

# Regional Rail for Metropolitan Boston

## Case Study: Providence/Stoughton Line

### Introduction

This paper is a case study analyzing the advantages of infrastructure and service improvements for the MBTA's Providence/Stoughton Line that are required to bring service to a Regional Rail standard. This paper serves as an additional installment in a series of supplements to the TransitMatters 2018 report Regional Rail for Metropolitan Boston ("Regional Rail Report"). An earlier version of this case study was published as an appendix (Appendix C1) to the Regional Rail Report. Here, we provide a more detailed blueprint for modern, reliable, and fast Regional Rail service on the Providence/Stoughton Line, which has only become more urgent for Massachusetts and Rhode Island since 2018. In November 2019, the Providence/Stoughton Line was selected by the MBTA's Fiscal Management Control Board (the "FMCB") as one of three lines for the first phase of implementing a major transformation of the MBTA Commuter Rail System, reflecting the findings of the MassDOT/MBTA Rail Vision process.

This updated case study was a collaborative effort amongst TransitMatters members, led by Peter Brassard, Alon Levy, and Ethan Finlan.

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TRANSITMATTERS

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## Current Situation

The Providence/Stoughton Line is the busiest in the MBTA Commuter Rail network, with 12,965 weekday inbound[1] riders as of 2018.[2] The main line to Providence connects Boston and Providence both to one another and to intermediate suburbs. Providence and Mansfield (along with Salem on the Newburyport/Rockport Line) regularly alternate for first place among stations with the highest number of passengers in the MBTA commuter rail system outside of Boston. As of 2018, 1,995 inbound passengers board each weekday at Providence Station. Mansfield has the second highest ridership, at 1,877 inbound riders. In the outbound direction, 2,071 passengers disembark at Mansfield, then 1,853 at Providence. The Stoughton Branch's two stations have a combined inbound ridership of 1,386, with no weekend service. We believe Regional Rail investments allowing for a frequency of every 15-30 minutes on each branch will drive increased ridership on both branches.

*The Providence/Stoughton Line is the busiest in the MBTA Commuter Rail network, with 12,965 weekday inbound riders as of 2018.*

The Providence Line is the only MBTA Commuter Rail line that is electrified. Because of long-standing MBTA policy preferring a standardized diesel fleet, and limited substation capacity, however, the electric overhead wires power only the Amtrak trains which share tracks with MBTA trains along the entirety of the Providence Line. In November of 2019, the FMCB resolved and directed the transition to electric rolling stock along the Providence Line as part of Phase 1 of a transition to Regional Rail service similar to that recommended by TransitMatters. These recommendations specifically include all day 15-30 minute frequencies, high level platforms and dictating the procurement and operation of electric multiple unit (EMU) trains, which will allow the MBTA to begin a transition to Regional Rail. This initiative will also free up other trains for frequent service on the rest of the system as a transition to full Regional Rail.

*If the improvements we propose are made, the Boston-Providence trip would be 23 minutes faster … and the Boston-Stoughton trip would be sped up by 14 minutes…*

Improved connections between Boston and Providence are particularly critical for the economy of Rhode Island, both in terms of access to Boston and in making commuting and day trips to Providence viable for more people. Employers in Providence have difficulty attracting and retaining employees from Boston and the intermediate suburbs in Norfolk and Bristol counties, due in part to the poor transportation links despite their proximity. While some non-trivial infrastructural challenges need to be addressed, improvements to the Providence Line can be made to facilitate better mobility in this corridor within the 2020s, given a political commitment to do so and disciplined project management to avoid cost overruns. If the improvements we propose are made, the Boston-Providence trip would be 23 minutes faster, with MBTA trains between the two running every 15 minutes, and the Boston-Stoughton trip would be sped up by 14 minutes, with service at least every 30 minutes all day. We estimate that full electrification of both branches and the completion of all other needed improvements, including full level boarding where it is lacking, will cost no more than $300 million.

We explicitly do not favor proposals for an express train service between Providence and Boston, for the reasons we lay out later in this case study. Additionally, the recommendations of this case study should be adopted in tandem with the incremental achievement of the capacity-increasing changes we advocated for South Station in our Proof of Concept report.

## Line Segments

- The shared Providence and Stoughton Line extends along the Northeast Corridor (NEC) from South Station to Canton Junction, a distance of 15 miles.
- The Providence Line segment continues 29 miles south from Canton Jct. along the NEC to Providence Station, and beyond, and an additional 19 miles to Wickford Junction on the south side of Providence. The total distance of the Providence line is about 63 miles.
- The Stoughton Line segment branches off the NEC and extends from Canton Junction to Stoughton, a distance of 4 miles.

