

RAIL VISION



Boston MPO Presentation

DECEMBER 5, 2019

Purpose of Today's Meeting

1. Project Refresher
2. Review of Rail Vision Alternatives
3. FMCB Resolutions
4. Next Steps

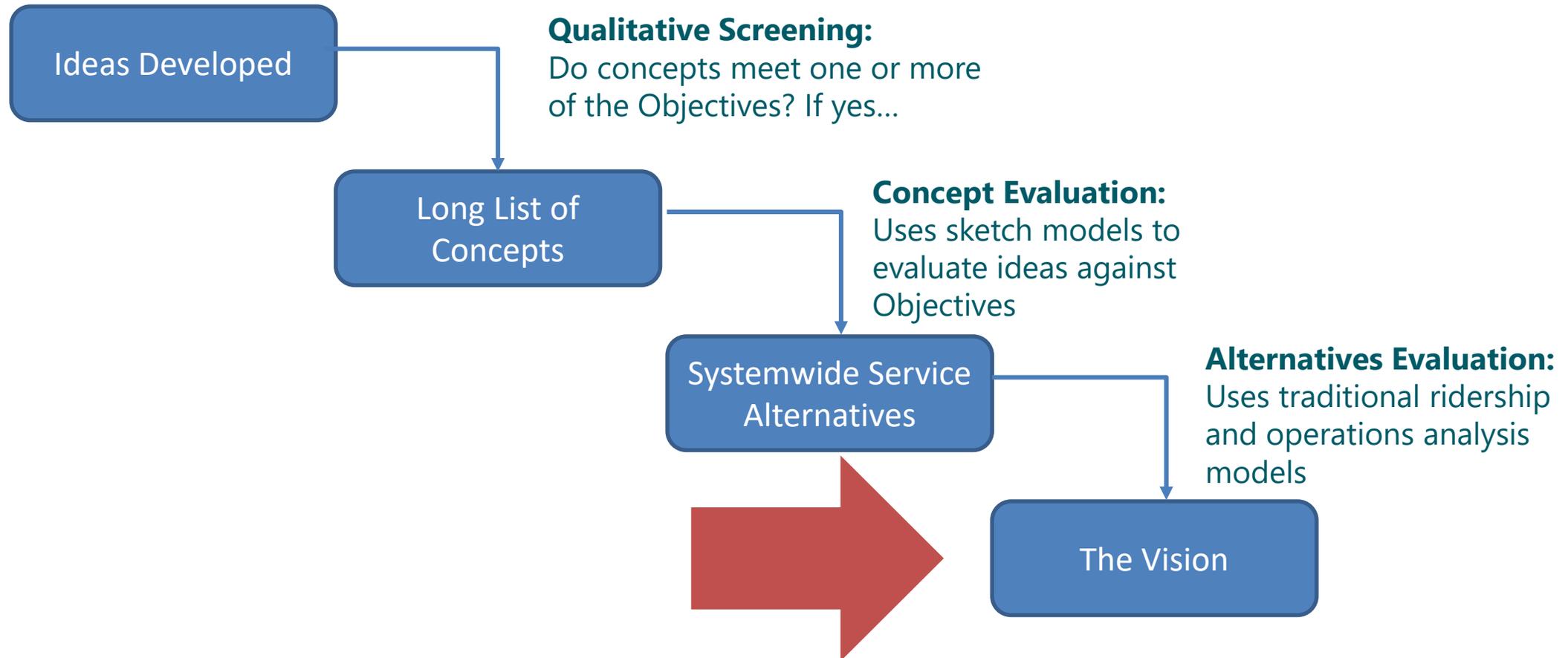
Project Goal

Leverage the MBTA's extensive commuter rail network to best meet the transportation and economic growth needs of the region.

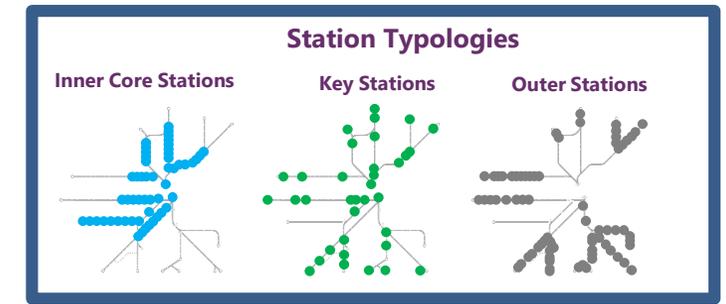
Project Objectives

1. Match service with the growing and changing needs of the region
2. Enhance economic vitality
3. Improve the passenger experience
4. Provide an equitable and balanced suite of investments
5. Help the Commonwealth achieve its climate change resiliency targets
6. Maximize return on investment (financial stewardship)

Where We Are Now



Review of Alternatives



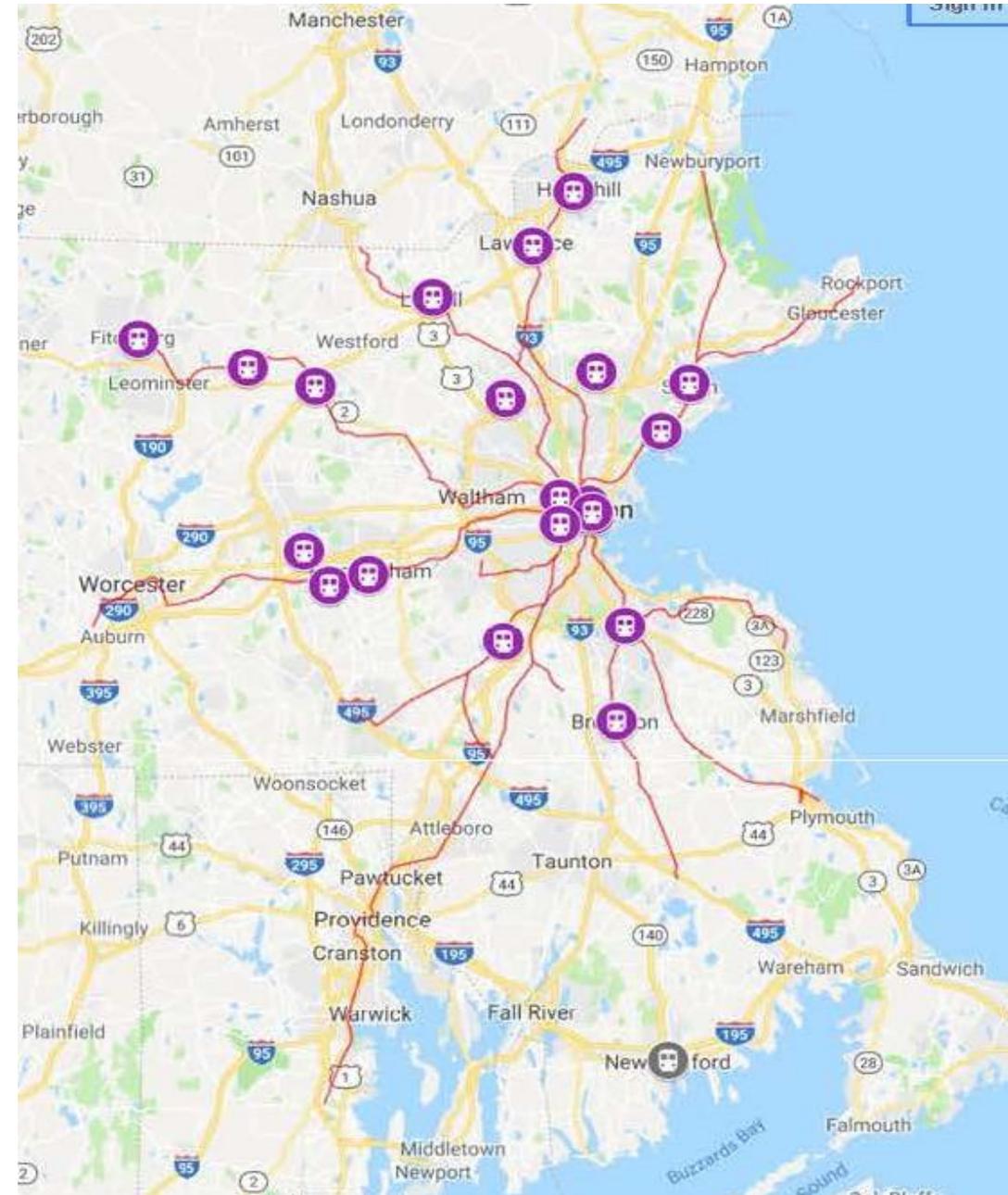
	1: Higher Frequency Commuter Rail	2: Regional Rail to Key Stations (Diesel)	3: Regional Rail to Key Stations (Electric)	4: Urban Rail (Diesel)	5: Urban Rail (Electric)	6: Full Transformation
Typical Frequency (Peak/Off-Peak)						
Key Stations	● 30/60	● 15/15 (North Side) ● 30/30 (South Side)	● 15/15	● 30/60	● 30/60	● 15/15
Inner Core	● 30/60	● 30/60	● 30/60	● 15/15	● 15/15	● 15/15
Outer Stations	● 30/60	● 30/60	● 30/60	● 30/60	● 30/60	● 15/15
Fully Accessible High-Level Platforms						
Key Stations		✓	✓	-	-	✓
Inner Core	Existing or Programmed Upgrades Only	-	-	✓	✓	✓
Outer Stations		-	-	-	-	✓
Parking Modeled as Unconstrained						
Most Key Stations		✓	✓	-	-	✓
Urban Rail Termini	Parking Modeled Fully Constrained	-	-	✓	✓	✓
Non-Rapid Transit Stations with >50 Spaces		-	-	-	-	✓
Electrification						
Major Expansions						

Evaluating relative benefits and costs across the alternatives will provide the foundation to build one or more Visions for the future of commuter rail, which may combine features from multiple alternatives to maximize the effectiveness of the MBTA rail network.

