

Modernizing the Lowell Line

Rapid, Reliable Transit for Lowell, Nashua, and Manchester, NH

Introduction

The Lowell Line is the MBTA's fifth busiest commuter rail line, providing a key transportation link to a large population center and Gateway City. The line also parallels Interstate 93 and Route 3, and has the ability to relieve congestion on those major thoroughfares. This case study focuses on how to enact Regional Rail standards of service, as proposed in our [first Regional Rail report](#). Better service to Boston may also help convince New Hampshire to fund service restoration to Nashua and Manchester, increasing access to the line and the jobs along it.

We wish to acknowledge the following TransitMatters members who contributed to this report:

- » Alex Boccon-Gibod
- » Peter Brassard
- » Abby Cutrumbes
- » David Dimiduk
- » Dhruv Gupta
- » Ethan Finlan
- » Jay Flynn
- » David Houser
- » Alex Ishkin
- » Alon Levy
- » Elizabeth Martin
- » John Takuma Moody
- » Ian Purcell
- » Matt Robare
- » David Sindel
- » Asher Smith
- » Jack Spence
- » Andrew Kapko-Stephens



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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Current Situation

As of 2018, Lowell was the fifth busiest line in Boston and the second busiest feeding North Station, with an average weekday ridership of 10,625 and 5,938 riders on weekends.

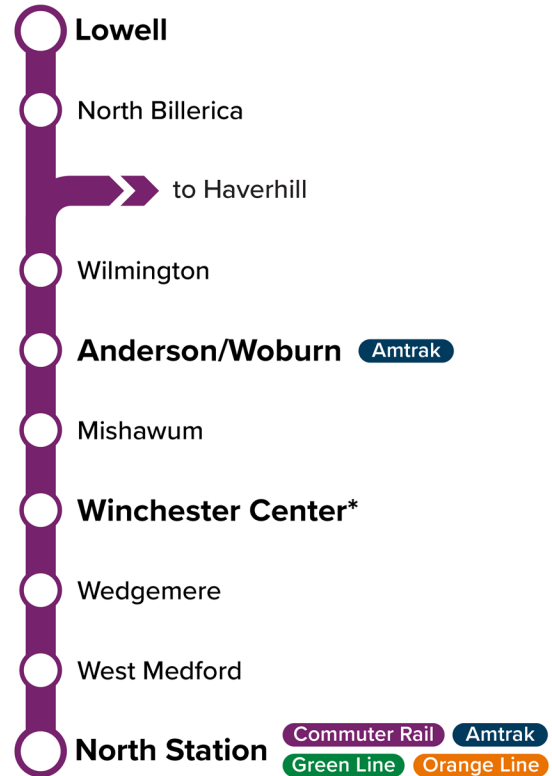
The busiest station is Lowell (1,522 inbound riders), followed by the park-and-ride at Anderson/Woburn (1,196) and the penultimate stop at North Billerica (911). Frequent all-day service would greatly increase ridership both from the suburbs and the inner segments of the line. In particular, the dense, walkable neighborhoods surrounding West Medford and Winchester Center have high ridership potential. Better all-day service and small investments in better land use would also increase ridership at Mishawum, which only has a few dozen daily riders but has 6,900 jobs within half a mile. Only the suburban park-and-ride stations like Anderson/Woburn, would remain as peak-dominated as they are today, serving people who would otherwise drive to Downtown Boston at rush hour.

Line Characteristics

The Lowell Line connects North Station with Lowell in 46 minutes. In comparison, nonstop trains made the trip in 45 minutes when the line first opened in the 1830s. Modern operations using electric multiple units (EMUs), high track standards and level boarding at all stations could reduce the end-to-end trip time to 31 minutes. The schedule will be even faster if the North-South Rail Link (NSRL) tunnel is built, eliminating the slow approach to the stub-ended North Station.

The line between North Station and Lowell is straight, fully double-tracked, and has a wide distance between stations, which allows for high speeds. The line can be extended north to New Hampshire, where it curves along the Merrimack River, but even the sharpest curve only limits speeds to about 70 mph. Overall, an average speed of 55 mph between Boston and Manchester is feasible. Between Boston and Lowell alone, the line would be slightly slower, 49 mph on average, due to terminal speed limits around North Station.

