The Missing Mile: Evaluating the Economic Costs and Benefits of the North South Rail Link and Regional Rail Integration

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The original proposal for a rail link connecting North and South Stations dates to 1912. In the century since, many people across the region have examined the possibility and devoted years of effort to understanding its potential costs and benefits. This study is part of that long tradition.

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[1] North South Rail Link Working Group, https://www.northsouthraillink.org/supporters.

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Abstract

The North South Rail Link (NSRL) is a proposed underground tunnel connecting Boston's North and South Stations, eliminating the one-mile gap that divides the regional rail network and prevents through running across Greater Boston and the Northeast Corridor. This study evaluates the economic case for the NSRL by estimating costs and benefits incremental to full Regional Rail implementation and by examining alternative approaches to implementation. Projected incremental benefits substantially exceed incremental costs: under the Maximum Build scenario (two tunnels, four tracks), the NSRL generates $37.6 billion in benefits against $8.0 billion in incremental costs. By replacing terminal operations with through running, the project could reduce average passenger wait times by 71 percent, more than double rail ridership, and substantially expand regional access to employment. Improved connectivity could also encourage residential development around existing stations and broaden the geographic distribution of housing demand, although these effects depend on local land-use policies. Finally, the study introduces a potential phased implementation approach in which the tunnel is built to full Regional Rail specifications and begins with a frequent, dedicated shuttle between the two stations. This could generate benefits immediately upon completion and accommodate additional lines as the system is modernized.

Executive Summary

The North South Rail Link (NSRL) is a proposed underground tunnel that would connect Boston's North and South Stations, which are currently separated by a one-mile gap. Because the rail lines do not connect, currently passengers must finish their trips by walking, biking, or transferring to a bus or subway. This specific gap is the "missing link" preventing a continuous, uninterrupted rail trip throughout Greater Boston and from Maine down the Northeast Corridor to Washington, D.C. This study examines the costs and benefits of building the tunnel by focusing on three main questions: (1) How much would it cost to build? (2) What are the total economic benefits? and (3) Can the project be implemented in a staged approach to deliver benefits as soon as possible?

The research produced seven key findings that highlight the potential impact of the tunnel. These findings and the analysis throughout this study are intended to inform further evaluation and should not be interpreted as definitive policy recommendations or prescribed approaches to implementation.

1. **The incremental economic benefits are much higher than the incremental costs.** In the most comprehensive "Maximum Build" plan, the study projects $37.6 billion in total incremental benefits compared to $8.0 billion in incremental costs.

2. **Passenger wait times would be drastically reduced.** By allowing trains to move through the city rather than stopping at dead-end terminals, the project would cut platform wait times by 71 percent. This would bring the average wait down from 34 minutes to less than 10 minutes.

3. **Rail ridership could more than double.** Unifying the network with a "one-seat ride" makes the train a much more attractive alternative to driving, which is projected to result in a massive increase in the number of people using the system.

4. **Valuable urban land would be unlocked for new use.** Building the tunnel provides a more efficient solution to the region's rail capacity problems, which we believe would make the proposed $4.7 billion South Station Expansion project unnecessary. The tunnel solution thus allows underutilized sites like Widett Circle to be turned into new housing and commercial space, potentially creating up to $7.8 billion in value.

5. **Regional access to jobs would expand significantly over time.** The link would connect people on one side of the state to job centers on the other side that are currently too hard to reach. For instance, the number of jobs reachable within a one-hour commute from the Lowell line would jump from approximately 48,000 to over 163,000.

6. **Improved rail service could spur new housing development around stations.** By significantly improving access to jobs and other destinations, the NSRL could encourage new residential development near stations and redistribute housing demand outward along the rail network, helping to flatten the price gradient between the urban core and surrounding areas. However, this will depend heavily on local zoning and permitting decisions.

7. **A phased approach could accelerate delivery of NSRL benefits**. The "Transporter" concept would entail constructing the full NSRL (either the Minimum Build or Maximum Build), and running, *at minimum*, a frequent, dedicated shuttle between South Station and North Station. It could launch immediately upon completion of the NSRL and could accommodate through running as lines electrify and as priority corridors adopt dual-mode locomotives. This offers a practical implementation pathway that could begin generating benefits well before Full Regional Rail build-out.

Introduction

Background

The North South Rail Link ("NSRL") is a proposed passenger rail tunnel that would connect the train lines feeding into North and South Stations and unify Boston's divided Commuter Rail system. The Massachusetts Bay Transportation Authority (MBTA) Commuter Rail and Amtrak lines currently terminate at North and South Stations. No rail connection exists between these two terminals (see Figure 1), resulting in a roughly 1-mile gap that passengers must navigate using other modes of transportation, such as subway, bus, bicycle, or foot. This study presents a comprehensive analysis of the benefits and costs of unifying the region's rail network.

Figure 1. Area highlighted by author shows North Station and South Station. Underlying map from Massachusetts Bay Transportation Authority, "Commuter Rail Map," March 24, 2025, https://cdn.mbta.com/sites/default/files/2025-03/2025-03-24-commuter-rail-map-v.42f.pdf.

The problem of fragmented rail terminals is common in large cities both in the United States and globally. In the nineteenth century, expansive railway networks transformed cities, but they typically terminated at the edges of the urban core due to expensive land, regulatory restrictions, and a lack of advanced tunneling technology. This resulted in either a “hubless wheel” of disconnected lines or massive central terminal stations that were highly susceptible to cascading delays and capacity bottlenecks. Although modern underground metros eventually emerged, they were built to supplement rather than replace the older rail networks. Consequently, many major cities today feature small, modern metro systems operating alongside vast, underutilized Victorian legacy railways.[2]

To maximize the potential of these disconnected legacy networks, planners have developed a highly cost-effective concept known as “through running.” This involves building a relatively short central tunnel to connect suburban lines on opposite sides of the city. Through running allows cities to leverage the massive rail infrastructure they already have, essentially building the final ten percent of a world-class transit system for a fraction of the cost of a brand-new metro.[3] Boston’s extensive Commuter Rail network and the short (one mile) gap between North and South stations make it an ideal candidate for this solution.[4]

The present study builds on a 2017 Harvard Kennedy School cost analysis that examined construction costs but did not assess economic benefits. We evaluate two build scenarios: a “Maximum Build” (four tracks and two tunnels) and a “Minimum Build” (two tracks and one tunnel). For each build scenario, we further evaluate two fleet configurations: a “Full Regional Rail” configuration, which assumes full implementation of Regional Rail — a system-wide transformation of the MBTA Commuter Rail network to fully electrified, high-frequency service with high-level platforms — and a “Transporter” configuration, which uses a limited fleet to run a frequent, dedicated shuttle between North and South Station on a stand-alone basis, without any assumed changes to the existing Commuter Rail system. This yields four configurations in total: Minimum Build with Full Regional Rail, Minimum Build with Transporter, Maximum Build with Full Regional Rail, and Maximum Build with Transporter.

[2] Benedict Springbett, “The Magic of Through Running,” *Works in Progress Magazine*, Issue 19, 2025. https://worksinprogress.co/issue/the-magic-of-through-running/.

[3] Springbett, “The Magic of Through Running.”

[4] The distance of one mile is the actual, surface-level separation between the headhouses of North Station and South Station, per the MBTA’s North South Rail Link Major Investment Study / Draft Environmental Impact Report of June 2003. Estimated tunnel lengths under the scenarios analyzed are higher due to factors such as the additional tunnel lengths required for portal approaches and connections to surface tracks, the underground routing required to navigate around existing infrastructure, and the exact locations of underground station platforms.

To the extent that Regional Rail implementation takes place over an extended time period, the Transporter configuration under either build scenario could be thought of as an early phase. The Transporter configuration is evaluated on a fully stand-alone basis, without any assumed changes to the existing Commuter Rail system. The dedicated shuttle would provide meaningful benefits immediately, and the tunnel infrastructure would support through running as Regional Rail is implemented. High-priority corridors could use dual-mode locomotives to run through the tunnel until they are fully electrified. The dedicated shuttle would eventually be eliminated and Full Regional Rail service completed for that build scenario, as and when additional capacity is needed for the network.

Total quantified benefits over a 30-year period are projected at $17.5 billion for the Minimum Build with Full Regional Rail, $0.3 billion for the Minimum Build with Transporter, $37.6 billion for the Maximum Build with Full Regional Rail, and $0.6 billion for the Maximum Build with Transporter. These figures (all in 2031 dollars) include six major categories of benefit: increased rail fare revenues to government; improved tax revenues and housing affordability from new construction on three significant underutilized sites that would be unlocked due to the NSRL; increased property tax revenues on existing properties due to transit-driven property value appreciation; social cost of carbon savings (net of foregone gas tax revenues); increases in private property values on existing properties along the Commuter Rail corridor; and reduced wait times for existing and new Commuter Rail riders. The marginal benefits of reduced wait time alone amount to $1.4 billion for the full Minimum Build and $5.6 billion for the full Maximum Build, reflecting the substantial reduction in expected platform wait times as service frequencies increase.

The benefit estimates do not fully capture several important sources of value from NSRL. In particular, it would substantially expand access to employment by providing direct, one-seat service to major job centers near South Station and Back Bay. Through running would also eliminate the need for the proposed $4.7 billion South Station Expansion project by removing the terminal capacity constraints that drive it.

Total estimated costs (again in 2031 dollars) are projected at $4.6 billion for the Minimum Build with Full Regional Rail, $3.4 billion for the Minimum Build with Transporter, $8.0 billion for the Maximum Build with Full Regional Rail, and $6.7 billion for the Maximum Build with Transporter.[5] These estimates are based on a flexible line-item model that

[5] As described in more detail in the “Cost of the North South Rail Link” section below, the key driver of the lower total costs for the scenarios with the Transporter is the significantly reduced vehicle fleet required for the Transporter scenarios. For example, the modeled total vehicle fleet for the full Maximum Build is 233 locomotives and coaches, while the modeled total vehicle fleet for the Maximum Build with Transporter is 40 locomotives and coaches.

improves on the 2017 HKS methodology by incorporating updated cost data, refined project filtering, and new parameters for tunneling method and transit modes. All estimates incorporate a conservative 50% contingency figure (versus the FTA's reference range of up to 40% for early-stage estimates).[6] Our estimates are separately validated through an updated regression analysis and a high-level cost-per-mile benchmarking against comparable projects, with all three methodologies producing consistent results.

Context

The NSRL was first discussed and planned shortly after the completion of South Station in 1900.[7] However, the two World Wars and the Great Depression made such a project difficult. Discussions revived in the 1970s and 1980s, when the initial plans for the Central Artery Project (also known as the "Big Dig") included the NSRL.[8] In 1987, President Reagan vetoed funding for the entire project. He particularly disliked the inclusion of a rail connection, and the NSRL was eventually sacrificed in the Congressional battle to overturn his veto and secure the necessary funding.

Support for the NSRL persisted, however, and in 1993 Massachusetts Governor William Weld commissioned a task force to reintroduce an NSRL into the Central Artery Project.[9] Shortly thereafter, the US Senate approved funding for an engineering and environmental study, which was conducted from 1995-2003. Despite this progress, in 2003 Massachusetts Governor Mitt Romney suspended work on exploring the NSRL further.

The 1995-2003 effort resulted in a Major Investment Study/Draft Environmental Impact Report (MIS/DEIR).[10] This study provided a detailed review of the design and cost of the NSRL. Two project designs were highlighted: a two-track option (one tunnel) and a four-

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[6] Federal Transit Administration, *Project and Construction Management Guidelines*, January 2025 update (Washington, DC: U.S. Department of Transportation, 2025), 134, https://www.transit.dot.gov/sites/fta.dot.gov/files/2025-02/Project-and-Construction-Management-Guidelines-January-2025.pdf.

[7] "Two Terminals." North South Rail Link (Citizens for the North South Rail Link), n.d. https://www.northsouthraillink.org/two-terminals/. Accessed December 2025.

[8] "Rise and Fall of Highways." North South Rail Link (Citizens for the North South Rail Link), n.d. https://www.northsouthraillink.org/rise-and-fall-of-highways/. Accessed December 2025.

[9] "Rise and Fall of Highways." North South Rail Link (Citizens for the North South Rail Link).

[10] Massachusetts Executive Office of Transportation / Central Artery Rail Link project team (VHB). North South Rail Link Major Investment Study/Draft Environmental Impact Report. June 2003. https://www.sierraclub.org/sites/default/files/sce-authors/u3922/2003-06%20NSRL%20DEIR%20Major%20Investment%20Study.PDF. Accessed December 2025.

track option (two tunnels). The designs featured varying numbers of stations and portal locations, with a range of estimated total costs.

In 2017, a Harvard Kennedy School (HKS) team conducted a new analysis of the cost of the NSRL (*Connecting the Northeast: A Cost Estimate for the North South Rail Link*).[11] The HKS team estimated rough order of magnitude[12] costs of a "Maximum Build" scenario (two tunnels, four tracks, and three stations) and a "Minimum Build" scenario (one tunnel, two tracks, and two stations), in line with the options discussed in the 2003 MIS/DEIR Report. The study found an estimated cost of $5.9 billion (2031 dollars) for the "Maximum Build" scenario and $3.8 billion (2031 dollars) for the "Minimum Build" scenario.[13] See Appendix B for further details.

The impact of the 2017 study, along with increased advocacy from civic leaders in the Boston area (including Governors Michael Dukakis and William Weld and Congressman Seth Moulton), led the Massachusetts Department of Transportation (MassDOT) to conduct a feasibility reassessment study for the NSRL. A January 2019 MassDOT study estimated costs for the two and four track options that were significantly higher than those presented in the 2003 MIS/DEIR or 2017 HKS report.[14]

Current Study

The present study builds on and advances previous work. It updates the earlier NSRL cost estimates and incorporates two new areas of analysis: (a) estimated economic benefits of NSRL and (b) an alternative and distinct new-build approach, the "Transporter," which

[11] White, Laura, Jean-Louis Rochet, Pete Mathias, Kate O'Gorman, and Linda J. Bilmes. "Connecting the Northeast: A Cost Estimate for the North South Rail Link." HKS Faculty Research Working Paper Series RWP17-032, Harvard Kennedy School, August 2017. https://www.hks.harvard.edu/publications/connecting-northeast-cost-estimate-north-south-rail-link.

[12] Federal Transit Administration. "Capital Cost Database." U.S. Department of Transportation, updated October 2024, https://www.transit.dot.gov/capital-cost-database ("...the database should be used for preparing conceptual, ballpark estimates for conceptual projects or for better understanding the unique characteristics of a cost estimate by comparing the costs to historical experiences."); Federal Transit Administration, Capital Cost Database Quick Guide, June 2023.

[13] The 2017 team developed cost estimates for these builds because they provide a full plausible range of likely project costs, based on the estimates in the 2003 NSRL Project Major Investment Study (MIS)/Draft Environmental Impact Report (DEIR).

[14] Massachusetts Department of Transportation, "North South Rail Link Feasibility Reassessment Study," Mass.gov, January 2019. https://www.mass.gov/lists/north-south-rail-link-feasibility-reassessment-study-documents#north-south-rail-link-feasibility-reassessment---report-. (Accessed December 2025.)

could be applicable under either the Maximum Build or Minimum Build Scenario. All scenarios are summarized in Table 1 below.[15]

Table 1. Key build features

Build Scenario	**Minimum Build**		**Maximum Build**	
	Vehicle Fleet Composition		**Vehicle Fleet Composition**	
	Full Regional Rail	***Transporter Only***	***Full Regional Rail***	***Transporter Only***
Number of Tracks	Two	Two	Four	Four
Number of Tunnels	One	One	Two	Two
Corridor Length (miles)	2.788	2.788	2.958	2.958
Power Distribution	Catenary	Catenary	Catenary	Catenary
Assumed Regional Rail?	Yes	No	Yes	No
Dual-Mode Locomotives	85	4	85	8
Coaches	111	16	148	32

Our cost estimates are based on a revised and updated financial model and regression analysis that incorporate additional datapoints, including data that were unavailable in 2017. We have incorporated new parameters for the percentage of underground tunneling required (e.g., limited tunneling versus extensive tunneling) and the transit mode of comparable projects (e.g., heavy rail versus bus rapid transit) to filter the full US FTA Capital Cost Database for only the most comparable projects to the NSRL. We believe that this refined subset of project costs improves the accuracy of our cost estimates. We have also added new analysis that benchmarks our cost-per-mile estimates against a small subset of comparable projects in the US that were recently completed or are currently underway. The key financial assumptions underlying the model are detailed below.

[15] The "Transporter Only" vehicle fleet under either the Minimum Build or the Maximum Build scenarios could efficiently adjust as needed over time to accommodate incremental Regional Rail transformation and/or dual mode locomotives on key corridors; however, it would be inefficient and difficult to change *between* the Minimum Build and the Maximum Build scenarios themselves after the start of design or construction or after being placed into service.

The NSRL is expected to improve speed and reliability for passengers, increase ridership, and reduce congestion and wait times. Benefits include both direct financial benefits (such as higher property values and savings from reduced car usage) as well as intangible benefits (including reduced commute times and lower carbon emissions). The Study uses a variety of recognized analytical techniques to quantify these benefits, focusing primarily on the Maximum Build and Minimum Build scenarios.

Estimated ridership increases even more significantly with a four-track NSRL (Maximum Build) compared to a two-track NSRL (Minimum Build) due to bottleneck effects in the two-track design. With four tracks, two trains can travel simultaneously in each direction - northbound and southbound - rather than a single train at a time. This improves operational efficiency across the four northern and eight southern train lines. For example, in a two-track system, a train from one of the southern lines may need to wait for up to seven other trains to pass through a portal before proceeding. In contrast, a four-track NSRL allows multiple trains to pass simultaneously, reducing delays and increasing capacity. With this congestion minimized, train frequencies to and from North and South Stations can be significantly higher, driving the significant increase in ridership in the Maximum Build versus the Minimum Build scenario.

Regional Rail as a Precursor

Our approach is a *marginal analysis* that estimates the costs and benefits of NSRL *above and beyond* those of implementing Regional Rail alone.

The NSRL leverages the MBTA's Regional Rail Modernization Plan, which includes increased train frequencies across the entire network (assumed 15-minute frequencies at most stations, with the potential for even higher frequencies during weekday rush hours not included in our estimates), high-level platforms systemwide, and significant additional parking at most stations.[16, 17] *Full* Regional Rail implementation is a necessary precursor to achieve the *maximum* benefits of the NSRL for several reasons:

- Frequency – Regional Rail increases train frequency dramatically, filling the tunnel(s) with the high throughput that through running is designed to enable.

