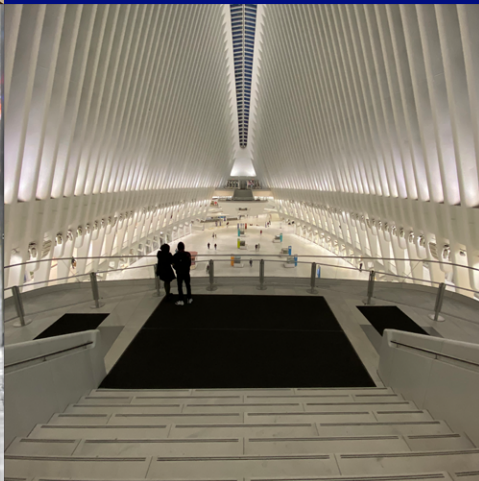
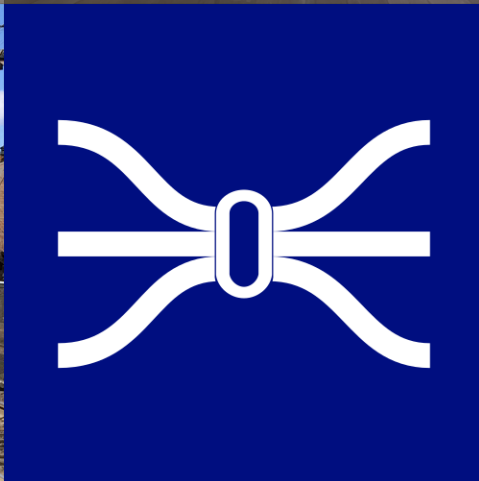




Modernizing New York Commuter Rail

A Report by the Effective Transit Alliance



Northon	7:28	Far Rockaway	J	Speonk	7:43	Huntington
Oakdale	6:41	Huntington	J	St. Albans	7:13	Babylon
Oceanside	7:43	Huntington	J	St. James	5:45	Huntington
Oyster Bay	7:28	Far Rockaway	J	Stewart Manor	6:32	Hempstead
Patchogue	8:23	Far Rockaway	J	Stony Brook	5:45	Huntington
Pinelawn	8:23	Far Rockaway	J			
Plandome	6:50	Port Washington	J			
Port Jefferson	5:45	Huntington	T			
Port Washington	6:50	Port Washington	J			
Q-R-S						
Queens Village	6:00	Ronkonkoma	J			
Riverhead	6:00	Ronkonkoma	J			
Rockville Centre	6:13	Ronkonkoma	J			
Ronkonkoma	6:00	Ronkonkoma	J			
Rosedale	6:29	Ronkonkoma	J			
Roslyn	7:45	Ronkonkoma	J			
Sayville						
Sea Cliff						

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Introduction

Commuter rail in Greater New York has a problem. It was designed to pick up white-collar suburbanites from their bedroom communities, deliver them to their 9-to-5 office jobs in Manhattan, and return them home in the evening. It has changed little since the 1960s, when there were few jobs or other destinations in the suburbs, and rush-hour commutes to Manhattan were more dominant than they are today. But in the generations since, people's travel needs have changed dramatically. Central city neighborhoods are no longer solely bastions of employment, but are vibrant communities full of people, activities, and destinations; suburbs are no longer merely bedroom communities for the affluent, but are increasingly the home of diverse communities, employment centers, and recreational opportunities. The way the region travels has shifted, and now is the time for New York's commuter rail system to modernize to meet the realities of the 21st century.

Modernization is particularly important now, as the region seeks federal funding from the Bipartisan Infrastructure Law (BIL) to undertake the \$50 billion Gateway Program, which aims to increase capacity between New Jersey and New York. Currently, all commuter and intercity rail service between New York and New Jersey must run through the two tracks of the North River Tunnel (NRT). Although travel demand on these tubes is only growing, the NRT cannot handle more trains than it does today. To address the problem, the Metropolitan Transportation Authority (MTA), Amtrak, and New Jersey Transit (NJT) are planning a number of high-profile capital investments under the aegis of Gateway. Most notable is the project's centerpiece, the \$16 billion Hudson Tunnel Project (HTP), which will dig two new tracks under the river, and which has just received full federal funding.

The Gateway Program envisions far more investments than the \$16 billion HTP. Most of this spending, however, would be on infrastructure that further enshrines the current, outdated operating paradigm. Instead, the region and its agencies must move forward with a slate of modernization projects designed to meet the needs of today's riders. This way, it could build a 21st-century commuter rail system for not much more money than what has already been committed to HTP, not only allowing the region to fit its plans to meet currently available funding, but freeing up much needed funds for the New York region's other transit priorities.

The most important feature of modern commuter rail operations is **high all-day frequency**. Transit is ultimately a service-driven industry: potential riders will not orient their lives around unreliable, infrequent trains. Conversely, when transit agencies provide quality service, it attracts riders. It is not acceptable that busy stations like Fordham, Bellerose,

or the stations of Montclair—all within 20–30 minutes of Midtown Manhattan—see only one train per hour off-peak.

To support increasing train frequency, additional investments include **electrification, high platforms, and some junction reconstruction**. These are intended to not only increase capacity, but modernize other aspects of rail service, including speed, reliability, wheelchair accessibility, local air quality, and passenger experience. The total cost of those items fits comfortably within the BIL's bucket of \$30 billion for the Northeast Corridor including tie-in lines and branches.

To fully make use of these investments, however, one final piece is required. This is the practice of **through-running**, the keystone of coordinated modern planning for the 21st century. Through-running involves operating trains across Manhattan and through to the other side of the city, instead of immediately turning them back to the suburb they came from, as is done today. To see the power of through-running in action, one need look no further than the New York City Subway, which extensively utilizes the practice to improve efficiency, lower costs, and offer better service to riders. The A train from Inwood, for example, does not end in Midtown or the Financial District, but continues all the way through the Manhattan core to Brooklyn and Queens. Commuter rail can and should operate in the same vein: for example, NJT trains should continue past Penn Station to serve destinations such as Stamford or Flushing, while LIRR trains should serve Newark and points south. Through-running would not only allow regional trips, but would make much more efficient use of expensive Manhattan infrastructure.

Fully modernizing New York's commuter rail system would accomplish all of the following goals:

- Higher capacity at rush hour, achieved with through-running, relieving certain bottlenecks in the suburbs, and better planning.¹
- Faster and more reliable trips at all times of day, thanks to the benefits of electrification, high platforms, and the aforementioned bottleneck upgrades.
- Enabling trips between neighborhoods and jobs on opposite sides of Manhattan, such as between South Orange in New Jersey and Flushing or between Co-op City in the Bronx and Newark, by offering frequent one- or two-seat rides.
- Increasing frequency and reliability for the growing market of off-peak commutes, including not only reverse-peak trips from the city to suburban job centers like Stamford, but also more traditional commuting occurring at nontraditional hours.
- Supporting non-work trips, such as trips to visit family, the beach, cultural events, ethnic and otherwise specialized retail, sporting events, universities, hospitals, and airports.

1 Yonah Freemark, "For rail services, downtown sometimes isn't the right place for a terminus," *The Transport Politic*, accessed October 24, 2023, <https://www.thetransportpolitic.com/2015/07/06/for-rail-services-downtown-often-isnt-the-right-place-for-a-terminus/>.



The centerpiece of any through-running system is New York’s Penn Station, where tracks from New Jersey meet tracks from Long Island. The station as it exists today permits some through-running—in fact, Amtrak already runs through on its way between Boston and Washington. Metro-North Railroad and NJT also operated through-service for football games at the Meadowlands between the New Haven Line and Secaucus Junction between 2009 and 2016; see [Section 2B](#) for more information. Present-day commuter rail service, however, does not run through.

Through-running would increase Penn Station’s capacity and enable rail travel between opposite sides of the region. New York would gain a new east-west rapid transit line complementing Manhattan’s north-south subway lines. The result would be a line similar to London’s newly-completed Elizabeth Line at a fraction of the cost. The Elizabeth Line has been a clear success: it has propelled the UK’s total rail travel volume *above* its pre-pandemic level.^{2 3 4} In the same fashion, robust through-running service in New York would stimulate significant new ridership.

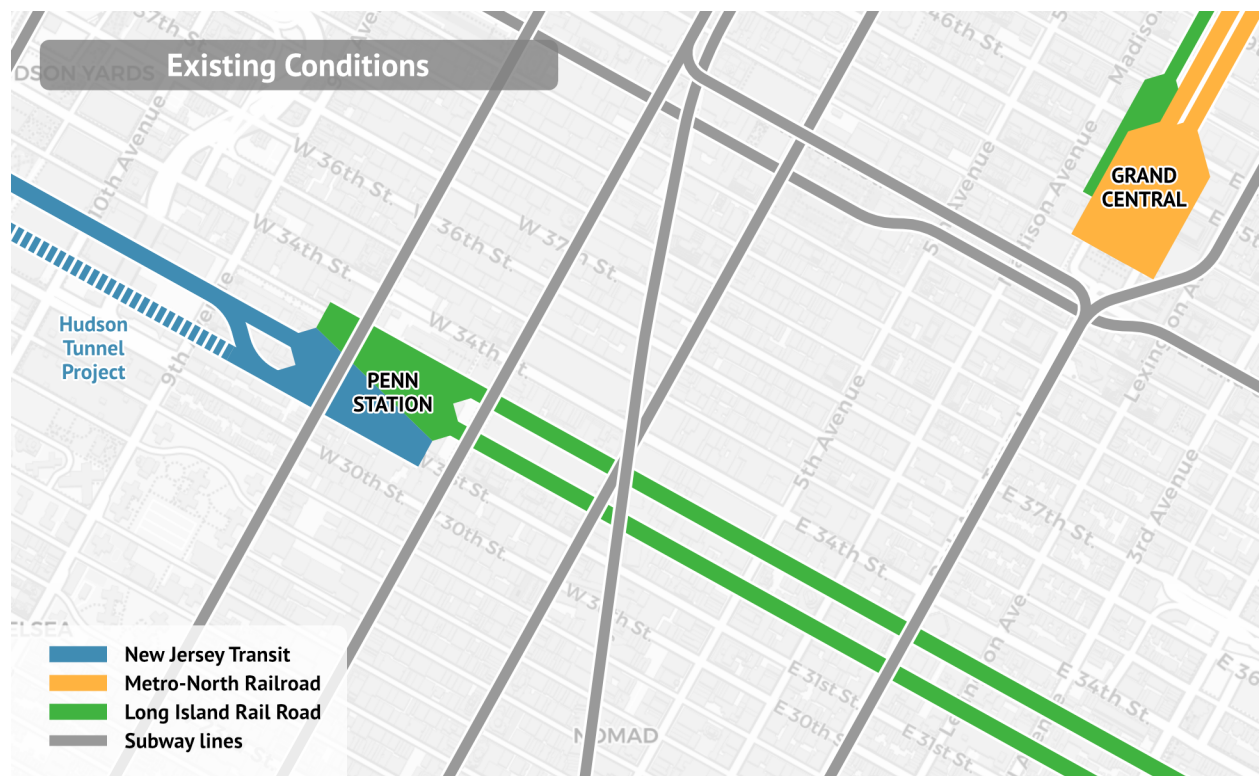
For this reason, most of New York’s international peers, and not just London, have adopted through-running wherever

possible. In fact, many cities have spent billions of dollars on new center city tunnels because of the immense ridership and reliability benefits through-running provides over terminal stations. In this, New York is lucky: Penn Station’s tracks already permit through-running commuter rail service. As a result, New York could start to realize these benefits immediately, with only a modest expenditure needed.⁵

The only real barriers to through-running today are political, not technical. Unfortunately, to date, leaders in Greater New York have largely demonstrated a **lack of political commitment** to coordinating commuter rail service between the region’s operators. As a result, the region’s current, massively expensive proposals for Penn Station fail to incorporate through-running.

Instead, the current plans include both the \$7 billion **Penn Reconstruction** and the \$17 billion **Penn Expansion**. On the one hand, Penn Reconstruction seeks to rebuild Penn Station’s passenger areas above the existing tracks, revamping the station’s passenger experience. While the cost is high and much of the project is focused on passenger experience instead of increasing capacity, many of its elements are both good and genuinely necessary. Penn Expansion, on

- 2 Ian Mansfield, “Elizabeth line passenger numbers beating forecasts,” *Ian Visits*, accessed October 24, 2023, <https://www.ianvisits.co.uk/articles/elizabeth-line-passenger-numbers-beating-forecasts-2-64311/>.
- 3 Transport for London, Elizabeth Line Committee Meeting, May 18, 2023, accessed October 24, 2023, <https://board.tfl.gov.uk/documents/g743/Public%20reports%20pack%20Thursday%2018-May-2023%2014.30%20Elizabeth%20Line%20Committee.pdf?T=10>, p. 19.
- 4 Guy Taylor, “Elizabeth line sees hybrid workers flock back to the office,” *City A.M.*, May 11, 2023, accessed October 24, 2023, <https://www.cityam.com/elizabeth-line-sees-hybrid-workers-flock-back-to-the-office/>.
- 5 Amtrak, New Jersey Transit, and MTA, *Penn Station Master Plan*, MTA Board Briefing, April 21, 2021, accessed October 24, 2023, <https://new.mta.info/document/37416>.



the other hand, represents doubling down on the outdated status quo, focused on peak commuters to the exclusion of all other users. It is billed as a necessary capacity improvement, but as we explain in [Section 5C](#), Penn Expansion is neither necessary nor sufficient for higher throughput at Penn Station.

Between these two projects, Greater New York is on the verge of a momentous decision, on the same level as the decisions to massively expand the subway system with the Dual Contracts in the 1910s and 1920s,⁶ or to construct Robert Moses' parkways and expressways. With the amount of money planned to be spent, it is crucial to do the right thing at Penn Station. **Penn Expansion should be canceled** and replaced with something that will actually meet the region's travel needs: a modern, through-running commuter rail plan.

Many leaders and groups around the region have recognized the usefulness of through-running. Most recently, former New York City Transit head and current Amtrak vice-president for high-speed rail Andy Byford spoke in favor of through-running and against Penn Expansion.⁷ Previous MTA leaders such as Joe Lhota and Elliot Sander have spoken in favor of through-service⁸—indeed, Sander said, “the barriers to regional rail are less geographic and more institutional, labor and political.”⁹

In addition to those more official supporters, there have been advocacy groups supporting modernization of commuter rail, often including through-running. ReThinkNYC has its own proposal, centered on a trunk line from Secaucus to Sunnyside;¹⁰ Byford's comment in favor of through-running was at a ReThink-sponsored event. The Tri-State Transportation Campaign has a similar proposal.¹¹ The Regional Plan Association supports Penn Expansion, but its Fourth Regional Plan proposes a multi-line through-running network.¹² TransitCenter has a proposal to increase frequency and reduce fares on commuter rail within the city, to make the system more usable by city residents.¹³ The MTA Permanent Citizens Advisory Committee (PCAC) has proposed fare integration between the LIRR and Metro-North.¹⁴ We situate this

report within the umbrella of those proposals; if there are two takeaways from this analysis, they are that the region must as soon as practically possible raise and regularize off-peak commuter rail frequency, and that in the medium term it must both adopt through-running and plan capital improvements around this new service.

Greater New York is at an inflection point. Billions of dollars are being spent to upgrade the region's commuter rail. In one direction, this money could be spent on locking in an outdated status quo, one which doesn't meet the needs of the 21st century. In another lie projects that could tie this region of more than 20 million people together as never before. A modern commuter rail system is potentially at hand. Other cities have already demonstrated the way forward. Now it is New York's turn to join them, and build a truly effective transit network for both today and tomorrow.

If you want to help achieve this vision of frequent rail service connecting across Manhattan, you can contact your local elected officials, and the Governors of New York, New Jersey, and Connecticut, and take actions like the following:

- Write or call your elected officials in support of through-running options for New York's commuter rail system.
- Speak at [MTA](#), [Port Authority](#), and [New Jersey Transit](#) board meetings.
- Write op-eds and letters to the editor about the advantages of through-running.
- Testify at state legislative hearings.
- Comment during the Penn Expansion environmental review process in favor of serious consideration of through-running.
- Volunteer with organizations that are working to support aspects of commuter rail modernization, including the Effective Transit Alliance (ETA) and others in the region.

6 For a compendium of references, see “The Dual Contracts,” *NYCSubway.org*, 2012: https://www.nycsubway.org/wiki/The_Dual_Contracts.

7 “Train Daddy speaks: Andy Byford explains why Penn Station needs through-running out the other side instead of a dead-end new terminal,” *New York Daily News*, July 28, 2023, <https://www.nydailynews.com/2023/07/28/train-daddy-speaks-andy-byford-explains-why-penn-station-needs-through-running-out-the-other-side-instead-of-a-dead-end-new-terminal/>.

8 Jim O'Grady, “NY MTA Chief Says Railroads Need To Work Together To Overcome Maxed-Out Hudson River Crossings,” *WNYC*, June 14, 2012, <https://www.wnyc.org/story/284308-ny-mta-chief-says-railroads-need-to-work-together-to-overcome-maxed-out-hudson-river-crossings/>.

9 Guest column, “Meadowlands trains-to-game show potential of regional rail,” *New Jersey Star Ledger*, September 13, 2009, https://www.nj.com/njv_guest_blog/2009/09/meadowlands_trainstogame_show.html.

10 ReThinkNYC, Home Page, accessed October 25, 2023, <https://www.rethinknyc.org/>.

11 Liam Blank, “From Here to There: Regional Rail for Metro New York.” Tri-State Transportation Campaign, New York: 2022. <https://tstc.org/wp-content/uploads/2022/06/Regional-Rail-for-Metro-New-York.pdf>.

12 Regional Plan Association, “Combine three commuter rail systems into one network,” *Fourth Regional Plan*, accessed October 25, 2023, <http://fourthplan.org/action/combined-commuter-network>.

13 Steven Higashide, Kapish Singla, Anson Stewart, and Matthew Wigginton Bhagat-Conway, “Renewing the New York Railroads: How Affordable, Frequent Metro-North and LIRR Service Can Grow Ridership and Expand Opportunity.” TransitCenter, New York: 2022. https://transitcenter.org/wp-content/uploads/2022/12/Renewing-the-Railroads_RGB_Online-1.pdf.

14 Permanent Citizens Advisory Committee to the MTA, “Integrate, Simplify, and OMNYvate: On Track for Better MTA Fare Payment,” by Ryan Leighton and Kara Gurl. New York: 2022, <https://pcac.org/app/uploads/2023/10/Integrate-Simplify-and-OMNYvate-Full-Report.pdf>.



Our Vision

Modernizing commuter rail

The current operating assumption of American commuter rail is that *nearly all* users are city center commuters, and all other trips are done by car. It is a series of disparate shuttles from various suburban regions to city centers, running almost exclusively at rush hour.^{15 16} This paradigm does not meet the challenges we face today as a region. Between 1960 and 2019, the total volume of travelers entering the Manhattan core rose from 3.35 to 3.86 million per working day, but the volume of travelers entering at the peak hour, between 8 and 9 am, actually fell from 848,000 to 619,500; the proportion of travelers entering between 8 and 9 fell from 25% to 16%.^{17 18}

In contrast, our future vision is that commuters working in Manhattan are *the largest group* of users but *not the only one*. The following groups of potential riders are each smaller than the group of commuters to Manhattan, but together they are sizable:

- Commuters whose trip takes them across Manhattan, such as those commuting between New Jersey and Long Island, Westchester, or Connecticut.
- Urban riders, whose alternative today is a slow bus and subway trip, or even not taking the trip at all if it is too onerous.
- Non-work travelers, whose trip may be for school, medical care, leisure, socialization, or shopping.

To reflect the 21st-century reality of travel and serve all of these groups adequately, including the existing rider base of suburban commuters, commuter rail must be heavily reformed. Reforms must tackle both operations and capital projects.

Off-peak service and frequency

The most important thing to do to improve public transit is to ensure it runs at adequate frequency. Commuter rail is no exception: passengers ought to be able to use the trains without having to orient their entire lives around an unpredictable, infrequent schedule. Frequency is so non-negotiable that, as explained below in [Section 3A](#), Philadelphia's commuter rail reforms have had mixed results because they did not include sufficient off-peak frequency.

Unfortunately, traditional American transit planning holds that the sole job of service frequency is to provide capacity. If the trains are not full—or if there is a perception that they are not full enough—then frequency is cut. But in reality, passengers ride less when frequencies drop, just as they do when trips get longer or when it takes longer to get to the station (for example, because of road work, or if the nearest station were closed).

The impact of frequency is especially high when the interval between trains approaches the in-vehicle trip time, and remains high even though commuter rail is scheduled and in principle passengers can adapt their schedule to that of the train.^{19 20 21 22} To that effect, the maximum wait at a station should be no more than half the expected trip time. This is an extension of the campaign led by Riders Alliance for Six-Minute Service²³ calling for boosting midday and weekend frequency to this level. ETA added that operating costs would barely grow, and planning would be made easier, improving system reliability.²⁴

An urban station thus needs a train every five to 10 minutes all day in each direction, every day, at worst. An inner suburban station like Elizabeth, Lynbrook, Great Neck, or Mount Vernon West needs a train to come every 10–15 minutes all day. More suburban stations can afford lower frequencies, but they still need a train every 20 minutes at worst. Distant stations, located at least an hour away from Manhattan, could get away with a train every half hour. Hourly trains are only acceptable hours away from Manhattan, and less than hourly trains are not acceptable anywhere in the region.

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- 15 Donald Eisele. Application of Zone Theory to a Suburban Rail Transit Network. *Traffic Quarterly* vol. 22 (1), pp. 49–67 (January, 1968). <https://babel.hathitrust.org/cgi/pt?id=pst.000060089311&seq=77>.
- 16 Donald Eisele. Zone Theory of Suburban Rail Transit Operations: Revisited. *Traffic Quarterly* vol. 32 (1), pp. 5–22 (January, 1978). <https://babel.hathitrust.org/cgi/pt?id=mdp.39015021808756&seq=15>.
- 17 Regional Plan Association, *Hub Bound Travel*. December 1961: https://s3.us-east-1.amazonaws.com/rpa-org/pdfs/1961_RPABulletin99.pdf, p. 6.
- 18 New York Metropolitan Transportation Council, *Hub Bound Travel Data*. January 2021: https://www.nymtc.org/Portals/0/Pdf/Hub%20Bound/2019%20Hub%20Bound/DM_TDS_Hub_Bound_Travel_2019.pdf, pp. 14 and I-4.
- 19 Armando Lago, Patrick Mayworm, and Matthew McEnroe, "Ridership Response to Changes in Transit Services," *Transportation Research Board*, 818 (1981), pp. 13–19, <https://onlinepubs.trb.org/Onlinepubs/trr/1981/818/818-003.pdf>.
- 20 Todd Litman, "Transit Price Elasticities and Cross-Elasticities," *Journal of Public Transportation*, 7 (2) (April 2004), pp. 37–58, <https://www.sciencedirect.com/science/article/pii/S1077291X22003861>.
- 21 Joe Totten and David Levinson, "Cross-Elasticities in Frequencies and Ridership for Urban Local Routes," *Journal of Public Transportation*, 19 (3) (July 2016), pp. 117–125, <https://digitalcommons.usf.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1487&context=jpt>.
- 22 Vukan R. Vuchic, *Urban transit: operations, planning and economics* (New York: Wiley, 2005).
- 23 "#6MinuteService Campaign," *Riders Alliance*, accessed October 24, 2023, <https://www.ridersalliance.org/six-minute-service>.
- 24 ETA, "A Step in the Right Direction: The Keys to a Six Minute Service Paradigm," *Effective Transit Alliance* New York, June 1, 2023, <https://www.eta.org/statements/keys-to-a-six-minute-service-paradigm>.



Current service at Lynbrook station deserves special attention. The station gets two trains per hour to Manhattan, one to Grand Central and one to Penn Station. However, under current schedules, transferring at Jamaica for a train to the other destination can add up to 15 minutes of travel time. Moreover, the two eastbound trains per hour have a 50-minute gap between them. Thus, passengers who have to go to Penn Station and cannot use Grand Central—and vice versa—effectively face hourly waits.

Preventing this type of situation requires timed connections. The LIRR used to have such connections at Jamaica, where passengers could transfer cross-platform between Penn Station- and Brooklyn-bound trains. The trains were timetabled so that there would be no extra wait time, and they were held momentarily in the station to ensure that riders could make their connection in case of small delays. More timed connections should be introduced network-wide even where they have not traditionally existed. For example, in [Section 3B](#), we call for a potential infill station in Sunnyside for transfers between Penn Station Access and LIRR trains. To make the timed transfers easier to manage, railroads should rationalize their schedules, and introduce *clockface schedules*. The clockface schedule is an all-day repeating

timetable, which originated in Germany and has guided rail timetable planning there since the 1970s. With a clockface schedule, on a branch with half-hourly service, trains leave at exactly the same time relative to the hour, say an inbound train departing at :05 and :35 every hour, making the exact same stops without time-of-day variation. If additional rush hour service is needed, it respects the clockface schedule, and departs at the midpoints between baseline service, so at :20 and :50.

In contrast, today, each train is timetabled separately, with a different stopping pattern. For example, the 16 trains from the New Haven Line (excluding branches) that enter Grand Central in the peak hour have 13 different stopping patterns. Such planning leads to fragile schedules in which delays are unavoidable; it is not possible for the planning department to make sure every pair of trains is conflict-free. With clockface schedules, however, it is done thousands of times per day in German-speaking countries.

Station	Time to Penn/GCT	Headway (current, midday)	Headway (proposed)
Kew Gardens	0:17	30 minutes	5 minutes
Flushing	0:21	30 minutes	10 minutes
Fordham	0:22 ²⁵	20-30 minutes ²⁶	5 minutes
Co-op City ²⁷	0:25	30 minutes	10 minutes
Elizabeth	0:32	20-30 minutes ²⁸	10 minutes
Lynbrook	0:33	30-50 minutes (see above)	10 minutes
Mount Vernon West	0:34	Hourly	10 minutes
Bellerose	0:35	Hourly	10 minutes
Great Neck	0:37	30 minutes	10 minutes
Wantagh	0:51	30-40 minutes ²⁹	20 minutes
Dobbs Ferry	0:53	Hourly	20 minutes
Perth Amboy	0:59	Hourly	20 minutes
Morristown	1:05	Hourly	30 minutes

Table 1: Current and proposed headways between commuter rail stations and their Manhattan terminals

25 This trip time includes about six minutes spent just in the last mile into Grand Central.
 26 There are three trains per hour, but they arrive unevenly, the longest gap standing at 30 minutes.
 27 Both the trip time and headway are imputed from Penn Station Access plans.
 28 There are three trains per hour, but they arrive unevenly, as at Fordham.
 29 There are two off-peak trains an hour, but they arrive unevenly, with the wider gap standing at 38 minutes.



