

Laying the First Tracks Toward Recovery

The TransitMatters Plan for Regional Rail Phase 1

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Cover art: Liz Haney



TransitMatters is a 501(c)(3) nonprofit dedicated to improving transit in and around Boston by offering new perspectives, uniting transit advocates, and informing the public. We utilize a high level of critical analysis to advocate for plans and policies that promote convenient, effective, and equitable transportation for everyone.

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Executive Summary

Over the last two years, there has been growing consensus that the MBTA's Commuter Rail system is outdated and specifically fails to respond to current, evolving commuting needs. It has become clear that the solution is to adopt a modern, efficient, and zero-emission operating model, broadly known as Regional Rail. Regional Rail emphasizes frequent all-day service: a train at least every 15 minutes all day in Boston and the inner core, and at least every half-hour in the suburbs. Delivering this operating model depends on adopting four key changes: electrifying the system to improve reliability, speed, and air quality; instituting lower, rationalized fares, running the same frequency in both directions, and establishing free transfers to other transit modes. It also requires investment in high level platforms and strategic infrastructure investments to eliminate bottlenecks.

Today, the MBTA faces a new challenge: the COVID-19 pandemic and resulting economic downturn. Commuter rail has been especially hard hit: since many white-collar jobs have shifted to remote work during the crisis, ridership has dropped by nearly 99%. It's expected that the shift for at least some of these jobs will be permanent. But while white-collar workers have left transit en masse, low-income riders have remained: ridership drops on major bus routes like the #28 and #111 have not been nearly as drastic. Transit remains an essential lifeline for Metro Boston's economy, and will be crucial to the recovery process. The essential workers relying on transit to reach their jobs are clearly not well-served by the current commuter model, focused on suburb-to-downtown commutes. Transforming commuter rail into an all-day, affordable, and reliable transit mode has only become more important. With frequent all-day service, workers with more flexible schedules can use transit for when they visit the office, without having to orient their whole day around the schedule. Such a shift can also provide more opportunities for the people of Metro Boston to have an affordable option to take advantage of the region's cultural amenities in the years to come.

Following the 18-month Rail Vision planning process led by the MassDOT Office of Transit Planning, the MBTA's Fiscal & Management Control Board (FMCB) voted in November 2019 to embrace this vision. This followed months of deliberations by an Advisory Committee consisting of local and state officials, transit experts, and business leaders, which culminated in unanimous support for a major transformation of the commuter rail. In a series of resolutions, the board directed the MBTA to move toward Regional Rail, starting with electrification and 15-minute frequencies on the Providence, Fairmount, and inner Newburyport/Rockport ("Eastern") lines, while also directing MBTA leadership to establish an Office of Rail Transformation. While this clarified the long-term vision, important questions remain about near-term steps that the Commonwealth can take to advance us toward a Regional Rail system.

In this document, TransitMatters lays out practical steps to start implementing Regional Rail over the next 5-7 years, including steps that can be taken in the next year. We call this Regional Rail Phase 1.

What is Regional Rail Phase 1?

Regional Rail Phase 1 will electrify and provide the requisite additional upgrades for the three line segments included in the FMCB's November 2019 resolutions. Phase 1 will also begin modernization of the Framingham/Worcester Line, the system's fastest growing, to increase rush hour capacity and all-day service to mitigate impending gridlock from the Allston I-90 Interchange construction work and other major I-90 projects scheduled for the years to come. The Worcester Line would gain five new trains, faster trip times at rush hour, and 20-minute peak headways for express trains to Worcester and local trains to Framingham. We also propose an expanded program to eliminate key single-track bottlenecks for increased peak hour service and to operate 30-60 minute frequencies off-peak on other lines, particularly Ballardvale, the Salem tunnel, and JFK/UMass. These are the building blocks of full Regional Rail for the entire system.

Regional Rail Phase 1 aggressively prioritizes level boarding, where platforms match the entry level of passenger coaches, based on ridership levels per station. This is because each stop with level boarding cuts the trip time by about a minute. We propose that by 2026, level boarding will have been implemented at the ten busiest stations which lack level boarding (with the exception of Framingham, because more intensive work may be required) and at all stations on the lines targeted for modernization. All lines will have level boarding added at at least some stations, with the exception of the Old Colony lines, which already have level boarding at all stations.

Beginning the process of systemwide transformation now allows us to achieve the dual goals of making our transportation system more resilient, and facilitating the economic recovery process. With staggered work hours and shifts likely, and an increased burden being placed on low-income essential workers, we need transit that provides frequent, affordable service all day. This is particularly important in Gateway Cities like Lynn, providing good connections to the bus network. With the link between air quality, asthma rates, and susceptibility to COVID-19 becoming clearer, the need to drastically cut emissions, particularly in environmental justice communities like Chelsea and Dorchester, is now even more urgent. We need frequent service to reduce and prevent crowding as the Commonwealth maintains social distancing guidelines during the transition period, giving riders confidence in the safety of our transit system.

Based on international best practices and recent costs, the entire Phase 1 package can be completed for \$2.62 billion. This figure includes fleet costs for procuring new multiple unit trains. This is a significant investment, but compared to the cost of buying new locomotives and coaches, it is far cheaper in terms of unit costs and a better investment in terms of reliability and performance. Now more than ever, we need a dynamic, resilient, and clean Regional Rail network to meet the needs of Metro Boston and the Commonwealth.

