NORTHERN NEW ENGLAND PASSENGER RAIL AUTHORITY

Downeaster Corridor Service Development Plan

FINAL DRAFT
6/22/2016

Executive Summary

The Downeaster is an intercity passenger train service managed by the Northern New England Passenger Rail Authority (NNEPRA) and operated under contract by Amtrak. The Downeaster operates along a 143-mile long corridor in Massachusetts, New Hampshire and Maine, connecting Boston to Portland and Brunswick, Maine. Service began in 2001 and ridership has grown 96% since then, outpacing nationwide ridership growth on Amtrak routes. The Downeaster operates along the Massachusetts Bay Transportation Authority's (MBTA) Lowell Line, Wildcat Branch and Haverhill line in Massachusetts. In New Hampshire and Maine, the Downeaster uses the Pan Am Railways (PAR) Freight Main Line, with one of the track miles in Brunswick owned by the Maine Department of Transportation (MaineDOT).

Purpose and Need: In order to support future growth, NNEPRA has prepared a Service Development Plan consisting of an operating plan and capital improvement plan to increase incremental travel speeds, reduce trip time, and provide capacity along the corridor (shared with freight and commuter rail activity) for up to two additional round-trips between Boston and Maine.

Alternatives Considered: NNEPRA considered capital projects and operation alternatives that would meet the service goals listed above, and studied options that meet the stated service goals without impacts to existing commuter and freight rail activities (operated by MBTA in Massachusetts and PAR north of Andover, MA, respectively). Items such as the addition of main track and passing sidings and curve modifications that provide capacity improvements, raise operating speeds and reduce trip time were incorporated into the capital improvement plan, while improvements that were incompatible with existing or expanded freight and commuter rail activity were omitted.

Market Analysis: NNEPRA conducted significant public outreach to solicit input on the goals of the Service Development Plan. The market analysis showed that the Downeaster is a popular service, with ridership which grew faster than the population growth in the region and faster than the national growth in Amtrak ridership through FY14. As NNEPRA has provided funds for expanded service (an additional frequency in 2007 and the extension to Brunswick in 2012), it has seen increases in ridership. With over 430,000 annual trips in 2015, ridership has grown 96% since Downeaster service began in 2001.

Existing Conditions: The Downeaster operates along a 143-mile corridor that is predominantly single-tracked, with small sections of double track to allow trains traveling in opposite direction to pass with minimal delay. Although the majority of the 36-mile MBTA-owned segment is double-tracked to accommodate commuter rail operations in Massachusetts, the remaining 10 miles of single track create impactful bottlenecks due to the significant volume of rail traffic. More than 90 miles of the 106-mile PAR segment in New Hampshire and Maine is single tracked, and has limited spaces where trains traveling in opposite directions can pass. These conditions impede reliability and limit the frequency and schedule of service. The Portland Transportation Center (PTC) is located on a spur that is oriented towards Boston, requiring trains traveling from Brunswick to travel past the station towards Boston and reverse direction to gain access into the station. Additionally, the train overnight layover facility in Portland necessitates the operation of dead-head moves between Brunswick and Portland to position equipment, again limiting frequency of service and impacting reliability. A layover facility is under construction in Brunswick and is expected to be fully operational in November 2016, enabling two sets of Downeaster equipment to be serviced overnight in Brunswick. At that time, three of the Downeaster's five daily round-trips will operate between Brunswick and Boston, and dead-head trips will be eliminated.

Capital Improvement Plan: The Capital Improvement Plan identifies projects which will deliver improvements that support the goals of the Service Development Plan. It includes curve modifications, additional sections of main line track, and station improvements. The Downeaster Corridor Improvement Plan (CIP) includes the following major elements:

- A 4-mile passing siding at Royal Junction in Falmouth/Cumberland, ME to increase the frequency and reliability of service between Brunswick and Boston.
- A wye-track which connects Portland Station to the freight mainline, eliminating back-up moves and reducing travel time between Brunswick, ME and Boston, MA.
- A center island platform at Portland Station, which will add a second track to enable trains to meet at the station and facilitate the future development of passenger rail service to that station.
- More than 25 miles of capacity improvements to the Pan Am Main Line which include the extension of the passing siding in Wells, ME, a controlled passing siding in Arundel, ME; and extension of a controlled siding/second main track from Plaistow, NH to E. Kingston, NH to improve reliability and freight and passenger train recovery.

- Construction of a second passenger platform in Wells, ME to enable passenger train meets and to support bicycle access.
- Modifications of up to 80 curves which will enable increased operating speeds.

Service Plan: NNEPRA analyzed various service plans that included six round-trips between Boston and Portland (with 5 round-trips continuing to Brunswick) and seven round-trips between Boston and Portland (with potentially 6 or 7 round-trips continuing to Brunswick). The Plan also contemplated the possibility of storing one train at Boston North Station overnight and offering an early morning departure from Boston North station towards Portland and Brunswick. Potential service plans were modeled and validated using the improvements in the Capital Improvement Plan.

Implementation Plan: In order to deliver the service expansion outlined in the Service Development Plan, NNEPRA intends to work with state and federal agencies and Pan Am Railways (PAR) to build support for increased funding from all local, state and federal funding sources. Capital improvements will be grouped into manageable packages that are eligible and competitive for grant money under existing funding programs. NNEPRA has consulted with Amtrak, PAR and MBTA regarding various operating scenarios, and will ensure that service improvements outlined in the Service Development Plan are included as amendments to existing operating agreements before investments are made. NNEPRA will also work to identify funding sources to deliver the necessary capital improvements along the corridor and provide the needed capacity and speed improvements for the planned Downeaster service expansion.

It is expected that the capital improvement program will proceed in logical phases based on the availability of funding. The completion of Royal Junction Siding will enable five round trips to operate between Brunswick and Boston. The sixth round-trip between Portland and Boston may not be implemented until all double-track has been completed, and a seventh round-trip between Portland and Boston cannot be implemented until Positive Train Control is installed.

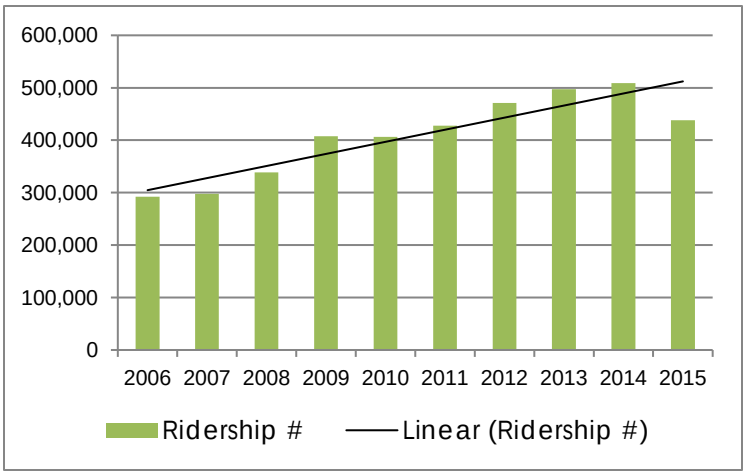
The information assembled in this document was derived from work which commenced in 2012 and has continued to evolve. Specific reference documents are listed at the end of the document. Unless noted, costs are presented in 2015 dollars.

1.0 Purpose & Need

The Downeaster is an intercity passenger train service managed by the Northern New England Passenger Rail Authority (NNEPRA) and operated under contract by Amtrak. NNEPRA is a public transportation authority created in 1995 by the Maine State Legislature to develop and provide passenger rail service between Maine and Boston and points within Maine.

The Downeaster began operation in December of 2001 between Boston North Station and the Portland Transportation Center. In November 2012, Downeaster service was extended 29 miles from Portland to Brunswick, Maine. Within the state of Massachusetts, the Downeaster utilizes the Lowell Line, Wildcat Branch and Haverhill Line owned and maintained by the Massachusetts Bay Transportation Authority (MBTA). From the Massachusetts-New Hampshire State Line to Brunswick, ME, the Downeaster operates on the Freight Main Line owned and maintained by Pan Am Railways (PAR), with the exception of the last mile which is owned by the Maine Department of Transportation (MaineDOT). The 143-mile corridor has 12 stops in 7 counties in 3 states. At present, the Downeaster provides 5 roundtrips between Boston and Portland, with 2 roundtrips continuing north of Portland to Brunswick. An additional non-revenue roundtrip between Portland and Brunswick is necessary to position and store equipment until the Brunswick Layover Facility is brought on line November 2016. Figure 1 on the following page displays a map of the Downeaster corridor.

Between FY 2003 and FY 2014, Downeaster ridership doubled to over 520,000 annual trips. A decline in ridership in FY 2015 is attributed to construction outages and severe weather which resulted in the cancelation of more than 500 trains, 14% of annual scheduled trains. The Downeaster has posted some of the largest growth rates of any Amtrak service in the past 15 years, even as track maintenance has hurt on-time performance and capacity constraints have curtailed service growth. In order to continue to work towards and deliver expanded service, NNEPRA has completed this Service Development Plan to support reliability, increase frequency and reduce travel time up to 15 minutes.



1.1 Study Area

The Study Area for the Downeaster Service Development Plan consists of the existing Downeaster rail corridor from Boston North Station to Brunswick Station and 1,000 feet on either side of the rail line.