Stakeholder Engagement

- Peer Reviews
- Advisory Committee (7 meetings + optional)
- Public Meetings and Open House (3/5 + 10/23)
- State House/Legislative Briefing (2)
- Briefings/Meetings throughout the region (45, to date)
- Non-Rider Survey focused on trade-offs
 - nearly 3,000 responses

I would like the rail service to be:



Methodology – No-Build Demand (2040)

- Modeled using CTPS regional travel demand model for 2040 Future Year using MAPC projected land use
- Assumes current fare structure
- Alternatives are compared to a 2040 No-Build Scenario
 - **No-Build is demand, not ridership. It does not constrain boardings to available seats, but does constrain to current parking supply** and assumes existing MBTA services and expansions from financially constrained plans (e.g., SCR Phase 1)
- Systemwide commuter rail demand increases in all alternatives
- Other modes are impacted by increased commuter rail service (diversions, connectivity), so demand increases by 12% (157,400 boardings)

General Findings – No-Build Demand (2040)

No-Build Results	Total 2040 No-Build Daily Boardings	Increase in Daily Boardings (2018 – 2040)	% Increase in Daily Boardings (2018 – 2040)	Findings on Growth
Commuter Rail	150,800	24,000	19%	Growth without Rail Vision in place by 2040
North Side	46,100	3,800	9%	Highest on Haverhill and Lowell Lines
South Side	104,700	20,200	24%	Highest on Old Colony Lines and SCR
Other Modes	1,500,500	157,400	12%	Highest on Rapid Transit and Silver Line

Alternatives 1-6 – Preliminary Results

DRAFT – final values in development, numbers may vary

	Alternative 1: Higher Frequency Commuter Rail	Alternative 2: Regional Rail to Key Stations (Diesel)	Alternative 3: Regional Rail to Key Stations (Electric)	Alternative 4: Urban Rail (Diesel)	Alternative 5: Urban Rail (Electric)	Alternative 5: Urban Rail (Electric) with Modified Fares	Alternative 6: Full Transformation
2040 Ridership (compared to No-Build)	+ 19,000 daily CR boardings (+ 13%)	+ 36,200 daily CR boardings (+ 24%)	+ 52,900 daily CR boardings (+ 35%)	+ 80,400 daily CR boardings (+ 53%)	+ 81,600 daily CR boardings (+ 54%)	+ 99,000 daily CR boardings (+ 66%)	+ 225,900 daily CR boardings (+ 150%)
	+5,300 drive access +13,700 walk access	+10,200 drive access +26,000 walk access	+19,400 drive access +33,500 walk access	+12,600 drive access +67,800 walk access	+10,300 drive access +71,300 walk access	+20,000 drive access +79,000 walk access	+94,400 drive access +131,500 walk access
Assumptions:							
-Fare Structure	-Current fares	-Current fares	-Current fares	-Current fares	-Current fares	-Urban rail fares	-Urban rail fares and distance-based fares
-Parking	-Parking constrained	-Parking unconstrained at most key stations	-Parking unconstrained at most key stations	-Parking unconstrained at urban rail termini	-Parking unconstrained at urban rail termini	-Parking unconstrained at urban rail termini	-Parking unconstrained at all stations (excluding rapid transit & limited parking stations)
Fleet Needs	Diesel Locomotives Bi-Level Cab Cars/Coaches	Locomotives Bi-Level Cab Cars/Coaches	Bi-level EMUs	Diesel Locomotives Bi-Level Cab Cars/Coaches Single-Level DMUs	Locomotives Bi-Level Cab Cars/Coaches Bi-Level EMUs	Locomotives Bi-Level Cab Cars/Coaches Bi-Level EMUs	Bi-Level EMUs
Preliminary Capital Costs (2020\$/ 2030\$)	\$1.7B (2020\$)/ \$2.3B (2030\$)	\$4.5B (2020\$)/ \$6.3B (2030\$)	\$17.9B (2020\$)/ \$25.2B (2030\$)	\$8.9B (2020\$)/ \$12.6B (2030\$)	\$10.6B (2020\$)/ \$14.9B (2030\$)	\$10.6B (2020\$)/ \$14.9B (2030\$)	\$28.9B (2020\$)/ \$40.7B (2030\$)
Incremental MBTA Systemwide Revenues (2020\$)	\$29M/Year	\$52M/Year	\$52M/Year	\$58M/Year	\$48M/Year	\$15M/Year	\$80M/Year
Incremental MBTA Commuter Rail O&M Costs (2020\$)	\$130M/Year	\$379M/Year	\$439M/Year	\$333M/year	\$304M/year	\$304M/year	\$643M/year

Parking Capacity and Demand in Alternatives 1-6

- Ridership increases are partially driven by unconstrained parking for Alternatives 2-6
- Drive access boardings increase in all alternatives
- Drive access comparison to existing capacity demonstrates a need for additional parking to support the projected ridership

	Approximate Existing Parking Availability	Alternative 1: Higher Frequency Commuter Rail	Alternative 2: Regional Rail to Key Stations (Diesel)	Alternative 3: Regional Rail to Key Stations (Electric)	Alternative 4: Urban Rail (Diesel)	Alternative 5: Urban Rail (Electric)	Alternative 6: Full Transformation
Daily Drive Access Boardings (2040)	~43,000 Spaces Exist Today (Includes both Public and Private)	98,100	103,000	112,200	105,400	103,100	187,200
Additional Parking Spaces Required*		~10,000	~15,000	~21,000	~16,000	~16,000	~45,000

Note: Parking capacities were estimated for each station based on the Boston MPO 2012-13 Inventory of Park-and-Ride Lots at MBTA Facilities, and was updated based on the MBTA website and further review. Station-level estimates include MBTA facilities as well as municipal and private facilities. Station-level estimates were aggregated to the line-level and compared to line-level drive access boardings, assuming that every two drive access boardings (one inbound and one outbound boarding) requires one parking space. This results in a conservative estimate of the additional parking spaces required as it does not account for potential kiss-and-ride boardings included in the drive access totals, and assumes all drive access boardings are in single-occupancy vehicles. For Alternative 6, drive access boardings on trips traveling through the North South Rail Link were distributed to the line level based on the period-level directional ridership.

Feedback from Advisory Committee and Public

- Public dialog revealed preferences for:
 - **Alternative 6** as a long-term vision, to support Commonwealth goals (climate, housing, etc.)
 - A **phased approach** to enable **short-term improvements**
 - **System electrification** to reduce emissions
 - **Lower fares** and a focus on **equity** (including service improvements to Gateway Cities)
 - Improved **first/last mile** connections and/or increased **parking**
 - Continued discussion of **terminal needs** (South Station Expansion, North South Rail Link)

MBTA Fiscal Management Control Board Direction

The FMCB directed the MBTA to “**transform the current commuter rail line into a significantly more productive, equitable and decarbonized enterprise.**” The FMCB adopted five resolutions:

1. An endorsement of electrification, higher frequency service, and accessibility improvements,
2. Identification of priority lines and elements of Phase 1 of the transformation effort,
3. Establishment of a Commuter Rail Transformation Office, with the single mission of advancing the Rail Vision,
4. Consideration of new contract mechanisms and new labor practices, and a formal request of the Legislature to enact the reform proposals in Governor Baker’s transportation bond bill,
5. Establishment of a Bus Transformation Office, with similar responsibilities as the Commuter Rail Transformation Office.

Highlights of FMCB Resolution #1

- The rail system of the future should:
 - Provide service similar to rapid transit, **all day service on its most dense corridors at 15-20 minute headways**, and appropriately scheduled additional service on all of its lines,
 - Be largely electrified,
 - Fully integrate rail service with the rest of the MBTA system, and
 - Implement first mile/last mile and increased parking access as part of this program.
- Critical next steps:
 - Create a set of options to maximize the ridership returns on investment over the next 10 years
 - Support a pathway to more improvement over the long term, with particular emphasis on lines that are most likely to be well used
 - Develop a program of high-level platform implementation in a sequence that is consistent with the Program for Accessible Transportation Investment (PATI) and optimizes impacts for the customer

Highlights of FMCB Resolution #2

- Immediately take steps to prepare for implementation for **Phase 1 of the transformation:**
 - EMU powered service along the **Providence/Stoughton line**
 - EMU powered service with rapid transit headways at fare levels akin to the fare structure of the rapid transit system along **the Fairmont line** and **Newburyport/Rockport line through Lynn** (covering Boston, Everett, Chelsea, and Revere)
- Generate a refined cost estimate for Phase 1 and prioritize pursuit of the estimated \$1.5 billion dollars required for this three-pronged effort

Highlights of FMCB Resolution #3

- Immediately establish a Commuter Rail Transformation Office, which shall:
 - contain responsibility for all short, medium- and long-term elements of transformation including developing and maintaining the business case to support the investments needed
 - develop and implement environmental, financial, procurement, current commuter rail operating agreement re-bid and operational strategies as well as others as needed
 - be responsible for developing and implementing a stakeholder engagement plan
 - have no responsibilities outside the transformation mission
- No later than January 2020, the GM shall present to the Board for approval:
 - the staffing plan (not individual employees) for the transformation office
 - the budget necessary to support the office
 - target completion dates for the three components within Phase 1 of the transformation effort
 - a conceptual work plan and schedule outlining the work to be pursued in the years 2020 and 2021
 - a proposed consulting support plan that would bring in best practice international expertise
 - a presentation by the current procurement strategy work consultant to present their work to date and the approach they intend to take

Highlights of FMCB Resolution #4

- Achievement of Resolutions 1 and 2 will require consideration of new contract mechanisms and new labor practices.
- **The Board requests the Legislature support the statutory authorization for a public-private partnership and reform proposals in Governor Baker's transportation bond bill proposal.**
- Greater use of the talent and innovation in the private sector is critical and tools that provide the Authority with greater leverage over long term performance of the private sector is essential.