[16] Massachusetts Bay Transportation Authority. Rail Vision Final Report. February 2020. https://cdn.mbta.com/sites/default/files/2021-07/2020-02-rail-vision-report.pdf.

[17] For additional information about our assumed train scheduling, see "Appendix C: New Train Schedule."

- Acceleration and Braking – Electrification and modern rolling stock enable rapid acceleration and braking, without which increased frequencies are not possible.
- Logistics / Administrative – Regional Rail enables reliably timed connections across the network for riders, a unified fare and ticketing structure for easier “one-seat” rides, and strict dwell-time reductions for bottleneck relief.

The MBTA has estimated the total capital costs, including system electrification and an all-new fleet of electric multiple units (EMUs) at $28.9 billion in 2020$, or $40.7 billion in 2030$, which is not included in our cost estimates for the NSRL.

Table 2 provides a high-level summary of estimated benefits. NSRL would also improve access to jobs and have a positive impact on economic growth throughout the region. However, quantifying the value of these benefits is beyond the scope of our present Study.

Table 2. Benefits by category

Build Scenario	Minimum Build		Maximum Build	
Vehicle Fleet Composition	***Full Regional Rail***	***Transporter Only***	***Full Regional Rail***	***Transporter Only***
Benefits to Government	**Incremental to Regional Rail**	**Stand Alone (no Regional Rail)**	**Incremental to Regional Rail**	**Stand Alone (no Regional Rail)**
Fare Revenues	$3,467.3	$0.0	$10,128.3	$0.0
Tax Revenues (Land Use)	$3,763.1	$0.0	$3,763.1	$0.0
Tax Revenues (Properties)	$316.7	$0.0	$978.5	$0.0
Social Cost of Carbon Savings	$444.8	$16.9	$1,314.7	$26.6
less Gas Taxes (Offset)	($42.3)	($1.6)	($125.2)	($2.5)
Total Benefits to Government	**$7,949.5**	**$15.3**	**$16,059.4**	**$24.1**
Benefits to Public	**Incremental to Regional Rail**	**Stand Alone (no Regional Rail)**	**Incremental to Regional Rail**	**Stand Alone (no Regional Rail)**
Increase in Property Values	$1,206.5	$0.0	$3,728.2	$0.0
Affordability Benefits (Land Use)	$4,045.2	$0.0	$4,045.2	$0.0
Wait Time Savings	$1,353.5	$193.7	$5,576.8	$430.2
Gas Savings	$760.6	$29.0	$2,248.0	$45.6
Maintenance Cost Savings	$1,292.0	$26.6	$3,818.6	$39.6
Toll Savings	$861.2	$49.2	$2,088.2	$77.4
Total Benefits to Public	**$9,519.0**	**$298.4**	**$21,505.0**	**$592.8**
Grand Total Benefits	**Incremental to Regional Rail**	**Stand Alone (no Regional Rail)**	**Incremental to Regional Rail**	**Stand Alone (no Regional Rail)**
Total Benefits to Government	$7,949.5	$15.3	$16,059.4	$24.1
Total Benefits to Public	$9,519.0	$298.4	$21,505.0	$592.8
Grand Total Benefits	**$17,468.6**	**$313.7**	**$37,564.4**	**$616.9**

Note: 2031 US Dollars in Millions; Present Value of Cumulative 2035-2064.

New Build Approach: Transporter

Our research for the current study led us to identify and analyze a new implementation approach:

1) Under either the Minimum Build or Maximum Build, the NSRL would be constructed consistently with all parameters required for eventual Full Regional Rail.
2) At minimum, the initial service through the tunnel(s) would consist of a frequent, dedicated shuttle that connects South Station and North Station.

3) Any Commuter Rail lines that are already upgraded at the time the NSRL is placed into service could also run through immediately; similarly, select dual mode through running trains could complement the Transporter service. [18]
4) Additional lines would then be added through the tunnel(s) incrementally as they become available, and eventually the Transporter itself would be phased out entirely.

This concept is inspired by dedicated, fixed rail shuttles at airports, convention centers, and large resorts and is in some ways similar to the 42nd Street Shuttle (S Train) in New York City's MTA system that connects Times Square and Grand Central Terminal.

The Transporter would incur many of the same construction costs as either the Minimum Build or the Maximum Build, including digging at least one tunnel, as well as electrified tracks, signals, elevators, platforms, and so on. However, it would require a significantly lower quantity of new rolling stock, resulting in much lower estimated initial build costs, as summarized in Table 3 below and shown in more detail in Table 18.

The Transporter would start generating benefits immediately upon completion (e.g., reduced wait times for moving between South Station and North Station), without requiring any other changes to the rest of the system. The Transporter concept contemplated in this study would not be intended as an "end state" but rather as an initial phase of the NSRL project under either build scenario, with Transporter service running in parallel with select dual-mode through running trains plus upgraded Commuter Rail lines as they are completed, and eventually being phased out altogether as the system migrates 100% to seamless routes.

[18] Dual mode locomotives can switch between diesel and electric power, enabling operation through an electrified tunnel while continuing to run on non-electrified portions of the existing Commuter Rail network. This means that the NSRL could function with only partial – or even no – regional rail implementation. However, without the full frequency and other upgrades that full Regional Rail implementation provides, the tunnel's capacity would be severely underutilized.

Benefit-Cost Analysis: Summary of Key Findings

Table 3. Summary of Benefit-Cost Analysis

Build Scenario	Minimum Build		Maximum Build	
Vehicle Fleet Composition	***Full Regional Rail***	***Transporter Only***	***Full Regional Rail***	***Transporter Only***
Grand Total Benefits	**Incremental to Regional Rail**	**Stand Alone (no Regional Rail)**	**Incremental to Regional Rail**	**Stand Alone (no Regional Rail)**
Total Benefits to Government	$7,949.5	$15.3	$16,059.4	$24.1
Total Benefits to Public	$9,519.0	$298.4	$21,505.0	$592.8
Grand Total Benefits	**$17,468.6**	**$313.7**	**$37,564.4**	**$616.9**
Grand Total Costs	**Incremental to Regional Rail**	**Stand Alone (no Regional Rail)**	**Incremental to Regional Rail**	**Stand Alone (no Regional Rail)**
Hard Costs	$3,069.0	$1,884.3	$4,935.3	$3,725.7
Soft Costs	$667.1	$631.5	$1,283.6	$1,247.3
Contingency	$887.3	$887.3	$1,752.3	$1,752.3
Grand Total Costs	**$4,623.4**	**$3,403.2**	**$7,971.2**	**$6,725.3**

Notes:

- 2031 US Dollars in Millions; Present Value of Cumulative 2035-2064.
- In keeping with standard construction industry terminology, “Hard Costs” are direct, physical expenses, such as materials, labor, and equipment, while “Soft Costs” are indirect expenses (including pre- and post-construction activities) such as architectural, engineering, financing, and legal fees.
- All amounts are *marginal* (incremental) amounts *above and beyond* costs and benefits of the full implementation of Regional Rail
- Total Costs are the specific estimates for each scenario from the full line-item financial model. This model draws from the FTA’s Capital Cost Database, refined to include only the 10 projects that were at least 30% tunneled. For further details about the line-item financial model, the FTA Capital Cost Database, and other cost estimation methodologies (regression analysis and cost-per-mile), see the section “The Cost of the North South Rail Link” and related appendices.

Project Timeline

A comprehensive Benefit-Cost Analysis of the NSRL involves complex interactions between the assumed build scenario of the NSRL and the status of upgrades to the current MBTA

Commuter Rail System. The latter could range from no changes, to partial electrification with increased frequencies on key lines, to full implementation of Regional Rail with increased frequencies, high-level platforms systemwide, and significant additional parking at most stations.

The maximum benefits of NSRL and the largest increases in ridership would be achieved with full implementation of Regional Rail. In a scenario of limited or gradual implementation, a Maximum Build NSRL (four tracks with two tunnels) would provide excess rail capacity for an extended period. A more efficient approach, in this scenario, might be to start with the Minimum Build, paired with the Transporter configuration rather than Full Regional Rail. This would likely be sufficient to realize the maximum benefits and ridership increases under alternatives short of full transformation, such as "Alternative 3: Regional Rail to Key Stations (Electric)" or "Alternative 5: Urban Rail (Electric)" in the MBTA's February 2020 Rail Vision report. The Transporter configuration could be an efficient way to provide immediate benefits and ridership increases even absent any changes to the current MBTA Commuter Rail System, regardless of which build size it is paired with. Its dedicated shuttle could then accommodate incremental improvements to the system as they are built over time.

This paper has been updated from the 2017 HKS study to assume a 2031 construction midpoint and a placed-in-service date of January 1, 2035. [19] Table 4 and Table 5 below show the high-level dependencies, durations[20] and key milestones required to meet the assumed placed-in-service date of January 1, 2035. Applicable illustrative dates are shown in the third column of these tables, but we also note that the durations shown in the second column of these tables could be used for estimating any target placed-in-service date. [21] The total project timeline of 10 years includes five quarters of Engineering/Design before the start of any construction, four years of Tunnel Construction and four years of Station Construction (overlapping with Tunnel Construction for five quarters). Demolition and Mitigation is ongoing throughout most of the project and includes activities such as hazardous materials mitigation and temporary facilities. The NSRL is assumed to be placed into service in January 2035, though certain activities and costs continue through the end of

[19] The 2017 HKS study assumed a 2025 construction midpoint and a placed-in-service date of January 1, 2030.

[20] Durations are estimated based on comparable projects in the FTA Capital Cost database and the Eno Transit Construction Cost Database.

[21] For example, to meet a projected placed-in-service date of January 1, 2037, Pre-Construction would need to begin on January 1, 2029, the construction midpoint would be 2033, and all costs and benefits would be updated to 2033$.

2036 to close out the project. Per standard convention, the midpoint of construction (2031) is the baseline for inflating or discounting dollars (i.e., all amounts are in 2031$).

Table 4. Project timeline

Activity	Duration	Illustrative Milestone Dates for 2031 Construction Midpoint
Engineering/Design	3.3 years (39 months)	1/1/2027 through 3/31/2030
Demolition and Mitigation	7.0 years (84 months)	1/1/2030 through 12/31/2036
Major Works Procurement	1.0 years (12 months)	4/1/2030 through 3/31/2031
Tunnel Construction	4.0 years (48 months)	4/1/2028 through 3/31/2032
Station Construction	4.0 years (48 months)	1/1/2031 through 12/31/2034
Trackwork	1.0 years (12 months)	1/1/2031 through 12/31/2031
Integration and Readiness	1.3 years (15 months)	1/1/2028 through 3/31/2029

Table 5. Key durations and milestones

Activity	Duration	Illustrative Milestone Dates for 2031 Construction Midpoint
Pre-Construction (incl. Planning, Engineering, Design, Integration & Readiness)	1.0 years (12 months)	1/1/2027 through 12/31/2027
Major Construction (incl. Demolition & Mitigation, Tunnel(s), Stations, Trackwork)	7.0 years (84 months)	1/1/2028 through 12/31/2034
Initial Service Date (Total From Start of Planning)	8.0 years (96 months)	1/1/2035
Final Project Close-Out (Post-Initial Service Date)	2.0 years (24 months)	1/1/2035 through 12/31/2036
Total Project Duration (From Start of Planning through Final Close-Out)	10.0 years (120 months)	1/1/2027 through 12/31/2036
Benefits Projection Period (Years From Initial Service Date)	30.0 years (360 months)	1/1/2035 through 12/31/2064

Benefit Calculations and Results

Key Relationships

Each benefit category incorporates unique calculation methodologies, assumptions, and other factors, as described throughout this section and in the related Appendices. However, there are key drivers for each major category, as summarized below.

Driver:	Ridership (e.g., # of riders per train, # of riders per year)
Related Categories:	Fare Revenues; Social Cost of Carbon less Gas Taxes; Wait Time Savings; Gas Savings; Maintenance Cost Savings; Toll Savings
Relationship (Holding all else equal):	More riders → Higher value Simplified Example: More riders → Greater mode shift from car → Higher gas savings

Driver:	Improvement in transit service (e.g., greater frequency of trains)
Related Categories:	Tax Revenues (Properties); Increase in Property Values
Relationship (Holding all else equal):	Better service → Higher value Simplified Example: More frequent trains → Higher Transit Score → Greater increase in property value

Driver:	Implementation of NSRL Maximum Build or Minimum Build (Binary Yes/No)
Categories:	Tax Revenues (Land Use); Affordability Benefits (Land Use)
Relationship: **(Holding all else equal)**	If Maximum Build or Minimum Build is Implemented → Benefits Unlocked Simplified Example: If the Maximum Build or Minimum Build moves forward, the land use benefits of Widett Circle could be achieved

These key drivers and relationships explain the order-of-magnitude differences between the total benefits of the scenarios. For example, as shown in Table 10 later in this section, the Transporter (on a stand-alone basis under the Minimum Build) generates modest additional ridership above the current system. Therefore, it generates modest wait time savings, gas savings, etc.

Increased Train Frequency and Reduced Wait Times

Infrequent train schedules lead to wasted time. Under the current Commuter Rail schedule, a passenger has an expected wait time of nearly 34 minutes for a train to come. This means that before someone has even set foot on the train, they have lost as much as $27.02 in the monetary value of their time for a single ride.[22] That is over $50 a day for someone who uses the Commuter Rail to commute to and from work. This is time that could be used for additional productivity, leisure activities, or anything more pleasurable than standing on a platform for an extended period. Moreover, the U.S. Department of Transportation estimates that time saved in the waiting portion of travel is generally more valuable than time saved during the trip itself, which may be more comfortable to the traveler.[23]

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[22] Based on U.S. Department of Transportation Benefit Cost Analysis, 2022 hourly value in USD for Walking, Cycling, Waiting, Standing, and Transfer Time inflated to 2031 dollars.

[23] White, Vinn. "Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis." U.S. Department of Transportation, September 27, 2016. https://www.transportation.gov/sites/dot.gov/files/docs/2016%20Revised%20Value%20of%20Travel%20Time%20Guidance.pdf.

At a baseline, adopting the regional rail schedule described above reduces the expected wait time to just over 20 minutes, a reduction of over 40%. Table 6 shows how the full Minimum Build and the full Maximum Build scenarios would affect expected wait times and how those savings translate to monetary savings compared to the current schedule.

Table 6. Wait time savings by project

Build Scenario	Minimum Build	Maximum Build
Vehicle Fleet Composition	***Full Regional Rail***	***Full Regional Rail***
Expected Wait Time (minutes)	18.38	9.56
% Reduction from Current System	45.57%	70.82%
$ Savings per Ride versus Current System	$12.31	$19.14

Given a full implementation of Regional Rail, the bottlenecking effect of the Minimum Build means that option would only produce a slight increase in frequency and thus reduce wait times by an additional 1.6 minutes. However, once the Maximum Build option is introduced, the significant increase in train frequency that becomes possible can reduce expected wait times to less than 10 minutes, a 71% reduction from the current system. In the four-track option, the cost of wait time per ride is reduced to under $8.00, a daily cost of less than $16 for an out-and-back commute versus the existing cost of over $50.

When applied across all the riders currently utilizing the Commuter Rail system, which account for 11.8% of systemwide ridership as of 2024,[24] these differences in time value savings become even more stark. By itself, the wait time reduction of switching to a Full Regional Rail system culminates in over $3.52 billion in savings from 2035 to 2064 (in 2031

[24] The Commuter Rail has experienced the strongest post-pandemic recovery in ridership across the MBTA system, accounting for 11.8% of systemwide ridership as of 2024, up from 8.7% in 2019. See Appendix E: Ridership Analysis Methodology for further details.

dollars). When each of the projects is added on top of Full Regional Rail, Table 7 presents the additional savings for current Commuter Rail passengers.

Table 7. Cumulative wait time benefits

Build Scenario	**Minimum Build**		**Maximum Build**	
Vehicle Fleet Composition	***Full Regional Rail***	***Transporter Only***	***Full Regional Rail***	***Transporter Only***
	Incremental to Regional Rail	**Stand Alone (no Regional Rail)**	**Incremental to Regional Rail**	**Stand Alone (no Regional Rail)**
Wait Time Benefits	$1,353.5	$193.7	$5,576.8	$430.2

Note: 2031 US Dollars in Millions; Present Value of Cumulative 2035-2064.

Existing North to South Station Commuters

The NSRL will benefit existing commuters by reducing the time required to travel between North and South Stations. Currently, passengers wishing to make this journey must exit and utilize some other method of transport to get to the other half of the Commuter Rail system.

There is currently no easy method for doing this. We identified five potential options: subway, bus, bike, walk, and rideshare. Each comes with its own challenges including long wait times, added costs, and physical exertion. By comparison, the NSRL would include no additional fare, transfers, or wait time and an estimated travel time of just 4 minutes. Table 8 summarizes how much time value would be saved versus each alternative route option. Even assuming that the subway and bus run on time with no traffic delays, the NSRL tunnel produces significant savings in both time and additional costs. [25]

[25] As of August 2026, certain monthly Commuter Rail passes allow for free transfers between service modes; our model of wait time benefits generalizes to full fare payment for all transfers. See: Massachusetts Bay Transportation Authority, "Transfers," Fares Overview. https://www.mbta.com/fares/transfers. (Accessed August 2026.)

Table 8. Time and cost savings from NSRL vs. existing transit modes

	Subway	Bus	Bike	Walk	Rideshare
Time Per Trip (minutes)	21.09	30.09	9.00	25.71	7.69
% of Riders	56.90%	18.97%	12.07%	10.34%	1.72%
Additional Costs	$2.40	$1.70	$0.00	$0.00	$20.00
Total Savings per Trip	$16.29	$22.91	$4.07	$17.66	$23.00

Existing MBTA data does not allow us to track specific routes that passengers take, making it difficult to determine a precise estimate of the number of riders currently making the trip between North and South Stations. Given these limitations, we created a proxy for expected traffic based on a share of all city jobs within a 10-minute walk of each terminal station – North Station, South Station, and Back Bay. We then applied a 'friction' discount factor to account for the difficulty of reaching those jobs. Using this method, we estimate the number of people regularly making this journey at roughly 153,000, with a range of ± 51,000 depending on the size of the discount factor. Table 9 below shows the estimated valuation of benefits across this full range of current commuters, and we have used the "Medium Friction" values in our overall benefit calculation (~153,000 riders with an estimated valuation of benefits of $48.1 million). We believe that this estimate is conservative, as it does not account for those making the journey between North and South Stations for non-work purposes (for example, medical care at Massachusetts General Hospital, cultural and sporting events at TD Garden or leisure activities in Seaport). A full description of the methodology for estimating time value, data sources, and assumptions is provided in Appendix D: Time Value Estimates.