The only alternative passenger rail service serving any portion of the study corridor is the existing MBTA commuter rail service which operate over the 33 miles segment between Haverhill, MA and North Station in Boston. This compares with 114 miles between Portland and Boston and 143 miles between Brunswick and Boston. The service frequency and scheduled station stops of the Downeaster are such that it does not attempt to compete with the MBTA service for intrastate transportation in Massachusetts. Moreover, the Downeaster does not receive "inbound" passengers at Woburn (Anderson Transportation Center) for the short trip from that point to North Station, nor does it discharge passengers at Woburn "outbound" from Boston.

Figure 1: Downeaster Corridor Map

Transportation Alternatives:

Concord Coach Lines operates non-stop intercity bus service between the Portland Transportation Center and Boston South Station. It is both a competitor and a feeder to the Downeaster and provides an alternative for travelers that are traveling between Boston and Portland directly. Concord Coach Lines offers twenty-six daily trips in each direction. Of those, eleven are branded "Logan Express" targeting the travel market to and from Boston's Logan International Airport on a schedule of approximately two hours depending on the time of departure.

Interstate 95 is a controlled access highway that roughly parallels the Downeaster Corridor. In Maine it is otherwise known as the Maine Turnpike which is a toll road. A traveler operating a conventional automobile will pay a cash toll of $4.00 in each direction between downtown Portland and the New Hampshire state line, and will pay an

additional $2.00 cash toll in New Hampshire if continuing on I-95 to Boston. I-95 does not pass through Haverhill, Exeter, Durham or Dover. Therefore, travelers originating or terminating at those origins or destinations face additional travel time to access I-95 via feeder roads or must take slower routes to make a more direct trip. The highway does access Woburn and Wells very conveniently and indirectly accesses Saco/Biddeford and Old Orchard Beach via dedicated connector routes that were constructed as feeders to the Maine Turnpike. I-295 from I-95 via downtown Portland accesses Freeport, Maine very directly but does not directly serve Brunswick. To access Brunswick a motorist exits I-295 onto U.S. 1 or visa- versa.

Typically, the point-to-point travel time by automobile between Boston and Portland is two hours. However, the traveler's actual experience can vary greatly because of traffic congestion in the Greater Boston area, especially during peak travel hours, summer getaway weekends and/or weather, especially in the winter. Boston traffic is one reason why travel on the Downeaster is attractive despite its somewhat longer existing schedule compared with the best possible travel time by auto consistent with the posted speed limits. When the improvements proposed by this SDP are implemented, the portal-to-portal trip time between Brunswick or Portland and Boston by rail will be comparable to the best practical driving time by private auto leaving only a 15 minute trip time difference on paper. In practice, the traveler is likely to save time by taking the train instead of driving due to the heavy roadway congestion that makes travel times unpredictable.

1.2 Historical Perspective

What is currently designated as the Downeaster Corridor was a portion of a predominantly double-tracked regional mainline during its mature years from roughly the 1920s into the early 1960s. Its primary reason for existence was - and still is - the inbound and outbound freight business offered by Maine's forest products industry and to a lesser extent overhead traffic moving between the upper Midwest (and other origins) and the Canadian Maritimes provinces.

After World War II and especially following construction of the interstate highway network beginning in 1956 and the paralleling Maine Turnpike in particular, the Boston & Maine Railroad and its critical connections the Maine Central and the Bangor & Aroostook railroads lost market share to interstate trucking firms. This, coupled with the discontinuance of all scheduled passenger service north (railroad "east") of Haverhill, Massachusetts during the 1960s, rapidly resulted in excess capacity. It was quickly "rationalized" to one track in many areas by dire necessity and advancements in train control technologies (signaling systems and radio communications). This was followed by gradual

disinvestment. Almost simultaneously, the forest products industry entered a multi-decade period of slow, uneven decline which acted as a further disincentive to private investment in the railroad physical plant and operations.

As a result of capital improvements implemented to support the startup of the Downeaster service in late 2001 and some additional, private investment by the owner/host railroad, the physical condition and operational reliability of the corridor in New Hampshire and Maine was stabilized and began to improve. However, it was and is still predominantly single-tracked.

1.3 Purpose

The purpose of the proposed development plan is to improve intercity passenger rail service by increasing speed and reducing travel times, increasing frequency, and improving reliability of passenger service along the Downeaster rail corridor to accommodate current and future ridership demands.

Currently, about 83% of the 78 route-miles in the segment between the Massachusetts state line and Portland consist of a single main track. The 29-mile Brunswick extension is almost entirely single-track, meaning that 87% of the Downeaster corridor between Brunswick and the MA state line is single-track. In Massachusetts, about 87% of the MBTA portion of the Downeaster corridor will be double-track once major projects underway by the MBTA and NNEPRA to reconstruct and restore about 4 miles of second main track are complete.

The existing infrastructure is marginally adequate for the existing five-daily-frequency service in each direction between Boston and Portland and the two daily frequencies between Portland and Brunswick. However, when operations are delayed or disrupted, the existing network struggles to absorb the delays and it can be challenging to recover to schedule. This indicates that more capacity is needed in order to support any increase in service frequency.

1.4 Service Development Goals

NNEPRA, in collaboration with Amtrak, PAR and MBTA, and factoring feedback from passengers and the public at large, has identified the following service development goals for the Downeaster service:

- Increase Service Frequency between Portland and Brunswick to five daily round trips
  Additionally, the service is imbalanced. Only three of the Downeaster's ten daily round-trips provide service to Freeport and Brunswick. These gaps create inefficient operations and limit the development of various travel markets, therefore constraining Downeaster growth.

- Reduce Trip Time between Portland and Boston up to 15 minutes
  Travel time is also a barrier, not only from the perspective of customers looking for a reduced trip time, but from the perspective of track capacity (as noted above) and the ability to turn train sets. The Portland-Boston trip time of 2 hours and 30 minutes is slightly longer than an off-peak automobile trip would be. Three Amtrak train sets are used to operate the five daily round-trips made by the Downeaster each day between Portland and Boston. Two of those sets make two round-trips each day, while the third set makes only one round-trip. A shorter trip time will improve schedule flexibility, enable longer turns between trains, and would be required to support the operation of a sixth round-trip using the Downeaster's existing equipment pool.

- Increase Service Frequency between Portland and Boston to six daily round trips.
  Public input consistently and overwhelmingly indicates that more frequency is needed, and given the Downeaster's schedule, it is evident that there are major gaps in service. The SDP will increase Brunswick to Boston frequency from three to five daily round trips, and increase Portland to Boston frequency from five to six daily round trips. These additional trips will be scheduled to will fill in large gaps which currently exist in the schedule.

- Improve Reliability by Adding Track Capacity
  Reliability is a critically important factor emphasized by riders, and a growing challenge for the Downeaster. While access to North Station is limiting, Downeaster frequency, schedule and reliability however, are most severely constrained by insufficient track capacity

- Improve Service Efficiency
  Maximizing the overall efficiency of the Downeaster operation is of paramount importance to the NNEPRA Board of Directors. Improvements which eliminate redundancy, maximize equipment utilization, reduce or mitigate costs, increase ridership and revenue and contribute to improved efficiency are critical in order to sustain the operation.

  The Downeaster is currently operated using three train sets. Two of those sets make two round-trips to Boston daily, while the third set makes only one. The third set could be used to operate a third frequency, improving service while improving efficiency.

- Improve and expand the facilities at the existing Portland Station.
  There is currently only one platform and track servicing this station. Adding a center island platform and a second track will create more flexibility and support future feeder services.

- Allow for Expanded Service
  Several communities throughout Maine have expressed interest in an expanded passenger rail system in Maine which could provide new rail service to Lewiston, Auburn, Augusta, Bangor, Rockland, Bethel, Gorham and more. There is also interest in improving passenger connectivity to economic hubs outside Maine including Montreal and New York City. Although this SDP does not specifically address expansion of service or the development of feeder service, the improvements identified will support future expansion of passenger rail service by providing increased capacity between Portland and Brunswick and improving the configuration of the Portland platform.

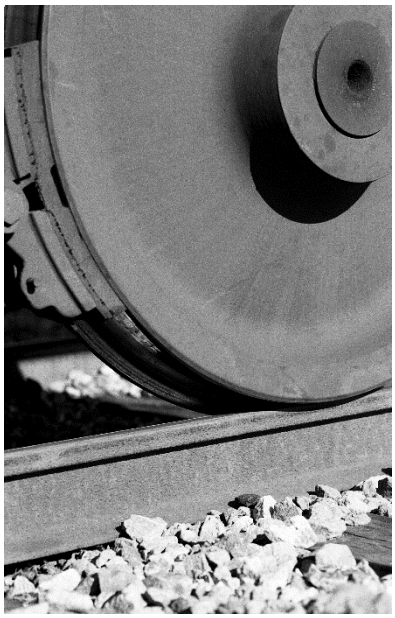
  The Capital Improvement Program (CIP) has been developed to identify projects which would meet Service Development Goals of decreasing travel time and increasing capacity, therefore enabling more frequency, flexibility and reliability. The Downeaster Corridor Improvement Plan (CIP) includes the following major elements:

    - Modifications of curves to increase speeds
    - Restoration of second main track and/or passing sidings
    - Installation of new interlockings or modifications to existing interlockings
    - Upgrades to grade crossings
    - Station and platform improvements

2.0 Alternatives Analysis

The alternatives analysis focused on improvements to the existing Downeaster Corridor that achieved the project goals while remaining consistent with operating realities of the host railroads, Pan Am Railways (PAR) in Maine and New Hampshire and the Massachusetts Bay Transportation Authority (MBTA) in Massachusetts. With significant commingled freight, commuter rail and intercity rail services on shared infrastructure, any operational or technological changes that are inconsistent with the railroad owners were considered fatally flawed and eliminated from further analysis. To be consistent with the project goals and the project Purpose and Need without impairing the existing commuter or freight operations, a Build Alternative would have to address or include the following:

- Adequate capacity to support robust on-time performance in a mixed traffic environment under normal operating conditions;
- Adequate capacity to support increased service frequency and operate it reliably;
- Track and/or train control improvements to support a shorter trip time without reliance on skipping station stops;
- Allow the freight service to operate daytime and/or nighttime as the freight carrier requires;
- Anticipate at least a modest increase in freight rail traffic;
- Not impair existing or planned MBTA commuter rail/North Station operations or expansion projects;
- Avoid or minimize property acquisitions; and
- Avoid and minimize adverse environmental impacts wherever possible.