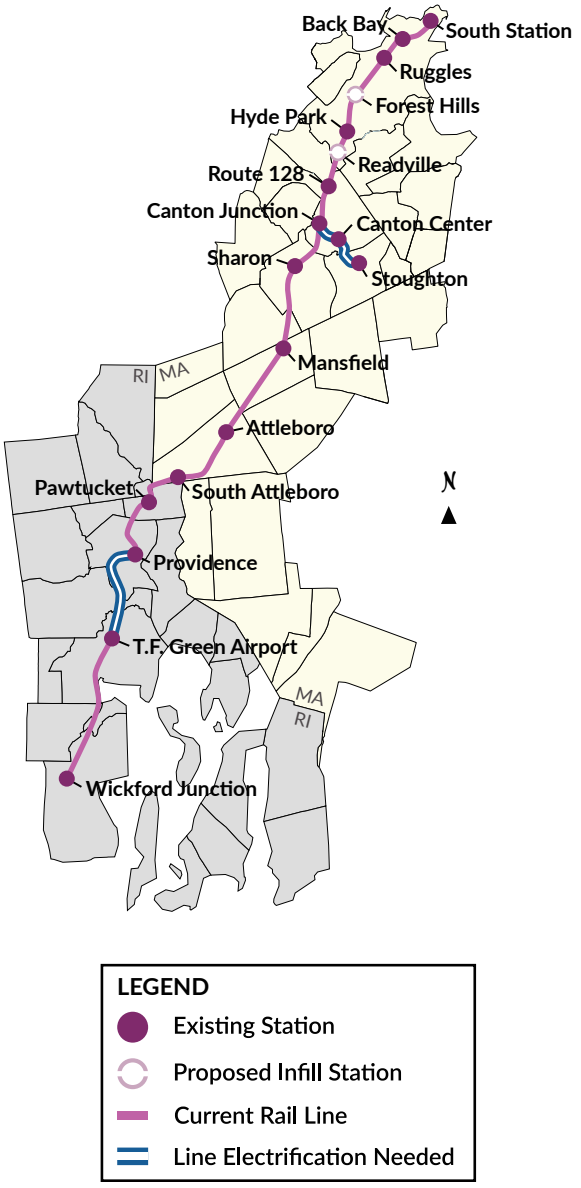
## Line Characteristics and Needed Improvements Summary

Between Boston and Providence, a distance of 43.6 miles, there are ten stops. The potential time saving from running Electric Multiple Units (EMUs) is substantial for how wide the stop spacing is, because the current MBTA rolling stock generally has a maximum speed of 79 mph, whereas long stretches of the line have speed limits of 100-150 mph.

To transform the Providence/Stoughton Line to run fast EMU rail service in the near term, the MBTA needs to complete the following action items:

- Procure electric multiple units as soon as possible,
- Electrify the Pawtucket service yard, which was designed for electrification,
- Build high-level platforms at the eight stations that currently have only "mini-high[3]" platforms serving at most one car per train, and
- Electrify short track segments that have not previously been electrified due to the absence of any specific need by Amtrak NEC service.

FIGURE 1: Geographic map of needed electrification improvements on the Providence/Stoughton Line



## Completing Electrification and Acquiring New EMU Rolling Stock

The MBTA, MassDOT, and the State of Rhode Island should commit to purchasing electric rolling stock in the immediate future to improve performance and travel time on the line as soon as possible. An all-EMU fleet should be the unambiguous goal for the Providence Line, as well as every other MBTA commuter rail line. Negotiations between the MBTA, MassDOT, the Rhode Island Department of Transportation (RIDOT), and Amtrak ought to begin now to ensure that electric power be made available for both local and long-distance services at economical rates. The importance of electrification cannot be understated: in addition to the carbon emission and public health benefits, it allows for faster trips, which in turn allows for more frequency.

*Electrification costs vary, but based on recent projects, wiring of the Stoughton Line could be completed for as little as $3 million per mile.*

While all station stops from South Station to Providence Station except the southbound platform at Attleboro have catenary, the substation powering the line would have to be expanded to ensure that both MBTA and Amtrak trains have sufficient power. Fortunately, sufficient space exists to do so; we estimate a range of tens of megawatts would be needed. Building enough capacity to accommodate several megawatts of power in Britain costs in the range of $1.2 million.[4] Catenary would have to be added to the southbound siding at Attleboro station, the Pawtucket storage yard, and to both sides of the stations south of Providence, which are on unelectrified sidings. Current plans for the Pawtucket-Central Falls station, scheduled to open in 2022, place it on the mainline, meaning that trains should be able to access the catenary.

The branch to Stoughton is completely unelectrified; it requires overhead catenary wire but nothing else, since it could use the mainline's substations. Electrification costs vary, but based on recent projects in Scotland, France, Israel, and New Zealand, wiring of the Stoughton Line could be completed for as little as $3 million per mile.[5]

## Proposed Express Service

The State of Rhode Island has been exploring ways to reduce the current MBTA trip time between Providence Station and South Station, which currently ranges from 1:03 to 1:23. To this end, additional rush-hour express trains have been proposed, possibly running nonstop from Providence to Boston. Unfortunately, express service is not an effective solution under present-day operating assumptions (that is, highly peaked schedules and locomotive-hauled trains). Furthermore, *no expresses should operate under modernized Regional Rail assumptions (that is, all-day frequency with EMUs) because high ridership throughout the line will be supported by faster travel times*. Instead, Rhode Island and Massachusetts should focus on increasing frequency and building full-high platforms. These measures would do far more to boost ridership and speed trips to Boston or Providence than even the best express train.