Lowell Line Current

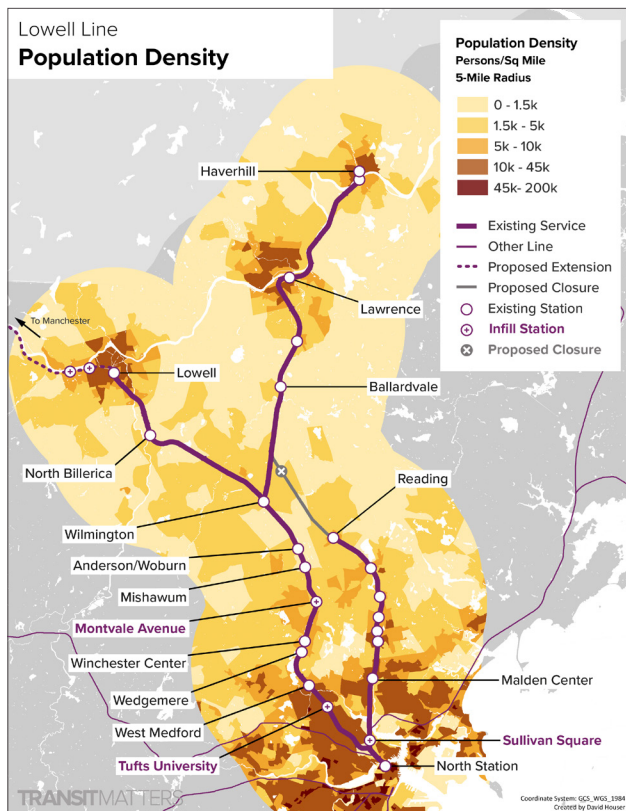
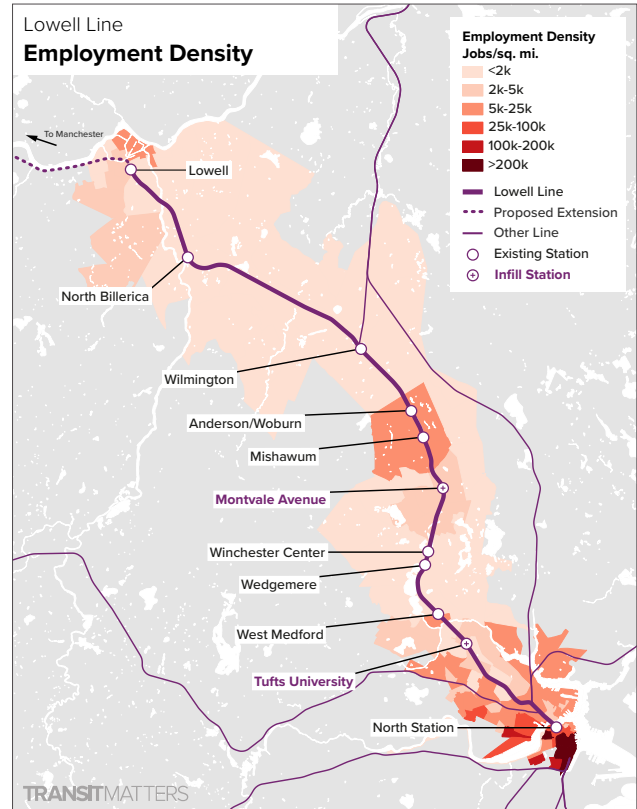
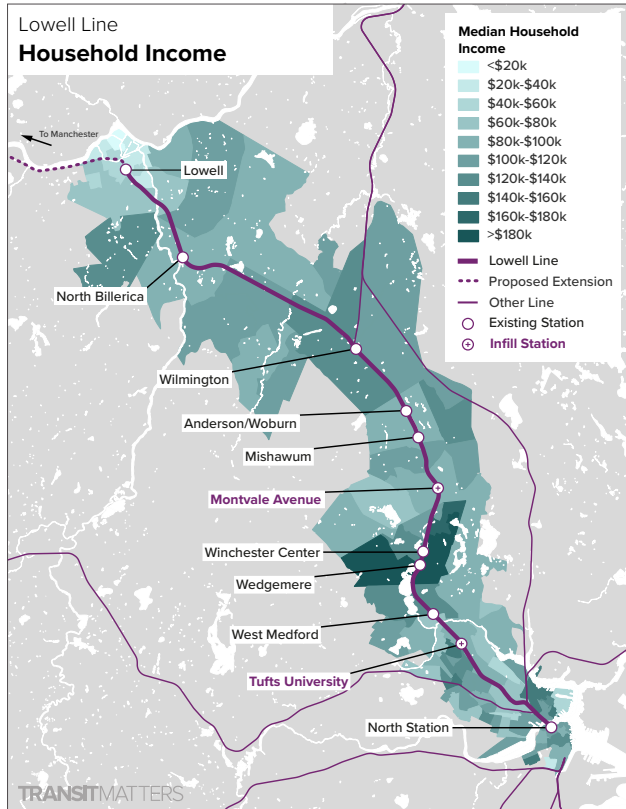


Legend

- Existing Line
- Branch Line
- Existing Station
- Transit Connection

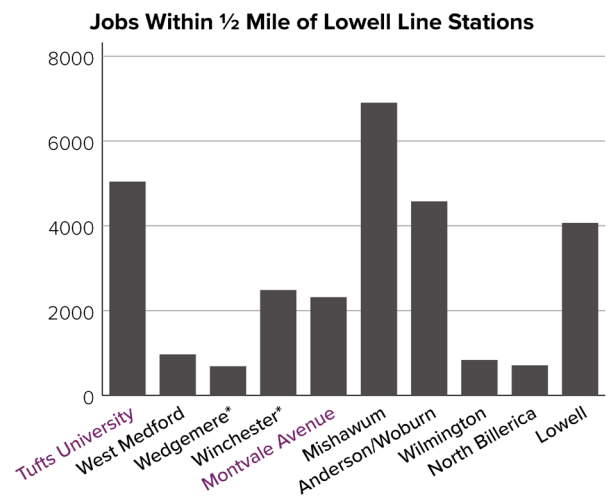
* At time of publishing, Winchester Center station is closed indefinitely awaiting critical repairs.

Demographics



Jobs

Excluding North Station, there are 28,178 jobs near the train stations on the line. Below are the counts of jobs within half a mile by air of each train station on the line, all as of 2018:



* 463 of these jobs are in the overlapping area between Wedgemere and Winchester.

Required Infrastructure Investment

Electrification

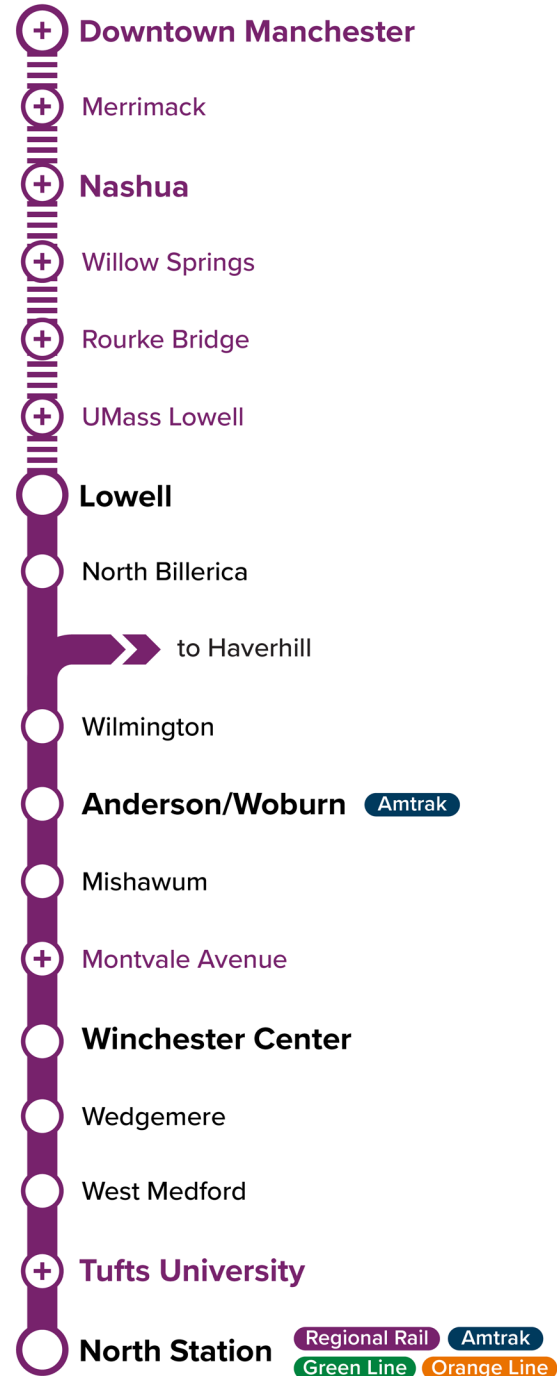
The entire line from North Station to Lowell should be electrified. The cost of doing so, based on recent projects in similar countries, ranges between \$60 million and \$100 million.