2.1 No-Build Alternative

The No Build Alternative would be a continuation of the existing Downeaster service as improved by the CIP elements already underway, which include the Merrimack River Bridge rehabilitation, the MBTA Haverhill Line project and the Brunswick Layover facility. The five daily scheduled round-trips between Portland and Boston would continue and the existing scheduled trip time of 2-1/2 hours would presumably be sustained with no improvement, however three daily round-trips would be offered between Portland and Brunswick as a result of the Brunswick Layover facility. Many or most of the existing on-time performance reliability issues would remain because there would be no further capacity improvements. In fact, if there is a modest increase in freight traffic as owner/host PAR anticipates, there is a clear potential for the Downeaster to be negatively impacted. The No Build Alternative would not meet the stated Purpose and Need.

2.2 Preferred Build Alternatives

The Build Alternatives that were advanced focused on incremental improvements to the existing Downeaster Corridor to achieve the project goals. To be consistent with the project goals and the project Purpose and Need without impairing the existing MBTA commuter or PAR freight operations already operating on the Corridor and predating the Downeaster, a Build Alternative would have to provide adequate capacity to support robust on-time performance in a mixed traffic environment under normal operating conditions, allow freight and commuter operations to expand and to operate reliably, and be compatible with existing North Station capacity constraints in Boston.

The Preferred Alternatives, discussed in further detail throughout the Downeaster Service Development Plan, will:

- Increase service frequency between Portland and Brunswick to five daily round-trips.
- Reduce trip time between Portland and Brunswick by 10 minutes;
- Reduce trip time between Portland and Boston by up to 15 minutes;
- Increase service frequency between Portland and Boston initially to six daily round-trips;
- with the goal of increasing service frequency to seven round-trips daily between Brunswick and Boston;
- Improve and expand the facilities at the existing Portland station; and
- Provide track and station capacity improvements to eventually accommodate potential future rail feeder service(s) that could connect other Maine communities with the Downeaster.

Figure 3: Map of planned new second track in the Build Alternative

The group of actions comprising the Preferred Action Alternative are illustrated in Figure 3 and detailed in this chapter and would be further developed at the Project-level. In all cases, the individual actions comprising the Preferred Action Alternative are within the existing right-of-way and the acquisition of property would not be required.

Curve Modifications

Curve modifications would consist of increasing the super-elevation in the body of the curve and lengthening the existing curves. Curve modifications would occur within the limits of the existing trackbed, and maximum shifts would be within a few inches of existing track location. Curve modifications could result in a temporary increase in noise and fugitive dust during construction. The temporary impacts would be limited to the duration of construction.

Restoration of Second Main Track and/or Passing Sidings

The restoration of tracks in locations that previously had tracks may necessitate clearing of vegetation or the extension of a culvert to accommodate the second track. Restoration of tracks would result in a temporary increase in noise and fugitive dust during construction. The temporary impacts would be limited to the duration of construction.

Installation of New Interlockings or Modifications to Existing Interlockings

Improvements to interlockings may require modification or replacement of underdrains (a concealed drain with openings through which the water enters when the water table reaches the level of the drain) and/or outlet piping, temporarily impacting soils underneath the existing paved areas. Improvements to interlockings could result in a temporary increase in noise and fugitive dust during construction. The temporary impacts would be limited to the duration of construction.

Upgrading Highway–Rail at-grade Crossings

Depending on location, upgrading highway–rail at-grade crossings would range from installing traffic signals preempted by the railroad control systems to upgrading signs, signals and safety equipment; to replacement of the warning system with four-quadrant gates and interconnected traffic signals. Upgrading highway–rail at-grade crossings may require clearing vegetation if it hasn't occurred recently as part of maintenance activities. Modification or replacement of underdrains may be required temporarily impacting soils underneath the existing paved areas. Upgrading highway–rail at-grade crossings could result in a temporary increase in noise and fugitive dust during construction. The temporary impacts would be limited to the duration of construction.

Station Improvements

The station improvements could result in the need to clear vegetation and disturb soils. Station improvements would result in a temporary increase in noise and fugitive dust during construction. The temporary impacts would be limited to the duration of construction.

Preferred Alternatives were also developed based on the following assumptions:

- The Portland Transportation Center will remain in its existing location.
  A detailed alternatives analysis was conducted to evaluate the location of the Portland Transportation Center (PTC). The analysis concluded that the existing Portland station location is the most suitable of three distinct alternative sites that were considered. The existence of adjacent planned third-party economic development that was predicated in part on the existence of the Downeaster train service was one reason, but not the only reason. The existing transfer opportunity to a robust connecting intercity bus service was another.

- No existing Downeaster Stations Stops will be completely eliminated from the core (5 r/t) Downeaster service. Skip-Stop service may be considered on some trains in the future, and express service may be considered once Downeaster frequency meets or exceeds 6 trips per day.

- Positive Train Control will likely not be installed prior to 2030.
  Existing Federal law mandates installation of an approved, interoperable Positive Train Control (PTC) system. This becomes a significant cost hurdle at the point when the service frequency may be increased from six to seven daily trains each way (i.e., from 12 to 14 total trips) on any part of the corridor – or for that matter if the total number of trains carrying passengers on any part of the corridor exceeds twelve per day regardless of who the operator(s) are or what type of equipment is used. The indicated ROM cost of installing PTC between Plaistow, NH and Portland, Maine, would be approximately $78-million (2015 dollars). Due to these cost constraints, PTC installation is not contemplated by the CIP until the daily frequency of passenger trains exceeds 12 daily trips.

2.3 Alternatives considered and eliminated from detailed analysis

A number of other alternatives were explored and ultimately rejected, including:

<u>Increased Maximum Authorized Speed (MAS)</u>

The MAS of the Downeaster Corridor is 79 miles-per-hour. Increased speed is a way to both reduce travel time and increase capacity, and while the SDP recommends improvements to incrementally increase speeds within the maximum authorized speed (MAS), it does not recommend improvements which will increase the MAS. Because some of the alignment dates to as early as 1835 and also because of significant freight train operations between Lowell Junction (Andover, Massachusetts) and Royal Junction (Yarmouth, Maine), operation of passenger trains at significantly higher speeds would trigger a number of issues that would add substantial cost and complexity to infrastructure and operations and bring significant additional environmental impacts under NEPA (and MEPA in Massachusetts). Moreover, operation of a higher maximum speed without commensurate improvements to capacity and safety is

unlikely to result in improved on-time performance or operating reliability. In fact, such a strategy could make existing problems worse.

Because the line is shared with freight trains and very significant MBTA commuter rail traffic between Haverhill and Boston, 90 mph would likely be the maximum practical long-term speed goal which could be achieved along corridor. Although the corridor could be further upgraded to support passenger train speeds as high as 90 mph where the alignment permits, operation at such speed within the MBTA service territory is not achievable during peak daytime and evening travel periods without a third track to mitigate delays caused by MBTA commuter trains.

Further, it is noteworthy that a simplified simulation predicted only a 3- to 4-minute additional trip time improvement if MAS was increased to 90 mph and all existing station stops were made.

Addition of a third track

The possibility of adding a third track to any operationally significant portion of the MBTA alignment, which is extensively abutted by developed parcels, is difficult to imagine in the current or foreseeable funding environment and has therefore not been included in the recommended CIP, despite the operating benefits that could accrue from doing so. It is important to also note that triple-tracking through active MBTA station facilities would trigger the need to partially or completely reconstruct each affected facility.

Electrification of the Corridor

The environmental and operating benefits of electrification are well understood. Electrification was considered but not advanced because of the very substantial cost associated with raising existing clearances beneath older overgrade structures and incompatibility with existing and near-term future MBTA commuter rail operations.

Other Alternatives dismissed include the expensive and impractical relocation or separation of grade crossings through Old Orchard Beach, extending double track through Exeter (which would require the reconstruction of Exeter Station), and moving interlockings.

3.0 Market Analysis

3.1 Public Outreach

NNEPRA has held meetings since 2011 that have informed the development of the Service Development Plan and the capital improvement program. Table 1 includes a list of meetings, presentations and public events that presented information about the Service Development Plan.

