May 24, 2017

Patrick Warren
Federal Railroad Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

Subject: TF Green Airport Intercity Rail Feasibility Study

On behalf of the Rhode Island Department of Transportation (RIDOT) and the National Railroad Passenger Corporation (Amtrak), we are pleased to submit this report to Patrick Warren. The report is a collaborative effort between the Federal Railroad Administration (FRA), RIDOT, Amtrak, and the Rhode Island Airport Corporation (RIAC), in response to the Transportation, Housing and Urban Development, and Related Agencies Appropriations bill for Fiscal Year 2016 requiring a feasibility study of bringing intercity passenger rail service to commercial airports adjacent to the Northeast Corridor (NEC), in this case TF Green Airport.

Recognizing the strategic location of TF Green Airport along the NEC, RIDOT and Amtrak entered into a project agreement in September 2016 that has led to this report and the fulfillment of the congressional mandate.

Analysis occurred on the conceptual feasibility of four distinct service scenarios both regionally and in-state. The results of the study show that increased rail service at TF Green Airport is feasible through a variety of scenarios. However, the study did not assign responsibilities for infrastructure improvement costs and operating subsidy requirements associated with those scenarios. Instead, the study provides a framework for business and policy decisions such that discussions can occur among the interested parties. Reference the Executive Summary for the recommended next steps and long term requirements. Should advancement of any short or long-term recommendation proceed, RIDOT and Amtrak will work with the Northeast Corridor Commission and its capital planning and programming process.

We look forward to continuing this collaborative effort in the future.

Sincerely,

Peter Alviti, Jr., P.E
Director
Rhode Island Department of Transportation

Stephen J. Gardner
Executive Vice President
Amtrak

Feasibility Study for Intercity Rail Service to T.F. Green Airport

Photo Credit: RIAC

April
2017

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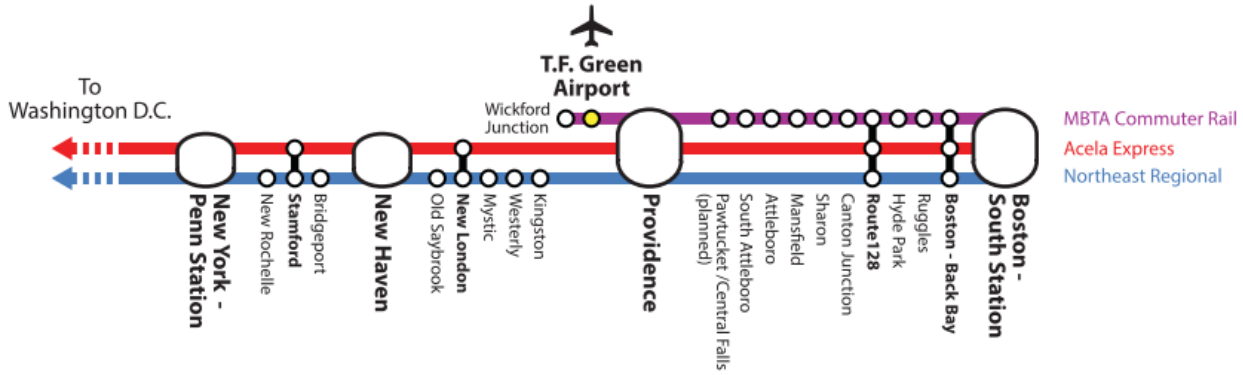
Executive Summary

This *Feasibility Study for Intercity Rail Service to T.F. Green Airport* was prepared by Amtrak and Rhode Island Department of Transportation (RIDOT) in partnership with the Federal Railroad Administration (FRA). The study was a preliminary feasibility analysis to satisfy the requirement in Senate Report 114-75 of the Transportation, Housing and Urban Development, and Related Agencies Appropriations bill for Fiscal Year 2016 on promoting intercity rail and airport connections on the mainline of the Northeast Corridor railroad.

Rhode Island and its neighboring states along the Northeast Corridor (NEC) rail line have made commitments towards improving rail options as a means of promoting a balanced transportation system. The addition of intercity rail service at T. F Green Airport has the potential to improve regional and intrastate connectivity and better position T.F. Green Airport comparable to other airports on the NEC such as Newark Liberty International Airport and Baltimore/Washington International Thurgood Marshall Airport. Current passenger rail service at and near T.F. Green Airport is illustrated in Figure ES-1.

Figure ES-1: By agreement with RIDOT, MBTA provides commuter rail service at T.F. Green Airport via the Providence/Stoughton Line. Amtrak service is available at Providence, Kingston and Westerly.



Rail Service Scenarios

This feasibility study identified four rail service scenarios that could provide enhanced rail service to the T.F. Green Airport. The four rail service scenarios studied were as follows:

- **Scenario 1** would extend Shore Line East from New London to Providence to provide connections between southeastern Connecticut and Providence via T.F. Green Airport and South County.
- **Scenario 2** would provide new intrastate commuter rail service between Westerly and Providence via T.F. Green Airport and intermediate stops.
- **Scenario 3** would provide new intercity rail service between Boston, Providence, T. F. Green Airport, Wickford Junction/New London and intermediate stops.
- **Scenario 4** would stop Amtrak *Northeast Regional* at T.F. Green Airport, providing intercity rail connections between the airport and Amtrak stations between Boston and Washington, D.C./Virginia.

The scenarios also included additional variations such as the use of electric or diesel trains, and additional station stops; these variations are described in the report. Characteristics of the four rail service scenarios are presented in Table ES-1.

Table ES-1: Rail Service Scenario Characteristics

		Scenario 1	Scenario 2	Scenario 3	Scenario 4
	Existing	**Extend SLE Commuter Rail Service to Rhode Island**	**Begin Rhode Island Commuter Rail Service**	**Begin Boston-Rhode Island Intercity Rail Service**	**Add Amtrak *Northeast Regional* Stop at T.F. Green Airport** (6)
	MBTA Providence Line and *Amtrak Northeast Regional* service	Providence-New London +/- infill trains between Providence & Westerly +/- Amtrak Regional stop at TFG	Providence-Westerly +/- Limited Boston–Wickford Junction MBTA trains	Boston-Wickford Jct/New London/TFG	Full-time Amtrak *Northeast Regional* service at TFG
Annual Operating Cost					
Operations and Maintenance(1)	n/a	$11M-$20M	$12M-$13M	$9M-$27M	$1M
Fare Revenue (1)	n/a	$2-$4M	$3-$4M	$2M-$9M	($1M)
Net Operating Subsidy (1)	n/a	$9M-$16M	$8-$9M	$8M-$18M	$3M
NEC Use Charge (2)	n/a	TBD	TBD	TBD	n/a
Capital Cost (3)					
New Infrastructure	n/a	$125-140M	$70-220M	$20-195M	$90M
New Trains	n/a	$75M	$40-65M	$145-275M	$0M
Annual NEC Recapitalization (2)	n/a	TBD	TBD	TBD	n/a
Ridership - Forecasted Annual Trips to 2025 (4)					
T.F. Green Airport	98,000	220,000-410,000	270,000-280,000	290,000-430,000	300,000
RI Stations west of Providence (5)	304,000	470,000-690,000	560,000-630,000	720,000-960,000	540,000
Estimated Station-to-Station Trip Times (Averaged)					
PROV-BOS	1:05	1:05	1:05	0:39	0:44
TFG-PROV	0:16	0:10	0:10	0:09	0:09
TFG-BOS	1:22	1:16	1:17	0:49	0:54
NLC-BOS	1:42	2:20	No Service	1:44	1:43
NLC-TFG	No Service	0:51	No Service	0:54	0:48

(1) 2015 dollars. Totals may not add up due to rounding.

(2) NEC RRs pay annual NEC use and recapitalization fees

(3) High end estimate across scenario variations. Does not include "soft costs."

(4) Low end estimate across scenario variations

(5) Low end estimate for T.F. Green Airport, Wickford Junction, Kingston, and Westerly stations combined

(6) This scenario assumes stops of all nine *Northeast Regional* round-trips at T.F. Green; other *Regional* service options were evaluated which result in better net revenue impact but significantly restrict travel options to TF Green and anticipated ridership levels.

Summary of Findings

The study explored key factors affecting rail service feasibility: ridership, costs, implementation, and economic impacts. The implementation of any rail service would require a substantial capital investment including the construction of infrastructure improvements at TF Green Airport Station, and an annual commitment to subsidizing operating and maintenance costs. Any new rail service would also pay annual NEC use and recapitalization fees.

All cost estimates in this report are "order-of-magnitude," a term used to indicate that the cost is a concept-level estimation and does not include engineering design as a basis for estimating construction costs. Without some initial level of engineering design, there may be existing conditions or other complications that have not been identified which could result in higher costs than "order of magnitude."

An overall evaluation of the four preliminary scenarios is as follows:

- **Scenario 1, extension of Shore Line East service to Rhode Island**. Estimated capital costs across Scenario 1 variations are $125M - $140M for new infrastructure plus $75M for new trains. The annual operating subsidy requirement (which considers the additional cost to operate and maintain the service minus new fare revenue) is $9M - $16M. This option would expand the airport market into southwestern Rhode Island and southeastern Connecticut, but it has limited benefits in connecting T.F. Green Airport to Boston. This scenario would leverage existing (or planned) rolling stock from Shore Line East.

- **Scenario 2, beginning Rhode Island Commuter Rail Service**. Estimated capital costs across Scenario 2 variations are $70M - $220M for new infrastructure plus $40M - $65M for new trains. The annual operating subsidy requirement is $8M - $9M. This could be positioned as a new service with less implementation constraints compared to a new intercity service. The commuter market to Providence would be positively impacted, but the airport would not necessarily experience big gains in catchment. This scenario would not improve intercity passenger rail connections as identified in Senate Report 114-75.

- **Scenario 3, beginning Boston – Rhode Island Intercity Rail Service**. Estimated capital costs across Scenario 3 variations are $20M - $195M for new infrastructure plus $145M - $275M for new trains. The annual operating subsidy requirement is $8M - $18M. This option would maximize ridership and economic development, but the implementation issues of a complicated governance structure, NEC capacity constraints, ridership and revenue impacts on Amtrak's existing rail services, and overall costs present multiple hurdles.

- **Scenario 4, adding an Amtrak *Northeast Regional* stop at T.F. Green Airport**. Estimated capital costs are $90M for new infrastructure and no cost for trains, assuming the *Northeast Regional* schedule could be modified to use today's trains. A *Northeast Regional* stop at T.F. Green Airport could generate additional annual ridership and revenue of 71,200 and $4.8M respectively, but create longer trip times for Amtrak passengers traveling along the Northeast Corridor, thereby more than offsetting the benefits. Thus, adding a T.F. Green Airport stop to all *Northeast Regional* trains would require a net operating subsidy for Amtrak of an estimated $3M in the first year to be

paid by RIDOT. (The $2.6M includes additional operating and maintenance costs plus the net loss in *Northeast Regional* fare revenue.)

Other *Northeast Regional* service options were evaluated by Amtrak, such as eliminating station stops within New England to maintain current *Regional* trip times between the major service points on the Corridor. While these options demonstrated better net revenue impact, they restricted travel options to T.F. Green Airport and anticipated ridership levels. Scenario 4 could also be combined with any of the other scenarios evaluated as part of this study to provide enhanced intercity passenger rail connections to T.F. Green Airport. More information about this analysis can be found in Section 6 of the report.

Next Steps

The *Feasibility Study for Intercity Rail Service to T.F. Green Airport* is a preliminary feasibility analysis undertaken by Amtrak and RIDOT. Substantial project development, cost estimation and engineering design is required prior to the implementation of any new railroad infrastructure or additional rail service.

Following further discussions between Amtrak and RIDOT regarding which scenarios covered under this study warrant further analysis, the parties will develop a work plan to define the appropriate next steps. Project stakeholders will include the FRA, Massachusetts Department of Transportation (MassDOT), Massachusetts Bay Transportation Authority (MBTA) and the Connecticut Department of Transportation (ConnDOT). Rhode Island Airport Corporation (RIAC) and Providence & Worcester Railroad Company (P&W) will be consulted.

Further analysis will likely cover some or all of the following topics:

1. Outreach involving key stakeholders,
2. Detailed rail operational analysis,
3. Market analysis,
4. Detailed capital and operating cost estimates,
5. Identification of funding sources for capital and operating costs,
6. Environmental screening and conceptual design,
7. Preliminary and final design,
8. Project phasing and capital programming,
9. Institutional arrangements, and
10. Implementation planning for early, medium, and long term actions.

1 Introduction

With the December 2010 opening of the T.F. Green Airport station in Warwick, Rhode Island, a third air-to-rail connection opened along the Northeast Corridor (NEC), joining Baltimore/Washington Thurgood Marshall International Airport (BWI) in Maryland and Newark Liberty International Airport (EWR) in New Jersey. Maryland Area Regional Commuter (MARC) rail and Amtrak's intercity rail are provided at BWI, and NJ TRANSIT's commuter rail and Amtrak's intercity rail are provided at EWR. T.F. Green Airport is served by MBTA commuter rail service but not Amtrak intercity rail service.

Travelers in New England (as well as the Rhode Island economy in general) would benefit by expanding intercity passenger rail service at T.F. Green Airport. Additional passenger rail service would potentially also offer opportunities to better connect the region through an optimized and enhanced integration of commuter and intercity rail services between New Haven, CT, and Boston, MA.

1.1 Context for Study

This report was developed to satisfy the requirement in Senate Report 114-75 of the Transportation, Housing and Urban Development, and Related Agencies Appropriations bill for fiscal year 2016 as excerpted below.

> **"Promoting Rail and Airport Connections**
>
> The Committee supports efforts to improve intercity passenger rail connections at commercial airports that are adjacent to the mainline of the Northeast Corridor [NEC] and not currently served by Amtrak and directs FRA, in coordination with Amtrak, to study the feasibility of establishing service at such airports. Such an assessment of feasibility should include consideration of how intercity passenger service may complement existing or planned commuter passenger rail service at such stations and analyze the projected ridership and revenue levels, impacts on network service levels and performance, operating and capital costs, and local economic impacts associated with any service options."

Amtrak and RIDOT entered into a Memorandum of Understanding on June 15, 2016, and a subsequent study scope agreement on September 20, 2016, to initiate this feasibility study of additional rail service to T.F. Green Airport with FRA support.

1.2 Scope for Study

This study examines the general feasibility of four rail service concepts that could provide additional travel options to T.F. Green Airport, including stopping Amtrak *Northeast Regional* trains as well as implementing new rail services sponsored by Rhode Island. The study explored how many travelers might use the rail services and addressed some of the rail operations capacity challenges on the NEC. The study provided initial parameters of economic benefits, rail operating subsidy requirements, and institutional and contractual factors. A consulting engineering firm was hired by Amtrak and RIDOT to support the technical analysis.

The study is an initial feasibility study to generate potential rail service concepts. Further study would be required to develop concepts to a more detailed level prior to implementation of additional rail services or an Amtrak *Northeast Regional* stop at T.F. Green Airport.

1.3 Reference Studies

The following studies were used to provide background information.

- South County Commuter Rail (2007) (RIDOT)
- Rhode Island Intrastate Commuter Rail: Feasibility Study (June 2009) (Providence Foundation)
- The Northeast Corridor Infrastructure Master Plan (May 2010) (Amtrak)
- Ridership and Revenue Assessment of Amtrak Service to T.F. Green (2017) (Amtrak)
- Rhode Island State Rail Plan (2014)
- Rhode Island Commuter Rail Expansion Study (2015) (RIDOT)
- Pawtucket/Central Falls Commuter Rail Station (Ongoing) (RIDOT)
- South Coast Rail (Ongoing) (MassDOT)
- Boston South Station Expansion Project (Ongoing) (MassDOT)
- NEC FUTURE (Ongoing) (Federal Railroad Administration)
- Let's Go CT! Shore Line East (SLE) Improvement (2015) (Connecticut Department of Transportation)

2 Existing Rail Service

2.1 Rhode Island

Track Configuration

The NEC in Rhode Island is primarily a two-track electrified railroad, with several three-track sections. Between Cranston and west of Kingston, *Acela Express* trains operate at speeds up to 150 mph and *Northeast Regional* trains operate up to 125 mph.