Phase 1 Principles

- » Projects should be focused specifically on upgrading the Commuter Rail system to Regional Rail service standards (frequent all day service, electrification, and high platforms), immediately on the three lines identified by the FMCB's November 2019 resolutions and incrementally on other lines
- » Projects strive to improve air quality and thus public health, both through electrification which removes pollutants and through making rail competitive with private car trips
- » Projects should include "no regrets" investments that provide clear improvements to capacity and reliability
- » Projects should adhere to a strict budget and have cost control in line with international best practices
- » Minimize disruptions
- » Any capital improvements should be built in ways that do not preclude further enhancements or expansions that will be necessary to achieve the full Regional Rail vision in future years
- » Phase 1 should provide benefits across a broad geography of riders, not concentrated on a particular line
- » Where possible, investments should be made that advance projects that provide rail access to underserved parts of the Commonwealth, including the South Coast and Western Massachusetts (e.g., South Coast Rail and East West Rail)

Phase 1 Goals

- » More frequent service: at least every 15 minutes all day on the Providence, Boston-to-Beverly, and Fairmount Lines, and every 30 minutes to hourly all day everywhere else on the system by 2025
- » More accessible service with the construction of full high-level platforms at the busiest stations by 2026
- » Begin electrification: electrify the three segments targeted in the FMCB's 2019 resolutions by 2026; begin planning for electrification of the Framingham/Worcester Line plus another line to be determined on a metrics basis with completion by 2030
- » Eliminate key bottlenecks: remove the biggest constraints to Regional Rail service, including doubling or mitigating single-track segments that currently make it difficult to operate 15-30 minute headways

Project Summary

Service

Phase 1A

By 2024, frequency will increase on the Providence/Stoughton and Fairmount lines to every 15 minutes, and at least half-hourly off peak on the Newburyport/Rockport Line up to Beverly. Everywhere else will have all-day half-hourly or hourly service (with some additional peak trains). This process can and should begin in the next year: with peak ridership down by almost 99%, the MBTA should use this opportunity to provide a schedule that is both frequent and easy to interpret (see our discussion of clockface scheduling elsewhere). Whether trains run half-hourly or hourly depends on the availability of train sets and demand. The Framingham/Worcester Line should at minimum get all day-half hourly service to Worcester during this phase.

Phase 1B

By 2026, frequency will increase on the inner Newburyport/Rockport Line to every 15 minutes all day. All other lines will have all-day half-hourly service. The completion of the Worcester Triple Track will facilitate 30 minute "local" service to Framingham and 30 minute express service to Worcester, with the possibility of 20-minute peak headways. This service will be clockface and bidirectional.

Key Projects:

Line Transformation

Phase 1A

In Phase 1A, the Providence/Stoughton and Fairmount lines will be fully electrified, with electric multiple unit (EMU) trains running all commuter service on these lines. The better reliability and faster speeds will allow for all-day 15-minute headways in both directions. This will also eliminate local pollution from diesel locomotive emissions. Because electric trains accelerate faster and are capable of higher speeds, Providence Line service would be faster serving all stops (47 minutes) than a currently proposed nonstop express train. Trip times on the Fairmount Line will also be cut down by 10-12 minutes. An electrified and frequent Fairmount Line will provide rapid transit like service to environmental justice communities in Dorchester, Mattapan, and Hyde Park, with densities similar to many Orange Line station areas. This will also relieve crowding the #28 bus and provide opportunities for the MBTA's Network Redesign.

Phase 1B

Phase 1B will see the completion of electrification and EMU implementation on the Eastern Line up to Beverly, sometimes called an “Environmental Justice Corridor.” The FMCB’s 2019 resolutions called only for electrifying and running high-frequency service on the Eastern Line up to Lynn. We support electrification to Lynn, but find three reasons that Regional Rail Phase 1 should include electrification and frequent all-day service at least as far north as Beverly. First, Beverly and Salem are already among the busiest commuter rail stations; Salem is the busiest station outside of downtown Boston, busier than even Providence or Worcester stations. Second, frequent, reliable service north of Lynn will give Lynn and Chelsea residents better access to job centers in Salem and Beverly, and possibly elsewhere through last-mile connections. Third, because the line branches at Beverly (into the Rockport and Newburyport lines), continuing electrification at least to the junction here reduces operational conflicts with diesel service. This modernization effort would also include building at least one additional station in Revere.

While it will not yet be electrified, the Framingham/Worcester Line will also move closer to the Regional Rail model of service, with higher frequency and high platforms at all stations; some stations, particularly Framingham, will have a train every 15 minutes. The Triple Track completion will allow for more reliable, frequent, and faster express service, taking at most 1:10 to reach Boston. Phase 1B also guarantees the rail portion of West Station to be built by 2025, adding much needed transit options to residents of Allston while mitigating congestion during the eight-to-ten year construction along I-90 related to the Allston Multimodal Project. This facility will eventually include a bus station to provide a link for Metro West residents to reach Harvard and Kendall Square without having to travel through downtown Boston.

