



**Massachusetts Bay
Transportation Authority**

Regional Rail Modernization Update

Traction Power Planning for Regional and Urban Rail Services

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Regional Rail Modernization

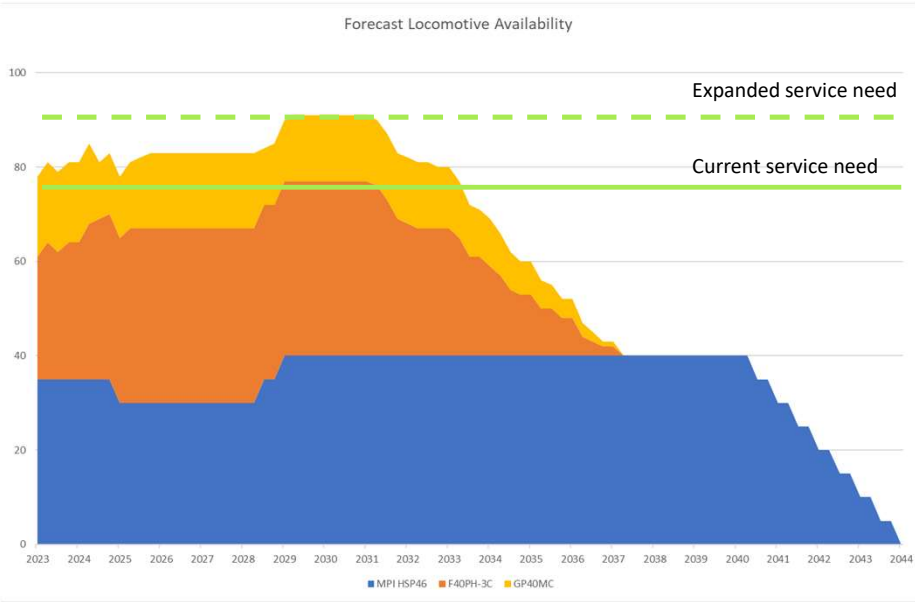
- The MBTA strongly committed to Regional Rail Modernization and Decarbonization
- First steps in Spring 2021 service
 - All day bi-directional service on all lines
 - At least hourly Clock face service on 8 lines/branches
 - Planning projects to bring remaining 4 branches to hourly
- Phase one of electrification defined by the FMCB as:
 - Providence/Stoughton Line,
 - Fairmount Line
 - Environmental Justice corridor of the Newburyport/Rockport Line
- Rail Vision was in 2019 and times have changed
 - Demand will be different
 - Emissions are worse
- Investigating battery mixed with Catenary sections to reduce cost and accelerate delivery

Phase One



Electrification starts as Good Repair Project

Just to maintain today's service new trains will need to be in revenue service by 2033 in large quantities