A third track (Track 3) runs between Warwick and the Massachusetts state line at Central Falls. Most of the track is not electrified, and it primarily accommodates the passage of freight trains to minimize conflicts with passenger rail traffic on the two electrified mainline tracks. The Rhode Island Department of Transportation (RIDOT) upgraded much of Track 3 as part of its Freight Rail Improvement Project (FRIP) in the early 2000s, and made additional improvements during the construction of new stations at T.F. Green Airport and Wickford Junction.

Rail Stations

Rhode Island currently hosts five rail stations (see Table 2.1-1). Additional potential commuter rail stations have been studied in Cranston, East Greenwich and a new station in Pawtucket is advancing into final design and construction.

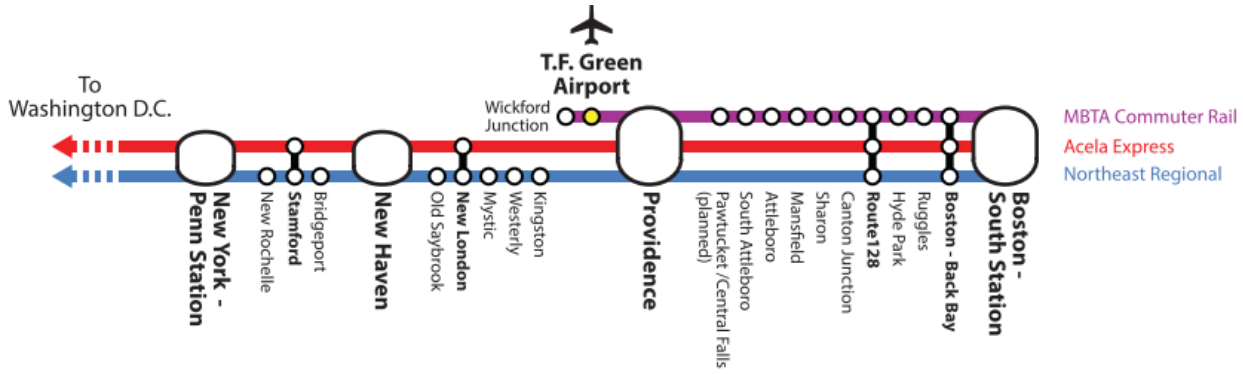
Table 2.1-1: Rail Stations in Rhode Island

Station	Operator: Service		
	Amtrak: *Acela Express*	Amtrak: *Northeast Regional*	MBTA: Commuter Rail
Providence	X	X	X
T.F. Green Airport			X
Wickford Junction			X
Kingston		X	
Westerly		X	

Rail Operations

Three railroads operate on the NEC in Rhode Island: intercity passenger rail provider Amtrak, commuter rail provider Massachusetts Bay Transportation Authority (MBTA), and freight rail provider Providence and Worcester (P&W) Railroad Company. Each of these rail operations are described in greater detail below. Figure 2.1-1 summarizes current passenger rail services.

Figure 2.1-1: Existing Passenger Rail Service in Rhode Island and Northeast Corridor Connections



Amtrak

Amtrak owns and operates the NEC in Rhode Island. Amtrak also provides two types of intercity rail passenger service—*Northeast Regional* and *Acela Express*. *Northeast Regional* trains operate between Boston South Station and Newport News/Norfolk or Lynchburg, Virginia with numerous intermediate stops. All *Northeast Regional* trains stop at Kingston, while Westerly is served by four westbound and five eastbound weekday trains.[1] *Acela Express* trains operate between Boston South Station and Washington, D.C. with intermediate stops only at major cities including Providence.

Massachusetts Bay Transportation Authority (MBTA)

MBTA contracts with Keolis North America to operate commuter rail service between Rhode Island and Boston on the Providence/Stoughton Line via T.F. Green Airport. The service is provided with diesel trains. The Providence/Stoughton Line is MBTA's most popular with over 20,000 daily weekday boardings. Trains do not serve T.F. Green Airport or Wickford Junction on weekends or holidays as service terminates at Providence. Providence is MBTA's fourth-busiest commuter rail station after Boston's South Station, North Station, and Back Bay. The average number of weekday boardings is approximately 200 passengers at T.F. Green Airport station.

Providence and Worcester Railroad (P&W) Company

P&W is a Class II freight railroad operating in Massachusetts, Rhode Island, Connecticut, and New York, with freight service rights along the entire length of the NEC in Rhode Island. P&W operates primarily between Davisville in North Kingstown and Boston Switch in Central Falls along the NEC. P&W operates a daily freight train between Worcester and Davisville, periodic unit ethanol trains to the Port of Providence on an irregular schedule, and a weekday local switching operation between Central Falls, the port, and customers on the NEC in Cranston, Warwick, and Kingston.

[1] Amtrak Northeast Corridor Boston/Springfield - Washington, DC Schedule, NRPC Form W4, Effective November 14, 2016 - January 8, 2017

2.2 Southeastern Connecticut

Track Configuration

Like the Rhode Island segment, Amtrak's NEC in Connecticut is primarily a two-track electrified railroad. Some sections of third track can be found at SLE stations including New London, Old Saybrook, and Guilford. Track speeds are slower in southeastern Connecticut than in Rhode Island and Massachusetts due to numerous curves and moveable bridges.

Rail Operations

Southeastern Connecticut hosts Amtrak and P&W service. Shore Line East commuter rail service between New Haven and New London is sponsored by the Connecticut Department of Transportation (ConnDOT).

Amtrak

As in Rhode Island, Amtrak owns and operates the NEC east of New Haven and provides both *Northeast Regional* and *Acela Express* intercity service. New London is served by *Acela Express* service (one round trip on weekdays) and *Northeast Regional* service (nine round trips on weekdays). Old Saybrook and Mystic are served by *Northeast Regional* service with six and four roundtrips on weekdays, respectively.

Shore Line East (SLE)

Shore Line East (SLE) is a commuter rail service operating daily with diesel trains on the NEC. Amtrak operates SLE service under contract to ConnDOT between New Haven and New London; west of New Haven Metro-North Railroad (Metro-North) operates SLE trains. SLE is oriented towards the New Haven commuter market. In 2018, ConnDOT plans to replace the existing diesel trains with "electric multiple unit" (EMU) trains.

Diesel-hauled SLE service at New Haven. Right: M8 EMU that will replace the diesel-hauled equipment.
(Photo by Paul Pasante, used with permission.)

Providence & Worcester Railroad

The P&W provides local freight service along the NEC in Connecticut east of New Haven. Weekday freight traffic is typically two trains a day serving local customers, with local operations based in Norwich, CT. P&W does not have any customers between Groton, CT and Kingston, RI, so it does not typically run along this portion of the NEC.

3 Service Scenarios

3.1 Objectives

This study defines and analyzes four concepts for expanded passenger rail service to T.F. Green Airport. Each scenario addresses the following objectives:

- Identify potential number of trains at T.F. Green Airport by time of day.
- Identify potential operational constraints and conflicts and potential solutions.
- Address "first cut" operational feasibility of the service.
- Identify rail infrastructure requirements.
- Identify rolling stock requirements.
- Identify train frequency and travel durations for ridership and revenue estimates.
- Identify rail service inputs for operations and maintenance cost estimates.

3.2 Methodology

Two steps comprise the methodology for developing the four scenarios of expanded rail service at T.F. Green Airport:

- Define a base schedule of passenger rail service for the year 2025.
- Define the characteristics of each new service scenario.

3.2.1 Base Schedule – 2025

The 2025 base schedule included the same rail services that exist today:

- Amtrak *Acela Express*
- Amtrak *Northeast Regional*
- MBTA Commuter Rail
- ConnDOT Shore Line East

The schedule was derived from the train schedule and operations simulation developed for the Boston South Station Expansion Project, which maintains the existing NEC alignment and service mix and has traffic levels consistent with those planned by Amtrak and MBTA for the 2025 to 2035 timeframe. Train timings were extended through Rhode Island based on existing train performance characteristics, while holding times at Boston constant. The 2025 base schedule is based on the following assumptions about future train schedules and rolling stock in the Boston to New Haven section of the NEC:

- Amtrak will introduce hourly *Acela Express* service from Boston to New York City.
- *Northeast Regional* schedules will remain unchanged from present levels.
- MBTA will increase peak-period commuter rail service on the Providence Line.
- Shore Line East will maintain the current level of service, with 17 weekday round trips (6-7 of which run to/from New London).

3.3 Rail Service Scenarios

Introduction

All four scenarios would increase and improve rail service at T.F. Green Airport. To support the increase in service, the following improvements would be necessary under most circumstances:

- A new station track and platform.
- For rail services using electric propulsion, electrification of Track 3 at T.F. Green Airport station including lowering Track 3 and the platform to maintain the required vertical clearance for freight traffic under existing bridges and the air rights construction.

Four concepts (see Table 3.3-1) to expand passenger rail service to T. F. Green Airport were developed:

- Scenario 1 would extend SLE from New London to Providence to provide commuter rail service connections between southeastern Connecticut and Providence via T.F. Green Airport and South County. Three variations of this scenario are studied in this report.
- Scenario 2 would provide intra-state commuter rail service between Westerly and Providence via T.F. Green Airport using DMU or EMU trains sponsored by RIDOT. Three variations of this scenario are studied in this report.
- Scenario 3 would provide new hourly intercity service focused on Providence and T. F. Green Airport and extending to Boston and potentially New London. Four variations of this scenario are studied in this report.
- Scenario 4 would add an Amtrak *Northeast Regional* stop at T.F. Green Airport; thus providing intercity rail connections between T.F. Green Airport and existing Amtrak stations on the NEC from Boston to Washington, DC and/or Virginia.

Table 3.3-1: Four Scenarios for Expanded Rail Service at T.F. Green Airport

	Scenario			
	1	2	3	4
Service Name	Extend Shore Line East Commuter Rail Service to Rhode Island	Begin Rhode Island Commuter Rail Service	Begin Boston–Rhode Island Intercity Rail Service	Add Amtrak *Northeast Regional* stop at T.F. Green Airport
Service Description	Extend Shore Line East service from New London to Providence	New intrastate rail service from Westerly to Providence	Boston regional service to Wickford Junction or New London or TFG	Stop all nine Amtrak round-trips at T.F. Green Airport
Variations	1.1, 1.2, 1.3	2.1, 2.2, 2.3	3.1, 3.2, 3.3, 3.4	4.1

Note: Each scenario is color coded throughout this report as indicated in this table. Variations of the four basic scenarios have been developed. In all, this study presents eleven alternatives.

Scenario 1: Extend *Shore Line East* Commuter Rail Service to Rhode Island

Description

Scenario 1 would extend SLE service from its eastern terminus in New London to Providence. Service would be capped at current levels due to the limited number of allowable train movements across the five movable bridges on the NEC in southeastern Connecticut. Within Rhode Island, these trains would stop at Westerly, Kingston, T.F. Green Airport, and Providence. Wickford Junction would be omitted by SLE trains, but would continue to be served by MBTA commuter rail trains from Boston. All variations of this scenario would require two additional revenue trains over and above the existing SLE fleet.

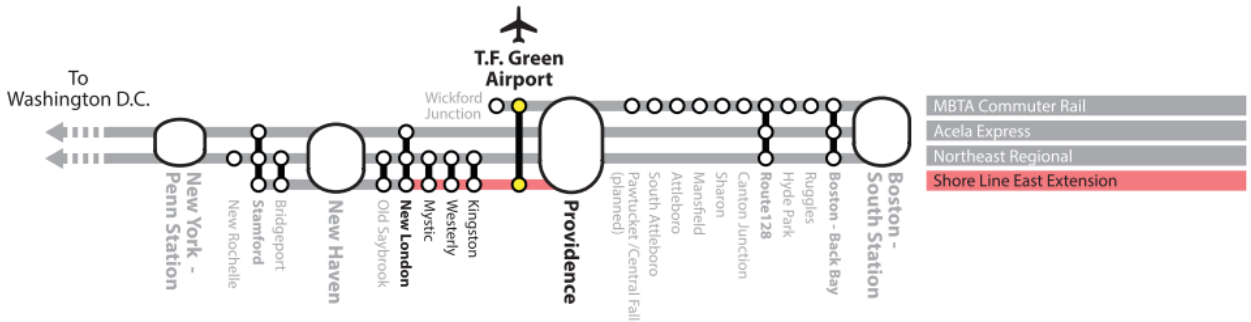
Infrastructure assumptions for Scenario 1 include electrification of Track 3 at T.F. Green Airport, an electrified eastbound Track 4 and second platform at T.F. Green Airport station, and a high level platform at Westerly to accommodate ConnDOT's new M8 EMU trains, which will replace ConnDOT's existing diesel trains by 2018.

Scenario Variations

The original concept for this scenario, which terminated the SLE service at T.F. Green Airport, was eliminated from further consideration. There are several disadvantages to turning a train at T.F. Green Airport compared to Providence. At T.F. Green Airport, turning a train would require a difficult "cross the plant" move in high speed territory. Transfers to other trains would be limited to MBTA service. In addition, laying up a train at T.F. Green Airport would require construction of a pocket track to avoid interference with MBTA and P&W trains. These shortcomings led to possibly extending SLE to Providence, which has existing facilities for cross-platform transfers and where turning the train would "cross the plant" in low-speed territory. Slightly longer train mileage from New London would marginally affect operating costs, and the number of trains needed would not change. Providing SLE service to Providence also connects SLE to the largest market in Rhode Island and allows for additional connections to Providence for T.F. Green Airport riders.

Three variations were defined for SLE service to Providence. Variation 1.1 would complement existing MBTA commuter rail service at T.F. Green Airport with 6 eastbound and 7 westbound trains on weekdays (See Figure below). Layup of SLE trains would occur at the Providence Station – potentially on Track 3/5 – which could allow for convenient cross-platform transfers between MBTA and SLE trains in most circumstances.

Figure 3.3-1: Variations 1.1/1.2 – Extend Shore Line East Service to Rhode Island



Idle trains laying up at Providence (4 to 5 hours) under Variation 1.1 would create inefficiencies. Rather than keep the equipment and crew idle, Variation 1.2 would keep the train sets moving as "infill" runs between Westerly and Providence. This would increase overall SLE service at T.F. Green Airport to 12 trains in each direction. Variation 1.2 would adjust train patterns in Rhode Island to maximize the use of the two trains for intrastate service and for connections to Boston-bound MBTA service at Providence.

Variation 1.3 would augment Variation 1.2 by adding Amtrak *Northeast Regional* service (as defined in Variation 4.1) at T.F. Green Airport (See Figure below). This would increase service at T.F. Green Airport with up to 29 trains in each direction, fill some service gaps, and allow for a better mix of local and express/intercity service.