With more existing equipment freed up by electrifying the inner Eastern Line, frequencies can be increased to a train every 30 minutes on the majority of the system.

Systemwide Capacity & Accessibility Projects

Phase 1A

During Phase 1A, work will begin to improve capacity at South Station. This includes completing work on the Tower 1 interlocking, which is already underway. To the fullest extent possible, all lines should be given dedicated platforms at North and South Stations, particularly the three lines that the FMCB voted to modernize in the near term. This becomes more useful as more lines gain high level platforms and are electrified, because they become more reliable. While some flexibility may need to be retained in the short term, a move to mostly dedicated platforms will incrementally improve reliability and provide a better passenger experience, reducing in-station crowding and queuing (as riders will know which platform their train uses, and when changes are necessary, they will be announced). The amount of time a train remains at a downtown terminal (known as “turn time”) will also be decreased to 10-20 minutes. The Newburyport/Rockport Line’s capacity will be increased by eliminating speed restrictions and adding a new station at South Salem, which will allow for better timing of trains through the single-track Salem tunnel.

The level boarding expansion will begin in Phase 1A. By 2025, all Providence/Stoughton, Fairmount, and Newburyport/Rockport line stations will have full level boarding, either through full high level platforms or shorter level platforms that align with opening doors. All stations from Worcester to Ashland will be given full high platforms as well, as will Back Bay station on the Framingham/Worcester Line. This would decrease express travel times by 10 minutes or better and allow for 1-2 more rush hour trains.

Phase 1B

This phase focuses on boosting capacity and speeding up service system-wide, by completing switch reconfiguration and track renewal work at South Station, focusing on the access point to South Station (the “throat”). This improves capacity drastically for a far lower cost than the full South Station Expansion proposal.

Phase 1B further includes major capacity increases on the Eastern Line, Old Colony Main Line, and Haverhill Line. About 1 mile of single track in Dorchester, including JFK/UMass Station, will be doubled. The line is largely single tracked through Dorchester, Quincy, and Braintree, and this has limited frequencies: all three lines currently have only three rush hour trains each and sporadic service throughout the day. Doubling this segment will allow for a train every 15 minutes each way. Future phases will need to account for the other single track segments which are harder to resolve, particularly in Quincy. The Salem tunnel bottleneck will also be addressed during Phase 1B;

either mitigating this bottleneck or doubling the tunnel is essential, as this is a high demand line with potential for even higher frequency. Double tracking Ballardvale station on the Haverhill Line will allow for eventual 15-minute headways to Haverhill and future increases in intercity service to Maine and New Hampshire.

Increased capacity on the Framingham/Worcester Line will be made possible by adding a third track through Natick and Wellesley, and upgrading tracks and signals.

Level boarding will be rolled out at 14 key stations, based on ridership, cost, and operational desirability. By 2026, all lines should have full level boarding at key stations. This includes Porter Square on the Fitchburg Line (a major transfer point), Reading on the inner Haverhill Line (with the station given double track or moved slightly south), and multiple stations on the Franklin Line, which has closely-spaced stops. This also includes the three stations in Newton and all stations in Wellesley and Natick, adding level boarding at all Framingham/Worcester Line stations but Framingham.

Capital Costs (2020 dollars)

FIGURE 1: Estimated capital costs broken down by phase

Item	Phase 1A	Phase 1B	Final Cost
Fleet Costs	\$525,000,000	\$90,000,000	\$615,000,000
Electrification¹	\$92,000,000	\$103,000,000	\$195,000,000
Platforms	\$372,000,000	\$508,000,000	\$880,000,000
Right-of-Way Expansion²	\$0	\$236,883,000	\$236,883,000
Track & Signals	\$91,000,000	\$243,210,000	\$334,210,000
Other³	See note 3	See note 3	\$367,400,000
Grand Total	\$1,080,000,000	\$1,181,093,000	\$2,628,493,000

¹ Our estimate of electrification costs comes from a figure of \$5.62 million per mile, based on Amtrak’s electrification of the northern half of the Northeast Corridor from New Haven to Boston in the late 1990s (adjusted for inflation). Electrification costs vary widely, from \$2 million per mile on recent projects in Israel to \$10 million per mile, based on the recent Caltrain modernization project in the San Francisco Bay Area; however, the latter’s per mile costs are attributable to cost overruns and include signal modernization cost.

² Right-of-way expansion costs are difficult to identify. The North Shore Transit Improvements study, completed in the mid 2000s, projected a cost of \$161 million in 2020 dollars for expanding the Salem tunnel; the 2018 North-South Rail Link feasibility study projected a cost before contingency and escalation of just under \$198 million for the Salem tunnel. In the other major double tracking projects, Ballardvale and JFK/UMass, there will be a need to expand the right of way itself, subsuming the existing platform at Ballardvale and a station access road at JFK/UMass.

³ Project management, contingency, escalation, etc. The cost figures for the Worcester Triple Track already include contingency and soft costs, so that is already reflected in Platforms and Track & Signals.