Capital Needs

- Station improvements, including new stations, platforms, tracks, and accessibility upgrades
- Additional track mileage
- Signals and systems upgrades
- Grade crossing upgrades
- Bridge/Structure improvements or replacements
- Additional fleet, including locomotives, bi-level cab cars and coaches, and EMUs
- Maintenance and Layover areas
- Full and/or Partial Electrification
- Terminal Expansions

Next Steps – Advancing the Rail Vision

- Continued stakeholder engagement
- FMCB Presentation – Winter 2020

Project Contacts & Website

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Appendix



General Findings and Methodology – Order-of-Magnitude (OOM) Capital Costs

- Presented in 2020\$ and 2030\$
 - Unit costs obtained from similar MBTA and peer agency projects
 - Fleet unit costs based on market conditions and industry comparisons, and includes ancillary costs such as spare parts and training
 - Major expansion costs (e.g., SSX, NSRL) based on previous work
 - Real estate impacts accounted for to the extent practicable (i.e., major takings)
 - Contingencies and soft costs applied consistent with MBTA project controls
 - Capital costs estimated in current year dollars (2020\$) and escalated to 2030\$ to reflect an approximated time period for future construction
- Fleet, and associated layover/maintenance, and electrification found to be the largest capital costs
- Initial findings do not account for life cycle costs

General Findings and Methodology - Fleet and Consist Sizing

- Fleet sizes (number of vehicles) are calculated based on service plans needs, based on the following:
 - Consist sizes (lengths of trains) are based on CTPS ridership estimates
 - Estimates provided may change based on period and direction ridership data and associated consist sizing
- Fleet Estimates for Costs Estimates
 - Current Approach - Estimate incremental fleet or new vehicle types needed beyond an assumed "credit" for current and future MBTA investments

General Findings and Methodology – Operating and Maintenance (O&M) Costs

- Presented in 2020\$
 - Presented as increase over baseline costs and annualized
 - Grounded in existing cost data from the MBTA commuter rail
 - Peer US commuter rail system data used for:
 - Electric locomotives and EMUs
 - Electric transmission system (catenary, etc.) costs
 - DMUs
 - Uses operational and ridership outputs from each alternative as inputs into the model
 - Costs are not offset by revenue
- All alternatives increase operating costs
 - Increase in service levels drives increase in operating costs



Preliminary Findings: Alternative 1 Higher Frequency Commuter Rail

Alternative 1: Higher Frequency Commuter Rail

Goal:
 Assess costs and benefits of providing predictable, bi-directional service every **30 minutes during peak periods and 60 minutes during off-peak periods to all stations***, with modest investments in new infrastructure

Key Features

Typical Frequency (Peak/Off-Peak)	All Stations*: 30/60 bi-directional
Station Accessibility	High-level boarding platforms at stations where they are currently existing or programmed
Electrification	None
Train Type(s)	Diesel Locomotives
Major Expansions	South Coast Rail Phase 1



*Note: Approximate 30 minute peak period and 60 minute off-peak period service applies to all stations, with the exception of Mishawum, Plimptonville, Wickford Jctn, TF Green and Old Colony/SCR Stations, which are consistent with today's service schedules.

Alternative 1: Higher Frequency Commuter Rail – Preliminary Ridership (2040)

- Daily boardings compared against 2040 No-Build Demand
- Assumes current fares; **fully constrained parking**

Daily Boardings	No-Build	Alternative 1	Change in Daily Boardings	% Change in Daily Boardings	Findings on Growth
Commuter Rail	150,800	169,800	19,000	13%	Overall growth
North Side	46,100	54,700	8,600	19%	Highest on Newburyport/Rockport and Fitchburg Lines
South Side	104,700	115,100	10,400	10%	Highest on Framingham/Worcester Line; Old Colony/SCR service pattern does not change in Alternative 1
Drive Access	92,800	98,100	5,300	6%	Parking is fully constrained
Walk Access	58,000	71,700	13,700	24%	Greater growth in walk access than in drive access
Other Transit Modes	1,500,500	1,506,500	6,000	<1%	Increases on Green, Red, Silver Lines; Blue Line and bus reductions/diversions

Notes: Parking was modeled as fully constrained.

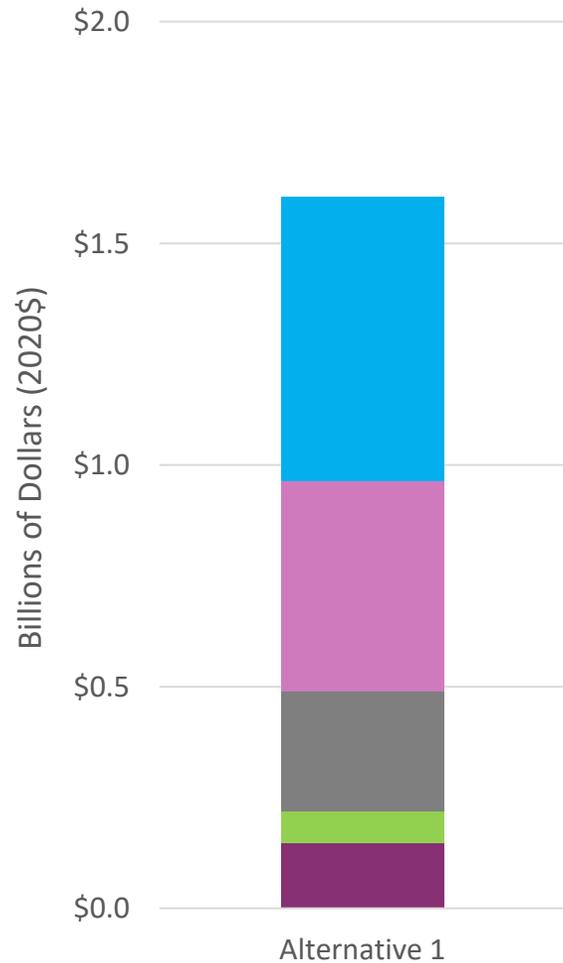
Other transit modes include rapid transit, BRT, local bus (including other RTAs), express bus (including private and Logan buses), shuttle bus (including Logan and MGH shuttles), and ferry. The percentage change for other transit modes is in comparison to the No-Build demand for these modes.

Alternative 1: Preliminary Capital Needs

- Station improvements, including new stations, platforms, tracks, and accessibility upgrades (9 stations)
- Additional track mileage (~4 miles)
- Signals and systems upgrades
- Grade crossing upgrades (6)
- Bridge/Structure improvements or replacements (6)
- Fleet Needs:
 - Equipment
 - Diesel Locomotives
 - Bi-Level Cab Cars and Coachses
 - Maintenance and Layover areas
- Expansions:
 - South Coast Rail Phase 1



Alternative 1: Higher Frequency Commuter Rail – Preliminary Capital Costs



Preliminary Capital Costs (2020\$/2030\$)
\$1.7B (2020\$)/\$2.3B (2030\$)

Improvement Category	Cost (2020\$)
Track and Signal Work	\$0.2B
Structures	\$0.1B
Stations	\$0.3B
Layover and Maintenance Facilities	\$0.5B
Fleet Procurement	\$0.6B

Note: Values are rounded and may not sum to totals. **\$1.7 B (2020\$)**

Fleet costs are based on incremental fleet for diesel options. Total fleet includes:

- 120 locomotives
- 120 bi-level cab cars
- 411 bi-level coaches

Expansions exclude SCR Phase 1



Preliminary Findings: Alternative 2 Regional Rail to Key Stations (Diesel)

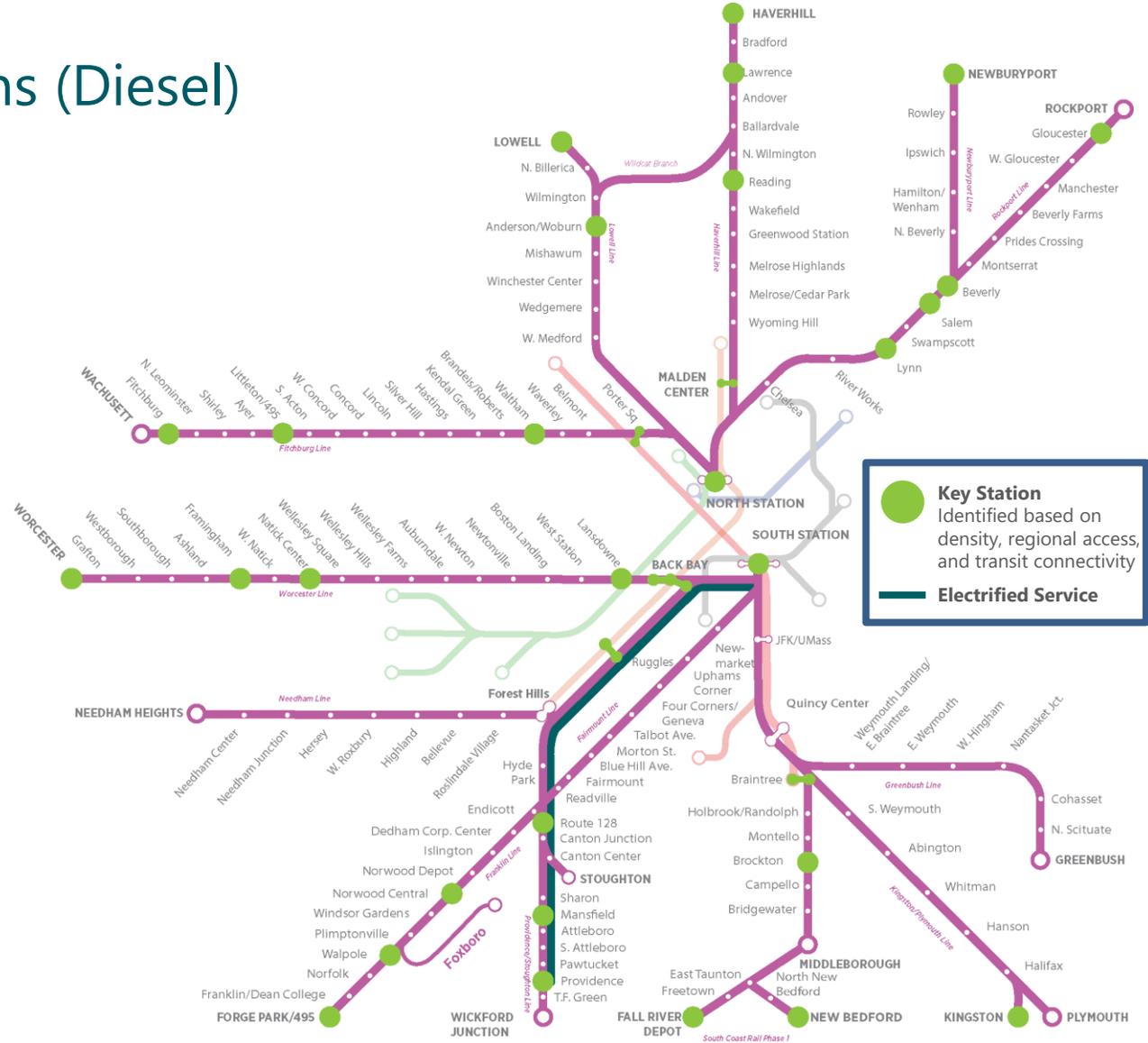
Alternative 2: Regional Rail to Key Stations (Diesel)

Goal:

Focus on regional rail – high-frequency service for longer-distance trips to key stations – using mainly diesel-powered locomotives. Key stations are in Gateway Cities, dense areas outside the core, and/or provide regional access and transit connectivity. Stations not identified as key stations would receive more modest increases in service.