Systemwide fare integration

High frequency works well with better intermodal integration, covering schedules, routes, and fares. Planning for commuter trains must be integrated with planning for the subway and buses, creating a seamless system in which passengers are encouraged to take whichever mode works best for their trip.

Right now, LIRR and Metro-North trains charge a premium over the subway within the city,³⁰ and all three commuter rail systems require passengers who transfer to the subway or a bus to pay an additional fare. This creates absurd situations in which during the morning rush hour, LIRR trains are full westbound and empty eastbound while lower-fare buses carrying city residents to suburban jobs are full eastbound and empty westbound.

Instead, fares must be mode-neutral: longer trips should cost more than short ones, but all trips within a zone must cost the same regardless of which mode of public transit is used and regardless of how many times the rider transfers. Bus service should be designed to feed the trains rather than to compete with it.

With fare integration and high all-day frequency, it is natural to plan bus service to complement the trains. The timetables for both buses and rail should be written in coordination to ensure short transfers in both directions. Today, no such coordination takes place, even when both buses and trains are under the same roof as at the MTA and NJT; instead, commuter rail is planned under the assumption that all riders drive to the station, and buses sometimes run parallel with the train, competing with it.

General capital projects

Rail modernization requires not just good operations but also some basic capital standards, including level boarding, simplifying rail infrastructure/removing operational bottlenecks, and wider electrification. These are present on most but not all of the New York system.

Level boarding, with high platforms, permits passengers to step onto the train easily, and also permits wheelchair users to board unaided. The LIRR and Metro-North have high platforms at nearly every station,³¹ and thus all trains have level boarding, facilitating rapid boarding and alighting and providing wheelchair accessibility. Only about half of NJT stations have high platforms.

In addition, the train service should use self-propelled electric cars, called *electric multiple units* (EMUs). The large advantages EMUs confer over any other type of train have motivated railways around the world to electrify. EMUs unlock operating cost, train performance, reliability, air quality, and climate benefits. The Boston-based advocacy group TransitMatters wrote a report on this subject in Boston's context.³² New York's busier system has an even stronger case for completing overhead wire or third rail electrification on all lines.

In general, it is valuable to integrate capital planning with operations. Level boarding and all-EMU service are general improvements, but most capital projects are more specific, fixing specific bottleneck tracks or junctions. Moreover, clockface schedules help plan capital projects efficiently. For example, if trains run on a half-hourly clockface schedule, then trains in opposite directions meet every 15 minutes at the same places, and thus it is possible to build sidings at only those locations, saving money on full double-tracking.

30 There has been some progress with CityTicket, discounting commuter rail tickets within the city to \$7 peak, \$5 off-peak. However, CityTicket is not at all planned based on principles of fare integration. There are no free transfers to the subway, and the fare is still twice the typical per-ride subway fare with a monthly ticket.

31 This excludes some trail stops on Metro-North, and some stops on branch lines in Connecticut, where work is already planned to raise them.

32 TransitMatters, "Regional Rail Electrification: Costs, Challenges, Benefits," fall 2021, accessed October 24, 2023, <http://transitmatters.org/s/Regional-Rail-Electrification-Final.pdf>.

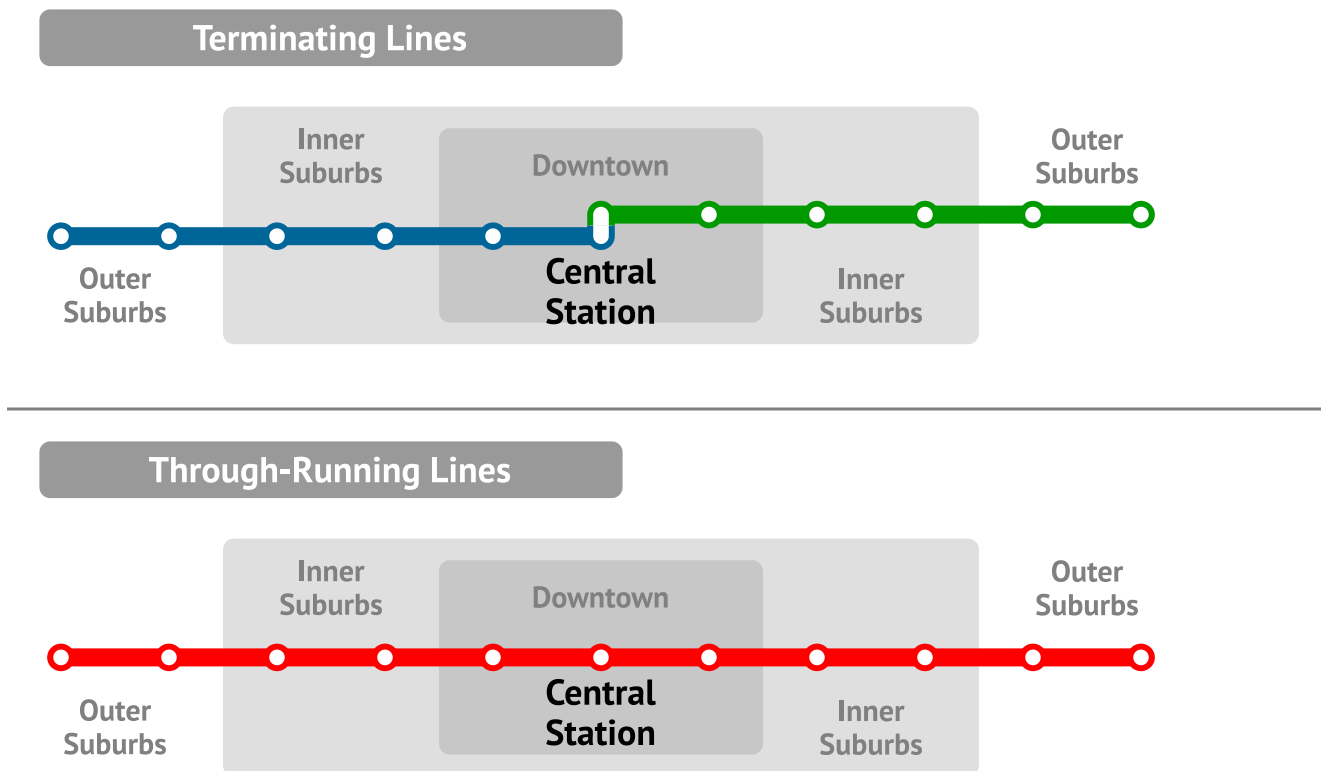


Through-running

The final key element in rail modernization is integrating currently disparate services on each side of the central business district into a cohesive whole, via through-running: trains in through-service continue to carry passengers beyond a city's main station, rather than ending there. This makes a far greater number of trips throughout the region doable by transit, and also has operational benefits as we describe below in [Section 2C](#).

The trains might run on lines owned by the same transit agency or different ones. Even when operated by multiple agencies, through-running service typically features integrated ticketing and scheduling, providing seamless travel. Suburban rail systems use through-running in many cities around the world, including Tokyo, Osaka, London, Paris, Berlin, Madrid, Milan, and Philadelphia.^{33 34 35 36 37} Plans are in place to implement the practice in Los Angeles³⁸ and Toronto.³⁹

Presently, using commuter rail service to cross Manhattan requires travel on multiple operators. NJT, the LIRR, and Metro-North offer no trains that pass through Manhattan to the other side of the region. Connecting between them involves inconvenient and uncoordinated transfers at Penn Station, or, worse, a transfer between Penn Station and Grand Central involving a two-seat subway ride. For example, a student living in University Heights in the Bronx and attending college in New Brunswick must currently transfer three times in Manhattan and purchase three separate fares, or instead ride slower subway trains and still purchase two separate fares.



- 33 Makoto Ito, "Through Service between Railway Operators in Greater Tokyo," *JRTR*, 63 (2014), pp. 14–21, https://www.ejrcf.or.jp/jrtr/jrtr63/pdf/14-21_web.pdf.
- 34 Louis Sato and Phillippe Essig, "How Tokyo's Subways Inspired the Paris RER," *JRTR* 23 (2000): 36-41, https://www.ejrcf.or.jp/jrtr/jrtr23/pdf/F36_Sato.pdf.
- 35 Freemark, "For rail services, downtown sometimes isn't the right place for a terminus."
- 36 Pedantic of Purley, "What's it all about, Thameslink?," *London Reconnections*, February 20, 2013, <https://www.londonreconnections.com/2013/whats-it-all-about-thameslink/>.
- 37 Roger Rudick, "Will Philadelphia Ever Get its S-Bahn?" *Streetsblog USA*, February 25, 2021, <https://usa.streetsblog.org/2021/02/25/will-philadelphia-ever-get-its-s-bahn/>.
- 38 Joe Linton, "Metro to Approve Early Phase of Union Station Run-Through Tracks Construction," *Streetsblog Los Angeles*, May 24, 2022, <https://la.streetsblog.org/2022/05/24/metro-to-approve-early-phase-of-union-station-run-through-tracks-construction/>.
- 39 "GO Expansion," *Metrolinx*, accessed October 26, 2023, <https://www.metrolinx.com/en/projects-and-programs/go-expansion>.



How would riders benefit from commuter rail modernization?

The frequency, capacity, and versatility provided by commuter rail modernization would benefit everyone, including riders and transit agencies.

Higher all-day frequency, better urban service, and through-running would benefit many groups of riders. The present system, focused as it is on peak commuters from the suburbs to Manhattan, leaves the needs of all other groups unmet. Moreover, as we explain below, even peak suburban commuters who work in Manhattan and have little need to travel cross-regionally would benefit from modernization, piggybacking on what would be a much more frequent and reliable system. Much of this has been studied before in past reports, but nothing has been implemented yet, unfortunately.^{40 41}

Existing suburban commute trips

While much of the benefit of higher frequency and through-running would accrue to people whose trips commuter rail does not currently serve well, existing riders would greatly benefit too. Some of the medium-cost, high-impact infrastructure investments outlined in [Section 3B](#)—electrification and high platforms—would lead to large increases in speed, and even benefit passengers on already electrified lines because of the improvements in reliability.

The biggest improvement is higher frequency outside rush hour, which today is treated as an afterthought. The 9-to-5 commute is no longer as predominant as in the past. Tech, law, finance, and academic workers all tend to both start and end work later than the 9-to-5 tradition. Corporate jobs have somewhat irregular hours: when a project is near a deadline, workers are expected to stay in the office for as long as necessary, whereas they can often leave for home well before the afternoon rush hour at lighter times. If usable train service home is not there at 9 pm, or at 3 pm, many workers will either drive to their job or live elsewhere.

Indeed, in both Nassau and Suffolk Counties, 32% of all workers leave home for work at 8:30 am or later, too late to get to a Manhattan job by 9, but less than 19% of transit

commuters do so. This is not an inherent artifact of mass transit commutes but a result of today's narrowly conceived commuter rail service. Within New York City, where transit runs much more frequently off-peak, 38% of all workers leave home at 8:30 am or later, as do 37% of those commuting by transit.⁴²

Short-run fixes should start by simplifying complex service patterns whereunder many trains currently make a few suburban stops and then run nonstop to Manhattan. While the resulting schedule would have express trains, they would make more stops, for example all stopping at express stations like Hicksville, Jamaica, and Stamford. This change would not compromise speed: the current schedules are so fragile that, to keep the trains on time, the LIRR and Metro-North add a large contingency factor, or pad, to the technical minimum run time, reaching about 30% on the LIRR Main Line and New Haven Line.⁴³ While most lines in the region are not this extreme, these complex intermeshed service patterns cause delays that add time and inconvenience to trips.

Instead, trains running simplified schedules with more stops would be able to run nearly as fast as the minimum technically feasible trip time between each station, avoiding any slowdowns. Swiss railroads have been able to reduce this pad factor to as low as 7%.⁴⁴ This does add up; trip times can, counterintuitively, improve if express trains make standard stopping patterns, similar to the express trains on the subway, rather than having once-a-day nonstop trains from as far as Ronkonkoma to Manhattan. Simple service patterns would provide significant relief to Long Island, allowing all trains from each branch to run either to Grand Central Madison or Penn Station with very frequent timed connections at Jamaica and Woodside.

A final short-term fix is to integrate bus and rail schedules, so that buses can feed the trains better, with timed connections. In New Jersey, it is common for suburban commuters to ride a bus all the way into Manhattan, even if it runs parallel to a faster rail line. For example, the 113 bus runs parallel to the Raritan Valley Line and parts of the Northeast Corridor Line, serving all the communities at a substantially lower speed than the train. Elizabeth is 32 minutes from Penn Station by train yet is 47 minutes from the Port Authority Bus Terminal by bus. Buses duplicating trains to Manhattan should be redeployed to feed train stations instead.

40 The Penn Station Capacity and Utilization Analysis Phase C (1992) states that, "while the use of Penn Station as a terminal station is rational for the vast bulk of the ridership market, the lack of local through service may be inhibiting regional mobility and the increased utilization of public transportation." It continues, saying that while it is "unclear how much demand currently exists for the type of interstate travel," "the total absence of a convenient, well promoted and reliable public transportation network linking the two may seriously inhibit the basic formation of such a market," and that it is "not unreasonable to assume that the mere existence of such a service, coupled with an aggressive public information campaign, could very well induce at least a modest level of demand." <https://drive.google.com/file/d/1BQvb22wRSMtQEDOGYolvyR00yLEsFHc6/view?usp=sharing> (pp. 68–69)

41 MTA Twenty-Year Needs Assessment 2010-29, August 2009. <http://web.mta.info/mta/pdf/CP/NeedsAssessment.pdf>, p. 88.

42 All data in this paragraph comes from the Means of Transportation to Work by Selected Characteristics data tables in the American Community Survey, as of 2019.

43 See LIRR calculations in Alon Levy, "LIRR Scheduling," *Pedestrian Observations*, September 30, 2015, accessed October 24, 2023, <https://pedestrianobservations.com/2015/09/30/lirr-scheduling/>.

44 George Raymond, "Developing the schedule," *Railweb.ch*, 2001, accessed October 24, 2023, <https://www.railweb.ch/funnel/sched/develop.htm>.



Longer term, further construction could ameliorate the compromised post-East Side Access (ESA) service on the LIRR. Since ESA's opening, some trains on each branch go to Grand Central and others to Penn Station, both at reduced frequency from before. Moreover, before ESA, Jamaica had timed transfers between Manhattan- and Brooklyn-bound trains, but current service mostly eliminated those, and almost all trains running through Jamaica go to Manhattan.

In the medium run, as we explain in [Section 3B](#), the region should build a transfer station at Sunnyside Yard, which we call Queens Junction, to enable cross-platform transfers between all Grand Central- and Penn Station-bound LIRR and Metro-North trains including those on the Port Washington Branch. The transfer can even be configured to allow easy wrong-direction transfers for so-called diagonal trips, between Long Island or Queens and Connecticut or the Bronx.

Urban trips

Commuter rail can be used for not just suburban trips but also trips entirely within New York City (and, with the extensive construction we outline in [Section 6C](#), Hudson County). Today, premium fares and poor service discourage almost anyone but a reduced number of suburbanites from riding, literally passing by huge potential pools of travelers. The volume of Manhattan-bound commuters in Queens dwarfs that of commuters on Long Island: 384,000 vs. 191,000. Similarly, the volume of Manhattan-bound commuters in the Bronx is 225,000, whereas in all east-of-Hudson Metro-North counties combined the volume is 149,000.⁴⁵

Bronx and Queens residents have some of the longest commute times in the United States.⁴⁶ Moreover, these long commutes skew working-class, breaking the usual American pattern of suburban supercommuters having above-average incomes.⁴⁷ Today, those in-city commuters use the subway, which travels at an average speed of 18.3 mph,⁴⁸ too slow for neighborhoods at the city's edges. Worse, the express buses serving these areas average only 16 mph.⁴⁹ They also

have high operating costs per rider, which the premium fares do not come close to covering, and carry few passengers in total.⁵⁰

Useful urban commuter rail would shorten those commutes considerably. Access from Co-op City to the rest of New York City is set to improve greatly when Penn Station Access opens later this decade. To deliver the most benefits, trains must run frequently all day and charge the same fares as the subway, with free transfers, since Co-op City residents would still need to take a bus to the train station. Likewise, those operating improvements would benefit other outer neighborhoods like Bayside, Wakefield, Queens Village, Marble Hill, and Rosedale.

These could also be paired with bus redesigns feeding not just the subway but also the commuter rail. The example we give above of NJT bus route 113, under existing suburban commute trips, has many analogs in New York such as duplicative buses on Long Island and within the urban core such as Newark, and Eastern Queens.⁵¹ All the saved time would be plugged into higher bus frequency, creating an integrated show-up-and-go system with high reliability and, thanks to the connections to fast commuter trains, high average speed.

Non-commute trips

Most trips that people take are not for the purpose of work. The U.S. Census, which only asks about work trips, does not capture this travel, but other travel studies do.^{52 53} American public transit is generally weak at serving such trips. In Metro New York, on the eve of the pandemic, 31.6% of commutes were by public transit, nearly all on a train rather than a bus, and residents took about 90 annual rail trips per capita. By contrast, residents of European metropolitan areas with similar commute modal splits, like the Berlin area, take considerably more rail trips because frequent, integrated service encourages non-work trips all day. For example, the combined metro region of Berlin and Brandenburg has a

45 All commute volumes come from LEHD data and are as of 2019: <https://onthemap.ces.census.gov/>.

46 Per the 2011-15 American Community Survey, Queens averaged 42.6 minutes one-way and the Bronx 43 minutes; the worst county in the United States, Pike, Pennsylvania, was 44. See Overflow Data, "What is the average commute time in each U.S. county?," *Tableau Public*, accessed October 24, 2023, https://public.tableau.com/app/profile/overflowds/viz/WhatistheaveragecommutetimeineachU_S_county/WhatistheaveragecommutetimeineachU_S_county.

47 Transit commuters in Nassau and Suffolk Counties outearn solo drivers by 50%, and in Westchester they do by 25%. In contrast, within the Bronx and Queens, transit commuters are poorer than solo drivers by 35% and 18% respectively. See Census Bureau, "Means of Transportation to Work by Selected Characteristics," ACS 2019 one-year estimates.

48 Federal Transit Administration, *National Transit Database: Top 50 Profiles Report*, <https://www.transit.dot.gov/sites/fta.dot.gov/files/2020-11/2019%20Top%2050%20Profiles%20Report.pdf>

49 Ibid.

50 Ibid.; see analysis in Alon Levy, <https://mastodon.social/deck/@Alon/110864887479884652>.

51 See map by Christof Spieler: <https://twitter.com/christofspieler/status/1026118951762382850>.

52 For example, in Germany, this is the Mobilität in Deutschland framework. The 2017 short report is available in English at BMVI, *Mobility in Germany: Short Report*, September 2019, https://www.mobilitaet-in-deutschland.de/archive/pdf/MiD2017_ShortReport.pdf, p. 19.

53 In New York, only 20% of trips are for work or work-related purposes. See RSG, 2019 Citywide Mobility Survey Results, <https://www.nyc.gov/html/dot/downloads/pdf/nycdot-citywide-mobility-survey-report-2019.pdf>, p. 30.



work trip modal split of 31%,⁵⁴ yet its populace takes 200 yearly rail trips/capita.^{55 56}

In contrast, the paradigm of New York-area commuter rail from the 1950s and 1960s discourages such trips. The current fare structure, dating to 1964, was implemented with the express purpose of discouraging such trips, called short trips (that is, trips short of Manhattan), in order to focus on the core market of commutes to Manhattan.^{57 58} In that era, railroads were retrenching and rationalizing operations in order to reduce operating costs and stay profitable despite competition with the car, and the planners treated short trips as a distraction from the core market. This paradigm must be reversed in order to fit commuter rail service to the 21st-century reality of how people travel. New Yorkers could take many types of non-work trips on the train, some short, some longer, if the off-peak frequency were more accommodating:

- **Trips to specialized neighborhood centers**, often for ethnic amenities, like the Apollo Theater in Harlem, the Chinese supermarkets of Flushing, and the Indian supermarkets of Woodbridge and Edison. Commute data does not pick up these trips. However, other data does, where it exists. The Washington Metro publishes origin-destination data, which reveals special ties between Black communities in Anacostia and Columbia Heights.⁵⁹ New York has no such data, but the song “Take The A Train” is part of New York City culture.
- **Leisure trips to amenities that are not available on every side of New York City.** For example, since there are beaches on Long Island and along the Jersey Shore, but none in Metro-North territory, riders from Metro-North territory would benefit from direct trains to the Jersey Shore. Conversely, New Jersey, New York City, and Long

Island have several large sports stadiums, while Connecticut has almost none. For that reason, between 2009 and 2016, Metro-North and NJT collaborated on a through-train from the New Haven Line to Secaucus with connections to the Meadowlands, called the Train to the Game, which was intended to show that through-running was possible^{60 61} and demonstrate the trip possibilities that a truly regional rail network would offer.^{62 63 64 65} This service could be restored and expanded: with future through-running, passengers from New Jersey could also get direct trains to Citi Field and Yankee Stadium.

- **Trips between different university campuses**, for social or academic reasons. Currently, academics at campuses like Princeton, Yale, Stony Brook, Rutgers, Hofstra, and Adelphi have access to the universities of New York, but not so much to one another. New York’s internal connections on the subway have elevated its research profile.^{66 67} Paris’s through-running commuter rail has facilitated extensive ties across the entire region’s universities and research institutes; this has enabled it to become the world’s primary research center for mathematics.
- **Social trips**, such as meeting friends who live in a different part of the region. Within the city, users of dating apps sometimes specify what subway line they live on, just because transfers between different lines are onerous; at regional scale, a distance of 20 miles on the current commuter rail network might as well be long-distance.
- **Trips to and from airports**, between New Jersey and JFK or between east-of-Hudson suburbs and Newark.
- **Hospital trips**, by patients reaching appointments or staff traveling to conferences and seminars. Many

54 BMVI, *Mobilität in Deutschland: Regionalbericht, Hauptstadtregion Berlin-Brandenburg*, June 2020, https://mil.brandenburg.de/sixcms/media.php/9/20200703_MiD2017_infas_BerlinBrandenburg_Regionalbericht_MiD5431_20200629_final.pdf, p. 76. The 31% modal split is imputed from Berlin having about 60% of the combined total of both states; numbers are as of 2017.

55 Marienfelde, “BVG-Zahlenspiegel 2019,” *BahnInfo-Forum*, accessed October 24, 2023, <https://www.bahninfo-forum.de/read.php?9,629337> gives 583 million subway and 204 million tram trips.

56 Center Nahverkehr Berlin, *Zahlen und Fakten zum ÖPNV*, accessed October 24, 2023, <https://www.cnb-online.de/hintergruende/zahlen-und-fakten-zum-oePNV/> gives 485 million commuter rail trips in 2019.

57 Shaul Picker, https://twitter.com/Union_Tpke/status/1412199485762150400.

58 Uday Schultz, <https://twitter.com/A320Lga/status/1412273380066312199>.

59 The data can be downloaded from “Metrorail Ridership Data Download, October 2015,” *Plan It Metro*, accessed October 24, 2023, <https://planitmetro.com/2016/03/14/metrorail-ridership-data-download-october-2015/>.

60 Federal Transit Administration and New Jersey Transit, *Access to the Region’s Core in Hudson County, New Jersey and New York County, New York: Environmental Impact Statement*. New York: 2008, https://books.google.com/books?id=bEM3AQAAMAAJ&pg=RA11-SA18-PA33&dq=of+operating+through+-+MN-R+trains&hl=en&newbks=1&newbks_redir=0&sa=X&ved=2ahUKEwiswl2pyMb5AhVtGVkFHxkYCKkQ6AF6BAgHEAI#v=onepage&q&f=false, p. 18-33.

61 Ken Valenti, “Train to the game: Metro-North draws Giants, Jets fans,” *The Journal News*, September 10, 2014, <https://www.lohud.com/story/news/transit/2014/09/10/metro-north-service-reaches-meadowlands-games-rye-larchmont/15412379/>.

62 Judy Rife, “The draw of Secaucus: The junction is more than a hub for commuters, officials remind,” *Times Herald-Record*, October 21, 2007, <https://www.recordonline.com/story/business/2007/10/22/the-draw-secaucus-junction-is/52418827007/>.

63 Judy Rife, “Metro-North Orange County trains don’t match up well with Giants games,” *Times Herald-Record*, August 7, 2009, <https://www.recordonline.com/story/business/2009/08/07/metro-north-orange-county-trains/51906235007/>.

64 Andrew Grossman, “Rough Ride: Unsarling the Penn Choke Point,” *Wall Street Journal*, January 4, 2011, <https://www.wsj.com/articles/SB10001424052748704278404576037631824416772#U401697556436zk>.

65 Shaul Picker, https://twitter.com/Union_Tpke/status/1558861653462159361.

66 National Science Foundation, “NSF Award: Joint Columbia-CUNY-NYU Research Training Group in Number Theory,” 2008, https://www.nsf.gov/award-search/showAward?AWD_ID=0739380.

67 The Renaissance, Columbia-NYU university seminar, accessed October 24, 2023, <https://universityseminars.columbia.edu/seminars/the-renaissance/>.



commuter rail stations lie near medical campuses such as Robert Wood Johnson University Hospital in New Brunswick, NYU Langone Hospital in Mineola, Monmouth Medical Center in Long Branch, and Yale New Haven Hospital in New Haven. Lake Success's office and medical complex could also be accessed with better bus-LIRR connections.