Impacts

Jobs

Regional Rail Phase 1 will support job growth, both directly (through construction and engineering work) and through improving access to employment opportunities, particularly from Gateway Cities and environmental justice communities like Attleboro, Dorchester, and Lynn. Based on APTA analysis of jobs created per dollar of transit investment, we estimate that approximately 22,000 direct jobs and nearly 23,300 indirect jobs can be created with a \$2.62 billion investment in rail construction and expansion work (Tri-Met). Regional Rail work could provide opportunities to the Commonwealth's students in concert with programs that encourage STEM education. Examples of targeted programs include the DC Infrastructure Academy, and trade schools in Los Angeles and New York City.

Full transformation of commuter rail into regional rail will take decades, but Phase 1 provides an opportunity to begin collaborating with workforce development educational programs immediately to ensure that the new generation of engineers, planners, designers, architects, electricians, HVAC workers, mechanics, and others are all educated and ready to be placed into well-paying and fulfilling careers working on the Commonwealth's infrastructure.

Moreover, regional rail expansion will open up more employment opportunities. One study found that in 2016, the number of employees that employers in the Minneapolis-St. Paul metro area hoped to hire was roughly the same number of people seeking employment, but that spatial and skills mismatches were preventing the necessary connections between employer and employee. Frequent, reliable, and affordable transit will allow for improved access to the job markets of Metro Boston, and improve employer access to a diverse workforce.

Environmental and Public Health Improvements

Electrification dramatically reduces pollution generated by rail service: there is near-zero local emissions (save modest releases of particulate matter), and the source power becomes more environmentally friendly as the entire grid moves toward renewable energy. Electrifying the Regional Rail system will aid in meeting the Commonwealth's goal of net-zero emissions by 2050. Near-zero emissions will not only reduce the MBTA's carbon footprint, but can also improve health outcomes, particularly in environmental justice neighborhoods, including the parts of Dorchester served by the Fairmount Line. Public health data show that Dorchester contends with high levels of air pollution. There are multiple reasons for this, and we do not suggest that rail electrification alone will be sufficient to solve long-standing environmental injustices. However, according to the Regional Asthma Management and Prevention program, diesel emissions are a significant source of negative externalities from air pollution.

⁴ "Asthma and Diesel" <http://www.phi.org/uploads/application/files/xq1rssi18tmqtavs3k97m6ojpp6reyhgmy3ajnh9jhcjy93r.pdf>

Funding Opportunities

Federal Funding

The Federal Railroad Administration makes available grants for “core capacity” projects. Regional Rail Phase 1 projects, such as double tracking and the Salem tunnel expansion, may qualify for some of this revenue.

Stimulus and Economic Recovery

The ongoing COVID-19 pandemic and subsequent economic impact will have ramifications for mass transit capital projects and operating budgets, and Regional Rail Phase 1 is no exception. However, the first round of recovery federal funding included \$25 billion for transit operating expenses, meaning there is an understanding in Congress that transit is a vital part of the emergency response system. We must now make sure that investments in transit projects like Regional Rail Phase 1 are seen as a key part of the recovery. It is important that Regional Rail Phase 1 projects seek federal funding when it becomes available. Policymakers should aggressively support funding for these projects, as they are cost effective and will be crucial to the Commonwealth’s economic recovery. Our expectation is that the federal government will pass additional stimulus bills. Regional Rail Phase 1 will put people back to work while preparing the Commonwealth for a stronger, more resilient, and lower-carbon future.

MassDOT and the MBTA should take measures now to advance and design projects like completing Providence Line electrification, the Worcester Line Third Track, and key high level platforms identified here, so they can be considered “shovel ready” for a possible near-future federal stimulus bill.

⁵ See the *TransitMatters Providence/Stoughton Line case study* for more information on service frequency south of Providence.

⁶ Fuel costs for commuter rail are unavailable.

Public-Private Partnerships

Where possible, public-private partnerships should be pursued to help finance station improvements. For example, the company facilitating the private development underway at River Works could finance the entire platform project, as could the owner of the shopping mall near South Attleboro. This would be similar to models commonly seen in Hong Kong and Japan, as well as the construction of Boston Landing station in the mid 2010s.

Operating Costs

While ultimately, Regional Rail’s annual operating costs will be lower than present costs by as much as \$100 million, in the short term, there will be higher costs from running more service. Fuel is relatively cheap; the main issue is labor costs. Currently, all MBTA train sets run with one conductor and at least one assistant conductor (typically two).

The cost of electricity in Massachusetts is \$0.0642/kWh for transportation. This makes the annual power cost of 15-minute all day frequencies on the Providence Line \$630,916 if all trains terminate in Providence (or \$695,968 if every other train runs to Wickford Junction)⁵, \$414,960 on the Stoughton Line, \$197,592 for the Fairmount Line, and approximately \$384,592 on the Eastern Route up to Beverly.

Current operating costs break out to approximately \$657 per hour and \$26.96 per mile. This means that the added per-mile operating costs for all lines with 30-minute weekday headways would total \$165,626,437 per year.⁶ These costs assume current staffing levels. In order to lower operating costs, the current model will need to be revisited.

We also explored cleaning, given the renewed importance of cleaning given the current pandemic. Assuming that a cleaner earns \$50,000 a year in base pay and \$80,000 including benefits (likely in line with the Massachusetts median, and accounts for labor needed to clean a train in 7 minutes), this is about \$250,000 in annual cleaning costs per train set.

