two-seat ride to Riverhead or the Tanger Outlets, with the benefit of being able to use either the S-92 or the new S-98 out of Bridgehampton.

In addition, based on the TAG's expressed desire to achieve greater availability and frequency of transit services, we have proposed significant improvements in both the daily span of service and the peak period frequencies on all routes (aside from the new S-96 and S-98 routes). For modeling purposes, additional vehicles and departures were added to each route to achieve target frequencies of around 30 minutes during peak periods and 60 minutes off-peak. Each route has its own running time and other operating characteristics, and in some cases peak frequencies were left a bit longer (e.g. 35-45 minutes) to avoid adding another vehicle.

For routes that leave the five-town East End area, figures in the summary chart below have been based on the entire length of the route, often including substantial portions in western Suffolk County. This is simply a modeling assumption. Further discussion with stakeholders from the

western Towns would be needed to clarify how these service changes would be implemented and how the costs would be shared.

Ronkonkoma Express

The concept of express bus service to the Ronkonkoma LIRR station has been discussed as an important regional link between the East End and points west, and could be used as a stopgap until local rail services are developed further. These bus services are intended to complement, not replace, the existing rail connections.

As TAG members have also noted, since Islip-MacArthur airport is nearby, multimodal linkages can be created that would make it easier for East End residents to access this airport, and for fly-in visitors to come to the East End without a car. As part of this alternative, two bus services were modeled: one from Riverhead running express to Ronkonkoma, and one from East Hampton, which would provide limited-stop service to Bridgehampton, Southampton, Hampton Bays, and Westhampton before running express to Ronkonkoma. After serving Ronkonkoma, both routes would have a request stop at Islip airport.

Both routes were modeled with service every 120-130 minutes, likely starting around 4:30 a.m. so that travelers can make connections to New York City or early flights. This requires one bus on the Riverhead route and two buses (due to the longer travel time) on the South Fork route. The exact bus timing could, to some extent, be adjusted based on existing East End train service, so as to stagger bus and train departures over the course of the day and not have one service cannibalize the ridership of the other.

It would also be possible to extend some or all of the Riverhead runs to Greenport (or even Orient) so as to provide North Fork residents with a "one seat ride" to Ronkonkoma and the airport, rather than requiring a transfer via the S-92. This would increase the convenience of the service (particularly for those traveling with luggage) but the additional running time would entail additional vehicles and costs.

Based on the mix of customers on these routes, luggage racks could be installed for greater convenience for airport passengers, though this would reduce overall seating capacity. For financial modeling purposes, it is worth considering the possibility that a higher fare could be charged for this route, since it is a premium "express" service. The current LIRR fare between Riverhead and Ronkonkoma is $6.50. No specific assumption has been made at this point. Fare policy will be part of the next phase of evaluation.

Demand-Response and Flex Services

New demand-response services are recommended to connect residential areas beyond the current route network with village and hamlet centers and with the fixed-route bus and train services. As a starting point, twelve service areas were identified based on population, population density, presence of existing fixed-route transit service, and TAG priorities. These service areas can be

adjusted based on further input, but have been depicted on the enclosed map using shaded circles that denote the approximate geographic areas within which each service would operate.

- Riverhead
- Hampton Bays
- Wading River
- Southold
- East Hampton – Springs – Amagansett
- Southampton – North Sea
- Montauk
- Mattituck
- Quogue – Quiogue – East Quogue
- Westhampton / Westhampton Beach – Speonk – Remsenburg
- Sag Harbor – Noyack
- Shelter Island

Operating costs for these services were based on one vehicle per coverage area, operating 10-15 hours per day, 6-7 days per week (see summary chart below). Using SCT's average cost figures, this equates to about $280,000 to $490,000 per vehicle per year.

Specific service concepts could include point-to-point travel by reservation only, fixed routes with the capability to "flex" off-route, hamlet/village shuttles, or combinations of these approaches. As noted in the memo on the rail-bus network, Shelter Island's geography lends itself well to a route that travels between the ferry terminals but can deviate off-route by request. For other areas, a single vehicle could provide service within roughly a 3-mile radius around a hamlet center or rail station while still providing acceptable service frequencies. This radius is not a binding constraint, and in some cases it may be effective to use a larger area. It may be possible, for example, for the East Hampton-Springs-Amagansett vehicle to also provide coverage to Northwest Woods, or for the Mattituck and Southold vehicles to cover the in-between areas of Cutchogue and New Suffolk. However, as coverage areas grow larger, it could become necessary to use additional vehicles, impose longer waiting times on travelers, and/or provide service only to and from a limited set of origins and destinations rather than between any two points in the zone. Specific service details of this nature will need to be refined over time based on demand and actual operating experience, in keeping with the approach of many communities that have introduced flexible or demand-response services.[1] (In some cases, the demand-response services have even been converted to fixed-route once a fairly consistent pattern of usage was identified.)

To the extent that an enhanced rail component is later developed as part of this alternative, these demand-response vehicles could also double as station shuttles that bring connecting passengers to and from rail stations at the scheduled arrival and departure times, with more flexible operations at other times. The flexible nature of the service also means that it has the potential to partially substitute (or complement) the region's paratransit and human services transportation.

[1] Koffman, D., *Operational Experiences with Flexible Transit Services*, TCRP Synthesis of Practice No. 53, Washington, D.C.: Transportation Research Board, 2004.

Bus Service Summary

These bus service changes are summarized in the chart below. The chart has been designed to highlight the specific costs associated with each of several possible enhancements to fixed route, demand response, and express bus services.