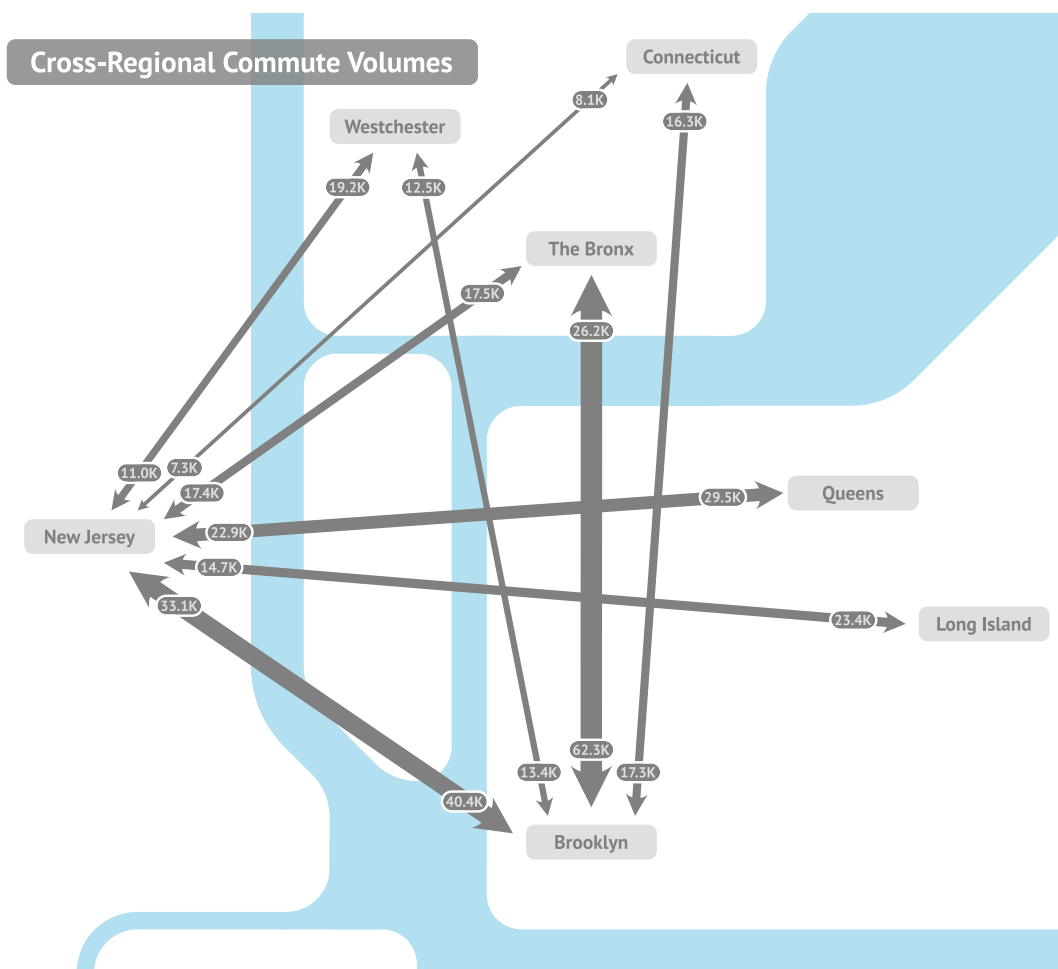
- **Trips to shopping centers** in places such as Bridgewater, Stamford, Port Chester, White Plains, Hicksville, and Valley Stream.

Cross-regional work trips

The quality of cross-regional transportation service in the region is poor: the commuter trains do not run through, and driving through Manhattan is infamously painful. Nonetheless, many work trips already go through Manhattan, and would benefit from through-running, as shown below.⁶⁸

Crucially, since the transportation options available for the work trips shown in the graphic above are all inconvenient, we can expect through-running to induce more train travel and mode shift. Moreover, it will induce the additional trips when and where there is spare capacity, rather than just overloading Penn Station and its approaches.

This way, frequent all-day through-running service stands to lower the barrier posed by geographic features like the Hudson River, knitting the region into a more cohesive whole.^{69 70 71} A home health care worker living in Woodside could access clients in Nassau County using one train instead of a subway and one or two slow buses. A doctor or nurse living in South Orange in New Jersey could take a job at the Albert Einstein College of Medicine or Montefiore in Morris Park in the Bronx. A teacher from Flushing could get to schools in Newark without a cumbersome transfer to crowded PATH trains.⁷²



68 All numbers in the image come from LEHD data and represent daily commutes as of 2019. New Jersey and Connecticut comprise the entire respective states, including trace numbers of commutes to areas beyond the metropolitan area; Long Island comprises Nassau and Suffolk Counties.

69 Ito, "Through Service between Railway Operators in Greater Tokyo."

70 MTA, *MTA Transportation Reinvention Commission: Report*. New York: 2014. http://web.mta.info/mta/news/hearings/pdf/MTA_Reinvention_Report_141125.pdf.

71 MTA Capital Construction, *MTA Twenty-Year Capital Needs Assessment 2015-2034*. October 2013. <https://new.mta.info/document/11976>, p. 131.

72 The CityTicket program offers \$5 off-peak and \$7 peak in-city commuter rail fares, compared to \$2.90 for the subway and buses.

Would modernization and service expansion cost a lot of money?

Large increases in off-peak frequency do not require a significant increase in operating costs. Other aspects of modernization reduce operating costs through planning simplification and more consistent service.

Off-peak frequency

Today, at rush hour, service on the LIRR, Metro-North, and NJT runs about four times as frequently as during the mid-day off-peak. In contrast, peer cities like Tokyo, Paris, Berlin, and London, run ratios ranging from 1:1 to 2:1. Those less peaked schedules cost much less to run than New York's peak-focused timetables, as seen in the table below.

Increases in reverse- and off-peak frequency cost very little additional money to operate. In 2019, the total operating costs of the LIRR, Metro-North, and NJT were \$3.8 billion, for a total of about 20 million train-miles.⁷³ Our proposal for a train every 10 minutes all day on the inner-suburban trunk lines would increase service by about 60%, but would only incur about \$120 million in extra electricity and right-of-way maintenance costs.

Extra crew costs are less certain but, due to the effect of peakiness on efficiency, would be low as well. Already, many NJT and LIRR trains already run through Penn Station without passengers; extending them to outlying stations converts deadhead hours to revenue hours.

We also suspect that more regular frequencies would simplify crew scheduling: train engineers today are required to certify on multiple lines, since they may be moved between different lines based on frequent changes in schedule, and low-seniority workers have little control over which yard they are required to report to. In contrast, a regular clock-face schedule that is rarely changed could permit more stable work on consistent lines, out of consistent yards, with predictable hours, facilitating hiring.

Thus, the higher frequency would incur only a minimal increase in the total cost of service, which means the cost per trip would fall dramatically. Lower costs mean more service can run, and additional service would stimulate new ticket revenue, more than enough to pay for service increases.⁷⁴

Cost Item	Details
Infrastructure: rail lines	Infrastructure needs, such as the HTP, depend entirely on the peak. Infrastructure is being built for service that runs only a few hours each weekday.
Infrastructure: rail yards	Globally, less peaky rail services require less intensive railyard infrastructure—typically overnight storage and a moderate amount of midday storage for maintenance. However current agency plans for New York require significant railyards for not only overnight but also off-peak storage, requiring a larger footprint.
Rolling stock	Fleet size depends almost entirely on the peak, yet a peaky service results in a large fleet pool that sits idle most of the time. EMUs are usually replaced on a 40-year cycle regardless of how far they are driven. ^{75 76}
Crew labor	Crew get paid per hour in actual service, but peaky timetables introduce difficult crew scheduling; many railroads employ split shifts, in which workers work a few hours in the morning and then a few in the evening with a gap in between. These crew assignments draw high amounts of overtime pay as a default part of their job description. ^{77 78 79}

⁷³ FTA, *Top 50 Profiles Report*; train-miles are imputed from typical train lengths.

⁷⁴ Litman, "Transit Price Elasticities and Cross-Elasticities."

⁷⁵ London Underground rolling stock lasts as long as that of New York City Transit even though it is driven 87,500 miles/year per Tfl, "Tube trivia and facts," Made by Tfl Blog, accessed October 24, 2023, <https://madeby.tfl.gov.uk/2019/07/29/tube-trivia-and-facts/> where NYCT stock averages 55,000, both having 40-year service life in theory but frequently keeping trainsets for 50 years or even a little more.

⁷⁶ The Paris Métro has the same service life as London and New York with 43,500 miles/trainset, imputed from 727 sets and train-kilometer figures from Comité d'évaluation de l'amélioration de l'offre de transport en Île-de-France, 2016, accessed October 24, 2023, https://www.iledefrance-mobilites.fr/medias/portail-idfm/a84b2f7d-1ade-49f5-950b-74849f417ebf_Rapport_Comite_Bailly_BAT.pdf, p. 10.

⁷⁷ Law Office of Kristine A Sova, "New York's 'Extra Pay' Requirements for Non-Exempt Employees," *Lexology*, accessed October 24, 2023, <https://www.lexology.com/library/detail.aspx?g=352358fe-be6a-4dfe-801a-f41de1cb9590>.

⁷⁸ The LIRR has no split shifts, but gets only 450 annual service-hours out of every train operator; Metro-North gets 600, but has to pay extra for split shifts. Both figures are imputed from numbers of employees on the Empire Center, *See Through NY*, <https://www.seethroughny.net/payrolls> and some revenue-hour figures from FTA, *Top 50 Profiles Report*.

⁷⁹ The almost peak-free Berlin S-Bahn gets 673 annual per driver. See S-Bahn Berlin, "Auf einen Blick - Zahlen und Fakten," accessed October 24, 2023, <https://sbahn.berlin/das-unternehmen/unternehmensprofil/auf-einen-blick-zahlen-und-fakten/>.



Through-running and service efficiency

Expanding off-peak service frequency would raise operating costs by a minimal amount. But through-running would do more than provide better service at low cost: it would actually reduce capital costs, through better efficiency, and massively reduce operating costs per rider.

The operating efficiencies of through-running center on fewer turnarounds, especially for the shorter trips that commuter rail modernization would unlock. Short-hop lines to destinations like Port Washington, Hempstead, and New Rochelle lose a lot of time if trains spend 15 minutes out of every hour sitting at a terminal rather than running in revenue service.

Through-running thus combines well with the large increases in off-peak short-distance frequency. The combination of the two would consolidate the many service patterns today into a regular clockface timetable, giving planners time and space to optimize the fewer patterns. We explain an analog on the subway in our report on the Six-Minute Service campaign: today's subway timetables require extensive tweaking by time of day, day of week, midday service disruptions for maintenance, and regular changes to frequency every six months. As a result, schedulers have to take shortcuts and write schedules with conflicts between trains.⁸⁰

Turnarounds today also involve conflict between tracks. The NRT connects to 19 of Penn Station's 21 platform tracks. Therefore, trains from New Jersey that terminate and reverse at Penn Station need to cross many tracks, conflicting with each other, causing congestion and delays. Conversely, continuing trains to smaller stations speeds them up in the city center and increases reliability.^{81 82} Many trains already continue through the station without passengers for this reason; this resolves some of the conflicts, but at the cost of additional deadheading, incurring higher operating costs without providing more useful service for passengers.

Finally, through-running reduces the need for some capital spending projects. It would render rail yard expansions near Midtown Manhattan unnecessary, such as at Secaucus, where an expansion plan is budgeted at \$2.4 billion.⁸³ In planning documents from the Gateway Program's predecessor project, Access to the Region's Core (ARC), two explored options, Alternatives G and AA, incorporated rail tunnel connections to varying parts of Grand Central which it was found would dramatically lower operating costs. However, because a more robust commuter rail network was not

properly integrated into these plans, they still included expensive yard expansions at 12th Avenue.⁸⁴ With the system designed around through-running and high all-day frequency, such close-in railyards become unnecessary and existing facilities such as Sunnyside Yard and LIRR's Hillside facility can be used.

80 ETA, "A Step in the Right Direction."

81 STV Group, "Penn Station Utilization and Capacity Analysis," by Christopher Kaiser. New York: 1995. <https://archive.org/details/penn-station-utilization-and-capacity-analysis>.

82 Amtrak, "Analyzing the Potential for Commuter Train Run-Through Service at New York Penn Station." 2014, http://irum.org/20140807_Amtrak_NYP_Thru_Running_Assessment.pdf, p. 3.

83 New Jersey Transit, *2022 Capital Plan Appendix B: Project Sheets*, https://content.njtransit.com/sites/default/files/njtplans/NJ%20TRANSIT%20Capital%20Plan%202022%20Update_Appendix%20B%20Project%20Sheets_7-24-23.pdf, pp. 201–202.

84 Port Authority of NY and NJ, MTA, and New Jersey Transit, "Access to the Region's Core Major Investment Study: Summary Report 2003." https://www.irum.org/20031125_ARC_MIS_Summary_Report.pdf, p. 15.



Detailed Vision

Which peers of New York City have through-running?

Through-running is ubiquitous in large transit cities, such as Tokyo, Seoul, London, Paris, Berlin, and Madrid. Moreover, the New York City Subway runs through.

Large transit cities worldwide have built tunnels to permit commuter rail through-running. In Tokyo, a large majority of urban rail ridership is not on the city's 13 subway lines, but on its commuter rail network. Nearly all Tokyo commuter rail service employs through-running, often via the subway, most of which is built to Japanese commuter rail standards.^{85 86 87 88} Within the United States, Philadelphia opened the Center City Commuter Connection in 1984, producing the only through-running system in the United States to date.⁸⁹ Ultimately, the way all the networks described in this section developed over time underscores the need for a long-term vision.

Paris

Paris's commuter rail network carries 5 million passengers every weekday,^{90 91 92} more than that of any other European city. Of those 5 million users, about 3.8 million use the five through-running routes, labeled *Réseau Express Régional* (RER) A through E.

Traditionally, Paris's commuter rail service terminated at one of the city's six main intercity stations (Gare du Nord, Gare de l'Est, Gare de Lyon, Gare d'Austerlitz, Gare Montparnasse, Gare Saint-Lazare), or at one of the three minor commut-

er-only terminals (Bastille, Luxembourg, Invalides). Cross-regional trips required two transfers via the Paris Métro, which has the narrowest stop spacing of any major world metro, even narrower than the local lines of the New York City Subway. The close stop spacing also meant that extending the Métro into suburbs would not provide competitive trip times.

Starting in the 1950s, the region began planning and constructing express commuter rail tunnels connecting the various terminals through the city center. This involved extensive collaboration between Paris Métro operator RATP and national railway SNCF, which operated the commuter lines. For example, the first, most expensive, and most popular route, the RER A, was routed to undulate through central Paris in order to serve SNCF's Gare Saint-Lazare and Gare de Lyon, even though the route itself would be operated entirely by RATP. This process took years: initially SNCF was hostile, and only in the 1960s, with a change in leadership, did it become more accommodating.⁹³

Through-service immediately attracted heavy ridership upon opening in 1977 as the RER A and B. This has led to the construction of additional tunnels. In 1983, the RER B began connecting RATP and SNCF territory with through-service;⁹⁴ until recently, operating crews switched off trains mid-route at the central station.^{95 96 97 98} Since then, crowding on the RER A became so severe that the region built Métro Line 14 and the RER E and is extending the latter line west.⁹⁹

85 Sato and Essig, "How Tokyo's Subways Inspired the Paris RER."

86 Ito, "Through Service between Railway Operators in Greater Tokyo."

87 Mitsuo Shinbo, "High-Density Transport Systems Supporting Giant Metropolis of Tokyo" *JRTR* 64 (2014): 84–95. https://www.ejrcf.or.jp/jrtr/jrtr64/pdf/84-95_web.pdf.

88 Makoto Aoki, "Railway Operators in Japan 4: Central Tokyo" *JRTR* 30 (2002): 42–53. https://www.ejrcf.or.jp/jrtr/jrtr30/pdf/s42_aok.pdf.

89 William Robbins, "Few Use Philadelphia Tunnel on 1st Day." *New York Times*. September 5, 1984. <https://www.nytimes.com/1984/09/05/us/few-use-philadelphia-tunnel-on-1st-day.html>.

90 RATP Group, "Pourquoi dit-on que la ligne du RER A est la plus fréquentée d'Europe?," *Askip*, accessed October 25, 2023, <https://askip.ratpgroup.com/question/pourquoi-dit-on-que-la-ligne-du-rer-a-est-la-plus-frequencee-deurope/>.

91 "RER B : Presque 1 million d'usagers par jour !," *Vivre Paris*, May 3, 2019, <https://vivrepairs.fr/rer-b-presque-1-million-dusagers-par-jour/>.

92 SNCF, "Présentation du réseau Transilien," *SNCF Open Data*, accessed October 25, 2023, <https://ressources.data.sncf.com/explore/dataset/presentation-reseau-transilien/table/>.

93 "Anne-Marie Idrac, Présidente-Directrice Générale de la RATP," accessed October 25, 2023, <https://docplayer.fr/46447879-Avant-propos-anne-marie-idrac-presidente-directrice-generale-de-la-ratp.html>.

94 In 1981, trains from either half of the modern RER B terminated at Gare du Nord, with a transfer between sections. 1983 was the start of through-service. The number of through-trains ramped up slowly between 1983 and 1987.

95 "Tout sur l'alimentation en énergie électrique du RER B !," *RER B Le Blog*, March 29, 2018, accessed October 25, 2023, <https://www.rerb-leblog.fr/2-prises-electriques-differentes-faire-rouler-trains-rer-b/>.

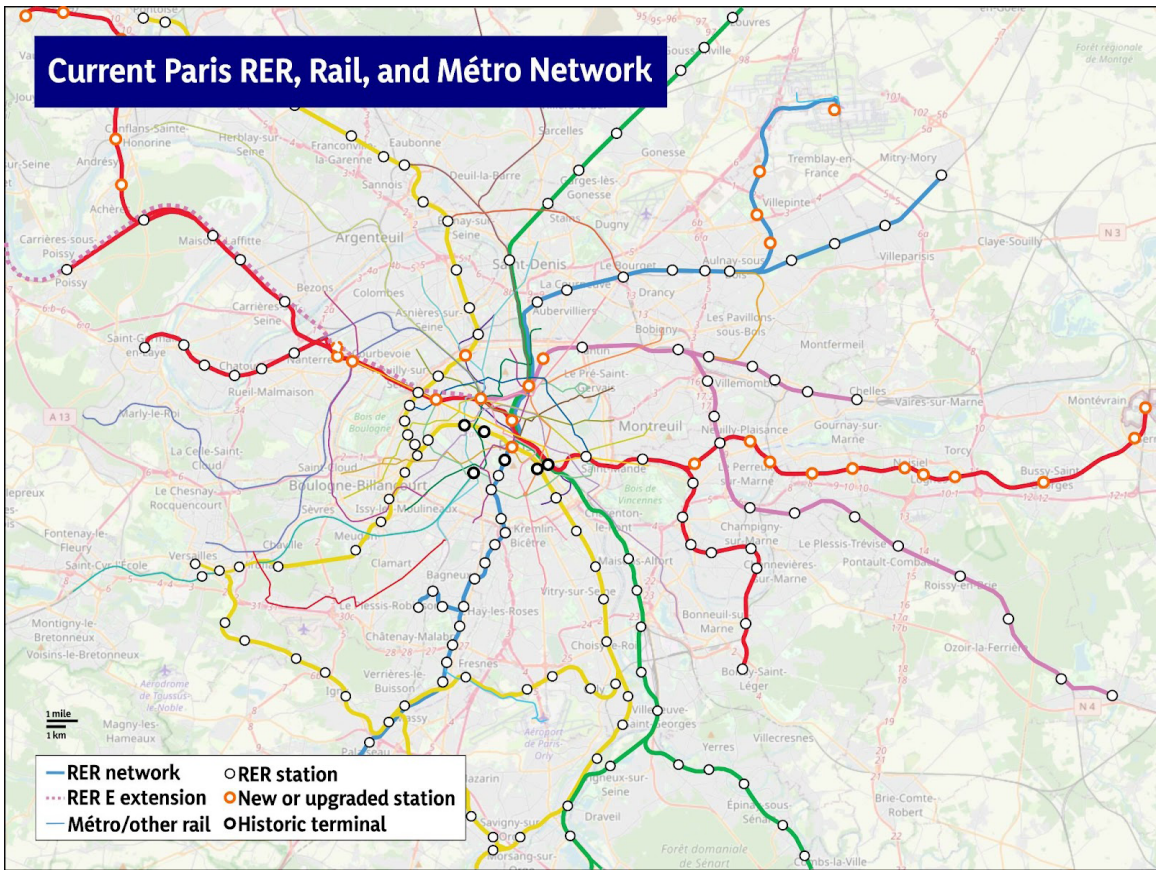
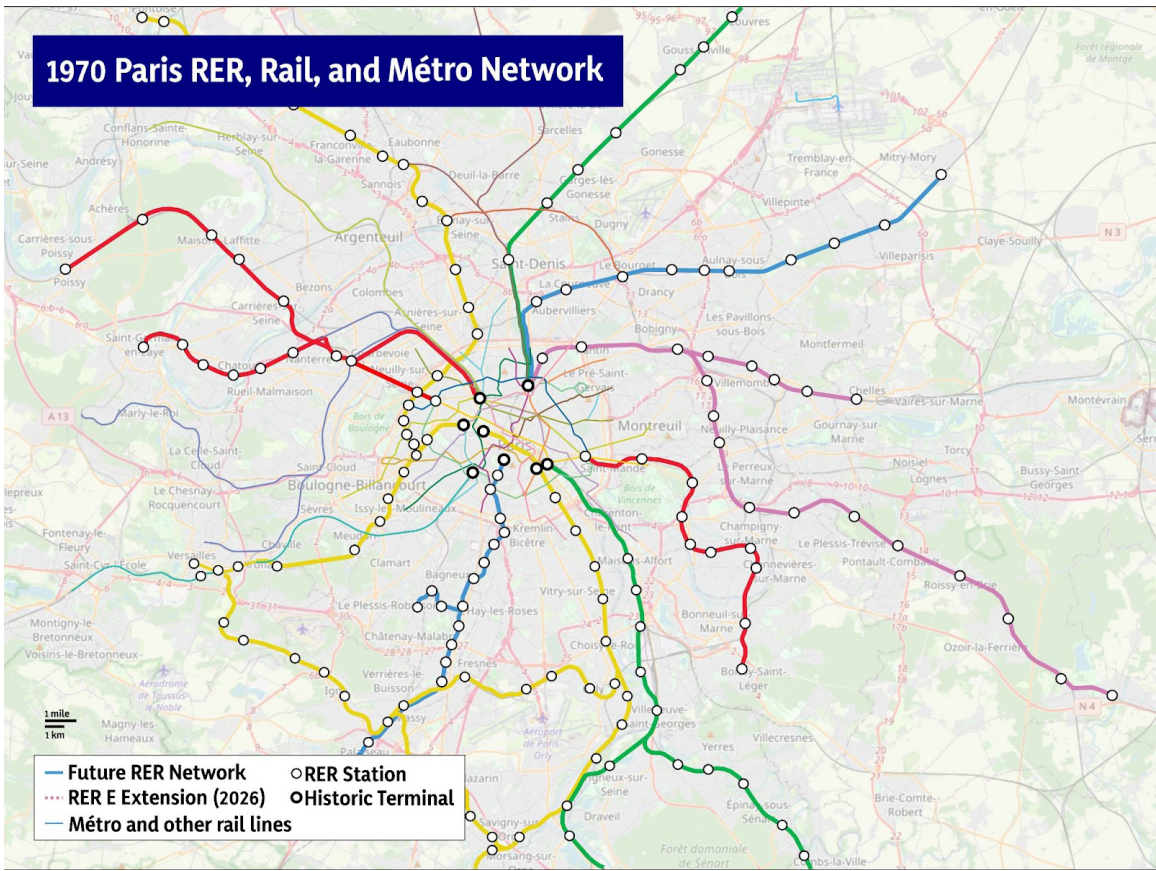
96 "Mieux comprendre la gestion des circulations: Le RER A « La ligne de tous les superlatifs »," *RER A Le Blog*, February 13, 2017, accessed October 25, 2023, <https://rera-leblog.fr/mieux-comprendre-gestion-circulations-rer-a-ligne-de-superlatifs-1/>.

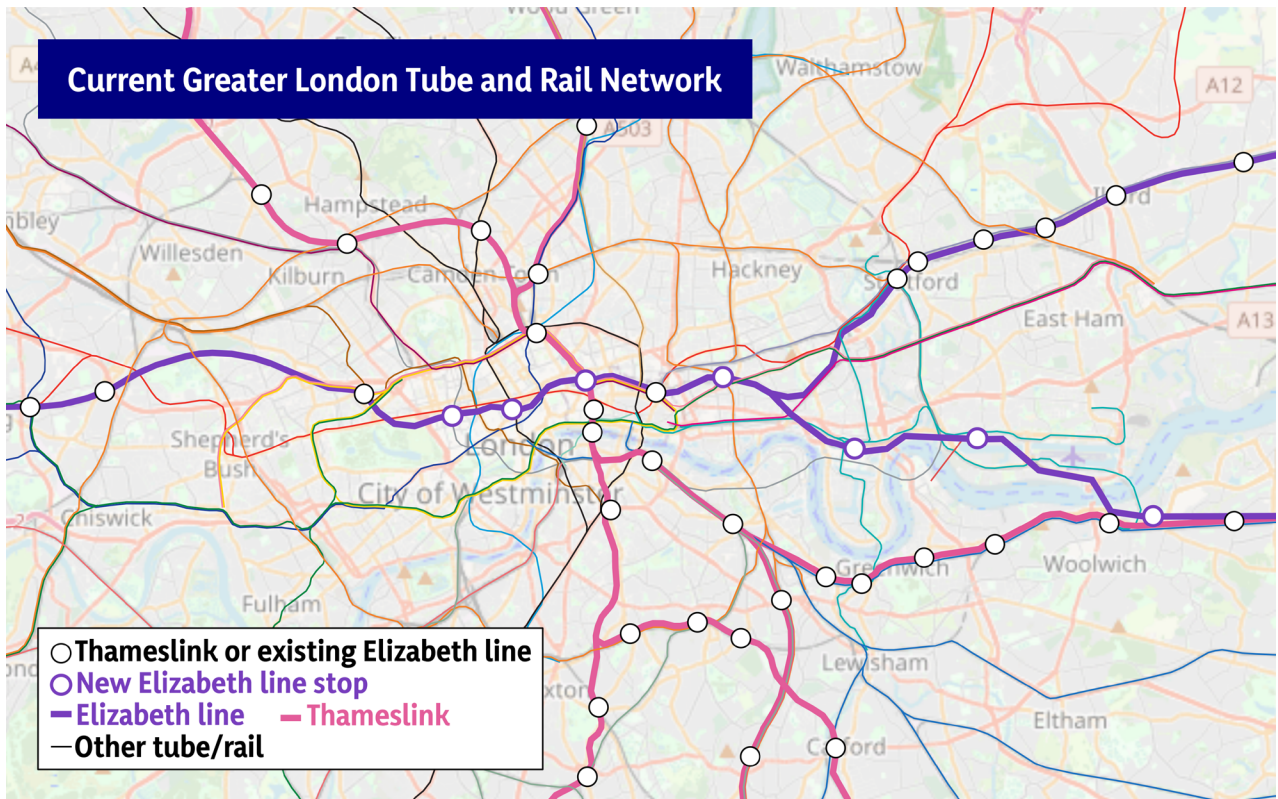
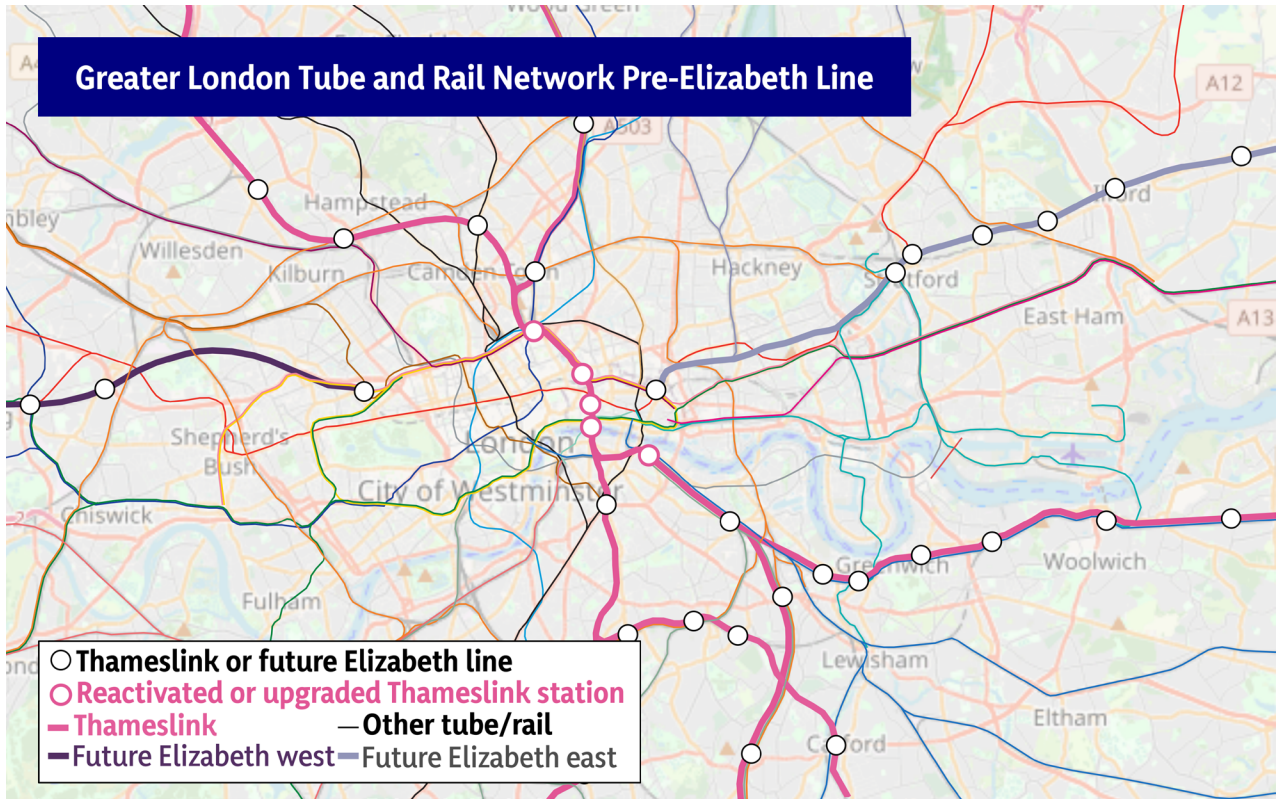
97 "Anne-Marie Idrac."