Under current operating practices, slow diesel service and platform constraints at South Station limit the capacity available. Additional express service would eat up capacity without gaining many new passengers: the ridership on a nonstop train with diesel locomotives would not be enough to fill the train. For comparison, the Framingham/Worcester Line's Heart-to-Hub train runs nonstop between Worcester and Lansdowne, making the trip to South Station in 1:06, 14 minutes faster than trains which only run express from West Natick and 28 minutes faster than all-stops trains. Yet because mixing express and local trains on the same line constrains arrival times at South Station, it arrives just after 9 AM, later than useful for most commuters. Consequently, it only carries 266 passengers. An additional Providence express train would most likely have similar scheduling challenges.

*Additional express service would eat up capacity without gaining many new passengers: the ridership on a nonstop train with diesel locomotives would not be enough to fill the train.*

FIGURE 2: Inbound ridership on the Providence Line

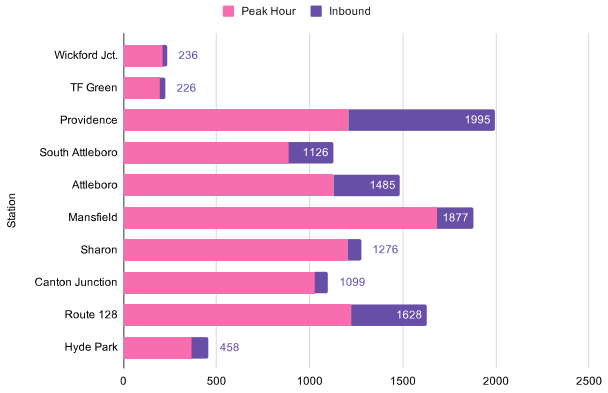
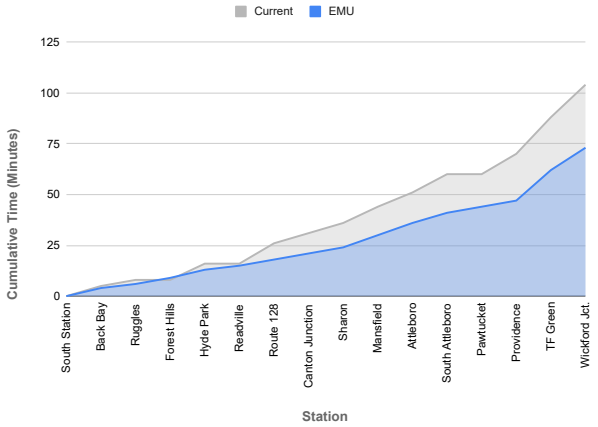



FIGURE 3: Cumulative trip time on the Providence Line




Furthermore, an ideally-scheduled express train would not have enough ridership potential to begin with. There already exist some express trains; Train 808, the busiest inbound train, runs nonstop between Mansfield and Back Bay, and achieves a 1:03 trip time. In total, the train carries 1,249 people to Boston. Yet only 334 passengers board at Providence, and only 196 board south of Providence.

In no case can the higher speed of express service by itself increase ridership by much. A diesel train running nonstop between Providence and Boston would be about eight minutes faster than Train 808, taking into account scheduling contingency for mixing trains of different speeds on the same line. The elasticity of ridership with respect to in-vehicle trip time is too low for 1:03 vs. 0:55 to boost ridership enough. In contrast, the elasticity of ridership with respect to frequency is high when the preexisting frequency is hourly or worse,[6] averaging 0.76 in four older studies and as high as 1 in more recent reviews: in other words, doubling frequency would increase ridership 70-100%. The higher speed, representing about a 15% improvement, would only increase ridership by about 5%.[7] This small increase in ridership would come at the expense of precious line capacity, and require the MBTA to run a half-full train.

Not only would ridership growth from any express option be poor, the base of riders at intermediate stops is high enough that a large proportion of the line's ridership would be cut off by additional express trains. Running inbound at rush hour, the busiest station on the line is not Providence (1,209 average riders per weekday morning rush) but Mansfield (1,681 average boardings); Providence is third, after Route 128 (1,224). All stations between Providence and Route 128 are similarly busy, with 7,150 peak inbound boardings between them; of these, only South Attleboro has below 1,000. Even if express trains served Mansfield and Route 128, two-thirds of the potential ridership would be lost. Further, Mansfield lacks a high-level platform; given peak loads, a Mansfield stop at the height of rush hour would likely add at least 4.5 minutes to the trip time.[8]

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Only during off-peak and in the reverse-peak does Providence dominate the ridership profile, and yet the state's plan does nothing for off-peak service. In the reverse peak direction, end-to-end ridership is stronger, with 367 average riders coming from Boston versus 77 from the suburbs, and most alightings at Providence, but these loads are much lower.