Figure 3.3-2: Variation 1.3 – Extend Shore Line East Service and Add Amtrak *Northeast Regional* Stop

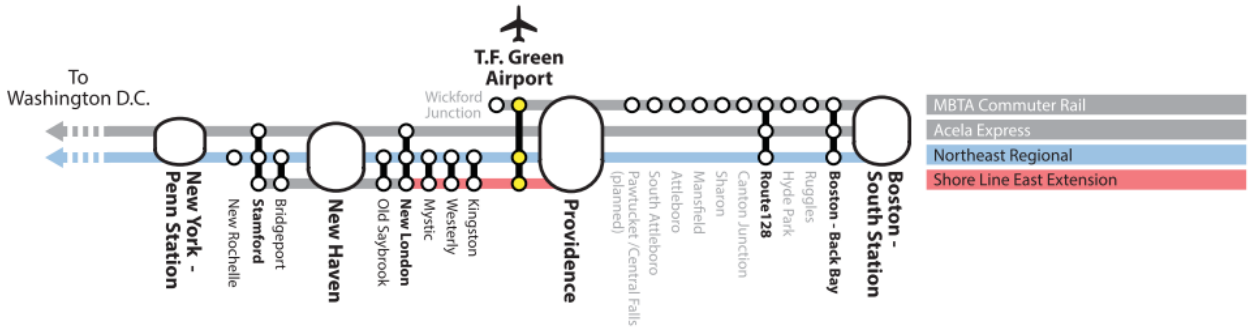


Table 3.3-2: Scenario 1 Variations

	Variation		
	1.1	**1.2**	**1.3**
Addition	Extend SLE New London trains to Providence	Extend SLE trains to Providence with more trains between Westerly and Providence	Extend SLE New London trains to Providence; *Northeast Regional* trains stop at T.F. Green Airport
New trains	7 EB 7 WB	13 EB 13 WB	22 EB 22 WB
Baseline MBTA revenue trains	8 EB 7 WB	8 EB 7 WB	8 EB 7 WB
Total trains at T.F. Green Airport	15 EB 14 WB	21 EB 20 WB	30 EB 29 WB

Note: EB=Eastbound, WB=Westbound

Operational considerations

Trains would utilize ConnDOT M8 EMU trains. The M8 equipment is capable of 90 mph operation, which is slower than Amtrak equipment. Due to the curves and movable bridges between New London and Westerly, the speed differential with intercity trains is not significant. In the rest of Rhode Island, however, where there is a significant speed differential, the SLE trains would need to be carefully scheduled to run after the faster Amtrak service or in the early morning or midday windows where there is less potential conflicts. All three variations require two additional train sets and one spare. The equipment would be based in New Haven rail yard for overnight layover as well as maintenance and inspection, if yard space and staffing can support the added equipment.

Schedule and Trip Times

Potential schedules for each variation of Scenario 1 are shown below.

Table 3.3-3: Scenario 1 – Schedule Times at T.F. Green Airport:

Variation 1.1

Westbound	5:11	6:11	8:11	8:03	11:29	12:43	15:10	17:40	18:01	18:26	19:00	19:07	20:23	21:36	
Eastbound	5:07	6:12	6:58	7:11	7:51	9:26	10:59	13:25	14:55	15:54	18:21	19:37	20:29	22:44	22:49

Note: Proposed SLE Extension train times are shaded red; existing MBTA commuter rail train times are unshaded

Variation 1.2

Westbound	5:11	6:11	7:19	8:11	8:38	9:39	11:29	12:43	14:29	15:10	16:09	17:40	18:01	18:26	19:00	19:07
Eastbound	5:07	5:30	6:12	6:58	7:11	7:51	8:30	9:26	10:59	11:50	13:25	14:55	15:54	16:50	17:50	18:21

Westbound	19:39	20:23	21:36	22:39												
Eastbound	19:37	20:29	21:30	22:44	22:49											

Note: Proposed SLE Extension train times are shaded red; existing MBTA commuter rail train times are unshaded

Variation 1.3

Westbound	5:11	6:11	7:08	7:19	8:11	8:38	8:59	9:39	10:19	11:29	12:43	12:57	14:19	14:29	15:10	16:09
Eastbound	5:07	5:30	6:12	6:44	6:58	7:11	7:51	8:30	9:26	10:20	10:59	11:50	11:56	13:25	13:56	14:55

Westbound	16:25	17:40	18:01	18:26	18:28	19:00	19:07	19:39	20:02	20:23	21:36	22:29	22:39			
Eastbound	15:46	15:54	16:50	17:06	17:50	18:21	18:56	19:37	20:29	20:36	21:30	22:44	22:49	23:23		

Note: Proposed SLE Extension train times are shaded red; existing MBTA commuter rail train times are unshaded; Amtrak *Northeast Regional* train times are shaded blue

Market Considerations

The market for commuter rail service between southeastern Connecticut/Westerly, RI, and Providence/Boston is relatively small. However, direct service to T.F. Green Airport and Providence may draw additional passengers from southeastern Connecticut, where the current 150,000 residents of coastal towns between Old Lyme and Westerly currently choose between T. F. Green and Bradley International Airports for air travel. The lack of rail service from these towns to Bradley could provide a competitive advantage for T.F. Green Airport, as well as provide another public transportation option for travel to the airport as well as across the region (e.g., to the Providence Place Mall).

Scenario 2: Begin New Rhode Island Commuter Rail Service

Description

Under Scenario 2, a new commuter rail service within Rhode Island would be introduced, providing synchronized transfers with MBTA commuter rail trains at Providence. Either DMU or EMU trains would be used. MBTA commuter rail service from Boston would be truncated at Providence; the new intrastate commuter rail shuttle would stop at Providence, T.F. Green Airport, Wickford Junction, Kingston, and turn at Westerly. Although Scenario 2 provides enhanced intrastate/commuter service for communities in Rhode Island, this scenario would not improve intercity passenger rail connections as identified in Senate Report 114-75.

With diesel trains, the service would be similar to MBTA service in Rhode Island, with a 16-minute trip time between Providence and T.F. Green Airport if the existing FRIP track is used. Using electric trains, or with diesel trains operating at track speed on Tracks 1 and 2 in slots between Amtrak trains, the rail service would operate with improved travel times, in the range of 9 to 10 minutes.

Infrastructure assumptions depend on whether diesel or electric trains are used. Either train type would require a new pocket track at Westerly for train turns; conversion of the existing pocket track at Wickford Junction to a controlled side track; and equipment storage and maintenance facilities and staff. All variations of Scenario 2 would also require an eastbound platform track at T.F. Green Airport (Track 4). Electric trains would require additional electric propulsion infrastructure.

Scenario Variations

Variation 2.1 would use diesel trains, and Variations 2.2 and 2.3 would use electric trains. Variations 2.1 and 2.2 would operate Providence–Westerly service with a total of three train sets, with 20 eastbound and 20 westbound trains stopping at all stations and replacing MBTA service south of Providence. The service would run approximately half-hourly during peak periods and hourly during off-peak hours. Variation 2.3 would use two train sets and operate 14 trains in each direction, providing approximately hourly service, and retaining two morning and two evening peak period MBTA commuter rail round trips to T.F. Green Airport and Wickford Junction. All scenarios with a Westerly terminus would require a new pocket track at Westerly to avoid interference with through Amtrak trains. The variations are summarized in the figures and tables below.

Figure 3.3-3: Variations 2.1/2.2 –Rhode Island Rail Service from Westerly Station to Providence Station using Diesel or Electrical Multiple Units

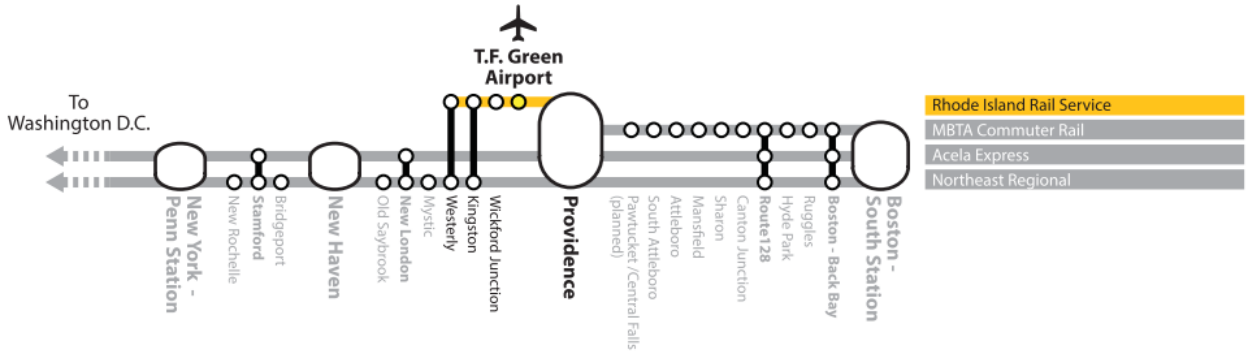


Figure 3.3-4: Variation 2.3 – Rhode Island Rail Service from Westerly to Providence plus rush hour MBTA service to Wickford Junction and T.F. Green Airport

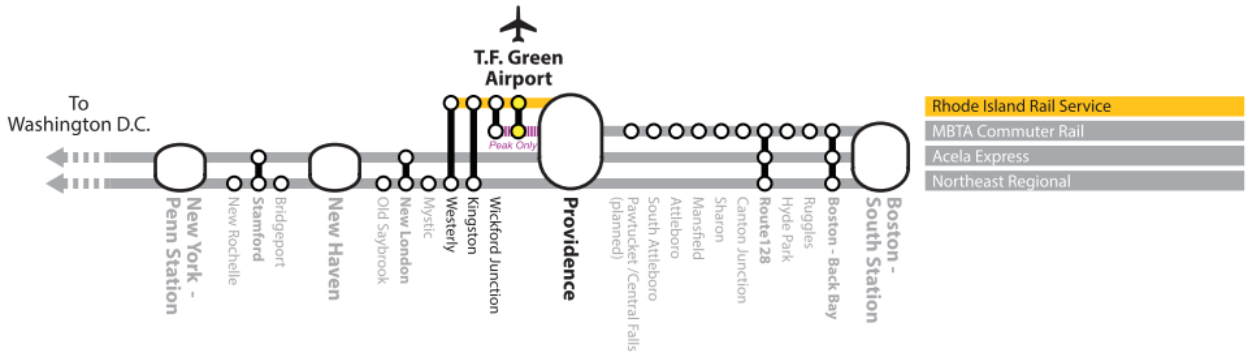


Table 3.3-4: Scenario 2 Variations

	Variation		
	2.1	**2.2**	**2.3**
Addition	Providence–Westerly (with diesel trains)	Providence–Westerly (with electric trains)	Rush hour MBTA Wickford Junction trains ;Providence – Westerly (with electric trains)
New trains at T.F. Green Airport	20 EB 20 WB	20 EB 20 WB	14 EB 14 WB
MBTA revenue trains at T.F. Green Airport	0 EB 0 WB	0 EB 0 WB	2 EB 2 WB
Total revenue trains at T.F. Green Airport	20 EB 20 WB	20 EB 20 WB	16 EB 16 WB

Note: EB=Eastbound, WB=Westbound

Operational Considerations

The use of electric trains, which can operate at higher speeds with faster acceleration, would reduce conflicts with existing NEC service, and reduce travel times, as shown in Table 3.3-6.

Variations 2.1 and 2.2 would connect with all MBTA service at Providence. These services would require three revenue shuttle train sets, including one train set that operates primarily within the peak periods. Variation 2.3 would use two train sets to connect with off-peak MBTA trains and most peak MBTA trains at Providence. Selected MBTA trains during peak periods would be extended to Wickford Junction to preserve existing peak service frequencies at T.F. Green Airport and Wickford Junction.

Schedule and Trip Times

The tables below summarize potential schedules.

Table 3.3-5: Scenario 2 – Schedule Times at T.F. Green Airport:

Variation 2.1

Westbound	5:45	6:35	7:05	7:35	8:35	9:20	10:00	11:20	12:40	14:00	14:40	15:10
Eastbound	5:42	6:22	7:07	7:57	8:46	9:33	10:13	11:04	12:04	13:31	14:31	15:31
Westbound	16:10	17:05	17:40	18:20	19:00	19:40	20:20	21:35				
Eastbound	16:02	16:57	17:49	18:29	19:17	19:51	20:11	21:31				

Variation 2.2

Westbound	5:44	6:34	7:04	7:34	8:34	9:19	9:59	11:19	12:39	13:59	14:39	15:09
Eastbound	5:40	6:20	7:05	7:55	8:43	9:31	10:11	11:02	12:02	13:29	14:29	15:29

Westbound	16:09	17:04	17:39	18:19	18:59	19:39	20:19	21:34				
Eastbound	16:00	16:55	17:47	18:27	19:15	19:49	20:09	21:29				

Variation 2.3

Westbound	6:09	7:34	8:34	9:59	11:24	12:39	13:59	15:09	16:29	17:09	17:40	18:19	19:06	19:39	20:19	21:39
Eastbound	5:16	5:40	6:20	6:59	7:55	9:31	10:57	12:07	13:29	14:29	16:00	16:45	17:47	19:15	19:54	21:14

Note: proposed MBTA commuter rail train times are shaded purple; proposed Rhode Island Commuter Rail trains are unshaded

Table 3.3-6: Variations 2.1/2.2 – Travel Times to/from T.F. Green Airport – Diesel versus Electric Trains

	T.F. Green Airport–Providence	T.F. Green Airport–Boston (w/transfer)	T.F. Green Airport–Westerly	Boston–Westerly (w/transfer)
Diesel	0:10 - 0:16	1:20 - 1:26	0:48	1:58
Electric	0:09	1:18	0:30	1:40

Market Considerations

The market for commuter rail service within Rhode Island would be relatively small, although potentially adding infill stations at Cranston and East Greenwich may improve usage. Westerly and Kingston are not major population centers, and much of southern Rhode Island falls outside the urbanized area. Amtrak Northeast Regional serves both Westerly and Kingston throughout the day, although the service is not peak oriented. Currently, just two Northeast Regional trains — No. 66 eastbound and No. 177 westbound — provide a single peak- period round trip between Westerly, Kingston, and Boston.

Most Scenario 2 variations with travel to/from Boston would require a transfer at Providence, which tends to discourage ridership. Also, truncating MBTA services at Providence limits the potential for T.F. Green Airport to attract air travelers from the Massachusetts markets. Up to 30% of the T.F. Green Airport enplanements are made by Massachusetts residents. Air travelers from the southwest Boston suburbs (particularly those within the Route 128 station catchment area in Westwood) may consider traveling to Logan Airport over T.F. Green Airport under this scenario. Variation 2.3, which would retain several one-seat round trips to/from South County (during the peak only), would have a much lower impact on the Boston commuter market. Most South County commuter rail riders use just a few trains during the peak anyway (existing midday and late night ridership at Wickford Junction and T.F. Green Airport is very low). Any new rail service in Rhode Island may cause a mode shift away from RIPTA bus service.

Adding Northeast Regional service at T.F. Green Airport was not analyzed as a variation of Scenario 2, but might benefit suburban Providence residents. Parking at Providence Station is limited to 330 spaces, and the garage usually fills up by 7 AM. Parking in the T.F. Green Airport station garage is more abundant, with 650 spaces. Amtrak service at T.F. Green Airport would likely take away some riders from Providence; however, the superior accessibility of T.F. Green Airport station to Warwick/Cranston and I-295 corridor residents may attract some new Northeast Regional riders.

Scenario 3: Begin New Boston–Rhode Island Intercity Rail Service

Description

Scenario 3 would introduce a new intercity service between Boston South Station and stations in Rhode Island, including T.F. Green Airport. In Variation 3.1, the service would terminate at Wickford Junction, while in Variation 3.2 it would continue to New London. The service for variations 3.1 and 3.2 would operate between approximately 6 AM and midnight and provide hourly service throughout the day, supplemented by half-hourly service during weekday peak periods in the peak direction of commuter travel (eastbound towards Boston in the A.M. and westbound away from Boston in the P.M.). Variations 3.1 and 3.2 would replace existing MBTA commuter service at Providence and T.F. Green Airport. The peak hour supplemental service would provide a level of service at T.F. Green Airport and Wickford Junction equivalent to the current MBTA commuter rail service.