Electrification allows for significantly faster end-to-end trip times. The line’s straight trajectory allows EMUs to achieve very high speeds: 80 mph on the line south of Winchester and 100 mph on the section of the line north of Winchester. Additional reasons for electrification include reliability and reduced emissions. EMUs are more reliable than modern diesel locomotives and have better acceleration and braking qualities. Fast, electrified Regional Rail reduces emissions by replacing current diesel train trips and attracting new riders who would otherwise be contributing to congestion and pollution on the I-93 and US-3 corridors.

Project Type	Total
Electrification	\$90M
Platforms and Stations	\$250M
Total	\$340M

Because the extension to New Hampshire involves factors including track restoration and possible right-of-way expansion, we do not include the extension cost here.

Lowell Line Proposed



Legend

- Existing Line
- Proposed Extension
- Branch Line
- Existing Station
- Proposed New Station
- Transit Connection

High-Level Platforms

The MBTA must enable level boarding at all current and future stations. Today, only North Station and Anderson/Woburn have full-high platforms. Lowell, Wilmington, Wedgemere, and North Billerica have mini-high platforms; Wedgemere, Mishawum and West Medford have only low platforms. The ongoing Winchester Center Station accessibility project includes high platforms and additional amenities.

High platform level boarding reduces dwell time by about a minute per station stop at peak travel times. Combined with higher speeds from electrification, level boarding reduces the overall trip time to Lowell by 15 minutes when compared to today's diesel trains. High level platforms are also required for the rail system to be accessible to people of all ages and abilities.



Platform gap fillers, like those shown here, allow for stations to be built with high-level platforms that don't interfere with wide freight cars, while also providing safe access for passengers to embark and disembark the train.

Credit: Hoff1980, [CC BY-SA 3.0](https://creativecommons.org/licenses/by-sa/3.0/), via Wikimedia Commons

Freight Interaction

The Lowell Line was previously the designated freight clearance route to Boston from the north; however, during GLX construction, freight has been shifted to the current Haverhill Line between Reading and North Station. About three to four daily freight roundtrips operate through Lowell, and only one to two of those go down to Boston. However, because freight tends to operate outside of peak hours, the need to adjust scheduling should not be burdensome. Thus, moving freight back to the Lowell Line should not be a problem. One important change is that today's freight trains run at night, but in the future they should run in the evening when passenger service is ramping down and early in the morning before passenger service ramps up, reserving the night for track closure and maintenance.

To prevent conflicts with Regional Rail, speed restrictions and any locomotive availability issues must be addressed to ensure freight trains can run faster than 20 mph, enabling them to fit in slots around the passenger trains around 6:00 am or 11:00 pm. Thankfully, there is some room for overtakes north and south of the Winchester viaduct. This cost should be borne by the freight operator. Platforms may need to be less wide in order to accommodate wide freight; however, EMUs with retractable gap fillers can be procured and are about to become the standard for American passenger service.

Station Access

Mishawum and Anderson/Woburn

Anderson/Woburn and Mishawum serve the Route 128 employment corridor, which is very auto-oriented and lacks mass transit access. Historically, Mishawum was a park-and-ride for Route 128 headed towards Burlington with shuttles providing connections to office parks. In recent decades these parking lots have been converted to commercial real estate. So, while there are 6,900 jobs near Mishawum, they are difficult to access without a car. Current access to Anderson, via I-93 or Commerce Way, is circuitous and congested, so if reverse-peak service were better and there were better pedestrian and bike connections, a critical mass of people would choose not to drive.

This area has become the focus of proposed rezoning and redevelopment efforts led by Woburn. New development at the Woburn Village site will bring 350 new housing units within a quarter mile of the existing Mishawum station. This includes rebuilding the overpass with bike and pedestrian access to Anderson and proposed access improvement involving walk/bike trails along the Mishawum Lake to Anderson. The road overpass to the north of the station helps, but the route to the station is still circuitous, from most jobs and the new transit-oriented development, especially for bicycles and pedestrians.

Because of these difficulties, we recommend adding access to Anderson from the west with improved multimodal access. The change would substantially improve the current mobility hub and ridership. Current (and recent historical) bus and auto access from the south either contributes to the highway bottleneck at I-93/I-95, or travels over the pedestrian-unfriendly Commerce Way and its traffic-overloaded intersection with Mishawum Road. Extending the western end of the current pedestrian bridge past the center platform to an additional entry west of the tracks would result in shorter, faster non-automobile connections. It would facilitate bus access from Burlington, which currently has little service despite destinations such as a major regional medical center, and many industrial and office parks.



Anderson/Woburn station is impossible to access from the residential streets to the west, forcing residents to access the nearby station by driving. Adding a pedestrian crossing would make the station more accessible to the community and increase the areas reachable by rail.

West Medford

A Complete Streets project in Medford includes pedestrian improvements near West Medford station, on High Street at Allston Street and in West Medford Square. There are four buses that connect to West Medford: the 94, 95, 101, and 326. The 94 and 95 have irregular frequencies every 20-30 minutes, the 101 runs every 6 minutes at rush hour but only every 27 off-peak, and the 326 runs infrequently only during rush hour. Better Regional Rail service to West Medford means there must be better bus access: the buses should run to the station at very high frequency.

Lowell

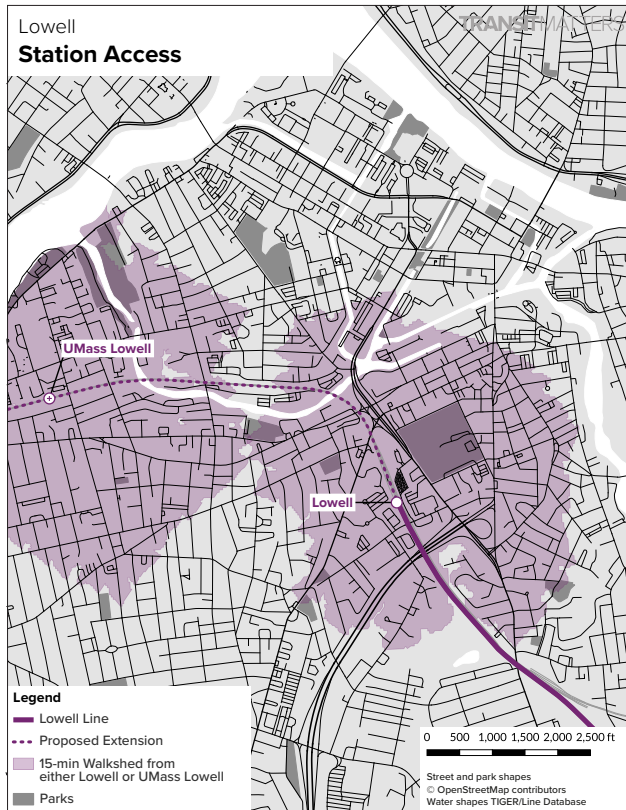
Lowell's station is unfortunately offset from the center of town; only 10% of the city's jobs are located within half a mile of the station. Fortunately, the station has good bus connections, as the hub for the Lowell Regional Transit Authority (LRTA). However, bike and pedestrian access must be improved, and the bus network must be reliable, frequent, and timed with the trains. Near the station, the Lord Overpass project is replacing the current structure, improving both car and bike access. Still, Thorndike Street is very wide with high traffic levels and could be rebuilt to be friendlier to pedestrians and cyclists traveling to Back Central or Downtown Lowell.