		Current Service	With SCT Proposed Service Changes	Plus Volpe/TAG Proposed Route Changes & Additional Sunday/Hol. Service	Plus Extended Daily Hours of Service	Plus Increased Peak-Period Service Frequency
Fixed Route SCT Service	Annual Vehicle-Hours	106,707	162,135	176,599	185,042	207,008
	Annual Operating Cost	$9.5 million	$14.5 million	$15.8 million	$16.5 million	$18.5 million
East End Demand Response	Annual Vehicle-Hours	0	0	43,680	65,520	65,520
	Annual Operating Cost	$0	$0	$3.9 million	$5.9 million	$5.9 million
Ronkonkoma Express Buses	Annual Vehicle-Hours	0	0	21,112	21,112	21,112
	Annual Operating Cost	$0	$0	$1.9 million	$1.9 million	$1.9 million
	Total Annual Cost	$9.5 million	$14.5 million	$21.6 million	$24.3 million	$26.3 million
	Incremental Cost		*$5.0 million*	*$7.1 million*	*$2.7 million*	*$2.0 million*

Notes: Costs are initial estimates based on SCT's average operating cost of $89.42 per vehicle-hour. Figures may not agree due to rounding. See route-by-route tables for further detail.

Cost-Effectiveness Considerations

If all of these recommendations were implemented at once, the overall level of East End bus service (again including sections of routes that leave the East End) would be nearly three times current levels, and 60 vehicles would be needed for peak-period service, compared to an estimated 27 today. Assuming that full-size vehicles are needed for about two-thirds of the fleet, capital costs for an entirely new fleet of hybrid-drive buses would be roughly $36 million.[2] This figure is something of an upper bound on the likely actual cost, since SCT's existing fleet presumably could continue to be used for some time and since non-hybrid buses can be acquired at lower cost.

[2] A total of 72 vehicles are needed to ensure adequate spares for scheduled repairs and emergencies. The cost estimate is based on 24 smaller buses at $300,000 each and 48 larger buses at $600,000 each. As with earlier estimates for the rail-bus network, these are estimates based on the federal GSA purchasing schedule. Vintage-style buses and replica (rubber-tired) trolleys are also available and may be considered, if this is considered to be an important aspect of marketing the service, though these vehicles are significantly more expensive than standard buses. In addition, there may be additional costs involved for maintaining and repairing multiple vehicle types. For improved bike-bus travel connections, bike racks can be added to almost any bus model at minimal cost; further discussion of intermodal policies will come in subsequent phases of this study.

As with the earlier memo on the rail-bus network, a rough estimate of potential ridership was generated using published estimates of elasticities – that is, the expected change in ridership for a given change in transit service provided.[3] In this case, if all of the proposed service enhancements were implemented, annual ridership on East End bus routes (including western Suffolk portions) would be expected to rise, after an adjustment period, from about 1.1 million now to about 2.0 – 2.5 million. This would produce farebox recovery in the 8% to 14% range at current fare levels ($1 to $1.50 per ride). The SEEDS process produced an estimate of ridership increases in the 30-40% range for a transit expansion scenario; this more conservative estimate which would translate to about 1.5 million riders per year and lower farebox recovery. More detailed analysis of SCT's boarding and alighting data could help to refine these estimates based on current demand, but it is still quite likely that the full service expansion scenario would not be cost-effective by traditional metrics. It is therefore recommended that the service enhancements be phased in over time to build the ridership base. Indeed, one of the key advantages of this bus-based approach, with its modest capital costs and "scalability," is that new service can be introduced incrementally.

Transit Technologies

Operating in mixed traffic subjects bus services to traffic congestion, which degrades travel speeds and reliability. Short of obtaining an exclusive bus right-of-way (transitway), these issues will always be a mitigating factor, but it is important to keep in mind that summer and autumn weekends only represent a small share of the overall transit service year, and that certain technologies and operational strategies can improve service reliability. In particular, the following approaches are recommended:

- *Transit signal priority (TSP)*: uses transponders to hold a green signal or delay a red signal for the bus, improving travel time reliability
- *Electronic fare collection*: contactless smart cards (or other media) can speed boarding by eliminating the need for passengers to deposit exact change, reducing the dwell time at each stop and improving the bus' overall on-time performance. These systems are also more convenient for passengers and allow workplaces to more readily participate in employer transit subsidy programs. A new electronic approach could also enable compatibility with the Metrocard system used for New York City transit and LI Bus, allowing the convenience of a single card that could be used for almost all transit trips in the broader region.
- *Automatic Vehicle Location and Computer-Aided Dispatch* (AVL/CAD): these systems use GPS to track buses in real-time. They can be used to manage demand-response services, for example by dispatching the vehicle that is closest to the request for service.
- *Passenger information systems*: one example is "next bus" passenger information displays at stops. This reduces the anxiety associated with waiting for the bus and allows passengers to use their waiting time more productively. An online trip planner would allow prospective travelers to find the easiest transit route between Point A and Point B, making use of both SCT and LIRR schedules, without having to work out the connections using separate paper

[3] See: Litman, Todd (2007). Transit Price Elasticities and Cross-Elasticities. Victoria Transport Policy Institute, Victoria, B.C., Canada. The elasticity range used was 0.5 to 0.7, which is the short-term range suggested by Litman's meta-analysis.

schedules. (Google Transit offers this service for many metropolitan areas, and most major transit agencies have an in-house version as well.)

Dedicated bus lanes and "queue jump" lanes (i.e., small bus-only lanes at intersection approaches) can also be used, particularly in coordination with TSP, to improve bus travel times and reduce schedule variability. These approaches require roadway configuration changes that may be politically unacceptable and/or lane-use restrictions that can be difficult to enforce.