Table 1: Public Outreach & SDP Presentations

2011	
JAN	Brunswick Rotary
FEB	Bath Rotary
MAR	Lewiston/Auburn Municipal Leaders
MAR	ME Transportation Committee Chair
APR	Senator Susan Collins' Staffer
OCT	Portland City Council
NOV	Durham NH City Council
DEC	Maine Transportation Conference
2012	
FEB	Southern Maine Coast Chamber
MAR	ME Transportation Committee
MAY	**Downeaster Station Committee**
JUN	**PACTS - MPO**
SEP	Portland City Council
NOV	Woman in Transportation
NOV	Maine Rail Group
DEC	Portland Sustainability Conference
2013	
JAN	International Women's Forum - ME
FEB	Kennebec Valley Women's Networks
FEB	American Society of Civil Engineers
MAR	ME Real Estate Developers Assoc.
APR	NARP
APR	Freeport Elders
MAY	ME Transportation Committee
NOV	NNE Transportation Conference
2014	
MAR	Passenger Rail Advisory Council
MAR	**SDP Public Meeting in Portland, ME**
MAR	NH Rail Transit Authority
JUN	**SDP Public Meeting in Dover, NH**
AUG	Amtrak Crew Base - Portland
OCT	Coos County Rail Group
DEC	Yarmouth & Falmouth Town Managers
2015	
FEB	Maine State Legislature Train Ride
FEB	Kennebec Valley Women's Network
APR	Brunswick Town Council
SEP	Lewiston/Auburn Rail Rally
OCT	NH Rail Summit
NOV	Am. Society of Consulting Engineers

Public input overwhelmingly suggests that passengers would ride more often if Downeaster frequency was increased, and that improvements should support the eventual introduction of feeder services from outlying markets. Municipalities, tourism organizations, private businesses, developers and others along the entire Downeaster corridor are encouraging NNEPRA to add more trips to meet growing demand. The following are consistent themes:

- The limited frequency of service to Freeport and Brunswick constrains ridership. Extending more of the Downeaster's existing trips to Freeport and Brunswick will attract many more travelers and develop more travel markets within and outside of Maine.
- The Downeaster's Portland-Boston schedule is also limited in that there are large gaps in morning southbound service and afternoon northbound service, and also in early evening southbound service and mid-evening northbound service. These "gaps" constrain ridership.

The addition of a sixth and eventually a seventh daily round-trip would enable trains to operate within those gaps, and add even more ridership potential to/from Freeport and Brunswick. Because one of the three train sets used to operate the Downeaster service only makes one round-trip each day (the others make two round-trips each day), the third train set could provide one additional frequency quite efficiently. A fourth train set would be required to operate a seventh round-trip.

NNEPRA developed a network simulation model of the Downeaster territory using Berkeley Simulation Software's Rail Traffic Controller (RTC) software package to test different schedule options available and to evaluate the most effective means of increasing speed and

capacity to reliably support additional frequencies. Four different operating plans for an additional round-trip were tested, and proved to be viable based on a total Brunswick to Boston running time of 3 hours and 15 minutes.

Among the four scenarios tested, market demand would indicate that the earlier round-trip scenario (mid-morning and mid-afternoon round-trip) would generate the most ridership and should be pursued first, with the ability to add more equipment and a seventh round-trip in the future. TCP's were used to predict potential schedules for the 6th and 7th round-trips.

3.2 Ridership Trends

NNEPRA is responsible for the Downeaster service and markets it aggressively. Fiscal year ridership was 520,790 in 2014 compared with 223,287 in FY2003, illuminating an overall ridership increase of over 133% since inception. Ridership has increased every year except 2003, 2004, recession year of 2009 and 2015 when more than 500 trains were cancelled due to severe weather and track construction. Table 2 summarizes the ridership history of the corridor through the end of fiscal year 2015 and the corresponding average monthly on-time performance for each. Total revenue of $8.6 million in FY2014 was 98% greater than $3.5 million in FY2003. During the same period, the average fare per passenger increased from $14.34 to $17.00.

Table 2: Ridership History and OTP

Fiscal Year	Ridership (trips)	% Change prior year	Cumulative % Change	On-Time Performance
2003	223,287			90%
2004	221,252	-1%	-1%	91%
2005	212,955	-5%	-5%	89%
2006	291,734	37%	31%	80%
2007	298,487	2%	34%	72%
2008	388,352	30%	74%	68%
2009	407,288	5%	82%	83%
2010	406,273	0%	82%	71%
2011	444,809	9%	89%	74%
2012	471,237	6%	111%	86%
2013	497,483	6%	123%	82%
2014	520,790	5%	133%	58%
2015	438,364	-16%	96%	30%

The decline in ridership in FY2015 is attributed to poor weather and track maintenance projects which resulted in the cancellation of more than 500 trains and significantly impacted OTP.

Set in national context, data analyzed by the Brookings Institution indicates that Amtrak ridership grew 55% overall since 1997, which means the Downeaster's ridership growth is a true standout – significantly above average compared with all Amtrak routes even though the Downeaster did not begin operating until December 2001 and its first full fiscal year of operation was FY2003.

This strong trend underscores the twin themes that travel demand along the corridor has responded strongly to the inception of the service and to increases in service frequency and reduction of travel time; and that planning for improvements to capacity and reliability is necessary and appropriate in order to keep pace with demand while maintaining and improving service delivery.

Overall customer satisfaction as measured by recent on-board surveys is high notwithstanding the weak historical on-time performance stability, with an overall score of about 93% in FY14. Customer satisfaction scorings have typically exceeded Amtrak's overall nationwide scorings. Even in FY15, when OTP was 30%, overall satisfaction of 80% was still higher than Amtrak's national average.

Table 3: 2010 Census by County and % change from 2000

Downeaster Station	State	County	County pop. 2010 Census	% change from 2000	Effective annual % change
Boston	MA	Suffolk	722,023	4.70%	0.50%
Woburn	MA	Middlesex	1,503,085	2.60%	0.30%
Haverhill	MA	Essex	743,159	2.70%	0.30%
Exeter	NH	Rockingham	295,223	6.40%	0.60%
Durham	NH				
Dover	NH	Strafford	123,143	9.70%	0.90%
Wells	ME				
Saco	ME	York	197,131	5.60%	0.50%
Old Orchard Be	ME				
Portland	ME				
Freeport	ME	Cumberland	281,674	6.00%	0.60%
Brunswick	ME				
Total 2010 pop.; avg 10-yr. and annual grow			**3,865,438**	**5.40%**	**0.30%**
Downeaster 10-yr. and avg annual ridership growth				**90.30%**	**6.60%**

Multi-ride pass holders represent about 25% of Downeaster ridership and about 18% of revenue, and about 55% of Downeaster passengers travel to or from points within Maine.

Between FY2006 and FY2014, the Downeaster's average annual ridership growth rate was 79% and averaged about 5% per year barring any external factors such as service improvements or construction projects. This vastly outpaced population growth in Downeaster communities. Table 3 demonstrates that Downeaster ridership has outpaced population growth in the service area.

3.3 Fare Analysis

Ridership estimates were made using the existing fare policy for Downeaster service. Fares run between $6 and $29 depending on the train and distance. NNEPRA and Amtrak also provide multi-ride passes that provide discounts to frequent riders; these include 6-one way tickets good for 1 year marketed to college students, 10-one way passes good for 45 days and a monthly pass marketed to commuters. Prices for each multi-ride pass are based on distance.

3.4 Ridership Forecasts

Ridership forecasts for increased service were developed using the established elasticity formula used by Amtrak.

The elasticity used is .34, which corresponds to a 3.5% increase in ridership for every 10% increase in service frequency. This is conservative given that the previous addition of a 5th round-trip on the Downeaster resulted in more than a 30% increase in ridership. Project ridership is summarized in Table 4.

Ridership forecasts developed using that methodology indicate that increasing the frequency of trains which operate between Brunswick and Boston from two daily round-trips to five daily round-trips and adding a sixth round-trip between Portland and Boston will increase ridership by more than 840,000 passengers by 2030 as compared to the no-build scenario. This is particularly relevant given that not all improvements are expected to take place at the same time. A phased approach has been developed to make incremental changes, resulting in the implementation of the 6th round-trip in 2021, and a full build-out by 2025.

Table 4: Projected Ridership 2020-2030 with Improvements

	Target Date for Improvement	Total 2020 Ridership	Total 2030 Ridership	Cumulative 2015-2030
No Build		560,652	760,575	9,716,380
5 Round-trips BRK-BON	2019	575,213	786,652	9,947,863
6 Round-trips	2021	n/a	845,352	10,405,828
7 Round-trips	2024	n/a	907,767	10,731,157

4.0 Existing Conditions

NNEPRA completed an existing conditions assessment to support the development of capital improvement projects that support the objectives of the Service Development Plan.

Three key categories of infrastructure were examined throughout the territory between Portland and Boston: Track, Train control (signal) system; Grade crossing warning systems.