98 Pierre Zembri, "La difficile modernisation des transports parisiens à travers les avatars du RER (1965-1977)." 2006. https://www.researchgate.net/profile/Pierre-Zembri/publication/319669547_La_difficile_modernisation_des_transports_pariens_a_travers_les_avatars_du_RER_1965-1977/links/5c376a6d-458515a4c71b6e0e/La-difficile-modernisation-des-transports-parisiens-a-travers-les-avatars-du-RER-1965-1977.pdf.

99 David Haydock, "Electrification completed on RER Line E extension to Nanterre," *International Railway Journal*, June 28, 2023, <https://www.railjournal.com/infrastructure/electrification-completed-on-rer-line-e-extension-to-nanterre/>.







London

Like Paris, London has a large number of disconnected intercity rail terminals, each built by a separate private company to connect to a different part of the country. The situation in the north and west was especially difficult, as the rail terminals were outside the historic core (in East and South London, property values were lower due to poverty,¹⁰⁰ and thus rail terminals were built into the core). By the 1850s, the streets were congested with horsecars.¹⁰¹

Unlike Paris, London built the Underground to be compatible with mainline standards from the start: when the first Underground line opened in 1863, it had some intercity through-service. This through-service was never high-quality, due to inevitable delays, and eventually ceased; but even today, there are sections of shared track between the Underground and some commuter lines.¹⁰²

London began implementing true through-running on commuter rail in 1988 with Thameslink, which started with the narrow scope of reusing some disused rail infrastructure. Planners contended with two different power sources, awkwardly connected separate stations at Kings Cross, old infrastructure, and generally undersized platforms. The project reactivated a rail tunnel through central London that had been out of use for decades, the Snow Hill Tunnel.¹⁰³ Thameslink proponents justified it primarily on the basis of cheaper operating costs from through-running efficiencies, and it was thus initially built on the cheap, running just 4-6 trains per hour (tph).¹⁰⁴ Despite predictions of low ridership, the line quickly gained substantial traffic. The service

provoked a fourfold increase in travel between points on the north and south sides of the new system, building support for later upgrades to the line under the Thameslink Programme,^{105 106} which increased frequency to 24 tph, and allowed more lines to run through.^{107 108 109}

The success of Thameslink and the example of the RER drove London to build the complementary east-west Crossrail project, now called the Elizabeth line. Where Thameslink reused existing infrastructure and incrementally upgraded it, the Elizabeth line uses 13 miles of new tunnel, connecting all major job centers in Greater London: the West End, the historic City of London, and Canary Wharf. Through-service, which opened just last year, has been a clear success: with over 600,000 passengers a day it has propelled the UK's total rail travel volume *above* its pre-pandemic level.^{110 111 112 113}

Philadelphia

The SEPTA Regional Rail system is the only one in the United States where trains run through the city center, and the largest that is completely electrified. The system as it is today was planned in the 1970s. The Center City Commuter Connection opened in 1984, connecting what had previously been two disconnected networks, one inherited from the Pennsylvania Railroad (PRR) and one inherited from the Reading Railroad.¹¹⁴

Unfortunately, ridership has never taken off. Ridership, which was 32 million in 1980, nosedived in the mid-1980s due to service cuts and a 108-day strike in 1983; it would take until

100 Charles Booth, *The Descriptive Map of London Poverty*, 1889 remains the best visualization, but the pattern would not have been significantly different in the 1830s, 40s, and 50s, when those terminals were built. https://quod.lib.umich.edu/m/misc/2/BOOTH?bbid=2112927554;chapter=5-MISC-X-2+BOOTH;lasttype=bbaglist;lastview=bbreslist;resnum=8;sort=dc_cr;start=1;subview=detail;view=bbentry;xc=1.

101 "Public transport in Victorian London – underground," London Transport Museum, accessed October 25, 2023, <https://www.ltmuseum.co.uk/collections/stories/transport/public-transport-victorian-london-underground>.

102 The Bakerloo line shares tracks with the Watford DC line, but the Watford DC line terminates at the north end of city center at Euston whereas the Bakerloo runs through and crosses the Thames.

103 In fact, trains originally ran through the Snow Hill Tunnel and the City Widened Lines, producing through-running already in the 1860s and 70s. But service was awkward, and the steam trains on the line were outcompeted by the electric London Underground services starting in 1890; through-service ceased in 1916 and would only return with Thameslink.

104 Service was later increased to 15 trains per hour to meet increased demand.

105 Thameslink was much more popular than expected "and in the first year carried the number of passengers only predicted to be carried in the fifteenth year". David Howarth, *Capacity Achievement on Thameslink 2000*. In *IMEchE Conference Transactions* (May 1999), pp. 153–168, https://drive.google.com/file/u/2/d/1yCJ-lPbxRkd65bGan_QLJsoyT9ZHKmU9/view?usp=sharing.

106 Work included platform extensions, major station upgrades, upgraded signaling, additional tracks to eliminate a bottleneck, a grade-separated duck-under, and new rolling stock. See Pedantic of Purley, "Making the Grade (Separation): The Bermondsey Diveunder," *London Reconnections*, August 2, 2015, accessed October 25, 2023, <https://www.londonreconnections.com/2015/bermondsey-diveunder/>.

107 Department for Transport, *Thameslink Evaluation Programme: Baseline Report*. London: 2018, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/689701/thameslink-programme-baseline-evaluation-report.pdf.

108 Christof Spieler, <https://twitter.com/christofspieler/status/1558996150031732743>.

109 Pedantic of Purley, "Holy Grails and Thameslink Fails (Part 1): A Brief History of Thameslink," *London Reconnections*, June 5, 2018, accessed October 25, 2023, <https://www.londonreconnections.com/2018/holy-grails-and-thameslink-fails-a-brief-history-of-thameslink-part-1/>.

110 Ross Lydall, "Passenger numbers on Elizabeth line soar by 41 per cent in three months," *Evening Standard*, March 16, 2023, <https://www.standard.co.uk/news/transport/passengers-elizabeth-line-soar-41-per-cent-tfl-overcrowding-b1067730.html>.

111 Transport for London, Elizabeth Line Committee Meeting, p. 19.

112 Taylor, "Elizabeth line sees hybrid workers flock back to the office."

113 Gwyn Topham, "Elizabeth line to be fully running from 21 May in 'last milestone' for Crossrail," *The Guardian*, April 24, 2023, <https://www.theguardian.com/business/2023/apr/24/elizabeth-line-to-be-fully-running-from-21-may-crossrail>.

114 More detail can be seen in Sandy Johnston, "Must (Only) the Rich Have Their Trains?," master's thesis (University at Albany, 2016), <https://itineranturbanist.wordpress.com/masters-paper-must-only-the-rich-have-their-trains/>.



2008 to exceed the 1980 ridership, and in 2019, on the eve of COVID, ridership had inched up to 36 million.^{115 116 117 118}

While Philadelphia has built commuter rail through-running, it did not reform operations sufficiently. University of Pennsylvania Professor Vukan Vuchic, who designed the service concept for the regional rail system, recommended that each of the system branches run every 10 minutes all day. Instead, most branches run hourly off-peak, and the urban branches also charge a premium fare even while serving low-income North Philadelphia neighborhoods.¹¹⁹ The system remains used almost exclusively by suburban commuters to the city center, and Philadelphia has a weak central business district by the standards of old large American cities.¹²⁰ Advocates in

the Philadelphia region have called for increasing off-peak frequency, as has Vuchic, but so far increases are only on the planning board.^{121 122}

Furthermore, the through-running concept has withered over time. Vuchic originally designed the system with seven lines, labeled R1 through R8 (R4 was omitted), each connecting a specific PRR-side branch with a specific Reading-side branch.¹²³ However, planners reverted to tradition and dropped those designations in 2010. Simultaneously, they stopped running lines consistently, so that now a branch from the PRR side may through-run to any Reading branch, or even terminate on the Reading side just beyond Center City without full through-running.¹²⁴



Jefferson Station (formerly Market East) is a 4-track through station built as part of the Center City Commuter Connection. Photo Credit: John Phelan, Wikimedia Commons

- 115 Jake Blumgart, "As SEPTA Looks Forward, a Few Suggestions for Improving Its Regional Rail," *NextCity*, April 2, 2013, <https://nextcity.org/urbanist-news/as-septa-looks-forward-a-few-suggestions-for-improving-its-regional-rail>.
- 116 Ronald DeGraw, "Regional Rail: The Philadelphia Story," *Transportation Research Record* 1433 (1994), pp. 107–112, <https://onlinepubs.trb.org/Onlinepubs/trr/1994/1433/1433-014.pdf>.
- 117 Pew Charitable Trusts, *Philadelphia 2013: State of the City*. https://web.archive.org/web/20130514094902/http://www.pewtrusts.org/uploadedFiles/www-pewtrustsorg/Reports/Philadelphia_Research_Initiative/Philadelphia-City-Statistics.pdf, p. 43.
- 118 "Public Transportation Ridership Report: Fourth Quarter, 2019," APTA. <https://www.apta.com/wp-content/uploads/2019-Q4-Ridership-APTA.pdf>.
- 119 See also "Regional Rail for Metropolitan Boston," *TransitMatters*, Boston: 2018. <https://transitmatters.org/regional-rail-report>, p. 29.
- 120 This point is made in Robert Lang and Jennifer LeFurgy, "Edgeless cities: Examining the Noncentered metropolis," *Housing Policy Debate* 14 (3) (2003), pp. 427–460, <https://www.tandfonline.com/doi/pdf/10.1080/10511482.2003.9521482>. It can also be seen by directly examining LEHD data: a blob of 100 square kilometers surrounding the central business district, designed to include job centers as much as possible, has 520,000 jobs in Philadelphia, compared with 700,000 in Washington, 830,000 in Boston, and 900,000 in San Francisco and Oakland. For comparison, New York, with three times the metro population of Philadelphia, Boston, or the Bay Area, has in the same 100 square kilometer blob 3 million jobs, in the Manhattan core as well as Downtown Brooklyn, Long Island City, the biggest Uptown Manhattan job centers, and the Jersey City waterfront.
- 121 Anthony Campisi, "Prominent transit planner criticizes SEPTA regional rail changes," *WHYY*, June 15, 2011, <https://whyy.org/articles/prominent-transit-planner-criticizes-septa-regional-rail-changes/>.
- 122 Blumgart, "As SEPTA Looks Forward, a Few Suggestions for Improving Its Regional Rail."
- 123 Vukan Vuchic and Shinya Kikuchi, *A Plan for SEPTA's Regional Metrorail System*. Philadelphia: 1993, <https://repository.upenn.edu/entities/publication/d3c0343d-5c48-43d8-87b0-b91e46ff98ec>.
- 124 Josh Fernandez, "SEPTA takes the 'R' out of Regional Rail," *Philadelphia Inquirer*, July 23, 2010, https://www.inquirer.com/philly/hp/news_update/20100723_SEPTA_takes_the_R_out_of_Regional_Rail.html.



Other cities

New York has many global examples to learn from. London and Paris are the two largest European networks, but there are many others, each with its own quirks:

- Berlin has the world's oldest commuter rail through-running, operating since 1882. The Berlin S-Bahn, the city's commuter rail network, is notable in that it is heavily used within the city as if it is part of the U-Bahn (subway) system.¹²⁵ Both systems run frequent flat service all day with practically no extra peak trains. Only some additional terminating lines run extra service at the peak. With such a flat schedule, the system makes efficient use of labor, getting 673 revenue-hours a year out of each train driver.¹²⁶ The success of Berlin's multi-line network inspired a slew of through-running German S-Bahn projects, including an underground second line in Hamburg (the first is above ground and from 1907) and new tunnels in Munich, Frankfurt, Stuttgart, and most recently Leipzig.
- Madrid has two commuter rail through-tunnels through its city center, another tunnel just for intercity trains, and a fourth through-line just outside it. An additional through-tunnel for commuter trains is in planning. Madrid has extraordinarily low construction costs, and so has built an extensive network of new subway and commuter rail tunnels just in the 21st century.¹²⁷
- Stockholm long had through-running, but there were only two tracks connecting Stockholm Central Station with the south. Economic growth in the 1990s led to problems with capacity, as there was only room for 24 tph including commuter, regional, and intercity trains. To solve this problem, the state built a new tunnel dedicated to commuter rail. The tunnel contains a deep-mined station at Stockholm Central, underneath its two-level, three-line subway station and another deep-mined station a mile north at Odenplan, a mixed-use neighborhood. The line opened in 2016, and by 2019, ridership was up from 325,000 per weekday to 410,000.¹²⁸
- Tokyo has, by far, the largest urban rail network in the world by ridership.¹²⁹ It does not have separate subway and commuter rail networks; instead, 10 out of its 13 subway lines are built to be compatible with commuter lines. The commuter lines are privately operated. Thus, a train using the subway, operated by the state-owned Tokyo Metro or city-owned Toei, may change hands

twice during its trip. Rolling stock is pooled, and operators change quickly (in 1–2 minutes) at the boundaries between railroads' zones.

New York City Subway

While the subway is not a commuter rail network, it is a great place to learn the value of through-running from. Nearly all subway routes run through Manhattan. For example, the A train runs between Inwood in Upper Manhattan and Far Rockaway in Queens. While few riders travel the entire route, many travel on overlapping sections, such as between the Rockaways and Columbus Circle or between Inwood and Bedford-Stuyvesant.

The Manhattan core itself is much larger than one station could hope to serve. On the A train, there are eight stations in the core from Columbus Circle at 59th Street to Fulton Street. To connect to all of these locations from both sides of the line, it is obligatory to run through.

The New York City Subway even historically took over the LIRR branches to the Rockaways in 1956 to provide service to outer-urban parts of the city where building new underground lines would have been cost-prohibitive. Such a takeover is sometimes an alternative to improving commuter rail, if a subway line exists to connect the line to. The service levels on such a system are usually comparable to outer-urban (but not suburban) RER and S-Bahn branches; BART in the Bay Area has built its entire system along such principles, which we call *suburban metro*, and many in the United States conflate BART with a modernized commuter rail system.

However, trips from the Rockaways to Downtown Brooklyn and Manhattan remain prohibitively long, even though the express A train serves them. We mention this alternative model here because it is historically important to New York, but due to the long trip times, we do not recommend it for existing commuter lines, even short local ones like the Port Washington and Far Rockaway Branches.

125 See traffic density map at Senatsverwaltung für Umwelt, Verkehr und Klimaschutz, *Nahverkehrsplan Berlin 2019–2023: Anlage 2 – Rahmenbedingungen*, https://www.berlin.de/sen/uvk/_assets/verkehr/verkehrsplanung/oeffentlicher-personennahverkehr/nahverkehrsplan/broschure_nvp_2019_anlage_2.pdf, p. 6.

126 S-Bahn Berlin, "Auf einen Blick - Zahlen und Fakten."

127 For more information about the history of the Madrid Cercanías, see Isidro Barqueros, "La historia de Cercanías Madrid: 1975-1989: Los inicios," *Ecomovilidad.net*, September 29, 2009, accessed October 25, 2023, <https://ecomovilidad.net/madrid/historia-cercanias-madrid-1975-1989/>.

128 Alon Levy, Eric Goldwyn, and Elif Ensari, Transit Costs Project. The Sweden Case: How Stockholm Builds Infrastructure Cheaply, and Why It's Becoming More Expensive? New York, 2022: https://transitcosts.com/wp-content/uploads/Sweden_Case_Study.pdf, pp. 23–24.

129 Adding up all railroads and metro systems in the region gives 15 billion riders per year. See *Train Media*, 2018, accessed October 25, 2023, <http://web.archive.org/web/20190327142737/http://www.train-media.net/report/1810/index.html>.



Supporting investments

Commuter rail modernization requires higher frequency and other supporting investments to make the system more usable; these should be implemented before megaprojects such as through-running tunnels.

Systemwide investments are required to support commuter rail modernization. This includes very high-cost items like HTP, but also smaller items that are required to make full use of the new capacity unlocked by new tunnels and maximize service quality. The two such systemwide investments are high platforms and electrification. High platforms are fortunately installed at nearly all stops east of the Hudson, but there are significant gaps on NJT; electrification is incomplete, with some high-operating cost diesel tails on nearly all lines.

In addition, more specific investments into new stations and some bottleneck relief are useful for both more capacity at rush hour and better schedule planning in general.

Which specific relief is required depends on future decisions about the timetable, and many projects could be postponed if the desired peak frequency is lower than the theoretical maximum. For planning, we assume an aggressive peak timetable for NJT, where the bulk of the work needs to be done since HTP involves doubling peak service whereas no such thing is planned on Metro-North and the LIRR. In this assumed timetable, the Northeast Corridor Line should get a local train every 10 minutes and an express train every 10 minutes, and every other branch feeding into Manhattan—North Jersey Coast, Raritan Valley, Morristown, Gladstone, and Montclair-Boonton—should get a train every 10 minutes.

High Platforms

High platforms are required for level boarding. Level boarding ensures wheelchair accessibility without requiring a conductor to lend personal assistance. Unaided mobility has become increasingly salient in 21st-century disability advocacy, as wheelchair users demand that strangers not touch their wheelchairs, for fear of equipment damage^{130 131 132} or

violation of their bodily autonomy in general.^{133 134}

Level boarding constitutes an essential element of universal design for a rail system. Far from only benefitting wheelchair users, it eliminates barriers for many, including passengers with luggage or strollers, or disabled people who use walkers. Even able-bodied commuters take longer to board a train when the train floor is several feet higher than the platform than when the platform and train are at the same level or nearly so.

A key time to minimize for good timetable planning is the time a train spends at each station with its doors open, called the *dwelt time*. With level boarding, the dwell time can be reduced substantially. Low-platform stations without level boarding usually have 45–60-second dwell times, and sometimes more at very busy stations.

Level boarding not only reduces the overall dwell times but also reduces variability, which permits writing timetables with less schedule padding. If there are low-platform stations on the line, then two wheelchair users could be enough to turn the station dwell time from 30 seconds to four minutes even if the station is not very busy, and the schedule needs to account for such possibility. In contrast, if all stations have level boarding, then wheelchair users can get on and off unaided in the same amount of time as able-bodied passengers, and the timetable can be both faster and less padded.

All LIRR stations have level boarding, going back to the 1960s and 1970s, when the M1 rolling stock entered service.¹³⁵ The same is true of nearly all east of Hudson Metro-North stations; the exceptions are the Waterbury Branch, where three stations are being upgraded with Bipartisan Infrastructure Law funding,¹³⁶ and two hiking trail stations.¹³⁷

Unfortunately, the NJT system is not at all close to universal high platforms. As shown on the diagram on the following page, only about half of the stations have them. The busiest stations on lines with direct service to Manhattan generally have high platforms, but Morristown, with 1,935 boardings per weekday as of 2012,¹³⁸ still only has low platforms. The remaining stations must be rebuilt with level boarding platforms that are long enough for the entire train, a minimum

130 Meghan Smith, “You literally stole my independence: What happens when an airline breaks a wheelchair,” *GBH*, April 20, 2023, <https://www.wgbh.org/news/local/2023-04-20/you-literally-stole-my-independence-what-happens-when-an-airline-breaks-a-wheelchair>.

131 Emily Alpert Reyes, “An airline broke an activist’s wheelchair. Her death months later amplified calls for change,” *LA Times*, January 6, 2022, <https://www.latimes.com/california/story/2022-01-06/la-activist-broken-wheelchair-airlines-death>.

132 Lucy Webster, “Airlines keep breaking my wheelchair,” *BBC*, August 12, 2017, <https://www.bbc.com/news/uk-40876598>.

133 Harry Low, “Spikes - and other ways disabled people combat unwanted touching,” *BBC*, October 15, 2019, <https://www.bbc.com/news/disability-49584591>.

134 Morgan Mac Caisin, “Why You Shouldn’t Touch Someone’s Wheelchair Without Permission,” *The Mighty*, May 26, 2022, <https://themighty.com/topic/disability/dont-touch-someones-wheelchair-without-permission/>.

135 Bernie Bookbinder, “In ‘69, LI-NY in Half the Time,” *Newsday*, December 13, 1966, <https://www.newspapers.com/article/newsday-nassau-edition/121351888/>.

136 Cate Hewitt, “Waterbury Line To Receive \$30 Million Federal Grant to Improve Three Stations,” *Connecticut Examiner*, December 19, 2022, <https://ctexaminer.com/2022/12/19/waterbury-line-to-receive-federal-grant-to-improve-three-stations-for-accessibility/>.

137 Work is planned to upgrade Breakneck Ridge.

138 New Jersey Transit, “Quarterly Ridership Trends Analysis: First Quarter, Fiscal Year 2013, July through September, 2012,” by A. Tillotson. 2012. https://media.nj.com/bergen_impact/other/1Q2013.pdf.



New Jersey Transit Platform Heights



of eight cars. There are 68 low-platform stations on the NJT Northeast Corridor, North Jersey Coast, Raritan Valley, Morris and Essex, and Montclair-Boonton Lines, but 26 of them have funding for high platform conversions.¹³⁹

NJT did have an aggressive program of installing level boarding improvements at a number of their stations in the 1980's to 2000's. This included almost all stations on the Northeast Corridor and North Jersey Coast Lines as well as several stations on other lines. Sadly, this program was curtailed due to budget costs in the 2010's and is only now slowly resuming albeit with only two stations (Perth Amboy and Lyndhurst) under construction.

Electrification

All urban commuter railways we are aware of outside North America are electrified, or in the process of electrifying. This includes not only very large cities like Tokyo, London, and Paris, but also ones with the population of a New York City neighborhood: Trondheim, a Norwegian city of 210,000 with another 260,000 in its suburbs in the wider region of Trøndelag, is currently wiring its commuter rail network,¹⁴⁰ which runs hourly at rush hour.

In nearly all cases, electric rail service is run with EMUs rather than trains with dedicated locomotives. The LIRR and Metro-North run electric service with EMUs; but NJT uses a mix of ALP-46 electric locomotives hauling unpowered coaches and EMUs. EMUs have superior performance and a much larger global base of manufacturers, making them easier to procure.

The Boston-based advocacy group TransitMatters wrote a report on electrification in Boston's context.¹⁴¹ Its estimate for the construction costs is about \$4.5 million per mile, based on many European examples. The report explores what has caused the costs of projects in the Bay Area (Caltrain) and Toronto to balloon. The LIRR, Metro-North, North Jersey Coast Line, Raritan Valley, and Morris and Essex and Montclair-Boonton Lines, have a total of 381 unelectrified route-miles, most of which are single-track and have little reason to be double-tracked. At the cost the TransitMatters

report imputes, these could be wired for \$1.7 billion.

The benefits of EMUs coming from this expenditure are considerable, including all of the following:

- Much better performance, with acceleration rates approaching 3 mph per second, three times what is available with diesel; even the conservative assumptions for the Caltrain electrification project have San Jose–San Francisco local trains speeding up from 100 to 75 minutes end-to-end.¹⁴²
- Higher reliability: where the LIRR and Metro-North's diesel locomotives have a mean distance between failures (MDBF) of 20,000–30,000 miles depending on type, their M7, M8, and M9 EMUs have MDBFs of 350,000, 900,000, and 450,000 miles respectively.¹⁴³ A passenger on a diesel train going 25 miles one-way each weekday spends about 12,500 miles on a train per year, and therefore sees a breakdown every two years. In contrast, on EMUs, that passenger would see a breakdown once in a working lifetime. This effect also permits timetables with less padding, speeding trains up even further.
- Lower lifecycle costs: a benchmarking report finds that on average, EMUs have half the acquisition, operations, and maintenance costs of diesels.¹⁴⁴
- Air quality: diesel locomotives emit particulate pollution, whereas electric trains do not. The overall greenhouse gas emissions of diesel trains and buses are very small compared with those of gas-powered cars, but local pollution still negatively impacts air quality near bus depots.^{145 146}

The TransitMatters report assumes electrification with overhead wire; third rail has similar benefits. It explains why alternatives, such as hydrogen technology (increasingly abandoned¹⁴⁷) or battery-electric trains, do not provide equivalent benefits, and are only used on very low-ridership lines.