Table 9. Estimated current North to South Station commuters and benefits

	Low Friction	Medium Friction	High Friction
# of Current Commuters	203,844	152,883	101,922
Total Wait Time Benefits	$64.2	$48.1	$32.1

Note: 2031 US Dollars in Millions; Present Value of Cumulative 2035-2064.

New Riders: Mode Shifts

We analyzed the number of rides into North and South Stations in a base year and projected changes under different scenarios. Our analysis considered existing system ridership, new regional system ridership, and additional rides with a two- or four-track NSRL. These ridership estimates inform the calculation of benefits presented in later sections of the report.

To generate our model estimates, we used 2018 MBTA Commuter Rail ridership data; current train frequencies from the MBTA Commuter Rail website; the anticipated new train schedule for a Full Regional Rail system, two-track NSRL (Minimum Build), and four-track NSRL (Maximum Build); and other inputs from comparable projects.[26, 27] A full description of the ridership model methodology, data sources, and other inputs is provided in Appendix E: Ridership Analysis Methodology.

Table 10 shows our projected ridership under various scenarios. Ridership under the Current System is based on actual 2024 data, and ridership under each scenario is calculated as if the given scenario were in place and functional as of 2024. The 2024 figures are increased at the assumed Massachusetts population growth rate of 0.31% per year for 11 years to arrive at projected 2035 ridership amounts, and the 2035 amounts are then increased at 0.31% per year for the 30 years of the benefits projection period.

[26] Massachusetts Bay Transportation Authority / MassDOT. "MBTA Blue Book Open Data Portal -- Commuter Rail." ArcGIS Open Data. Accessed December 2025. https://mbta-massdot.opendata.arcgis.com/search?tags=commuter%20rail.

[27] Massachusetts Bay Transportation Authority. "Commuter Rail | Schedules & Maps." MBTA.com. Accessed December 2025. https://www.mbta.com/schedules/commuter-rail.

Table 10. Projected Commuter Rail ridership by scenario

	Actual CY2024	Estimated as if fully operational in CY2024				
Build Scenario	**Current System**	**Full Regional Rail (no NSRL)**	**Minimum Build**		**Maximum Build**	
Vehicle Fleet Composition	***Current System***	***Full Regional Rail (no NSRL)***	***Full Regional Rail***	***Transporter Only***	***Full Regional Rail***	***Transporter Only***
North Station Lines						
Fitchburg	2.0	6.6	7.9		14.0	
Lowell	2.3	3.7	4.5		7.9	
Haverhill	1.7	7.6	9.0		15.9	
Newburyport/Rockport	3.9	8.0	9.6		16.8	
Total North Station Lines	**9.9**	**25.9**	**31.0**		**54.5**	
South Station Lines						
Worcester/Framingham Line	4.2	10.0	30.3		53.7	
Needham Line	1.5	2.8	5.7		10.0	
Franklin/Foxboro Line	2.8	4.5	4.0		7.0	
Fairmount Line	1.1	1.3	1.2		2.1	
Providence/Stoughton Line	6.3	11.6	23.3		41.1	
Middleborough/Lakeville	2.2	4.5	5.4		9.5	
Kingston Line	1.6	1.9	2.2		3.9	
Greenbush Line	1.3	1.5	1.8		3.2	
Total South Station Lines	**20.9**	**38.2**	**74.0**		**130.6**	
Grand Total	**30.8**	**64.1**	**105.0**	**32.2**	**185.1**	**32.8**
Increase over Current		**2.08x**	**3.41x**	**1.05x**	**6.02x**	**1.07x**

Notes:

- Franklin/Foxboro and Fairmount ridership is modeled as declining slightly from the Full Regional Rail (no NSRL) scenario to Minimum Build because both lines share a single interlined corridor between South Station and Readville (see Appendix C), and the two-track Minimum Build tunnel has less through-capacity than the surface-only Full Regional Rail scenario assumes. The model allocates this constrained capacity across the corridor, which reduces assumed frequency — and therefore ridership — on these two lines specifically, even as system-wide ridership continues to grow. This does not occur under Maximum Build, where the four-track tunnel removes the capacity constraint.
- There are no line-by-line ridership projections for the Transporter on a stand-alone basis because Transporter ridership is projected from the baseline estimate of current North Station-to-South Station transfers, for which line-by-line data are not available (see Table 9 and related discussion).
- Riders in Millions.

As shown in Table 10, we project that the full implementation of Regional Rail has the potential to more than double Commuter Rail ridership, while adding either version of the NSRL would significantly increase ridership even further. This can be attributed to several factors, including increased train frequency, the impact of a unifying tunnel that allows through running, and the removal of a bottleneck under the four-track NSRL.

As a result of through running trains that are also much more frequent and reliable, our model projects increases in ridership of each train line in accordance with the additional frequency of service as well as each train operating at a higher capacity utilization.[28, 29] Our projection that the NSRL will allow increased train frequencies beyond the Full Regional Rail's increase in part explains why we predict the NSRL will bring additional ridership on top of Full Regional Rail.

Our model also assumes that a connective tunnel like the NSRL will have a transformative effect on how people travel throughout the Boston region. Based on the impacts of similarly connective projects in London, Philadelphia, and New York City, we project there to be an additional 20% increase in ridership with the NSRL.[30, 31, 32] This adds further incremental ridership under either version of the NSRL versus the Full Regional Rail system alone.

As shown in the tables below and discussed in further detail in Appendix E: Ridership Analysis Methodology, our ground-up ridership model projects per capita usage that is in line with benchmarks and historic MBTA operations.

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28 Specifically, we included an elasticity of ridership to assess how much fuller each train would be. We estimated that there would be 0.7% more riders with 1% more frequent trains, which we base on other analyses including: Levy, Alon. "Frequency, Ridership, Spirals." Pedestrian Observations, February 25, 2019. https://pedestrianobservations.com/2019/02/25/frequency-ridership-spirals/. Accessed December 2025.

29 Past research reflects network effects in transportation, where added capacity and frequency lead to greater system usage: Levinson, David. "The End of Traffic and the Future of Access" (preview). Transportist, 2017. https://transportist.org/wp-content/uploads/2017/10/eotfoa-preview.pdf. Accessed December 2025.

30 Kyriakodis, Harry. "Single Most Transformative Investment? The Commuter Rail Tunnel, Now Turning 30." Hidden City Philadelphia, November 7, 2014. https://hiddencityphila.org/2014/11/single-most-transformative-investment-the-commuter-rail-tunnel-now-turning-30/. Accessed December 2025.

31 Saxe, Shoshanna, and Steve Denman. "Greenhouse Gas from Ridership on the Jubilee Line Extension." Proceedings of the Institution of Civil Engineers - Transport 170, no. 2 (2017): 108-120. https://doi.org/10.1680/jtran.15.00095. Accessed December 2025.

32 Levy, Alon. "The LIRR and East Side Access." Pedestrian Observations, July 3, 2023. https://pedestrianobservations.com/2023/07/03/the-lirr-and-east-side-access/. Accessed December 2025.

Reduced Car Usage

The Boston Metro Area is largely a region of car commuters. According to A Better City, 23% of commuters drove alone to work prior to the COVID-19 pandemic with 28% expecting to do so afterwards.[33] As such, improving the performance of the Commuter Rail has the potential to significantly reduce commuting costs for those who shift from driving alone to taking the train. This is especially true given the distance that potential mode shifters generally drive. Based on the distance between each Commuter Rail stop and downtown Boston—as well as the distribution of expected ridership origins by stop and by line—the weighted average number of driving miles that a new rider would be expected to save by shifting to the Commuter Rail is 23.5 miles each way, ranging from 8.3 miles on the Fairmount line to 30.9 miles on the Providence/Stoughton line. The benefits for drivers who switch to the Commuter Rail are the costs associated with driving these miles, including savings on gas and gas taxes, lower car maintenance costs, and avoided toll costs.

The most obvious benefit of not driving is savings on the cost of gas and gas taxes. In 2024, the monthly average pump price of gasoline across all grades in Massachusetts was $3.39 per gallon, including a $0.24 per gallon tax.[34, 35] Based on an average gas mileage of 22.8 miles per gallon in 2022,[36] this equates to an expected savings of $4.44 per person per trip.

Assuming that the only change in the price of gas between now and 2031 is inflation, we would expect the price of gas to increase to around $4.31 per gallon by 2031. We do not add inflation to the tax rate since under current law, it is fixed at $0.24 per gallon.[37]

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33 Rivera, Marissa. "Anticipating Post-Pandemic Commute Trends in Metro-Boston: Spring 2021 Update." A Better City, August 2021. https://abctma.com//assets/documents/Report-CommuterSurveyPhase2.pdf. Accessed December 2025.

34 U.S. Energy Information Administration. "Massachusetts All Grades All Formulations Retail Gasoline Prices (Dollars per Gallon)," March 10, 2025. https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMM_EPM0_PTE_SMA_DPG&f=M. *(Accessed March 2025)*

35 Massachusetts Department of Revenue. "DOR Motor Fuel Excise." Mass.gov. https://www.mass.gov/info-details/dor-motor-fuel-excise. *(Accessed March 2025)*

36 Weighted average combined fuel economy of cars and light trucks: U.S. Environmental Protection Agency. "Greenhouse Gas Equivalencies Calculator -- Calculations and References." EPA.gov, n.d. https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator-calculations-and-references. Accessed December 2025.

37 Massachusetts Department of Revenue. "DOR Motor Fuel Excise." Mass.gov. https://www.mass.gov/info-details/dor-motor-fuel-excise. *(Accessed March 2025)*

We also account for the growing shift to electric vehicles, which means that the benefits accrued from gas savings will diminish over time. In 2022, Massachusetts instituted the Advanced Clean Cars II (ACC II) program which requires that any new vehicles sold in the state must be zero-emission or plug-in hybrid-electric by 2035.[38] That said, this does not mean that there will be no savings on gas in 2035 or thereafter. Due to expected lags in new purchases and existing vehicle stocks, the Massachusetts Clean Energy and Climate Plan for 2050 assumes that only 19% of all on-road vehicles in Massachusetts will be EVs by 2030.[39] EVs are not expected to fully account for all vehicles on the road until after 2050. Therefore, even though gas savings will shrink over time, we still find that the two-track NSRL model is expected to account for $760.6 million in gas savings between 2035 and 2064, and the four-track model is expected to account for $2,248.0 million.[40]

The transition to electric vehicles also does not eliminate other savings for commuters who switch from driving to the Commuter Rail. Other costs like maintenance and tolls are unavoidable to drivers no matter what car they drive. The U.S. Department of Energy estimates that the per mile maintenance cost for a battery-electric vehicle is $0.061 and $0.101 for an internal combustion engine.[41] Thus, even as we see expected savings on maintenance for combustion engines decrease over the lifespan of the Rail Link, we would also see a corresponding growth in maintenance savings for electric vehicles. When potential savings are combined for internal combustion engines and battery-electric vehicles, we estimate total maintenance savings for the two-track model to reach $1,292.0 million over the 30-year period and the four-track model to reach $3,818.6 million.

Similarly, tolls are an unavoidable expense for many drivers in the Boston area. For several towns like Worcester that connect to Boston both by roads and the Commuter Rail, there is

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[38] Massachusetts Department of Environmental Protection, "Massachusetts Low Emission Vehicle (LEV) Program," Mass.gov, https://www.mass.gov/guides/massachusetts-low-emission-vehicle-lev-program. (Accessed August 2026.)

[39] Massachusetts Executive Office of Energy and Environmental Affairs, *Massachusetts Clean Energy and Climate Plan for 2050* (Boston: Commonwealth of Massachusetts, 2022). https://www.mass.gov/doc/2050-clean-energy-and-climate-plan/download.

[40] While the long-term targets for EV adoption remain unchanged, in May 2025, Massachusetts announced a two-year pause of EV sales requirements under ACCII effective for model years 2026 and 2027. See: Commonwealth of Massachusetts, Executive Office of Energy and Environmental Affairs, "Massachusetts Announces Flexibilities for Electric Vehicle Requirements," press release, May 23, 2025, https://www.mass.gov/news/massachusetts-announces-flexibilities-for-electric-vehicle-requirements.

[41] U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, "FOTW #1190, June 14, 2021: Battery-Electric Vehicles Have Lower Scheduled Maintenance Costs than Other Light-Duty Vehicles," Transportation Technologies Office, June 14, 2021, https://www.energy.gov/cmei/vehicles/articles/fotw-1190-june-14-2021-battery-electric-vehicles-have-lower-scheduled. (Accessed August 2026.)

no route that avoids tolls without significant detours. For Worcester, the ending stop on the most trafficked Commuter Rail line, the cheapest driving route to get to Downtown Boston costs $2.90 each way. Across the towns connected to Boston via the Commuter Rail, the expected toll savings for mode shifters add up to $861.2 million in toll savings from the 2-track Rail Link and $2,088.2 million for the 4-track Rail Link. (See Table 11.)

Table 11. Individual mode shift benefits by scenario

Build Scenario	**Minimum Build**		**Maximum Build**	
Vehicle Fleet Composition	***Full Regional Rail***	***Transporter Only***	***Full Regional Rail***	***Transporter Only***
	Incremental to Regional Rail	**Stand Alone (no Regional Rail)**	**Incremental to Regional Rail**	**Stand Alone (no Regional Rail)**
Gas Savings	$760.6	$29.0	$2,248.0	$45.6
Maintenance Cost Savings	$1,292.0	$26.6	$3,818.6	$39.6
Toll Savings	$861.2	$49.2	$2,088.2	$77.4

Note: 2031 US Dollars in Millions; Present Value of Cumulative 2035-2064.

The benefits described in this section are not an exhaustive list of how drivers benefit from switching to the Commuter Rail. Other tangible benefits like time saved from sitting in traffic and the cost savings on parking are not included due to data limitations. As such, the benefits estimated here are a conservative estimate given that the 2024 Global Traffic Scorecard ranked Boston as the 12th worst city in the world for traffic with drivers losing on average 79 hours a year to it.[42]

Additional Fare Revenue

Fare revenues from new riders are presented as a benefit to government without a corresponding deduction on the public side. We believe this is reasonably and justifiably offset by two conservative exclusions elsewhere in the model: 1) the analysis excludes travel-time savings for mode-shifting riders, and 2) new ridership is estimated only from automobile mode-shift, excluding other diversions (e.g., from bus) and induced demand. This is a simplified approach combining distinct points that arise independently, but all fall

[42] INRIX. "2024 Global Traffic Scorecard." INRIX. https://inrix.com/scorecard-2024/. Accessed August 2026.

within the standard framework for calculating consumer surplus established by Small, Verhoef, and Lindsey.[43]

Furthermore, MBTA Commuter Rail fares are also inexpensive relative to peer regional rail systems, which provides additional support for our approach. Monthly passes on New York's Long Island Rail Road reach $487.75, nearly 15% above the MBTA's $426 maximum[44], while Philadelphia's SEPTA Regional Rail carries similar or higher nominal fares (one-way fares start at $5.00, versus $2.40 on the MBTA) despite a cost of living approximately 28% below Boston's — making SEPTA fares comparatively higher in real terms.[45,46]

The Commuter Rail sells a variety of fare types including monthly passes, weekend passes, pay-per-day, and reduced fare pay-per-day. These fare types also vary in cost based on the MBTA's commuting zones, increasing the cost of each type the further out of the city the starting stop is. Because the Commuter Rail currently only measures ridership through rough estimates of train density and ticket sales, we cannot track what passes are coming from where or how often those with weekend or monthly passes are taking the train. However, MBTA surveys suggest that 25% of riders use monthly passes and that over 30% of current riders take the Commuter Rail five or more times a week on average.[47] Assuming that the most frequent riders are those with monthly passes, we estimate that increased ridership specifically from the Rail Link would add an additional $3,467.3 million in revenue over the 30-year project lifespan for the 2-track version and $10,128.3 million for the 4-track version. This is the value on top of the added fare due to switching to Full Regional Rail. Conservatively, the Transporter configuration (on a stand-alone basis, under either build scenario) is assumed to be a free service, so there is no additional fare revenue generated.

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[43] Kenneth A. Small, Erik T. Verhoef, and Robin Lindsey, The Economics of Urban Transportation, 3rd ed. (New York: Routledge, 2024).

[44] Metropolitan Transportation Authority, "MTA/Long Island Rail Road Station Fares," effective January 4, 2026, https://www.mta.info/document/194866. (Accessed August 2026.)

[45] Southeastern Pennsylvania Transportation Authority, "Fare Information," https://www.septa.org/fares/. (Accessed August 2026.)

[46] Redfin, "Cost of Living Comparison: Boston, MA vs Philadelphia, PA," https://www.redfin.com/cost-of-living-calculator/boston-ma/vs/philadelphia-pa. (Accessed August 2026.)

[47] Massachusetts Bay Transportation Authority. "2023 MBTA System-Wide Passenger Survey." MBTA 2023 System-Wide Passenger Survey Interactive Web Tool. 2023 MBTA System-Wide Passenger Survey, May 16, 2024. https://cdn.mbta.com/sites/default/files/2025-05/2025-05-09-rider-census-2023-rider-census-report.pdf.

Lower Carbon Emissions

The NSRL (in whatever format) will contribute to achieving the State of Massachusetts' stated goal of achieving zero carbon emissions, even with the gradual adoption of electric vehicles. We quantified this benefit as follows. In 2023, the U.S. Department of Transportation estimated the social cost of carbon at $262 per metric ton in 2031$.[48] Given this and the EPA's estimate of average auto emissions at 0.00044 tons of CO_2 per mile, we estimate that increased ridership due to NSRL could result in social cost of carbon savings of $444.8 million under the Minimum Build scenario and $1.3 billion under the Maximum Build scenario. Note that this estimate is based only on the reduction in miles from additional riders generated by each version of the project.

Increased Access to Jobs

A significant portion of Boston's workforce currently resides close to the innermost station stops of the MBTA (see Figure 2). Improved public transportation could dramatically enhance mobility, which in turn would expand access to job opportunities. In transportation economics, improvements to public transportation systems allow workers to move more freely within the labor market, creating a shift in the spatial general equilibrium model of the city. Such improvements change commuter market access—individuals' access to employment and firms' access to workers—and firm market access, which is firms' ability to reach consumers and residents.

[48] USDOT "Benefit-Cost Analysis Guidance for Discretionary Grant Programs", December 2023, Table A-6.