Appendix I: Project Breakdown

Figure 2: Phase 1A Project Breakdown

Phase 1A (2021-2024)		
Task	Cost	Notes
<p>Systemwide Frequency Improvements:</p> <p>Half-hourly off-peak service on:</p> <ul style="list-style-type: none"> » Fairmount » Providence » Eastern Route Main Line » Framingham/Worcester » Lowell » Needham <p>Hourly off-peak service on all other lines.</p> <p>Timeline: 2022</p>	<p>Total: \$5M</p>	<p>Challenges: The primary obstacle is current crew agreements, which dictate split shifts and also appear to require more than one conductor per train in nearly all circumstances. The split shifts problem ought to be easy to resolve, although there may be a need to hire some additional staff for the evening operating hours. Service can be incrementally added, allowing for other lines to gain half-hourly frequencies prior to Phase 1B.</p>
<p>Providence/Stoughton and Fairmount Line Electrification & High Platforms</p> <p>Electrification Projects:</p> <p>Providence/Stoughton: Substation expansion; electrifying the southbound platform at Attleboro station; electrifying the Stoughton</p> <p>Fairmount: Full electrification</p> <p>High Platforms:</p> <p>Fairmount: Fairmount, Readville</p> <p>Providence/Stoughton: Hyde Park, Readville, Canton Junction, Canton Center, Stoughton, Sharon, Mansfield, Attleboro, S. Attleboro</p> <p>Timeline: Complete by 2024</p>	<p>Electrification:</p> <p>Substation Expansion: \$20M</p> <p>Attleboro Southbound Siding: \$6M</p> <p>Stoughton (4.1 RM): \$23M</p> <p>Fairmount (8 RM): \$45M</p> <p>Subtotal: \$95M</p> <p>High Platforms:</p> <p>Fairmount: \$40M</p> <p>Providence/Stoughton: \$200M</p> <p>Subtotal: \$240M</p> <p>Total: \$339M</p>	<p>Costs based on recent electrification projects overseas and Amtrak electrification from New Haven to Boston: \$5.6M/mile. Substation costs are based on a British study estimating costs in the tens of millions.</p> <p>RM = Route Miles</p> <p>Platform work is based on a per-station cost of \$20-25M, inclusive of vertical circulation and ADA compliance.</p> <p>Challenges: Constraints at Mansfield will present challenges, because of constraints that limit platform lengths. Still, the return on investment from high level platforms here is high, as Mansfield has the highest rush-hour ridership on the Providence Line and the second highest all day ridership on the line.</p> <p>Electrifying the Pawtucket Yard is necessary to store electric equipment, but that investment is the responsibility of the State of Rhode Island. We conservatively estimate a cost in the range of \$14 million, but this could potentially be lower. Similarly, we do not include the cost of catenary south of Providence Station, but it is possible to reduce costs by moving trains south of Providence Station off the freight track.</p>

Phase 1A (2021-2024)		
Task	Cost	Notes
<p>Procure Electric Multiple Units (EMU) for Providence/Stoughton (PVD) and Fairmount (FRM) line</p> <p>Timeline: Begin procurement as soon as possible, complete by 2024-5</p>	<p>Rolling Stock: PVD: \$170-480M FRM: \$45M</p> <p>Total: \$215-525M</p>	<p>Based on EMU costs throughout Europe, including recent Avenra, Coradia, Talent, Mireo, and FLIRT orders. Differences in dimensions do not appear relevant - the costs are the same in Britain, Scandinavia, and the rest of Europe, all with different loading gauges and floor heights.</p> <p>Would require (8) 8-car trainsets for the Providence Line and (4) 4-car sets for Fairmount.</p> <p>It is crucial to begin the procurement process as soon as possible, because of the time between the beginning of the process and the deployment of the new rolling stock.</p> <p>Challenges: This will be the MBTA's first procurement of EMUs. However, the agency has expressed interest in procuring best-practice European equipment. The high end costs for Providence reflect Caltrain's procurement of Stadler KISS EMUs, which are bilevel cars. However, these are low-platform, and as such not a perfect comparison. The Fairmount Line should run exclusively single-level trains, because of the tight stop spacing and longer dwell time from bilevels; but the gap between stations on the Providence/Stoughton Line is wider.</p>
<p>Boston Terminal Capacity Program Phase 1:</p> <ul style="list-style-type: none"> » Tower 1 Upgrades » Dedicated Platforms » 10-20 Min. Turn Times <p>Timeline: Complete by 2023</p>	<p>Total: \$40M</p>	<p>Allowing a 30-50% increase in peak capacity. Tower 1 Upgrades are already proceeding and at least partially funded by a recent federal grant. Cost figure from FTA document.</p> <p>Challenges: The South Station Expansion project has long been presumed necessary, so there may be opposition to cutting it. However, best practices demonstrate that switch optimization and dedicated platforms achieve capacity increases for lower costs and without the negative impacts of expanding a downtown terminal.</p> <p>Further work beyond Tower 1 will be necessary to increase capacity, detailed in Phase 1B.</p>