Variation 3.3 and 3.4 would introduce a new intercity service that operates between Boston South Station and T.F. Green Airport Station and complement the existing MBTA commuter rail service on the Providence Line. The intent of these variations is to provide rail service between T.F. Green Airport and both Providence and Boston at reasonable intervals throughout the day in both directions, in a manner that could be implemented in the short-to-medium term at a relatively low capital cost. This new service would be operated with two revenue trainsets assumed to consist of a high-performance diesel locomotive and coaches operating in a push-pull configuration. Diesel equipment is assumed in both Scenarios 3.3 and 3.4 to avoid the difficulty and cost of re-profiling and installing catenary over Track 3 at T.F. Green Airport.

The service pattern would be similar to that operated by MBTA on the Providence Line, with top speeds capped at 80 mph. Running times would be equivalent between Providence and T.F. Green Airport, while slightly longer between Boston and Providence.

Variation 3.4 is almost identical to Variation 3.3. Under Variation 3.4, all Boston-Rhode Island intercity trains are scheduled to operate via Track 3 (the FRIP track) between Providence and T.F. Green Airport in both directions. All scheduled meets in this territory between Rhode Island intercity trains and MBTA revenue trains are avoided in this variation. This variation also operates with two revenue trainsets consisting of diesel equipment.

Analysis of Scenario 3 did not address capacity constraints at South Station or along the Massachusetts portion of the NEC between Canton Junction and South Station, where several other MBTA Commuter Rail Lines—from Framingham/Worcester, Needham, Franklin, Stoughton and potentially Fall River and New Bedford (if the Stoughton electric alternative of South County Rail is implemented)—merge and create a bottleneck. This scenario assumes that the movable bridges east of New London may limit the number of addition of trains. The substantial capacity constraints at Boston South Station as well as capacity along the congested NEC railroad will need to be addressed if this scenario moves forward.

Scenario Variations

The service characteristics of Variations 3.1 and 3.2 are identical, including the number and timing of trains, rolling stock equipment and station stopping variations. A total of 20 revenue trains are operated on weekdays in each direction. All trains would make stops at Boston Back Bay, Route 128,

Providence, and T.F. Green Airport in between Boston South Station and Wickford Junction. Variation 3.2 would continue west stopping at Kingston, Westerly, Mystic and New London (see Table 3.3-7).

In Variation 3.3, the new service starts operating towards the end of the morning peak period, runs through the mid-day period, tapers off during the evening peak period, and continues to provide late evening service, terminating around 10:30 pm. The new Boston-Rhode Island intercity trains do not operate during the height of the morning and evening peak periods, when MBTA service is running. The new service essentially fills gaps in the existing commuter rail service at T.F. Green Airport, mostly running in the peak shoulder hour and during off-peak hours when MBTA service is extremely limited. This is done for two reasons: in recognition that the frequency of service during the weekday peak periods is reasonably good (headways generally between 30 and 60 minutes), and to avoid introducing additional trains at Boston South Station during the peak periods when the station platforms and approach trackage are expected to have very little available capacity.

In Variation 3.4, all three scheduled meets between the new Boston-Rhode Island intercity trains and MBTA revenue trains are avoided. The service intervals at T.F. Green Airport are more irregular in Variation 3.4 than in Variation 3.3. The most significant gap occurs in the eastbound direction in the latter portion of the evening peak period, where there is a gap in service of approximately three hours – the period of the day during which the commuter service from Boston to Wickford Junction fully utilizes the available existing platform capacity at the T.F. Green Airport Station.

Table 3.3-7: Revenue Trains - Scenario 3 Variations

	Variations			
	3.1	**3.2**	**3.3**	**3.4**
	Boston to **Wickford Junction** (electric locomotive hauled)	Boston to **New London** (electric locomotive hauled)	Boston to **T.F. Green Airport** (diesel locomotive hauled)	Boston to **T.F. Green Airport** (diesel locomotive hauled)
New trains at T.F. Green Airport	20 EB 20 WB	20 EB 20 WB	9 EB 8 WB	7 EB 7 WB
MBTA trains at T.F. Green Airport	None	None	8 EB 8 WB	8 EB 8 WB
Total revenue trains at T.F. Green Airport	20 EB 20 WB	20 EB 20 WB	17 EB 16 WB	15 EB 15 WB

Note: EB=Eastbound, WB=Westbound

Figure 3.3-5: Variation 3.1 - Boston–Wickford Junction Intercity Service

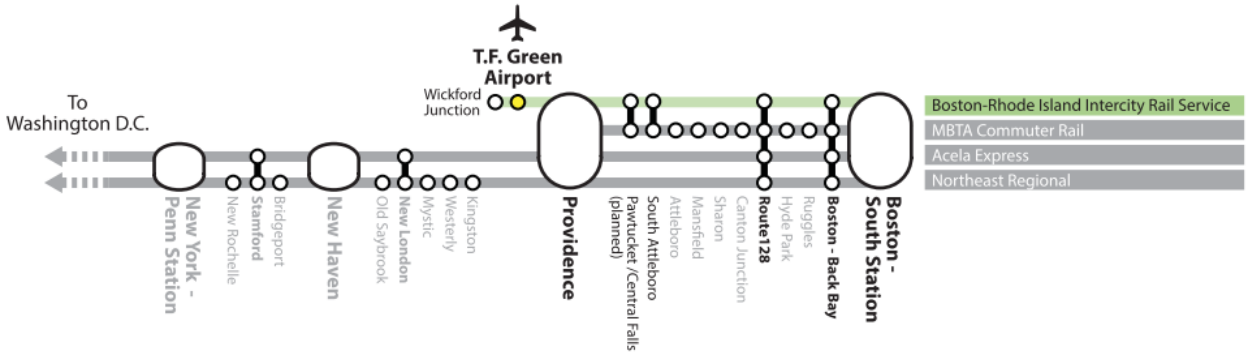


Figure 3.3-6: Variation 3.2 - Boston–New London Intercity Service

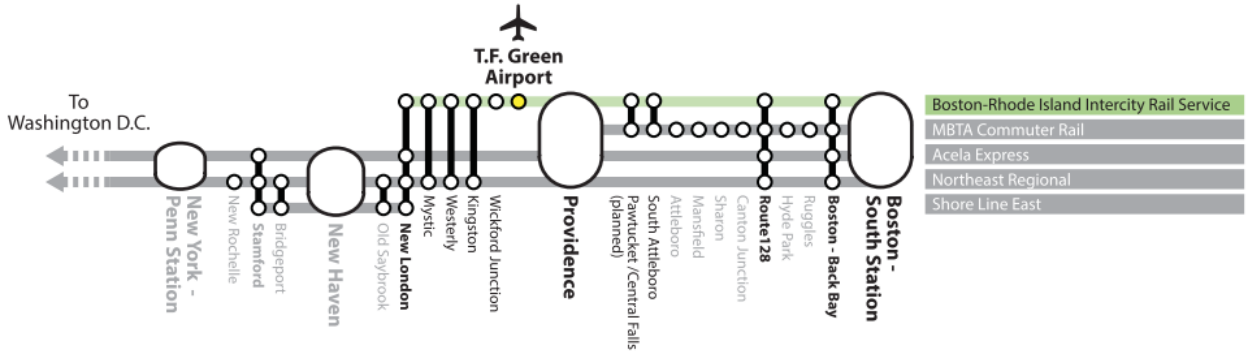
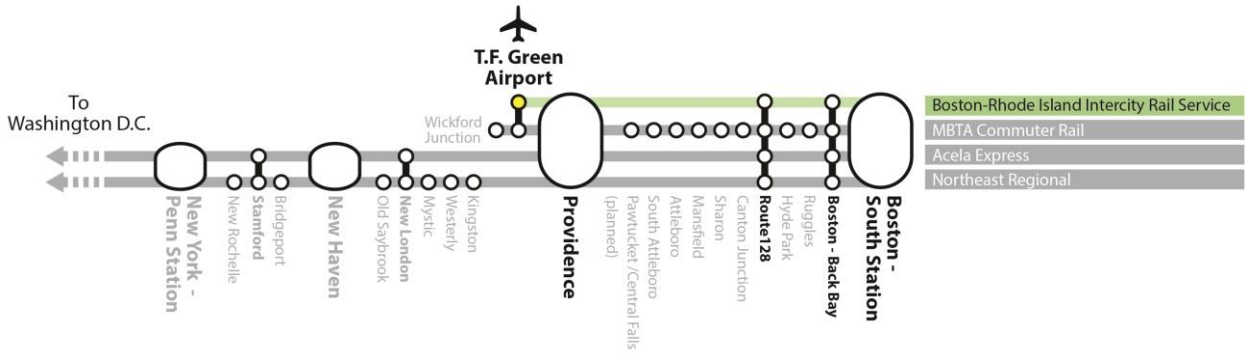


Figure 3.3-7: Variations 3.3/3.4 – Boston-T.F. Green Airport Intercity Service



Variation 3.1 requires five revenue train sets. In the event that layover space is needed towards the west end of Variation 3.1, there will be additional analysis to determine its location. Four train sets would start at an undetermined location subject to further analysis and would likely return to this location at the end of the service day. The fifth train set would be based overnight at Boston and

provide the first westbound departure in the morning and the last eastbound arrival at night. The hourly all-day pattern would be operated with three trains.

Variation 3.2, with trains extended to New London, would require six revenue train sets, four of which would provide the hourly service, with the remaining two providing the extra half-hourly peak service. As in Variation 3.1, one train set would be based overnight in Boston, with the other five based at a new rail yard in southeastern Connecticut.

In Variation 3.3, a total of eight round trips are provided between Boston South Station and T.F. Green Airport, with trains making intermediate stops at Back Bay, Route 128 and Providence. One of the trainsets originates at Boston South Station and is assumed to be stored overnight within the Boston terminal area. The second trainset originates at T.F. Green Airport and is assumed to be stored overnight at the yard in Pawtucket. During the evening peak period, one of the two trainsets would be stored temporarily within the Boston terminal area. The second trainset would shuttle back to Providence, to free up the platform track at T.F. Green Airport for use by rush hour MBTA trains and to provide a transfer connection at Providence to fill an eastbound service gap around 5:00 PM.

In Variation 3.4, by eliminating the three scheduled Boston-Rhode Island service meets that exist in Variation 3.3, the number of Boston-Rhode Island intercity service is reduced to seven round trips per day. Overnight storage of the two revenue trainsets is assumed to be the same as outlined above for Variation 3.3.

Schedule and Trip Times

Potential rail schedules and trip times are shown below.

Table 3.3-8: Scenario 3 – Schedule Times at T.F. Green Airport

Variations 3.1 and 3.2

Westbound:	—	6:04	—	7:04	—	8:09	9:04	10:09	10:49	12:04	13:04	14:04
Eastbound:	5:16	6:16	***6:46***	7:16	***7:46***	8:21	9:16	10:16	11:16	12:16	13:16	14:16

Westbound:	15:04	16:04	16:54	***17:34***	18:09	***18:34***	19:04	20:04	21:04	22:04	23:04	
Eastbound:	15:16	16:31	17:16	—	18:16	—	19:16	20:16	21:16	22:16	—	

Note: Proposed Boston-Rhode Island intercity train times are shaded green. Trains shown in bold italics operate during weekday peak periods. These trains could make additional stops at Pawtucket and South Attleboro to enable selected MBTA commuter trains to turn short at Attleboro, thereby freeing capacity between Attleboro and Providence.

Variation 3.3

Westbound:	—	—	—	—	8:38	—	9:44	11:22	12:43	13:32	14:34	15:10
Eastbound:	5:07	6:12	6:58	7:51	9:00	9:26	10:05	12:05	13:25	14:04	14:55	15:54

Westbound:	16:12	17:40	17:54	18:26	19:07	19:32	20:24	21:36	22:34	—	—	—
Eastbound:	16:50	—	18:12	—	—	20:05	21:10	—	22:24	—	—	—

Proposed Boston-Rhode Island intercity train times are shaded green.

Variation 3.4

Westbound:	—	—	—	—	8:38	—	10:00	11:26	12:43	13:56	—	15:10
Eastbound:	5:07	6:12	6:58	7:51	8:56	9:26	10:08	12:01	13:25	14:38	—	15:54

Westbound:	16:12	17:40	17:54	18:26	19:07	—	20:28	21:36	22:56	—	—	—
Eastbound:	16:50	—	—	—	19:57	—	21:00	—	22:24	—	—	—

Note: Proposed Boston-Rhode Island intercity train times are shaded green; existing MBTA commuter rail train times are unshaded

Table 3.3-9: Scenario 3 – Travel Times to/from T.F. Green Airport

Variation	T.F. Green Airport–Providence	T.F. Green Airport–Boston (Express)	T.F. Green Airport–Westerly	T.F. Green Airport– New London	Boston– Westerly (Express)
3.1	0:09	0:49	n/a	n/a	n/a
3.2	0:09	0:49	0:32	0:54	1:22
3.3	0:16	0:59	n/a	n/a	n/a
3.4	0:16	0:59	n/a	n/a	n/a

Market Considerations

Scenario 3 would significantly benefit the Boston-bound market by offering more and faster train service. T.F. Green Airport would also benefit from greater access to Massachusetts markets. Up to 30% of the T.F. Green Airport enplanements are made by Massachusetts residents. Air travelers from the southwest Boston suburbs (particularly those within the Route 128 station catchment area in Westwood) may find hourly train service to T.F. Green Airport an easier and more affordable alternative than traveling to Logan Airport in mixed traffic. Frequent trains to T.F. Green Airport also would attract Providence area passengers, including Downcity and College Hill, which together have the highest population and employment concentrations in Rhode Island.

Frequent trains at T.F. Green Airport would likely attract some airport and airline employees from central Providence and Massachusetts. Variation 3.2 would also attract a share of those airport workers from Westerly, Mystic, and New London stations. Residents of metropolitan Providence—in particular those in downtown Providence and Warwick/Cranston—would likely find faster, more frequent intercity rail service a more attractive choice than existing diesel-hauled MBTA commuter rail service.

The number of passengers using commuter rail to travel between Boston and Providence during the AM peak-period is already fairly significant. New intercity service could grow that market.

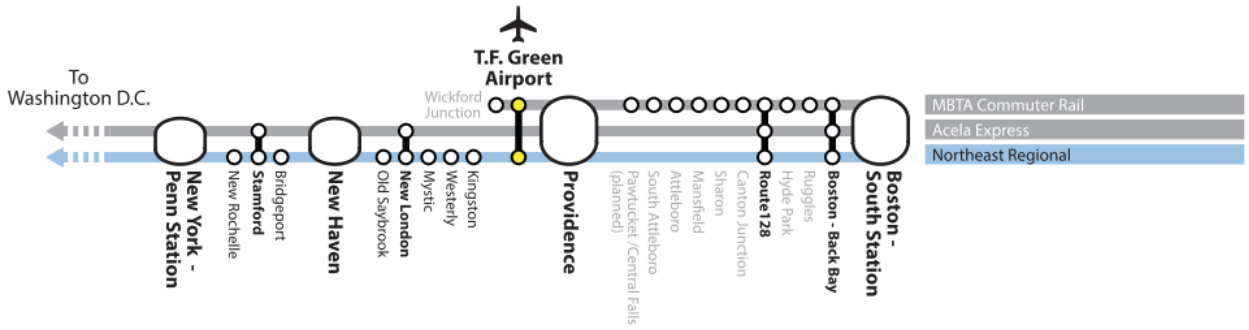
Scenario 4: Add Amtrak *Northeast Regional* Stop at T.F. Green Airport

Description

Scenario 4 would have all existing Amtrak *Northeast Regional* trains stop at T.F. Green Airport. This stop would be in addition to *Northeast Regional* stops already occurring at Westerly, Kingston, and Providence in Rhode Island. On weekdays, nine eastbound and westbound *Northeast Regional* trains would serve T.F. Green Airport; and 12 eastbound and westbound MBTA commuter trips would occur. MBTA commuter rail service frequency and times at T.F. Green Airport would remain essentially unchanged in this scenario.