Rail Options

Under this alternative, the region's rail service would remain largely as-is for the near term, as the emphasis would be on improvements to the bus network. However, some small-scale improvements could be made incrementally. As the region's transit ridership increases, additional service expansions could be made. The following scenarios comprise a phased approach:

- In the near term, some low-cost modifications to the existing rail schedules could be made to better match the rail service to the needs of the East End. Members of the TAG have developed concepts that would yield modest improvements, though these may affect other LIRR operations and would need to be reviewed with LIRR staff. Some examples that have been discussed include replacing an existing Ronkonkoma-Yaphank evening service with a round-trip to Greenport, and running the last eastbound train to Greenport later in the evening to allow more time for travelers to make connections from Manhattan.

- In the longer term, additional rail service can be introduced on the South Fork to allow inter-hamlet travel. This would target the areas of highest employment density and peak traffic congestion, thus taking advantage of rail's consistent travel times and economies of scale. As the South Fork Commuter Connection showed, three additional round-trips on the Montauk line can be run using existing track infrastructure, at a cost of $1-2 million per year. The SFCC worked well as a congestion mitigation measure during the CR 39 project but was not cost-effective afterwards. Achieving sufficient ridership in the absence of severe congestion or increases in gasoline prices would require a significant commitment to supportive policies, such as transportation demand management (TDM) programs with large employers.

  Even if ridership demand were present, further discussion with LIRR staff would be needed to determine whether new rail vehicles or other equipment would be needed to operate this service on a more permanent basis. Additional maintenance of the right-of-way could also be required due to increased wear and tear. (On the other hand, railroad policing costs may be lower if the service becomes established rather than a one-time event.) SFCC did not run in summer due in part to conflicts with the LIRR summer schedule. The current summer schedule, particularly on Fridays and Mondays, does not readily allow for much additional bidirectional service without significant infrastructure upgrades. The schedule nonetheless has some gaps that could present limited opportunities to add South Fork service even in summer.

Overall Cost Summary

Capital Costs:	
New Buses: Medium- and Heavy-Duty	$72 million, less allowance for use of existing SCT fleet
Bus Fueling Station / Storage / Call Center	$7 million
Intelligent Transportation Systems (ITS) Equipment (e.g. AVL/CAD)	$5 million
Rail Vehicles and Infrastructure Upgrades	Minimal in near term; possible vehicle acquisition longer term
Total Capital	+/- $84 million
Operating Costs	
Incremental O&M – Bus	$5.0 to $16.8 million
Incremental O&M – Rail	$0 to $1.5 million
Incremental General & Admin Costs	$0.5 to $ 1.0 million
Total Direct Annual Costs	$5.5 to $19.3 million

"Incremental" costs are based on the cost of the proposed alternative, over and above the cost of current SCT and LIRR service. General and administrative costs will vary according to the institutional and financial arrangements; the figure used here assumes the existing SCT management structure but allows for additional staff time and consulting support for the expanded transit system and for managing the ITS deployments.

Current Service

Route	Service Hours High Season Low Season	Weekend Hours High Season Low Season	RT Travel Time (minutes)	Peak Frequency (minutes)	Peak # Vehicles	Non-peak Frequency (minutes)	Non-Peak # Vehicles	Sunday/ Hol. Service	Weekday Vehicle Hours	Weekend Vehicle Hours	Annual Vehicle-Hours
S58	5:40 - 20:40	6:20 - 20:40	155	50	4	60	3	No	53	51	16,432
S62	6:00 - 19:50	6:15 - 19:50	220	60	4	60	3	No	55	41	16,506
S66	5:35 - 19:20	5:35 - 19:20	160	60	3	60	3	No	41	41	12,870
S90	7:45 - 18:00	7:45 - 18:00	105	105	1	190	1	No	10	10	3,198
S92	5:15 - 20:45	5:15 - 20:45	320	30	7	60	6	No	102	102	31,668
S94	0:00 - 0:00 10:05 - 17:45	0:00 - 0:00 10:05 - 17:45	30	60	1	60	1	No	8	8	368
8A	7:00 - 19:00	8:10 - 17:57	120	70	2	70	2	No	24	20	7,257
10A	6:25 - 18:30	6:25 - 18:30	160	160	1	160	1	No	12	12	3,770
10B	6:50 - 19:00	6:50 - 19:00	85	100	1	100	1	No	12	12	3,796
10C*	6:50 - 19:50	6:50 - 19:50	155	95	2	95	2	No	26	26	8,112
10D-E	7:55 - 18:25		65	105	1	120	1	No	11	0	2,730
*10C Travel Time Includes Double Loop in Montauk											**106,707**

SCT Proposed Service

Route	Service Hours High Season Low Season	Weekend Hours High Season Low Season	RT Travel Time (minutes)	Peak Frequency (minutes)	Peak # Vehicles	Non-peak Frequency (minutes)	Non-Peak # Vehicles	Sunday/ Hol. Service	Weekday Vehicle Hours	Weekend Vehicle Hours	Annual Vehicle-Hours
S58	**5:40 - 22:00**	**6:20 - 22:00**	155	50	4	60	3	**Yes**	58	56	21,025
S62	6:00 - 19:50	6:15 - 19:50	220	60	4	60	3	No	55	41	16,506
S66	**5:35 - 22:00**	**5:35 - 22:00**	160	60	3	60	3	**Yes**	49	49	17,927
S90	7:45 - 18:00	7:45 - 18:00	105	105	1	190	1	No	10	10	3,198
S92	**5:15 - 22:00**	**5:15 - 22:00**	320	15	11	60	6	**Yes**	149	149	54,327
S96	5:15 - 20:45	5:15 - 20:45	125	65	2	62	2	No	31	31	9,672
S98	5:15 - 20:45	5:15 - 20:45	135	70	2	67	2	No	31	31	9,672
8A	7:00 - 19:00	8:10 - 17:57	120	70	2	70	2	No	24	20	7,257
10A	6:25 - 18:30	6:25 - 18:30	160	160	1	160	1	No	12	12	3,770
10B	**6:50 - 22:00***	**6:50 - 22:00***	145	100	2	100	2	No	27	27	8,528
10C	**6:50 - 22:00***	**6:50 - 22:00***	155	95	2	95	2	**Yes**	28	28	10,253
* 10B Includes SCT Proposed Amagansett & LI University Routing and Expected RunTime											**162,135**