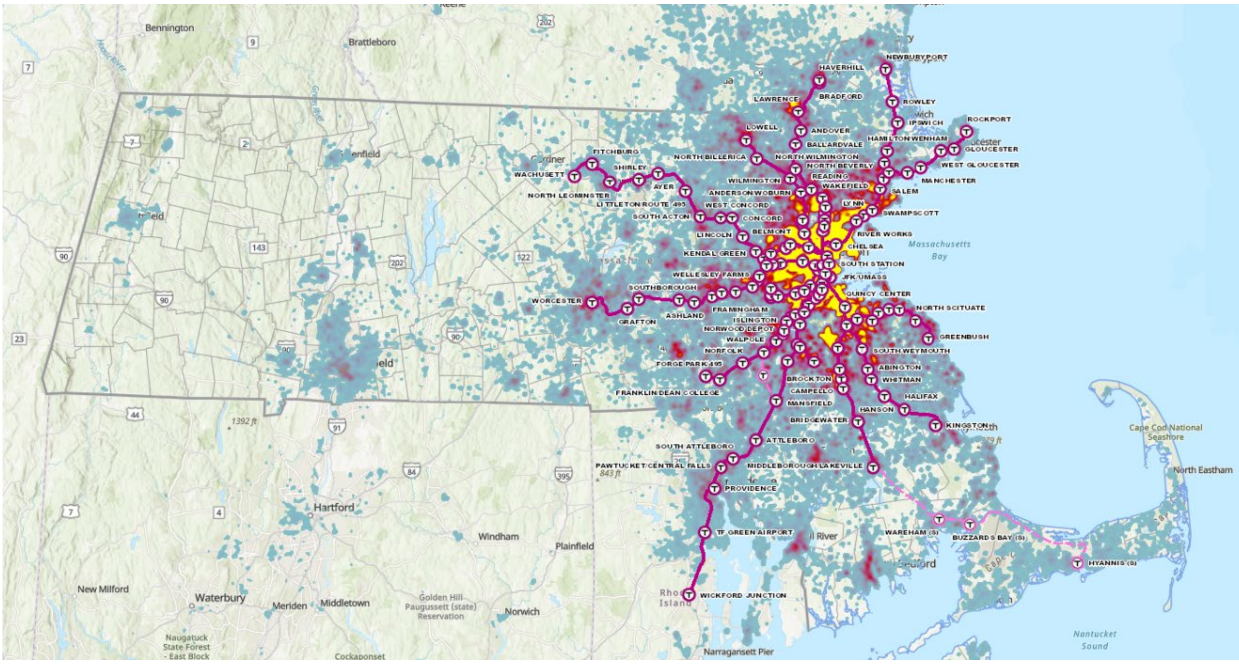

Figure 2. Origination points of Boston commuters. Author analysis using Esri's ArcGIS geographic information system software.

Developing a spatial equilibrium model to project the impact of such changes on the Greater Boston region was beyond the scope of the present project. Instead, we focused on a general measure of access to existing jobs. Simply put, the NSRL would provide direct access to MBTA stations on both the northern and southern sides of the region that commuters cannot access easily today. By creating a seamless, four-minute connection between North and South Stations, a commuter from Lowell could reach South Station in 49 minutes, without any intermediate steps. The NSRL would also make it easier for the commuter to reach Back Bay, opening up additional job opportunities in this densely populated area of the city. Regional Rail would further reduce commute times to these stations. Similarly, commuters living in southern areas of the state would also benefit. For example, a person living in Sharon might consider taking a job closer to North Station rather than in Providence, since with NSRL the commuting time would shrink to under one hour.

To get a clearer picture of what exactly the NSRL could mean for baseline accessibility to jobs, we created 10-minute walksheds around each MBTA Commuter Rail station using

Esri's ArcGIS.[49] We then utilized Esri's Business Analyst[50] data to record the number of employees in each 10-minute walkshed as a proxy for the number of jobs in each. Because the stations are more than a mile apart, the walksheds between them did not overlap. This information enabled us to calculate the number of jobs currently accessed at each Commuter Rail station.

From there, we were interested in calculating the number of jobs that would be accessible within one hour on each train line. To do so, we reviewed each train line's current schedule and summed the number of jobs reachable within one hour in both directions of each station. We found that the NSRL would open up as many as 42,837 North Station jobs to commuters on the southern lines, and as many as 115,486 jobs near South Station to commuters on the northern lines. In addition, Back Bay jobs (totaling as many as 62,528) would be increasingly accessible to northern line commuters.

As a result, the most significant improvements in job access were seen at the stations to the north: Fitchburg, Lowell, Haverhill, and Newburyport/Rockport. This is because the walkshed around South Station is densely populated with jobs, which could now be reached within an hour thanks to the new connections.

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[49] Esri is a leading provider of geographic information system (GIS) software and mapping technology. Esri's ArcGIS is geographic information system (GIS) software used to map and spatially analyze, data such as station locations and walksheds.

[50] Esri Business Analyst is an ArcGIS-based tool providing standardized demographic and market data for a defined trade area or walkshed.

Table 12. Jobs accessible to northside Commuter Rail lines

	Current System	Maximum Build	Increase over Current System	
Fitchburg	48,864	88,037	Number of Jobs	39,173
			% Increase	80.2%
Lowell	47,909	163,395	Number of Jobs	115,486
			% Increase	241.1%
Haverhill	64,184	148,874	Number of Jobs	84,690
			% Increase	131.9%
Newburyport / Rockport	62,176	146,664	Number of Jobs	84,488
			% Increase	135.9%

Note: Jobs within one hour of MBTA stations pre- and post-NSRL with Maximum Build.

Table 13. Jobs accessible to southside Commuter Rail lines

	Current System	Maximum Build	Increase over Current System	
Greenbush	125,558	168,395	Number of Jobs	42,837
			% Increase	34.1%
Fairmount	134,483	177,320	Number of Jobs	42,837
			% Increase	31.9%
Kingston	124,727	167,564	Number of Jobs	42,837
			% Increase	34.3%
Middleborough / Lakeville	130,401	169,296	Number of Jobs	38,895
			% Increase	29.8%
Providence / Stoughton	174,047	209,547	Number of Jobs	35,500
			% Increase	20.4%
Franklin / Foxboro	201,737	244,574	Number of Jobs	42,837
			% Increase	21.2%
Needham	207,483	250,320	Number of Jobs	42,837
			% Increase	20.6%
Framingham / Worcester	186,802	221,859	Number of Jobs	35,057
			% Increase	18.8%

Note: Jobs within one hour of MBTA stations pre- and post-NSRL with Maximum Build.

Property Values, Property Taxes, and Induced Housing Development

Beyond increasing access to jobs, public transportation projects are also theorized to increase property values near stations ("value creation") and induce additional housing development.[51] In this section, we estimate potential increases in property values and property taxes from the NSRL. It was beyond the scope of this study to quantify potential new housing development, but we also provide an overview of the potential for induced housing development from the NSRL.

Property Values and Property Taxes

This increase in property values due to improved transit service is often known as a transit premium. This is especially the case if governments pursue a unified transit and land use policy, incentivizing mixed-use, dense, and economically diverse transit-oriented development near stations. The exact percentage that property values increase varies, and different studies have found a wide range of impacts: while the FTA states that transit projects increase nearby property values by 30-40%,[52] a study of the Hudson-Bergen Light Rail project in New Jersey found that properties within a quarter-mile of stations appreciated 18.4% higher than other properties.[53] A 2013 study of the SEPTA Regional Rail improvements, which increased service levels in existing stations, found that these improvements led to an additional 2.6% in property value increases for those within a half-mile of the station.[54] Additionally, research has also pointed to greater capitalization and increases in property values for stations further away from central business districts—in this case downtown Boston—indicating that areas with lower transit accessibility are more likely to see escalation in property values.[55]

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[51] Higgins CD, Kanaroglou PS (2016) Forty years of modelling rapid transit's land value uplift in North America: Moving beyond the tip of the iceberg. *Transport Reviews* 36(5): 610–634.

[52] "Value Capture." Federal Transit Administration, U.S. Department of Transportation, https://www.transit.dot.gov/valuecapture. Accessed December 2025.

[53] Kim, Kyeongsu, and Michael L. Lahr. "The Impact of Hudson-Bergen Light Rail on Residential Property Appreciation." *Papers in Regional Science*, vol. 93, 2014, pp. S79–S97. Wiley Online Library, https://doi.org/10.1111/pirs.12038. (Accessed December 2025.)

[54] Econsult Solutions, Inc. The Impacts of SEPTA Regional Rail Service on Suburban House Prices. October 2, 2013, https://econsultsolutions.com/wp-content/uploads/2014/04/Econsult-Solutions-Report_FINAL-Oct-2-2013.pdf. Accessed December 2025.

[55] Kim, Kyeongsu, and Michael L. Lahr. "The Impact of Hudson-Bergen Light Rail on Residential Property Appreciation." *Papers in Regional Science*, vol. 93, 2014, pp. S79–S97. Wiley Online Library, https://doi.org/10.1111/pirs.12038 (Accessed December 2025) and Boyce, David E. "Impact of Rapid Transit on Suburban Residential Property Values and Land Development: Analysis of the Philadelphia-Lindenwold High-Speed Line." Transportation Research Board, 1972.

Economic studies typically estimate a potential increase in property values using a hedonic pricing model. This model assesses the value of a property based off of its individual characteristics, including factors like building size, age, location attributes, accessibility to public transit, transit frequency, and neighborhood attributes.[56] The introduction of NSRL with Full Regional Rail service would increase ridership and improve overall accessibility. Following this theory, the areas located near the MBTA stations would become more desirable, and as a result drive up property values in the areas along these stations. As described previously, the Transporter configuration (on a stand-alone basis, under either build scenario) is conservatively assumed to have limited ridership and minimal impact on stations over the entire MBTA system because it assumes no Regional Rail or any other upgrades to the current system; therefore, it has no assumed impact on property values or taxes.

While a comprehensive hedonic pricing model to quantify these potential property value increases was not within the scope of the current study, we developed an alternative approach. We created our own model to estimate potential increases in property values using the Transit Score[57] methodology and a hedonic regression analysis by Redfin that found that a 1-point increase in the transit score of Boston led to a 1.1% increase in property values.[58] (See Appendix G for detailed methodology.)

With individual property values calculated for each station, we then determined the total sum of increased property values that would occur under each scenario. (See Table 14.)

[56] Lieske, Scott N., Ryan van den Nouwelant, Jung Hoon Han, and Christopher Pettit. "A Novel Hedonic Price Modelling Approach for Estimating the Impact of Transportation Infrastructure on Property Prices." Urban Studies 58, no. 1 (2021): 182-202. https://doi.org/10.1177/0042098019879382 (published online 2019). Accessed December 2025.

[57] "Transit Score® Methodology." *Walk Score*, Walk Score, www.walkscore.com/transit-score-methodology.shtml. *(Accessed December 2025)*

[58] Finn, Alanna. "How Much is One Point of Transit Score Worth?" *Redfin*, 20 Mar. 2017, www.redfin.com/news/how-much-is-one-point-of-transit-score-worth/. *(Accessed March 2025)*

Table 14. Total property value increase by scenario

Build Scenario	Current System	Full Regional Rail	Minimum Build	Maximum Build
Vehicle Fleet Composition	***Current System***	***Full Regional Rail***	***Full Regional Rail***	***Full Regional Rail***
Total Property Value (2031$ millions)	$114,097.4	$118,603.5	$119,810.0	$122,331.6
Incremental to Current System	N/A	$4,506.0	$5,712.6	$8,234.2
Incremental to Regional Rail	N/A	N/A	$1,206.5	$3,728.2

From there, we utilized a 1.3% property tax rate across the board (benchmarked at the approximate median of municipalities in the Commuter Rail service area) to estimate the grand total of property taxes captured over 30 years (2035-2064).[59] (See Table 15.)

Table 15. Property taxes captured by scenario

Build Scenario	Minimum Build	Maximum Build
Vehicle Fleet Composition	***Full Regional Rail***	***Full Regional Rail***
	Incremental to Regional Rail	**Incremental to Regional Rail**
Property Taxes Captured	$316.7	$978.5

Note: 2031 US Dollars in Millions; Present Value of Cumulative 2035-2064.

Induced Housing Development

The property value increases modeled above capture only part of the potential housing market response to improved transit: better service would also be expected to spur new housing development in station areas.

[59] Massachusetts Proposition 2½ is a 1980 law that constrains growth in local property taxes. For this analysis, we have made the simplifying assumption that the incremental growth generated under the given scenarios will not be constrained by Proposition 2½.

Although it was beyond the scope of this study to quantify this effect, the direction of the effect is supported in the literature. For example, research examining subway and light-rail systems finds that improved high-speed transit can stimulate residential construction activity and redistribute housing demand outward along the network, flattening the price gradient between the urban core and surrounding areas.[60] This pattern is directionally consistent with the NSRL scenarios modeled in this paper, in which some of the largest gains in accessibility accrue to stations farther from downtown Boston.

Massachusetts appears well positioned to capture some of these effects. MassINC has documented substantial vacant and underutilized land within walking distance of Commuter Rail stations in the Commonwealth's Gateway Cities—capacity sufficient to accommodate thousands of new housing units—and identified improved rail service as a potential catalyst for activating new development.[61]

At the same time, the availability of developable land does not guarantee that improved transit will produce new housing. In many station areas, local zoning and related land-use controls are likely to materially constrain whether underutilized land can be redeveloped at transit-supportive densities. A study of station areas in Los Angeles found that incompatible zoning and related land-use policies can constrain redevelopment even following major rail investment and that transit-supportive zoning alone is not sufficient to cause development.[62]

Massachusetts' recent experience illustrates both the potential impact and the political fragility of zoning reform. Under the MBTA Communities Act, Lexington—one of the first municipalities to adopt compliant zoning, and one that initially zoned well beyond state minimums—drew proposals for more than 1,000 housing units within approximately two years, demonstrating how quickly developer interest can respond when land is opened to multifamily housing.[63] In March 2025, however, Town Meeting voted to substantially

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[60] Pang and Shen. "High-Speed Public Transit and Housing Affordability in the US." Journal of Real Estate Finance and Economics (2025).

[61] MassINC. "The Promise and Potential of Transformative Transit-Oriented Development in Gateway Cities." Boston: MassINC, 2018. https://massinc.org/wp-content/uploads/2018/04/TTOD-Report.pdf.

[62] Schuetz, Jenny, Genevieve Giuliano, and Eun Jin Shin. "Does Zoning Help or Hinder Transit-Oriented (Re)development?" Urban Studies 55, no. 8 (2018): 1672–1689.

[63] "Lexington Scales Back MBTA Communities Zoning After Deluge of Multifamily Proposals." Bisnow, March 2025.

reduce the town's zoned capacity, from nearly 13,500 units to approximately 2,400, in response to resident concerns.[64]

The transit improvements projected in this paper would be expected to generate meaningful development pressure in station areas, although the magnitude and location of that response would vary considerably across the system. Whether increased demand ultimately translates into new housing will depend on local market conditions, development feasibility, and, critically, zoning and permitting decisions made at the state and municipal level.

Land Use

With through running, the North South Rail Link (NSRL) would improve operational efficiencies across the MBTA's Commuter Rail network. This, in turn, would free up land that is currently used for Commuter Rail maintenance, enabling redevelopment that benefits the public and government. The NSRL would also positively impact land use and values because, according to our analysis, it would eliminate the need for the proposed South Station Expansion project ("SSX"). The most recent cost estimate for the SSX is $4.7 billion (grand total inclusive of all trackwork, station work, signaling, vehicles, etc. plus soft costs, and contingencies).[65] In addition to these costs, the SSX would also limit potential land uses and values at other sites in Boston.

For this study, we have assessed the potential land use benefits of three sites under either NSRL scenario: 1) Widett Circle, 2) the United States Postal Service site adjacent to South Station, and 3) the Boston Engine Terminal in Somerville. For each site, we estimated the potential increases in tax revenues (a benefit to government) and housing affordability (a benefit to the public). Affordability Gains represent the value of below-market rents captured by tenants of income-restricted units (i.e., an implied subsidy), rather than an efficiency gain from new real resources. Consistent with OMB Circular A-94's treatment of distributional effects, this benefit is presented as a distinct category to reflect its intended incidence on lower-income households.[66]

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[64] "Town Meeting Votes to Scale Back Multifamily Zoning." Lexington Observer, March 18, 2025.

[65] MassDOT/Arup, *North South Rail Link Feasibility Reassessment Final Report*, January 2019, Chapter 6, https://www.mass.gov/doc/chapter-6-7/download. (Accessed August 2026.)

[66] Office of Management and Budget, Circular No. A-94, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs," revised November 9, 2023, § 10, "Distributional Effects and Incidence," https://www.whitehouse.gov/wp-content/uploads/2023/11/CircularA-94.pdf. (Accessed August 2026.)

For the Boston Engine Terminal site only, we then discounted the resulting values by 50% because it is the most speculative of the three sites and some or all of the site may not be able to be redeveloped even with the NSRL. It is an operational maintenance building and yard, and, unlike Widett Circle and the USPS Site, it has not been the subject of significant redevelopment discussion. That said, community groups and advocates such as TransitMatters have posited that the site could be more easily redeveloped if the NSRL is built. We include it here at the 50% reduced value as an example of a significant land parcel that is not directly connected to the NSRL but could still benefit from the increases in MBTA operational efficiency that the NSRL could generate.

As described previously, land use benefits are modeled as binary: if either the full Minimum Build or the full Maximum Build is constructed, then the full estimated land use benefits are unlocked; otherwise, there are no land use benefits assumed.

Table 16. Land use and values (under either full Minimum Build or full Maximum Build)

Project	**Widett Circle**	**USPS Site**	**Boston Engine Terminal**	**Total**
Property Tax Revenues	$2,091.4	$1,189.3	$482.4	**$3,763.1**
Affordability Gains	$2,792.0	$378.8	$874.5	**$4,045.2**
Total	**$4,883.3**	**$1,568.1**	**$1,356.8**	**$7,808.3**

Note: 2031 US Dollars in Millions; Present Value of Cumulative 2035-2064.

A full description of the land use benefit analysis methodology, data sources, and other inputs is provided in Appendix H: Land Use Analysis Methodology.