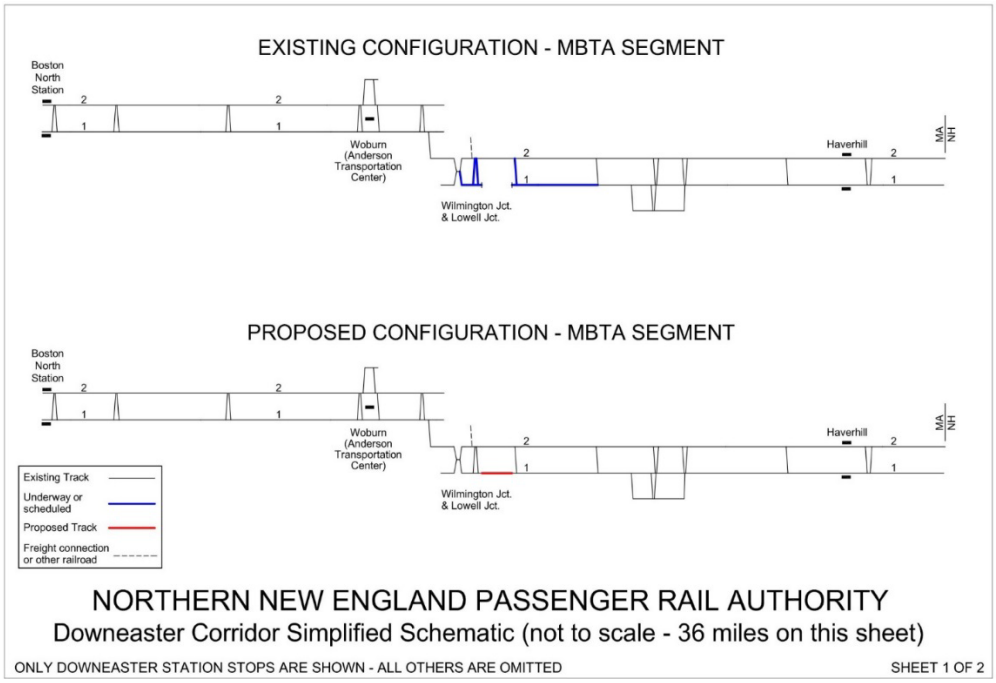
The track and signal inspections were not carried out between Portland and Brunswick because the infrastructure was in the process of being upgraded and rehabilitated in connection with the Brunswick Expansion Project. Brief descriptions follow based on the ownership of railroad in the Downeaster Corridor.

The corridor is owned by two primary entities and therefore maintenance and capital program responsibility is split as well. The Massachusetts Bay Transportation Authority (MBTA) controls the right-of-way between North Station in Boston and the New Hampshire state line at about Mile Post 36. at Plaistow, New Hampshire. North of that point, Pan Am Railways (PAR) is the owner of the Freight Main Line and Brunswick Branch. The State of Maine owns a small segment in Brunswick, ME.

4.1 Massachusetts Bay Transportation Authority (MBTA) Segment

The 36.6 miles of track in Massachusetts is owned and operated by the MBTA. Almost 87% of the track will be double-tracked once projects underway are complete in 2017. The Downeaster shares this segment with MBTA trains on the Haverhill Lines (between Haverhill and Wilmington Junction) and the Lowell Line (between the Wildcat Branch Junction and North Station). The Downeaster makes use of the single-track Wildcat Branch to switch between the Haverhill and Lowell line, which is also used by some Haverhill Line trains. Within the MBTA portion, rail is predominantly 115# with some 132# to 136# on timber crossties with crushed stone ballast and box anchors. In segments where multiple tracks exist, track centers are conventional (14 +/- feet) which is consistent with the age of the right-of-way. The rail on the Wildcat Branch is newer and is 132#, installed in 2000 to support Downeaster service.

Figure 4: Diagram of MBTA owned Downeaster Segment

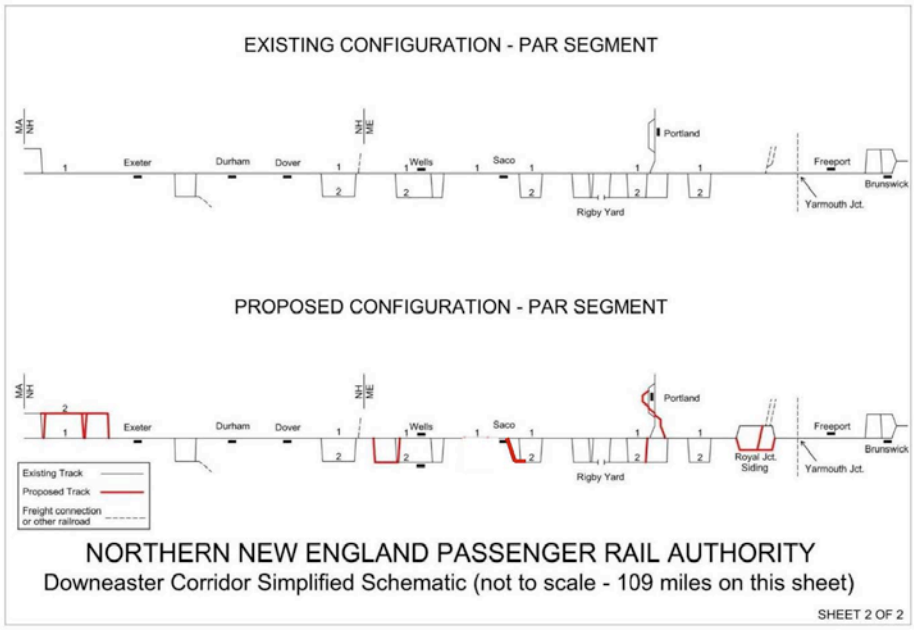


MBTA line projects underway include the restoration of most of the former second main track that was dismantled by the Boston & Maine Railroad from about Mile Post 17.92 to Mile Post 24 in Andover, Massachusetts and will also rehabilitate a segment of existing contiguous track up to approximately the Lawrence city line. The projects also include remediation of two severe speed restrictions over two historic stone bridges and the rebuilding of grade crossings within the project limits. This badly needed capacity improvement will incrementally enhance operational reliability for both the MBTA and the Downeaster.

4.2 Pan Am Railways (PAR) Segment

An initial set of trip time and capacity improvements were implemented on the PAR Freight Main Line in preparation for the initial service launch of the Downeaster in December, 2001 supporting four daily round-trips between Portland and Boston. Track conditions were improved to FRA Class 3 and 4 and a significant amount of 115# RE continuous welded rail (CWR) was installed, especially along the PAR-owned territory in New Hampshire and Maine. The warning systems at many public grade crossings were improved or were improved and replaced, notably within the PAR-owned portion of the corridor where approach speeds were being increased and there had been no passenger rail service since the 1960s.

Figure 5: Diagram of PAR owned Downeaster segment



To support the introduction of a fifth frequency in mid-2007, an additional controlled siding improvement was completed at Dover, NH to better facilitate meets between opposing Downeaster trains and between Downeaster and freight trains. NNEPRA and PAR completed the Brunswick Expansion Project in 2012 under a $38.2-million Federal grant to rehabilitate approximately 29 route-miles owned and dispatched by PAR between Portland and Brunswick.

Existing track conditions on the PAR-owned track between New Hampshire and Portland are similar to typical conditions within the MBTA territory. The dominant rail in the mainline is 115# RE CWR that was installed to support the initial startup of the Downeaster in 2001. All of the track is on timber ties with box anchors and crushed stone ballast. Drainage is generally good; however the line is overwhelmingly single-tracked, with minimal sections of passing and double tracks, which are used for scheduled passing of Downeaster trains and freight trains.

4.3 Existing Conditions Impacting Downeaster Service Performance

Since 2003, the Downeaster has had only two years with 90% or better average OTP. Since 2007 when a fifth round-trip was added and Portland to Boston travel time was reduced 15 minutes, OTP has never exceeded the OTP benchmark set in 2003-2004. The weak and uneven OTP is primarily due to "interference" with other passenger and freight trains caused by capacity constraints, temporary speed restrictions, and some state-of-good-repair issues particularly in Massachusetts. Table 5 shows the Downeaster OTP history.

Table 5: Downeaster On-Time Performance History

Fiscal Year	Avg	Best Month	Worst Month	1Q	2Q	3Q	4Q
2003	90.0	96.3	79.6	90.1	89.5	88.6	92.8
2004	91.6	96.4	83.3	95.3	88.9	87.7	94.5
2005	84.6	93.7	68.3	90.3	84.6	84.1	79.3
2006	80.0	98.3	54.4	89.4	66.8	73.7	90.0
2007	72.1	93.6	49.3	92.8	66.0	64.7	64.9
2008	68.2	89.3	48.0	76.2	79.2	62.5	54.9
2009	82.5	93.0	64.5	81.0	80.6	82.5	86.0
2010	70.8	85.1	43.6	77.2	53.8	67.3	84.8
2011	74.3	91.0	43.3	76.4	81.7	58.5	80.7
2012	86.4	94.7	78.1	91.0	89.8	83.7	81.0
2013	82.2	81.3	57.5	83.7	81.0	84.9	79.2
2014	58.0	81.3	8.1	60.7	74.3	75.3	20.8
2015	29.6	72.6	0.0	52.6	33.4	22.2	10.1
2016*	54.9	93.3	18.0	51.4	79.2	83.3	

The condition issues with the infrastructure used by the Downeaster result in numerous deficiencies that weaken the performance of the Downeaster. These impacts are discussed below:

<u>Insufficient Rail Line Capacity</u>

Today, the Downeaster corridor is predominantly single-tracked. Trains operating on the single track must wait on a passing track or along a double-tracked section for freight and passenger trains operating in the opposite direction to pass before proceeding, increasing total travel time. Additionally, single tracking limits scheduling flexibility and restricts capacity. It is more difficult and more expensive to perform programmed maintenance because there is no routing alternative when single main track is taken out of service. Additional capacity is needed to support increases in service frequency while maintaining freight operations and performing required maintenance.