* Use one vehicle after 19:00 & 19:50 respectively

Volpe Proposed Changes and Additional Sunday Service

Route	Service Hours High Season Low Season	Weekend Hours High Season Low Season	RT Travel Time (minutes)	Peak Frequency (minutes)	Peak # Vehicles	Non-peak Frequency (minutes)	Non-Peak # Vehicles	Sunday/ Hol. Service	Weekday Vehicle Hours	Weekend Vehicle Hours	Annual Vehicle-Hours
S58	5:40 - 22:00	6:20 - 22:00	155	50	4	60	3	Yes	58	56	21,025
S62	6:00 - 19:50	6:15 - 19:50	220	60	4	60	3	**Yes**	55	41	18,625
S66	5:35 - 22:00	5:35 - 22:00	160	60	3	60	3	Yes	49	49	17,927
S90	7:45 - 18:00	7:45 - 18:00	105	105	1	190	1	**Yes**	10	10	3,731
S92	5:15 - 22:00	5:15 - 22:00	320	15	11	60	6	Yes	149	149	54,327
S96	5:15 - 20:45	5:15 - 20:45	125	65	2	62	2	**Yes**	31	31	11,284
S98	5:15 - 20:45	5:15 - 20:45	135	70	2	67	2	**Yes**	31	31	11,284
8A	7:00 - 19:00	8:10 - 17:57	120	70	2	70	2	**Yes**	24	20	8,275
10A	6:25 - 18:30	6:25 - 18:30	160	160	1	160	1	**Yes**	12	12	4,398
10B*	6:50 - 22:00*	6:50 - 22:00*	135	100	2	100	2	**Yes**	27	27	9,949
10C*	6:50 - 22:00*	6:50 - 22:00*	180	95	3	95	3	Yes	43	43	15,773
											176,599
12 Demand Response Services	8:00 - 18:00	8:00 - 18:00	N/A	N/A	12	N/A	12	Yes	120	120	43,680
Riverhead - Ronkonkoma	4:00 - 23:00	4:00 - 23:00	112	120	1	120	1	Yes	19	19	6,916
South Fork - Ronkonkoma	4:00 - 23:30	4:00 - 23:30	260	130	2	130	2	Yes	39	39	14,196
											241,391

*10B reroutes East Hampton portion to current 10B route but includes the extension to LI University