In the medium term, fully electric service and changes to operating practices at South Station would eliminate the capacity issues. Nonetheless, express service on this line remains ill-advised, for the following reasons:

1. The wide stop spacing means an EMU-operated express train would not speed up end-to-end travel as much as where spacing is closer, such as on the Framingham/Worcester line. As our timetables below demonstrate, an EMU-operated all-stops ("local") train could make the trip in 47 minutes, roughly the same amount of time as the Amtrak Regionals, even with new station stops at Pawtucket, Readville, and Forest Hills.

2. With the exception of Hyde Park, the inner segment stations are major connection points to the transit network; Ruggles also serves significant job centers, such as the Longwood Medical Area, and an average 852 riders get off here. Similarly, with frequent service Hyde Park would become more useful, as commuters could more easily reach these destinations. Thus, there are no stations on the inner segment that warrant being skipped.

3. Express trains dictate higher padding, meaning contingency built into schedules to account for possible delays. Providence/Stoughton trains share tracks with Needham, Franklin, and Amtrak trains, and interact with freight around Mansfield and south of Providence. The more distinct service patterns that exist, the more challenges to reliable operations.

While we support the goal of taking incremental steps towards better service, an express train does not meet this goal. Ultimately, full high-level boarding provides the best trip time improvements next to introducing EMUs. Moving to a high frequency clockface scheduling with high frequency does far more to boost ridership. This improves service without leaving any riders worse off, in contrast to an express train. While these measures require more investment, they are a better use of funds and resources than an express train that only boosts ridership by 5%.

*Ultimately, full high-level boarding provides the best trip time improvements next to introducing EMUs; moving to a high frequency clockface scheduling with high frequency does far more to boost ridership.*

## The Issue of Electric Locomotives

There has been occasional discussion between the MBTA, Amtrak, and third parties regarding the potential purchase or lease of electric locomotives. For a number of reasons, we have come to believe that this is no longer an advisable pursuit, and that the relevant stakeholders must focus on implementing an all EMU fleet for the Providence/Stoughton Line.

*The MBTA needs to focus 100% of its time, energy and attention on EMU procurement.*

First, electric locomotives have significant drawbacks compared to EMUs. For one, their acceleration rate at low speeds is very weak, sometimes even weaker than that of diesel locomotives. For another, they are quite expensive - the median cost in Europe appears to be about $3-4 million apiece,[9] whereas European EMUs average $2.5 million per car.

Second, given the FMCB's important recommendation to commence a phased transition to Regional Rail (fast, frequent, all day service with EMUs) beginning with the Providence Line, and its directive to the general manager to commence building a dedicated internal staff through establishment of an office of rail transformation to accomplish this, we believe it is essential to waste no time or financial resources in the pursuit of temporary and inadequate equipment.

We have undertaken a comprehensive review of the US passenger rail industry and the potential to procure EMUs in the short term. We believe that there are multiple time-and-cost efficient approaches to procuring EMUs that ought to be the focus of the MBTA in the short term. There is no cost or schedule advantage to looking to electric locomotives. Our research convinces us that EMUS can be procured in roughly the same time it will take to negotiate a locomotive purchase or lease deal. Moreover, in addition to the fact that it would unnecessarily increase the fleet complexity, we do not want a locomotive lease or purchase deal to distract from or interfere with the prompt procurement of EMUs.

The window to purchase or lease electric locomotives as a reasonable approach to transition to EMUs on the Providence Line has closed. The MBTA needs to focus 100% of its time, energy and attention on EMU procurement. Should electric locomotives become available to Rhode Island in the near term, the state could instead explore their use for service to Westerly or into Connecticut, as has been occasionally proposed.

## Train Speed

As stated above, much of the Providence line allows for speeds of up to 100-150 miles per hour. EMUs are fast, both in terms of acceleration/deceleration and maximum allowable speed. With EMUs in operation, MBTA trains can run at 100 miles per hour over long stretches. Lower speeds would be required within the approach to South Station, immediately south of Attleboro station, around Pawtucket-Central Falls, and in Providence. For each track mile where speed can be increased, 9.6 seconds are shaved off the total trip time.

## High-Level Platforms

Eight of the line's stations only have mini-high platforms, which are about two-thirds the length of a typical coach: Hyde Park, Canton Junction, Sharon, Mansfield, Attleboro, South Attleboro, Canton Center, and Stoughton. The remaining stations already have high platforms. In order to facilitate true speed gains, it is essential that high platforms be added at each of the eight stations which lack them. Infill stations must be constructed with full high-level boarding from their inception.