Capacity constraints exist at the Portland Transportation Center, (which has only one passenger track and platform), and at the Wells, Maine station (which has two tracks but one passenger platform) which add delay and limits operational flexibility along the corridor because train meets cannot be scheduled in these areas, and if non-scheduled meets occur, one train has to wait while the other train receives and discharges passengers.

Signal Conditions

NNEPRA performed an interlocking and signal system assessment on the ground of the Downeaster Corridor from Portland, ME to Boston, MA. Specific issues addressed included verifying the status of the existing interlocking and wayside signal devices, the condition of any existing facilities that are to remain and improvements to be implemented. The field equipment was examined and found to be in good general physical and mechanical condition and the equipment is sufficient for current operations. However, vegetation obstructions of wayside signals were observed. An aggressive brush cutting and vegetation control program is essential to have ample preview of wayside signals.

An increase in speed above 79 mph anywhere on the Corridor or increased service frequency above 12 daily train trips will exceed the FRA's regulations for limited operations and positive train control would be required.

Grade Crossing Conditions

NNEPRA individually inspected all public crossings and accessible or viewable private crossings along the Downeaster corridor in the summer of 2011. The equipment was examined and found to be in good physical and mechanical condition, as most of the crossings between Plaistow and Portland were upgraded prior to the start of Downeaster service in 2001, and the crossings between Portland and Brunswick were upgraded between 2010 and 2012. The equipment was found to be of the size, design and capacity for current operations.

Specific Infrastructure Deficiencies

The lack of a 'wye' requires trains operating to Portland to and from the east to execute a reversing movement to enter and exit the PTC, which is effectively a stub terminal (i.e., dead-end track). This results in a trip-time penalty of between seven and ten minutes each way (each trip).

5.0 Capital Improvements Needed for Improved Downeaster Service

5.1 Capital Improvement Program Goals and Objectives

NNEPRA has identified the necessary improvements to meet the purpose and need of the Service Development Plan for the Downeaster passenger rail service. NNEPRA aims to improve service frequency and service reliability on the 146-mile long corridor, as well as reduce trip time and improve service efficiency. NNEPRA outlined specific goals that meet this purpose and need:

- Increase service frequency between Portland and Brunswick to five daily round-trips;
- Increase service frequency between Portland and Boston initially to six daily round-trips (from five daily round-trips) and subsequently to seven daily round-trips;
- Reduce trip time between Portland and Boston by 15 minutes;
- Reduce trip time between Portland and Brunswick by 10 minutes; and
- Accommodate potential future rail feeder service(s) that could connect other Maine communities with the Downeaster.

This chapter will discuss the necessary capital improvements to meet the goals of the new Service Development Plan. Table 6 offers an overview of the capital improvements that deliver the necessary benefits in additional capacity, time savings and reliability improvements to run the additional service in the Service Development Plan.

Several operating plans were modeled by a train performance calculator (TPC) to verify that the capital improvements under consideration could accommodate the planned service growth. The model was based on the assumption that six freight trains would operate in each direction every day between Lowell Junction on the Western Route and Rigby Yard on the Freight Main Line in Portland with seven daily freight trains between Rigby Yard and Royal Junction. These traffic levels were based on guidance received from Pan Am Railways (PAR). One daily freight train was assumed to be operating between Dover, NH and Boston, MA.

MBTA Lowell Line and MBTA Haverhill Line trains were included in the RTC network simulation models based on published schedules dated 22 Nov 2010 and 11 Jan 2010, respectively. All MBTA and Amtrak (Downeaster) midline station dwell times were assumed to be one minute, except for Amtrak trains at Portland, which were assumed to require a minimum 10 minute dwell because the train must reverse direction (i.e., crews must "change ends").

The New Hampshire Mainline was not modeled in detail south of Mile Post 1, which includes the Tower A Interlocking and North Station in Boston. This area was instead modeled as a two- track stub terminal with platforms representing North Station. It is beyond the scope of the Service Development Plan to model the entire North Station/Boston Engine Terminal complex including MBTA trains originating and terminating at North Station that do not operate on the MBTA's Lowell or Haverhill Lines relevant to the Downeaster Corridor.

It was assumed that operations at North Station and Tower A will not constrain the Downeaster operating plan more than is presently the case. The basis for this assumption is that none of the proposed Downeaster operating plans developed for this study rely on more than a single platform berth (track) being available to the Downeaster at North Station at any given time, day or night. This is exactly the same operational constraint the Downeaster faces today. Moreover, any future capacity improvements to North Station will have to be a multi-agency endeavor and potentially a multi-state endeavor. Detailed capacity analysis of Boston's North Station clearly merits a separate study.

5.2 Capital Improvement Projects Underway

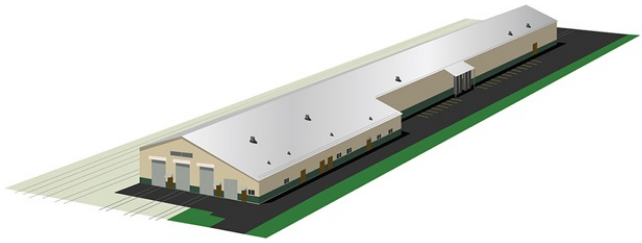
NNEPRA, in consultation with Amtrak, Pan Am Railways and the MBTA has identified the improvements necessary to support the goals and objectives of the Downeaster Service Development Plan.

Some improvements, currently underway, are considered complete in the no-build alternative. They include:

- MBTA Haverhill Line Double Tracking
  NNEPRA and MBTA have secured federal funding to add track capacity starting on the Wildcat Branch, just east of the Route 38 grade crossing in Wilmington. The project includes track and signal interlocking reconfiguration and improvements at Wilmington Junction (WJ) and Lowell Junction (LJ) on the Haverhill Line along with the addition of 2.7 miles of second track between WJ to the Tewksbury Street crossing north of LJ. Other work includes modifications to the existing grade crossing at Lowell Junction Road for the new second track. The Project also includes the replacement of 25,650 track feet of rail with CWR on portions of the Western Route between Lawrence and the State Line. MBTA is also construction a second main track beginning a short distance to the north of Ballardvale station, extending to Lawrence. These projects will alleviate congestion on the portion of the MBTA line used by the Downeaster, create more flexibility in schedules, and facilitate the eventual operation of an additional Downeaster frequency on that segment of track.

- Brunswick Layover Facility

  In October 2015, NNEPRA began construction on the Brunswick layover facility, the cornerstone of Downeaster service improvements. The facility includes a main building that will span three railroad tracks, with approximate dimensions of 655 feet long by 70 feet wide and with a maximum height of 37 feet at the roof's peak. Offices, locker rooms, wash rooms and storage facilities are incorporated through construction of an attached building on the north side of the main building, 180 feet long by 26 feet wide and with a maximum height of approximately 22 feet at its peak. The building is equipped with a ventilation system designed to handle diesel locomotive exhaust and to keep workplace temperature at a range which will enble locomotives to be shut down between runs, and to allow snowpack to be removed from trainsets in the winter.

  The facility is located on NNEPRA-owned property (historically know as the Brunswick rail yard), located on the north side of the railroad main line corridor and situated 0.6 miles west of Brunswick Station, the terminus of expanded Downeaster service (Exhibit 2). The adjacent railroad main line and freight siding tracks are located on property owned by MaineDOT.

The Brunswick layover will eliminate the need for two daily 29-mile dead-head moves between Brunswick and Portland and replace them with an additional daily round-trip between Brunswick and Boston. The conversion of these dead-head moves to a third round-trip revenue run, is expected to generate thousands of new riders and associated ticket revenues annually. An indoor facility will also eliminate the need for trains to idle outside in Brunswick during daytime holdovers, plus improve overnight layover service reliability, safety and efficiency.

Once service frequency to Brunswick is expanded to five round-trips daily, all three Downeaster trains sets will be serviced in Brunswick.

- Merrimack River Bridge

  The MTBA is repairing and rehabilitating the Merrimack River Bridge in Haverhill, MA. This bridge has a speed restriction of 15 mph for passenger trains and 5 mph for freight trains. The repairs will allow for the restoration of full speed operations over the bridge which will improve overall travel time between Brunswick and Boston. Construction is expected to be completed in April 2017.

5.3 Capital Improvement Projects included in Build Scenario

The following are projects identified for future improvements to the Downeaster service.

- Royal Siding

  A second main track extending approximately four miles west from Royal Junction in Yarmouth, ME will provide the capacity necessary to allow all five daily Downeaster round-trips to operate on that segment. The ability to operate all Downeaster trains between Brunswick and Boston will eliminate the need for crew ground transport and redundant train servicing operations for trips which may begin in Brunswick but terminate in Portland or visa versa. This will save labor and mechanical costs while increasing mobility and supporting economic growth in the region by allowing for the reliable movement of both freight and passenger rail traffic.