Infrastructure assumptions for Scenario 4 include electrification of Track 3 (over 3.4 miles from POST to PACKARD interlocking); and a newly added eastbound track and platform at the existing station.

Figure 3.3-8: Scenario 4 – Amtrak *Northeast Regional* Stops at T.F. Green Airport



Scenario Variations

One variation of Scenario 4 was evaluated fully in this study - Variation 4.1. This scenario assumed that all existing Amtrak *Northeast Regional* trains (9 round trips) would stop at T.F. Green Airport Station. Table 3-3.10 summarizes Variation 4.1.

Table 3.3-10: Scenario 4.1 Variation

	4.1
Addition	Amtrak *Northeast Regional* trains stop at T.F. Green Airport
Added trains at T.F. Green Airport	9 EB 9 WB
Baseline MBTA trains at T.F. Green Airport	8 EB 7 WB
Total trains at T.F. Green Airport	17 EB 16 WB

Note: EB=Eastbound, WB=Westbound

In addition to Variation 4.1, Amtrak analyzed ridership and revenue outcomes for four other variations, some of which dropped existing station stops on selected *Northeast Regional* trains. The four additional variations analyzed by Amtrak included:

- Stop five (5) *Regional* round trips, retain all current stops and add 5 minutes per new stop
- Stop two (2) *Regional* round trips, retain all current stops and add 5 minutes per new stop
- Stop all *Northeast Regional* trains (9) and drop a total of 9 existing stops in each direction

- Stop five (5) *Regional* round trips and drop a total of 5 existing stops in each direction.

More details of Amtrak's ridership and revenue analysis for Scenario 4 and the scenario variations can be found in Section 6 of the report.

Operational Considerations

Scenario 4 would use Amtrak's existing electric locomotive-hauled trains typically found on *Northeast Regional* trains (Amfleet coaches and cafés with Siemens ACS-64 electric locomotives). A new stop a T.F. Green Airport would add about 5 minutes to the overall *Northeast Regional* schedule unless other station stops were dropped. No new train sets would be needed for this service variation. Existing *Northeast Regional* equipment would continue to layover at the terminal stations and be maintained in Boston, New York, and Washington, DC.

Additional stopping patterns and service frequencies were considered in Amtrak's analysis, which would provide less service frequency to T.F. Green Airport. These options are discussed further in Section 6.2

Schedule and Travel Times

A potential schedule for Scenario 4 is shown below. Amtrak *Northeast Regional* trains would stop at T.F. Green Airport every 1½–2½ hours on weekdays and would be distributed throughout the day. MBTA commuter rail service would continue to serve the airport. Northeast Regional travel times would be 9 minutes to Providence (versus 16 minutes on MBTA commuter rail); 49 minutes to Boston (versus 85 minutes on MBTA commuter rail); and 3 hours to New York Penn Station.

T.F. Green Airport InterLink

Table 3.3-11: Variation 4.1 – Schedule Times at T.F. Green Airport

Westbound	7:08	8:38	8:59	10:19	12:43	12:57	14:19	15:10	16:25	17:40	18:26		18:28	19:07	20:02	21.36
Eastbound	5:07	6:12	6:58	7:51	9:26	10:20	11:56	13:25	13:56	15:46	15:54		17:06	18:56	20:36	22:44

Note: Proposed Amtrak *Northeast Regional* train times are shaded blue; proposed MBTA commuter rail train times are unshaded.

Market Considerations

Existing rail service at T.F. Green Airport station is much less frequent than at the other major airports on the NEC. Nine *Northeast Regional* trains per day serve Newark Liberty International Airport (EWR), in addition to New Jersey Transit's frequent commuter rail service. At Baltimore/Washington International Thurgood Marshall Airport (BWI), the combination of *Acela Express*, *Northeast Regional*, and MARC commuter trains serve the airport station at least hourly throughout the day.

Amtrak *Northeast Regional* service use at EWR is fairly modest; in 2015 an average of 380 passengers per day arrived and departed from the station.[2,3] Not every *Northeast Regional* train stops at EWR,

[2] Source: https://www.amtrak.com/ccurl/536/496/NEWJERSEY15,0.pdf
[3] The primary markets for Amtrak service to/from EWR are New Haven, Stamford, Philadelphia, and Wilmington.

which indicates that saving trip time for through travelers is very important. Further planning for rail service at T.F. Green Airport will present similar issues and tradeoffs. NJ TRANSIT service at EWR is more heavily used and averages approximately 3,314 passengers on weekdays.[4]

At BWI, Amtrak use (both *Northeast Regional* and *Acela Express*) is much greater than EWR, with an average of 1,744 passengers per day arriving and departing from the station.[5] MARC service at BWI is more heavily used; MARC counts only boardings and reports BWI weekday boardings as 2,000.[6]

T.F. Green Airport Station is considerably closer to the airport terminal building than either BWI or EWR. InterLink, a quarter-mile-long enclosed moving sidewalk, connects rail passengers with the terminal in about 5 minutes. However, a shuttle is not available. The distance between EWR and the airport terminals is 1–2 miles over a connecting monorail system (AirTrain) operating every 3 to 4 minutes. The BWI rail station is even farther from the airport terminal, requiring a 10-minute shuttle bus ride (in mixed traffic) that runs every 12–25 minutes and does not necessarily coordinate with train arrival and departure times.

Additional analysis is needed to understand rail ridership potential at T.F. Green Airport, as it differs in size and rail connectivity from the other two stations. The impact on Amtrak ridership and revenue for longer distance travel needs to be assessed, as added travel time of even a few minutes has a negative impact on Amtrak ridership levels. The impact on ridership levels at nearby stations must also be evaluated, to determine whether riders accessing the Amtrak intercity train at T.F. Green Airport station stop are new riders, or have just shifted the travel points from other nearby Amtrak stations, such as Providence, Kingston or Westerly. Results from a preliminary analysis performed by Amtrak to examine these issues are discussed below and in more detail in Section 6.2.

[4] Source: NJTRANSIT. Quarterly Ridership Trends Analysis (2012).
[5] BWI rail station benefits from having a highway access road and a 3,200-space parking garage. EWR does not have parking at the station, which would attract long-distance commuters.
[6] Estimate from Maryland Transit Administration, 2017.

4 Travel Demand and Rail Ridership

Daily and annual rail ridership was estimated at the T.F. Green Airport station for variations within each of the four service scenarios. Four primary categories of riders are expected at the T.F. Green Airport station, and each required its own method of estimation.

- Regional travel from the catchment area surrounding T.F. Green Airport station to Providence and Boston (primarily journey-to-work commuting).
- Intercity travel from the catchment area surrounding T.F. Green Airport station to points west on the NEC.
- Air passengers at T.F. Green Airport, using the rail mode to access the airport.
- Airport employees at T.F. Green Airport, using the rail mode to travel to and from work.

Ridership in each of these categories will depend on the extent and characteristics of the rail service—including frequency, travel time and fare—as well as the relative competitiveness of rail versus alternative modes.

4.1 Variation Comparison

Ridership comparisons among the nine service variations are presented from three perspectives:

Table 4.1-1: Estimated 2025 Annual Ridership at T.F. Green Airport (thousands of trips)

- presents annual ridership estimates at T.F. Green Airport station, for the four markets;

Table 4.1-2: Estimated 2025 Annual Ridership at Stations West of Providence (thousands of trips)

- presents annual ridership for all four Rhode Island stations west of Providence; and
- Table 4.1-3 presents the incremental increase in annual ridership at the same four stations.

All figures are estimates of annual rail trips in the year 2025. The estimates provide a range, recognizing the uncertainty associated with high-level projections. The airport access market range is generated from the two levels of potential future air passenger traffic at T.F. Green Airport. For the other markets, the range includes 15 percent above and below the estimated level of annual ridership.

The following observations can be made.

- Scenario 3 results in the greatest ridership.
- Scenario 3 best serves all four markets of potential rail riders at T.F. Green Airport.
- Improved commuter service within Rhode Island (Variations 1.2, 1.3, Scenarios 2 and 3) will generate additional ridership at the four stations west of Providence; however, the majority of the new ridership would be at T.F. Green Airport station.
- Introducing a T.F. Green Airport stop on *Northeast Regional* trains would generate Amtrak ridership at the airport station from two potential travel markets – airport access trips by air passengers flying to/from the airport and intercity trips by residents and visitors traveling to/from places within the catchment area of the station. On the other hand, stopping *Northeast Regional* trains at T.F. Green Airport will shift some Amtrak ridership away from existing stations, as well as reduce through ridership due to the extra time required to make a new station stop. These topics are addressed in more detail in Section 6.2.

Table 4.1-1: Estimated 2025 Annual Ridership at T.F. Green Airport (thousands of trips)

Station		Variation										
		1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1
		SLE Extension	SLE Extension with Infill Trains	SLE Extension with Infill Trains & NE Regional Stops	Rhode Island Service – DMU	Rhode Island Service – EMU	Rhode Island Service – EMU with Selected MBTA Wickford	Boston-Wickford Junction Express Service	Boston-New London Express Service	Boston-T.F. Green Diesel Express Service (9 EB/ 8WB rnd trips)	Boston-T.F. Green Diesel Express Service (7 rnd trips)	Add Northeast Regional Stops at T.F. Green
Commute to/from Boston and Providence	Low	111	145	192	119	119	123	222	222	183	170	157
	High	147	192	254	158	158	163	293	293	243	225	208
Airport Employees to T.F. Green Airport	Low	73	95	105	95	95	73	83	102	67	57	51
	High	97	126	139	126	126	97	109	134	88	76	67
Intercity Travel to Northeast Corridor	Low	—	—	19	—	—	—	—	—	—	—	19
	High	—	—	25	—	—	—	—	—	—	—	25
Air Passengers	Low	36	65	94	65	65	72	98	101	75	62	68
	High	72	120	180	117	117	129	180	192	141	117	126
Total Ridership at T.F. Green Airport Station	Low	220	310	410	280	280	270	400	430	320	290	300
	High	320	440	600	400	400	390	580	620	470	420	420
Note: Totals may not add due to rounding.												

Table 4.1-2: Estimated 2025 Annual Ridership at Stations West of Providence (thousands of trips)

		Variation										
		1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1
Commute to/from Boston and Providence	Low	90	120	120	190	190	130	150	370	50	50	80
	High	120	160	160	250	250	170	200	490	70	70	110
Intercity *Northeast Regional* (at Kingston and Westerly)	Low	165	165	160	165	165	165	165	165	165	165	160
	High	215	215	210	215	215	215	215	215	215	215	210
Total Ridership at Four Rhode Island Stations west of Providence	Low	470	590	690	630	630	560	720	960	540	510	540
	High	650	820	970	860	860	780	1,000	1,320	760	710	750

Table 4.1-3: Estimated 2025 Annual Additional Ridership (thousands of trips)

Station		Variation										
		1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1
T. F. Green Airport Station	Low	124	209	314	183	183	172	301	307	229	193	200
	High	189	311	471	274	274	262	458	455	345	291	300
Wickford Junction, Kingston and Westerly Stations	Low	40	72	68	135	135	81	--	103	--	--	30
	High	53	95	90	178	178	107	--	137	--	--	40
Total Additional Ridership	Low	160	280	380	320	320	250	410	650	230	190	230
	High	240	410	560	450	450	370	590	910	350	290	340
Note: Totals may not add due to rounding.												

5 Operating and Maintenance Costs

5.1 Cost Estimation Methodology

The projected operating costs of train service were derived from a concept operating plan that developed planned train miles, unit miles, and crew hours needed as inputs into the operations and maintenance (O&M) cost model. The operating cost model utilized unit costs disaggregated from a variety of cities in the US. O&M costs are associated with operating the passenger service, including not only the trains but also the passenger stations and other needed support services. The following items comprise the passenger rail system O&M costs:

- Train maintenance;
- Maintenance-of-way (e.g., station, tracks);
- Train operating labor and dispatching;
- Fuel and / or electric utility costs;
- Station operations;
- Police and security, environmental compliance, safety monitoring and reporting;
- Yard operations; and,
- Other (including general administrative and overhead costs).

Unit costs for train, track and route miles, and per passenger costs were multiplied by units derived from the operating plan or passenger demand forecast. Fuel costs were derived in gallons per mile and power consumption for electric train sets as a dollar value for kilowatt hour. Trainset and car and locomotive maintenance were based upon known agency costs developed in 2015. For this exercise, DMU maintenance and fuel consumption costs were developed from information gathered from Denton County Transit Authority (in metropolitan Dallas-Ft. Worth).

The model provided inflation indexing. For the purposes of this study, costs are for a base year of 2016. They represent a snapshot of operations in the year 2025, with costs presented in 2016 dollars.

Federally-mandated annual NEC usage fees, based on railroad use metrics such as train miles, were not included in this version of the O&M model. This additional annual cost will be added to future versions of the model.

5.2 Summary of Operating and Maintenance Costs

Scenario 1: Extend Shore Line East Service to Rhode Island

Table 5.2-1 presents the total estimated annual costs for Scenario 1. The table includes the current costs for the SLE diesel-hauled operations as well as for use of EMUs. Scenario 1 costs are shown as total annual costs as well as the incremental costs compared to the planned SLE operations. For Variation 1.3, the additional costs of adding an Amtrak Northeast Regional stop at T.G. Green is presented in Table 5.2-3.

Table.5.2-1: Scenario 1 - SLE O&M Costs by Variation and Train Type (2016$)

	Existing SLE Service (Diesel-hauled)	Future Baseline SLE Service (M8 EMUs)	Scenario 1	
			Variation 1.1 Extend SLE to Providence	Variations 1.2 / 1.3 Extend SLE to Providence with Infill Runs
TOTAL ESTIMATED O&M COST	$16,920,000	$14,520,000	$25,290,000	$33,720,000
Incremental Annual O&M Cost Compared with Future Baseline (1)	n/a	n/a	$10,770,000	$19,200,000

(1) Further study is needed to estimate annual NEC usage fees

Scenario 2: Begin Rhode Island Commuter Rail Service

Table 6-2.2 presents estimated annual costs for Scenario 2 and includes current costs for the MBTA diesel service to Wickford Junction. Scenario 2 costs are shown as total annual costs, as well as the incremental costs compared to the current MBTA operations. For Variation 2.3, incremental costs for peak MBTA rush hour trips between Providence and Wickford Junction are added.

Table 5.2-2: Scenario 2 – O&M Costs by Variation and Train Type (2016$)

	Existing Baseline (MBTA service)	Scenario 2 Start RI Rail Service		
		Variation 2.1 DMU: Providence to Westerly	Variation 2.2 EMU: Providence to Westerly	Variation 2.3 EMU: Providence to Westerly
ESTIMATED ANNUAL O&M COST	$6,768,000	$18,240,000	$19,440,000	$15,756,000
Additional O&M Cost for Operating rush hour MBTA Trains between Providence and Wickford Junction	n/a	n/a	n/a	$2,461,000
TOTAL ESTIMATED ANNUAL O&M COST FOR SERVICE IN RHODE ISLAND	$6,768,000	$18,240,000	$19,440,000	$18,220,000
Incremental Annual O&M Cost Compared with Existing Baseline (1)	n/a	$11,470,000	$12,670,000	$11,450,000

(1) Further study is needed to estimate annual NEC usage fees

Scenario 3: Begin New Boston-Rhode Island Intercity Rail Service

Table 5.2-3 presents total estimated annual costs for Scenario 3. The table also includes the current costs for the MBTA diesel-hauled operations to Wickford Junction. Scenario 3 costs are shown as total annual costs, as well as the incremental costs compared to the current MBTA operations.