We want to reiterate what we wrote in our 2018 Regional Rail Report, *"The cost of designing and building high-level platforms can be contained by utilizing standardized designs for these platforms. Each station does not require an expensive bespoke design. Use of standard design specifications (which may require modest modification in appropriate circumstances) and creative use of materials can make a meaningful difference in keeping the cost of this important equity and service improvement in reasonable and affordable territory."* That approach remains our guiding principle.

We believe that all existing stations lacking high level platforms on the Providence/Stoughton Line could be given high level platforms and requisite accessibility for a maximum cost of $200 million. This is based on a baseline cost of $20-25 million for two side platforms and requisite accessibility work per station. While stations on the Stoughton branch are currently in a more constrained environment, there is an existing proposal to relocate the Stoughton station to a site more conducive to high platform construction. It is also possible to widen the station area in Canton Center. If these projects proceed, new high-level platforms can be built on the branch for a total of no more than $50 million, accounting for necessary double tracking at the new Canton Center. Prior to the completion of this work, Stoughton can be served by shorter trains.

FIGURE 4: Diagrammatic map of needed high platforms on the Providence/Stoughton Line

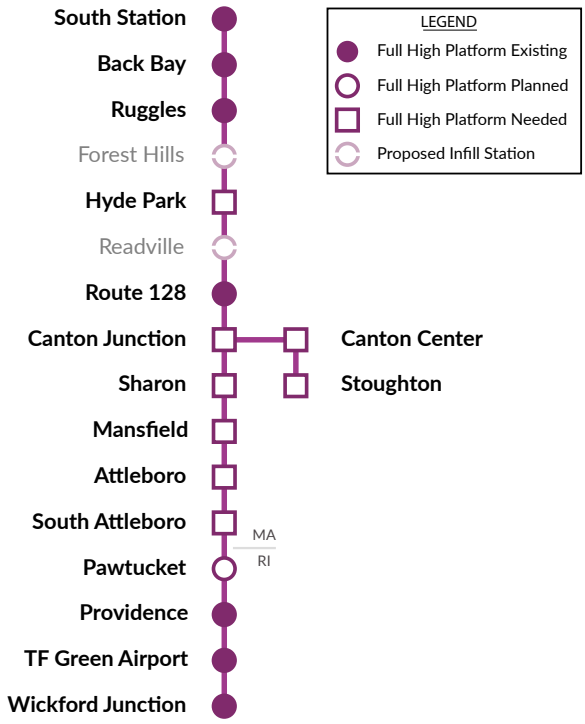

FIGURE 5: High level boarding at Lansdowne


FIGURE 6: Vertical circulation at Boston Landing

High level platforms often require additional vertical and grade separated circulation for access between sides of the station. This is typically accomplished vertically (a bridge over the station, with elevators) or through an underpass. This adds costs to the station project; with elevators, the added cost is typically in the range of $1 million per elevator.

Attleboro may not require the same level of investment for constructing high platforms as other stations, and should therefore be considered as an early target for high platform construction. Connections between both sides of the station are possible by using the existing nearby street underpass, and ramps already extend to street level. However, there may be need for additional work to ensure ADA compliance. Since the station has siding tracks off of the NEC mainline, construction of platforms themselves need not be limited to off-hours, meaning that construction can move more quickly and with less active work and staging difficulty compared to some other stations.

Mansfield is the busiest station on the line after Providence, but it faces more challenging conditions for high platforms than other stations. Due to its location, Mansfield station falls under federal Strategic Rail Corridor Network (STRACNET) regulations that require accommodating wider trains for moving such military equipment as tanks, which poses challenges for high level platforms. The southbound platform is constrained and limited to a 770-foot platform length, below the MBTA's standard of 800', due to the freight track entering at the north and a street underpass at the south, but this length is still enough to accommodate a 9-car train.

Recently, the MBTA rebuilt the mini-high platforms and re-surfaced the existing low platforms, ignoring ADA requirements to construct full-length high platforms because of the freight track and platform length conditions. Because of the STRACNET limitations, flip-up platform sections were installed on the mini-high platforms. One solution is to install a flip-up platform on a full-length platform. Flip-up platforms are labor-intensive, but the same attendant who flips a mini-high can also flip a full-length platform. The drawback is that installation may be complex and would add costs.

A second potential solution is to construct a separate new freight track to the west of the mainline with a crossover south (railroad west) of the station. This would eliminate the need for flip-up or retracting platform sections to allow for wider freight trains to pass and allow the room to construct a standard length platform. The drawback is that new track construction may prove expensive, and would require additional vertical circulation elements to allow passengers to cross over the freight track to this platform.

*All existing stations lacking high level platforms on the Providence/Stoughton Line could be given high level platforms and requisite accessibility for a maximum cost of $200 million.*

A third solution is to procure EMUs with automatically-deployed extenders; these operate in such cities as Berlin and Zurich, and the extenders are reliable and deploy almost instantaneously. Such extenders are compliant with the Americans with Disabilities Act,[10] and are used in the US on the recently-opened Brightline service in Florida.[11] That makes it possible to build platforms entirely on the outside of the dynamical clearance envelope, even if the train is considerably narrower. This option is likely the most economical.