A planned mixed-use development, the Hamilton Canal Innovation District, will include 125 new housing units located roughly a half mile away from the commuter rail station. Regional Rail would stimulate demand for further TOD, building on the existing density within the city.

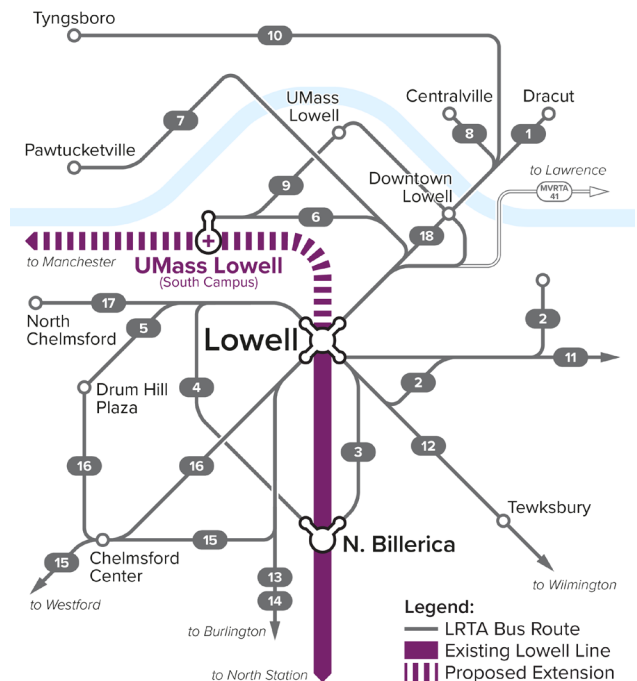


The Hamilton Canal in Lowell borders a number of renovated and new buildings accessible from the Lowell rail station.

Photo Credit: Emw, [CC BY-SA 3.0](https://creativecommons.org/licenses/by-sa/3.0/), via Wikimedia Commons



The existing Lowell station, as well as our proposed UMass Lowell station, both provide access to a great deal of the surrounding area within a 15-minute walk.



For further destinations, almost all LRTA buses connect at the same transit center as Lowell's rail station, providing access to nearby areas and surrounding cities and towns.

Infill Stations

Like the Providence Line, most Lowell Line ridership is end-to-end, and much of the suburban segment is low-density. The densest part of the line, which goes through Somerville, will soon have high-frequency service via the Green Line Extension. However, a new stop here is still worthy of consideration.

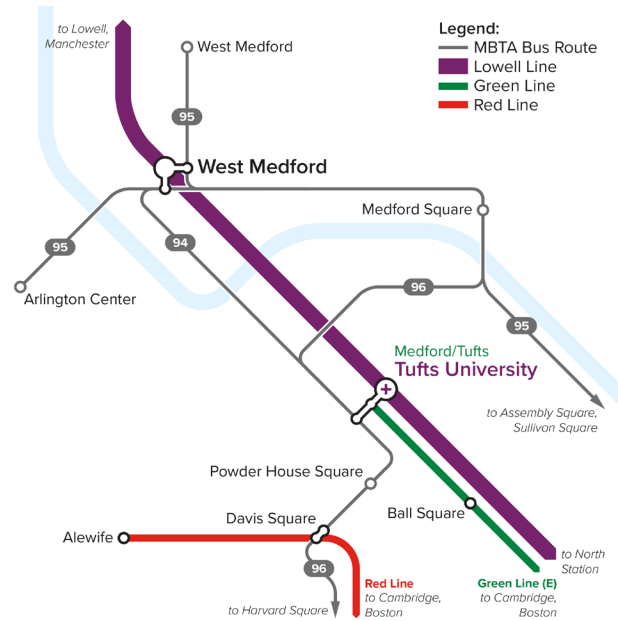
Somerville

The Green Line Extension will serve Tufts in the near future, but student travel and university jobs are significant enough to make a Regional Rail stop worth consideration. There are 5,041 jobs within half a mile, the most of any station on the line besides North Station and Mishawum, even ahead of Lowell. The station requires fare integration to ensure that a Regional Rail trip and a GLX trip will cost the same with free transfers. However, station construction could be complex and may require property acquisition due to the existence of GLX tracks.

Woburn

A stop at Montvale Avenue in Woburn would facilitate bus connections to Stoneham and job centers along I-93, and is in close proximity to the Tri-Community Greenway bike corridor.

We also call for reopening Mishawum, which has been out of service since December 2020; prior to that, only a few daily reverse-peak trains stop here, and thus it has very low ridership. It has the most jobs within half a mile of the existing stations on the line excluding North Station, 6,900, but the station does not interface well with the office parks. It should get regular service, including high platforms, for connections to Route 128 office parks, local retail, and new transit-oriented development in the area. Moreover, there should be some installation of foot and bike paths from the station to nearby offices. The distance between Mishawum and Anderson is short, just over a mile, but this does not significantly impact trip time; electrification substantially reduces the penalty for stopping at short distances.



An infill Regional Rail station at Tufts University would add an important link to the soon-to-be-completed Green Line Extension and the area's bus routes, making it much easier to access the area's jobs.



Despite being an accessible station with two platforms and shelters, Mishawum station is skipped on most trips along the Lowell line. Restoring frequent service would provide access to nearby business and residences.