Annual operations and maintenance costs are less for Variations 3.3 and 3.4, with fewer daily round trips, and slightly shorter trip lengths with trains turning at T.F. Green Airport instead of Wickford Junctions. The annual O&M cost estimates do not assume a completely stand-alone operation separate from and in addition to both Amtrak and MBTA. Stand-alone operations would require dedicated crews and rolling stock maintenance facilities and staff, which would be extremely inefficient given the relatively limited volume of service. Instead, the costs were estimated utilizing existing storage and maintenance facilities and drawing upon the train and engine crew personnel of a medium sized commuter rail operating organization (such as MBTA).

Scenario 4: Add Amtrak *Northeast Regional* stop at T.F. Green Airport

Table 5.2-3 also presents the total estimated annual incremental costs for Scenario 4. The majority of incremental costs are associated with police and security, environmental compliance, safety monitoring and reporting, with less substantial incremental costs for station operations and labor support from train, engine and on-board service crews,

Table 5.2-3: Scenarios 3 and 4 – O&M Costs by Variation and Train Type (2016$)

	Scenario 3 Begin Boston – Rhode Island Intercity Rail Service				Scenario 4 Add Amtrak *Northeast Regional* stop at T.F. Green
	Variation 3.1 Wickford Junction	Variation 3.2 Boston – New London	Variation 3.3 Boston - T.F. Green	Variation 3.4 Boston - T.F. Green	Variation 4.1
TOTAL ESTIMATED O&M COST	$19,800,000	$33,600,000	$11,600,000	$9,200,000	$1,200,000
Reduction in MBTA Annual O&M Cost with Service Truncated at Providence	($6,770,000)	($6,770,000)	--	--	n/a
Total Incremental Annual O&M Cost	$13,030,000	$26,830,000	$11,600,000	$9,200,000	$1,200,000

(1) Further study is needed to estimate annual NEC usage fees

6 Fare Revenue

6.1 Scenarios 1, 2, and 3 Revenue Estimate

Methodology

Fare revenue for Scenarios 1, 2 and 3 was estimated by calculating the average rail trip distance of expected new MA-RI-southeastern CT passengers in the year 2025 and applying an average "per mile" fare. The per-mile fare was $0.26, based on current MBTA commuter rail fares. The incremental commuter trips generated by the *Northeast Regional* station stop at T.F. Green Airport are included in the benefits of Variation 1.3 which also provides SLE trains serving this market.

Revenue Estimates

Estimates of new fare revenue for Scenarios 1-3 are shown in the following table.

Table 6.1-1: Scenarios 1, 2, 3 – Fare Revenue

		Scenario 1			Scenario 2			Scenario 3			
		Extend Shore Line East Commuter Rail to Rhode Island			Begin Rhode Island Commuter Rail Service			Begin Boston-Rhode Island Intercity Service			
	Existing	Variation 1.1	Variation 1.2	Variation 1.3	Variation 2.1	Variation 2.2	Variation 2.3	Variation 3.1	Variation 3.2	Variation 3.3	Variation 3.4
	MBTA Providence Line and *Amtrak Northeast Regional* service	Providence-New London	Providence-New London + infill trains between Providence and Westerly	Providence-New London + trains between Prov. & Westerly + Amtrak NE Reg.	Providence-Westerly	Providence-Westerly	Providence-Westerly + Limited Boston–Wickford Junction MBTA trains	Boston-Wickford Junction	Boston-New London	Boston-T.F. Green	Boston-T.F. Green
New Fare Revenue ($2015)	n/a	$2M	$3.3M	$4.4M	$3.7M	$3.7M	$3.5M	$5.2M	$8.5M	$2.8M	$2.3M

6.2 *Northeast Regional* Revenue Estimate

Methodology

Amtrak performed its own separate analysis of revenue and ridership that would result from adding a T.F. Green Airport stop to the *Northeast Regional*. The analysis assumed that the new railroad infrastructure at T.F. Green Airport to support the *Northeast Regional*, including a second station track and high level platform, as well as the installation of electric catenary system on both tracks to power Amtrak's electric locomotives, has been constructed. It is important to note, this analysis estimates the incremental change in riders – it does not supplant the estimate of annual ridership provided in other parts of this report.

The revenue and ridership assessment considered rail and other transportation modes, population density and anticipated growth, demand variability based upon variations in pricing, frequency and transit times, and other econometric variables. The analysis included two potential markets from travel using a T.F. Green Airport stop – (1) airport access trips by air passengers who are flying to/from the airport and (2) regular "intercity" trips by residents and visitors traveling to/from places within the catchment area of the station. The existing BWI Airport station similarly serves both of these types of markets.

The baseline level of ridership and revenue used in this forecast was Amtrak's current levels for *Northeast Regional* train service operating between Boston and Washington DC. Total forecast ticket revenue is $605.2 million and total forecast ridership is 8.31 million passenger trips. A total of five alternatives for serving T.F. Green Airport were considered – three that only add T.F. Green Airport stops to selected trains, which adds run time, and two that add T.F. Green Airport and drop existing stops on selected trains so that existing end-to-end run times can be maintained on all trains. These alternatives are as follows:

- Stop all *Northeast Regional* trains (9 round trips), retain all current stops and add 5 minutes
- Stop five *Northeast Regional* round trips, retain all current stops and add five minutes per new stop
- Stop two *Northeast Regional* round trips, retain all current stops and add five minutes per new stop
- Stop all *Northeast Regional* trains (9 round trips) and drop a total of 9 existing stops in each direction
- Stop five *Northeast Regional* round trips and drop a total of five existing stops in each direction

The results of the analysis are summarized below, expressed as a variance to projected levels.

Revenue Estimates

The addition of a T.F. Green Airport station stop would increase Amtrak's schedule in Rhode Island by five minutes due to train deceleration, passenger offloading and loading and train acceleration. Amtrak's ridership is sensitive to changes in train schedules, and an increase in trip duration will lead prospective passengers to decline to buy a ticket on a *Regional* train. The addition of a T.F. Green Airport station stop would also shift some Amtrak ridership away from existing stations. Under the alternatives that drop existing stops, there would be no impacts due to added time, but the reduced service at these existing stops leads to reduced demand at those stops.

Effect on Existing Stations-. Based upon the option of stopping all *Regional* trains at T.F. Green Airport station and retaining all existing stops, the combined impact of these factors is projected to lead to a reduction of 77,200 passenger trips in existing station markets and an annual reduction in ticket revenue of $6.20 million. If another station stop was removed along the route a reduction of 50,900 passenger trips in existing station markets and an annual reduction in ticket revenue of $5.36 million is estimated.

Stopping fewer trains at T.F. Green Airport Station will have less of an impact. Stopping five (5) *Regional* trains in each direction and retaining all existing stops results in a projected reduction of 50,700 passenger trips and a reduction of ticket revenue of $3.731 million. If instead an equivalent number of stops was reduced, a reduction of 55,100 passenger trips at existing stations and ticket revenue of $2.87 million is estimated. Stopping 2 *Regional* trains in each direction and retaining all existing stops results in a projected reduction of 27,500 annual passenger trips and a reduction of ticket revenue of $1.58 million annually.

Effect on T.F. Green Airport Station- These losses described above would be offset by new ridership and revenue associated with passengers travelling to or from the T.F. Green Airport stop, including "Airport Access Trips" and "Intercity Trips", as shown in Table 6.2.1. Stopping all *Regionals* at T.F. Green Airport would result in new airport passenger-related ridership of 6,800 annual passenger trips and new annual ticket revenue of $485,000 as well as 64,400 additional intercity trips and annual ticket revenue about $4.3 million. Lower impacts would be seen by stopping a lesser number of *Regional* trains at the T.F. Green Airport Station.

The ridership and ticket revenue losses associated with added *Northeast Regional* travel times could be mitigated by serving some of these customers on *Acela*, which would retain current travel times, assuming that adequate capacity is available. Further analysis is needed to estimate *Acela* ridership and revenue under these scenarios.

Net Annual Ridership and Revenue Impact to Amtrak

The net annual impact to Amtrak's *Northeast Regional* service from stopping all nine round trips at T.F Green Airport Station is a decrease in Amtrak annual ticket revenue of $1.41 million, if all existing stops were retained. If an equivalent number of existing stops was removed, a reduction in Amtrak annual ticket revenue of $610,000 is estimated. The net impact of stopping five *Regional* round trips is a decrease in Amtrak annual ticket revenue of $378,000, if existing stops were retained, or a small increase in Amtrak annual ticket revenue of $590,000, if an equivalent number of existing stops were dropped. The net impact of stopping two of nine *Regional* round trips at this station is a very small annual increase in ticket revenue of $161,000.

The following tables display the change in ridership and revenue with various *Northeast Regional* stopping patterns. In general, better net revenue impacts are associated with stopping fewer trains at T.F. Green Airport and dropping existing *Northeast Regional* stops.

Table 6.2-1: Scenario 4 Variations: Fare Revenue with Added Stops

Scenario 4 variations that retain all current stops and add 5 minutes for each new TF Green Airport stop						
	9 *Regional* Round Trips		5 *Regional* Round Trips		2 *Regional* Round Trips	
	Ridership	Ticket Revenue	Ridership	Ticket Revenue	Ridership	Ticket Revenue
Existing *Regional* Stations	-77,200	($6,200,000)	-50,700	($3,731,000)	-27,500	($1,580,000)
TF Green Airport Station						
Airport Access Trips	6,800	$485,000	3,800	$270,000	1,500	$108,000
Intercity Trips	64,400	$4,305,000	47,400	$3,083,000	26,700	$1,633,000
SUBTOTAL	71,200	$4,790,000	51,200	$3,353,000	28,200	$1,741,000
TOTAL (Net Change)	**-6,000**	**($1,410,000)**	**500**	**($378,000)**	**700**	**$161,000**

Table 6.2-2: Scenario 4 Variations: Fare Revenue with Consolidated Stops

Scenario 4 variations that remove a current stop for each new TF Green Airport stop				
	9 *Regional* Round Trips		5 *Regional* Round Trips	
	Ridership	Ticket Revenue	Ridership	Ticket Revenue
Existing *Regional* Stations	-50,900	($5,360,000)	-55,100	($2,870,000)
TF Green Airport Station				
Airport Access Trips	6,800	$485,000	3,800	$270,000
Intercity Trips	64,400	$4,263,000	47,400	$3,190,000
SUBTOTAL	34,000	$4,748,000	52,400	$3,460,000
TOTAL (Net Change)	**-16,900**	**($612,000)**	**-2,700**	**$590,000**

7 Implementation Issues

7.1 Governance

Scenario 1: Extend Shore Line East Service to Rhode Island

Under this scenario, Rhode Island and Connecticut would need to agree to fund and operate this interstate commuter/regional service. Since ConnDOT sponsors the SLE service, Scenario 1 assumes it would serve as the lead agency. This agreement would provide services similar to those under other agreements between states including the current agreement between RIDOT and the MBTA for Providence Line service in Rhode Island.

This service extension would also require an operating agreement with Amtrak, to which the other operating railroads (MBTA, P&W) would likely be partners. This would be similar to the Pilgrim Agreement for the current commuter rail service in Rhode Island.

Scenario 2: Begin Rhode Island Rail Service

Under this scenario, Rhode Island would fund its own rail operations, which could be operated through a third-party operating entity. In the northeast, various states operate commuter/regional rail services either by creating their own state-owned operating railroad (e.g., Metro-North, LIRR, NJ TRANSIT, SEPTA) or by contracting with a rail operating entity. The contracted services are typically procured either by the state department of transportation or from a state transit agency.

As with Scenario 1, this new service would also require an operating agreement with Amtrak, to which the other operating railroads (MBTA, P&W) would likely be partners. This would be similar to the Pilgrim Agreement for the current commuter rail service in Rhode Island.

Scenario 3: Begin Boston–Rhode Island Intercity Rail Service

For Variations 3.1, 3.3 and 3.4, Rhode Island and Massachusetts would need to agree to fund and operate this interstate commuter/regional service between Boston and Wickford Junction, RI. For Variation 3.2, agreement with Connecticut also would be required.

Operating this type of service would likely involve a contracting arrangement with an operating entity. The operating entity could be new or one of the two passenger railroads currently operating on this part of the corridor (Amtrak or the MBTA)., For Variations 3.1 and 3.2, Rhode Island and MBTA would terminate their agreement to operate MBTA trains west of Providence.

In all cases, this new service would require an operating and access agreement with Amtrak (owner of the NEC in Rhode Island and eastern Connecticut) and the MBTA (owner of the NEC in Massachusetts), to which the other operating railroads (P&W, CSX) would likely be partners. This would be similar to the Pilgrim Agreement for the current commuter rail service in Rhode Island.

For Variation 3.2 acquisition of a site for overnight storage and servicing of five Boston-Rhode Island express trains also would be required. Potential sites exist near the station in New London and adjacent to the Amtrak maintenance-of-way base in Groton, CT.

Variation 3.2 would also increase the number of trains crossing the two movable bridges east of New London. An agreement with the Coast Guard would be needed regarding providing opening times for recreational boating.

Scenario 4: Add Amtrak *Northeast Regional* Stop at T.F. Green Airport

There would be no change in operating governance for this scenario - Amtrak would continue to operate the *Northeast Regional* service. The State of Rhode Island and Amtrak would need to come to an agreement over the change in operations. The terms of such an agreement would likely include covering any revenue loss caused by the added station stop or a change in overall *Northeast Regional* stopping patterns at Rhode Island stations.

7.2 Capital Improvements

Each scenario adds a second side platform on a new controlled siding – Track 4 – at T.F. Green Airport, with the possible exception of Variations 3.3 and 3.4. Both of these variations could potentially operate without a second platform track. However, the operation of a bi-directional passenger service on what is effectively nine miles of single track, with a single-track terminal station, limits operational flexibility and reduces the ability of the system to recover from train delays. The potential to access a second platform track at the airport station, and to use slots on the NEC main tracks as they are available, would enhance the reliability of the operation. A detailed operations analysis is required to determine the effects of introducing new Boston- Rhode Island intercity service on the overall reliability of the NEC, and to confirm the requirements for rail infrastructure.

Scenarios 1, 2, and 3 also require additional train equipment. An estimate of the cost of the capital improvements is included in Table 7.2-1.

Pawtucket Layover Facility

This facility is used to layover the MBTA commuter trains providing service to Rhode Island stations. The facility construction in 2006 was funded by RIDOT, and the design included provisions to expand the facility for in-state rail operations by adding two additional layover tracks and a small maintenance building for servicing and inspection. For Scenario 2, the new fleet for the Rhode Island rail service would be based out of an expanded Pawtucket facility for layover, inspection and maintenance. In Variations 2.2 and 2.3, electrified tracks would be provided for the layover and maintenance facility.

FRIP Track Improvements

Between Providence and T.F. Green Airport, speed is restricted on Track 3 compared to the mainline tracks. In Scenario 2, the Rhode Island-based service would benefit by improvements to improve geometry to allow for higher operating speeds for passenger trains on Track 3. For the EMU variations of Scenario 2, the section of track would be electrified. Maintaining clearance for freight trains under the catenary would be essential, which could require vertical clearance improvements at some locations.

T.F. Green Airport Station

For all variations except Variations 2.1, 3.3 and 3.4, electrifying the existing Track 3 through the station would be necessary. Due to the vertical constraints of nearby overhead bridges and the garage built over the tracks at the station, Track 3 would need to be lowered to maintain the necessary vertical clearance for freight trains.

For all scenarios except possibly Variations 3.3 and 3.4, a new side platform and platform track would be built across from the existing platform. With the exception of Variations 2.1, 3.3 and 3.4, the new Track 4 would be electrified.