Widett Circle

The Massachusetts Bay Transportation Authority (MBTA) purchased Widett Circle, a 24-acre site one mile from South Station, for $255 million in April 2023.[67] The MBTA plans to develop the land for train storage and maintenance activities, and the MBTA's FY2027-2031 Capital Investment Plan includes $127.6 million for preliminary design of this work.[68, 69, 70]

The South Station Expansion project would reduce this value, as it would limit the site's redevelopment potential. Under SSX, part of Widett Circle would serve as a layover yard for trains, and full site development would require decking over the rail yard, which has unclear feasibility. In contrast, with the NSRL instead of SSX, Widett Circle would not be needed permanently for rail operations, though it could be a temporary staging area during construction. This would enable full redevelopment of the site in the long term.

Widett Circle also sits in a floodplain—exposing it to tidal and storm-related flooding—and Climate Ready Boston projects that by mid-century, the site will be exposed to high-probability coastal flooding, defined as a 10 percent annual chance (or "10-year") flood event.[71, 72] If two flood events occur between 2035 and 2064, we estimate damages to range from $81.9 to $122.9 million (with a midpoint value of $102.4 million).[73] These values are not incorporated into our calculations of estimated benefits and these risks may

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[67] "MBTA Finalizes Purchase of Widett Circle to Accommodate More Efficient Rail Facilities." Mass Transit, April 20, 2023. https://www.masstransitmag.com/rail/press-release/53057871/massachusetts-bay-transportation-authority-mbta-massachusetts-bay-transportation-authority-purchases-widett-circle-to-accommodate-more-efficient-rail-facilities. Accessed December 2025.

[68] Massachusetts Department of Transportation. "Attachment C: Layover Facility Alternatives Analysis Report." South Station Expansion Environmental Notification Form, March 14, 2013. https://www.mass.gov/doc/attachment-c-layover-facility-alternatives-analysis-report/download. Accessed December 2025.

[69] Our valuation of Widett Circle assumes ~3.3 million square feet of office or lab space, ~327,000 square feet of retail space, ~2.2 million square feet of light industrial/R&D/maker space, 11,890 residential units at market rate, and 2,972 residential units at an affordable housing rate.

[70] Massachusetts Bay Transportation Authority (MBTA), FY27–31 Capital Investment Plan (CIP), Final, May 2026. https://cdn.mbta.com/sites/default/files/2026-05/2026-05-28-fy27-31-final-cip-book.pdf. Accessed August 2026.

[71] City of Boston. Climate Ready Boston, "Focus Areas: South Boston." December 8, 2016. https://www.boston.gov/sites/default/files/document-file-01-2017/crb_-_focus_area_southboston.pdf. Accessed December 2025.

[72] Chesto, Jon. "Environmental Groups Criticize Potential Development of Widett Circle Because of Flooding Issues." The Boston Globe, March 16, 2021. https://www.bostonglobe.com/2021/03/16/business/environmental-groups-criticize-potential-development-widett-circle-because-flooding-issues/. (Accessed December 2025.)

[73] Our estimates assume a track cost of $2 million per mile, 11.5 miles of trackage in the yard, a 50% contingency rate, and a 50% increase for yard ancillary structures.

affect development feasibility under both scenarios. However, NSRL construction would require significant excavation, and repurposing the excavated material to elevate Widett Circle could mitigate flooding risk while lowering the costs of moving dirt out of the city.[74]

United States Postal Service Site

A large United States Postal Service ("USPS") site sits adjacent to South Station and has been the topic of discussion for potential redevelopment for many years.[75, 76]

Like at Widett Circle, the proposed SSX project would limit the uses and value of the USPS site. The proposed construction plans for SSX would require the use of most of the land of the USPS site and so would require expensive and uncertain overbuilding of the new tracks to allow for new redevelopment of the air rights.[77, 78]

Boston Engine Terminal

The MBTA has a maintenance building and yard in Somerville (also known as the Boston Engine Terminal or "BET") located across from a major neighborhood scale redevelopment and that has development potential in and of itself.[79] The MBTA also owns the old PanAm Billerica yard.[80] There is precedent for using the Billerica yard for rail operations, as the MBTA is planning to move maintenance-of-way equipment to that location from its small yard at Alewife. With the NSRL, maintenance could more easily be distributed between different sites at Billerica, Amtrak's Southampton shop, Readville, and Salem. As such, the

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74 The MBTA recently programmed and funded a "Phase 1" of Widett Circle layover facility upgrades to include elevating the site by five feet. See: Massachusetts Bay Transportation Authority, "MBTA Board of Directors Approves $850 Million in Funding from Healey-Driscoll Administration to Enhance Safety, Reliability," news release, October 23, 2025, https://www.mbta.com/news/2025-10-23/mbta-board-directors-approves-850-million-funding-healey-driscoll-administration.

75 Catherine Carlock, "Could the postal center next to South Station move at last? The US postmaster may be open to it," *Boston Globe*, June 18, 2026, https://www.bostonglobe.com/2026/06/18/business/south-station-post-office-moving/.

76 Our valuation of the USPS Site assumes 3.5 million square feet of office space, a maximum building height of 13 stories, 100,000 square feet of retail space, 1,936 market-rate residential units, and 484 affordable units, consistent with applicable zoning regulations and the scale of the existing South Station air rights project.

77 Jon Chesto, "Signed, sealed, delivered? Some are optimistic South Station will expand after visit from Postal Service head," Boston Globe, November 26, 2024, https://www.bostonglobe.com/2024/11/26/business/south-station-expansion-postal-service-mbta-amtrak/. (Accessed December 2025.)

78 The MBTA has not acquired the USPS site. This analysis assumes the site is acquired for redevelopment.

79 "Commuter Rail Maintenance Facility," DHK Architects, n.d., https://www.dhkinc.com/project/commuter-rail-maintenance-facility/. (Accessed December 2025.)

80 Insights from an interview with TransitMatters.

BET could be redeveloped. Without the NSRL, the MBTA would likely not shut down the BET because it has access to all northern Commuter Rail lines and can therefore perform light maintenance quickly when challenges arise.

Cost of the North South Rail Link

In this section, we present our estimates for the capital cost of designing and constructing the NSRL. The current study includes fully updated order-of-magnitude cost estimates for the Maximum Build and Minimum Build scenarios that were originally presented in the 2017 HKS Study, as well as full order-of-magnitude cost estimates for the Transporter approaches under the Maximum Build and the Minimum Build scenarios.[81] (See "Appendix B: Financial Model Cost Comparison to 2017" for a comparison of the 2025 financial model estimates to the 2017 HKS study.)

As described further below, line-item assumptions are estimated using a selected subset of the most comparable data from the Federal Transit Administration (FTA) Capital Cost Database.[82] This is a detailed database of built transit project costs that is intended for performing historical cost analysis and developing order-of-magnitude cost estimates for transit projects. The regression and cost-per-mile analyses use data from the Eno Transit Construction Cost Database[83] that has limited line-item details but for a much broader list of projects, including international projects.

The critical distinction of the cost of the Transporter (on a stand-alone basis) under either the Minimum Build or the Maximum Build is that it incorporates only a limited fleet of vehicles (locomotives and coaches) necessary for the short, continuous service running between South Station and North Station. For example, there are 233 new vehicles assumed under the full Maximum Build, but only 40 new vehicles assumed under the Maximum Build with Transporter. Accordingly, as shown in Table 18 below, the vehicle fleet cost is the key driver of the cost savings of the full Maximum Build ($1,400.0 million in vehicle costs) versus the Maximum Build with Transporter ($190.4 million in vehicle costs).

[81] A new regression analysis for the Transporter scenarios was outside the scope of this study.

[82] The FTA is an agency within the U.S. Department of Transportation that provides financial and technical assistance to local transit systems. The FTA's Capital Cost Database includes thousands of cost datapoints for each project in the database, organized by 10 top-level Standard Cost Categories (SCC) and 49 subcategories, covering construction costs, as well as purchase of land, professional services, and vehicles: "Capital Cost Database," Federal Transit Administration, U.S. Department of Transportation, last updated October 11, 2024, https://www.transit.dot.gov/capital-cost-database. (Accessed December 2025.)

[83] The Eno Center for Transportation is a non-profit organization that provides research and analysis for transit around the world. In 2019, Eno launched its Project Delivery Resources Hub which collected data from more than 180 projects built over the last 20 years. This paper uses Eno's Transit Construction Cost Database as of April 2022, which included 283 projects. The database was updated again in 2025 and now includes nearly 300 rail transit projects worldwide: "Project Delivery Resources Hub," Eno Center for Transportation, https://projectdelivery.enotrans.org/. (Accessed December 2025.)

Key Assumptions

Table 17. Key financial assumptions

Item	Assumption	Notes
Cost Inflation	3.8%	Based on the average increase in the Producer Price Index: Construction for the 20-year period 2005 – 2024.[84] Both the 2017 HKS Study and the 2003 MIS/DEIR used a lower rate of 3.5%.
Discount Rate	3.0%	Per Federal guidelines and industry standards, we use a "social discount rate" in our NPV calculations[85] calculated as 2.50% for the real, long-term risk-free rate plus 0.50% to reflect sub-sovereign risk factors and liquidity constraints.[86] Note that this does not incorporate a monetary inflation factor and is distinct from a nominal discount rate.
Contingency	50.0% of Construction Costs	We believe this to be a conservative estimate, as the FTA suggests a reference range of up to 40% for early-stage estimates.[87]

[84] U.S. Bureau of Labor Statistics, "Producer Price Index by Commodity: Special Indexes: Construction Materials [WPUSI012011]," retrieved from FRED, Federal Reserve Bank of St. Louis, https://fred.stlouisfed.org/series/WPUSI012011. (Accessed December 2025.)

[85] OMB Circular A-94, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs," revised November 9, 2023, Section 6(a)(4). Available at: https://www.whitehouse.gov/wp-content/uploads/2023/11/CircularA-94.pdf.

[86] As of August 2026, the real, long-term, risk-free rate reflected in US Treasury Inflation Protected Securities (TIPS) is ~2.40% for the 10-year maturity and ~2.96% for the 30-year maturity; over the past 10 years, TIPS have averaged ~0.65% for the 10-year maturity and ~1.15% for the 30-year maturity. https://www.federalreserve.gov/releases/h15/.

[87] Federal Transit Administration, *Project and Construction Management Guidelines*, January 2025 update (Washington, DC: U.S. Department of Transportation, 2025), 134, https://www.transit.dot.gov/sites/fta.dot.gov/files/2025-02/Project-and-Construction-Management-Guidelines-January-2025.pdf.

Boston Construction Cost Premium	16.4%	A regional adjustment factor per the FTA Capital Cost Database to reflect Boston's above-average construction cost environment.
Professional Services (Soft Costs)	30.0% of Construction Costs	Soft Costs are typically estimated as a percentage of Hard Costs, and our estimate is at the high end of the typical range of 20.0-30.0% (excluding outliers).[88]
Tunnel Construction Methodology	Bored Earth Mixed Shield ($39,846 per lineal foot of guideway)	Bored Earth Mixed Shield is a relatively high-cost tunneling method that is required for excavation through variable mixed soil and rock conditions with groundwater control.[89]
Stations	$142 million per station	Three underground stations in the Maximum Build scenario and two underground stations in the Minimum Build scenario
Dual Mode Locomotives	$9.0 million per vehicle	Locomotives capable of operating on both diesel and electric power, enabling travel through the electrified tunnel and on non-electrified portions of the existing Commuter Rail network.
Coaches	$2.7 million per vehicle	Passenger rail cars pulled by dual-mode locomotives, sized to standard Commuter Rail configurations.

[88] Eno Center for Transportation, Transit Construction Cost Database / Project Delivery Resources Hub, 2025, https://projectdelivery.enotrans.org/. (Accessed December 2025.)

[89] Standard Cost Category 10.073

Cost Summary

Table 18. Major cost line items

Build Scenario	Minimum Build		Maximum Build	
Vehicle Fleet Composition	***Full Regional Rail***	***Transporter Only***	***Full Regional Rail***	***Transporter Only***
Major Line-Items				
Guideway & Track Elements (FTA Cost Code 10)	$860.4	$860.4	$1,825.7	$1,825.7
Stations, Stops, Terminals, Intermodal (FTA Cost Code 20)	$415.7	$415.7	$623.5	$623.5
Support Facilities: Yards, Shops, Admin. Bldgs (FTA Cost Code 30)	$64.9	$64.9	$137.8	$137.8
Sitework & Special Conditions (FTA Cost Code 40)	$279.7	$279.7	$593.5	$593.5
Systems (FTA Cost Code 50)	$154.0	$154.0	$324.1	$324.1
ROW, Land, Existing Improvements (FTA Cost Code 60)	$14.4	$14.4	$30.6	$30.6
Vehicles (FTA Cost Code 70)	$1,279.9	$95.2	$1,400.0	$190.4
Professional Services (FTA Cost Code 80 / 30% of Cost Codes 10-50)	$532.4	$532.4	$1,051.4	$1,051.4
Contingency (FTA Cost Code 90 / 50% of Cost Codes 10-50)	$887.3	$887.3	$1,752.3	$1,752.3
Finance Charges (3.0% of all other costs)	$134.7	$99.1	$232.2	$195.9
Grand Total Costs	**$4,623.4**	**$3,403.2**	**$7,971.2**	**$6,725.3**

Note: 2031$ in Millions.

Construction Challenges

The NSRL will face two types of construction challenges, regardless of which Scenario is selected. First is vertical density (the layering of tunnels, utilities, and other subsurface infrastructure beneath dense urban areas). Second are the complicated geotechnical conditions (diverse or difficult subsurface materials, such as mixed soils, fault zones, or artificial fill, that require specialized tunneling techniques). [90, 91, 92]

Construction of the NSRL would require deep tunneling beneath existing road tunnels, subway lines, and utilities (Vertical Density). It also requires tunneling through landfill and unstable soft soil (Complicated Geotechnical Conditions). [93, 94, 95] These challenges are not precisely quantifiable in a study of this nature, but we account for them by taking a conservative approach to our cost calculations, including the careful selection of comparable projects, the addition of a 16.4% Boston construction cost premium and the substantial 50.0% contingency factor that is applied to all construction costs.

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[90] Y. Zeng, P. G. Atangana Njock, W. Xiong, X.-L. Zhang, and S.-L. Shen, "Risks Analysis of Large Diameter Slurry Shield Tunneling in Urban Area," Underground Space 13 (2023): 281–300, https://www.sciencedirect.com/science/article/pii/S2467967423000806. (Accessed December 2025)

[91] E. Comodromos, M. Papadopoulou, and I. Konstantinidis, "Numerical Assessment of Subsidence and Adjacent Building Movements Induced by TBM-EPB Tunneling," Journal of Geotechnical and Geoenvironmental Engineering (2014), https://ascelibrary.org/doi/10.1061/(ASCE)GT.1943-5606.0001166. (Accessed December 2025.)

[92] J. Qiu et al., "Countermeasures to Treat Collapse During the Construction of Road Tunnel in Fault Zone: A Case Study from the Yezhuping Tunnel in South Qinling, China," Environmental Earth Sciences 78, no. 15 (2019), https://link.springer.com/article/10.1007/s12665-019-8481-z. (Accessed December 2025.)

[93] "The Big Dig: Project Background," Massachusetts Department of Transportation, Mass.gov, n.d., https://www.mass.gov/info-details/the-big-dig-project-background. (Accessed December 2025.)

[94] David Woodhouse and Patrick J. Barosh, "Geotechnical Factors in Boston," Civil Engineering Practice (2011/2012), pp. 237–263.

[95] Y. Zeng, P. G. Atangana Njock, W. Xiong, X.-L. Zhang, and S.-L. Shen, "Risks Analysis of Large Diameter Slurry Shield Tunneling in Urban Area," Underground Space 13 (2023): 281–300, https://www.sciencedirect.com/science/article/pii/S2467967423000806. (Accessed December 2025.)

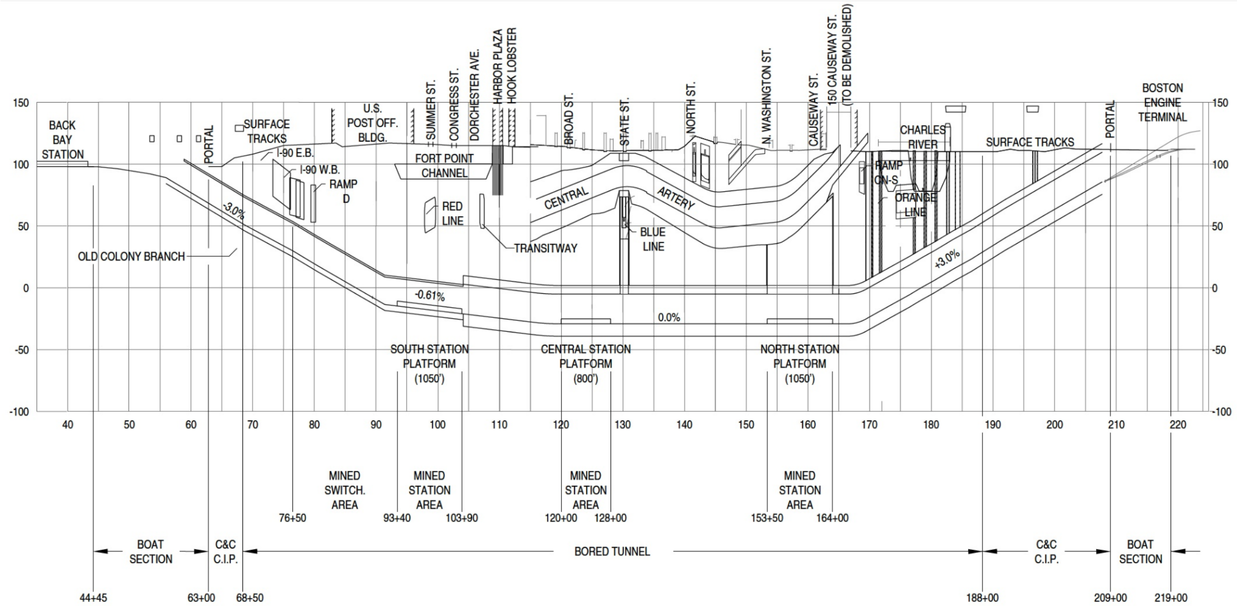

Figure 3. Longitudinal elevation of the NSRL, with the depth below grade (the vertical axis) plotted against horizontal distance (the bottom axis). The NSRL would need to tunnel below stacked infrastructure including (from left to right), I-90 eastbound and westbound, the Fort Point Channel and the Red Line, the Central Artery and the Blue Line, and the Charles River and the Orange Line. For example, the proposed Central Station Platform would need to be at least ~50-100 feet deeper than the Central Artery and the Blue Line. Image from North South Rail Link, "Alignment," Citizens for the North South Rail Link. https://www.northsouthraillink.org/alignment. (Accessed December 2025.)