Credit: Magicpiano, [CC BY-SA 4.0](https://commons.wikimedia.org/wiki/File:Mishawum_station.jpg), via Wikimedia Commons

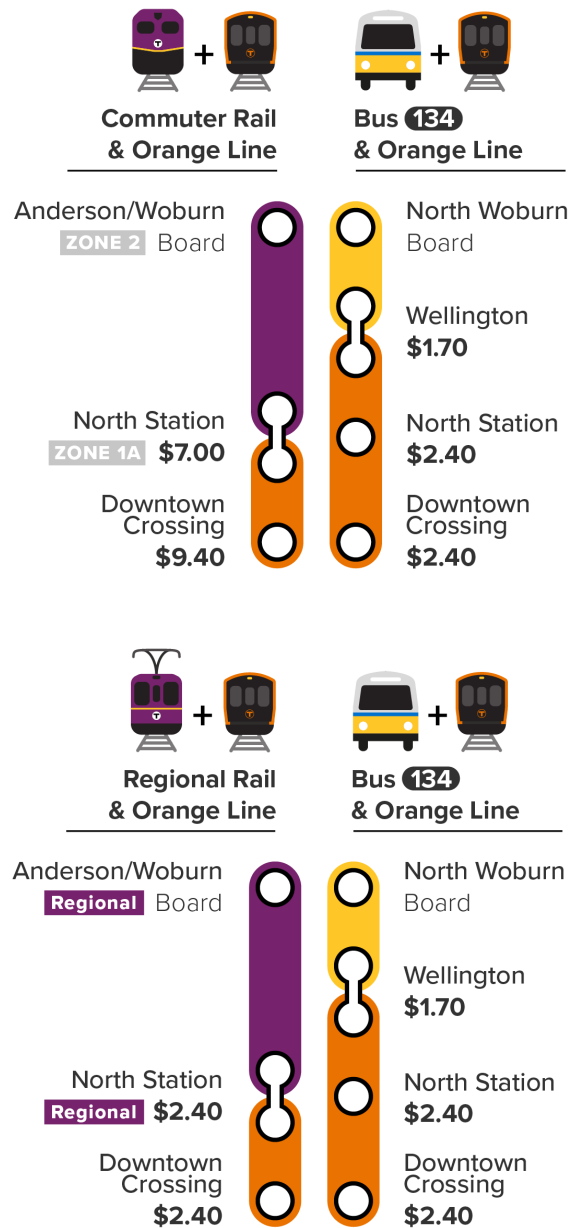
Bus and Light Rail Connections

Maximizing ridership requires trains to work together with buses, rather than running as two separate systems. This means implementing the following reforms:

- » Mode-neutral fare integration: buses, subways and trains should charge the same fare within a specified zone, with free transfers and revenue sharing agreements with RTAs.
- » Orienting bus routes and schedules to feed Regional Rail, made easier by clockface scheduling and the reliability improvements from electrification.

The Lowell Line connects with bus routes operated by the MBTA, the Lowell Regional Transportation Authority (LRTA), and the Merrimack Valley Regional Transportation Authority (MVRTA). Most connecting bus routes function more as feeders or connecting routes than substitutes to rail service, with the exception of MBTA expresses from Burlington, Woburn and West Medford to Haymarket. Since Regional Rail would provide a faster trip downtown, even with transfers, these routes could run more frequently by terminating at Regional Rail stations, perhaps running crosstown to terminate at stations on both the Lowell and Haverhill Line in Medford and Malden.

Bus service to Wilmington and North Billerica is provided by LRTA and operates hourly, a frequency that is not sufficient to provide worthwhile service. Lowell, as an LRTA terminus, sees more frequent service. Service should run at least half-hourly. If buses serve Anderson/Woburn, as at least one route is planned to do under the MBTA's bus network redesign, connections will be feasible here too, albeit untimed.

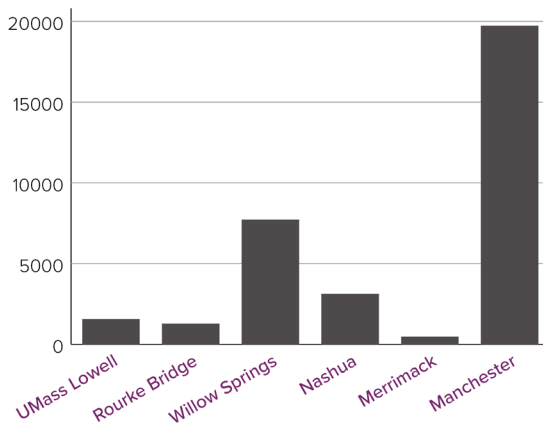


The current fare system charges considerably more to take a trip by rail versus a slower bus and subway transfer. Under the proposed fare system, traveling the same distance costs the same reasonable price, regardless of mode used.

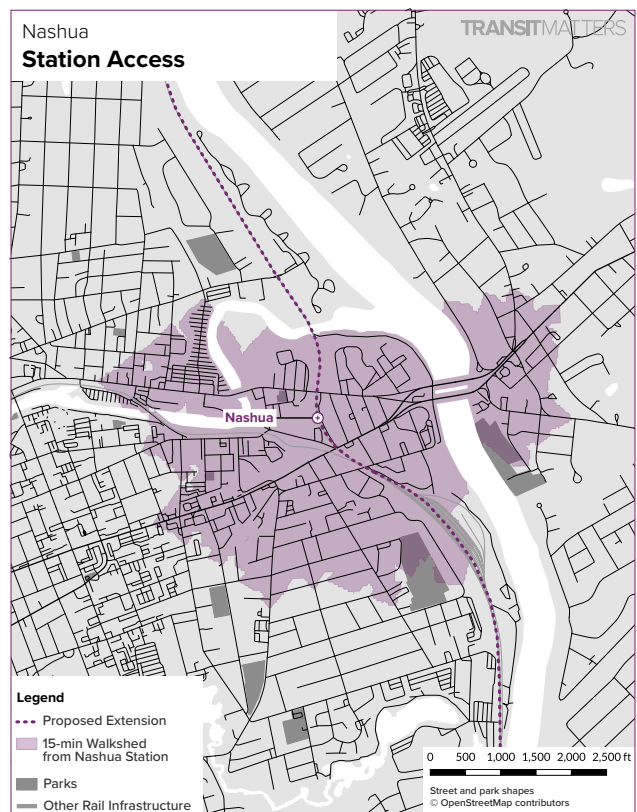
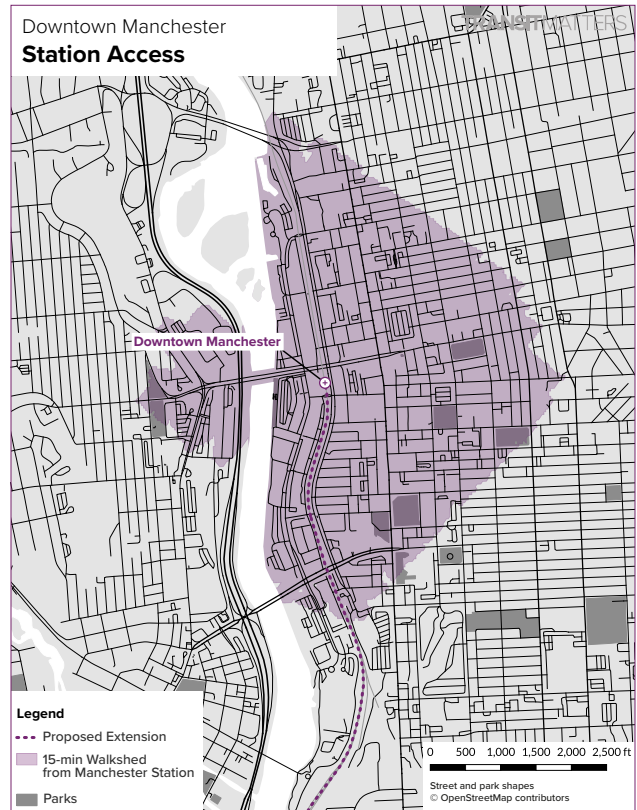
New Hampshire