*10C includes route extension to Bridgehampton

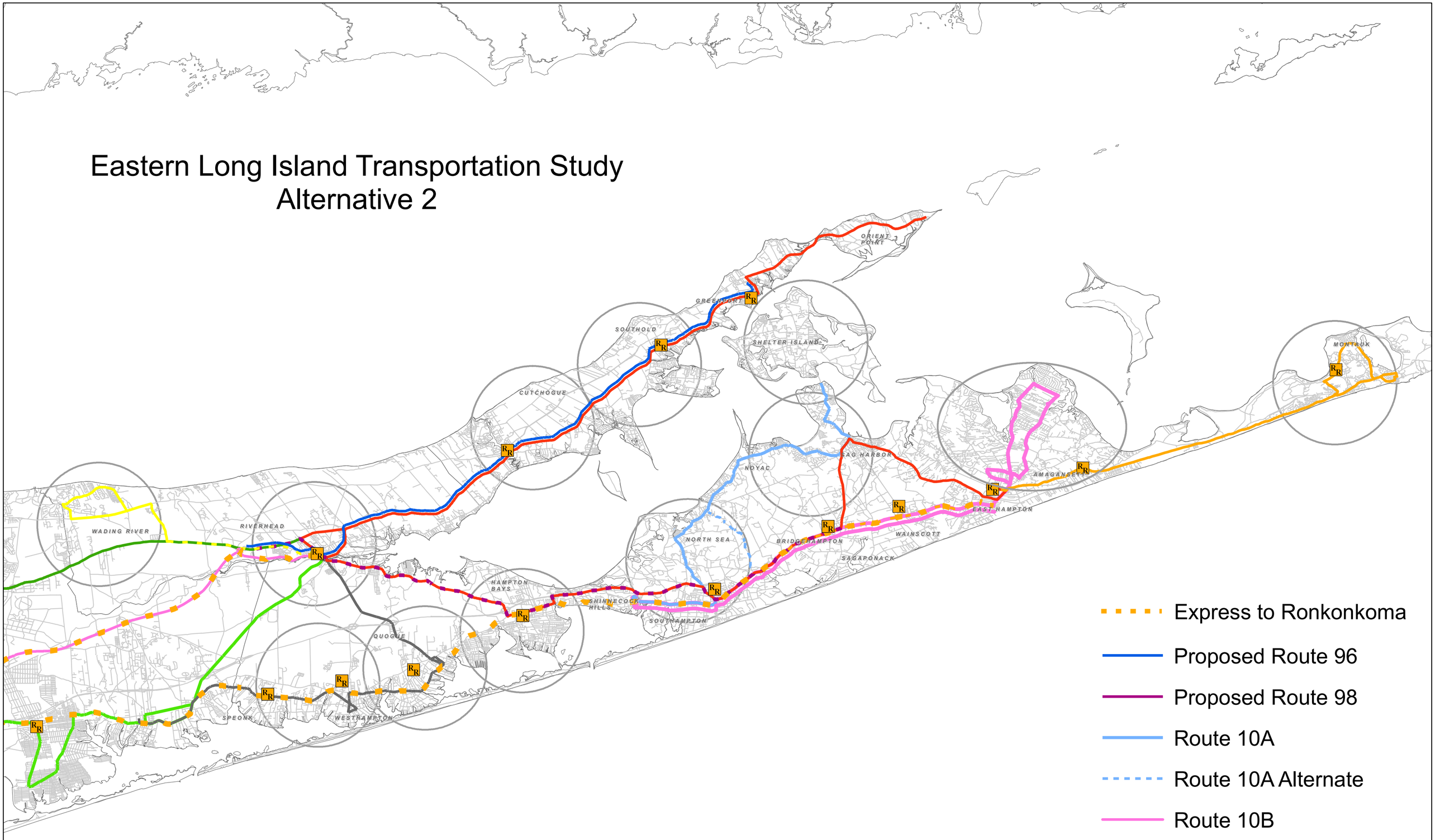
Extended Hours

Route	Service Hours High Season Low Season	Weekend Hours High Season Low Season	RT Travel Time (minutes)	Peak Frequency (minutes)	Peak # Vehicles	Non-peak Frequency (minutes)	Non-Peak # Vehicles	Sunday/ Hol. Service	Weekday Vehicle Hours	Weekend Vehicle Hours	Annual Vehicle-Hours
S58	**5:40 - 23:30** **5:40 - 22:00**	**6:20 - 23:30** **6:20 - 22:00**	155	50	4	60	3	Yes	61	59	21,844
S62	**6:00 - 22:00** **6:00 - 19:50**	**6:15 - 22:00** **6:15 - 19:50**	220	60	4	60	3	Yes	60	44	20,089
S66	5:35 - 22:00	5:35 - 22:00	160	60	3	60	3	Yes	49	49	17,927
S90	**7:45 - 20:00** **7:45 - 18:00**	**7:45 - 20:00** **7:45 - 18:00**	105	105	1	190	1	Yes	11	11	4,095
S92	**4:30 - 24:30** **4:30 - 22:00**	**5:15 - 24:30** **5:15 - 22:00**	320	15	11	60	6	Yes	161	157	58,227
S96	5:15 - 20:45	5:15 - 20:45	125	65	2	62	2	Yes	31	31	11,284
S98	5:15 - 20:45	5:15 - 20:45	135	70	2	67	2	Yes	31	31	11,284
8A	**7:00 - 22:00** **7:00 - 19:00**	**8:10 - 22:00** **8:10 - 19:00**	120	70	2	70	2	Yes	27	24	9,533
10A	**6:25 - 22:00** **6:25 - 18:30**	**6:25 - 22:00** **6:25 - 18:30**	160	160	1	160	1	Yes	14	14	5,035
10B	6:50 - 22:00*	6:50 - 22:00*	135	100	2	100	2	Yes	27	27	9,949
10C	6:50 - 22:00*	6:50 - 22:00*	180	95	3	95	3	Yes	43	43	15,773
											185,042
12 Demand Response Services	**6:00 - 22:00** **6:00 - 20:00**	**6:00 - 22:00** **6:00 - 20:00**	N/A	N/A	12	N/A	12	Yes	180	180	65,520
Riverhead - Ronkonkoma	4:00 - 23:00	4:00 - 23:00	112	120	1	120	1	Yes	19	19	6,916
South Fork - Ronkonkoma	4:00 - 23:30	4:00 - 23:30	260	130	2	130	2	Yes	39	39	14,196
All extended service proposed for evenings except one earlier trip on S92											**271,674**

Increased Peak Service

Route	Service Hours High Season Low Season	Weekend Hours High Season Low Season	RT Travel Time (minutes)	Peak Frequency (minutes)	Peak # Vehicles	Non-peak Frequency (minutes)	Non-Peak # Vehicles	Sunday/ Hol. Service	Weekday Vehicle Hours	Weekend Vehicle Hours	Annual Vehicle-Hours
S58	5:40 - 23:30 5:40 - 22:00	6:20 - 23:30 6:20 - 22:00	155	**35**	**5**	60	3	Yes	70	68	25,242
S62	6:00 - 22:00 6:00 - 19:50	6:15 - 22:00 6:15 - 19:50	220	60	4	60	3	Yes	45	44	16,211
S66	5:35 - 22:00	5:35 - 22:00	160	40	4	60	3	Yes	49	49	17,927
S90	7:45 - 20:00 7:45 - 18:00	7:45 - 20:00 7:45 - 18:00	105	**60**	**2**	**120**	1	Yes	15	15	5,551
S92	4:30 - 24:30 4:30 - 22:00	5:15 - 24:30 5:15 - 22:00	320	15	11	**45**	**8**	Yes	179	173	64,623
S96	6:00 - 21:00	6:00 - 21:00	125	65	2	62	2	Yes	30	30	10,920
S98	6:00 - 21:00	6:00 - 21:00	135	70	2	67	2	Yes	30	30	10,920
8A	7:00 - 22:00 7:00 - 19:00	8:10 - 22:00 8:10 - 19:00	120	**30**	**4**	**45**	**3**	Yes	41	36	14,300
10A	6:25 - 22:00 6:25 - 18:30	6:25 - 22:00 6:25 - 18:30	160	**60**	**3**	**90**	**2**	Yes	28	28	10,071
10B	6:50 - 22:00*	6:50 - 22:00*	135	**50**	**3**	**75**	**2**	Yes	27	27	9,949
10C	6:50 - 22:00*	6:50 - 22:00*	180	**45**	**5**	**60**	**4**	Yes	59	59	21,294
											207,008
12 Demand Response Services	6:00 - 22:00 6:00 - 20:00	6:00 - 22:00 6:00 - 20:00	N/A	N/A	12	N/A	12	Yes	180	180	65,520
Riverhead - Ronkonkoma	4:00 - 23:00	4:00 - 23:00	112	120	1	120	1	Yes	19	19	6,916
South Fork - Ronkonkoma	4:00 - 23:30	4:00 - 23:30	260	130	2	130	2	Yes	39	39	14,196
											293,640