  Royal Junction Siding will begin east of CPF-185 (Royal Junction) and extend 21,700 feet west to a point approximately 1,000 feet east of MP- 189, and will be

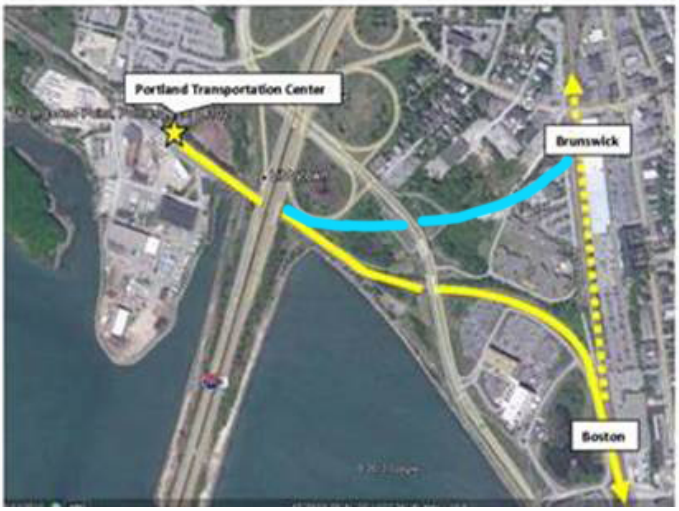
constructed as a double block passing siding to allow "at-speed" meets of passenger trains, meaning that both passenger and freight trains can move through Royal Junction concurrently, and without conflict. In addition to new track, which will require upgrades to five public grade crossings, one farm crossing and a bridge span, the new siding will require communication and signal upgrades such as a new mainline control point (CP-Cemetery), modification of an existing control point (CPF -185), new mainline automatic signals and three grade crossing AHCP conversions for double track.

All work for this element will be performed by Pan Am Railways within their railroad right-of-way with no additional environmental impacts anticipated.

- Portland “Wye” Track

  A “Wye” track, connecting the Mountain Branch (where the Portland Transportation Center (PTC) is located) in an eastbound direction to the Pan Am Railways freight main line, will improve safety, and reduce travel time by ten minutes while maximizing operational efficiency and flexibility.

  The awkward reversing movement which occurs with passengers on board, wastes time and ultimately results in a Portland to Brunswick travel time which is uncompetitive with the driving time. The existing track and signal system configuration is adequate for existing operations, but this maneuver cannot continue in the long term, particularly if service frequency increases.



  A “Wye” track, connecting the Mountain Branch in an eastbound direction to the Pan Am Railways freight main line will eliminate the reverse movement, and therefore improve safety, reduce approximately 7-10 minutes of travel time, and maximize operational efficiency and flexibility. The 2,500 foot long wye track will have a maximum grade of approximately 1.03% and will pass underneath the existing Fore River Parkway bridge, connecting to the main line just east of Congress Street in Portland.

  The majority of track can be constructed on land owned by the Maine Department of Transportation (MaineDOT) and can be aligned beneath the existing Fore River Parkway overpass without significant impacts to existing embankment slopes. The balance of property required will be purchased as necessary. Both the City of Portland and Pan Am Railways support the construction of the wye. To further public benefit, the Wye will include a separated and

fenced **pedestrian and bike trail**, which will connect Thompson's Point and the current Fore River Parkway with downtown Portland. The City of Portland has developed a vision for a shared use pathway network that extends 6.8 miles (3.6 miles existing) along the perimeter of the Portland peninsula – the economic and social hub of the city. The Libbytown Trail (1.2 miles) is one of three remaining pathway segments needed to complete this vision.

- Portland Platform Expansion

  Constrained capacity in the vicinity of the PTC impedes schedule flexibility and reliability while constraining the ability to add additional Downeaster service or potential future feeder services from other markets. Improvements would consist of reconstructing the track and platform infrastructure at the PTC to create a center platform with berthing capacity for two trains simultaneously. This will also enhance capacity between Portland and Boston, which will improve operational reliability and facilitate the eventual implementation of a 6th round-trip, and potentially feeder services.

  The concept is to construct an ADA-compliant island platform with an overgrade pedestrian walkway linking a future improved station building and parking facilities. The project could be incorporated into the Portland Wye Project or undertaken as a separate activity.

- Wells Platform Expansion

  Although there are two tracks adjacent to the Downeaster station in Wells, Maine, there is only one passenger platform. A second passenger platform will enable the Downeaster meet at this station location, enhancing capacity is a critical area.

- PAR Main Line Capacity Improvements

  There are currently 7 sidings, each approximately 2 miles long, between the 78 mile segment of PAR main line track between Portland and Plaistow, NH. This leaves approximately 64 miles of single track in 13-15 mile long segments. This significantly restricts schedule flexibility, impedes reliability, and negates the possibility of adding frequency.

  Construction of double-track sidings will enable at-speed meets at key locations identified to optimize train performance and support additional frequencies.

Four areas, illustrated in Figure 3, have been identified for double track projects which will cumulatively add 25.5 miles of double track to the PAR segment. They are:

1. Wells Siding: 6.2 mile extension of controlled siding in Wells from MP 234.2 to MP 228
2. Arundel Siding: 7.4 miles between 216.2 in Arundel to 208.8 in Old Orchard Beach
3. Kingston Siding: 5.09 miles between MP 272.89 in Plaistow to MP 267.8 in Kingston
4. Rollinsford Siding Extension: 6.8 miles between MP 234.0 in N. Berwick, ME to MP 241.0 in Rollinsford, NH.

- Curve Modifications

  Approximately 80 curves have been identified which, if modified, could contribute to increased operating speeds. Modifications to these curves will be evaluated and incorporated into capital projects identified within this plan or within the annual Capital Maintenance Program as necessary to reduce travel time.

- Community Improvements

  In addition to the capital improvements sponsored by NNEPRA, Downeaster communities are continually investing in assets which will benefit the Downeaster service.

  Kennebunk Station: The Town of Kennebunk, ME plans to design and construct a passenger train platform in their community, estimated to be complete in spring 2018, and connecting ground transportation to the nearby community of Kennebunkport. The NNEPRA Board of Directors has agreed that the Amtrak Downeaster will provide seasonal service to Kennebunk to enhance Downeaster

ridership, revenue and tourism to and within Maine. It has not yet been determined which Downeaster trains will serve Kennebunk.

Portland Station Upgrades: The Portland Transportation Center (PTC), owned by Concord Coach, is shared by both Concord Coach and the Downeaster. While functional, the facility is constrained by its size, poor visibility and limited parking. The development plans for Thompson's Point, located adjacent to the south of the Downeaster train platform, include facilities, housing and attractions which would likely increase the popularity of that station. The City of Portland has committed to develop improved transportation connections between the PTC and the downtown and Old Port sections of the City as well as other transportation hubs (jetport and ferry terminal). As a result, Concord Coach Lines is considering expanding and redesigning the PTC to expand and improve passenger facility, provide better traffic circulation, increase parking capacity and create connectivity to the Thompson's Point attractions.

5.4 Estimated Costs

Table 5 also contains NNEPRA's estimated costs of the capital improvements that constitute the Capital Improvement Plan outlined. NNEPRA will investigate means of securing funding to deliver these improvements in time for projected revenue service of the service improvements. The information and costs presented originates from the Corridor Improvement Plan Detail document, which was drafted in 2012 and updated in 2015.

Table 6: Capital Improvement Plan

Downeaster Capital Improvement Plan At a Glance								
	Primary Project Benefits							
Project Name	Frequency	Reliability	Time	Efficiency	Expansion	Other	Estimated Cost	Status
Royal Siding	●	●	●	●	●		$ 9,000,000	Final Design
Wells Siding	●	●	●	●	●		$ 12,600,000	10% design
Wells Platform	●	●	●	●	●	●	$ 8,000,000	Concept
Arundel Siding	●	●	●	●	●		$ 15,600,000	10% Design
Kingston Siding	●	●	●	●	●		$ 12,600,000	10% Design
Rollinsford Siding	●	●	●	●	●		$ 12,600,000	10% Design
Portland Wye & Trail	●	●	●	●	●	●	$ 11,000,000	Final Design
Curve Modifications	●	●	●		●		$ 9,000,000	10% Design
Portland Platform	●	●	●	●	●	●	$ 8,000,000	Concept
Portland Station Upgrade					●	●	TBD	Vision
Total CIP Investment							$ 98,400,000	

6. Service Operating Plan

6.1 No Build: Current Operating Plan

Currently, the Downeaster makes five round-trips daily between Portland and Boston with stops in between, but only two revenue trips serve Freeport and Brunswick.

The pending completion of the Brunswick layover facility will enable the operation of a third round-trip between Brunswick and Boston in the fall of 2016.

This will allow mid-day southbound Train 684 to originate in Brunswick and the late night northbound Train 689 to terminate in Brunswick.

Table 7: No Build Downeaster Schedule: 3 R/T BRK-BON; 2 RT POR-BON

Southbound Train #		680	682	684	686	688
Dep	**Brunswick**		7:00am	11:45am		6:25pm
	Portland	5:20am			2:35pm	
Arr	**Boston**	7:50am	10:25am	3:10pm	5:05pm	9:55pm
Northbound Train #		**681**	**683**	**685**	**687**	**689**
Dep	**Boston**	9:05am	11:25am	5:00pm	6:05pm	11:00pm
	Portland	11:35am			8:35pm	
Arr	**Brunswick**		2:50pm	8:20pm		2:25am

6.2 Service Development Plan Improvements

Upon completion of the Royal Junction Siding Project, all 5 Downeaster trains will operate between Brunswick and Boston, and all three Downeaster trainsets will be stored and serviced in Brunswick overnight.