Phase 1A (2021-2024)		
Task	Cost	Notes
<p>Eastern Route Modernization Program Phase 1:</p> <ul style="list-style-type: none"> » New South Salem Station » Chelsea Grade Crossing Modernization » Removing Rockport Branch Speed Restrictions » Four quadrant gates at all grade crossings not equipped with such protection » Newburyport Branch and Trunk Line Level Boarding <p>Timeline: Complete by 2024</p>	<p>New Station: \$20M</p> <p>Chelsea Work: \$4-6M</p> <p>Quad Gates: \$10M</p> <p>Level Boarding Work: \$102M</p> <p>Total: \$136-138M</p>	<p>The grade crossings in Chelsea and the slow speed zones on the Rockport Line impose speed and capacity constraints on the entire line.</p> <p>The River Works site east of the GE plant is the site of a mixed-use development. A public-private partnership should be pursued for high-level platforms here.</p> <p>Level boarding on the Newburyport branch, combined with speed improvements in Chelsea, could cut the all-local peak trip time from Newburyport to under an hour, allowing for more trains to serve Lynn and Chelsea.</p> <p>Building the South Salem infill station allows for better staging of trains through the single track bottleneck through Salem. A public-private partnership with Partners Healthcare (which owns nearby North Shore Medical Center) should be pursued to share costs.</p> <p>Challenges: There may be opposition to lifting the speed restrictions, as they were imposed after accidents; however, installing quad gates provides ample protection.</p> <p>Beverly Depot and Swampscott's platforms are somewhat constrained; we include a \$10M premium, but it may be possible to lower costs by offsetting the inbound and outbound platforms.</p>
<p>Worcester Line Improvements Program Phase 1:</p> <p>High Platforms: Back Bay, Grafton, Westborough, Ashland, Worcester (already funded)</p> <p>Track Work:</p> <ul style="list-style-type: none"> » Superelevation » Speed increases to 79-90 MPH » Signaling Work <p>Timeline: Begin as soon as possible, complete by 2024</p>	<p>Level Boarding Work: \$110M</p> <p>Outer Worcester Track Work: \$5M</p> <p>Possible Signaling Work: \$30M</p> <p>Total: \$145M</p>	<p>Reduces peak express time from 1:20 to 1:08-1:10 (with West Station).</p> <p>Superelevation, meaning banking tracks to increase speed, costs are hard to identify, because it is typically done in the context of full track renewal. We estimate a cost in the range of \$5 million.</p> <p>Challenges: Framingham Station may need to be grade separated to facilitate Regional Rail headways and intercity service. Accordingly, platform conversion at Framingham is not included in this phase.</p>

End of Phase 1A.

Phase 1B on following pages.

Figure 3: Phase 1B Project Breakdown

Phase 1B (2024-2026)		
Task	Cost	Notes
<p>Worcester Line Improvements Phase 2:</p> <ul style="list-style-type: none"> » Triple Track » Newton Station High Platforms, 3 stations at \$30 million each (partly already funded), in a difficult trench » New Westborough Center station » Construct West Station <p>Timeline: 2025</p>	<p>Triple Track and Station Work: \$375M</p> <p>Newton High Platforms: \$90M</p> <p>New Stations: \$50M</p> <p>Total: \$580M</p>	<p>West Station will serve an emerging job center and provide relief for commuters during the eight-to-ten year construction along I-90 related to the Allston Multimodal Project, as well as a faster trip downtown for some riders currently using the Green Line or #57 bus. The costs of bus station work are not reflected here.</p> <p>Challenges: The Mass Pike abuts the three stations in Newton, and there are several overpasses serving local roads, imposing significant constraints. MassDOT has projected a cost of \$50M per station. However, we believe that this cost can be cut by \$20M with value engineering (for instance, more conservative measures with respect to overpasses).</p>
<p>Boston Terminal Capacity Program Phase 2:</p> <ul style="list-style-type: none"> » Switch Work Beyond Tower 1 » Seaport Station <p>Timeline: 2025</p>	<p>Turnout Switch Costs (24 switches): \$4M-\$10M</p> <p>(Seaport Station: \$30M)</p> <p>Total: \$4-10M</p>	<p>Changes to throat layout to allow faster running into SS. Costs range from \$125K to \$400K for switches based on French, German, Spanish, and American costs.</p> <p>Double slip switch costs are likely to be higher than turnout switch costs.</p> <p>A station at the end of Track 61 near the Boston Convention and Exhibition Center may facilitate adding additional Old Colony trains. This should be undertaken with private funding, so we do not include it in the final total.</p> <p>Challenges: A reconfiguration project of this sort has not taken place in an American rail terminal. However, recent examples in Europe and a New Hampshire study suggest that costs would be in the low tens of millions. We include an extra \$2M for track work.</p>
<p>Half-Hourly All-Day Service Systemwide</p> <p>Timeline: 2024</p>	<p>Total: \$10M</p>	<p>Excludes electrified lines, which gain 15-minute all-day Service.</p>

Phase 1B (2024-2026)