Eastern Long Island Transportation Study
Alternative 2



- Express to Ronkonkoma
- Proposed Route 96
- Proposed Route 98
- Route 10A
- Route 10A Alternate
- Route 10B
- Route 10C
- Route 58
- Route 62
- Route 66
- Route 90
- Route 92

RR Railroad Station

Approx. 3 mile buffer representing coverage areas for the Demand Response services

N
W E
S

0 2.5 5 10 15 20 Miles

Appendix D

Appendix D: Illustrative South Fork Train Schedules, Summer Friday

Shaded columns represent approximate times for high-volume LIRR services from New York. All other services are local shuttle trains.

Eastbound - Morning

Speonk	5:00	5:30	6:00	6:30	7:03	7:33	8:05	8:39	9:09	10:00	11:00
West Hampton	5:05	5:35	6:05	6:35	7:09	7:39	8:10	8:44	9:14	10:05	11:05
Quoque	5:09	5:39	6:10	6:40	7:13	7:44	8:15	8:49	9:18	10:10	11:10
Hampton Bays	5:16	5:46	6:17	6:47	7:20	7:51	8:22	8:56	9:25	10:17	11:17
Southampton College	5:23	5:53	6:24	6:54	7:27	7:58	8:29	9:03	9:32	10:24	11:24
Southampton	5:28	5:58	6:30	7:00	7:32	8:04	8:35	9:09	9:37	10:30	11:30
Watermill	5:32	6:02	6:34	7:04	7:36	8:08	8:39	9:13	9:41	10:34	11:34
Bridgehampton	5:39	6:09	6:42	7:12	7:43	8:16	8:47	9:21	9:48	10:42	11:42
Wainscott	5:43	6:13	6:47	7:17	7:47	8:21	8:52	9:26	9:52	10:47	11:47
East Hampton	5:50	6:20	6:54	7:24	7:54	8:28	8:59	9:33	9:59	10:54	11:54
Amagansett	5:55	6:25	7:00	7:30	7:59	8:34	9:05	9:39	10:04	11:00	12:00
Montauk	6:13	6:43	7:18	7:48	8:17	8:52	9:23	9:57	10:22	11:19	12:18
Time to next train	*0:30*	*0:30*	*0:30*	*0:33*	*0:30*	*0:32*	*0:34*	*0:30*	*0:51*	*1:00*	*1:00*

Note: These timetables are simplified modeling outputs, designed only to show the scheduling interactions between existing LIRR service and proposed shuttle trains. See Section 2 for discussion and interpretation.

Eastbound - Afternoon

Speonk	12:00	13:11	14:00	15:35	15:50	16:19	16:49	17:33	17:48
West Hampton	12:05	13:16	14:05	15:40	15:55	16:25	16:55	17:39	17:54
Quoque	12:10	13:19	14:10	15:43	15:59	16:29	16:59	17:42	17:58
Hampton Bays	12:17	13:26	14:17	15:50	16:06	16:36	17:06	17:49	18:05
Southampton College	12:24	13:31	14:24	15:55	16:13	16:43	17:13	17:54	18:12
Southampton	12:30	13:37	14:30	16:01	16:18	16:48	17:18	18:00	18:17
Watermill	12:34	13:39	14:34	16:03	16:22	16:52	17:22	18:02	18:21
Bridgehampton	12:42	13:49	14:42	16:09	16:29	16:59	17:29	18:08	18:28
Wainscott	12:47	13:52	14:47	16:11	16:33	17:03	17:33	18:10	18:32
East Hampton	12:54	13:59	14:54	16:19	16:40	17:10	17:40	18:18	18:39
Amagansett	13:00	14:05	15:00	16:24	16:45	17:15	17:45	18:23	18:44
Montauk	13:18	14:23	15:18	16:43	17:03	17:33	18:03	18:42	19:02
Time to next train	*1:11*	*0:49*	*1:35*	*0:15*	*0:29*	*0:30*	*0:44*	*0:15*	*0:33*

Speonk	18:21	18:52	19:18	19:55	20:59	22:00	22:30	23:10	0:10
West Hampton	18:26	18:57	19:23	20:00	21:04	22:05	22:35	23:15	0:15
Quoque	18:29	19:01	19:26	20:03	21:07	22:09	22:39	23:19	0:19
Hampton Bays	18:36	19:08	19:33	20:10	21:13	22:16	22:46	23:26	0:26
Southampton College	18:41	19:15	19:38	20:15	21:18	22:23	22:53	23:33	0:33
Southampton	18:47	19:20	19:44	20:21	21:24	22:28	22:58	23:38	0:38
Watermill	18:49	19:24	19:46	20:23	21:26	22:32	23:02	23:42	0:42
Bridgehampton	18:55	19:31	19:52	20:29	21:32	22:39	23:09	23:49	0:49
Wainscott	18:57	19:35	19:54	20:31	21:35	22:43	23:13	23:53	0:53
East Hampton	19:05	19:42	20:02	20:39	21:42	22:50	23:20	0:00	1:00
Amagansett	19:10	19:47	20:07	20:44	21:47	22:58	23:28	0:05	1:05
Montauk	19:29	20:05	20:26	21:03	22:06	23:16	23:46	0:23	1:23
Time to next train	*0:31*	*0:26*	*0:37*	*1:04*	*1:01*	*0:30*	*0:40*	*1:00*	