Restoring passenger service to Nashua and Manchester, one of New England’s largest job centers, has long been a priority for rail advocates and the Manchester Chamber of Commerce¹. Nearly 20,000 people work within half a mile of a potential Manchester station. In fact, there are more people working near the six stations of the proposed extension than are near all of the current and infill stops on the Lowell Line combined, excluding North Station:

Jobs Within ½ Mile of Manchester Extension Stations

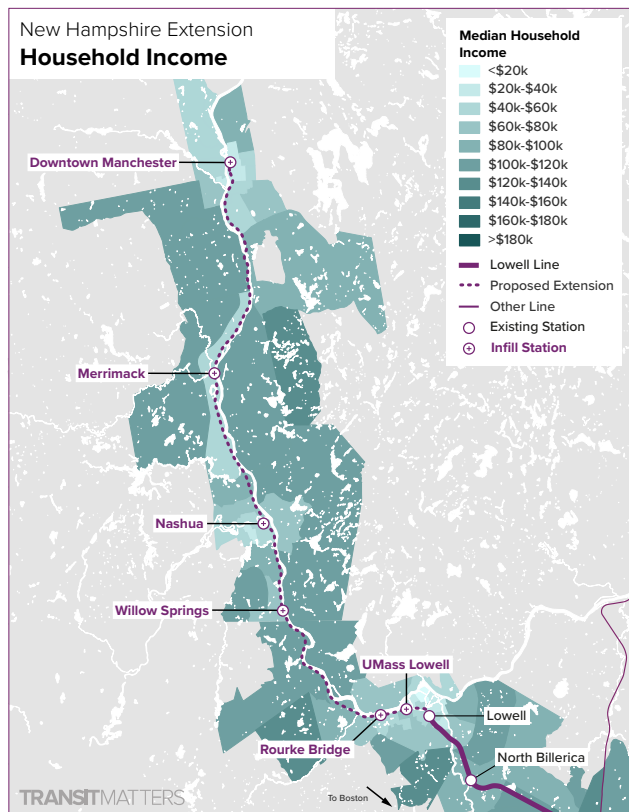
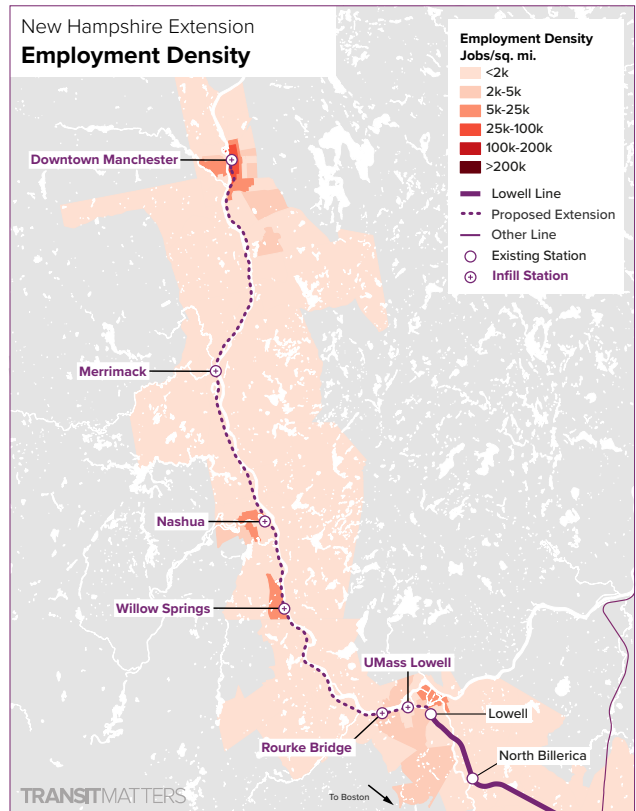
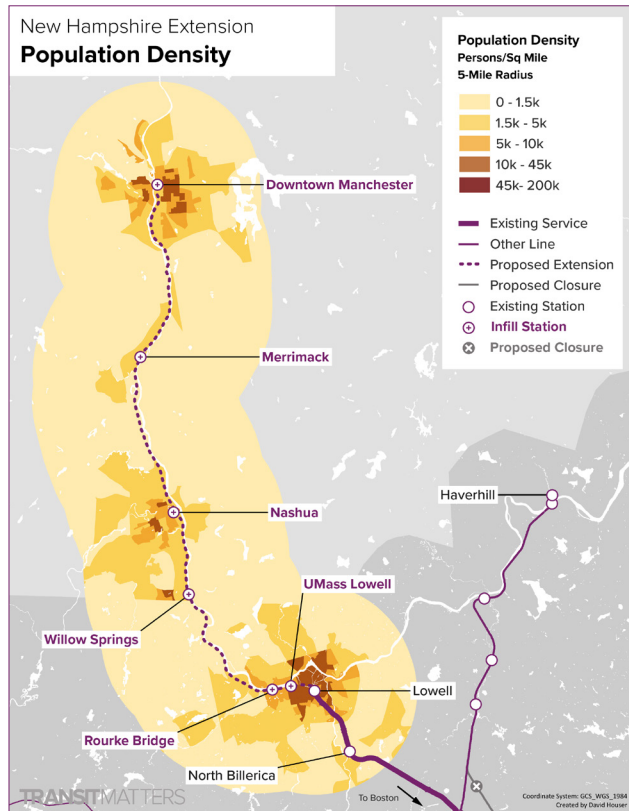


To properly serve the greater than 30,000 people who work near those stations, who are not just peak-hour commuters to Downtown Boston, the new service must be built to Regional Rail standards: full electrification, full high platforms at all stations, and at least half-hourly service all day, every day. Fast-moving EMUs would make the Boston-Manchester trip in just over an hour.