Based purely on the impact of electrification on lifecycle equipment costs, comparing the electrified SEPTA Regional Rail with the all-diesel MBTA system, the TransitMatters

139 New Jersey Transit, *2020 Capital Plan Appendix B: Project Sheets*, <https://web.archive.org/web/20220422162515/https://njtplans.com/downloads/archived/capital-project-sheets/2020%20Capital%20Plan%20project%20sheets.pdf>, pp. 90–92; this covers 30 stations, of which six are on lines with no way to get to Penn Station. Two additional stations are Millburn and Jersey Avenue, where level boarding is funded separately.

140 David Burroughs, "Bane Nor plans \$US 1.7 bn investment in Trøndelag," *International Railway Journal*, May 26, 2022, <https://www.railjournal.com/infrastructure/bane-nor-plans-us-1-7bn-investment-in-trondelag/>.

141 TransitMatters, "Regional Rail Electrification."

142 Caltrain Citizens Advisory Committee, "Caltrain Electrification: Proposed Service Plan for Fall 2024," September 20, 2023, <https://www.caltrain.com/media/31624/download>, p. 26.

143 All data is from <https://metrics.mta.info/> and represents a trailing 12-month average, current as of July 2023.

144 Heiner Bette and Adriaan Roeleveld, "Benchmarking identifies good practice in rolling stock maintenance," *Railway Gazette*, April 1, 2006, <https://www.railwaygazette.com/news/benchmarking-identifies-good-practice-in-rolling-stock-maintenance/27406.article>.

145 Israel Torres Penchi, "Harlem Fumes Over Bus Depot," *The Independent*, October 15, 2003, <https://independent.org/2003/10/harlem-fumes-over-bus-depot/>.

146 Laura Rivera, "Where the Air Leaves Them Breathless," *New York Times*, November 5, 2006, <https://www.nytimes.com/2006/11/05/nyregion/thecity/05asth.html>.

147 Ananya Bhattacharya, "The dream of the first hydrogen rail network has died a quick death," *Quartz*, August 7, 2023, <https://qz.com/the-dream-of-the-first-hydrogen-rail-network-has-died-a-1850712386>.



report estimates that electrification reduces annual operating costs by \$20,000 per mile, per peak car per hour. For example, the Montclair-Boonton Line runs half-hourly eight-car trains at rush hour past the end of electrification at Montclair State University, and so the cost reduction would be \$320,000 per route-mile, for a financial return on investment of 7%, taking into account just one of many benefits.

For this reason, the New York region should significantly expand the scale of its electric network; European lines that are left unwired run very little service, for example half-hourly two-car trains on regional lines operated by NBE in and north of Hamburg.¹⁴⁸ Unfortunately, American commuter rail agencies are reluctant to electrify, even where they are interested in other investments for modernization, such as the ongoing installation of high platforms at NJT and the MBTA. The MBTA has reacted tepidly to the Transit-Matters recommendation of maximum electrification, and is only willing to pilot it on the Providence Line, where there is wire for Amtrak service but the MBTA still runs diesels, and on two additional short lines.

NJT, LIRR, and Metro-North should commit to completing overhead wire or third rail electrification, prioritizing the following areas, which have the highest ridership in diesel territory:

- On NJT, the Raritan Valley Line and the outer North Jersey Coast Line.
- On LIRR, the Port Jefferson Branch beyond Huntington and possibly the Montauk Branch from Babylon to Speonk.
- On Metro-North, the Hudson Line north of Croton-Harmon and the New Haven Line's Danbury Branch.

Infill stations

Currently, the stop spacing on American commuter rail within cities is very wide, as the mode is designed for the use of suburbanites. For example, compare the following stop spacing on the LIRR Main Line, the RER A, and the Elizabeth Line, shown in the diagram on the following page.

In the suburbs, and even in parts of New York far from the subway, the stop spacing is about a mile, similar to London and Paris. But closer in, the stop spacing is very wide, as the trains are not designed for urban usage. To modernize service, it would be helpful to build infill stations in dense neighborhoods. The following locations are all desirable targets for infill:

- Sunnyside, Queens, which can include a station at the yard in order to permit a transfer between trains bound for Penn Station (which we call Queens Junction) and ones bound for the Grand Central Madison, or a station farther west near Queens Plaza and its skyscrapers,¹⁴⁹ or even stations at both locations.
- Astoria, Queens, which was studied as a station location for Penn Station Access and rejected under unfavorable assumptions on frequency and fares;¹⁵⁰ under more modern operating practices, the case for it is stronger and it should be built, permitting not just fast trips between Astoria and Penn Station but also between the Bronx and Queens.

There are many other attractive locations for infill in and just outside the city. Much depends on which lines are used for through-running and on the shape of the city's future bus network: intersections between rail lines and very busy bus routes are strong candidates.

Where commuter rail runs closely parallel to the subway, it can get away with a wider stop spacing. It is fine for Metro-North trains to run nonstop between 125th Street and Grand Central while the 4 and 5 trains make two more stops, and it is fine for the LIRR to have a wide stop spacing between Penn Station and Jamaica. But trains do need to stop at these intermediate stops frequently; today, Kew Gardens and Forest Hills only get half-hourly service.

Fortunately, in the Bronx, the infill proposed as part of Penn Station Access is already good, respecting intersections with the major bus routes within the borough. The stations on the existing Harlem Line are, likewise, located at intersections with major east-west buses. But the LIRR stop spacing in Eastern Queens is too wide and misses key north-south bus routes beyond the reach of the subway.

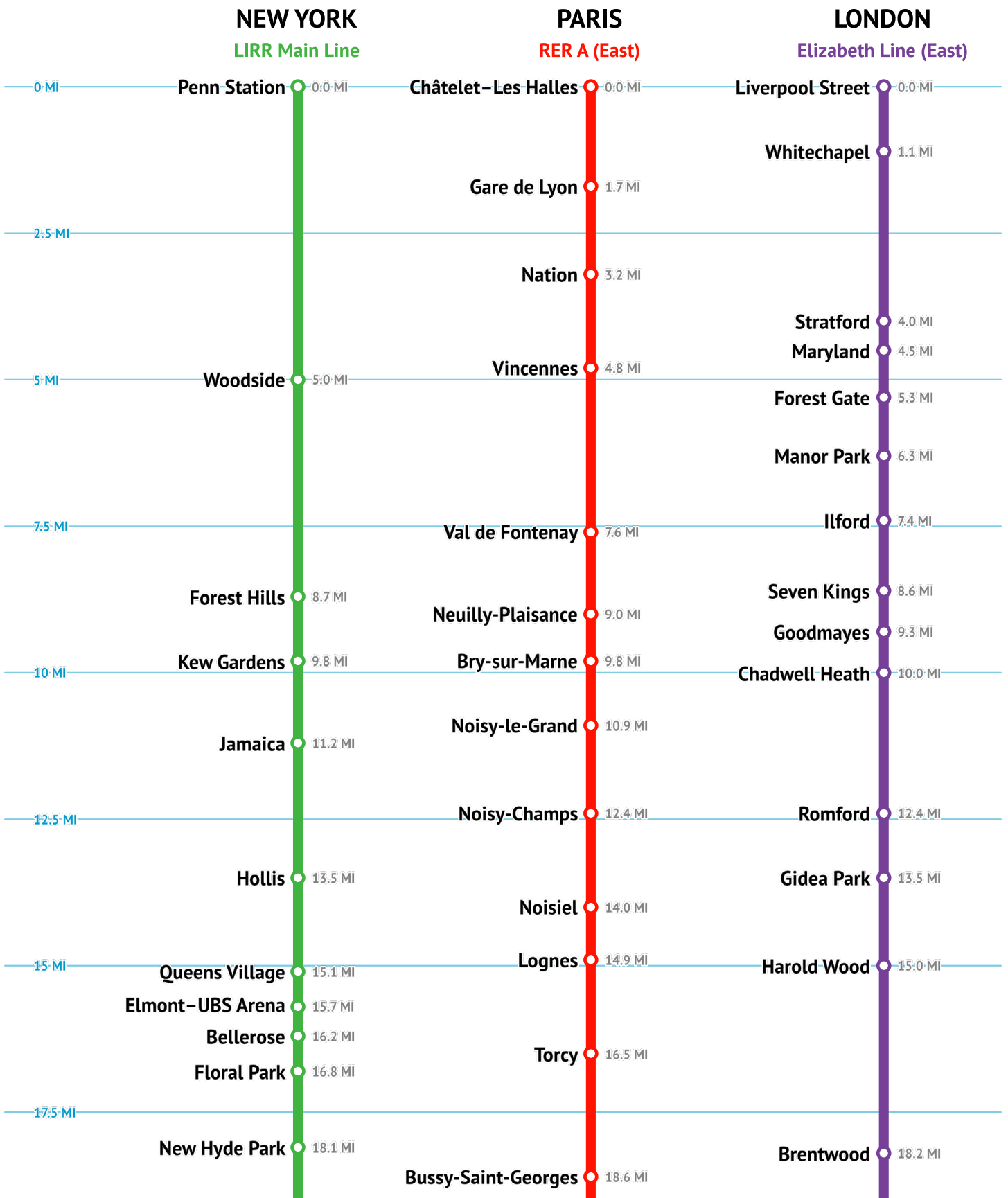
The cost of infill stations is unclear, since there are few such projects in New York; the infill in Penn Station Access is expensive, but is bundled with many other associated projects, such as expanding the line from two to four tracks. However, these types of infill stations have in almost every instance significantly improved regional connectivity and smoothed out various network inefficiencies. As such, even if costly, they are well worth the expense.

148 In fact, all NBE lines that serve Hamburg are wired; NBE is purchasing battery trains for suburban orbitals not serving the city. See "Moin, Mobilität von morgen," *Nordbahn*, accessed October 25, 2023, <https://www.nordbahn.de/unternehmen/start-im-akku-netz/>.

149 A station was initially planned here as part of East Side Access; see Clayton Guse, "New NYC train service linking Long Island to Grand Central omits promised LIRR stop in Sunnyside, Queens," *New York Daily News*, October 24, 2022, <https://www.nydailynews.com/new-york/ny-nyc-lirr-train-grand-central-bypass-sunnyside-queens-20221024-rxiqpyodzjdoxhtmg7c2mqks4a-story.html>.

150 Metro-North Penn Station Access Major Investment Study/Draft Environmental Impact Statement: Comparative Screening Results Report. 2002. <https://new.mta.info/document/36621>, p. 43.





Capacity investments in support of the Hudson Tunnel Project

The aforementioned systemwide investments make for a much more reliable, more convenient, and simply faster commuter rail network. However, there remain some specific capacity bottlenecks that need to be addressed. East of the Hudson, increases in service should largely be outside rush hour; the most significant capital work on the LIRR is Harold Interlocking, already under construction.¹⁵¹ However, west of the Hudson, HTP stands to double capacity into Manhattan, which requires extensive surface capacity improvements, to permit such throughput to run.

First of all, HTP would only provide four tracks' worth of service under the Palisades and under the Hudson. The surface route from the portal to Newark is largely double-track, and must be quad-tracked. Then, beyond Newark, every branch must run a train every 10 minutes at rush hour, and not much less frequently off-peak; this is not compatible with any but the briefest single-track sections. NJT's network largely comprises double-track lines, but the junctions between them have single-track sections, or are flat, meaning trains have to cross opposing traffic at grade, which is rarely feasible to schedule at such frequency. On some outer branches, it's fine to reduce frequency to a train every 20 or 30 minutes having half or two-thirds of the train turn closer in, at stations like Montclair State University, Long Branch, or Summit (for the Gladstone Branch). But even then, some sections remain that require additional investment in sidings and other upgrades.

Most of the projects on the following list are already in planning. We bring them up to urge agencies in the region to prioritize them for funding in conjunction with the Hudson Tunnel Project. A few are not even planned, but most are among the lower-cost, faster-to-build ones.

The Marron Institute's Transportation and Land Use Program, which produced the Transit Costs Project, is currently in the process of producing exact timetables. These schedules will inform which capital expansion projects are required for the intended increases in service or for high-speed rail service, and which are not. The following list of projects should be taken as preliminary, and should be the subject of further analysis.

- By far the costliest project is completing four-tracking of the Northeast Corridor between the portal of the HTP

¹⁵¹ "Harold interlocking Northeast Corridor congestion relief project," MTA, accessed October 26, 2023, <https://new.mta.info/projects/harold-interlocking>.

¹⁵² Northeast Corridor Commission, *Northeast Corridor Capital Investment Plan: Fiscal Years 2023-2027*. 2022. <http://nec-commission.com/app/uploads/2022/11/FY23-27-Capital-Investment-Plan-02-Appendix-Oct-22.pdf>, p. 210.

¹⁵³ NJT, *2022 Capital Plan Appendix B*, pp. 188–189.

¹⁵⁴ *Ibid.*, pp. 151–153.

¹⁵⁵ *Ibid.*, pp. 149–150.

¹⁵⁶ Improved signaling is installed in the southern two East River Tunnels, and may be installed in the northern two East River Tunnels as part of Penn Station Access, or a future project. Northeast Corridor Commission, *Northeast Corridor Capital Investment Plan: Fiscal Years 2021-2025*. 2020 <http://nec-commission.com/app/uploads/2020/11/FY21-25-Capital-Investment-Plan-Oct-20-1.pdf>, p. 137.

¹⁵⁷ NJT, *2022 Capital Plan Appendix B*, pp. 178–180.

and NRT and Newark, for which the most significant component is the new **Portal South Bridge**. While it is estimated at \$3.6 billion for a fixed high span,¹⁵² NJT's Capital Plan includes a lift bridge option estimated at **\$800 million**.¹⁵³ The only conflicting boat traffic is barges carrying sludge, which can be scheduled to pass at night, when no trains are running; thus, little is lost from having a lift bridge. More broadly, We urge the agencies of the region to look for ways to reduce the cost of this project. A double-track bridge of this length, about 0.2 miles, should not cost this much.

- **Hunter Flyover**: right now, trains from NJT's Raritan Valley Line have to cross Northeast Corridor trains at-grade at Hunter Interlocking in Newark. This is a major regional bottleneck as it requires these RVL trains to cross the entire Northeast Corridor at one of its busiest points.¹⁵⁴
- **Mid-Line Loop**: right now, local trains on the Northeast Corridor Line in New Jersey turning at Jersey Avenue have to cross oncoming traffic at-grade; a flyover and supporting projects are estimated to cost **\$511 million** in 2022 prices.¹⁵⁵
- **High-density signaling** in the East River Tunnels to increase capacity from 20 to 24 trains per hour.¹⁵⁶
- CP 216 Interlocking (called **Shell**): in New Rochelle, the junction between the Northeast Corridor (including future Penn Station Access) and the current Metro-North line to Grand Central is flat, forcing outbound trains from Grand Central to cross inbound trains to Penn Station. A project to grade-separate it is necessary for reliable rail service in the area, and would benefit both commuter and intercity rail. As this is not currently planned, we cannot estimate its cost, but it is likely of comparable size to Hunter Flyover, and could get federal high-speed rail funding.
- **Queens Interlocking**: on the LIRR, the junction between the Main Line and the Hempstead Branch is flat. While we are not certain of what operating model should be adopted on those lines as part of a through-running scheme, the Hempstead Branch should see a large increase in peak and off-peak frequency, and thus grade-separating the junction, at perhaps a similar cost to Shell and Hunter, is prudent.
- **Lehigh Line** capacity investments: NJT needs to add tracks to the Conrail-owned portion of the Raritan Valley Line, called the Lehigh Line, hosting more than 20 freight trains per day. The cost of this project has been estimated at **\$850 million**.¹⁵⁷ However, since much



of this work is for freight rail benefits, freight railroads Norfolk Southern and CSX should pay a portion of this cost. It should be a high priority for joint funding as it provides a myriad of benefits to both freight and passenger rail service. It also aligns well with Amtrak's long-term plans of instating service between New York at the Lehigh Valley.

These and other local bottleneck projects throughout the LIRR, NJT, and Metro-North networks should be prioritized.

Other expenditures on NJT's list can be avoided if the plans incorporate through-running. Most notably, a planned project for a Gateway storage yard and maintenance facility at Hoboken and Secaucus is estimated to cost \$2.4 billion.¹⁵⁸ This expenditure is unnecessary—instead, trains that currently use Secaucus as a midday layover should continue in passenger service to Connecticut and Long Island.^{159 160}

Working with current agency structure

The agencies would not need to merge, but they should coordinate operations and rolling stock procurement: while each railroad in the region uses a different electrification system, they already use multi-system trains, and can replace the remaining trains on the usual purchase cycle.

Commuter rail in New York is currently provided by three distinct agencies—the LIRR, Metro-North, and NJT. Additional agencies are involved, in that in Connecticut the infrastructure is owned by the state and operated by the New York MTA-owned Metro-North, and in that Amtrak owns Penn Station. This requires interagency coordination in operations and capital planning.

Would the commuter rail agencies need to merge?

No merger is required, just more coordination in capital planning, schedules, and fares. Many through-running systems around the world run with different operators and separate funding provided by multiple agencies. In Tokyo and Philadelphia, and formerly in Paris, train crews change over in the middle of runs.¹⁶¹ Unified service and fares go a long way to creating a seamless rider experience.^{162 163 164}

For Penn Station through-running, Amtrak, the MTA, and NJT would need to reach comprehensive agreements.¹⁶⁵ Such pacts have precedent. NJT and Metro-North have a service agreement for the operation of the Pascack Valley and Port Jervis Lines that addresses operations, maintenance, and revenue.¹⁶⁶ Similarly, NJT, Metro-North, and Amtrak reached similar operating agreements for Football Trains between New Haven and Secaucus.^{167 168}

A Verkehrsverbund (VV), or transport association, first used in Germany, can improve interagency coordination. Paris has a similar coordinating entity, Ile-de-France Mobilités.¹⁶⁹ VVs work with operators and government officials over entire metropolitan areas to coordinate customer information, service, planning, and fare structures. For instance, U5 and

158 Ibid, pp. 201-202.

159 Empire State Development, *Empire Station Complex Appendix A: Response to Comments on the Draft Scope of Work*, <https://esd.ny.gov/sites/default/files/Empire-Station-Complex-Appendices-A-and-B.pdf>, p. A-34.

160 Empire State Development, *Pennsylvania Station Area Civic and Land Use Improvement Project, Chapter 26: Response to Public Comments*, 2022, https://esd.ny.gov/sites/default/files/PSACLUIP-FEIS-26-RTC_0.pdf, p. 26-18.

161 "New management system for line B," RATP, accessed October 26, 2023, https://web.archive.org/web/20110322150331/https://www.ratp.fr/en/ratp/c_11200/new-management-system-for-line-b/.

162 Gabriel Dupuy, Corinne Gely, and Jean-Marc Offner, "RER & interconnexions: les vertus d'un réseau hybride," *FLUX Cahiers Scientifiques Internationaux Réseau et Territoires* 6 (2) (1990), pp. 81–94. https://www.persee.fr/doc/AsPDF/flux_1154-2721_1990_num_6_2_1143.pdf.

163 Aoki, "Railway Operators in Japan 4: Central Tokyo."

164 Ito, "Through Service between Railway Operators in Greater Tokyo."

165 Penn Station Capacity and Utilization Analysis Phase C, pp. 68–72.

166 "Metro-North Railroad and New Jersey Transit 2005 Service Agreement Operations Planning Department." 2005, <https://archive.org/details/njt-agmt-2995>.

167 This folder includes multiple documents that detail the agreements: <https://drive.google.com/drive/u/2/folders/134S69rObW2KK2sglyZogXLjkGnpROvH6>.

168 MTA Capital Construction, *MTA Twenty-Year Capital Needs Assessment 2015-2034*, p. 131.

169 "Organising Authority for Public Transport and Sustainable Mobility in Ile-de-France," February 2022, accessed October 26, 2023, https://www.ilede-france-mobilites.fr/medias/portail-idfm/01409158-24f9-4f3b-b0ed-c3ceef4f9ba0_presentation+idf+mobilités+2022_EN+Disclaimer_VIDFM+fe%C%81vriér+2022VF2.pdf.



S5 trains have timed cross-platform transfers in Berlin even though they are operated by different agencies.

VVs enable transportation operators to focus on what they do best: collecting fares, running service, and maintaining infrastructure and assets.¹⁷⁰ They also consolidate redundant functions such as finance, vehicle maintenance, administration, and ticketing and unify rolling stock procurement. Many VVs were created to help integrate large transit projects into regions' transportation systems, such as new S-Bahn and U-Bahn systems in Zurich, Munich, and Vienna.¹⁷¹

Would the railroads need to buy new trains?

Yes, but only on the normal equipment replacement cycle—no mass junking of serviceable rolling stock is required.

The issue is that there are multiple electrification systems used within the New York region, as can be seen in the diagram on the following page. This complicates train operations, but does not make through-running impossible.

The reason there are so many different electrification systems is that New York was one of the first cities in the world to electrify its commuter lines. The earliest electrification on the LIRR goes back to 1905¹⁷² and the first on Metro-North goes back to 1906.¹⁷³ As in many cities that began electrifying this early, New York-area railroads used a variety of methods. The LIRR and the Hudson and Harlem Lines use two kinds of third rail, whereas the New Haven Line and the electrified lines in New Jersey use AC catenary with different voltages and frequencies.

This issue has plagued the region since 1907, when the New Haven Line was first wired to Stamford.¹⁷⁴ Since then, there have been multi-voltage electric trains. All Metro-North trains that serve the New Haven Line are designed to run on both catenary and Metro-North's third rail. For New Jersey, the electric trains run on multiple voltages. Electric trains in other cities that electrified early, such as Paris (electrified since 1900)¹⁷⁵ and London (electrified since 1909),¹⁷⁶ routinely have multi-voltage capabilities too.¹⁷⁷

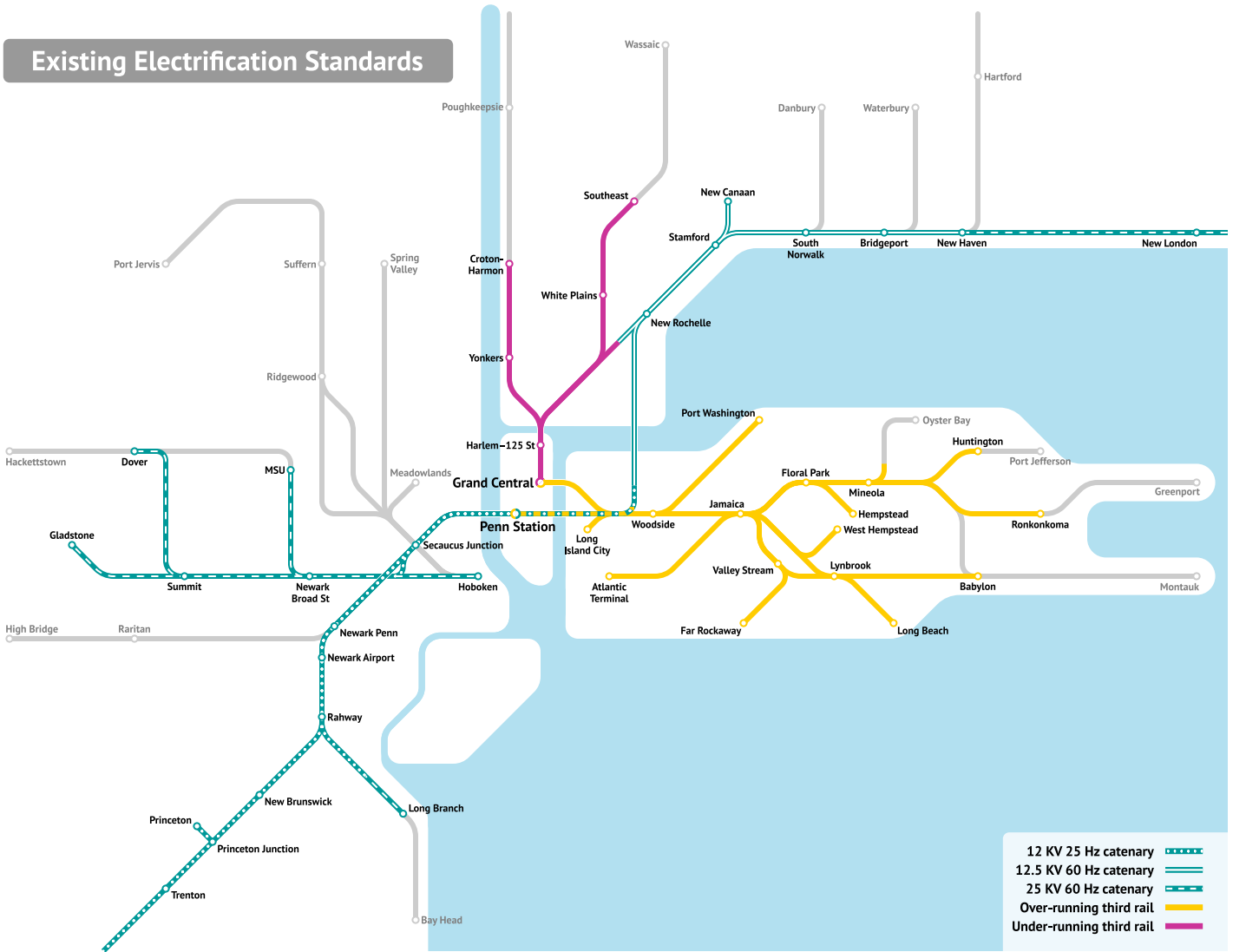
While no current train can run on every New York electrification system, the agencies could coordinate to procure a completely cross-compatible railcar with little change from the multi-voltage EMUs already in use. For example, while Metro-North's M8s can only run on the 60 Hz catenary north of New York,¹⁷⁸ not the 25 Hz catenary south of New York, they do run on Metro-North third rail and are also designed to use LIRR third rail.¹⁷⁹ Furthermore, NJT's new MultiLevel EMUs can run on every catenary system in the region, and therefore will be able to run through from New Jersey to the New Haven Line. Moreover, according to railcar manufacturers, adding third rail shoes to the NJT MultiLevels, permitting them to run through to the LIRR, would be a cheap modification.^{180 181 182}

Thus, in the medium run, the region's agencies should buy rolling stock compatible with multiple electrification systems based on the through-running program. This requires coordinated procurement but does not require going beyond the usual equipment replacement cycle.¹⁸³

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- 170 "How Germany standardizes signage, service and fare payment across separate transit providers," *Mobility Lab*, September 10, 2018, accessed October 26, 2023, <https://mobilitylab.org/2018/09/10/germany-standardizes-signage-and-wayfinding/>.
- 171 Ralph Buehler, John Pucher, and Oliver Dümmler, "Verkehrsverbund: The evolution and spread of fully integrated regional public transport in Germany, Austria, and Switzerland," *International Journal of Sustainable Transportation* 13 (2019), pp. 36–50 <https://www.tandfonline.com/doi/abs/10.1080/15568318.2018.1431821?journalCode=ujst20>.
- 172 "Electric Trains To Begin Operation On Western Lines of L.I.R.R. This Week, 1905," *The Standard Union*, July 9, 1905, <https://bklyn.newspapers.com/article/127749238/electric-trains-to-begin-operation-on-we/>.
- 173 "First Electric Train on N.Y. Central Today; It Will Run from Highbridge to the Grand Central," *New York Times*, September 30, 1906, <https://www.nytimes.com/1906/09/30/archives/first-electric-train-on-ny-central-today-it-will-run-from.html>.
- 174 "Stamford Road Open Soon, New Haven's New Electric Line Complete and Is Ready for Business," *New York Times*, July 13, 1907, <https://www.nytimes.com/1907/07/13/archives/stamford-road-open-soon-new-havens-new-electric-line-complete-and.html>.
- 175 "Gare d'Orsay," *Wikipedia*, accessed October 26, 2023, https://en.wikipedia.org/wiki/Gare_d'Orsay.
- 176 "South London Line," *Wikipedia*, accessed October 26, 2023, https://en.wikipedia.org/wiki/South_London_Line.
- 177 The Thameslink through-running system in London uses dual-voltage trains running on 750 V DC third rail south of the Thames and 25 kV AC catenary to the north. "British Rail Class 700," *Wikipedia*, accessed October 26, 2023, https://en.wikipedia.org/wiki/British_Rail_Class_700.
- 178 The size of an onboard transformer is inversely proportional to frequency. Changing the power to the catenary in New Jersey from 25 Hz to 60 Hz would allow M8s to run west of Penn Station. Richard Howell, "Implementing an Electrification Program: The Northeast Corridor Improvement Project." *Transportation Research Board Special Report* 180: Railroad Electrification, 1977, pp. 20–23. <https://onlinepubs.trb.org/Onlinepubs/sr/sr180/180-006.pdf>.
- 179 MTA, "Contract No. PS864: General Engineering Consultant Professional Design Services for Metro-North Railroad Penn Station Access Project Scope of Services January 2019," *Penn Station Access Project: Environmental Assessment and Section 4(f) Evaluation; Agency Correspondence and Public Involvement: Appendix E*, p. A-25. https://static1.squarespace.com/static/5d278d57950ce60001fd9b83/t/60a58751441b54130b026310/1621460819160/Appendix+E_Agency+Correspondence+and+Public+Involvement_Part+1.pdf#page=79.
- 180 Barry Caro, <https://web.archive.org/web/20220907161932/https://twitter.com/BarryCaro/status/1567547879899758596>.
- 181 The ARC Milestone Summary Report recommended low profile tri-voltage locomotives that can operate using either 25 Hz, 12.5 kV or 60 Hz, 25 kV overhead wire or DC third rail for New Jersey-Long Island through-running.
- 182 William Vantuono "For NJ Transit, another rolling stock innovation," *Railway Age*, December 12, 2018, <https://www.railwayage.com/passenger/commuterregional/for-njt-another-rolling-stock-innovation/>.
- 183 "Future plans for rolling stock purchases should take into account design needs for possible future regional rail operations." MTA Capital Construction, *MTA Twenty-Year Capital Needs Assessment 2015-2034*, p. 131.