Calculation Methodology

Line Items

The line-item financial model uses data from the Capital Cost Database maintained by the Federal Transit Administration (FTA), U.S. Department of Transportation.[96] The costs are

[96] The FTA is an agency within the U.S. Department of Transportation that provides financial and technical assistance to local transit systems. The FTA's Capital Cost Database includes thousands of cost datapoints for each project in the database, organized by 10 top-level Standard Cost Categories (SCC) and 49 subcategories, covering construction costs, as well as purchase of land, professional services, and vehicles: "Capital Cost Database," Federal Transit Administration, U.S. Department of Transportation, last updated October 11, 2024, https://www.transit.dot.gov/capital-cost-database. (Accessed December 2025.)

grouped into ten top-level Standard Cost Categories (SCC) listed below and then further grouped into 49 standard subcategories and hundreds of individual line-items.

10.00	Guideway & Track Elements
20.00	Stations, Stops, Terminals, Intermodal
30.00	Support Facilities: Yards, Shops, Admin Buildings
40.00	Sitework & Special Conditions
50.00	Systems
60.00	Right-of-Way, Land, Existing Improvements
70.00	Vehicles
80.00	Professional Services
90.00	Unallocated Contingency
100.00	Finance Charges

The full FTA Capital Cost Database includes 54 federally funded transit projects, of which 25 included some tunneling component. The projects include four transit modes (bus rapid transit, light rail, Commuter Rail, and heavy rail) and various levels of tunneling (from 0 to 100% tunneled). For the comparable project costs that are incorporated into our line-item cost estimate models, we selected a refined subset of these projects with midpoint construction between 1994 and 2013 and that were at least 30% tunneled.

Using the selected subset of projects and costs, the financial model calculates a point estimate cost using the following methodology:

- A pivot table calculates the average, minimum, maximum, and standard deviation values for each of the Standard Cost Categories from projects in the dataset.
- All unit costs were increased by 16.4% to reflect Boston's higher construction costs. [97]
- The average and range figures for each SCC were linked to a sheet calculating an NSRL project cost by multiplying the unit costs from the pivot table by the unit quantities (or project design parameters) in the NSRL.
- Line-item costs were inflated to 2031, the assumed midpoint of construction, using an annual cost inflation rate of 3.8%. [98]

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[97] The 16.4% regional adjustment factor to reflect higher Boston construction costs was obtained from the FTA's Capital Cost Database cost models.

[98] The FTA requires inflating cost estimates to the projected midpoint year of construction to provide a more realistic picture of the final project costs (due to expected inflation during the course of the project).

- A 50% contingency was added to total hard costs to account for potential cost overruns and uncertainty surrounding the design, engineering, construction, and financing of such a complex project at a conceptual stage.[99, 100]
- A 3% finance charge factor was added to all project costs immediately before generating the baseline project cost estimate.[101]

Cost-Per-Mile

A limitation of the FTA Capital Cost Database is that it does not include all relevant projects due to significant time lags, data availability gaps, and other limiting factors. To analyze a group of more recent and especially comparable projects, we calculated cost-per-mile figures using data from the Eno Transit Construction Cost Database.[102] This database is less granular than the FTA Capital Cost Database but its coverage is much broader (including projects both in the United States and around the world) and more up to date.

While the cost-per-mile calculation is less refined than our line-item approach, it enables us to compare our earlier point estimates to data from more recent "megaprojects" with similar construction challenges to NSRL and that are likely to be cited in any discussion of the NSRL project.

We filtered the Eno Transit Construction Cost Database for comparable projects. This produced the following four projects:[103]

- New York City 2nd Avenue Subway Phase 1
- San Francisco Central Subway
- New York City 7-Line Extension

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[99] Cost overruns are commonplace in large infrastructure projects. Bent Flyvbjerg, professor at Oxford University's Saïd School of Business and the leading researcher in this field, found that almost nine out of every ten infrastructure projects run over budget, and that the average cost overrun for rail projects is 45% of budgeted costs: Bent Flyvbjerg, Mette Skamris Holm, and Søren Buhl, "How Common and How Large Are Cost Overruns in Transport Infrastructure Projects?" Transport Reviews 23, no. 1 (2003): 71–88.

[100] The 50% contingency rate is consistent with the 2003 MIS/DEIR and 2017 Harvard Kennedy School studies.

[101] A detailed examination of potential financing options and costs for the NSRL was outside the scope of this study, but our estimate of 3.0% is in line with FTA guidelines: Federal Transit Administration, Project and Construction Management Guidelines, U.S. Department of Transportation, 2016.

[102] "Project Delivery Resources Hub," Eno Center for Transportation, https://projectdelivery.enotrans.org/. (Accessed December 2025.)

[103] Our filters were: 1) Built in the contiguous U.S.; 2) Either light rail, commuter rail, or heavy rail; 3) At least 80% tunneled; and 4) Built since 2000.

- Seattle U-Link.

We added data for three additional projects that are still currently underway: [104]

- New York City 2nd Avenue Subway Phase 2
- The Gateway Program between Newark, NJ, and New York City
- Baltimore Frederick Douglass Tunnel

As shown in Table 19 (completed projects) and Table 20 (underway projects) below, our estimated cost-per-mile falls within the range of recently completed projects and slightly below projects currently underway.

Table 19. Cost-Per-Mile versus comparable transit projects (completed)

Project	**Minimum Build**	**Maximum Build**	**7 Line Extension** (1)	**2nd Avenue Subway Phase 1** (2)	**U-Link** (3)	**Central Subway** (4)
Location	**Boston, MA**	**Boston, MA**	**New York, NY**	**New York, NY**	**Seattle, WA**	**San Fran., CA**
Time Period	2027-2036	2027-2036	2007-2015	2007-2017	2009-2016	2010-2022
# of Tracks	2	4	2	2	2	2
# of Stations	2	3	1	3	2	4
# of Tunnels	1	2	1	2	2	2
Tunnel Length (miles)	2.788	2.958	1.5	1.7	3.1	1.7
Cost ($ billions)	**$4.6**	**$8.0**	**$2.4**	**$4.5**	**$2.0**	**$2.0**
Cost per Mile ($ billions)	**$1.7**	**$2.7**	**$1.6**	**$2.6**	**$0.6**	**$1.1**

Notes:

(1) 7 Line Extension: Expanded the IRT Flushing Line west from Times Square to a new terminal at 34th Street–Hudson Yards; two parallel single-track bores; cost includes station, systems, design, and other project-wide costs.

(2) 2nd Avenue Subway Phase 1: Extended the Q line from 63rd Street to a new terminus at 96th Street, adding three new stations (72nd, 86th, 96th St); two parallel single-track bores; $4.45B nominal cost includes stations, systems, and design.

[104] Since these projects are still underway, the cost figures reflect the most recently-available total project budget for each project.

(3) U-Link: Extended Link light rail underground from downtown to the University of Washington, adding Capitol Hill and UW stations; opened on schedule and under budget.
(4) Central Subway: Extended the T Third Street line from SoMa through Union Square to Chinatown, adding four stations (one at-surface, three underground); final cost ran $375M over the original estimate and exceeded contemporaneous professional cost-database estimates.

Table 20. Cost-Per-Mile versus comparable transit projects (underway)

Project	Minimum Build	Maximum Build	2nd Avenue Subway Phase 2 (1)	Gateway Program (Hudson River) (2)	Frederick Douglass Tunnel (3)
Location	**Boston, MA**	**Boston, MA**	**New York, NY**	**NY / NJ**	**Balt., MD**
Time Period	2027-2036	2027-2036	2024-2032	2023-2035	2023-2036
# of Tracks	2	4	2	2	2
# of Stations	2	3	3	0	1
# of Tunnels	1	2	2	2	2
Tunnel Length (miles)	2.788	2.958	1.76	2.4	2
Cost ($ billions)	**$4.6**	**$8.0**	**$7.7**	**$16.0**	**$6.0**
Cost per Mile ($ billions)	**$1.7**	**$2.7**	**$4.4**	**$6.7**	**$3.0**

Notes:

(1) 2nd Avenue Subway Phase 2: Extends the Q line north from 96th to 125th Street, adding three new stations (106th, 116th, 125th St); reuses a partially-built 1970s tunnel shell (110th–120th St); new boring only from 120th to 125th St.
(2) Gateway Program (Hudson River): New two-tube passenger rail tunnel under the Hudson River and rehabilitation of the existing 116-year-old North River Tunnel; amounts reflect the Hudson Tunnel Project specifically, not the full multi-project Gateway Program; other scopes of work expected to continue through 2038.
(3) Frederick Douglass Tunnel: Replaces Baltimore's 153-year-old B&P Tunnel with two new single-track tubes and adding an ADA-accessible West Baltimore MARC station; $6.0B is a total program cost covering five bridge replacements and ~10 miles of corridor work; not a pure tunnel-boring cost; Amtrak's current target is a 2036 opening.

Regression Analysis

In order to validate the cost estimates derived from our financial model, we conducted a linear regression analysis using data from the Eno Transit Construction Cost Database, which we filtered by three key factors to produce a subset of the most comparable projects to use in the regression.[105]

Unlike the FTA's Capital Cost Database, Eno's Transit Construction Cost Database includes projects from around the world. Therefore, unlike the line-item financial model, the linear regression includes projects outside of the U.S., which can be more difficult to compare on a line-item basis due to data availability and the unique construction environment in the U.S. versus Europe (e.g., building rules and requirements, environmental regulations, labor relations, etc.).

The regression model's three explanatory variables are 1) whether a project was or was not located in the U.S., 2) length of tunnel miles, and 3) construction duration. All three explanatory variables were positively and statistically significantly associated with total project cost (the regression model's output).[106]

We used the model to obtain point estimates and 95% confidence intervals for the capital costs of the Maximum Build and Minimum Build scenarios, which we inflated to 2031$ at a 3.8% annual rate. As shown in Appendix A, our cost estimates are within or above the 95% confidence intervals of the regression analysis outputs, which we believe validates that our line-item financial model is realistic or conservative.

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[105] Our filters were any heavy rail, commuter rail, light rail or bus project that was over 29.99% tunneled with a project start date after 1993.

[106] The regression output and three explanatory variables match the 2017 HKS Study. We considered adding number of stations as an additional explanatory variable, but there was a multicollinearity issue.

Conclusion

This study presents the first comprehensive benefit-cost analysis of the North South Rail Link, extending the 2017 Harvard Kennedy School cost analysis by introducing the Transporter as an alternative implementation approach under either build scenario, a fully updated cost model, and a systematic assessment of economic benefits across nine quantified categories. Under both the Maximum and Minimum Build scenarios with Full Regional Rail, quantified benefits substantially exceed estimated costs, while the Transporter configuration offers a potential strategic implementation pathway under either build size.

Several assumptions warrant acknowledgment. The benefit estimates for the Maximum and Minimum Build assume full implementation of Regional Rail, whose estimated capital cost exceeds $40 billion (2030 dollars) and whose timeline and financing remain unresolved. On the other hand, the 30-year benefit horizon, while consistent with federal guidance, understates the value of infrastructure with an expected service life of 50-100+ years. In addition, labor market effects and the full avoided cost of the South Station Expansion (SSX) are not fully reflected in the quantified benefits.

An important avenue for future research is to evaluate intermediate implementation scenarios. The present analysis is binary: the Full Regional Rail configuration assumes complete Regional Rail, while the Transporter configuration assumes none. In reality, Regional Rail will likely be implemented incrementally. Future work could model a staged transition. This would begin with the Transporter shuttle in combination with through running on selected corridors using dual-mode locomotives and shift to running of fully electrified lines on a line-by-line basis as they are completed. Electrification of the Fairmount and Newburyport/Rockport lines is already underway, meaning that through running service on those lines could begin under any of the four configurations as soon as a tunnel is operational. Such an analysis would provide policymakers with a more realistic assessment of near-term benefits and options for implementation and timing. Such an analysis would likely further strengthen the case for early tunnel construction by demonstrating that meaningful returns accrue well before Full Regional Rail implementation.

Boston is among the cities globally best positioned to benefit from through running, given its existing Commuter Rail network, the short gap between its terminals, and the substantial urban land currently devoted to low-value rail uses. The evidence assembled here supports advancing the NSRL project, which could begin generating meaningful benefits immediately through a dedicated shuttle while laying the foundation for substantially greater long-term benefits than either the Minimum Build or the expansion of South Station alone.

Appendix A: Regression Analysis

Our ordinary least squares (OLS) regression formula is:

$$Total\ project\ cost_i = \beta_0 + \beta_1 usa_i + \beta_2 tunnel\ miles_i + \beta_3 construction\ months_i + \epsilon_i$$

where,

Total project cost is a continuous variable for each project's capital cost.

USA is a dummy variable for the location of a project (1 = In the United States; 0 = Not in the United States).

Tunnel miles is a continuous variable for the sum of the lengths of all tunnel segments in the project, reported in miles.

Construction months is a continuous variable in months for the project's duration.

Table 21. Regression results for predicting total project cost values

	Dependent Variable: Total Project Cost
Intercept	-1,628.76 (449.68)
USA	1,373.89* (652.27)
Construction Months	26.61*** (5.07)
Tunnel Miles	267.32*** (31.13)
Number of Observations	97
Adjusted R^2	0.543

Notes: ***p<.001, **p<.01, *p<.05; coefficient values in thousands of dollars; standard errors in parentheses.

Table 22. Range in regression outputs

Grand Total Costs	Minimum Build	Maximum Build
Regression Range	\$2,710.0 million to \$5,990.0 million	\$3,830.0 million to \$7,150.0 million
Current Financial Model	\$4,623.4 million	\$7,971.2 million

Note: 2031 US Dollars

Appendix B: Financial Model Cost Comparison to 2017

Although we were able to incorporate new FTA data in our estimates, our methodology for developing line-item financial model estimates of the NSRL matched the work of the 2017 HKS study. In Table 23, we compare our current estimates of the NSRL cost (based on the financial model methodology) to the 2017 HKS study.

The 2017 point estimate, in 2025 dollars, was $4.67 billion for the Maximum Build and $3.0 billion for the Minimum Build. Comparing these to this study's current estimates (in 2031 dollars), the 3.8% annual inflation rate accounts for 35% of the total increase for the Maximum Build, and 46% of the total increase for the Minimum Build. The remaining increase for both builds (65% for the Maximum Build and 54% for the Minimum Build) reflects other factors, primarily the incorporation of newer and more up-to-date data from the FTA Capital Cost Database and a more refined selection of comparable projects.

Table 23. Financial model cost comparisons 2017 vs. current estimate

Build Scenario	**Minimum Build**			**Maximum Build**		
Estimate	2017	2017 Inflated	Current	2017	2017 Inflated	Current
Valuation Year $	2025$ billions	2031$ billions	2031$ billions	2025$ billions	2031$ billions	2031$ billions
Grand Total Costs	$3,000.0	$3,752.4	$4,623.4	$4,670.0	$5,841.2	$7,971.2

Appendix C: New Train Schedule

This section outlines the key assumptions and service model for a Regional Rail system operating seven days per week. The model is designed to provide frequent, evenly spaced service, improve connectivity across the network, and ensure logical scheduling decisions based on demand and infrastructure constraints.

Regional Rail service operates seven days per week, ensuring consistency in scheduling and reliability for riders. Service follows a clockface schedule, meaning trains run at evenly spaced intervals throughout the day. This does not necessarily mean trains depart on the hour but instead maintain a fixed interval (e.g., hourly departures at 1:33, 2:33, 3:33, etc., or every 15 minutes at 12:14, 12:29, 12:44, etc.).

Every outer terminal receives train service at least every 30 minutes, establishing a minimum baseline for Regional Rail operations. An exception applies to the Old Colony Lines, where a single-track segment between Quincy and JFK-UMass limits operational flexibility. To accommodate this constraint, the Greenbush and Kingston lines receive hourly service due to lower ridership, while the Middleborough line retains a 30-minute frequency given its higher demand, particularly in Brockton, a Gateway City with high residential density.

The inner, highly urban core receives service every 15 minutes or better. For lines that branch, 15-minute service is achieved naturally by running 30-minute service to each terminal, resulting in a combined frequency of 15 minutes where the branches merge. The Providence and Stoughton branches split at Canton Junction, while Needham branches earlier at Forest Hills, creating 15-minute service between Canton Junction and Forest Hills and 7.5-minute service between Forest Hills and South Station. The Newburyport and Rockport lines branch at Beverly, and the Lowell and Haverhill lines branch at the Wildcat Branch, with Haverhill-bound trains rerouted through this corridor instead of passing through Reading.

For non-branching lines, a short-turn location defines the point where 15-minute service terminates. These locations are generally near Route 128, which marks the transition between the dense urban core and the outer suburban areas. Proposed short-turn locations include Framingham for the Worcester Line, Brandeis for the Fitchburg Line, and full-length 15-minute service for the Reading Line, given that Haverhill trains now use the Wildcat Branch. On the Franklin Line, all trains operate via the Fairmount Line in 30-minute intervals, while additional 15-minute service is provided between South Station and Readville.

At South Station, train movements naturally split between Back Bay-bound and South Bay-bound trains (Fairmount and Old Colony Lines). While dispatching flexibility remains critical, a consistent platforming strategy should be established to ensure predictable and efficient operations.

Service may operate at even higher frequencies during weekday rush hours, with potential express overlays to reduce travel times on key corridors. Amtrak services are not explicitly included in this model but must be coordinated around MBTA slots. This consideration influenced the decision to route Franklin Line trains via the Fairmount Line, preserving Northeast Corridor capacity for Amtrak.

This Full Regional Rail service model forms the foundation for evaluating North South Rail Link (NSRL) operations. In this paper, we apply the model schedule to the NSRL to determine baseline tunnel throughput and overall system capacity requirements.

Appendix D: Time Value Estimates

To determine the value of benefits from a reduced wait time, we calculated an aggregate wait time to compare expected wait times (1/2 of frequency) against current wait times, using the alternative schedules created for Full Regional Rail, NSRL Minimum Build and NSRL Maximum Build.[107] We also assumed a 20% discount due to expected operational difficulties.

The model can be partially expressed in the following equation:

$$Aggregate\ Wait\ Time_i = \sum_{t=2035}^{2064} \frac{(CurrentWait - ProjectWait_i)(CurrentRides_t * HourlyValue)}{DiscountRate_t}$$

Note: we did not calculate wait time benefits for those shifting modes of transportation (e.g., new riders who may save time from car or bus to train) except for those making the journey between North and South Station.