## Infill Stations

While the Providence Line is primarily an intercity corridor with wide stop spacing, fast-accelerating EMUs allow for modest station additions while still making the trip in under an hour. Rhode Island is currently investing in one such stop in Pawtucket. In Massachusetts, we believe that two more such stops are warranted: Readville and, if feasible to construct, Forest Hills. These stations are primarily useful for providing connections: Readville for transfers to and from the Fairmount Line, and Forest Hills for connections to local buses and the Orange Line. At Readville, this would entail replacing the existing low platforms with high platforms for both Providence and Franklin trains. The most substantial benefits of a transfer option here come from Fairmount Line electrification, and the better frequencies that would enable.

More challenging engineering work is required at Forest Hills. The existing commuter rail platform is only used by Needham Line trains, and can only be accessed from one main line track. Either a new platform would need to be built, accessible from the main line, or the outbound Needham track would have to be reconfigured to run onto the main line. It is possible that the site is too constrained, or the costs are too high, for this to be viable. If it is possible, however, the connection opportunities would be worthwhile, as Forest Hills is one of the busiest transfer points in the system, and Regional Rail would provide fast service to the busiest alighting points on the Orange Line, relieving congestion. Additionally, NEC – Forest Hills transfers will facilitate faster trips from Forest Hills, which has recently seen increased development, and is one of the busiest transfer points in the system, to downtown and Back Bay. It will also guarantee connections to the extended Orange Line, which we have proposed as an alternative to Regional Rail on the Needham Line, as the latter would constrain capacity. Passengers whose destinations are close to Ruggles, Back Bay, or South Station would have the option to connect from the Orange Line to the Providence/Stoughton Line for a faster trip.

A more speculative third possibility is located between Forest Hills and Hyde Park, just south of Cummins Highway. A station in this area, named Mount Hope, existed until roughly the 1970s-80s when it was closed due to low ridership. Regional Rail frequencies would make a station here more useful; further, it would provide an additional connection to the busy 32 bus route, reducing trip times from this neighborhood and taking some pressure off of Forest Hills. However, the delicate timetabling required from sharing tracks with intercity trains may make this nonviable, and access can be improved with frequent bus connections to the Fairmount Line and Roslindale Village.[12] Nonetheless, this possibility is worth exploring.

## Beyond Providence

In the late 2000s and early 2010s, commuter rail service was extended south of Providence, first to T.F. Green Airport, then to Wickford Junction. This 19-mile extension runs on unelectrified track, is only served by select trains, with no weekend service, and has poor ridership; only 235 daily passengers board at Wickford Junction, and 226 at T.F. Green. Electrification of this segment would improve travel times by 10 minutes.

FIGURE 7: Proposed frequencies with Regional Rail EMU service on the Providence/Stoughton Line

| Station Segment | Peak | Current | Off-Peak | Current |
|---|---|---|---|---|
| SOUTH STATION - CANTON JUNCTION | 7.5 MIN | 17 MIN | 15 MIN | 46 MIN |
| CANTON JUNCTION - PROVIDENCE | 15 MIN | 29 MIN | 15 MIN | 79 MIN |
| CANTON JUNCTION - STOUGHTON | 15 MIN | 50 MIN | 30 MIN | 150 MIN |
| PROVIDENCE - WICKFORD JUNCTION | 30 MIN | 60 MIN | 30 MIN | 240+ MIN |

*Note: Current frequencies shown on this chart are general averages of present frequencies.*

While frequencies can be increased, the service plan for trains running south of Providence must take into account the large difference in demand north versus south of Providence. One way to do so is to have every other MBTA train continue past Providence, running every 30 minutes all day instead of every 15. Another way to provide better access to dense areas along the corridor could be through running intrastate trains at high frequency, and building additional infill stations. Such service has been regularly discussed in Rhode Island, with some proposals calling for trains to run as far south as Kingston, and others as far north as Woonsocket on the Providence & Worcester freight line. If eventually implemented, intrastate trains should run every 15 minutes off-peak between Pawtucket and Warwick, all day. Low EMU operating costs and integration with RIPTA buses make such service more viable. If all MBTA trains then turn at Providence Station,[13] with cross-platform transfers to shorter (~2-3 car) intrastate trains, more stops in Rhode Island could be made without impacting turn time, operating costs, or frequency for Boston-Providence service.[14]

While such trains have the potential to greatly enhance regional mobility, there exist significant timetabling challenges. Most of the line between Providence and Cranston presently has only three tracks; four-tracking the line to the fullest extent possible is likely necessary to prevent interference with MBTA and Amtrak trains, and at a few places it may require slightly widening the right-of-way. However, a potential station site in Cranston, at Park Avenue, is already four-tracked, and would provide a connection to a proposed high-frequency bus route. It may be possible to build this station as an early step towards intrastate service, served in the near term by MBTA Regional Rail trains.