Key Features

Typical Frequency (Peak/Off-Peak)	Key Stations (North Side): 15/15 bi-directional Key Stations (South Side): 30/30 bi-directional All Other Stations: 30/60 bi-directional
Station Accessibility	All Key Stations would have high-level boarding platforms
Electrification	Service between Boston and Providence would be electrified
Train Type(s)	Diesel Locomotives Electric Locomotives (to Providence)
Major Expansions	South Coast Rail Phase 1 Foxboro



Key Station
Identified based on density, regional access, and transit connectivity

Electrified Service

Alternative 2: Regional Rail to Key Stations (Diesel) – Preliminary Ridership (2040)

- Daily boardings compared against 2040 No-Build Demand
- Assumes current fares; **unconstrained parking at Key Stations**

Daily Boardings	No-Build	Alternative 2	Change in Daily Boardings	% Change in Daily Boardings	Findings on Growth
Commuter Rail	150,800	187,000	36,200	24%	Growth primarily on North Side due to less frequency on South Side (terminal capacity limitations)
North Side	46,100	70,200	24,100	52%	Highest on Fitchburg and Haverhill/Lowell Lines
South Side	104,700	116,800	12,100	12%	Highest on Framingham/ Worcester Line; Reductions on Old Colony lines due to diversions to unconstrained parking (e.g., Red Line/Braintree)
Drive Access	92,800	103,000	10,200	11%	Ridership increases at key stations near major roadways
Walk Access	58,000	84,000	26,000	45%	Ridership increases around dense urban key stations
Other Transit Modes	1,500,500	1,541,000	40,500	3%	Highest on Red Line, Green Line; Local bus reductions/diversions

Notes: Parking was modeled as unconstrained at at Gloucester, Newburyport, Beverly, Salem, Lynn, Haverhill, Lawrence, Reading, Lowell, Anderson/Woburn, Fitchburg, Littleton/495, Waltham, Worcester, Framingham, Natick Center, Forge Park/495, Walpole, Norwood Central, Providence, Mansfield, Route 128, Fall River Depot, New Bedford, Brockton, Kingston, and Braintree.

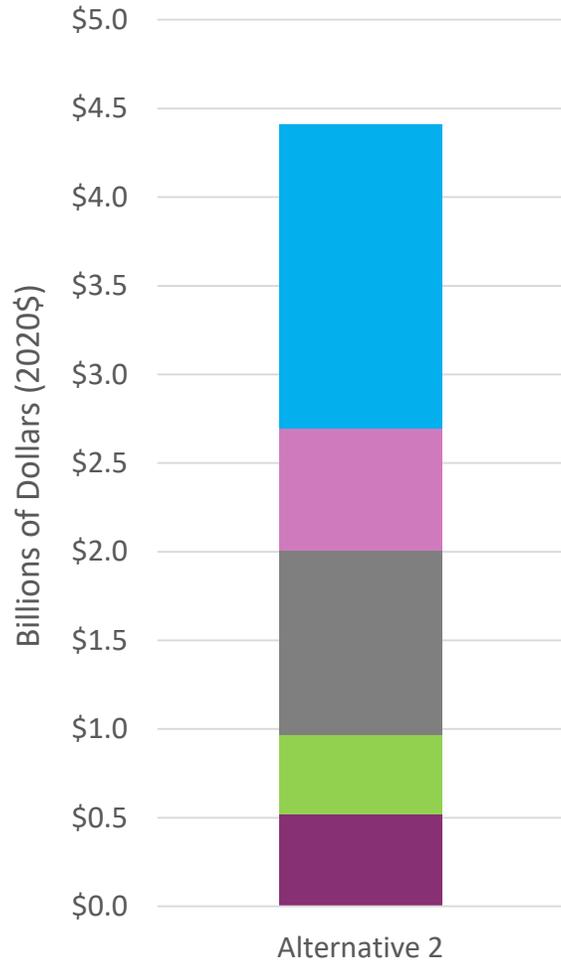
Other transit modes include rapid transit, BRT, local bus (including other RTAs), express bus (including private and Logan buses), shuttle bus (including Logan and MGH shuttles), and ferry. The percentage change for other transit modes is in comparison to the No-Build demand for these modes.

Alternative 2: Preliminary Capital Needs

- Station improvements, including new stations, platforms, tracks, and accessibility upgrades (32 stations)
- Additional track mileage (~34 miles)
- Signals and systems upgrades
- Grade crossing upgrades (35)
- Bridge/Structure improvements or replacements (36)
- Fleet Needs:
 - Equipment
 - Diesel Locomotives
 - Electric Locomotives
 - Bi-Level Cab Cars and Coaches
 - Maintenance and Layover areas
- Expansions:
 - South Coast Rail Phase 1
 - Foxboro



Alternative 2: Regional Rail to Key Stations (Diesel) – Preliminary Capital Costs



Preliminary Capital Costs (2020\$/2030\$)
\$4.5B (2020\$)/\$6.3B (2030\$)

Improvement Category	Cost (2020\$)
Track and Signal Work	\$0.5B
Structures	\$0.4B
Stations	\$1.0B
Layover and Maintenance Facilities	\$0.7B
Fleet Procurement	\$1.7B

Note: Values are rounded and may not sum to totals. **\$4.5B (2020\$)**

Fleet costs are based on incremental fleet for diesel options. Total fleet includes:

- 163 locomotives
- 163 bi-level cab cars
- 529 bi-level coaches

Expansions exclude SCR Phase 1, Foxboro



Preliminary Findings: Alternative 3 Regional Rail to Key Stations (Electric)

Alternative 3: Regional Rail to Key Stations (Electric)

Goal:

Focus on regional rail – high-frequency service for longer-distance trips to key stations – flexible electric-powered train sets called electric multiple units (EMUs) that can vary in train size to meet demand. Key stations are in Gateway Cities, dense areas outside the core, and/or provide regional access and transit connectivity. Stations not identified as key stations would receive more modest increases in service.

Key Features

Typical Frequency (Peak/Off-Peak)

Key Stations: 15/15 bi-directional
All Other Stations: 30/60 bi-directional

Station Accessibility

All Key Stations would have high-level boarding platforms

Electrification

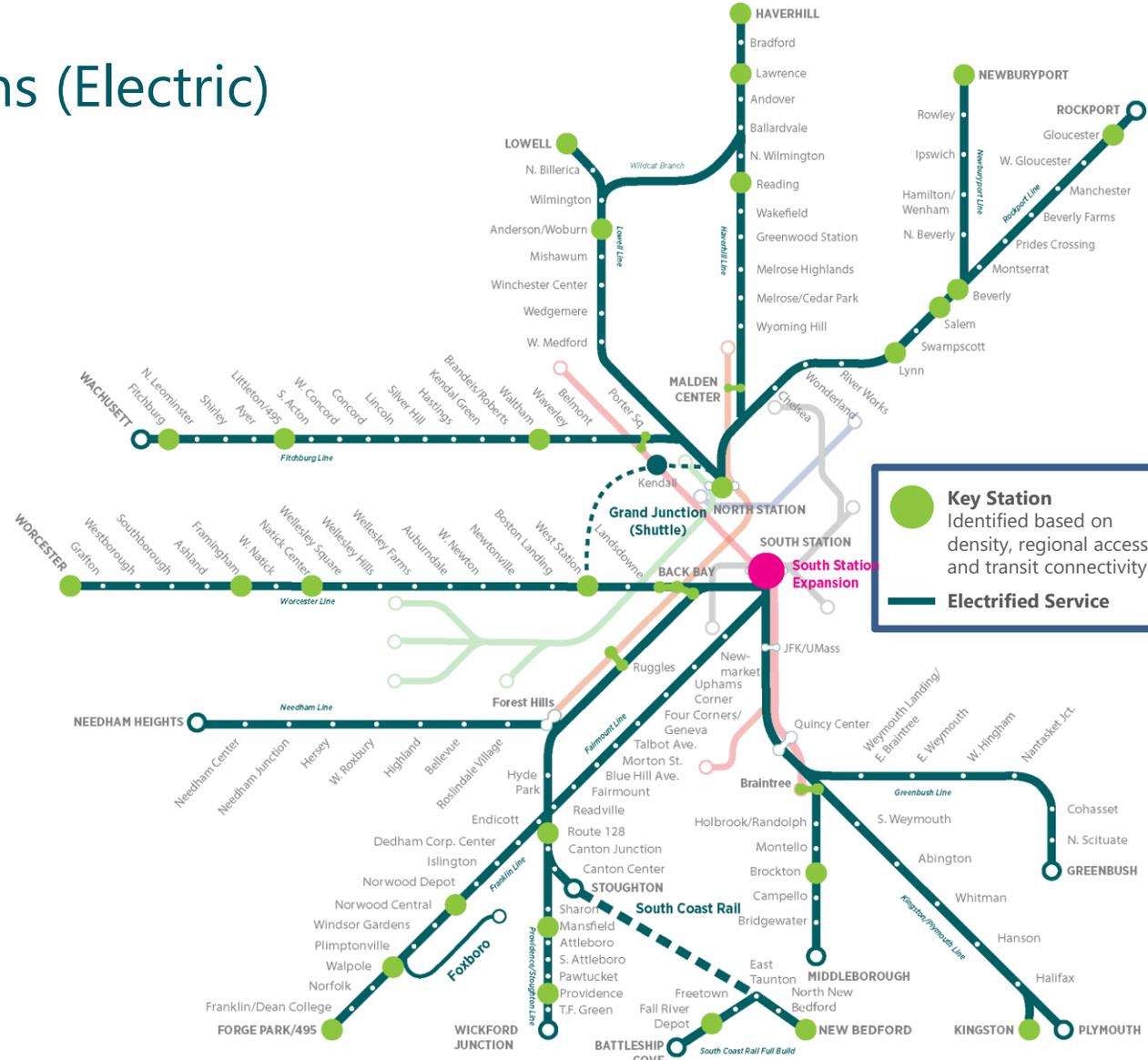
The full system would be electrified

Train Type(s)