Existing Electrification Standards



Implementation

We propose a three-phase implementation that first leverages existing infrastructure before making targeted improvements to increase service to its full potential.

To start through-running as soon as possible, the agencies in New York and New Jersey should implement it in phases. In each phase, more lines on either side of Penn Station are connected until all lines in New Jersey that enter Manhattan run through. Even then, some lines from east of the Hudson must terminate in Manhattan, as more trains would still run into Manhattan from the east than from the west. This contrasts with the situation today, wherein no trains run through in service, as shown in the diagram below.

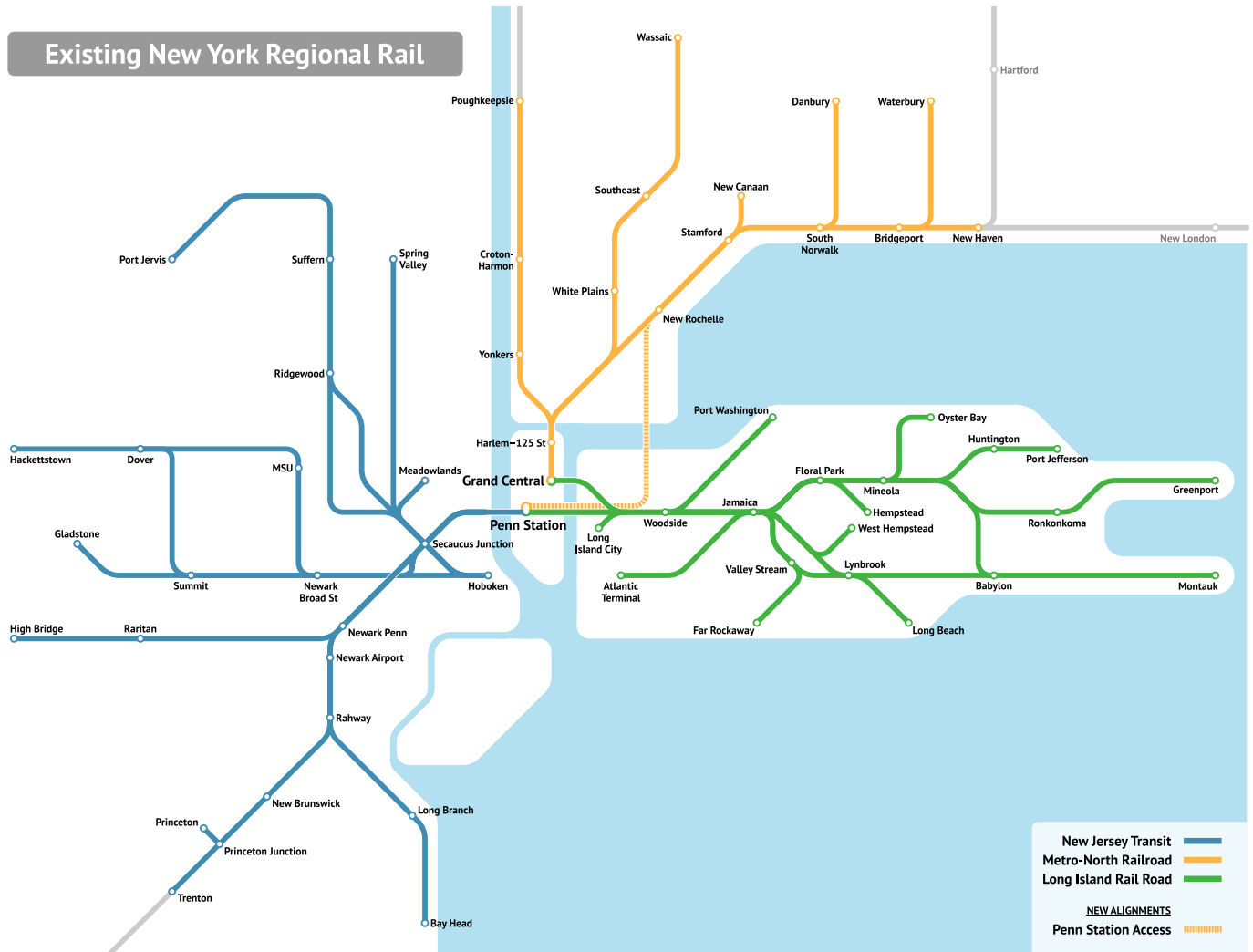
Principles for through-running

All trains from each line should run to the same line on the other side of Manhattan since this is easiest for riders to understand. This system should prioritize short routes close to the city, as most cities have done, and add longer trips later.

Focusing on lines near the urban core

Most through-running services have started by focusing on areas near the urban core: London, Paris, Berlin, and Tokyo all have approaches to their former terminals with four or more tracks, making it easy to dedicate two tracks to local through-service; the non-work trips and non-city-center work trips mentioned in Section 2B are usually by people who live in outer urban neighborhoods or inner suburbs.

In New York, the four-track approaches do not permit such neat separation. For example, the four-track approach to Grand Central has local stops on the Harlem Line—but the Harlem and New Haven Line both have their own sets of local and express trains, the local trains on the New Haven Line running express on the shared trunk rather than local. Between New Jersey and Manhattan, there are only two tracks, but even after HTP opens, segregating service into terminating express trains and through-running local trains is not straightforward—the proposed service plan is to instead separate the tracks so that the Northeast Corridor and North Jersey Coast Lines feed the NRT and the Morris and Essex Lines and Raritan Valley Line feed the HTP.



However, New York has an advantage that Penn Station Access and the LIRR Port Washington Branch already act as local service to areas relatively near Manhattan. These are the east-of-Hudson lines that are easiest to shoehorn into an early through-running system.

Moreover, on the LIRR, there is more room for separation of local and express tracks. One possible service pattern is that the Hempstead Branch should run local on the LIRR Main Line and run through to the Hudson Line, as we outline in [Section 6B](#), while the longer-range trains on the Port Jefferson and Ronkonkoma Branches should all terminate at Grand Central Madison, with cross-platform transfers to Penn Station at Jamaica.

Paired through-running

Through-running systems can be paired or trunk-based. As the graphic below shows, in a paired system, there is consistent pairing of branches on each side of the trunk: in the schematic, trains from branch A on the west always go to branch D in the east, trains from branch B always go to branch E, and trains from branch C always go to branch F. In a trunk system, trains from any branch on the west can go to any branch on the east, which may differ by time of day or even be purely arbitrary.

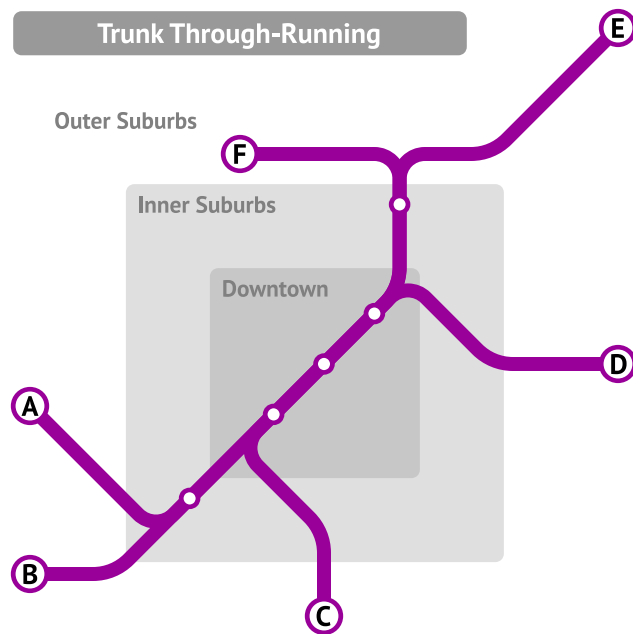
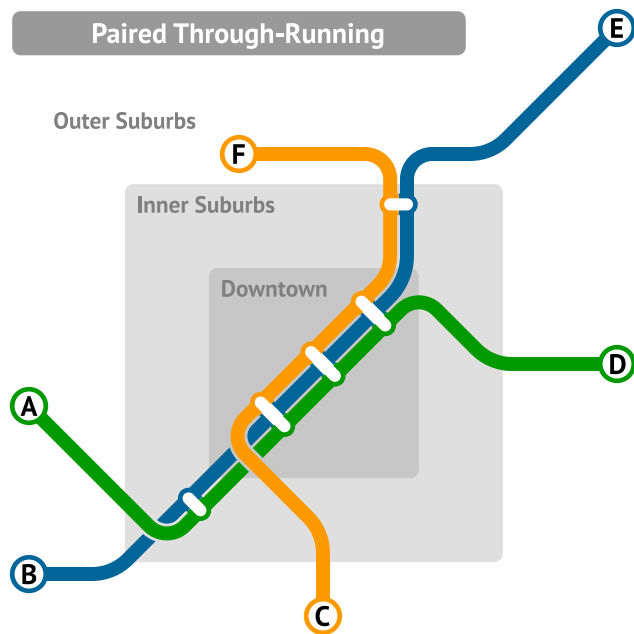
Paired systems are the most common method of through-running globally because they are easy to understand. Branch line pairings typically consider existing and projected regional travel patterns using ridership and car traffic

data and which pairings the branches' infrastructure and trains allow. In designing SEPTA Regional Rail, Vuchic based the pairing on ridership, train lengths, and yard locations.¹⁸⁴ In a similar vein, initial Penn Station through-running would pair the NJT Northeast Corridor Line with the Metro-North New Haven Line since their trains and infrastructure have the highest degree of compatibility.

Philadelphia transitioned to a trunk system in 2010, but as mentioned in [Section 3A](#), it is an unusually weak system partially for that reason. New York can do better.

In New York, many employment and activity centers such as White Plains, Stamford, Flushing, New Brunswick, and Princeton lie beyond the core line that would become the New York through-trunk. Knowing which train to take is easier with fixed line pairings, especially when a rider must change trains. On the subway, a rider traveling from 7th Avenue in Park Slope to Columbus Circle knows to change from the F or G train to the A or C train at all times of day. With a trunk system, the rider would still need to memorize a complex timetable.

Furthermore, a trunk system would have a higher upfront cost, because trains would need to use several outlying terminals on day one and thus be fully interoperable.¹⁸⁵ By contrast, New York can phase in paired through-running in the manner we discuss in subsequent sections. For these reasons, **through-running at Penn Station should use a paired system.**



184 Vukan Vuchic and Shinya Kikuchi, *General Operations Plan for the SEPTA Regional High Speed System*. Philadelphia: 1984. <https://repository.upenn.edu/entities/publication/3bee13c2-c265-4745-a098-474d8e0b7e04>.

185 For example, if the Port Washington Branch was the only LIRR line to through-run to NJT, existing LIRR M7s and M9s that cannot run to New Jersey could continue running service that terminates at Atlantic Terminal, Grand Central, or Penn Station. By contrast, a New Jersey-Long Island trunk system would require most trains to run to New Jersey, requiring premature retirement of the M7 cars built from 1999 to 2006.



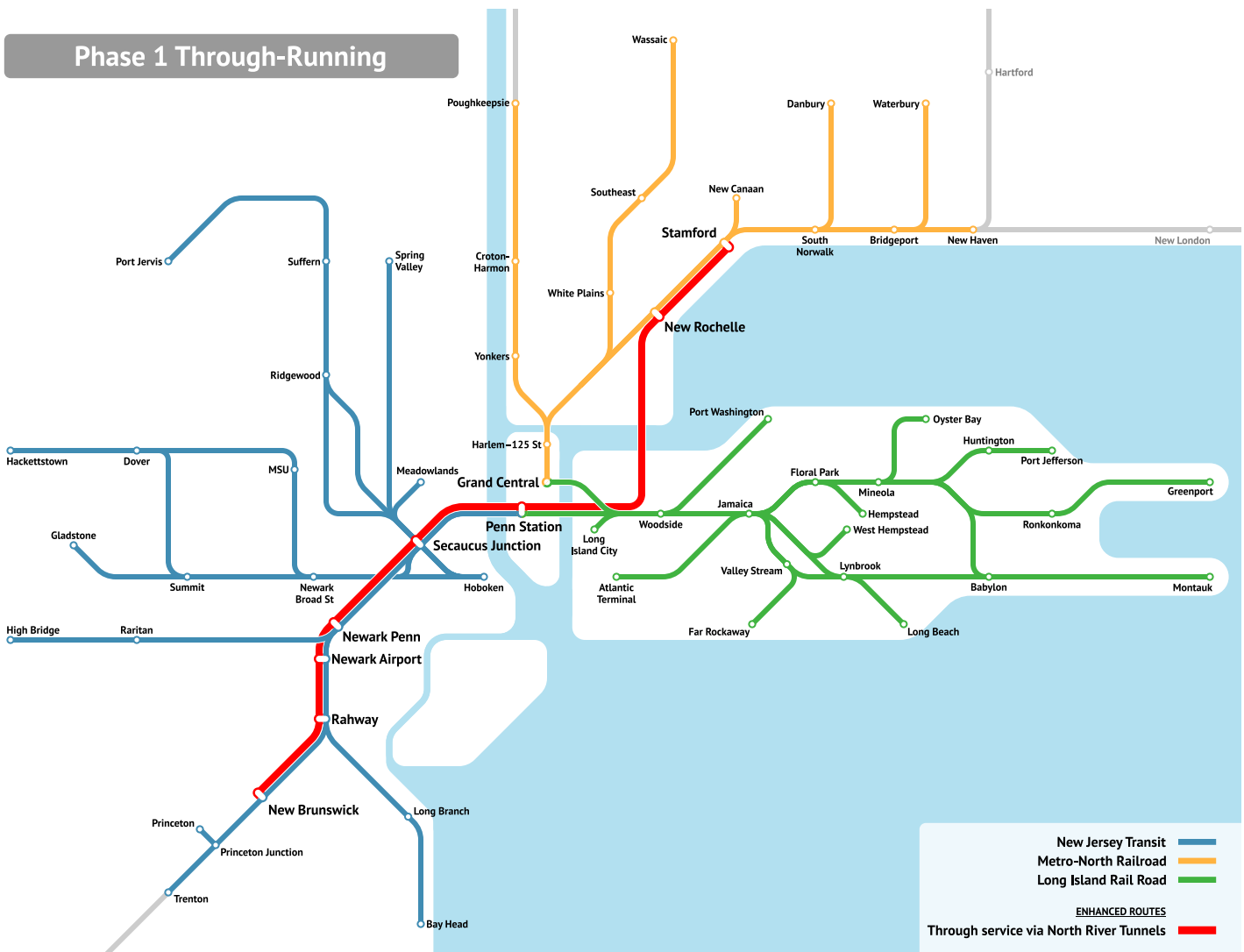
Phase 1

In Phase 1, a small number of existing NJT trains from the Northeast Corridor and North Jersey Coast Lines would through-run to New Rochelle and Stamford on the New Haven Line. The highest priority for through-running is the Northeast Corridor Line trains to New Brunswick and Jersey Avenue. After that, trains could either through-run all the way to Trenton, or instead on the local North Jersey Coast Line to South Amboy. We envision that this would be 6-8 tph at the peak, and a similar or slightly lower frequency off-peak.

This service can be implemented following the completion of Penn Station Access¹⁸⁶ and East River Tunnel rehabilitation work in 2027.¹⁸⁷ The frequency should be such that every Penn Station Access train runs through to New Jersey.

Since Penn Station Access serves dense Bronx neighborhoods relatively close to Manhattan (about 20 minutes one-way trip depending on station), the headway between trains must be short all day, at worst every 10 minutes. Trains may run as far east as New Rochelle or Stamford, depending on the service plan.

This through-service would reduce PATH crowding and have high ridership potential. The lines in question have all the necessary infrastructure, including high platforms and catenary electrification; see more detail in [Section 3B](#).



186 Penn Station Access will bring Metro-North Railroad service from the New Haven Line to Penn Station. It will increase capacity on Amtrak’s Hell Gate Line through the East Bronx and construct four new stations there. The project is expected to be complete in 2027. LIRR has reduced Penn Station service following East Side Access completion.

187 NEC Commission, *NEC Capital Investment Plan: FYs 2023-2027*, p. 200.

Phase 2

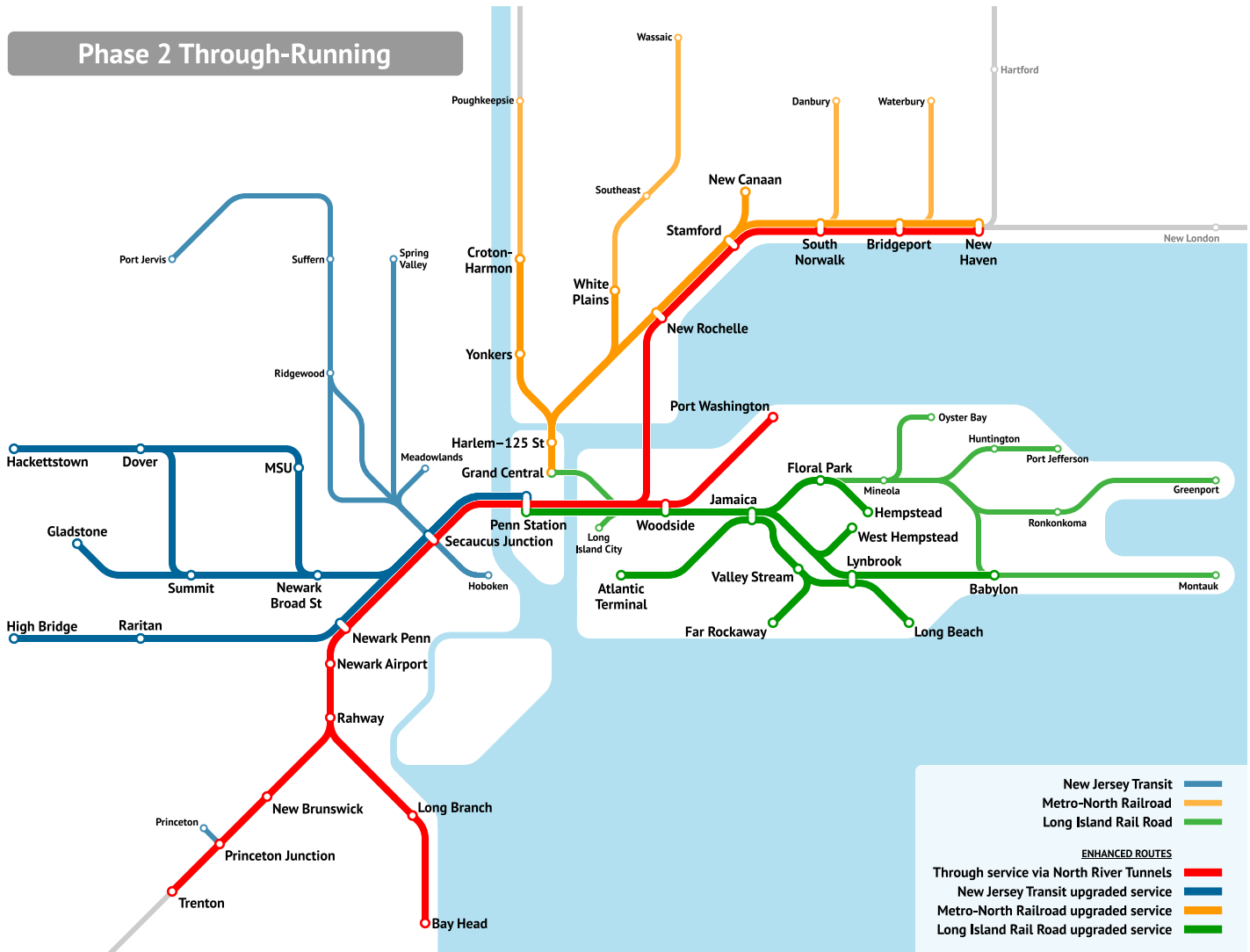
Further expansion of through-running in Phase 2 would require the completion of the HTP alongside more supporting investments on the surface, as detailed in [Section 3B](#). The exact details depend on which of those investments is completed first, but their timeline is comparable to that of HTP.

At this point, the new Hudson River Tunnels would only serve Penn Station Tracks 1–5, and the circulation improvements from Penn Reconstruction as explained in [Section 5B](#) would reduce dwell times, both of which would help increase capacity.

The service plan with HTP in place depends on which investments are in place. But in all cases, it is best to permanently pair some lines with the North River Tunnels and others with the HTP tracks; this increases system reliability, since delays on lines feeding one tunnel pair do not cascade

to lines feeding the other pair. While exact pairings require future study, most likely, the Northeast Corridor (NEC) and North Jersey Coast Lines (NJCL) should stay in the existing tunnels and the Morris and Essex Lines should use HTP. The Raritan Valley Line (RVL) is easier to keep in the NRT with the Northeast Corridor, but could instead divert to HTP if combined NEC, NJCL, and Amtrak traffic saturates the NRT.

East of the Hudson, the trains using the NRT can also run to the LIRR Port Washington Branch.¹⁸⁸ The Port Washington Branch is an attractive target for early through-running. It closely parallels the subway's 7 train, which is very crowded along its entire route, through areas with high latent travel demand. It serves Flushing, whose subway station was the busiest outside Manhattan pre-pandemic, and high-demand urban neighborhoods and suburbs to its east. It is isolated from the rest of the LIRR, which means that delays on it would not cascade to the rest of the system or vice versa.



188 Amtrak, New Jersey Transit, and MTA, *Penn Station Master Plan*.

Setting up such a service has some challenges. The Port Washington Branch is electrified with third rail rather than catenary, which requires buying new trainsets that can use both; thankfully, such trainsets already exist. Moreover, beyond Great Neck, the branch is single-track, and difficult to double-track; this requires adding a pocket track just east of Great Neck in addition to the one that has just been lengthened, at a cost that based on similar projects elsewhere in the region is likely to cost in the low tens of millions of dollars. On an optimistic timescale, it would take 10 years to set up this service, giving enough time to buy dual-voltage trains and add the pocket track.

Phase 3

Phase 3, breaking Tracks 1–5 out from Penn Station eastward, would finally permit all trains entering Manhattan from New Jersey to run through; we call this the Gateway extension to Grand Central, or in short Gateway extension. Dwell times would be short, and the station would no longer impose any capacity constraints. The best way to do so is to build a tunnel from Tracks 1–4 or 1–5 under 31st Street to Grand Central, which would turn the HTP into a through-running tunnel; for more detail, see [Section 4E](#) below. Adding an additional two tracks and platform under 31st Street or widening the southern two platforms could simplify construction of this project.^{189 190}

More supporting investments are needed, as detailed in [Section 3B](#), but those can be built simultaneously with the HTP proper, even before the Gateway extension opens.



189 Access to the Region's Core, "Technical Advisory Committee Meeting Highlights Thursday, November 16, 2000." Accessed October 26, 2023, https://web.archive.org/web/20020426021212/http://www.accesstotheregionscore.com/site/html/interactive/min_tac_more4.html.