Wickford Junction Station

In Variations 2.1, 2.2, 2.3, and 3.2, the existing stub end pocket track at the station would need to be converted into a controlled siding by extending the track across Ten Rod Road to a new interlocking. In Variations 2.2, 2.3, 3.1, and 3.2, Track 3 would be electrified. For Scenario 3, with hourly service stopping in both directions a Wickford Junction, a second platform and controlled siding – Track 4 – would be needed, along with a crossover bridge connection to the existing station and garage.

Kingston Station

The ongoing Kingston Station Capacity Expansion Project is providing high-level platforms and a 2-mile section of an electrified Track 3. This work sets up the station for a commuter or *Northeast Regional* train to stop at the station during a meet between two other trains. This project is scheduled for completion in summer 2017. The Kingston Station Capacity Expansion Project anticipated the need for a future pocket track allowing for a train to layup between scheduled runs.

Westerly Station

For Scenario 1, Shore Line East trains are to stop at Westerly, and a high level platform will be required for the M8 EMUs. This will require an electrified controlled, siding (new Track 3) extended to either end of the station. In Scenario 2, where trains are to be turned at Westerly, a pocket Track 3 is recommended so as not to restrict mainline capacity. For the variations that use electric equipment, the pocket track will need to be electrified.

Southeast Connecticut Layover Facility

For Variation 3.2 between Boston and New London, a layover facility near New London would minimize deadhead moves for equipment and crews.

New London Station

For Variation 3.2, trains would turn on Track 4, which would need to be electrified along with the existing crossover east of the station.

Description of Rolling Stock Capital Acquisitions

Scenario 1: Extend Shore Line East Service to Rhode Island

The extension of SLE service would require three additional train sets. The new trains were assumed to be M8s or similar EMUs. Each variation would require the same amount of equipment:

Variation	Equipment	No. of sets
1.1	M8 Trainsets (4-car set)	2 + Spare = 3
1.2	M8 Trainsets (4-car set)	2 + Spare = 3
1.3	M8 Trainsets (4-car set)	2 + Spare = 3

Scenario 2: Rhode Island Commuter Rail Service

The variations for this scenario include both DMUs and EMUs.

Variation	Equipment	No. of sets
2.1	DMU (3-car set)	3 + Spare = 4
2.2	EMU (3-car set)	3 + Spare = 4
2.3	EMU (3-car set)	2 + Spare = 3

Scenario 3: Boston–Rhode Island Intercity Service

Scenario 3 calls for 125 mph electric-traction equipment, similar to Amtrak's *Northeast Regional* equipment, shown in the photo to the left. Variation 3.1 (Boston – Wickford Junction) requires one less train set than Variation 3.2 (Boston – New London), while Variations 3.3 and 3.4 (Boston – T.F. Green Airport) both require a limited number of train sets:

Variation	Equipment	No. of sets
3.1	Electric locomotive-hauled train set (1+4)	5 + Spare = 6
3.2	Electric locomotive-hauled train set (1+4)	6 + Spare = 7
3.3	Diesel locomotive-hauled train set	2 + Spare = 3
3.4	Diesel locomotive-hauled train set	2 + Spare = 3

Scenario 4: Add T.F. Green Airport Stop on Amtrak Northeast Regional Stops

For this scenario, the increase in overall trip time of approximately 5 minutes would have no effect on the fleet size. This scenario has no rolling stock acquisition costs.

7.2.1 Summary of Capital Investments

Table 7.2-1: Order-of-Magnitude Capital Costs presents order-of-magnitude initial capital costs expressed as ranges based on figures provided by RIDOT. Federally-mandated annual capital charges for recapitalization of the NEC are not included in the estimates and will be added to future updates of the capital cost estimates.

Table 7.2-1: Order-of-Magnitude Capital Costs

	Variation										
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1
Infrastructure	$110-125M	$110-125M	$120-140M	$60-70M	$190-220M	$170-195M	$90-105M	$170-195M	$0-20M	$0-20M	$80-90M
Equipment	$55-75M	$55-75M	$55-75M	$50-65M	$40-55M	$30-40M	$180-240M	$205-275M	$110-145M	$110-145M	$0
"Soft Costs"	$30-40M	$30-40M	$35-45M	$15-20M	$55-70M	$50-60M	$25-35M	$50-60M	$0-5M	$0-5M	$25-30M
Total Costs	$195-240M	$195-240M	$210-260M	$125-155M	$285-345M	$250-295M	$295-380M	$425-530M	$110-170M	$110-170M	$105-120M

Estimates do not include federally-mandated annual NEC recapitalization charges.
Note: "Soft Costs" include elements such as engineering and contingency.

7.3 Capacity Impacts

Adding more train service on the NEC would require operational analyses to demonstrate how it can be accommodated without affecting existing or planned future services. For any scenario, some minor adjustment to existing schedules may be needed. A minor adjustment may shift an arrival or departure time elsewhere by 15 minutes or less.

7.3.1 Scenario 1: Extend Shore Line East Service to Rhode Island

In the base variation for this scenario, SLE service is assumed to fall within the existing travel "slots" between New Haven and New London, thus not affecting any NEC operations between these stations. Between New London and Providence the service extension could also be accommodated without significant operational impacts on existing NEC operations.

Variations 1.2 and 1.3 would provide infill service between Westerly and Providence before the train set returns to New London and New Haven. In Variation 1.3, *Northeast Regional* service trains would also stop at T.F. Green Airport, lengthening overall trip time by approximately 5 minutes. As explained in Section 7.3.4, stopping *Northeast Regional* trains at T.F. Green Airport could be implemented without significant impact to overall NEC operations.

7.3.2 Scenario 2: Begin Rhode Island Rail Service

In the base variations for this scenario, Rhode Island rail service is assumed to fall within the existing travel "slots" used by MBTA service between Providence and Wickford Junction, thus not affecting any NEC operations between these stations. Between Providence and Westerly, the new service might be accommodated without significant operational impacts on existing NEC operations. However, a detailed rail operations analysis will need to be completed.

7.3.3 Scenario 3: Begin New Boston–Rhode Island Intercity Service

For this scenario, developing an operations plan that minimizes impact on existing rail operations is essential. One possible strategy might be to operate westbound within the shadow of the existing travel "slots" used by the *Acela Express*. However, a detailed analysis of the NEC's operating plan is needed to confirm the feasibility of "shadowing" A*cela Express* without impacts. A very detailed operations analysis will be required prior to confirming the feasibility of introducing Rhode Island intercity rail service.

7.3.4 Scenario 4: Add Amtrak *Northeast Regional* Stop at T.F. Green Airport

With this scenario, overall run times of *Northeast Regional* trains stopping at T.F. Green Airport would be lengthened by approximately 5 minutes. A minor addition of trip time might be absorbed by an adjustment to run times, or by eliminating one other station stop. Therefore, this scenario could likely be implemented without significant impact to overall NEC rail operations.

8 Economic Impacts

8.1 Overview

The estimates of potential ridership developed in Section 5 reflect the variety of travel markets that would be would be served under various operational concepts. The matrix of service scenarios and travel markets (Table 8.1-1: Scenario Input for Economic Impacts Analysis

) indicates where and to what extent economic benefits would be realized for three of the scenario variations.

The intercity rail connection at T.F. Green Airport may benefit the Providence regional economy in some of the following ways:

- Provide additional airport choice for the regional air traveler market, improving regional competitiveness, and benefiting travelers directly. A rail connection improves airport access travel time, lowers cost and enhances reliability for some air travelers, including some who might otherwise use Logan Airport. Additional train service provides another option for air travelers in central and northeast Connecticut/Rhode Island.
- Enhance rail service and connectivity between T.F. Green Airport and all points along the NEC, particularly points west along the NEC and the major markets of New York City and Washington, DC. This strengthens T.F. Green Airport's aviation market position relative to other airports such as Logan Airport. More demand could mean more service/flights to and from T.F. Green Airport, which would improve overall air connectivity to Providence, even for passengers who never use rail.
- Provide options for business travelers outside of the Northeast Corridor, who may have additional business in New York City, Washington, DC, and Boston. The ability to make a connecting trip via rail can provide a better and more flexible alternative in some cases than driving or a connecting flight (if available). Consider, for example, visits by leading doctors from other parts of the U.S., who may be testing or vending new medical procedures to hospitals in Providence and other cities along the NEC. Flying to Providence, then traveling by train to Boston, New York City, or Philadelphia on the same day could be a great alternative to driving or making inconvenient connecting flights to other Northeastern and Mid-Atlantic cities. This effect would enhance Providence as a location for business, especially those engaged in research and other Science, Technology, Engineering and Mathematics (STEM) activities, where connectivity to the major NEC hubs of Washington, DC, Boston, and New York City are important.
- Provide new and enhanced connectivity to the Providence area for commuters, including those from Boston and other parts of Rhode Island.
- Create a second "node" of economic development in areas surrounding the airport, including the Warwick Station Development District (see below for further discussion). Increased passenger rail service at T.F. Green Airport enhances the market potential for airport off-site development.

Table 8.1-1: Scenario Input for Economic Impacts Analysis

Travel Markets	Scenarios		
	1 and 2	3	4
Commute from RI to Boston	Partial benefit	Full benefit	Negligible benefit
Commute from RI to Providence & Intra-RI travel	Full benefit	Full benefit	Negligible benefit
Commute from TF Green (airport employees & TOD development) - From Providence - From MA north of Prov. - From southern RI & SE CT	 - Full benefit - Partial benefit - Full benefit	 - Full benefit - Full benefit - Partial benefit	Negligible benefit
Air passenger access to TF Green Airport - From Providence - From MA north of Prov. - From southern RI & SE CT	 - Full benefit - Partial benefit - Full benefit	 - Full benefit - Full benefit - Partial benefit	Partial benefit
Intercity travel between TF Green & NEC cities to the south and west (New Haven, NYC, Washington)	No benefit	No benefit	Full benefit
Local CT-RI travel between New Haven & Providence (qualitative assessment only; no market numbers available)	Benefits with connections to or extension of Shore Line East	No benefit	Negligible benefit

8.2 Construction Period Economic Impacts

Construction at the T.F. Green Airport station and other locations would result in short-term job creation and immediate localized economic benefits for the Providence metropolitan. Equipment purchases, however, are not expected to significantly affect the Rhode Island economy since the equipment is unlikely to be sourced or assembled in the state.

According to the Federal Highway Administration, infrastructure projects generate 13,000 jobs (job years, including direct, indirect, and induced) for every $1 billion in direct spending.[7] By this metric, the construction necessary for the various scenarios would be expected to generate total local and

[7] http://www.fhwa.dot.gov/policy/otps/pubs/impacts/

regional employment effects ranging from approximately 208 job years to 875 job years across a variety of industry sectors.

8.3 Long-Term Economic Benefits from Improved Accessibility

The addition of intercity rail service would reduce automobile use by airport users, including air passengers and commuters, thus generating quantifiable economic benefits. These benefits would result primarily from reduced automobile operating costs borne by users, as well as by eliminating tailpipe emissions from the automobile trips not taken. In addition, air passengers who use intercity rail to arrive at T.F. Green Airport instead of driving would save money on overnight parking; over time, the reduced overall demand for parking would also result in "higher and better" uses for existing parking facilities, generating additional land value for parcels surrounding the airport.

Emissions rates and vehicle operating costs were obtained from the California Air Resources Board's Emissions Factors and the American Automobile Association, respectively. Parking costs were estimated using a model published by the Victoria Transport Policy Institute. To be conservative, parking cost savings have been assumed only for reduced airport access trips by auto. A parking cost of $10 per arrival at the airport (one half the total auto trip reduction) was assumed.

Ridership and mode shift forecasts were combined with these rates to produce a 30-year projection of economic benefits (thirty year discounted present value) that would result from the introduction of intercity rail service at T.F. Green Airport. Table 8.3-1 and Table 8.3-2 outline these benefits using both a 3 percent and 7 percent discount rate, respectively. These results should be viewed as high-level estimates of one subset of the project's likely economic benefits, and can be compared informally to the projected capital costs for the project. The three service scenarios are not mutually exclusive, and some or all of the benefits across the three service configurations could be additive.

Table 8.3-1: Total Benefits, Years 1-30; 3% Discount Rate

	Rhode Island Rail Service (Variation 2.2)	Boston–Wickford Junction Intercity Service (Variation 3.1)	*Northeast Regional* Stop at T.F. Green Airport (Variation 4.1)
Reduction in Auto VMT (Annual)	4,120,335	9,373,785	5,400,000
Reduction in Auto Trips (Annual)	231,891	389,800	60,000
Vehicle O&M Cost Savings	$21,738,486	$49,455,177	$28,489,874
Emissions Savings	$880,072	$2,002,168	$1,153,398
Parking Cost Savings	$0	$0	$5,224,422
Total Discounted Benefits – 30 Years	$22,618,558	$51,457,344	$34,867694

Table 8.3-2: Total Benefits, Years 1-30; 7% Discount Rate

	Rhode Island Rail Service (Variation 2.2)	Boston–Wickford Junction Intercity Service (Variation 3.1)	*Northeast Regional* Stop at T.F. Green Airport (Variation 4.1)
Reduction in Auto VMT (Annual)	4,120,335	9,373,785	5,400,000
Reduction in Auto Trips (Annual)	231,891	389,800	60,000
Vehicle O&M Cost Savings	$11,817,224	$26,884,250	$15,487,335
Emissions Savings	$845,751	$1,924,089	$1,108,419
Total Parking Cost Savings	$0	$0	$2,840,040
Total Discounted Benefits – 30 Years	$12,662,975	$28,808,339	$19,435,794

9 Feasibility and Risk Analysis

9.1 Approach

The objective of the feasibility analysis was to assess the practicality as well as cost and benefits of providing intercity rail service at T.F. Green Airport Station. The metrics are presented in a series of matrices in this section, including a summary matrix which identifies the most cost-effective actions. Risk analysis and potential barriers to implementation also need to be considered.

9.2 Analysis

Quantitative and qualitative features associated with the various aspects of each service variation were assessed and summarized. Key attributes include:

- Ridership Volumes;
- Operating and maintenance costs and passenger fare revenue;
- Implementation Issues;
  - Governance – agreements to negotiate,
  - Capital costs,
  - Duration of implementation,
- Economic benefits and costs; and
  - Service to travel markets,
  - Benefit to local and regional economy,
  - Construction employment opportunities,
  - Long term projected benefits.

Table 9.2-1 summarizes how each of the eleven service variations of the four rail service scenarios perform in the key attributes of ridership, operating costs, implementation, and economic benefits. Each variation had a numbered rating scale which varied depending on the attribute. The number scores were then prorated from low to high on a zero to 100% scale.

Table 9.2-1: Performance of Scenarios by Key Attributes (Prorated 0% - 100%)

	Scenario 1 Extend Shore Line East (SLE) Service to Rhode Island			Scenario 2 Begin Rhode Island Rail Service			Scenario 3 Begin Boston-Rhode Island Intercity Service				Scenario 4 Add Amtrak *Northeast Regional* Stop at TFG
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1
Propulsion	EMU	EMU	EMU + Electric Locomotive Hauled	DMU	EMU	EMU + Diesel Locomotive Hauled	Electric Locomotive Hauled	Electric Locomotive Hauled	Diesel Locomotive Hauled	Diesel Locomotive Hauled	Electric Locomotive Hauled
RIDERSHIP											
Score	50%	58%	75%	58%	58%	58%	83%	100%	75%	67%	58%
REVENUE AND O&M COSTS											
Score	41%	77%	100%	82%	83%	94%	78%	69%	82%	91%	91%
IMPLEMENTATION											
Score	67%	64%	63%	73%	65%	62%	35%	19%	83%	83%	100%
ECONOMIC IMPACTS											
Score	77%	77%	84%	81%	81%	81%	84%	100%	81%	81%	45%

9.2.1 Risk Analysis

Risk analysis considers factors that have a level of uncertainty and that could lead to failure. For this report, risks to successful implementation were qualitatively evaluated for each scenario, based on the following factors:

- NEC railroad and terminal capacity constraints;
- Environmental permitting;
- Capital funding availability;
- Availability of long term operations and maintenance funding;
- Community or public opposition;
- Interagency agreement complexity;
- New or untested technology;
- Long lead elements such as rolling stock procurement; and,
- Construction complexities.