Electric Multiple Units (EMUs)

Major Expansions

South Station Expansion
South Coast Rail Full Build
Grand Junction (Shuttle)
Foxboro



Alternative 3: Regional Rail to Key Stations (Electric) – Preliminary Ridership (2040)

- Daily boardings compared against 2040 No-Build Demand
- Assumes current fares; **unconstrained parking at Key Stations**

Daily Boardings	No-Build	Alternative 3	Change in Daily Boardings	% Change in Daily Boardings	Findings on Growth
Commuter Rail	150,800	203,700	52,900	35%	SSX allows for more south side growth than in Alternative 2; Some ridership growth from electrification
North Side	46,100	74,600	28,500	62%	Highest on Fitchburg and Haverhill/Lowell Lines
South Side	104,700	129,100	24,400	23%	Highest on Framingham/ Worcester Line and Providence/SCR Full Build; Reductions on Old Colony Lines due to interlining (Kingston/ Greenbush) and diversions to unconstrained parking (e.g., Red Line/Braintree)
Drive Access	92,800	112,200	19,400	21%	Ridership increases at key stations near major roadways
Walk Access	58,000	91,500	33,500	58%	Ridership increases around dense urban key stations
Other Transit Modes	1,500,500	1,548,400	47,900	3%	Highest on Red Line, Orange Line, Green Line; MBTA local bus reductions/diversions

Notes: Parking was modeled as unconstrained at at Gloucester, Newburyport, Beverly, Salem, Lynn, Haverhill, Lawrence, Reading, Lowell, Anderson/Woburn, Fitchburg, Littleton/495, Waltham, Worcester, Framingham, Natick Center, Forge Park/495, Walpole, Norwood Central, Providence, Mansfield, Route 128, Fall River Depot, New Bedford, Brockton, Kingston, and Braintree.

Other transit modes include rapid transit, BRT, local bus (including other RTAs), express bus (including private and Logan buses), shuttle bus (including Logan and MGH shuttles), and ferry. The percentage change for other transit modes is in comparison to the No-Build demand for these modes.

Alternative 3: Preliminary Capital Needs

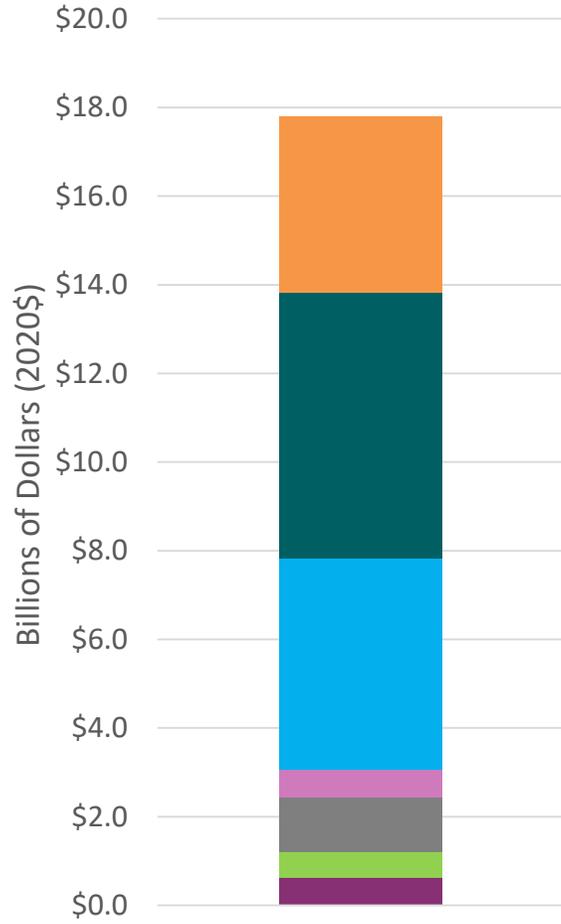
- Station improvements, including new stations, platforms, tracks, and accessibility upgrades (38 stations)
- Additional track mileage (~ 50 miles)
- Signals and systems upgrades
- Grade crossing upgrades (51)
- Bridge/Structure improvements or replacements (~50)
- Fleet Needs:
 - Equipment (EMUs)
 - Maintenance and Layover areas
- Electrification
- Expansions
 - South Coast Rail Full Build
 - South Station Expansion
 - Grand Junction
 - Foxboro



Alternative 3: Regional Rail to Key Stations (Electric) – Preliminary Capital Costs

Preliminary Capital Costs (2020\$/2030\$)

\$17.9B (2020\$)/\$25.2B (2030\$)



Alternative 3

Improvement Category	Cost (2020\$)
Track and Signal Work	\$0.6B
Structures	\$0.6B
Stations	\$1.2B
Layover and Maintenance Facilities	\$0.6B
Fleet Procurement	\$4.8B
Electrification	\$6.0B
System Expansions	\$4.0B
- South Station Expansion	
- Modified North Station	
- Grand Junction	
- Old Colony Braintree to S Station Double Track	

Note: Values are rounded and may not sum to totals.

\$17.9B (2020\$)

Fleet costs are based on need for entire new electric fleet. Total fleet includes:

- 733 EMUs

Expansions exclude SCR Full Build and Foxboro



Preliminary Findings: Alternative 4 Urban Rail (Diesel)

Alternative 4: Urban Rail (Diesel)

Goal:

Focuses on urban rail – high-frequency, rapid-transit-like service to stations in the inner core – using flexible diesel-powered train sets called diesel multiple units (DMUs) that can vary in train size to meet demand. Stations in the outer regions of the system would receive more modest increases in service.

Key Features

Typical Frequency (Peak/Off-Peak)	Inner Core: 15/15 bi-directional All Other Stations: 30/60 bi-directional
Station Accessibility	All Inner Core Stations would have high-level boarding platforms
Electrification	None
Train Type(s)	Diesel Locomotives Single-Level Diesel Multiple Units (DMUs)
Major Expansions	South Station Expansion South Coast Rail Phase 1



Alternative 4: Urban Rail (Diesel) – Preliminary Ridership (2040)

- Daily boardings compared against 2040 No-Build Demand
- Assumes current fares; **unconstrained parking at Urban Rail Termini**

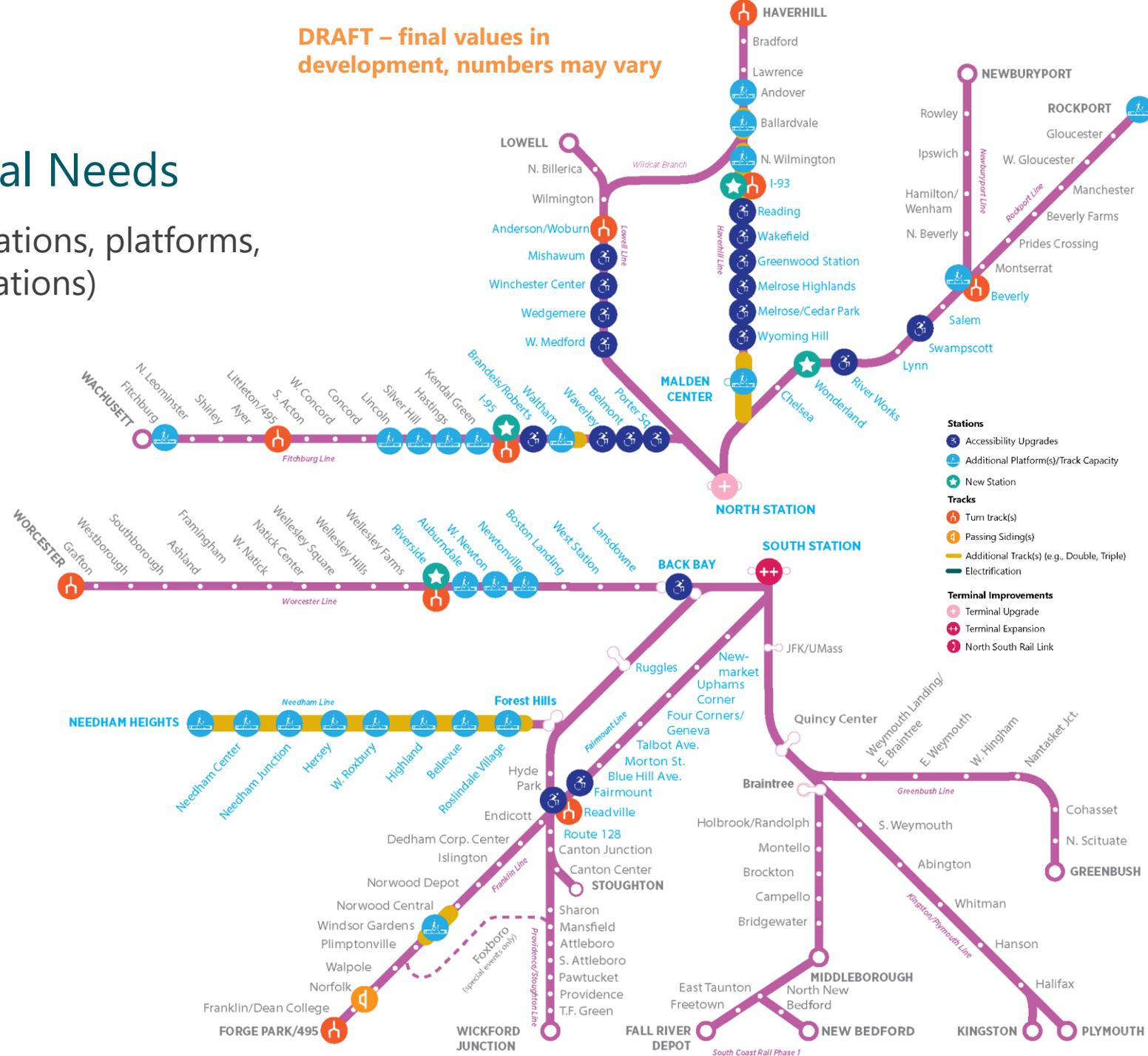
Daily Boardings	No-Build	Alternative 4	Change in Daily Boardings	% Change in Daily Boardings	Findings on Growth
Commuter Rail	150,800	231,200	80,400	53%	Highest absolute growth on the South Side, but greater % increase on the North Side
North Side	46,100	76,900	30,800	67%	Highest on Newburyport/Rockport
South Side	104,700	154,300	49,600	47%	Highest on Framingham/Worcester Line; Reductions on some lines due to diversions to other lines
Drive Access	92,800	105,400	12,600	14%	Due to unconstrained parking at urban rail termini
Walk Access	58,000	125,800	67,800	117%	Ridership increases in the dense inner core
Other Transit Modes	1,500,500	1,470,100	-30,400	-2%	Diversions to urban rail