¹ Regularly scheduled service ended in the late 1960s, save for a brief pilot program of commuter rail service to Concord in the 1980s. This pilot yielded disappointing results, but commuting demand and mobility preferences have changed since that time, and this service ran too infrequently to capture a regular and substantial share of commuters.

Demographics of the Proposed New Hampshire Extension



The extension will require substantial track repair and double-tracking. The line is curvier beyond Lowell—nonetheless, modern EMUs can still run quickly under these conditions and make several new stops in Massachusetts and New Hampshire. These include the city centers of Manchester and Nashua, a residential development in Merrimack, the Willow Springs development just north of the MA/NH state line, and two more neighborhood stops in Lowell west of downtown. All capital and operating expenses for service north of the state line would be the responsibility of the State of New Hampshire, under a similar agreement to that which exists between Massachusetts and Rhode Island for the Providence Line.

Aspirational plans call for service to continue to Concord. Commute volumes to Boston and intermediate points are low north of Manchester, so we exclude it from our timetable. However, if New Hampshire is able to attract denser infill development along the line beyond Manchester, the service could be restored in the future.

All trains to Manchester should be continuations of Lowell Line trains, not a separate service. In particular, running diesel trains that skip stops would lead to less reliable and slower service.

Haverhill Line via the Wildcat Branch

Several express Haverhill Line trains currently operate via the Lowell Line using a connecting track known as the Wildcat Branch. Best practice dictates choosing one route into Boston; running multiple alternating routes reduces frequency on the inner end and impacts reliability and confuses riders.

Our [Haverhill Line case study](#) discusses the pros and cons of both options. We recommend moving Haverhill trains from the current route to the Wildcat route, with Reading trains running as their own separate service, because the trip via the Wildcat route is slightly faster to Haverhill. However, this makes the schedules of trains to Lowell and New Hampshire and trains to Haverhill interdependent. This complicates timetable planning, but the schedule dependency is workable.

With very little additional construction, trains could run to both Lowell and Haverhill every 30 minutes. The timetable below leaves enough time for sufficient turnarounds and regular train cleaning, but does not waste money on idling trains through excessively long turnarounds. Doubling frequency on each of the three destinations is viable with some additional double-tracking on the Wildcat Branch and Haverhill Line.

Assuming minimum 30-minute headways on each line, permanently unifying the Lowell and outer Haverhill Lines would guarantee a minimal frequency of 15 minutes between Wilmington and North Station.

Scheduling and Frequency

- » Trains should operate between 5 AM and 1 AM, 7 days a week.
- » Scheduling should adhere to recurring clockface intervals all day.
- » Frequency should be the same for both inbound and outbound trains.
- » The top speed should be 100 mph, except where constrained by track geometry to 80 mph, and at approach restrictions near North Station where maximum speeds must be 30 mph.

With level boarding, electrification, and EMU deployment, the schedule at right and the following frequencies are possible:

Stations	Regional Rail	Current
North Station—Wilmington	15 min	2 hours
North Station—Haverhill	30 min (via Winchester)	2 hours (via Reading)
North Station—Lowell	30 min	2 hours
North Station—Manchester	30 min	—

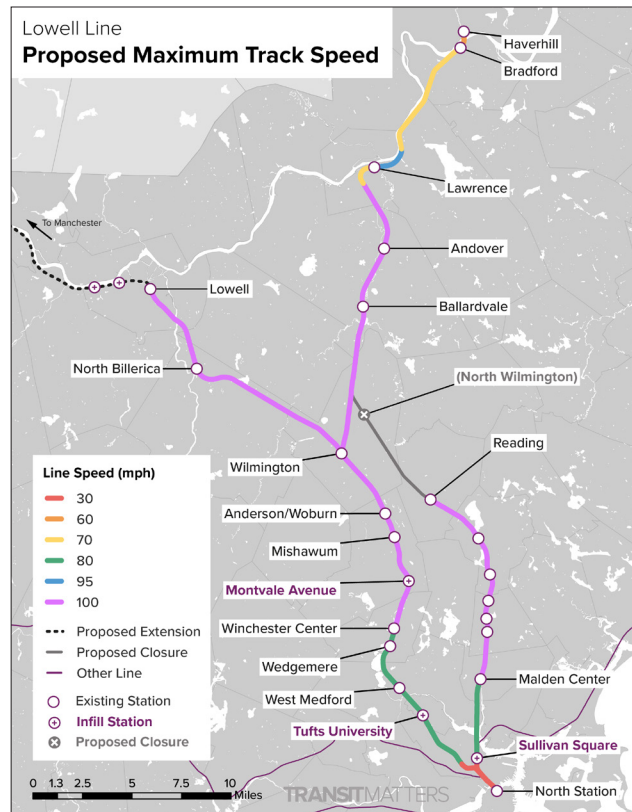
Once NSRL is built, the following increased frequencies become feasible:

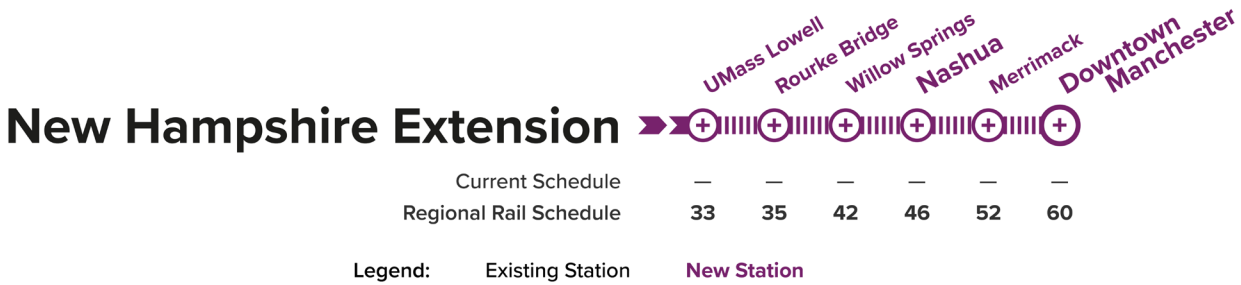
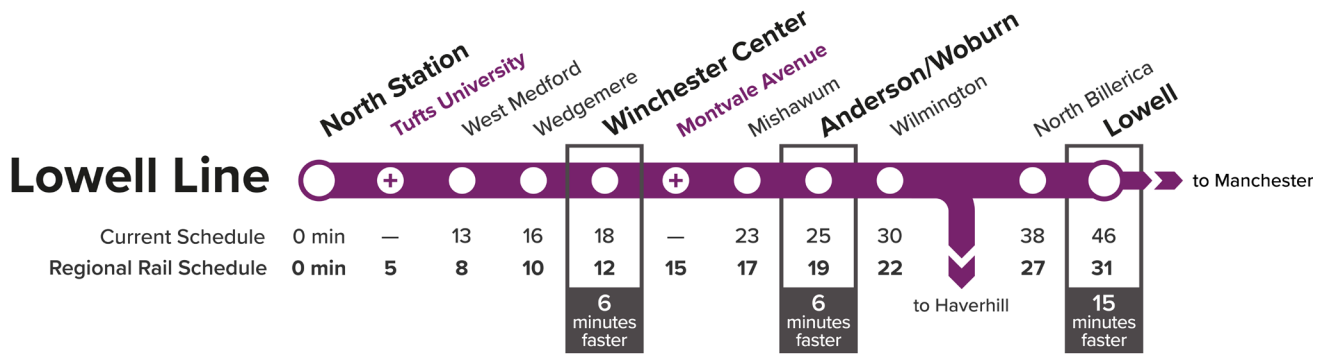
Stations	Peak	Off-Peak
North Station—Wilmington	5 min	10 min
North Station—Haverhill	15 min	30 min
North Station—Manchester	15 min	30 min

Track Speeds

The straightaways on the line support 100 mph, while the curved sections permit 80 mph. Trains would run at 30 mph upon entering and leaving the North Station terminal area. With NSRL, trains would run at 60 mph on the approach to North Station, as the speed constraints imposed by stub ending would be eliminated. This would save approximately one minute from the proposed schedule.

LOWELL LINE		
Station	Proposed	Current
NORTH STATION	0:00	0:00
<i>Tufts University</i>	0:05	—
WEST MEDFORD	0:08	0:13
WEDGEMERE	0:10	0:16
WINCHESTER CENTER	0:12	0:18
<i>Montvale Avenue</i>	0:15	—
MISHAWUM	0:17	0:23
ANDERSON/WOBURN	0:19	0:25
WILMINGTON	0:22	0:30
NORTH BILLERICA	0:27	0:38
LOWELL	0:31	0:46
<i>UMass Lowell</i>	0:33	—
<i>Rourke Bridge</i>	0:35	—
<i>Willow Springs</i>	0:42	—
<i>Nashua</i>	0:46	—
<i>Merrimack</i>	0:52	—
MANCHESTER CENTER	1:00	—





Schedule Offsets and Fleet Requirements

The timetables presented in this report are for the trains that share a trunk line, so they are not independent. Note also that schedules are symmetric: if a train departs Boston 6 minutes after the hour then it should arrive in Boston 6 minutes before the hour. The fleet requirement below assumes all Lowell trains run as far as Manchester.

There are two scenarios: an early investment scenario with just electrification and high platforms but no further expansion and with 30-minute frequency per branch, and a higher-investment scenario that has 15-minute frequency per branch and also service to New Hampshire.

Branch	Depart North Station	Arrive at Line Terminus	Depart Line Terminus	Arrive at North Station	Depart North Station
Lowell	0:06 after the hour	0:37	0:53	1:24	1:36
Haverhill	0:21 after the hour	1:01	1:29	2:09	2:21

Since schedules repeat based on a clockface pattern, these scheduled times can apply to any hour of the day that service runs. For example, a train would leave North Station at 8:06 AM, arrive at Lowell station at 8:37, then depart again at 8:53 and arrive at North Station by 9:24. It would then depart again at 9:36 to continue this pattern in 30-minute intervals.

This service pattern requires 7 trainsets, of which 3 are to be used to go to Lowell and 4 to Haverhill.

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:

- » With a modern electric Regional Rail system in place, **the North-South Rail Link (NSRL)** is the next step to drastically enhance regional mobility. NSRL allows trips between any two stations through a one-seat ride or single, seamless transfer, providing the flexibility and connectivity to which many riders and potential riders would be drawn.

MORE INFORMATION AND REPORTS AVAILABLE AT:

[HTTP://REGIONALRAIL.NET](http://REGIONALRAIL.NET)

<i>REGIONAL RAIL FOR METROPOLITAN BOSTON</i>	WINTER ‘18
<i>REGIONAL RAIL PROOF OF CONCEPT</i>	FALL ‘19
<i>REGIONAL RAIL PHASE 1</i>	SUMMER ‘20
<i>PROVIDENCE/STOUGHTON LINE</i>	SPRING ‘20
<i>FAIRMOUNT LINE</i>	FALL ‘20
<i>NEWBURYPORT/ROCKPORT LINE</i>	WINTER ‘21
<i>OLD COLONY LINES</i>	SPRING ‘21
<i>REGIONAL RAIL ELECTRIFICATION</i>	FALL ‘21
<i>HAVERHILL LINE</i>	FALL ‘21
<i>LOWELL LINE</i>	FALL ‘22

Regional Rail has 5 transformative benefits:



Almost all commuter rail stops have poor accessibility. 32 are entirely inaccessible. High-level platforms provide step free access to all riders, including those with mobility constraints, parents with strollers, and riders with heavy equipment or suitcases.



Regional Rail improvements facilitate economic growth and provide a wider customer base for local businesses. Frequent, reliable rail can increase development near stations. Regional Rail provides a green, economical way to access our rich cultural resources and recreational amenities.



Modern electric trains create zero local emissions, reduce noise pollution, and increase reliability, making rail more attractive relative to car trips. Electrification can thus help reduce respiratory ailments in environmental justice communities, and is critical for meeting the Commonwealth's 2050 zero net emissions goals.



Regional Rail opens up new housing markets, and makes transit-oriented development more attractive. Workers who commute some or all days of the week can use the train for other longer trips, and walk or bike to local destinations. Frequent, reliable, and affordable rail service opens up new employment opportunities, particularly in Gateway Cities, which are well positioned to become employment centers in their own right.



Frequent, reliable, and affordable rail service opens up new employment opportunities. Regional Rail both reduces the “spatial-skills mismatch” that holds back employment, and provides access to vocational opportunities to boost workers’ skills. Regional Rail itself will provide up to 250,000 direct and indirect jobs during construction.



62 SUMMER ST, BOSTON, MA 02110

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