190 Empire State Development, *Moy.nihan Station Development Project Environmental Assessment*. New York: 2010. https://cdn.esd.ny.gov/subsidiaries_projects/msdc/Data/NEPA/04_4%20StationPedCirculation.pdf, p. 4.4-27.



The Gateway extension to Grand Central

The Gateway extension to Grand Central is the natural conclusion of through-running at Penn Station.

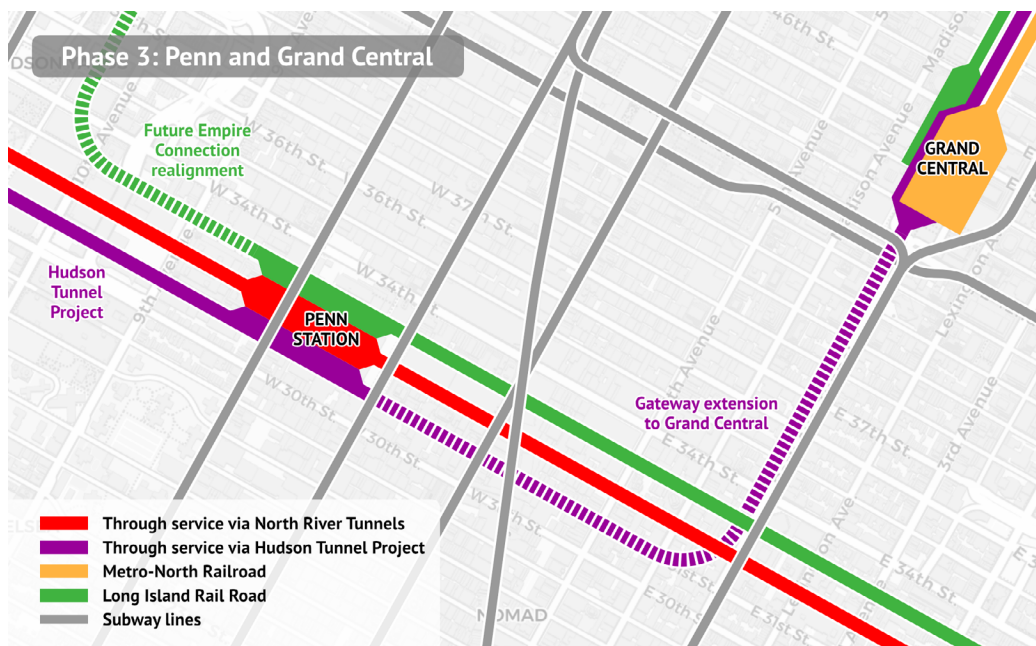
While it is not necessary to connect Penn Station with Grand Central to build a through-running system, the Gateway extension is desirable for both efficiency and passenger convenience, as detailed in [Section 2B](#). It unlocks all of the following benefits:

- The NJT trains serving the HTP tunnel and the Metro-North trains serving this new connection would stop at both Penn Station and Grand Central, providing riders with a choice between two Midtown destinations without reducing frequency to each destination.
- As planned, all trains using the HTP tunnel would have to terminate at Penn Station, limiting operational efficiency and capacity. By contrast, the Gateway extension would eliminate these constraints, allowing more trains to use the HTP and cutting dwell times at Penn Station and Grand Central.
- The connection would unlock more through-markets as depicted in [Section 2B](#). For example, residents of East Harlem, the central Bronx, and the suburbs along the Hudson and Harlem Lines would have trains to New Jersey, while people in New Jersey would have trains to Yankee Stadium, Fordham University, and jobs in White Plains. Also, many multi-leg trips that currently require a subway connection would turn into two-seat rides via Secaucus, Penn Station, or Grand Central.

When Penn Station was built in the 1900s, it was built with the possibility of connecting tracks 1–4 east. At the time, the plan was to have two more tracks across the East River, but the same infrastructure can be used today for a connection that arcs north to reach Grand Central. A version of this connector was studied 20 years ago as ARC Alternative G,¹⁹¹ but as explained in [Section 2B](#), it was imperfect as it did not fully integrate through-running. It is worthwhile to study it again in detail with better operational assumptions.

We assume that the tunnel would connect to the Grand Central Terminal lower level, where trains can continue onward to any Metro-North line. However, an alternative is to connect to Grand Central Madison providing through-service to the LIRR. Both options should be studied. There are real constructability issues for both, though we believe they are surmountable, as we detail below for the Metro-North option. Both options restrict train dimensions, but the LIRR option does so to a much greater extent, requiring customized rolling stock in the East Side Access tunnel. We also suspect a connection to Metro-North will prove superior, since through-service to Long Island is already possible, but the final choice requires more detailed study.

The tunnel itself, while short, would pass through the heart of Midtown, at a high cost, in either alignment. Thankfully, it does not require building any new stations, which are the most expensive element of construction in high-cost cities like New York.¹⁹²



191 Port Authority, MTA, and NJT, "Access to the Region's Core Major Investment Study," p. 14.

192 75% of the hard costs of Second Avenue Subway Phase 1 came from the stations, and only 25% came from the tunnels and systems. Modern tunnel-boring machines can weave between older tunnels, and it is station construction that is most difficult in such a constrained environment. See Goldwyn, Eric, Alon Levy, and Elif Ensari, Transit Costs Project, The New York Case Study. New York, 2023: https://transitcosts.com/wp-content/uploads/NewYork_Case_Study.pdf, pp. 19 and 52.

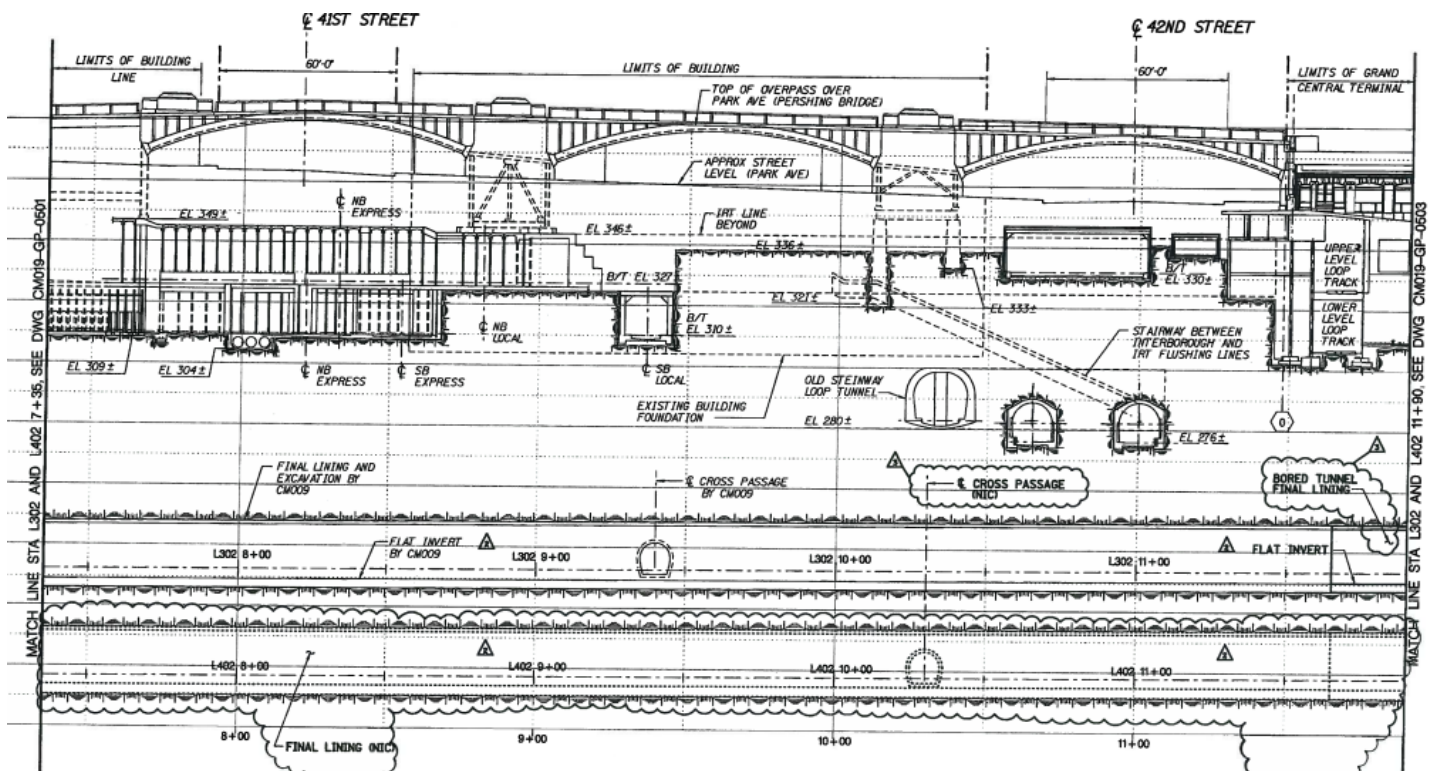


Nonetheless, there are serious concerns about modifications to Grand Central. The image below shows the blocks south of Grand Central in profile, where left is downtown and right is uptown.

There have been some concerns that the Gateway extension would require moving the southbound 6 train tunnel, annotated “SB Local” in the center of the image.¹⁹³ This is likely avoidable if the commuter rail tunnel is built with 4% grades, which modern EMUs routinely climb: in fact, the subway’s steepest grade is 5.4%,¹⁹⁴ with less powerful vehicles than European commuter rail EMUs.¹⁹⁵ The worst-performing locomotives used at Penn Station today can ascend a 2.5% grade,¹⁹⁷ enough to pass under Sixth Avenue with its required 2.45%,¹⁹⁸ but not to thread below the southbound 6 tunnel and the 7 tunnels. Thus, only EMUs should use the Gateway extension. At any rate, construction would be delicate and have little room for maneuver, rather like the Eye of the Needle of the Elizabeth Line, where there were only two feet of spare space.¹⁹⁹

In addition to the tunnel and attendant purchases of new EMUs, some further supporting investments are required. Moreover, modifications to the Grand Central Lower Level are needed, including moving some elevators that are currently located where track extensions to Penn Station would go, and potentially paving over tracks at Grand Central to widen the platforms.

Finally, it would be necessary at this point to build new flyovers in the Bronx to grade-separate Mott Haven Junction between the Hudson and Harlem Lines. Today, the lines cross at-grade, and there is such heavy traffic that it is not possible to run the Metro-North trunk line as a normal four-track railroad with two tracks in each direction. Instead, the westernmost of the four tracks is dedicated to the Hudson Line, which is cumbersome and reduces capacity. This undertaking is more difficult and in a more constrained area than Hunter Flyover discussed in [Section 3B](#), and would cost more accordingly.



193 Port Authority, MTA, and NJT, “Access to the Region’s Core Major Investment Study,” p. 15.
 194 Uday Schulz, <https://twitter.com/A320Lga/status/1311729248588181506>.
 195 The initial acceleration of subway trains is 2.5 mph/second. New York City Transit, *Subway Car Procurement for the B Division: Technical Specification, New Car Procurement Contract R34211 (R211)*. New York: 2019. <https://transitinnovation.org/wp-content/uploads/2019/12/R211%20Tech%20Spec.pdf> p. 2-9.
 196 The Stadler FLIRT’s initial acceleration is 1.3 m/s², or 2.9 mph/s. “New BLS FLIRT Unveiled,” *Railvolution*, September 10, 2020, <https://www.railvolution.net/news/new-bls-flirt-unveiled>.
 197 Future bypass tracks near Sunnyside Yard will have 2.5% grades. See Andrew Byler, <https://twitter.com/AndrewBylerPA/status/1462073815941451778>.
 198 Empire State Development, “Through-Running at Empire Station Complex: ESD Community Advisory Committee Working Group Briefing,” 2021, <https://reinventalbany.org/wp-content/uploads/2021/11/2021-05-18-Through-Running-Briefing-1.pdf>, p. 38.
 199 Adrian St. John, John Barker, Stephen Frost, and David Harris, “Crossrail project: a deep-mined station on the Elizabeth line, London,” *Proceedings of the Institution of Civil Engineers* 170 (CE5) (2017), pp. 47–56, <https://learninglegacy.crossrail.co.uk/wp-content/uploads/2017/04/A-deep-mined-station-on-the-Elizabeth-line-London.pdf>.

Penn Station

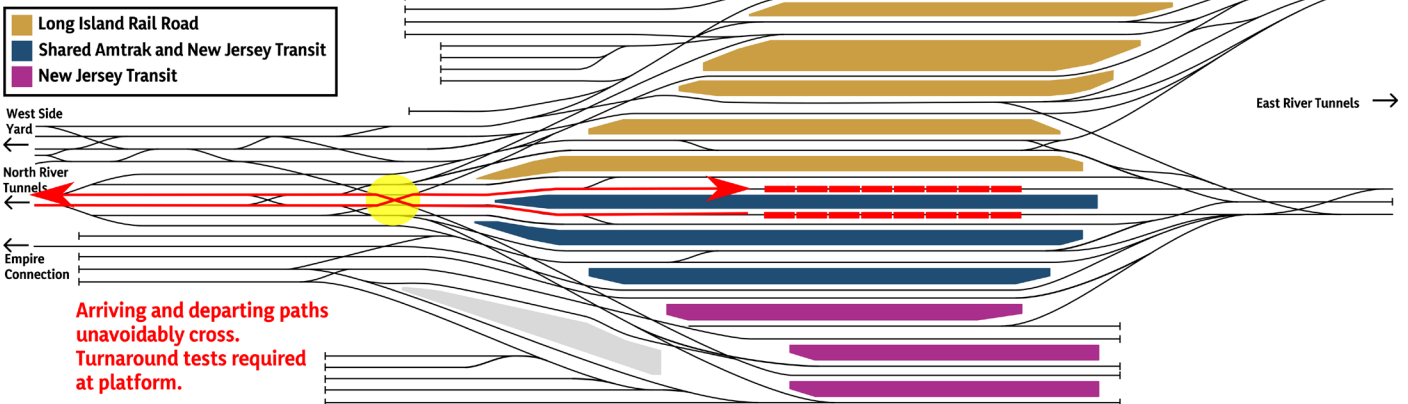
Station operations and through-running

At both track and concourse level, Penn Station is divided into three main areas. Some of its tracks allow through-service, while others do not. No commuter trains that serve Penn Station offer through-passenger service. HTP will necessarily work within this structure.

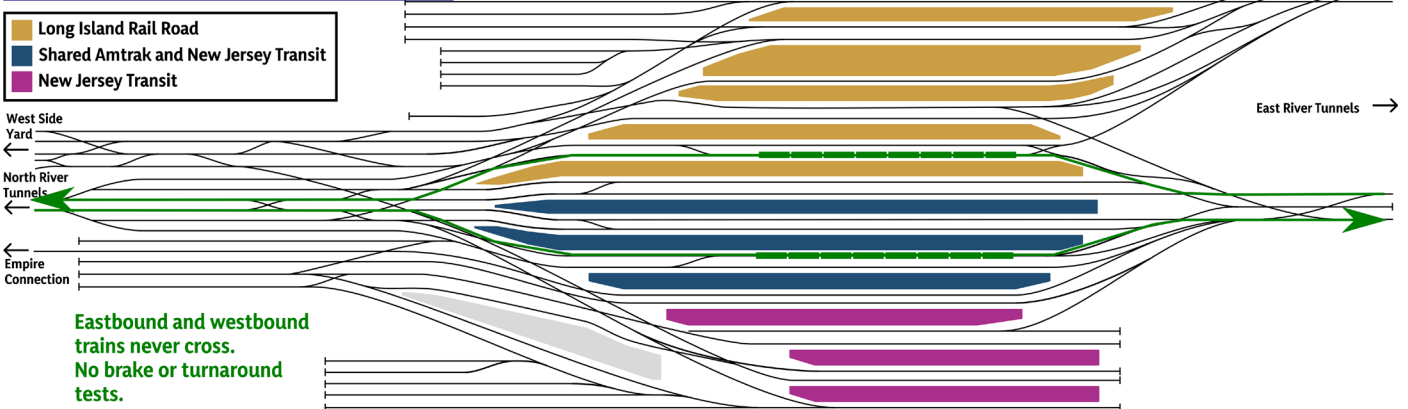
At track level, Penn Station has three operational zones, all of which overlap to some degree. The LIRR has exclusive use of the northernmost portion of the station comprising Tracks 17–21 and the northern two tunnels under the East River to Long Island. The middle portion of the station—Tracks 5–16 and the southern pair of tunnels under the East River—sees trains from multiple users (the LIRR uses 13–21, NJT uses 1–12 peak and also 13–16 off-peak, and Amtrak uses 5–12 peak and also 13–16 off-peak). The northern and middle portions already handle many trains that pass through the station to and from yards. Finally, the southernmost four tracks, Tracks 1–4, have no access eastward beyond the station, so they only handle NJT trains coming from New Jersey and returning there.

Moreover, there is no unified upstairs circulation. Each of Amtrak, LIRR, and NJT maintains its own turf at the concourse levels, with its own signage and ticketing. There are two concourse levels: the lower level is (except for one concourse) used by the LIRR and has no signage or ticketing machines for the other two, while the upper level has an Amtrak area with only Amtrak machines and a split-level NJT area with only NJT machines. Thus, passengers connecting between Long Island and New Jersey must currently buy separate tickets at separate vending machines for each journey, which wastes their time and requires mental effort at an already stressful station. Even the mobile apps are separate. In Germany, passengers can buy tickets from one operator’s app valid on other operators in the same region.

Penn Station Terminating Trains



Penn Station Through Trains



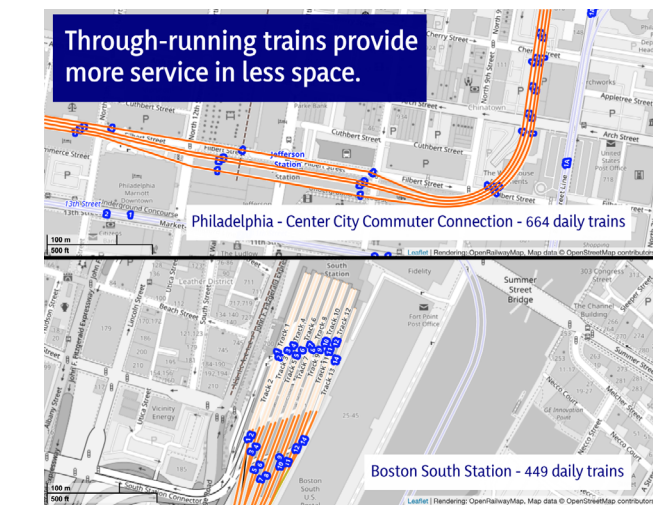
The impact of through-running

Trains today have to reverse direction across the entire track area. This introduces conflicts into the schedule, as depicted in the first image on the previous page.

Planning for a conflict-free schedule is impossible today. There are too many different train stopping patterns and too many surface conflicts at the junctions described in [Section 3B](#). As a result, train timetabling has to assume there will be some variation, forcing further delays.

To resolve this situation, first of all, the timetabling should be simplified to fewer patterns, as we outline above in [Section 2A](#). But second, every train using the middle section should run through for maximum efficiency. When a train reverses direction, crews must perform lengthy pre-departure checks and brake tests, even when there are no grade conflicts with arriving trains. Continuing in the same direction, even when one crew hands off the train to another, is much faster. Thus, through-running reduces the dwell time.

Because through-running reduces the minimum required dwell time, **a through-running station requires fewer tracks than a terminal for the same level of service.** While the 13 terminal tracks of Boston's South Station handle only 449 trains per day, the four tracks of the Center City Commuter Connection in Philadelphia handle 664.^{200 201}



200 "Capacity," *North South Rail Link*, accessed October 26, 2023, <http://www.northsouthrailink.org/capacity>.

201 "Philadelphia - Center City Commuter Connection," *North South Rail Link*, accessed October 26, 2023, <http://www.northsouthrailink.org/centercity-commuter-connection-philadelphia>.

202 Excluding the one-track Empire Connection from the west used by Amtrak trains to Albany.

203 John Porcari, "Gateway Program Overview and Update." 2017. <https://www.gatewayprogram.org/wp-content/uploads/content/dam/nec/gdc-board-items/2017-01-12-Porcari-GDC-Final.pdf>.

204 Amtrak, "Analyzing the Potential for Commuter Train Run-Through Service at New York Penn Station," p. 11.

205 "MTA Announces the Grand Opening of the East End Gateway at Penn Station—an Iconic New Entrance to the LIRR Concourse at Seventh Avenue and 33rd Street," *MTA*, December 31, 2020, <https://new.mta.info/MTA-Announces-the-Grand-Opening-of-the-East-End-Gateway-at-Penn-Station%E2%80%94an-Iconic-New-Entrance-to-the-LIRR-Concourse-at-Seventh-Avenue-and-33rd-Street>.

206 Penn Station Capacity and Utilization Analysis Phase C, pp. 68–72.

207 Federal Railroad Administration, *Northeast Corridor Intercity and Commuter Rail Service Coordination Study*. 1979. https://www.google.com/books/edition/Northeast_Corridor_Intercity_and_Commute/KA88z4a0esYC, p. 32.

208 Penn Station Capacity and Utilization Analysis Phase A, 1992, <https://drive.google.com/file/d/1Rf170C3FLOXHfWQMAMdDukSP-501uWaZ/view>, p. 2.

209 Penn Station Capacity and Utilization Analysis Phase B, 1992, https://drive.google.com/file/d/1VUstHGPyP2rZEkiXOfF_-5q5wCcTdbn3/view, p. 49.

210 Empire State Development, *Empire Station Complex Appendix A*, p. A-33.

Changes after the Hudson Tunnel Project opens

After the HTP is complete, the station will have four approach tracks from the east and four from the west,²⁰² of which only two on each side can through-run. The expected capacity of the HTP tunnel is 24 tph, in addition to 24 tph in the existing NRT.²⁰³

To ensure both high capacity and faster trips for through-passengers, it is important to control the dwell time. Trains at Penn Station currently have minimum authorized dwells as long as 18–22 minutes. However, in 2014, interagency working group Tri-Venture agreed that 12-minute dwells are possible with through-running.²⁰⁴ It should be possible to go lower: the limiting factor is egress from the platform to the concourse, and the analysis leading to this conclusion did not account for the additional escalators, staircases, and concourse space that the Moynihan Station project has since added.²⁰⁵ An assessment from 1992 assumed 10-minute dwell times in regular service.

Once HTP is complete, the three operational zones of Penn Station can be made fully distinct. Even though no through-running would be possible through the HTP tunnel, trains would cross fewer tracks as they reverse, reducing the time it takes to reverse direction and increasing reliability.^{206 207 208 209 210} Right now, NJT believes that tracks 1–5 can only turn seven trains per hour, because trains that are returning to New Jersey may conflict with trains entering from New Jersey on higher-number tracks; with the station simplified, tracks 1–5 could turn many more trains.

It bears repeating that every transfer converted to a through trip by through-running service simplifies operations. While a 10-minute dwell is enough to guarantee sufficient capacity, it still makes trips through Penn Station markedly less convenient. Very busy central stations in global exemplar regions such as Japan and many European countries support platform level operations that are almost as quick as at their outlying stations. This happens even with much heavier passenger flows, because these countries design their stations at all levels—platforms, concourses, and the connections between—to maximize throughput and efficiency.

Penn Reconstruction and further improvements

A yet-unfunded component of the Gateway Program is the \$7 billion Penn Reconstruction project. The goal of Penn Reconstruction is to rebuild the concourses and add more access points to the platforms, without disturbing either the track level below or buildings above like Madison Square Garden.

The vertical circulation to the tracks includes 29 new staircases and escalators to platforms, and the replacement of narrow switchback stairs with wider, straight stairs.²¹¹ The additional access points would bring all platforms into compliance with the fire safety standards of NFPA 130, which require enough circulation capacity to evacuate an entire platform in four minutes.²¹² Currently, only two platforms meet the standard, the others having been grandfathered.²¹³

Penn Reconstruction would also significantly widen concourses and unify all circulation on the same level, currently the lower concourse. The upper concourse would be reduced, eliminating the Amtrak rotunda level and the NJT split-level concourse, leaving the remaining concourse with better passenger circulation. Effectively, this project would eliminate the scramble passengers currently face, in which they may be at the wrong part of the station for the train they would like to take.

Finally, the project would add mid-block entrances on 31st and 33rd Streets. The project would reduce the preference for exits at 7th Avenue,^{214 215} instead encouraging more even use of the station.

All of these items are useful for improving Penn Station. However, many improvements above the platform level do not serve operational ambitions. Improving circulation on the concourse level is a welcome change from the current state of Penn Station, and permitting a reduction in the dwell time would significantly speed up through-trips. The one thing that is indispensable is adding access points to the NJT platforms, which have fewer escalators and staircases than the LIRR platforms.

211 Amtrak, New Jersey Transit, and MTA, *Penn Station Master Plan*, p. 29.

212 More precisely, NFPA 130 specifies that platforms must have enough throughput to evacuate all passengers in four minutes under worst-case conditions, and that the farthest-away passengers must be to reach safety in six minutes. See NFPA, “Technical Committee on NFPA 130 Fixed Guideway Transit & Passenger Rail Systems.” 2011. https://www.nfpa.org/assets/files/aboutthecodes/130/fkt-aaa_ropagenda_01-12.pdf, §5.3.

213 Empire State Development, “Empire Station Complex: Community Advisory Committee Working Group,” <https://esd.ny.gov/sites/default/files/CACWG-Meeting-4-Minutes-05-18-21.pdf>, p. 12.

214 Amtrak, New Jersey Transit, and MTA, *Penn Station Master Plan*, p. 13.

215 Empire State Development, *Moynihan Station Development Project Section 13: Station Circulation*, https://cdn.esd.ny.gov/subsidiaries_projects/msdc/Data/MSTM/13%20Station%20Circ.pdf, p. 79.

216 Nolan Hicks, “Penn Station expansion could balloon beyond single block, hit whopping \$16.7B, new plans reveal,” *New York Post*, September 19, 2023, <https://nypost.com/2023/09/19/penn-station-expansion-could-balloon-beyond-single-block-hit-whopping-16-7b-new-plans-reveal/>.

217 Ibid.

218 Empire State Development, “Empire Station Complex Project Final Scope of Work for the Preparation of an Environmental Impact Statement.” 2020. <https://esd.ny.gov/sites/default/files/Empire-Station-Complex-Final-Scope-of-Work.pdf>, p. 4.

219 Empire State Development, “Letter of Mutual Agreement: Pennsylvania Station Area Civic and Land Use Improvement Project.” 2022. <https://esd.ny.gov/sites/default/files/State-City-Penn-Letter-of-Mutual-Agreement-Signed-Final-071822.pdf>, p. iii.