Notes: Parking was modeled as unconstrained at Beverly, I-93, Anderson/Woburn, I-95, Riverside, Needham Heights, and Route 128. Other transit modes include rapid transit, BRT, local bus (including other RTAs), express bus (including private and Logan buses), shuttle bus (including Logan and MGH shuttles), and ferry. The percentage change for other transit modes is in comparison to the No-Build demand for these modes. Emissions, equity, and connectivity will be analyzed for each alternative as part of the upcoming analysis.

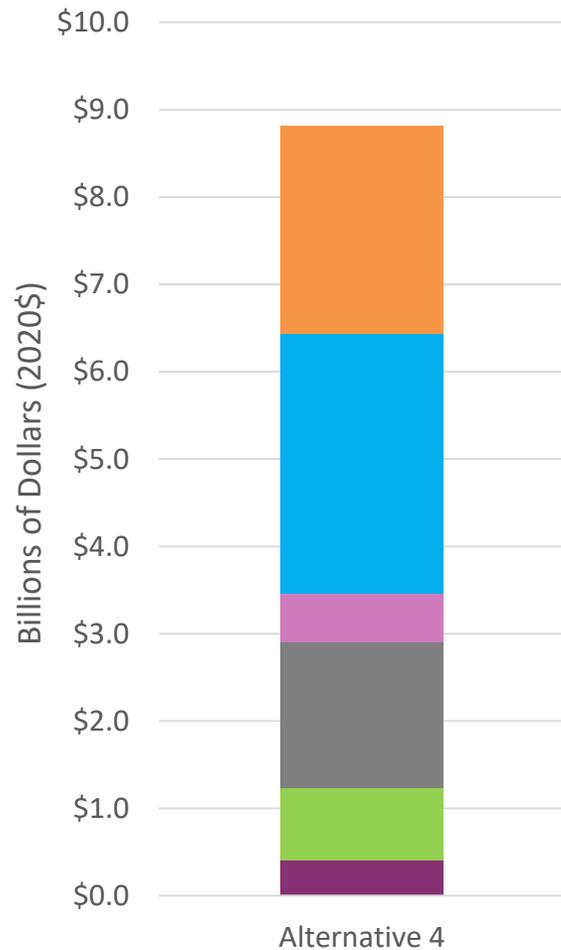
Alternative 4: Preliminary Capital Needs

- Station improvements, including new stations, platforms, tracks, and accessibility upgrades (47 stations)
- Additional track mileage (~24 miles)
- Signals and systems upgrades
- Grade crossing upgrades (21)
- Bridge/Structure improvements or replacements (49)
- Fleet Needs:
 - Equipment
 - Diesel Locomotives
 - Bi-Level Cab Cars and Coaches
 - DMUs
 - Maintenance and Layover areas
- Expansions:
 - South Station Expansion
 - South Coast Rail Phase 1

DRAFT – final values in orange, numbers may vary



Alternative 4: Urban Rail (Diesel) – Preliminary Capital Costs



Preliminary Capital Costs (2020\$/2030\$)
\$8.9B (2020\$)/\$12.6B (2030\$)

Improvement Category	Cost (2020\$)
Track and Signal Work	\$0.4B
Structures	\$0.8B
Stations	\$1.7B
Layover and Maintenance Facilities	\$0.6B
Fleet Procurement	\$3.0B
System Expansions - South Station Expansion - Modified North Station	\$2.4B

Note: Values are rounded and may not sum to total.

\$8.9B (2020\$)

Fleet costs are based on incremental fleet, and include entirely new DMU fleet. Total fleet includes:

- 114 locomotives
- 114 bi-level cab cars
- 443 bi-level coaches
- 336 DMUs

Expansions exclude SCR Phase 1



Preliminary Findings: Alternative 5 Urban Rail (Electric)

Alternative 5: Urban Rail (Electric)

Goal:

Focus on urban rail – high-frequency, rapid-transit-like service to stations in the inner core – using flexible electric-powered train sets called electric multiple units (EMUs) that can vary in train size to meet demand. Stations in the outer regions of the system would receive more modest increases in service.

Key Features

Typical Frequency (Peak/Off-Peak)	Inner Core: 15/15 bi-directional All Other Stations: 30/60 bi-directional
Station Accessibility	All Inner Core Stations would have high-level boarding platforms
Electrification	Urban rail service would be electrified Service on the Providence Line and South Cost Rail would be electrified
Train Type(s)	Diesel + Electric Locomotives Bi-Level Electric Multiple Units (EMUs)
Major Expansions	South Station Expansion South Coast Rail Full Build Grand Junction (Shuttle)



Alternative 5: Urban Rail (Electric) – Preliminary Ridership (2040)

- Daily boardings compared against 2040 No-Build Demand
- Assumes current fares; **unconstrained parking at Urban Rail Termini**

Daily Boardings	No-Build	Alternative 5	Change in Daily Boardings	% Change in Daily Boardings	Findings on Growth
Commuter Rail	150,800	232,400	81,600	54%	Highest absolute growth on the South Side, but greater % increase on the North Side
North Side	46,100	77,000	30,900	67%	Highest on Newburyport/Rockport
South Side	104,700	155,400	50,700	48%	Highest on Framingham/Worcester Line; Reductions on some lines due to diversions to other lines
Drive Access	92,800	103,100	10,300	11%	Due to unconstrained parking at urban rail termini
Walk Access	58,000	129,300	71,300	123%	Ridership increases in the dense inner core
Other Transit Modes	1,500,500	1,478,200	-22,300	-1%	Diversions to urban rail

Notes: Parking was modeled as unconstrained at Beverly, I-93, Anderson/Woburn, I-95, Riverside, Needham Heights, and Route 128. Other transit modes include rapid transit, BRT, local bus (including other RTAs), express bus (including private and Logan buses), shuttle bus (including Logan and MGH shuttles), and ferry. The percentage change for other transit modes is in comparison to the No-Build demand for these modes. Emissions, equity, and connectivity will be analyzed for each alternative as part of the upcoming analysis.

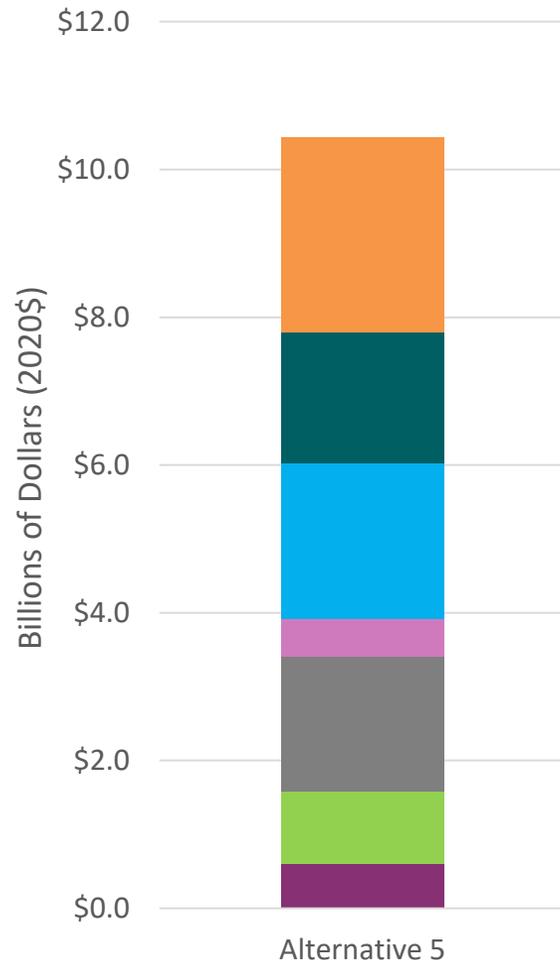
Alternative 5 Modified for Lower Fares: Urban Rail (Electric) – Preliminary Ridership (2040)