Table 8: Build Scenario Downeaster Schedule 5 R/T BRK-BON

Southbound Train #		680	682	684	686	688
Dep	**Brunswick**	**4:25am**	7:00am	11:45am	**1:40pm**	6:25pm
Arr	**Boston**	7:50am	10:25am	3:10pm	5:05pm	9:55pm
Northbound		**681**	**683**	**685**	**687**	**689**
Dep	**Boston**	9:05am	11:25am	5:00pm	6:05pm	11:00pm
Arr	**Brunswick**	**2:30pm**	2:50pm	8:20pm	**9:30PM**	2:25am

Further build-out of the projects identified in the CIP, which will ultimately add approximately 25 miles of new double track, reduce Brunswick to Boston travel time to 195 minutes, and add operational flexibility will significantly improve opportunities for additional Downeaster frequencies between Brunswick, Portland and Boston and will enhance schedule flexibility. NNEPRA considered a number of operating plans to confirm that the improvements identified in the CIP would support the ultimate goal of increasing service frequency to six daily round-trips, with the potential to add a seventh round-trip daily to fill gaps in the existing schedule and maximize ridership.

Six and seven round-trip scenario, in various configurations, were explored and verified by the TPC which included the addition of new round-trips in the following time slots:

- a mid-morning southbound train from Brunswick and a mid-afternoon northbound train from Boston;

- an early-morning northbound train from Boston and a late-afternoon southbound train from Brunswick;
- a late-afternoon southbound train from Portland and a mid-evening northbound train from Boston.

The availability of operation flexibility and schedule options is important, and these can be evaluated for both the sixth and seventh frequency as various improvements are incorporated. An initial market analysis indicates, however, that a sixth round-trip frequency would likely attract the most riders if it operated southbound mid-morning and operated northbound mid-afternoon. Because the additional frequency is expected to be added using the existing equipment pool, one of the mid-day turns would have to occur in Portland therefore only five round-trips would travel between Brunswick and Boston. That said, Brunswick would benefit from the added frequencies, but they would replace two existing frequencies. This scenario will maximize the utility of the existing three train sets.

Table 9: Build Scenario Downeaster Schedule: 5 R/T BRK-BON; 1 R/T POR-BON

Southbound Train #		680	682	#6 SB	684	686	688
Dep	**Brunswick**	4:15am	7:00am	**9:00am**	12:35pm		6:20pm
	Portland					2:55pm	
Arr	**Boston**	7:25am	10:15am	**12:20pm**	3:50pm	5:10pm	9:35pm
Northbound Train #		**681**	**683**	**#6 NB**	**685**	**687**	**689**
Dep	**Boston**	8:30am	11:05am	**2:00pm**	5:00pm	6:20pm	11:00pm
	Portland		1:25pm				
Arr	**Brunswick**	11:42am		**5:12pm**	8:12pm	9:32pm	2:12am

The potential of seventh frequency has also been explored with consideration given to the option of a morning train originating in Boston. This option is likely to add more operating costs, not only due to the additional trainset which would be required, but because it would require crews to operate out of a Boston crewbase. It would also necessitate the installation of Positive Train Control on the PAR line. Given that these challenges can be addressed, this seventh round-trip would enable a northbound commute option to Maine, by providing an early morning arrival and a late evening departure. The equipment rotation would also enable all seven round-trips to operate between Brunswick and Boston, allow three train sets to be stored in Brunswick overnight, and one set to return to Boston.

Table 10: Build Scenario Downeaster Schedule - 6 R/T BRK-BON; 1 R/T BON-BRK

Southbound Train #		680	682	#6 SB	684	686	#7 SB	688
Dep	**Brunswick**	4:30am	7:00am	9:00am	12:35pm	1:55pm	**4:30pm**	6:20pm
	Portland							
Arr	**Boston**	7:45am	10:15am	12:15pm	3:50pm	5:10pm	**7:30pm**	9:32pm
Northbound Train #		**#7 NB**	**681**	**683**	**#6 NB**	**685**	**687**	**689**
Dep	**Boston**	**6:00am**	8:45am	11:15am	2:00pm	5:00pm	6:30pm	11:00pm
	Portland							
Arr	**Brunswick**	**9:15am**	12:00pm	2:30pm	5:15pm	8:15pm	9:45pm	2:15am

A preliminary evaluation of ridership, revenue and cost implications of various scenarios is in section 6.4.

6.3 Equipment Plan

The existing service operates with three trainsets net of spares/standbys. Each consists of one (1) General Electric P42DC locomotive; one (1) F40- type cab control car and typically five (5) Amfleet cars including a Café car. Currently, two of the sets make two round-trips daily, and the third set makes only one round-trip daily. A 6-Frequency service has been designed such that it would utilize the third train set to make a second round-trip, and therefore would not require an additional trainset.

One additional trainset will be required to operate a seventh frequency, for a total of four (4) trainsets. It is assumed that the incremental locomotives and railcars will be part of the Amtrak operating pool as at present.

6.4 Service Financials

Table 11 reports key operating revenue forecast data. Annual operating revenue presented below is the product of projected ridership impacts of each enhancement (Table 4) and the actual average revenue per passenger realized by the Downeaster in 2015, based on projected city pairs, escalated periodically to reflect fare changes. In a No Build scenario it is assumed that ridership and revenue per passenger for three round-trips Brunswick to Boston and two round-trips Portland to Boston remain static except for periodic escalation of fares.

Table 11: Projected Operating Revenue 2020-2030 with Improvements

	Target Date for Improvement	Total 2020 Revenue	Total 2030 Revenue	Cumulative 2015-2030
No Build		10,916,011	15,749,841	192,845,267
5 Round Trips BRK-BON	2019	11,267,657	16,379,584	198,435,574
6 Round Trips	2021		17,914,608	210,411,352
7 Round Trips	2024		19,609,171	219,244,033

Table 12: Projected Operating Costs 2020-2030 with Improvements

	Target Date for Improvement	Total 2020 Operating Cost	Total 2030 Operating Cost	Cumulative Operating Cost
No Build		$ 21,024,067	$ 28,254,589	$ 365,440,877
5 Round Trips BRK-BON	2019	$ 21,534,067	$ 28,876,276	$ 372,146,922
6 Round Trips	2021	$ -	$ 30,507,242	$ 386,476,771
7 Round Trips	2024	$ -	$ 34,907,503	$ 411,028,938

The projected pace of ridership growth is consistent with the recommendation and expectation that the Downeaster will operate at a 6-frequency service level for a

period of several years before a further incremental step to a 7- frequency plan is taken. A target implementation date of 2024 for a 7th round-trip was established for illustration purposes only.

Projected total operating costs are presented in Table 12. Operating cost projections were prepared based on 2015 costs. A 3% annual escalation factor was used to compute costs in future years. No costs associated with Positive Train Control have been factored.

Table 13: Projected Net Operating Cost 2020-2030 with Improvements

	Target Date for Improvement	Total 2020 Operating Cost	Total 2030 Operating Cost	Cumulative Operating Cost
No Build		$ 10,108,056	$ 12,504,748	$ 172,595,610
5 Round Trips BRK-BON	2019	$ 10,266,411	$ 12,496,691	$ 173,711,348
6 Round Trips	2021		$ 12,592,635	$ 176,065,419
7 Round Trips	2024		$ 15,298,332	$ 191,784,904

Table 13 demonstrates that all scenarios will require subsidies. However, by making fewer equipment movements and more revenue operations with limited additional equipment, the 6-round trip scenarios require smaller amounts of continued support in the form of subsidies for passenger rail service, improve the efficiency of the service by reducing the cost per train mile of operating the service and by providing more mobility. This is illustrated in Table 14.

Table 14: Projected Net Cost per Train Mile 2020-2030 with Improvements

	Target Date for Improvement	2020 Net Cost Per Train Mile	2025 Net Cost Per Train Mile	2030 Net Cost Per Train Mile
No Build		$ 21.81	$ 23.69	$ 26.75
5 Round Trips BRK-BON	2019	$ 20.50	$ 22.10	$ 24.73
6 Round Trips	2021	$ -	$ 22.65	$ 21.60
7 Round Trips	2024	$ -	$ 20.37	$ 22.31

The proposed 6-frequency plan is more financially efficient on an operating cost basis than the existing 5-frequency service. This supports a recommendation to move forward with a 6-frequency service initiative. By 2030, ridership is projected to expand sufficiently to justify a further expansion to a "7-frequency" service to meet the demand.

7. Implementation Plan

In order to deliver the service expansion outlined in the Service Development Plan, NNEPRA intends to work with state and federal agencies and Pan Am Railways (PAR) to build support for increased funding from all local, state and federal funding sources. Capital improvements will be grouped into manageable packages that are eligible and competitive for grant money under existing funding programs. Coordination with Pan Am Railway and the MBTA regarding existing projects is underway, and discussions regarding additional capital improvements planned for the corridor are ongoing.

The capital improvement program will proceed in logical phases based on the availability of funding. As projects are completed, NNEPRA will work with Amtrak, PAR and MBTA to make incremental improvements to the Downeaster service plan until all elements are complete and the maximum travel time reduction and additional frequencies are achieved.

Reference Documents

Draft Summary Report Downeaster Corridor Service Development Plan and NEPA Documentation, Revision 3, April 1, 2013

Draft Appendix A-1, Existing Conditions Assessment, Track, Revision 1, December 29, 2012

Draft Appendix A-2, Interlocking and Signal System Assessment, December 15, 2012

Draft Appendix B, Corridor Improvement Plan, Revision 4, December 9, 2012

Draft Appendix C, Network Simulation and Analysis, Revision 1, November 26, 2012

Service Level Environmental Assessment for the Downeaster Service Development Plan, 2015

Public Involvement Plan, Downeaster Service Development Plan, Revision 1, January 11, 2016