There has also been discussion of extending commuter rail deeper into South County, possibly as far south as Westerly, with a connection to Shore Line East trains, themselves extended from New London, to the Connecticut coastal cities. Because of demand mismatch, Providence-Westerly service may have to be run independently of MBTA Regional Rail, possibly as an extension of an intrastate train from the north. Alternately, Shore Line East trains could extend directly to Providence. We offer these as possibilities to be explored, not as definitive recommendations.

## Train Scheduling

Trains should run on a consistent, frequent schedule all day (between 5 AM and 1 AM). Prior to EMU implementation, a minimum of half-hourly frequencies, or headways, to and from Providence should be operated, potentially with 15- or 20-minute peak service. Frequencies should be equal in both directions, to allow use of the line for reverse-peak trips and to avoid conflicts between revenue and non-revenue moves in Downtown Boston.

With EMUs, we believe an all-day 15-minute frequency between South Station and Providence Station is justified. This is because of the dramatically improved operating costs from running EMUs and reducing train turn times, and also due to the high all-day demand on the Boston-Providence corridor.

On the Stoughton Branch, a 30-minute off-peak frequency (doubled at the peak) may reflect demand better; however, an all-day 15-minute headway may be justified here as well, because the marginal cost of matching off-peak service to the peak is low. There is a question of capacity and demand relative to Stoughton to Boston service, because of the lower demand and constraints on longer trains at the end of the branch. It may be prudent to run at least some trains as "shuttles" to Canton Junction, at least so long as South Station remains a stub-end terminal. Passengers would then transfer to main line trains. This would further free up slots at South Station.

Before the North-South Rail Link (NSRL) opens, Providence/Stoughton trains should use consistent dedicated tracks at South Station with terminal turn times of less than ten minutes to avoid congestion, increase capacity, optimize trip-times and virtually eliminate the possibility for delays on other lines cascading into the Providence-Stoughton schedule (this last point is especially important while other lines are still running diesel trains which have much higher failure rates than EMUs).[15] With NSRL, dwell times at South Station would be greatly minimized (potentially by a factor of 5 or 10), as Providence/Stoughton trains would travel beyond to the north side of the MBTA system. Furthermore, through-running would free up enough slots that the capacity/ridership tradeoff considerations from the Stoughton Branch discussed above would go away.

In order to facilitate frequent all-day service and prevent the storage of trains at South Station, extended train layovers for the Providence and Stoughton line service should be at:

- Providence Station
- Stoughton
- Pawtucket service yard
- Wickford Junction

When NSRL is opened, end of the line locations for layovers on the north side should be selected.

## Travel Times

Assuming level boarding, the following travel times are achievable. NSRL would allow for a further savings on the trip time below of roughly one minute, by eliminating the slow approach speed (~30 MPH) required by the stub end platforms at South Station.

To cover the entirety of the Providence/Stoughton Line under our proposed frequencies, 13-15 EMU sets would be needed: five for the Stoughton Line, eight for the Providence Line if all MBTA trains terminate at Providence, and approximately ten for the Providence Line if every other MBTA train extends to Wickford Junction. This assumes all trains run to South Station.

FIGURE 8: Proposed timetable with Regional Rail EMU service on the Providence/Stoughton Line

| PROVIDENCE/STOUGHTON | | |
|---|---|---|
| **Station** | **EMU** | Current |
| **SOUTH STATION** | **0:00** | 0:00 |
| BACK BAY | 0:04 | 0:05 |
| RUGGLES | 0:06 | 0:08 |
| FOREST HILLS | 0:09 | -- |
| HYDE PARK | 0:13 | 0:16 |
| READVILLE | 0:15 | -- |
| ROUTE 128 | 0:18 | 0:26 |
| CANTON JUNCTION | 0:21 | 0:31 |
| CANTON CENTER | 0:23 | 0:34 |
| **STOUGHTON** | **0:26** | 0:42 |
| SHARON | 0:24 | 0:36 |
| MANSFIELD | 0:30 | 0:44 |
| ATTLEBORO | 0:36 | 0:51 |
| SOUTH ATTLEBORO | 0:41 | 1:00 |
| PAWTUCKET | 0:44 | -- |
| **PROVIDENCE** | **0:47** | 1:10 |
| T.F. GREEN AIRPORT | 1:02 | 1:28 |
| **WICKFORD JUNCTION** | **1:13** | 1:44 |

## Notes:

1 "Inbound" is defined as passengers or trains bound for Boston; "outbound" is defined as passengers or trains heading away from Boston.

2 Except where otherwise noted, all MBTA Commuter Rail ridership numbers are derived from the Central Transportation Planning Staff's (CTPS) 2018 Commuter Rail counts, the most recent available data.

3 "Mini-high" platforms are smaller platforms which are high enough to provide level boarding, but can accommodate at most doors for the first two train cars.