We based current wait times on published MBTA schedules, and we projected future wait times based on projected increases in frequency under the build scenarios (holding all else equal, projected wait times decline as frequency increases).

The monetary value of wait time saved is found by multiplying the aggregate difference in wait times saved by the USDOT BCA's 2022$ hourly value for Walking, Cycling, Waiting, Standing, and Transfer Time inflated to 2031$. This is approximately $48.

Finally, the per-ride wait time benefit is scaled to the number of rides on the current system, as these would be the people whose current trip would be improved by wait time reduction.

We also analyzed transfer benefits (the value to riders currently making the journey from North Station to South Station or vice versa). To determine this, we needed to model the affected number of passengers and the time it required them to get from North to South Station either by subway, walking, etc. The theory is that there are commuters who travel to

[107] White, "Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis."

either North or South Station via Commuter Rail, and then transfer via bus or subway to get near the other station.

To estimate the number of affected passengers, we looked at the number of total riders to each station, and then used a "draw" calculation, defined as the % of jobs within a 10-minute walkshed of that station compared to the total number of jobs within a 10-minute walkshed of North Station, South Station, and Back Bay. We then multiplied each station's draw by the % of jobs within Boston and Cambridge that are within any of those 10-minute station walksheds to understand the likelihood of working in a job near one of the stations if someone is taking the Commuter Rail into downtown.

These calculations are as follows:

$$\begin{aligned}
&\textit{Station A Transfer Ridership} \\
&\quad = (\textit{Station A Riders}) * (\%\textit{Draw Station B}) * (\%\textit{Stations Total of All City Jobs}) * (\%\ \textit{Friction}) \\
&\quad + (\%\textit{Draw Station C}) * (\%\textit{Stations Total of All City Jobs}) * (\%\ \textit{Friction})
\end{aligned}$$

$$\textit{Transfer Time Benefits} = \sum_{t=2035}^{2054} \frac{(\%Mode_m * TransferRidership_{t,a})(1 + PopGrowthRate_t)}{DiscountRate_t}$$

Where:

$m \in [subway, bus, walk, bike, rideshare]$ and

$a \in [North\,Station, South\,Station, Back\,Bay]$

Additional assumptions include:

- 15% friction discount (how many people who are dropped off at Back Bay/South Station/North Station are taking a job near the other port)
    - Portion of riders dropped off at terminal station determined through 2018 station disaggregated data

- Prior mode of transportation determined through A Better City's "Anticipating Post-Pandemic Commute Trends in Metro-Boston" [108]
    - Weighting by portion of people taking subway, bus, bike, walking, and taxi/rideshare
- Mode shift assumptions:
    - Assumes no wait time for ride share and fee of $20.00 per ride
    - Assumes average walking speed of 2.8 mph
    - Assumes no cost for biking or walking outside of time savings benefit
    - Assumes $1.70 for bus fare and $2.40 for subway fare
        - Subway time savings assumed for Orange-Red line route
        - Bus time savings assumed for Line #4
    - Alternative mode times determined through Google Maps and weighted by proportion of alternative mode usage.

[108] Rivera, Marissa. "Anticipating Post-Pandemic Commute Trends in Metro-Boston: Spring 2021 Update." A Better City, August 2021. https://abctma.com//assets/documents/Report-CommuterSurveyPhase2.pdf. Accessed December 2025.

Appendix E: Ridership Analysis Methodology

Below, we detail how we estimated Commuter Rail ridership under different scenarios: the current system, a Full Regional Rail system, and the Minimum Build and Maximum Build versions of the NSRL. We also outline the key assumptions and adjustable parameters used in the model, explaining how they were set to generate the ridership estimates presented in this paper.

We used the following equation to calculate ridership (number of rides into North and South Stations) in the Excel model:

$$Ridership_{time\ t+1} = \sum_{line\ l, time\ t} \left(\frac{ridership_{l,t}}{capacity_{l,t}} * capacity_{l,t+1}\right) + \Delta capacity_l * \Delta ridership_l + \Delta ridership_{nsrl}$$

Mathematically, this equation estimates the number of rides in a future time period (t+1) by summing ridership across all Commuter Rail lines. The term in parentheses accounts for how full each train line is in the base year (ridership divided by capacity) and the increased train capacity resulting from higher frequency with Full Regional Rail, the Minimum Build or the Maximum Build. The next term captures the change in capacity multiplied by the change in ridership, reflecting the ridership increase associated with greater frequency. The final term estimates the ridership change attributable to the NSRL.

System Ridership

Our Excel-based model incorporates 2018 Commuter Rail ridership data from the MBTA *Blue Book*.[109] For each train line serving North or South Station, we calculated the average number of on- and off-boardings per train.

To estimate the number of trains operating on each line per weekday, weekend, and holiday, we used data from the MBTA Commuter Rail website.[110] Since train capacities vary, we

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[109] Massachusetts Bay Transportation Authority (MBTA) and MassDOT, "MBTA Blue Book Open Data Portal" https://mbta-massdot.opendata.arcgis.com/search?tags=commuter%20rail. (Accessed December 2025.)

[110] Massachusetts Bay Transportation Authority. "Commuter Rail | Schedules & Maps." MBTA.com. https://www.mbta.com/schedules/commuter-rail. (Accessed December 2025.)

assumed an average of 600 seats per train on all lines except for the Fairmount Line, which has lower ridership and was assumed to have 400 seats per train.

Using ridership and train frequency data, we calculated total ridership per train, per day, and per year for each line, as well as train occupancy rates (the proportion of trains filled with riders, or ridership-to-capacity ratios). Our dataset included only weekdays, so we assumed that weekday ridership per train also applied to weekends and holidays. Additionally, to account for the fact that our data was from 2018, we introduced adjustable parameters to estimate ridership in the base year. For this analysis, we set base-year ridership at 80% of 2018 weekday ridership and 96% of 2018 weekend and holiday ridership.[111]

System Capacity

To estimate system capacity changes under different expansion scenarios, we calculated capacity multipliers for the Full Regional Rail system, the Minimum Build and the Maximum Build. These multipliers were based on our projected train schedules and assumed that both the Full Regional Rail system and either NSRL scenario would increase overall system capacity in proportion to service frequency increases. For the Full Regional Rail system, we assumed that weekend and holiday service would operate at 20% below weekday levels.

We applied an operational discount parameter to account for inefficiencies in train operations, set at 20% in this analysis (i.e., due to inefficiencies, train frequencies are 20% less than their maximum capacities). Additionally, for the four-track NSRL, we introduced a separate discount factor of 10%, assuming that operations would not scale perfectly with the increase in track capacity. From this analysis, we calculated frequency ratios, which represent the number of trains operating on each line under the current system, Full Regional Rail, the Minimum Build and the Maximum Build. These ratios illustrate the capacity increases associated with each expansion scenario, relative to the current system.

[111] We based these parameter values off conversations with MBTA and MassDOT staff, other transportation experts, and information from Brian Kane, 'Commuter Rail's Ridership Recovery Plan Is Working,' CommonWealth Beacon, March 20, 2024, https://commonwealthbeacon.org/opinion/commuter-rails-ridership-recovery-plan-is-working/. (Accessed December 2025.)

Ridership Projections

We calculated annual ridership per line for a base year under different scenarios by multiplying ridership-to-capacity ratios by the current system capacity (or frequency) and projected increases in system capacity (or frequency) from Full Regional Rail, the Minimum Build and the Maximum Build. These estimates incorporated an elasticity for ridership associated with frequency changes, assuming a 0.7% ridership increase for every 1% increase in frequency, which is based on other analyses.[112] Finally, these estimates assumed a 20% ridership increase from building a connective tunnel, derived from comparable projects in London, Philadelphia, and New York City.[113, 114, 115]

We then calculated the average and total projected annual ridership per line over a 30-year period under four scenarios: the current system, Full Regional Rail, the Minimum Build and the Maximum Build. We assumed annual ridership growth proportional to population growth in the Boston Metropolitan Area, set at 0.31% per year, which is based on Boston population data.[116] Our model allowed for adjustments to the base year, which we set at 2024, and we established 2035 as the ridership analysis start year to align with the NSRL's projected opening. We incorporated Boston's population growth rate to estimate ridership growth from 2024 to 2035. The ridership information presented in this report reflects yearly average ridership (in terms of number of rides) into or out of South and North Station for the 30-year period from 2035-2064.

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[112] We based our elasticity of ridership estimation on other analyses including: Alon Levy, "Frequency and the Ridership Spiral," Pedestrian Observations, February 25, 2019, https://pedestrianobservations.com/2019/02/25/frequency-ridership-spirals/. (Accessed December 2025.)

[113] Harry Kyriakodis, "Single Most Transformative Investment? The Commuter Rail Tunnel, Now Turning 30," Hidden City Philadelphia, November 7, 2014, https://hiddencityphila.org/2014/11/single-most-transformative-investment-the-commuter-rail-tunnel-now-turning-30/. Accessed December 2025.

[114] Saxe S, Denman S (2017), "Greenhouse gas from ridership on the Jubilee Line Extension". Proceedings of the Institution of Civil Engineers - Transport, Vol. 170 No. 2 pp. 108–120, doi: https://doi.org/10.1680/jtran.15.00095.

[115] Alon Levy, "The LIRR and East Side Access," Pedestrian Observations, July 3, 2023, https://pedestrianobservations.com/2023/07/03/the-lirr-and-east-side-access/. Accessed December 2025.

[116] "Boston Metro Area Population 1950-2026," MacroTrends, n.d., https://www.macrotrends.net/global-metrics/cities/22939/boston/population. (Accessed December 2025.)

Benchmarking Projected Ridership

We compared our ridership projections to historic MBTA operations and to comparable cities and transit systems in the United States and around the world, and we believe that our projections are realistic in comparison.

United States and International Comparisons

Table 24 and Table 25 below show Unlinked Passenger Trips ("UPTs"), the industry standard for measuring ridership,[117] and UPTs per Capita, which normalizes the number of UPTs over different population sizes.

With a UPT per Capita of 59, Boston sits just above the US average of 50 (excluding the outlier of the New York – New Jersey area), and far below comparable European cities that already have comprehensive regional rail networks.[118] Projected UPT per Capita of 107 under the Maximum Build with Full Regional Rail represents a significant increase above the current level, but it would still be ~40% below current levels in the New York – New Jersey area, and ~65% below current levels in the comparable European cities of Berlin[119, 120], Hamburg[121] and Vienna[122, 123].

[117] Unlinked Passenger Trips count each vehicle boarding, not each "origin-to-destination" journey. For example, a journey that starts on the Green Line or Commuter Rail with a transfer to the Red Line before the final destination would count as two UPTs.

[118] Author's analysis using data from Federal Transit Administration, Office of Budget and Policy, *National Transit Summaries and Trends: 2024 Edition*, version 1.1 https://www.transit.dot.gov/sites/fta.dot.gov/files/2025-11/2024%20National%20Transit%20Summaries%20and%20Trends%201.1.pdf. (Accessed February 2026.)

[119] Author's analysis using data from S-Bahn Berlin GmbH, "S-Bahn Berlin at a Glance," company profile, data as of December 31, 2025 https://sbahn.berlin/en/about-us/company-profile/s-bahn-berlin-at-a-glance. (Accessed February 2026.)

[120] Author's analysis using data from Berliner Verkehrsbetriebe (BVG), "BVG 2024 mit vielen Einstellungen und Fahrgastfahrten" [BVG 2024: Many new hires and passenger trips], press release, January 8, 2025, https://www.bvg.de/de/unternehmen/medienportal/pressemitteilungen/2025-01-08-pm-zahlen-2024. (Accessed February 2026.) Original in German; English rendering assisted by ChatGPT.

[121] Author's analysis using data from Hamburger Verkehrsverbund (HVV) GmbH, "Zahlen, Daten, Fakten" [Facts and figures], https://www.hvv.de/de/ueber-uns/der-hvv/zahlen-daten-fakten. (Accessed February 2026.) Original in German; English rendering assisted by ChatGPT.

[122] Author's analysis using data from ÖBB-Personenverkehr AG, "S-Bahn Vienna, Lower Austria & Burgenland," https://www.oebb.at/en/regionale-angebote/wien/s-bahn-wien. (Accessed February 2026.)

[123] Author's analysis using data from Wiener Linien GmbH & Co KG, "Die Wiener Öffis in Zahlen" [Vienna's public transit in numbers], https://www.wienerlinien.at/die-wiener-oeffis-in-zahlen. Original in German; English rendering assisted by ChatGPT. (Accessed February 2026.)

Table 24. Projected ridership compared to US cities

Area	Urbanized Area (UZA) Population	Population Density (per sq. mile)	Unlinked Passenger Trips (UPT)	UPT per Capita
New York—Jersey City—Newark, NY—NJ	19,426,449	5,981	3,510,100,000	181
Los Angeles—Long Beach—Anaheim, CA	12,237,376	7,476	421,800,000	34
Chicago, IL—IN	8,671,746	3,709	367,200,000	42
Washington—Arlington, DC—VA—MD	5,174,759	3,997	311,300,000	60
Philadelphia, PA—NJ—DE—MD	5,683,137	3,001	232,000,000	41
Boston, MA—NH (Actual 2024)	**4,382,009**	**2,646**	**260,500,000**	**59**
Boston, MA—NH (Projected 2035)*	**4,533,773**	**2,738**	**484,538,905**	**107**
San Francisco—Oakland, CA	3,515,933	6,843	264,400,000	75
Seattle—Tacoma, WA	3,524,893	3,607	165,300,000	47

Note: All figures are actual for 2024 except for Boston Projected 2035, which assumes the Maximum Build Scenario with Full Regional Rail.

Table 25. Projected ridership compared to international cities

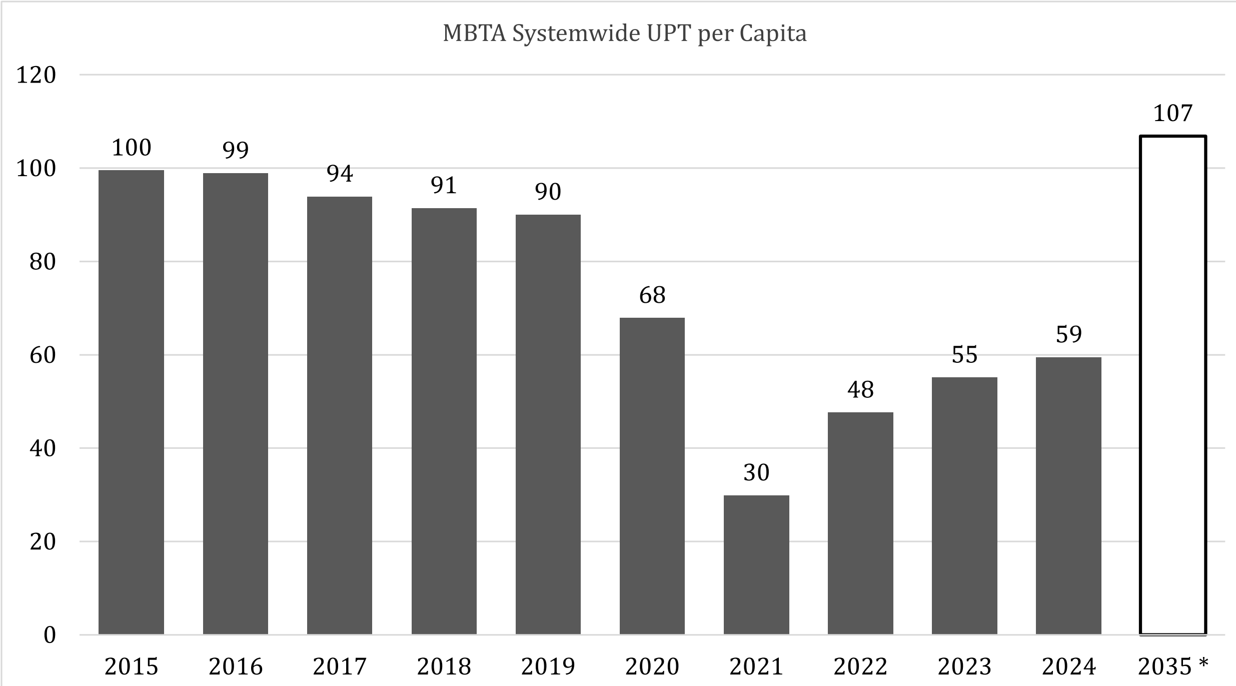
Area	Urbanized Area (UZA) Population	Population Density (per sq. mile)	Unlinked Passenger Trips (UPT)	UPT per Capita
Berlin	5,481,613	3,111	1,576,000,000	288
Boston, MA—NH (Actual 2024)	**4,382,009**	**2,646**	**260,500,000**	**59**
Boston, MA—NH (Projected 2035)*	**4,533,773**	**2,738**	**484,538,905**	**107**
Hamburg	3,700,000	2,170	1,100,000,000	297
Vienna (Wien)	2,971,753	1,987	962,000,000	324

Note: All figures are actual for 2024 except for Boston Projected 2035, which assumes the Maximum Build with Full Regional Rail.

Table 26, Table 27 and Table 28 below show historic MBTA systemwide UPTs per capita and ridership by mode.[124] These tables show that ridership has trended down across all modes over the past 10 years (with the exception of the small MBTA ferry service), but the Commuter Rail has exhibited the strongest post-pandemic recovery across the MBTA system. Furthermore, while the projected increase in UPT per capita represents a significant increase over recent years, the projected rate of 107 under the Maximum Build with Full Regional Rail is only slightly above past highs of 99-100 in 2015 and 2016.

[124] Author's analysis using data from Federal Transit Administration, *Complete Monthly Ridership (with Adjustments and Estimates)*, National Transit Database, October 2025 release (published December 1, 2025), https://www.transit.dot.gov/ntd/data-product/monthly-module-adjusted-data-release.