Westbound - Morning

Montauk	6:33	7:04	7:37	8:01	8:37	9:07	9:36	10:16	10:43	11:37
Amagansett	6:56	7:27	7:59	8:24	9:00	9:29	9:59	10:39	11:05	12:00
East Hampton	7:01	7:32	8:04	8:30	9:06	9:35	10:05	10:45	11:11	12:06
Wainscott	7:08	7:39	8:11	8:37	9:13	9:42	10:12	10:52	11:18	12:13
Bridgehampton	7:12	7:43	8:15	8:42	9:18	9:47	10:16	10:57	11:23	12:18
Watermill	7:19	7:50	8:22	8:51	9:27	9:56	10:26	11:06	11:32	12:27
Southampton	7:23	7:54	8:26	8:56	9:32	10:01	10:30	11:11	11:37	12:32
Southampton College	7:28	7:59	8:31	9:01	9:37	10:06	10:36	11:16	11:42	12:37
Hampton Bays	7:35	8:06	8:35	9:09	9:45	10:14	10:43	11:24	11:50	12:45
Quoque	7:42	8:13	8:42	9:17	9:53	10:22	10:51	11:32	11:58	12:53
West Hampton	7:46	8:17	8:46	9:22	9:58	10:27	10:57	11:37	12:03	12:58
Speonk	7:49	8:20	8:49	9:25	10:05	10:30	11:00	11:40	12:06	13:01
Time to Next Train	*0:31*	*0:33*	*0:24*	*0:36*	*0:30*	*0:29*	*0:40*	*0:27*	*0:54*	*1:00*

Westbound - Afternoon

Montauk	12:37	13:37	14:37	15:37	16:52	17:22	17:52	18:22	18:52	19:22
Amagansett	13:00	14:00	14:59	15:59	17:15	17:44	18:15	18:44	19:14	19:44
East Hampton	13:06	14:05	15:04	16:04	17:20	17:49	18:20	18:49	19:19	19:49
Wainscott	13:13	14:12	15:11	16:11	17:27	17:56	18:27	18:56	19:26	19:56
Bridgehampton	13:18	14:16	15:15	16:15	17:31	18:00	18:31	19:00	19:30	20:00
Watermill	13:27	14:23	15:22	16:22	17:38	18:07	18:38	19:07	19:37	20:07
Southampton	13:32	14:27	15:26	16:26	17:42	18:11	18:42	19:11	19:41	20:11
Southampton College	13:37	14:32	15:31	16:31	17:47	18:16	18:47	19:16	19:46	20:16
Hampton Bays	13:45	14:39	15:38	16:38	17:54	18:23	18:54	19:23	19:53	20:23
Quoque	13:53	14:46	15:45	16:45	18:01	18:30	19:01	19:30	20:00	20:30
West Hampton	13:58	14:50	15:49	16:49	18:05	18:34	19:05	19:34	20:04	20:34
Speonk	14:01	14:53	15:52	16:52	18:08	18:37	19:08	19:37	20:07	20:37
Time to Next Train	*1:00*	*1:00*	*1:00*	*1:15*	*0:30*	*0:30*	*0:30*	*0:30*	*0:30*	*0:30*

Montauk	19:52	20:22	20:52	21:33	22:37	23:33	0:06	0:41	1:41
Amagansett	20:14	20:44	21:14	21:55	22:59	23:55	0:28	1:04	2:03
East Hampton	20:19	20:49	21:19	22:00	23:05	0:00	0:33	1:09	2:08
Wainscott	20:26	20:56	21:26	22:07	23:10	0:07	0:40	1:16	2:15
Bridgehampton	20:30	21:00	21:30	22:11	23:14	0:11	0:44	1:20	2:19
Watermill	20:37	21:07	21:37	22:18	23:19	0:18	0:51	1:27	2:26
Southampton	20:41	21:11	21:41	22:22	23:23	0:22	0:55	1:31	2:30
Southampton College	20:46	21:16	21:46	22:27	23:26	0:27	1:00	1:36	2:35
Hampton Bays	20:53	21:23	21:53	22:34	23:34	0:34	1:07	1:43	2:42
Quoque	21:00	21:30	22:00	22:41	23:39	0:41	1:14	1:50	2:49
West Hampton	21:04	21:34	22:04	22:45	23:43	0:45	1:18	1:54	2:53
Speonk	21:07	21:37	22:07	22:48	23:47	0:48	1:21	1:57	2:56
Time to Next Train	*0:30*	*0:30*	*0:41*	*1:04*	*0:56*	*0:33*	*0:35*	*1:00*	

Appendix E

Overview of Flexible Transit Services

Roughly 50 transit agencies around the country operate some form of "flexible" services, which are usually defined as those that (1) are more demand-responsive than conventional fixed-route, fixed-stop services, but (2) do not provide the kind of door-to-door service associated with taxis and paratransit.[1] These services are often well-suited to rural and suburban areas where lower population density, dispersed origin-destination patterns, and/or pedestrian-unfriendly street layouts make conventional bus services less effective. In each case, the transit agency has taken account of local factors to create services that balance passenger needs, operational requirements, and cost-effectiveness. The result is a number of different types of service, each with its own characteristics. Many are still evolving as the agencies gain more experience with these flexible services. Although the term "flexible transit" is often used as a catchall, there are several major recognized service types:

- **Route deviation**: The bus operates along a predefined route with a regular schedule, but can also deviate from the route to accommodate requests for "off-route" drop-offs or pick-ups. Typically, the number of deviations per run is limited and advance reservations are required. Some services allow deviations anywhere within the city limits or other defined zone, while others permit deviations only with a given distance of the route (often ¾ mile). The "flex" route on the outer portion of Cape Cod is an example of this service type.
- **Flexible-route segments**: As above, except the "flex" capability is in place only for limited portions of the route.
- **Demand-responsive connector**: The bus serves as a feeder to a conventional transit system (e.g. rail station). It accommodates service requests within its service area, but only going to or from this transfer point. There are no other defined stops. In a typical situation, the service is designed to connect a residential neighborhood with a nearby transit stop in situations where conventional service is not cost-effective or practical. The Cedar Mill shuttle in Portland, Oregon, is an example of this service concept. It connects a spread-out suburban community with a nearby light-rail station.
- **Point deviation**: The bus operates within a defined geographic zone and accommodates requests for service within the zone, while also making a limited number of fixed stops. However, there is no defined route between the stops.
- **Request stops**: The bus operates as a conventional service, but also stops at a certain number of predefined off-route locations upon request. A more common variant is "flag" or "hail" stops, where passengers can ask to be dropped off or picked up at any safe point along a fixed route.
- **Zone route**: The bus accommodates service requests along a corridor, but also has fixed arrival and departure times for each zone along the corridor.

[1] Most of the material in this brief is drawn from the federally sponsored Transit Cooperative Research Program (particularly Koffman, D., *Operational Experiences with Flexible Transit Services*, TCRP Synthesis of Practice No. 53, Washington, D.C.: Transportation Research Board, 2004) and the Volpe Center's experience with the Cape Cod "flex" bus route.

Of these, *route deviation* and *demand-responsive connector* services are the most common approaches in North America. TCRP identified the following major findings from experience to date with flexible transit:

- Most services limit the number and length of deviations in order to maintain operational efficiency. About a third of the agencies also impose a fare surcharge (often around $1) on non-disabled riders who request an off-route stop, both to recoup the associated costs and to encourage able-bodied riders to use the designated stops.
- Initially, most agencies required reservations for pickup requests to be made at least one day in advance, but increasingly are able to reduce this time window. For example, the OmniLink service in suburban Virginia accepts reservations up to 2 hours before the scheduled time, as does the Cape Cod Flex. Most requests are made through a dispatcher, though a small number of agencies use communication directly to the bus driver.
- There are some examples of flexible transit service (when operated over the full geographic service area) being able to significantly reduce the expense associated with conventional paratransit. OmniLink, for example, operates without any separate paratransit service because of its ¾-mile route deviation with accessible vehicles. More commonly, however, paratransit continues to operate, with varying degrees of coordination with the flexible transit (e.g. shared dispatching and vehicles). The Cape Cod RTA continues to run its Capewide "b-bus" door-to-door service.
- Flexible services are most typically run on infrequent schedules, with headways of 1 hour or more, though transit station connectors can be more frequent. The Cape Cod flex service runs every 60 minutes during July and August and approximately every 2 hours during the shoulder seasons. Passenger volumes are also generally low, though this is a reflection more of the characteristics of the service area (e.g. low density) than of the flexible service.
- Vans and smaller buses are most commonly used for flexible services due to their lower passenger loads and the need to navigate neighborhood streets. At the larger end, the Cape Cod Flex and OmniLink both use 29- to 30-foot buses.
- Flexible systems benefit greatly both from technology (Automatic Vehicle Location / Computer Assisted Dispatching) and from additional operator training on passenger communication. However, many smaller, rural systems use more informal systems that are not as technology-intensive.
- Flexible services have an element of complexity that can make them hard to describe in promotional materials and difficult to explain to prospective riders.
- Flexible services can be used to gauge demand for transit in areas that have been more automobile-oriented. In many cases, agencies have switched over to fixed-route service once demand grows to a level that is better served by conventional service. While flexible service opens the door to additional ridership by those who cannot use conventional services, it also imposes extra travel time that makes the service less attractive compared to driving. Portland's Cedar Mill shuttle sometimes has to decline pick-up requests not because the vehicle is full, but because the additional travel time needed to reach that rider would create excessive delays for the other passengers already onboard.

Some points to consider for the East End:

- Most flexible services in other parts of the U.S. are not coordinated with fixed railroad schedules. The buffer time that must be built into the bus schedule for potential route deviations makes it operationally difficult to ensure highly coordinated RR transfers. Portland's Cedar Mill shuttle connects to a light rail system, but the bus runs only during peak periods, and connections are ensured by the fact that rail service operates every 5-15 minutes during those periods.
- The proposed bus routes for the coordinated rail-bus network are largely RR station feeder services, though some link multiple modes and activity centers (e.g. Orient Point to Greenport via hospital). It is worth considering whether the "route deviation" model or the "demand-responsive connector" model is more appropriate for each of these routes, or whether conventional fixed service might be able to offer better travel times and service levels.
- The East End has a number of paratransit services (SCAT and Town-sponsored services, plus those of various nonprofit groups) and in combination, their service areas exceed the statutory minimum under ADA. Service expectations are also generally higher in the East End than in other rural areas in the U.S. The nature of the rail-bus network concept is such that one or more rail-bus transfers may be needed for typical trips, which may limit its ability to serve the paratransit market effectively.

Conceptual Options for the Bus Components of the Rail-Bus Network:

- Fixed-route, fixed-stop service
- Fixed-route, fixed-stop service that can also be hailed at any safe point along the route
- Fixed-route, fixed-stop service, with a few predefined request/flag stops that are not far from the route (e.g. supermarket or senior housing that is two blocks from main road)
- "Flex" bus routes with ¾-mile (or other) deviation band
- Station shuttles that operate to and from the RR stations and will take customers anywhere within a defined radius / service zone