Why Penn Expansion does not work

Adding more tracks and platforms would be extremely costly and provide no benefits. Therefore, Penn Expansion should be canceled.

The largest component of the Gateway Program by cost may not be the HTP, but a project to expand Penn Station to an entire Manhattan block to its south, called Penn Station South or Penn Expansion, at the current cost of \$17 billion.²¹⁶

Penn Expansion would create a new terminal that trains could only reach from New Jersey, by demolishing the block south of Penn Station, commonly referred to as Block 780. The layout of the project is in flux: the initial plan called for eight to nine tracks on a single level,^{217 218} but further work has led to modifications such that the agencies are now considering various two-level station layouts containing between nine and 12 tracks.²¹⁹

Through-running trains at Penn Station through the center of the station, and increasing the number of trains that turn around on Tracks 1 to 5, would allow for a similar increase in cross-Hudson capacity. Moreover, it comes with benefits that expansion does not provide—namely, through-service with all the amenities explained in Sections [2B](#) and [2C](#).

At the same time, Penn Expansion is also not sufficient for all this new service on its own, because extensive surface work as documented in [Section 3B](#) is required to boost the capacity of the branches so that they could collectively feed 24 trains per hour through the tunnel. The current system has to contend with numerous flat junctions at locations such as Hunter Interlocking in Newark, numerous low platforms that add uncertainty to scheduling, insufficient signal capacity on many lines, and antiquated and insufficient maintenance facilities. All of those surface bottlenecks can be relieved with capital spending in the tens to hundreds of millions of dollars each, but this capital spending competes for scarce dollars with Penn Expansion. At best, building Penn Expansion now is equivalent to furnishing a kitchen and upstairs bedroom when the house’s foundation has not yet even been laid.



In effect, Penn Expansion is a \$17 billion project which would fail to accomplish its singular goal—increasing capacity, and suck the oxygen out of the room making actual increases in capacity harder to fund. We strongly urge that **Penn Expansion should be deprioritized or even canceled**, as it would be a massive expense of resources that may not even provide new capacity unless a number of contingent projects advance.



Long-term Improvements

Would through-running require multiple stations?

Through-running would not require multiple center city stations to start, but future service could benefit significantly from them. There are multiple possibilities to consider.

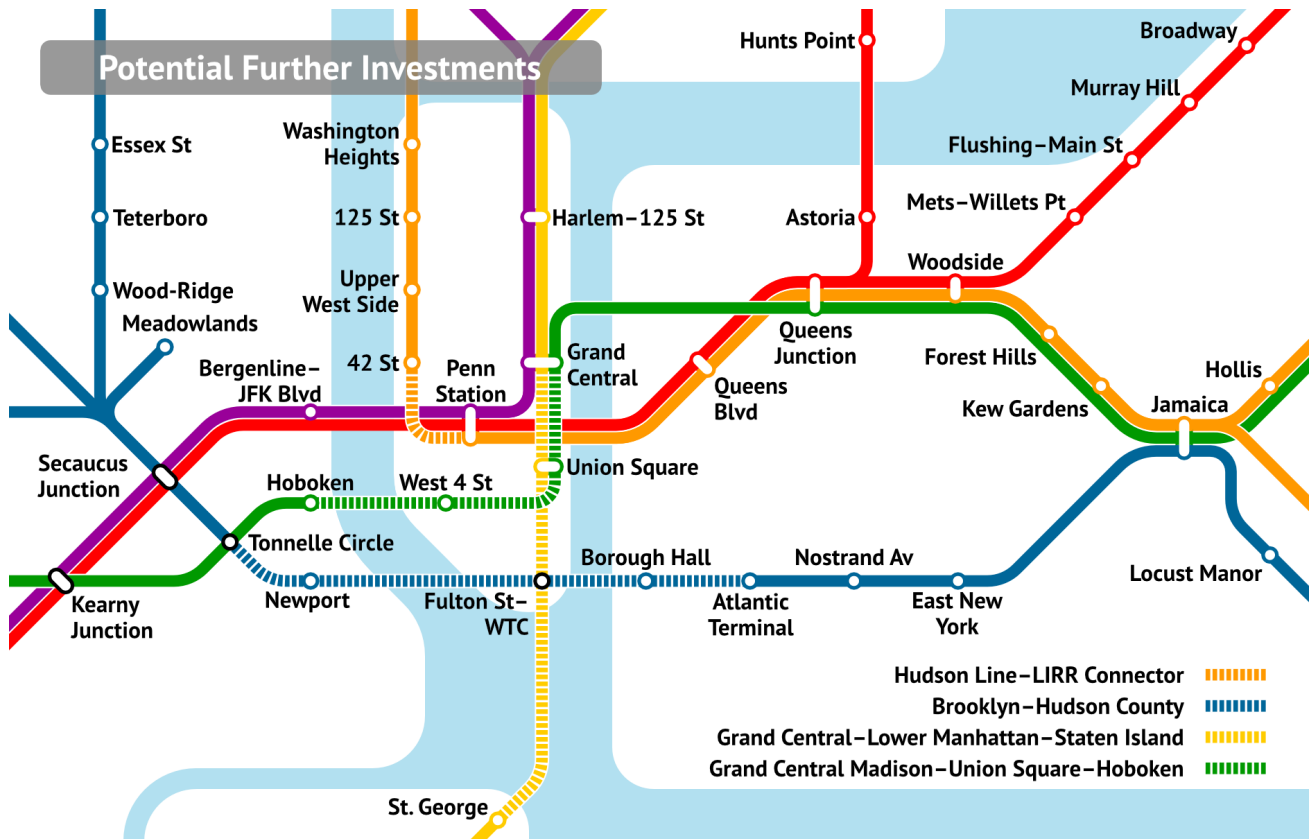
New York can and should start through-running at Penn Station without adding city center stations, as we propose above. While most cities' through-running rail systems have more than one station in their cities' central areas, not all do. Stockholm only has one city center station, plus two more in near-center residential areas. In 2019, the central station handled 16 peak trains per hour on four tracks and two platforms and accommodated 65,400 daily boardings,²²⁰ which is nowhere near capacity.

Nevertheless, having multiple city stations, while not *obligatory* for a through-running network, is certainly *very useful*. Even in Stockholm, a monocentric region,²²¹ the two near-center stations together have almost as many passengers as the central station. In London, the Elizabeth Line

with its six central stations has propelled UK rail travel volumes above pre-pandemic totals.²²² Thus, New York should both identify stations and future sites on existing lines that could be used as near-center nodes, and connect rail terminals to one another as far as possible. The demonstrated utility of multiple centrally located stations motivates our call for the Gateway extension to Grand Central as part of future through-running (Phase 3 of the plan, in [Section 4D](#)).

The most similar peers to New York have seen their commuter rail ridership skyrocket after the opening of through-running operations, such as the RER A in Paris or Thameslink in London; thus creating demand for further through-running tunnels. We expect New York to have the same success; thus, it should plan for future lines now. The most important of those is the Gateway extension, but there are others.

The exact alignments depicted on the diagram below matter less than the design principles, including both infill stations depicted on existing lines and new lines.



220 SL, "Fakta om SL och länet 2019." Stockholm: 2019, https://miljobarometern.stockholm.se/content/Trafikrelaterat/sl_och_regionen_2019.pdf, p. 52.

221 Panu Söderström, Harry Schulman and Mika Ristimäki, "Urban Form in the Helsinki and Stockholm City Regions: Development of Pedestrian, Public Transport and Car Zones," *Reports of the Finnish Environment Institute* 16 (2015), <https://core.ac.uk/download/pdf/33735222.pdf>, pp. 47–53.

222 Lydall, "Passenger numbers on Elizabeth line soar by 41 per cent in three months."

Hudson Line–LIRR connector

The planning for Penn Station Access included a future phase, dubbed Penn Station Access West, that would connect the Hudson Line to the station via the alignment used by Amtrak’s Empire Service to Upstate New York, called the Empire Connection. Through-running makes this future phase a stronger proposition, as there are thousands of jobs in Yonkers and Tarrytown and recreation destinations in Sleepy Hollow and Poughkeepsie.

The Empire Connection currently loops under the Penn Station side of the approach to the North River Tunnels and connects the Empire Corridor to southern tracks via a single-track alignment; rerouting it to Tracks 17–21 via a short new double-track tunnel would allow through-running from the LIRR to the Hudson Line. In current plans, the main benefit is to permit riders on Hudson Line suburbs to access Penn Station. However, with realignment and through-running, much more is achievable.

Most importantly, at several locations along the Empire Connection, the built-up area of Manhattan reaches as far as the tracks. Provided the line gets equipped with Manhattan infill stations, it would make trips like Jackson Heights or Sunnyside to the Upper West Side, Inwood, and Yonkers easier. Previous plans considered an infill station at West 125th Street. Several more locations are viable:

West 42nd Street, within walking distance of Times Square; the 10th Avenue Station once considered for the 7 extension is being considered in the Twenty-Year Needs Assessment,²²³ and they would connect here.

- West 72nd Street on the Upper West Side.
- 155th Street, where there is dense urban development right next to the park.
- 168th Street for the Columbia University Irving Medical Center, with new pedestrian tunnels across the Henry Hudson Parkway.
- Dyckman Street, a short walk to Inwood’s two subway stations bearing the same name as well as to recreation at the Cloisters and Inwood Hill Park.

Since LIRR and Metro-North trains can already use the third rail on both the entire LIRR and the Hudson Line, installing third rail along the Empire Corridor would be sufficient to unlock through-running.

Further through-running tunnels

The three-line system outlined above, comprising NRT–Northeast Corridor, HTP–Grand Central (Gateway extension), and Hudson-LIRR through-tunnels, has good coverage of Midtown, the most important destination in Manhattan. However, it has the following drawbacks:

- Some lines would remain stub-ends, including lines terminating at Hoboken or at Atlantic Terminal in Downtown Brooklyn, and some lines to Grand Central.
- There is no Lower Manhattan coverage.
- There is no coverage in Brooklyn except from Long Island, even though a large share of through-Manhattan commuters today work in Brooklyn.

All of these problems can be fixed through the construction of additional tunnels, with multiple stations in and near the core. Unlike Penn Station and Grand Central, Atlantic Terminal and Hoboken are far from nearly all riders’ destinations, so introduction of service through Manhattan stands to induce a particularly large ridership increase.

The map above depicts one such possible network. The cost of such a system would be high, but the ridership would be high as well; we expect the initial through-running system to succeed and encourage the construction of more lines as we detail below, in the same way the success of Thameslink drove the United Kingdom to build Crossrail.

Brooklyn–Hudson County

Under any through-running paradigm, much LIRR service would be going to Downtown Brooklyn; the easiest lines to connect there are those using the Atlantic Branch today, that is, the Far Rockaway and Long Beach Branches. Similarly, on the New Jersey side, there is no convenient way to connect the Main, Bergen County, and Pascack Valley Lines, inherited from the Erie Railroad, to Penn Station.²²⁴ A line connecting the Hudson County waterfront and Brooklyn would pass through Lower Manhattan, with about five total miles of new double-track tunnel.

One section of this project was studied immediately after the 9/11 attacks: a tunnel from Atlantic Terminal to Lower Manhattan, aiming to revitalize Lower Manhattan after the destruction of the World Trade Center.²²⁵ However, not much came of those studies, nor was there any through-running component.

On the New Jersey side, the tunnel could serve Hoboken, where trains on the Erie lines terminate today, or it could

²²³ MTA Capital Construction, *MTA Twenty-Year Capital Needs Assessment 2015-2034*, October 2023, accessed October 26, 2023, <https://new.mta.info/20YN>.

²²⁴ One element sometimes included in the Gateway program is the Bergen Loop, which would connect the Erie lines to Penn Station via a loop southwest of Secaucus. However, the loop would be awkward to operate, as the trains would pass Secaucus twice, once on the Erie lines and once again on the Northeast Corridor.

²²⁵ “Lower Manhattan Airport and Commuter Access Alternatives Analysis.” Lower Manhattan Development Corporation: 2004. http://www.renewnyc.com/plandesdev/transportation/pdf/Final_Report.pdf.



serve a new station in Jersey City. The Erie Railroad historically terminated at Pavonia/Newport; there is still a four-track trench connecting to this area, the Bergen Arches. Multiple reactivation proposals, including local transit and a bike path, exist. Any riverfront Hudson County station would need to be built deep underground regardless of location, in order to be able to dive under the Hudson. For that reason, multiple locations should be investigated, including Hoboken, Pavonia/Newport, and Exchange Place.

There would also need to be additional work on the Erie lines, which are currently unelectrified and have many low platforms. The investment would have to include 140 miles of electrification (of which almost half are on the Port Jervis Line) and 33 high platforms, at a cost of about \$1.5 billion. The single-track Pascack Valley Line would also have to be double-tracked; thankfully, the Main and Bergen County Lines are already double-track, and the Port Jervis Line has so little demand it can run at lower frequency and remain mostly single-track.

This tunnel should have more stations than just Lower Manhattan. Even beyond Atlantic Terminal, Lower Manhattan, and the Hudson County waterfront, the urban context and job density warrants further stations. Brooklyn Borough Hall is the most attractive location, as it is closer to Downtown Brooklyn jobs than Atlantic Terminal. Borough Hall would also offer connections to subway lines that do not serve Atlantic Terminal. A second Manhattan station may also be desirable, if the line goes to Hoboken rather than Jersey City, because then the tunnel would travel farther up Manhattan before turning west.

The Lower Manhattan station would be an expensive undertaking. It should be large enough for four tracks on two levels, two for this tunnel and two for the tunnel we detail below linking Grand Central and Staten Island. It would have to be deep-mined beneath all the subway stations of Lower Manhattan. However, the overall size of the dig need not be much more than that of a station on the Second Avenue Subway. All three of the station boxes on that line are oversized to accommodate crew rooms that older stations do without.²²⁶ Even in such a constrained location, a deep-mined two-level station could be built for \$1 billion, similar to the inflation-adjusted cost of 72nd Street on the Q train.

The benefits of this tunnel would be large. Suburban residents along the Erie lines would gain direct access to Lower Manhattan aboard faster, more frequent, and more reliable trains than they have to Secaucus today. Travelers bound for Lower Manhattan and Downtown Brooklyn from elsewhere in New Jersey would be able to make much faster trips by transferring at Secaucus than today with the subway connection at Penn Station. Urban residents would also gain a line that, within the city and innermost parts of New Jersey, functions as an express subway, offering faster trip times than the subway does today.

Origin	Destination	Route today	Trip time today	Future trip time ²²⁷
Rosedale	Fulton Street	LIRR, 4/5	0:49	0:33
Elizabeth	Atlantic Terminal	NJT, 2/3	0:56	0:36
Paterson	Fulton Street/WTC	NJT, PATH	0:57	0:31 ²²⁸
East New York	Newark	LIRR, 4/5, PATH	0:57	0:32

226 The 72nd Street station box is 1,305 feet long, more than twice the length of the train; the norm in comparison cases is that the box is 5-15% longer. Moreover, following American tradition, 72nd Street has a full-length mezzanine; however, the fire code, NFPA 130, is also used in Spain and Turkey, where it is accommodated with smaller mezzanines. If it is possible to find slant digs for escalator shafts from the platform ends to street level, such as at the southern end of City Hall Park and at Zuccotti Park, then no mezzanine is needed. It is thus possible to build a four-track, two-level station for 12-car trains in the same approximate footprint as 72nd Street. Transit Costs Project, The New York Case Study, pp. 52–58.

227 Both the present-day and future trip times exclude wait times, but do include time spent walking between platforms at transfer stations, which is deemed to be three minutes at Secaucus and Hoboken and four at commuter rail-subway and subway-PATH transfers.

228 The reduction in trip time is partly because of through-running but also because of assumed electrification and high platforms on the Main Line, which we impute to reduce trip times by 14 minutes (two per station stop), regardless of through-running.



Grand Central–Lower Manhattan

The Gateway extension would pair two of the four Metro-North tracks serving Grand Central with trains to New Jersey. But two tracks would be left unpaired. It is desirable to send them further south since the Lexington Avenue Line remains overcrowded even after the opening of Phase 1 of the Second Avenue Subway. Passengers getting off Metro-North at Grand Central overload the 4 and 5 trains.²²⁹ A tunnel of 3.6 miles would enable the system to act as a super-express Lexington Avenue Line.

A north-south line has been on some through-running proposals in the past. The Regional Plan Association included it in its Fourth Regional Plan,²³⁰ and another version in its Third Regional Plan in the 1990s,²³¹ and it was briefly studied as part of the Lower Manhattan Access Study in the early 2000s.²³² Some versions have a stop at 34th Street and a linked infill station on the LIRR. While this option should be investigated seriously, it has limited value absent a station on the eastern approach to Penn Station, which would be on a slope and thus difficult to build. In any case, this stop would be only a half mile from either Penn Station or Grand Central. Most likely, trains should only stop at Grand Central, Union Square, and Lower Manhattan.

This line is by far the most valuable to city residents, rather than suburbanites. About 55,000 people from the Bronx work near Union Square or Lower Manhattan, and another 62,000 work in Brooklyn and would benefit from a cross-platform transfer to the through-tunnel to Brooklyn at the Lower Manhattan station.

Grand Central Madison–Union Square–Hoboken

To complete the through-running system, the trains of East Side Access should continue beyond Grand Central Madison. One way to do so, as we mention above, is to connect them with Penn Station. However, while this option must be studied seriously, we suspect that a connection between Penn Station and Grand Central's lower level for Metro-North through-running, as discussed in [Section 4E](#), is better.

Regardless, the track pair that goes to neither Penn Station nor Lower Manhattan should get its own through-tunnel to Union Square connecting to the Morris and Essex Lines via Hoboken, and Union Square should have cross-platform transfers. This tunnel would relieve the uptown PATH tubes, Queens Boulevard Line, and Lexington Avenue Line. Better LIRR service would relieve the Queens Boulevard Line to some extent regardless, but the biggest destinations on the overcrowded E train are not near Penn Station; 53rd Street/Lexington Avenue is an overcrowded transfer point for passengers bound for East Side destinations, and this tunnel would permit them to stay on a more spacious commuter train.

From New Jersey, riders would now have frequent one-seat rides to Union Square, NYU, and Greenwich Village. Eliminating terminal operations at Hoboken would enable an increase in total Morris and Essex Lines service and its complete separation from the Northeast Corridor, simplifying schedules on both systems. NJT service would split into three systems:

Origin	Destination	Route today	Trip time today	Future trip time
Woodlawn/Nereid	Fulton Street	5	1:09	0:34
Fordham	Atlantic Terminal	4	1:03	0:32
Marble Hill	Union Square	1, 2/3, L	0:40 ²³³	0:29
Pelham Bay Park	Fulton Street	6, 4/5	0:58	0:52 ²³⁴

229 Peak crowding is south of 42nd Street even though peak employment is at 42nd Street, not 14th Street or Fulton Street. MTA, *Second Avenue Subway Final Environmental Impact Statement*. New York: 2004, <https://new.mta.info/project/second-avenue-subway-phase-2/final-eis>, p. 5B-4.

230 Regional Plan Association, "Combine three commuter rail systems into one network."

231 Regional Plan Association, *A Region at Risk: The Third Regional Plan*. February 1996. <https://rpa.org/work/reports/a-region-at-risk-the-third-regional-plan>.

232 MTA, "Lower Manhattan Access Major Investment Study/Draft Environmental Impact Study: Information," March 1999, <http://web.archive.org/web/20000915213210/http://www.mta.nyc.ny.us/planning/lmas/pdf/bulletin3.pdf>.

233 The cross-platform transfer between the 1 and the 2 is assumed instantaneous, but the transfer to the L requires four minutes of walking between platforms under 14th Street.

234 This includes a 25-minute Bx12 trip between Pelham Bay Park and Fordham.



- The Erie lines, connecting to Lower Manhattan and Brooklyn.
- The Morris and Essex Lines (including the Montclair-Boonton Line), connecting to Hoboken and Grand Central.
- The Northeast Corridor (NEC), North Jersey Coast Line (NJCL), and Raritan Valley Line (RVL), connecting to both the NRT and HTP, with different branches paired with different tunnels.

The last system, comprising the Northeast Corridor, would be somewhat less complex than today. The other two would just be three branches feeding a trunk; more complex commuter rail networks than those, such as the Munich S-Bahn and Copenhagen S-Tog, feed 30 tph per direction through their central sections at rush hour. Trips to Penn Station, as well as the NEC, NJCL, and RVL, could still be made via a new transfer station at Kearny.

All three systems could potentially take new branches, under discussion for reactivation. For example, the Morris and Essex system would take any trains using the Lackawanna Cut-Off, running toward the Delaware Water Gap, and the Northeast Corridor and branches could take trains on the Monmouth-Ocean-Middlesex Line, running parallel to the North Jersey Coast Line but farther inland.

Staten Island–Lower Manhattan

The above through-running tunnels would give all suburban counties in the region good service to Manhattan and near-Manhattan job centers such as Downtown Brooklyn, Long Island City, Newark, and Jersey City. However, they would leave Staten Island uncovered, offering little relief to residents who endure some of the longest commutes in the United States.²³⁵ Staten Island would benefit greatly from its own connection to the commuter rail system.

Such a connection requires a tunnel from the terminal of the Staten Island Railway at St. George to Manhattan spanning five miles under New York Harbor. The tunnel’s alignment must be studied carefully: it may run directly from St. George to Lower Manhattan, or it may prove beneficial to run indirectly, such as via Downtown Brooklyn or via Governors Island. From there, it would link to the Lower Manhattan–Grand Central tunnel described above.

The benefits to Staten Island would be massive. The distance from Fulton Street to St. George nonstop is about 5.7 miles. If trains run 60 mph under the Harbor, it would take 7 minutes to go between the two stations, compared with 32 minutes via ferry today, a 25-minute time saving. Passengers getting on at a Staten Island Railway station would save even more time through avoided transfers. In 2019, Staten Island had 59,778 residents who worked in Manhattan, 40,994 who worked in Brooklyn, 13,971 in Queens, and 2,665 in Westchester; 30,674 people work in Staten Island and live in those four counties, half of whom are in Brooklyn.²³⁶ Practically all of those 150,000 commuters would use the tunnel from the moment it opened. More would follow as the Island would be better integrated into the city economy and as people would use it for non-work trips as well.

The high benefits of this tunnel balance out its considerable price tag. The geology and archeology of the Harbor are likely to impose challenges, but more difficult through-running tunnels have been built, for example in Istanbul.²³⁷ Thus, we recommend the tunnel be studied early. While there is no hope of construction beginning before the 2030s, early design work would inform future planning for the rest of the system.

Origin	Destination	Route today	Trip time today	Future trip time
St. George	Fulton Street	Ferry, 4/5	0:32	0:07
St. George	Grand Central	Ferry, 4/5	0:43	0:14
Grasmere	Borough Hall	S79, R	0:57	0:21 ²³⁸
Grasmere	Queens Plaza	S79, R, N, R	1:22	0:36 ²³⁹

235 Overflow Data, “What is the average commute time in each U.S. county?”

236 All data comes from the LEHD and is as of 2019.

237 Istanbul has built the Marmaray tunnel connecting its European and Asian sides, at low cost considering the project’s complexity, comprising 8.5 miles of tunnel, partly under a dense city center with more than 2,000 years of archeology, partly under a mile-wide, earthquake-prone channel up to 190 feet below sea level. Ensari, Elif, Eric Goldwyn, and Alon Levy, Transit Costs Project. The Istanbul Case. New York, 2022: https://transitcosts.com/wp-content/uploads/Istanbul_Case_Study.pdf, pp. 56–78.

238 This includes a one-minute transfer at Fulton Street-WTC.

239 This includes a connection to the 7 train at Grand Central.

Conclusion

Right now is a pivotal moment for Greater New York. Between the Gateway Program and BIL funding, the region is gearing up to spend billions of dollars on its commuter rail system. This has the potential to be a major boon: few things will affect the competitiveness and livability of the region more than enabling quick, easy transportation across the entire Tri-State Area. Big public investments, however, bring with them equally big questions about what we want the future to look like. Will we invest in regional transportation infrastructure that locks in today's outdated, exclusionary status quo? Or will we follow the successful examples of so many cities around the world and commit to a modernized commuter rail system that can truly meet the needs of metropolitan New York in the 21st century?

Commuter rail in New York still assumes the logic of the 1950s: that its purpose is solely to move white collar commuters from bedroom suburbs to 9-to-5 office jobs in Manhattan. While those commuters remain an important market to serve, the world has changed in the intervening decades. Commuting now looks very different, often taking place at different times and on different days. Not all commuters are between suburbs and Manhattan—and not all suburban commutes are white-collar. More than that, even, the vast majority of transport trips are not about commuting. As we enter an ever more urban, interconnected world, we need to build systems that can support the varied types of trips that people actually take—trips that are as varied as the people in the region themselves. For both transportation operators and regional leaders, these are no longer philosophical questions. As peer cities across the globe show, when transportation meets people's travel needs, they will ride it. Right now, the agencies in the region are leaving a huge number of riders on the table.

When it comes to building a 21st-century transit network, however, New York is lucky: it already has the bones of a modern regional transportation network. Unlike most other cities, which needed to build expensive center city tunnels to connect their commuter rail networks, New York already has this type of invaluable connection at Penn Station. While we eventually envision adding new connections across Manhattan, the region essentially has the ability to start running truly modern commuter service tomorrow. Doing so would not only save billions of dollars on unnecessary projects like Penn Expansion, but also serve riders, giving them more and better transportation options that also just so happen to make full use of our existing transportation infrastructure.

All New York needs to create a truly modern commuter rail system right now is political will. This can start small, with frequency improvements and the comparatively inexpensive infrastructure upgrades required to support them.

The linchpin of any commuter rail modernization plan for the New York region, however, must be through-running. Through-running enables far more service to run far more efficiently on our existing and under-construction infrastructure. It will not only simplify a host of regional trips that are incredibly difficult today, it will also support the large increases in ridership that upgraded frequency and regional connectivity will bring. And while through-running does require coordination and cooperation between different political entities, this can be achieved in straightforward ways that maintain existing agency structures while making the final product transparent to riders.

At the most fundamental level, large cities are made up of millions of people living their lives—working, socializing, getting an education, enjoying recreation, and so on—all in the same proximity, both together and apart. A massive metropolis can only work well when its residents can quickly and easily get to and between the places they need and want to go. People being able to easily get around is a fundamental ingredient for economic, culturally, and social growth. Greater New York's future depends on making smart decisions now, lest it begin to be overtaken by other places across the country and the globe. New York's future relies on making regional transit—that is, on making commuter rail—work.

Now is the moment for Greater New York to modernize commuter rail, and build the regional transportation system that it both needs and deserves.