General observations include the following:

- All the variations scored low in environmental permitting challenges, as none require construction in environmental or historically sensitive areas, and anticipated community or public opposition.

- Scenario 3, with the extension to Boston, has the greatest risk associated with capacity issues approaching Boston and at South Station.

- All scenarios have some risk in negotiating agreements to implement the service, but the agreement for Scenario 3 is potentially riskier in its intent to create a bi- or tri-state agency agreement to operate the new rail service.

- To date, the M8s have not been successfully tested on the NEC east of New Haven. Therefore, use of this technology in certain scenario variations is considered to have more risk than the proven locomotive-hauled technology.

The preliminary ranking of each scenario from least risky to riskiest is as follows:

1. Scenario 4 – Add Amtrak *Northeast Regional* stop at T.F. Green Airport
2. Scenario 1 – Extension of Shore Line East to Rhode Island
3. Scenario 2 – Begin new Rhode Island commuter rail service
4. Scenario 3 – Begin new Boston - Rhode Island intercity rail service

Each scenario has some level of risk. A crucial next step in the planning process is to perform a more detailed risk assessment to temper the predicted implementation issues with schedule and budget.

9.2.2 Threshold Analysis

As none of the scenarios or variations can be implemented without significant capital expenditure, it is important to understand implementation issues for each scenario and identify potential strategies for addressing them.

Potential examples of implementation constraints for this project include:

- Capacity constraints on the NEC
- Capacity constraints at major stations including South Station
- Electrification of tracks
- Construction of new tracks
- Construction of new platform(s)
- New layover and maintenance facility
- Procurement of new rolling stock
- Offset Northeast Regional revenue loss due to longer trip times

The thresholds for all service variations are included in the table on the following page. That table indicates that Variation 4.1 and 2.1 present the least number of thresholds to implementation. The rest of the variations have equivalent levels of difficulty associated with the thresholds to implementation.

Workarounds to Avoid Thresholds

Examples of possible strategies to address threshold issues are presented in Table 9.2-2.

Table 9.2-2: Examples of Possible Strategies

Threshold Issue	Scenario Variations	Strategy
Capacity constraints on the NEC railroad	Scenarios 1, 2, 3	Add NEC capacity or schedule service around existing traffic
Capacity constraints at major stations including South Station	Scenario 3	Add capacity or Initiate service with arrival and departure times at South Station scheduled for off-peak periods
Electrification of tracks	All but 2.1, 3.3, 3.4	Use of DMU or diesel-hauled equipment
Construction of new tracks and 2nd platform at T.F. Green Airport	All but possibly 3.3, 3.4	Less frequent service using only the existing platform
Construction of new tracks and 2nd platform at Wickford Junction	3.2	Less frequent service using only the existing platform
Construction of new tracks and high level platform at Westerly	1.1, 1.2, 1.3, 2.2	Use equipment with compatible with low-level boarding
New or expanded layover and maintenance facility	Scenario 1	Keep equipment in full day revenue service (i.e., Variations 1.2 and 1.3)
	Scenarios 2 and 3	Operating procurement requires operator to provide its own inspection and maintenance facility
Procurement of new rolling stock	Scenarios 2 and 3	Operating procurement requires operator to provide its own rolling stock
Offset *Northeast Regional* revenue loss due to longer trip times	Scenario 4 and Variation 1.3	Subsidy by Rhode Island or re-assessment of *Northeast Regional* station stopping pattern in Rhode Island

10 Summary of Findings

10.1 Context

Rhode Island and neighboring states along the Northeast Corridor have made commitments towards improving rail options as a means of promoting a balanced transportation system. Expanded rail service in Rhode Island has the potential to improve intrastate connectivity and provide stronger links with Boston while providing rail service to T.F. Green Airport from Providence, Boston, and southeastern Connecticut comparable to other major airports on the NEC such as EWR and BWI.

The study explored key factors affecting rail service feasibility: ridership, costs, implementation, and economic impacts. The implementation of any rail service would require a substantial capital investment including the construction of infrastructure improvements at TF Green Airport Station, and an annual commitment to subsidizing operating and maintenance costs. All cost estimates in this report are order-of-magnitude.

10.2 Rail Scenario Findings

The critical elements of each rail service scenario are described below.

- **Scenario 1, extension of Shore Line East service to Rhode Island**. Estimated capital costs across all Scenario 1 variations are $125M - $140M for new rail infrastructure plus $75M for new trains. The annual operating subsidy requirement (which considers the cost to operate and maintain the service minus new fare revenue) is $9M - $16M. This option would expand the airport market into southwestern Rhode Island and southeastern Connecticut, but it has limited benefits in connecting T.F. Green Airport to Boston. This scenario would leverage existing (or planned) rolling stock from Shore Line East.

- **Scenario 2, beginning Rhode Island Commuter Rail Service**. Estimated capital costs across all Scenario 2 variations are $70M - $220M for new rail infrastructure plus $40M - $65M for new trains. The annual operating subsidy requirement is $8M - $9M. This could be positioned as a new service with less implementation constraints. The commuter market to Providence would be positively impacted, but the airport would not necessarily experience big gains in catchment. This scenario would not improve intercity passenger rail connections as identified in Senate Report 114-75.

- **Scenario 3, beginning Boston – Rhode Island Intercity Rail Service**. Estimated capital costs across all Scenario 3 variations are $20M - $195M for new rail infrastructure plus $145M - $275M for new trains. The annual operating subsidy requirement is $8M - $18M. This option would maximize ridership and economic development, but the implementation issues of a complicated governance structure, NEC capacity constraints, ridership and revenue impacts on Amtrak's existing rail services, and overall costs present multiple hurdles.

  Scenario 4, adding an Amtrak *Northeast Regional* stop at T.F. Green Airport. Estimated capital costs are $90M for new rail infrastructure and no cost for trains, assuming the *Northeast Regional* schedule could be modified to use today's trains. A *Northeast Regional* stop at T.F. Green Airport

could generate additional annual ridership and revenue of 71,200 and $4.8M respectively, but create longer trip times for Amtrak passengers traveling along the Northeast Corridor, thereby more than offsetting the benefits. Thus, adding a T.F. Green Airport stop to all *Northeast Regional* trains would require a net operating subsidy for Amtrak of an estimated $3M in the first year to be paid by RIDOT. (The $2.6M includes additional operating and maintenance costs plus the net loss in *Northeast Regional* fare revenue.)

Other *Northeast Regional* service options were evaluated by Amtrak, such as eliminating station stops within New England to maintain current *Regional* trip times between the major service points on the Corridor. While these options demonstrated better net revenue impact, they restricted travel options to T.F. Green Airport and anticipated ridership levels. Scenario 4 could also be combined with any of the other scenarios evaluated as part of this study to provide enhanced intercity passenger rail connections to T.F. Green Airport. These issues will be examined in more detail in future studies.

Key attributes of the rail service scenarios and an overall summary of study findings are provided in the following tables.

Table 10.2-1: Rail Service Scenario Key Attributes

		Scenario 1 Extend Shore Line East (SLE) Service to Rhode Island			Scenario 2 Begin Rhode Island Rail Service			Scenario 3 Begin Boston-Rhode Island Intercity Service				Scenario 4 Add Amtrak *Northeast Regional* Stop at T.F. Green Airport
	Existing	**Variation 1.1**	**Variation 1.2**	**Variation 1.3**	**Variation 2.1**	**Variation 2.2**	**Variation 2.3**	**Variation 3.1**	**Variation 3.2**	**Variation 3.3**	**Variation 3.4**	**Variation 4.1**
	MBTA Providence Line and *Amtrak Northeast Regional* service	Providence-New London	Providence-New London + infill trains between Providence and Westerly	Providence-New London + infill trains between Providence & Westerly + Amtrak Northeast Regional stop at TFG	Providence-Westerly	Providence-Westerly	Providence-Westerly + Limited Boston–Wickford Junction MBTA trains	Boston-Wickford Junction	Boston-New London	Boston-T.F. Green	Boston-T.F. Green	Full-time Amtrak *Northeast Regional* service at TFG
Annual Operations and M	n/a	$10.8M	$19.2M	$20.4M	$11.5M	$12.7M	$11.5M	$13M	$26.8M	11.6M	$9.20	$1.2M
Annual Fare Revenue[1]	n/a	$2M	$3.3M	$4.4M	$3.7M	$3.7M	$3.5M	$5.2M	$8.5M	$2.8M	$2.3M	n/a
Net Annual Operations and Maintenance Cost[1]	n/a	$8.7M	$15.9M	$16M	$7.8M	$9M	$8M	$7.8M	$18.3M	$8.8M	$6.9M	n/a
Capital Cost[2]												
Infrastructure	n/a	$125M	$125M	$140M	$70M	$220M	$195M	$105M	$195M	$20M	$20M	$90M
Equipment	n/a	$75M	$75M	$75M	$65M	$55M	$40M	$240M	$275M	$145M	$145M	$0
Ridership (Annual Passenger Trips) [3]												
T.F. Green Airport	98,000 existing 114,000 baseline[4]	220,000	310,000	410,000	280,000	280,000	270,000	400,000	430,000	320,000	290,000	300,000
Four RI Stations West of I	304,000 existing 360,000 baseline[4]	470,000	590,000	690,000	630,000	630,000	560,000	720,000	960,000	540,000	510,000	540,000
Typical Station-to-Station Trip Times (h:min) [6]												
PROV-BOS[7]	1:05 (MBTA)	1:05 (MBTA)	1:0 (MBTA)5	1:05 (MBTA)	1:05 (MBTA)	1:05 (MBTA)	1:05 (MBTA)	0:39	0:39	0:43	0:43	0:40 – 0:49
TFG-PROV[8]	0:16 (MBTA)	0:10	0:10	0:10	0:10	0:09	0:09	0:09	0:09	0:16	0:16	0:09
TFG-BOS9 [9]	1:22 (MBTA)	1:16 (MBTA)	1:16 (MBTA)	1:16 (MBTA)	1:20 (w/ Xfer)	1:19 (w/ Xfer)	1:12 (MBTA[10]) 1:19 (w/ Xfer)	0:49	0:49	0:59	0:59	0:50 – 0:59
NLC-BOS	1:42 (NE Reg.)	2:20 (SLE+MBTA)	2:20 (SLE+MBTA)	2:20 (SLE+MBTA)	No Service	No Service	No Service	No Service	1:44	No Service	No Service	1:39 – 1:48
NLC-TFG	No Service	0:51	0:51	0:51	No Service	No Service	No Service	No Service	0:54	No Service	No Service	0:48

[1] In 2015 dollars, incremental to 2025 baseline estimate

[2] High end estimate of capital costs for required infrastructure and fleet over and above current programmed capital improvements and state-of-good-repair needs.

[3] Low end estimate of total ridership

[4] Future baseline estimate for 2025.

[5] Low end estimate for T.F. Green Airport, Wickford Junction, Kingston, and Westerly stations combined

[6] Trip times for Amtrak NE Regional service in Variation 4.1 include a range of values, with the low end based on ideal train performance plus 10% schedule margin, and high end based on current eastbound scheduled times for Amtrak NE Regional trains (including schedule pad).

[7] Trip times for existing and Scenarios 1 and 2 based on existing westbound weekday timetables; trip times for Scenario 3 based on ideal train performance plus 10% schedule margin.

[8] Trip times for existing based on MBTA westbound weekday timetables, including operations between Providence and T.F. Green Airport on Track 3 with existing speed restrictions; trip times for Scenarios 1-4 based on operations on NEC Tracks 1 and 2 or upgraded Track 3.

[9] Trip times in Scenario 2 indicated as "w/ Xfer" assume scheduled transfer connections at Providence between R.I. local trains and MBTA trains, with five minutes allowed for a cross-platform transfer.

[10] Two trips in each weekday peak period in the peak direction (eastbound in the morning, westbound in the evening), skipping selected stops between Providence and Boston.

Table 10.2-2: Summary of Study Findings

	Scenario 1 Extend Shore Line East (SLE) Service to Rhode Island	Scenario 2 Begin Rhode Island Commuter Rail Service	Scenario 3 Begin Boston–Rhode Island Intercity Rail Service	Scenario 4 Add Amtrak *Northeast Regional* Stop at T.F. Green Airport
Ridership to TF Green Airport – 2025 forecast	220,000 to 600,000 passengers annually	280,000 to 400,000 passengers annually	290,000 to 620,000 passengers annually	300,000 to 420,000 passengers annually
Operations and Maintenance Cost	Moderate subsidy required to operate service	Smaller subsidy required to operate service	Large subsidy required to operate service	Impact on Northeast Regional revenue
Implementation	**Governance** would require negotiation of a bi-state agreement between RI and CT and agreements with NEC owners. **Impacts to NEC capacity** due to 125 mph+ operation of Amtrak trains in RI; less impacts in CT where speeds are lower due to curves and movable bridges. **Order of magnitude capital costs (including "soft costs")** from $120 million to $195 million not including NEC use fees. **Implementation timeframe** is medium term.	**Governance** by RIDOT in partnership with Amtrak—a simpler arrangement than other scenarios **Impacts to NEC capacity** due to 125 mph+ operation of Amtrak trains in RI. **Order of magnitude capital costs (including "soft costs")** from $150 million to $435 million not including NEC use fees. **Implementation timeframe** is medium term.	**Governance** is complex; new multi-state and multi-agency agreements; both Amtrak and MBTA would be included. **Impacts to NEC capacity** would be substantial and require additional study to determine an operating plan. **Order of magnitude capital costs (including "soft costs")** from $45 to $550 million not including NEC use fees. **Implementation timeframe** is long term.	**Governance** would require an agreement between Amtrak and RIDOT addressing the costs associated with adding the T.F. Green Airport stop. **Impacts to NEC capacity** would be low because it was assumed that no new trains are added and that *Northeast Regional* service can be modified. **Order of magnitude capital costs (including "soft costs")** from $80 million to $115 million. **Implementation timeframe** is shorter term.
Markets and Economic Impacts	Greater New London and South County alone are some of the smallest rail markets on the NEC. Modest economic impact overall.	Small market for intrastate rail service within RI. Modest economic impact overall. Greater impact with intercity service mixed in at T.F. Green Airport.	Attracts suburban Boston air passengers; Boston-bound commuters; and reverse commuters traveling from Boston to Providence. Significant economic impact due to decreased travel times.	Most benefits accrue to the NEC intercity market in greater Providence. Moderate economic impact overall.

10.3 Next Steps

The *Feasibility Study for Intercity Rail Service to T.F. Green Airport* was a preliminary feasibility analysis. Substantial project planning, cost estimation and engineering design is required prior to the implementation of any new railroad infrastructure or additional rail service.

Following further discussions between Amtrak and RIDOT regarding which scenarios covered under this study warrant further analysis, the parties will develop a work plan to define the appropriate next steps. Project stakeholders will include the FRA, Massachusetts Department of Transportation (MassDOT), Massachusetts Bay Transportation Authority (MBTA) and the Connecticut Department of Transportation (ConnDOT). Rhode Island Airport Corporation (RIAC) and Providence & Worcester Railroad Company (P&W) will be consulted.

Further analysis will likely cover some or all of the following topics:

1. Outreach involving key stakeholders,
2. Detailed rail operational analysis,
3. Market analysis,
4. Detailed capital and operating cost estimates,
5. Identification of funding sources for capital and operating costs,
6. Environmental screening and conceptual design,
7. Preliminary and final design,
8. Project phasing and capital programming,
9. Institutional arrangements, and
10. Implementation planning for early, medium, and long term actions.