Task	Cost	Notes
<p>Eastern Route Modernization Phase 2:</p> <ul style="list-style-type: none"> » Electrification to Beverly Junction » Revere (new station) » Salem capacity improvements to improve reliability and enable higher future service » Double track at and around Ipswich » Level boarding expansion at Ipswich, Gloucester, and Montserrat <p>Timeline: 2026</p>	<p>Electrification: To Beverly (18.7 RM): \$103M</p> <p>Rolling Stock: \$90M</p> <p>Ipswich double track: \$30M</p> <p>New Station: \$20M</p> <p>Level Boarding: \$6M</p> <p>Salem Tunnel Expansion: \$198M</p> <p>Total: \$410M</p>	<p>A \$4M additional cost was added for electrifying Castle Hill Yard in Salem, which provides space for storing some trainsets.</p> <p>A few miles of at-grade double track through Ipswich allow for timed meets; the \$30 million budget is in line with that for Franklin.</p> <p>Total assumes full electrification to Beverly Junction.</p> <p>Challenges: The Salem tunnel adds significant costs. If all other items are built, and the tunnel has sufficient clearance, it is possible to schedule trains around this bottleneck while operating high frequency. (For comparison, both of the Newburyport and Rockport branches could be electrified for \$90-160 million.)</p>
<p>Level Boarding Expansion Program:</p> <p>Haverhill: Second Lawrence platform, single 400' platform at Andover, mini-high at Ballardvale</p> <p>Fitchburg: Porter, Waltham Ctr., Concord</p> <p>Franklin: Norwood Central, Dedham Corp. Ctr., Norfolk</p> <p>Lowell: N. Billerica, Wilmington, W. Medford</p> <p>Needham: Roslindale Village, Hersey</p> <p>Timeline: Complete by 2026</p>	<p>Haverhill: \$27M</p> <p>Fitchburg: \$70M</p> <p>Franklin: \$60M</p> <p>Lowell: \$80M</p> <p>Needham: \$20M</p> <p>Total: \$257M</p>	<p>Each station with full level boarding cuts approximately one minute from the rush hour schedule. Stations with 500 or more weekday riders are targeted for full-high platforms.</p> <p>Challenges: Stations will likely require additional vertical circulation.</p>
<p>Bottleneck Elimination Program:</p> <p>Haverhill: Ballardvale Station double tracking, Reading station platform work and possible double tracking</p> <p>Old Colony: JFK/UMass Double Tracking and New Island Platform, Possible Quincy Center Double Tracking</p> <p>Timeline: Complete by 2026</p>	<p>Double Tracking:</p> <p>Old Colony: \$150M</p> <p>Haverhill: \$20-30M</p> <p>Subtotal: \$170-180M</p> <p>Platform Work:</p> <p>Haverhill: \$18-20M</p> <p>Old Colony: \$30M</p> <p>Subtotal: \$48-50M</p> <p>Total: \$118-230M</p>	<p>Eliminating the single track pinch at Ballardvale will improve reliability given freight traffic and possible expanded intercity service to Maine.</p> <p>It may be possible to relocate Reading station to just east of Ash Street, and build a 700' platform, eliminating the need to double track the existing Reading station.</p> <p>Challenges: The Old Colony double tracking projects are likely to be complex. Merging Ashmont and Braintree Red Line trains onto a single platform pair may reduce the cost of widening JFK/UMass.</p>

Appendix II: Frequency and Capacity Increases

Frequency by 2026

Regional Rail Phase 1 will increase train frequency across the system by 2026, with the following bidirectional frequencies of trains per hour (tph):

Newburyport/Rockport: 4 tph to Beverly, 2 to each of the branches

Haverhill: 2 tph

Reading: 2 tph

Lowell: 2 tph, combining with Haverhill for 4 tph to Woburn

Fitchburg: 2 tph

Framingham (local): 2 tph

Worcester (express): 2 tph

Needham: 2 tph

Franklin: 2 tph

Fairmount: 4 tph

Providence: 4 tph

Stoughton: 4 tph

Old Colony: 4 tph to Quincy Center, 2 to Brockton and 1 to each of the Middleborough (continuing from Brockton), Kingston/Plymouth,⁷ and Greenbush branches.⁸

South Coast Rail: 13 round trips per day via the Middleborough Line: 7 to New Bedford, 6 to Fall River

The increases on the non-electrified lines are made possible by electrifying the Phase 1 lines, which frees up equipment for additional service. We caution that reliability will remain an issue on the diesel lines: approximately 40 locomotives had maintenance performed on them in the 2010s, but this is not enough to provide half-hourly service everywhere until other lines are electrified.

⁷ The split between Kingston and Plymouth means that each terminal will be served half the time.

⁸ It may be possible to give each Old Colony branch 2 tph by running the Greenbush Line as a shuttle, short turning at Quincy Adams or reversing to Braintree, as this requires fewer train sets. However, this requires Greenbush riders to transfer and in the former case building new platforms. Once the Old Colony system is electrified, all three branches will be able to have at least 2 tph to South Station all day, as electrification and higher speeds increase demand and mitigate the single track bottleneck in Quincy.

Peak Trains and Capacity Table

The calculations below are based on morning rush hour service, defined as all trains that arrive at North or South Station between 6:30 and 9:30 AM. Calculations assume 4 EMUs operating per hour with a total seated capacity of 4,800 for Providence/Stoughton, Eastern, and Fairmount, nine-car bilevel sets for Framingham/Worcester and the Old Colony lines, and six car sets (with one bilevel car) for all other lines. These figures assume rush hour frequencies of 4 tph for the Providence/Stoughton, Fairmount, Newburyport/Rockport, and Framingham/Worcester lines, and 2 tph for all other lines (see note 1 with regards to Old Colony service).