- A second version of Alternative 5 was modeled with **lower urban rail fares** to understand impact that fares have on ridership
- Providing a lower fare structure resulted in ridership increases of approximately 7% systemwide total daily boardings, but increases vary by line and occur through both drive and walk access

Daily Boardings	Alternative 5 Total Daily Boardings	Alternative 5 Modified for Lower Fares Total Daily Boardings	Change in Total Daily Boardings	% Change in Total Daily Boardings	Findings Related to Lower Fares
Commuter Rail	232,400	249,800	+17,400	7%	Highest benefit on North Side
North Side	77,000	92,200	+15,200	20%	Highest growth on Fitchburg Line; all lines at least 15% growth
South Side	155,400	157,600	+2,200	1%	Limited growth on all urban rail lines
Drive Access	103,100	112,800	+9,700	9%	Lower fares increase drive access to urban rail fare zones
Walk Access	129,300	137,000	+7,700	6%	Some increase in walk access due to lower fares
Other Transit Modes	1,478,200	1,472,000	-6,200	0%	Diversions to urban rail greatest on Blue Line

Notes: Parking was modeled as unconstrained at Beverly, I-93, Anderson/Woburn, I-95, Riverside, Needham Heights, and Route 128. The modeling for the lower fare alternative assumed a flat urban rail fare between the existing Zone 1A and Zone 1 pricing. Zone 1A trips maintained Zone 1A pricing. Other transit modes include rapid transit, BRT, local bus (including other RTAs), express bus (including private and Logan buses), shuttle bus (including Logan and MGH shuttles), and ferry. The percentage change for other transit modes is in comparison to the No-Build demand for these modes. Emissions, equity, and connectivity will be analyzed for each alternative as part of the upcoming analysis.

Alternative 5: Urban Rail (Electric) – Preliminary Capital Costs



Preliminary Capital Costs (2020\$/2030\$)
\$10.6B (2020\$)/\$14.9B (2030\$)

Improvement Category	Cost (2020\$)
Track and Signal Work	\$0.6B
Structures	\$1.0B
Stations	\$1.8B
Layover and Maintenance Facilities	\$0.5B
Fleet Procurement	\$2.1B
Electrification	\$1.8B
System Expansions - South Station Expansion - Modified North Station - Grand Junction	\$2.6B

Note: Values are rounded and may not sum to totals. **\$10.6B (2020\$)**

Fleet costs are based on incremental fleet, and include entirely new EMU fleet. Total fleet includes:

- 112 locomotives
- 112 bi-level cab cars
- 450 bi-level coaches
- 185 EMUs

Expansions exclude SCR Full Build



Preliminary Findings: Alternative 6 Full Transformation

Alternative 6: Full Transformation

Goal:

Provide a combination of regional rail and urban rail – resulting in high-frequency service throughout the network – using flexible electric-powered train sets called electric multiple units (EMUs) that can vary in train size to meet demand. North-South Rail Link provides through trips for the inner core. Nearly every station in the network would receive service every 15 minutes.

Key Features

Typical Frequency (Peak/Off-Peak)

Key Stations: 15/15 bi-directional
 Inner Core: 15/15 bi-directional
 Outer Stations: 15/15 bi-directional where possible

Station Accessibility

All Stations would have high-level boarding platforms

Electrification

The full system would be electrified

Train Type(s)

Electric Multiple Units (EMUs)

Major Expansions

North South Rail Link
 South Coast Rail Full Build
 Grand Junction (Shuttle)
 Foxboro



Alternative 6: Full Transformation – Preliminary Ridership (2040)

- Daily boardings compared against 2040 No-Build Demand
- Assumes a flat urban rail fare (outside of Zone 1A) and non-urban rail mileage based fares; **unconstrained parking at most stations**

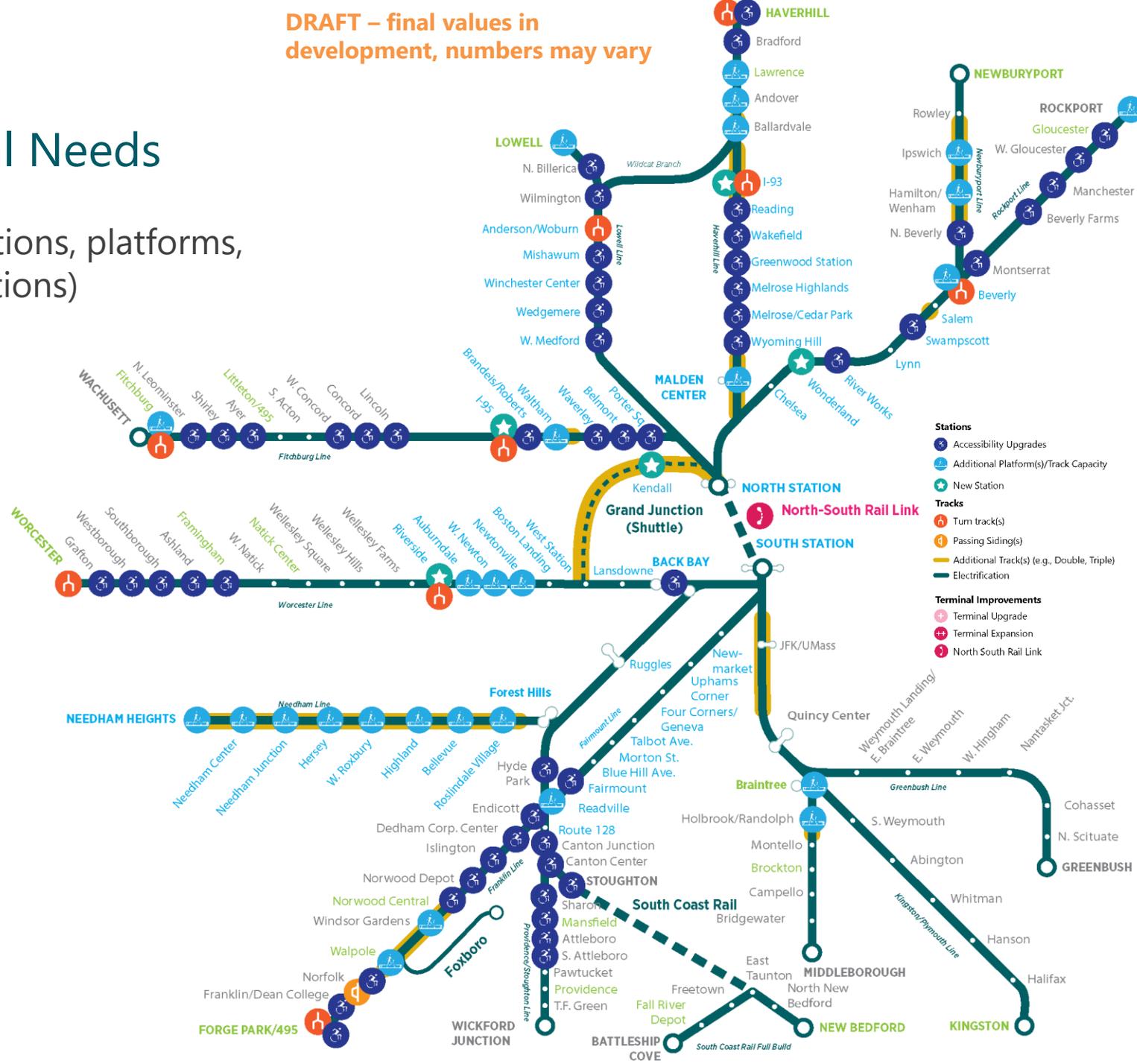
Daily Boardings	No-Build	Alternative 6	Change in Daily Boardings	% Change in Daily Boardings	Findings on Growth
Commuter Rail	150,800	376,700	225,900	150%	Highest absolute growth on the South Side, but greater % increase on the North Side
North Side	46,100	133,100	87,000	189%	Highest on Newburyport/Rockport
South Side	104,700	243,600	138,900	133%	Highest on Framingham/Worcester Line
Drive Access	92,800	187,200	94,400	102%	Unconstrained parking significantly increases drive access
Walk Access	58,000	189,500	131,500	227%	High frequency to high-density locations throughout the network results significant increase in walk access
Other Transit Modes	1,500,500	1,450,400	-50,100	-3%	Diversions from most other transit modes

Notes: Parking was modeled as unconstrained at all commuter rail stations that currently have at least 50 spaces and are not rapid transit stations. The modeling assumed a flat urban rail fare between the existing Zone 1A and Zone 1 pricing. Zone 1A trips maintained Zone 1A pricing. All other fares are mileage-based. Growth in north side and south side boardings includes NSRL ridership, and uses an approximate distribution of boardings for through-running trips. Other transit modes include rapid transit, BRT, local bus (including other RTAs), express bus (including private and Logan buses), shuttle bus (including Logan and MGH shuttles), and ferry. The percentage change for other transit modes is in comparison to the No-Build demand for these modes. Emissions, equity, and connectivity will be analyzed for each alternative as part of the upcoming analysis.