Table 26. Historic and projected MBTA systemwide UPT per capita



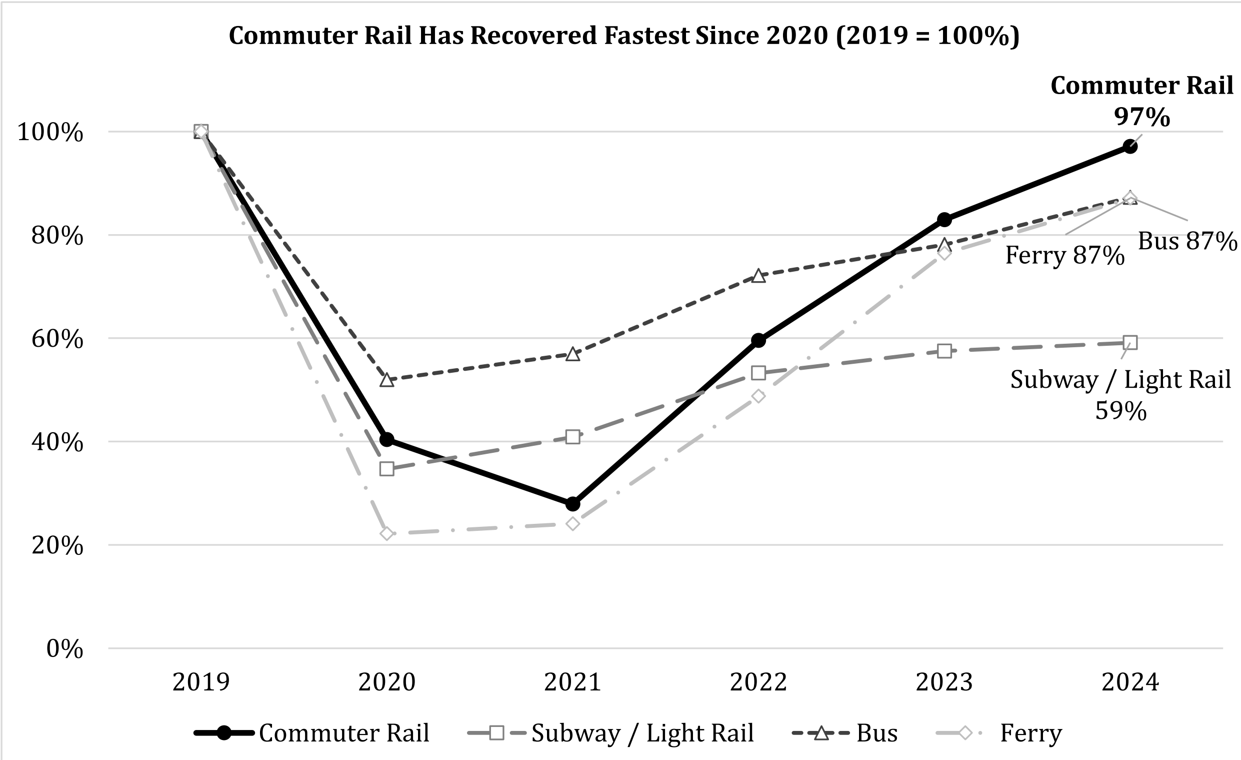
Note: Under Maximum Build with Full Regional Rail.

Table 27. Historic MBTA ridership by mode

Year	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Commuter Rail	35.6	32.2	33.9	33.7	31.6	31.9	12.9	8.9	19.0	26.4	31.0
Subway / Light Rail	246.7	233.9	234.2	223.9	219.0	215.5	74.8	88.1	114.8	123.9	127.4
Bus	130.3	131.0	123.4	121.0	118.2	117.3	61.0	66.8	84.7	91.6	102.4
Ferry	1.4	1.4	1.5	1.5	1.5	1.6	0.4	0.4	0.8	1.3	1.4
Total	**414.0**	**398.6**	**392.9**	**380.1**	**370.3**	**366.3**	**149.0**	**164.2**	**219.2**	**243.3**	**262.2**

Note: Ridership in millions.

Table 28. Post-pandemic Commuter Rail ridership recovery



Appendix F: Mode Shift Benefit Estimations

Gas/Gas Tax Savings

We use the two formulas below to calculate the aggregate gas benefit (e.g., savings) and aggregate tax loss (i.e., loss in terms of government revenue but gain to the consumer).

The inputs required for the model are expected miles, miles per gallon, average price per gallon in Massachusetts based on the 2024 average (inflated to 2031 with 3.5% inflation). Per Massachusetts law, gas taxes are not tied to inflation and have been fixed at $0.24 since 2013.[125] We hold this assumption and do not apply inflation to this amount going forward. Also note that gas taxes are included in the retail price of gasoline in Massachusetts and therefore included in our calculation of gas cost savings. We also expect electric vehicles to take over the car market over the next 25 years and include this as a % within the model. The Massachusetts Clean Energy and Climate Plan for 2050 assumes EVs will account for 19% of on-road vehicles by 2030 and 97% of on-road vehicles by 2050.

Since the percentage of gas vehicles declines each year, gas benefits decline and are virtually phased out by 2050. Electric cars do cost power, but we do not calculate power savings from switching from an electric car to the train. Calculations are presented below:

Aggregate Gas Benefit and Aggregate Gas Tax Loss:

$$Aggregate\ Gas\ Benefit_i = \sum_{t=2035}^{2064} \frac{(\Delta Ridership_{i,t} * ExpectedMiles * GasPricePerGallon_{2031} * \%ICEV_t)(1 + PopGrowthRate_t)}{MilesPerGallon * DiscountRate_t}$$

$$Aggregate\ Gas\ Tax\ Loss_i = \sum_{t=2035}^{2064} \frac{(\Delta Ridership_{i,t} * ExpectedMiles * GasTaxPerGallon_{2031} * \%ICEV_t)(1 + PopGrowthRate_t)}{DiscountRate_t}$$

Vehicle Maintenance

The U.S. Department of Energy estimates maintenance cost per mile for battery-electric vehicles to equal $0.061 compared to $0.101 for internal combustion engine vehicles.

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[125] Massachusetts Question 1 (2014), Eliminating Gas Tax Indexing, enacted as Massachusetts Acts of 2014, ch. 504 (approved by voters Nov. 4, 2014).

The model's calculation is presented below – we are multiplying the net miles of driving saved by that vehicle type and by maintenance cost, and then aggregate both types of vehicles for full maintenance savings.

Model:

$$Aggregate\ Maintenance\ Benefit_i = \sum_{t=2035}^{2064} \frac{(\Delta Ridership_{i,t} * ExpectedMiles * ICEVMaintenancePerMile * \%ICEV_t)(1 + PopGrowthRate_t)}{DiscountRate_t} + \sum_{t=2035}^{2064} \frac{(\Delta Ridership_{i,t} * ExpectedMiles * BEVMaintenancePerMile * \%BEV_t)(1 + PopGrowthRate_t)}{DiscountRate_t}$$

Tolls

We calculated expected tolls by train line (i.e., would a commuter using this line have to spend on tolls if they were driving) and multiplied that by the change in ridership for each line for each project (NSRL, SS, RR). The calculation is presented below.

Model:

$$Aggregate\ Toll\ Benefit_i = \sum_{t=2035}^{2064} \frac{(\sum(ExpectedTolls_l * \Delta Ridership_{i,l}))(1 + PopGrowthRate_t)}{DiscountRate_t}$$

Carbon Benefits

Additionally, the USDOT Benefit-Cost Analysis assigns a different discount rate for carbon emissions at 2.0% to account for additional future benefits of carbon reduction.[126] We use this rate for our carbon savings projections. For the price of carbon, we use the USDOT BCA

[126] U.S. Department of Transportation, Office of the Secretary, Benefit-Cost Analysis Guidance for Discretionary Grant Programs, November 2024, 12, 20, https://www.transportation.gov/sites/dot.gov/files/2024-11/Benefit%20Cost%20Analysis%20Guidance%202025%20Update%20(Final).pdf. (Accessed August 2026.) In May 2025, the Trump Administration reinstated the older OMB Circular A-94 (1992) discount rates and removed CO2 monetization values entirely.

Table A-6 Damage Costs for Emissions per Metric Ton which includes the value of reducing carbon emissions in future years. As the table only extends through 2053, we assume a 1% increase in cost between 2053 and 2064 to calculate the remaining values.

Increased Fare Revenues

There are several fare types for Commuter Rail, and we included them all in the model. The formula is shown below.

$$Expected\ Fare = \sum \frac{FareCost_f * \%RidershipPerFareType_f}{RidesPerTicket_f}$$

$$Aggregate\ Fare\ Benefit_i = \sum_{t=2035}^{2064} \frac{(\sum(ExpectedFare_l * \Delta Ridership_{i,l}))(1 + PopGrowthRate_t)}{DiscountRate_t}$$

For Monthly Pass users, we made the following assumptions.

- 25% of riders use monthly passes
- 3.1% of riders use Commuter Rail 6-7 times a week
- 28.2% of riders use Commuter Rail 5 times a week
- Assuming monthly pass holders are the highest riders, so all of the 6/7-day-users and the rest of riders come from the 5 times list. For all rides, we assume people use the Commuter Rail two ways, so we count the 5-day-a-week riders as 10 rides per week or 520 rides per year. Using the average rides per month for each of these ridership categories and weighing them by the size of each category, we get an expected 44.95 rides per month for monthly riders which we divide the monthly fare per station by to get expected monthly fare per ride.
- Similarly, for weekend passes, we assume weekend pass holders are using the full benefit, riding the Commuter Rail both Saturday and Sunday there and back, or 4 rides per pass with an expected per-ride cost of $2.50.

For other fare types, the calculations are somewhat more straightforward. For Pay-Per-Day, we take the regular fare schedules based on the zone of each station. For Reduced fare pay-per-day, we take the reduced fare schedules based on the zone of each station, and we assume a 20% reduction based on Massachusetts' expectations for the expanded fare reduction program.

To aggregate, we take the new riders for a project (i.e., expected ridership – current ridership projections) and multiply by the portion of ridership that falls into each category (60% monthly, 8% weekend, 8% reduced daily fare, 24% regular daily fare) and by the expected overall fare based on stop density and proportion of total ridership by line.

Appendix G: Property Values and Property Taxes

We use projected increases in Transit Scores to project increases in property values, which in turn lead to projected increases in property taxes.

Modeling Transit Scores

Transit Scores are a proprietary methodology of Walk Score, a subsidiary of real estate brokerage firm Redfin. Transit Scores measure how well a location is served by public transit, ranging from 0 to 100, with higher scores meaning better public transit.[127] Key inputs include the frequency of service, the type of service, and the walking distance to the service from the given location, adjusted for diminishing marginal returns and dependency on the beginning score. The overall Transit Score for Boston is 72, with lows of 40-60 in outlying neighborhoods like West Roxbury, and highs of 99-100 in the Back Bay and Financial District.

We do not have access to the complete, proprietary methodology, but we have approximated using publicly available information and known underlying relationships.

We began by collecting the Transit Scores for each Massachusetts city in which MBTA stations are currently located. If a city did not have a Transit Score, we used the lowest score of the closest city on the rail line that did have a Transit Score. We estimated the increases in the current scores stemming from the increases in frequency that would result from the given build scenario.

Holding all else equal, increases in public transit *frequency* result in increases in Transit Scores. However, the relationship is not strictly linear; Transit Scores exhibit decreasing marginal improvements as transit frequency increases (diminishing marginal returns). To estimate this relationship, we used Boston's overall score of 72 as a baseline and normalized using a log-based functional form, as follows:

$$TS_s = TS_0 + (TS_{\mathrm{RR}} - TS_0)\left(\frac{\ln(F_s)}{\ln(F_{\mathrm{RR}})}\right)$$

[127] "Transit Score Methodology," Walk Score, n.d., https://www.walkscore.com/transit-score-methodology.shtml. (Accessed December 2025.)

- TS_s = Transit Score under scenario s,
- TS_0 = baseline Transit Score (72 for the calibration point),
- TS_{RR} = calibrated Transit Score under the Full Regional Rail scenario (74.297)
- F_s = Commuter Rail frequency multiplier for scenario s,
- F_{RR} = Full Regional Rail frequency multiplier (2.1487)

Changes in Transit Scores also depend on the starting point: for a given change in frequency (or other similar variable), a *lower beginning* Transit Score will *increase more* than a *higher beginning* Transit Score. This is because a lower beginning score has more "potential" or "headroom" to reach the maximum of 100 versus a higher beginning score.

To estimate this relationship, we used Boston's current overall score of 72 and current transit system as a calibration point, as follows:

$$TS_{i,s}^{\mathrm{final}} = TS_i^0 + \left(\frac{100 - TS_i^0}{100 - 72}\right) \Delta TS_s$$

where:

- TS_i^0 is station i's original Transit Score;
- ΔTS_s is the scenario-specific increase in Transit Score calculated in the first step using the logarithmic frequency adjustment;
- 72 is the Boston-wide calibration score; and
- $\left(\frac{100-TS_i^0}{100-72}\right)$ is the station-specific headroom factor.

This reflects the principle that areas with poorer transit access have more room for impactful improvement, potentially leading to greater increases in property values.

To determine Property Taxes, we determined the incremental tax revenue: this is the additive tax revenue that the NSRL would bring beyond the Full Regional Rail property value additions.

Appendix H: Land Use Analysis Methodology

Below, we outline our approach to estimating land use benefits for Widett Circle, the USPS site adjacent to South Station, and Boston Engine Terminal under the NSRL scenarios. While we used the same general calculation process for each site, we adjusted assumptions as detailed under the relevant subheadings.

We calculated the net present value of the residential affordability benefit by comparing the difference in rent for affordable and market-rate apartments (i.e., the implicit subsidy) and the number of rental units in each group over a 30-year period. We assessed the net present value of tax amounts to Boston by considering the tax rates, site usage, and total value changes over a 30-year period. We then summed the affordability gain and Boston taxes number to yield a total estimate for the site under each scenario, which we inflated to 2031 dollars.

Widett Circle

To assess the land use benefits at Widett Circle, we made the following assumptions: [128]

- A parcel value of $255,000,000 [129]
- A floor area ratio (FAR) of 10 for full mixed-use zoning [130]
- A total floorplate of 1,415,700 square feet
- A Boston tax rate of $10.74 for residential and $24.68 for commercial space [131]
- A breakdown of site use that is 58% residential (20% of which is affordable), 2% retail (at $42.56 per square foot rent), 15% office or lab space (at $71.50 per square foot rent), 10% light industrial or maker space (at $22.31 per square foot rent), and 15% circulation [132]

[128] "Development Plans Dropped for Widett Circle as MBTA Moves to Acquire Property," BLDUP, n.d., https://www.bldup.com/posts/development-plans-dropped-for-widett-circle-as-mbta-moves-to-acquire-property. Accessed December 2025.

[129] Massachusetts Bay Transportation Authority, "MBTA Completes Purchase of Widett Circle to Improve Critical Rail Efficiency," MBTA News, April 12, 2023, https://www.mbta.com/news/2023-04-12/mbta-completes-purchase-widett-circle-improve-critical-rail-efficiency. Accessed December 2025.

[130] "Boston Zoning Code," Boston Planning & Development Agency, n.d., https://www.bostonplans.org/planning-zoning/zoning-code . Accessed December 2025.

[131] "Massachusetts Tax Rates," Massachusetts Department of Revenue, n.d., https://www.mass.gov/info-details/massachusetts-tax-rates. Accessed December 2025.

[132] Author analysis of CoStar commercial real estate data. Accessed March 2026.

- An expense percent of 85% and a cap rate of 5-8% [133]
- Any development would have a maximum of 15 floors

We also factored in the following zoning and site information: [134]

- Parcels are zoned as either General Industrial or I-2
- Rezoning would be required and the city wants to maximize usage of the site

United States Postal Service Site

To assess the land use benefits at the United States Postal Service (USPS) site adjacent to South Station, we made the following assumptions:

- A parcel size of 15.23 acres or 663,419 square feet [135]
- A floor area ratio (FAR) of 10 for full mixed-use zoning [136]
- A Boston tax rate of $10.74 for residential and $24.68 for commercial space [137]
- A breakdown of site use that is 31% residential (20% of which is affordable), 1.5% retail (at $42.56 per square foot rent), 52.5% office or lab space (at $71.50 per square foot rent), and 15% circulation [138]
- An expense percent of 85% and a cap rate of 5-8% [139]
- A building would be 200 feet tall (with a height limit of 294 feet according to the Federal Aviation Administration) [140]
- A parcel utilization rate of 75%
- A total floorplate of 497,564 square feet
- A developable area of 6,634,188 square feet

[133] Author analysis of CoStar commercial real estate data. Accessed March 2026.

[134] "Boston Zoning Code," Boston Planning & Development Agency, n.d., https://www.bostonplans.org/planning-zoning/zoning-code. Accessed December 2025.

[135] "Massachusetts Interactive Property Map," MassGIS, Commonwealth of Massachusetts, n.d., https://www.mass.gov/info-details/massachusetts-interactive-property-map. Accessed December 2025.

[136] "Boston Zoning Code," Boston Planning & Development Agency, n.d., https://www.bostonplans.org/planning-zoning/zoning-code. (Accessed December 2025.)

[137] "Massachusetts Tax Rates," Massachusetts Department of Revenue, n.d., https://www.mass.gov/info-details/massachusetts-tax-rates. (Accessed December 2025.)

[138] Author analysis of CoStar commercial real estate data. (Accessed March 2026.)

[139] Author analysis of CoStar commercial real estate data. (Accessed March 2026.)

[140] "BOS Public Airspace Analysis Tool," FAA Obstruction Evaluation/Airport Airspace Analysis Portal, n.d., https://ialp.airplanonline.com/PublicBOSP.aspx. (Accessed December 2025.)

- 13 stories for the maximum FAR

Boston Engine Terminal

To assess the land use benefits at the Boston Engine Terminal (BET), we made the following assumptions:

- A parcel size of 1,364,313 square feet[141]
- A floor area ratio (FAR) of 12 for full mixed-use zoning[142]
- A developable area of 16,371,752 square feet
- A parcel utilization rate of 80%
- A total floorplate of 1,091,450 square feet
- A Somerville tax rate of $10.52 for residential and $18.20 for commercial space[143]
- A breakdown of site use that is 58% residential (20% of which is affordable), 2% retail (at $42.56 per square foot rent), 20% office or lab space (at $71.50 per square foot rent), 5% light industrial or maker space (at $22.31 per square foot rent), and 15% circulation[144]
- An expense percent of 85% and a cap rate of 5-8%[145]
- Any development would have a maximum of 15 floors

[141] "Massachusetts Interactive Property Map," MassGIS, Commonwealth of Massachusetts, n.d., https://www.mass.gov/info-details/massachusetts-interactive-property-map. (Accessed December 2025.)

[142] "Somerville Zoning Ordinance," City of Somerville, n.d., https://online.encodeplus.com/regs/somerville-ma/doc-viewer.aspx?secid=8#secid-8. (Accessed December 2025.)

[143] "Assessing," City of Somerville, Massachusetts, Finance Department, n.d., https://www.somervillema.gov/departments/finance/assessing. (Accessed December 2025.)

[144] Author analysis of CoStar commercial real estate data. (Accessed March 2026.)

[145] Author analysis of CoStar commercial real estate data. (Accessed March 2026.)