The capacity increase in terms of seats is low for the Fairmount Line, because the seated capacities of single-level EMUs are slightly lower than the partial bilevel sets that currently run. However, service runs more frequently under Regional Rail Phase 1: every 15 minutes all day as opposed to every 20-30 minutes at peak and hourly off peak now. Moreover, single-level EMUs can be optimized for additional standing capacity, which is more reasonable on a short line such as Fairmount.

Figure 4: Proposed Peak Trains and Capacity

Line	Current trains per rush period (AM)	Proposed trains per rush period (AM)	Rush Period Capacity Increase (by # of seats added)
Eastern Route to Beverly	9 (6 from Newburyport, 2 from Rockport, 1 from Beverly)	10 (+1 more than current)	15%
Haverhill	7 (3 originate in Reading)	Haverhill: 6 (+2) Reading: 6 (+2)	50%
Lowell	7	Lowell: 8 (+1) Woburn: 12 (+6)	To Lowell: 28% To Woburn: 71%
Fitchburg	5	6 (+1)	20%
Framingham/ Worcester	9, 4 originating in Framingham	12, half originating in Framingham	33%
Needham	5	6 (+1)	20%
Franklin	6 (2 originate in Foxborough)	7 (+1)	17%
Fairmount	4	10 (+6)	4%
Providence/ Stoughton	11 (4 from Stoughton)	21 (+10)	12%
Middleboro/ Lakeville	4	6 (+2)	50%
Kingston/ Plymouth	4	6 (+2)	50%
Greenbush	4	6 (+2)	50%

MBTA REGIONAL RAIL

PROPOSED PHASE 1 IMPROVEMENTS



TRANSITMATTERS

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IMPROVEMENTS



INCREASE IN PEAK & OFF-PEAK SERVICE

UNIVERSAL IMPROVEMENT

- 15-minute all-day frequencies on Early Action lines
- 30-minute all-day frequencies everywhere else by 2026
- Increased span of the frequency (frequency is higher all day)
- Frequency will be the same inbound and outbound



ELECTRIFICATION

Adding electric power infrastructure to a line.

→ *Faster service and decrease in CO2 emissions*



UPGRADE TRACK AND SIGNALS

Renewing signalling and infrastructure to a line.

→ *Faster, more frequent, and more reliable service*



REMOVE SPEED RESTRICTIONS/ INCREASE SPEEDS

Eliminate outdated speed restrictions.

→ *Faster, more frequent service*



PASSING TRACK

Adding second tracks to single-track segment.

→ *More frequent, more reliable service*



DOUBLE TRACK SECTIONS

Add segments of double track.

→ *More frequent, more reliable service*



TRIPLE TRACK SECTIONS

Add segments of a third track.

→ *Faster, more frequent, more reliable, more accessible service*



SWITCH UPGRADES

Replacing and upgrading switches.

→ *More frequent service, more reliable service*



NEW HIGH-LEVEL PLATFORM

Building platforms that line up with most or all of a train.

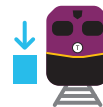
→ *Faster trips (less time at the station)*



2ND PLATFORM

Add platforms on opposite side of single platform stations.

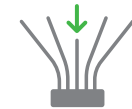
→ *Faster, more frequent, more accessible, more reliable service*



DEDICATED PLATFORMS

Assign specific terminal platforms to all lines or groups of lines. For example, currently Providence/Stoughton, Franklin, Needham, and Amtrak all share platform groups.

→ *Faster and more reliable service*



IMPROVE ACCESS POINTS AND SAFELY INCREASED SPEEDS NEAR TERMINAL STATIONS

Increase speeds from 10 to 30 mph.

→ *Increased system capacity and faster service, more frequent service*



NEW STATIONS

Building new stations along current lines.

→ *Serving Gateway cities, universities and hospitals, access for low income populations*



NEW ELECTRIC TRAINS

Buying electric multiple unit (EMU) trains.

→ *Faster service, more frequent service, more reliable service, decrease in CO2 emissions*

OUTCOMES

★ A more resilient network

By adding more off-peak service that better aligns with healthcare workers and other essential workers, Regional Rail becomes a service that is more resilient in future pandemics or health emergencies. By moving toward zero-emission vehicles with more open layouts, the MBTA better protects these workers by cutting pollution that makes people more vulnerable to disease and giving riders more space for social distancing.

Faster service

Electric trains enable faster service, which means valuable time saved and more trains throughout the day.

More reliable service

Electric trains are up to 25 times more reliable than our current diesel fleet, this means dependable, reliable service and lower maintenance costs.

Decrease CO2 emissions

More frequent service, even on diesel trains draws commuters out of single-occupancy vehicles; new electric trains emit no pollution in the communities they run through.

More accessible service

Moving to high-level platforms enables all with reduced mobility to access the train—whether you use a wheelchair, have a stroller, or just heavy luggage—it makes life easier.

More frequent service

Frequent all-day service means the train works around your schedule, not the other way around; this also means less crowding as riders have more choice on which train to take.

Better connect gateway cities and environmental justice communities

The current system either passes by these communities or provides inadequate service, Regional Rail means more equitable transit that serves all.



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