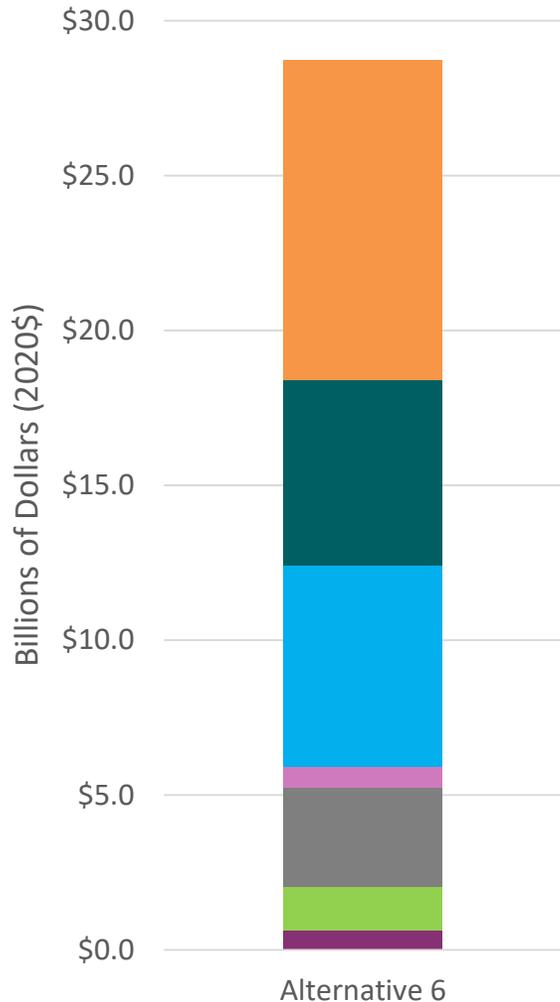
Alternative 6: Preliminary Capital Needs

- Station improvements, including new stations, platforms, tracks, and accessibility upgrades (87 stations)
- Additional track mileage (~59 miles)
- Signals and systems upgrades
- Grade crossing upgrades (35)
- Bridge/Structure improvements or replacements (82)
- Fleet Needs:
 - Equipment (EMUs)
 - Maintenance and Layover areas
- Electrification
- Expansions:
 - North South Rail Link
 - South Coast Rail Full Build
 - Grand Junction (Shuttle)
 - Foxboro

DRAFT – final values in development, numbers may vary



Alternative 6: Full Transformation – Preliminary Capital Costs



Preliminary Capital Costs (2020\$/2030\$)
\$28.9B (2020\$)/\$40.7B (2030\$)

Improvement Category	Cost (2020\$)
Track and Signal Work	\$0.6B
Structures	\$1.4B
Stations	\$3.2B
Layover and Maintenance Facilities	\$0.7B
Fleet Procurement	\$6.5B
Electrification	\$6.0B
System Expansions	
- North South Rail Link (Including Modifications)*	\$10.3B
- Grand Junction	
- Old Colony Braintree to S Station Double Track	

Note: Values are rounded and may not sum to totals. **\$28.9B (2020\$)**

Fleet costs are based on need for entire new electric fleet. Total fleet includes:

- 964 EMUs

Expansions exclude SCR Full Build and Foxboro



Summary of Alternatives 1- 6

	Alternative 1: Higher Frequency Commuter Rail	Alternative 2: Regional Rail to Key Stations (Diesel)	Alternative 3: Regional Rail to Key Stations (Electric)	Alternative 4: Urban Rail (Diesel)	Alternative 5: Urban Rail (Electric)	Alternative 5: Urban Rail (Electric) with Modified Fares	Alternative 6: Full Transformation
2040 Ridership (compared to No-Build)	+ 19,000 daily CR boardings (+ 13%)	+ 36,200 daily CR boardings (+ 24%)	+ 52,900 daily CR boardings (+ 35%)	+ 80,400 daily CR boardings (+ 53%)	+ 81,600 daily CR boardings (+ 54%)	+ 99,000 daily CR boardings (+ 66%)	+ 225,900 daily CR boardings (+ 150%)
	+5,300 drive access +13,700 walk access	+10,200 drive access +26,000 walk access	+19,400 drive access +33,500 walk access	+12,600 drive access +67,800 walk access	+10,300 drive access +71,300 walk access	+20,000 drive access +79,000 walk access	+94,400 drive access +131,500 walk access
Assumptions: -Fare Structure	+ 9,200 new linked transit trips in system -Current fares	+ 21,200 new linked transit trips in system -Current fares	+ 35,800 new linked transit trips in system -Current fares	+ 47,500 new transit trips in system -Current fares	+ 47,500 new transit trips in system -Current fares	+ 59,100 new transit trips in system -Urban rail fares	+ 122,400 new transit trips in system -Urban rail fares and distance-based fares
-Parking	-Parking constrained	-Parking unconstrained at most key stations	-Parking unconstrained at most key stations	-Parking unconstrained at urban rail termini	-Parking unconstrained at urban rail termini	-Parking unconstrained at urban rail termini	-Parking unconstrained at all stations (excluding rapid transit & limited parking stations)
Fleet Needs	Diesel Locomotives Bi-Level Cab Cars/Coaches	Locomotives Bi-Level Cab Cars/Coaches	Bi-level EMUs	Diesel Locomotives Bi-Level Cab Cars/Coaches Single-Level DMUs	Locomotives Bi-Level Cab Cars/Coaches Bi-Level EMUs	Locomotives Bi-Level Cab Cars/Coaches Bi-Level EMUs	Bi-Level EMUs
Preliminary Capital Costs (2020\$/ 2030\$)	\$1.7B (2020\$)/ \$2.3B (2030\$)	\$4.5B (2020\$)/ \$6.3B (2030\$)	\$17.9B (2020\$)/ \$25.2B (2030\$)	\$8.9B (2020\$)/ \$12.6B (2030\$)	\$10.6B (2020\$)/ \$14.9B (2030\$)	\$10.6B (2020\$)/ \$14.9B (2030\$)	\$28.9B (2020\$)/ \$40.7B (2030\$)
Incremental MBTA Systemwide Revenues (2020\$)	\$29M/Year	\$52M/Year	\$52M/Year	\$58M/Year	\$48M/Year	\$15M/Year	\$80M/Year
Incremental MBTA Commuter Rail O&M Costs (2020\$)	\$130M/Year	\$379M/Year	\$439M/Year	\$333M/year	\$304M/year	\$304M/year	\$643M/year

Parking Capacity and Demand in Alternatives 1-6

- Ridership increases are partially driven by unconstrained parking for Alternatives 2-6
- Drive access boardings increase in all alternatives
- Drive access comparison to existing capacity demonstrates a need for additional parking to support the projected ridership

	Approximate Existing Parking Availability	Alternative 1: Higher Frequency Commuter Rail	Alternative 2: Regional Rail to Key Stations (Diesel)	Alternative 3: Regional Rail to Key Stations (Electric)	Alternative 4: Urban Rail (Diesel)	Alternative 5: Urban Rail (Electric)	Alternative 6: Full Transformation
Daily Drive Access Boardings (2040)	~43,000 Spaces Exist Today (Includes both Public and Private)	98,100	103,000	112,200	105,400	103,100	187,200
Additional Parking Spaces Required*		~10,000	~15,000	~21,000	~16,000	~16,000	~45,000

Note: Parking capacities were estimated for each station based on the Boston MPO 2012-13 *Inventory of Park-and-Ride Lots at MBTA Facilities*, and was updated based on the MBTA website and further review. Station-level estimates include MBTA facilities as well as municipal and private facilities. Station-level estimates were aggregated to the line-level and compared to line-level drive access boardings, assuming that every two drive access boardings (one inbound and one outbound boarding) requires one parking space. This results in a conservative estimate of the additional parking spaces required as it does not account for potential kiss-and-ride boardings included in the drive access totals, and assumes all drive access boardings are in single-occupancy vehicles. For Alternative 6, drive access boardings on trips traveling through the North South Rail Link were distributed to the line level based on the period-level directional ridership.

O&M Costs and Revenues in Alternatives 1-6

- Each alternative results in a change in systemwide revenue and commuter rail O&M costs
- Revenue increases are due to ridership gains, which are partially offset by shifts from higher zone stations to lower zone stations (due to the differences across stations in frequency, unconstrained parking, or fares)
- Systemwide revenues do not account for non-fare revenue sources (e.g., parking)
- O&M costs do not reflect potential changes in O&M costs on other modes (e.g., bus, rapid transit)

Annualized Increase/Year (in 2020\$)	Alternative 1: Higher Frequency Commuter Rail	Alternative 2: Regional Rail to Key Stations (Diesel)	Alternative 3: Regional Rail to Key Stations (Electric)	Alternative 4: Urban Rail (Diesel)	Alternative 5: Urban Rail (Electric)	Alternative 5: Urban Rail (Electric) with Modified Fares	Alternative 6: Full Transformation
Incremental MBTA Systemwide Revenues	\$29M/Year	\$52M/Year	\$52M/Year	\$58M/Year	\$48M/Year	\$15M/Year	\$80M/Year
Incremental MBTA Commuter Rail O&M Costs	\$130M/Year	\$379M/Year	\$439M/Year	\$333M/year	\$304M/year	\$304M/year	\$643M/year

Automobile Use Projections

- Reductions in vehicle use, as well as auto diversions identified for all alternatives and compared to No Build statewide totals
- Percentage reduction in VHT greater than percentage reduction in VMT

Compared to No-Build	Alternative 1: Higher Frequency Commuter Rail	Alternative 2: Regional Rail to Key Stations (Diesel)	Alternative 3: Regional Rail to Key Stations (Electric)	Alternative 4: Urban Rail (Diesel)	Alternative 5: Urban Rail (Electric)	Alternative 6: Full Transformation
Change in Annual Vehicle Miles Traveled (VMT) (miles/year) <i>(% change statewide)</i>	-60.2 Million <i>(-0.1%)</i>	-189.6 Million <i>(-0.3%)</i>	-261.7 Million <i>(-0.4%)</i>	-174.3 Million <i>(-0.3%)</i>	-166.8 Million <i>(-0.2%)</i>	-428.4 Million <i>(-0.6%)</i>
Change in Annual Vehicle Hours Traveled (VHT) (hours/year) <i>(% change statewide)</i>	-7.9 Million <i>(-0.3%)</i>	-44.9 Million <i>(-1.8%)</i>	-52.9 Million <i>(-2.1%)</i>	-39.6 Million <i>(-1.6%)</i>	-37.5 Million <i>(-1.5%)</i>	-66.0 Million <i>(-2.7%)</i>
Change in Annual Auto Person Trips <i>(% change statewide)</i>	-2.6 Million <i>(-0.03%)</i>	-11.2 Million <i>(-0.12%)</i>	-15.3 Million <i>(-0.16%)</i>	-19.8 Million <i>(-0.21%)</i>	-18.8 Million <i>(-0.20%)</i>	-36.8 Million <i>(-0.39%)</i>