4 "Low-Cost Electrification for Branch Lines." DeltaRail. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/3872/low-cost-electrification-report.pdf

5 A forthcoming TransitMatters report will discuss electrification costs in more depth.

6 Armando Lago, Patrick McEnroe, and Matthew Monroe, "Ridership Response to Changes in Transit Services," TRB 818, pp. 13-19; and the literature review section in Joe Totten and David Levinson, "Cross-Elasticities in Frequencies and Ridership for Urban Local Routes," Working Papers 157, University of Minnesota.

7 Lago-McEnroe-Monroe cite an elasticity of 0.3 for in-vehicle time for bus priority projects, including bus lanes on Route 3 in Massachusetts.

8 This estimate comes from observations of the low-platform stop penalty (at Mansfield, peak hour trains often dwell for 3-4 minutes) plus the time it takes a diesel-powered train to slow down and get back up to speed (roughly 70 seconds each).

9 Railway Gazette, World Rolling Stock Market February 2019: https://www.railwaygazette.com/traction-and-rolling-stock/world-rolling-stock-market-february-2019/48072.article "Railpool has ordered a further 20 Bombardier Traxx electric locos for delivery from mid-2019, with options for 20 more. Based on the list price, the orders would have a combined value of €74m."

10 "OP35 ADA Review: Level Boarding for Commuter Rail." Federal Transit Administration, June 2018, p. 1. https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/regulations-and-guidance/117586/op-35-ada-review-06-2018.pdf

11 Matt Ball, "Retractable Gap Filler to be Part of Brightline Passenger Rail Service." Informed Infrastructure, February 8, 2016. https://informedinfrastructure.com/20103/retractable-gap-filler-to-be-part-of-brightline-passenger-rail-service/

12 As discussed in our Regional Rail report, NEC capacity constraints mean the Needham Line should be replaced with an Orange Line and Green Line extension; meaning that Roslindale Village would host a rapid transit station. A forthcoming supplement will discuss the case for this measure in more depth.

13 Depending on scheduling impacts, a third option may be for some MBTA trains to split off and recombine cars at Providence Station, since EMUs consist of individually powered cars. These shorter sets would then function as perhaps 2 of the 4 hourly intrastate trains, and through passengers could remain on board.

14 Rhode Island's ongoing statewide Transit Master Plan (Transit Forward RI 2040), due to be completed by January 2020, has not yet endorsed a proposal for intrastate trains, and instead up to this point has focused on using the rail corridor for more frequent MBTA rail service to Boston and T.F. Green Airport.

15 See the *Regional Rail Proof of Concept Report* (2019) for discussion of improving train turn times.

## What is Regional Rail?

MBTA Commuter Rail operates as a mid-20th century service with a mid-20th century business model. It reflects out of date biases about where people and jobs are located, and about how people desire to get from one place to another. Many people no longer work on a strictly 9 am to 5 pm weekday schedule, and many more want convenient and frequent train schedules that respond to the needs of their daily lives.

> *"The current Commuter Rail paradigm costs "way too much money for way too little ridership."*
>
> *— MBTA FMCB Chairman Joe Aiello, 11/20/17*

Our current approach to Commuter Rail, as a business model, fails to offer its rider/customers the service they want and need. As a result it contributes to the region's worsening traffic congestion, keeps Gateway Cities isolated during most of the day, and exacerbates income inequality since the inadequate service compels many to drive – for lower income people, the high cost of owning, maintaining and driving an automobile can have a crippling effect on their ability to make ends meet.

Public transit must be frequent all day, not just at rush hour. A Regional Rail system would have trains running at least every half hour all day in the suburbs and at least every fifteen minutes in Boston and other Inner Core communities.

Regional Rail requires both frequent all day service, accessible platforms and smarter equipment to provide the service. That means high-level platforms at stations to simplify and speed up boarding and alighting. It also means electrification of the system, enabling use of Electric Multiple Units to replace the current push/pull diesel fleet. EMUs will be more reliable and less expensive to maintain, will provide riders with speedier trips, and will provide better service without polluting the air around them.

## A highly functioning Regional Rail system includes five critical components:

- **Systemwide electrification** and the purchase of high-performance electric trains.
- **High platforms**, providing universal access and speeding up boarding for everyone.
- **Strategic infrastructure investments** to relieve bottlenecks.
- **Frequent service all day**: every 30 minutes in the suburbs and every 15 minutes in denser neighborhoods.
- **Free transfers** between regional trains, subways, and buses, and fare equalization with the subway in the subway's service area.

## And one useful component that will complete cross-region mobility:

- While not critical to implementing a Regional Rail system, **the North-South Rail Link (NSRL)** between North and South Stations, allowing service between any two stations with either a direct trip or a single, seamless transfer, would be a highly useful enhancement providing the flexibility and connectivity to which many riders and potential riders would be drawn.

**More information and reports available at:**
http://regionalrail.net

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|---|---|
| *Regional Rail for Metropolitan Boston* | Winter 2018 |
| *Regional Rail Proof of Concept* | Fall 2019 |
| *Regional Rail Supplemental Information* | Ongoing |

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