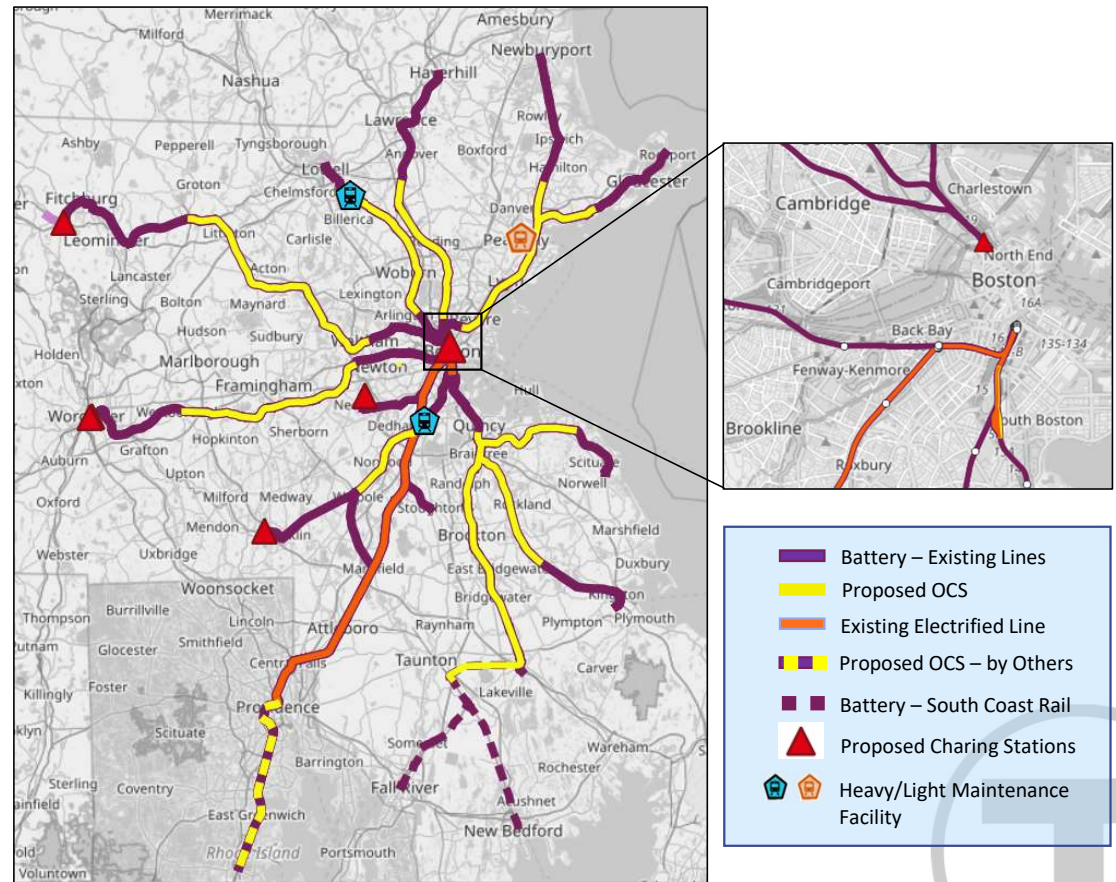


- Oldest half of Locomotive fleet (1970s/80s) is currently on its third or fourth overhaul
 - Once refurb programs complete in 2026 highly unlikely their life can be further extended
 - Many parts no longer available (have to be fabricated)
 - Corrosion reaching critical areas
- Half the fleet will reach end of life in 2030s
- New trains regardless of technology take at least 5-6 years to get first train in revenue service
 - 1-2 years to design and procure
 - 3 years to complete test train
 - 1 year to test and commission
 - Production 1 trainset per month



Discontinuous Electrification Concept

- Discontinuous electrification is the use of overhead catenary to charge battery-electric trains while moving so they can travel off-wire
- Initial use was for low bridges and tunnels which could not be modified
- Concept grew as battery technology evolved to serve short branch lines off electrified main lines
- Uses existing electrification technology for charging unlike battery only which needs special high current charging points
- By modeling power needs can reduce mileage of OCS and skip costly sections

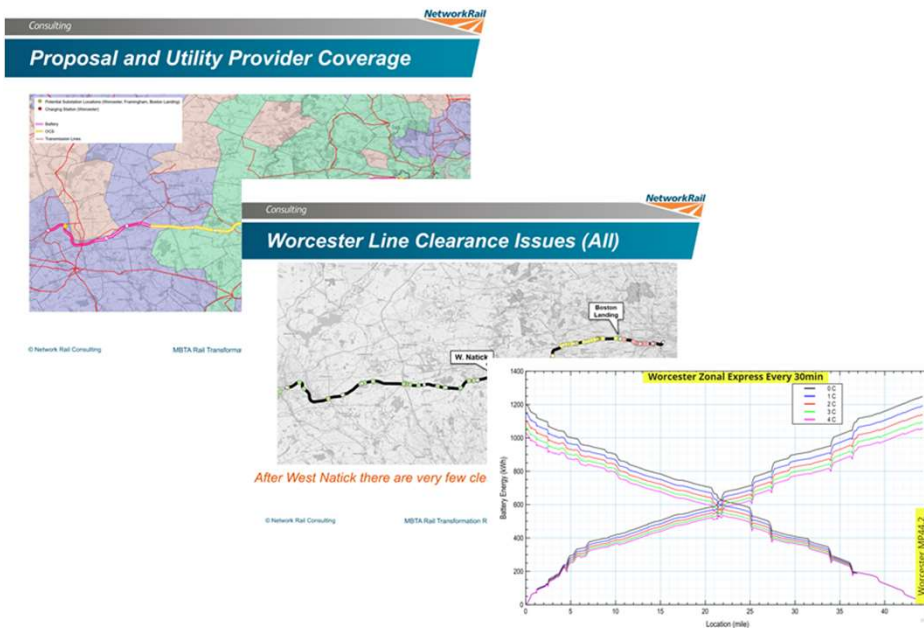


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Discontinuous Electrification Analysis

Analysis

- Current analysis optimizing layout within constraints of battery power, charging, grid and structures



Illustrative Phase 1 layout



Discontinuous Electrification Maturity

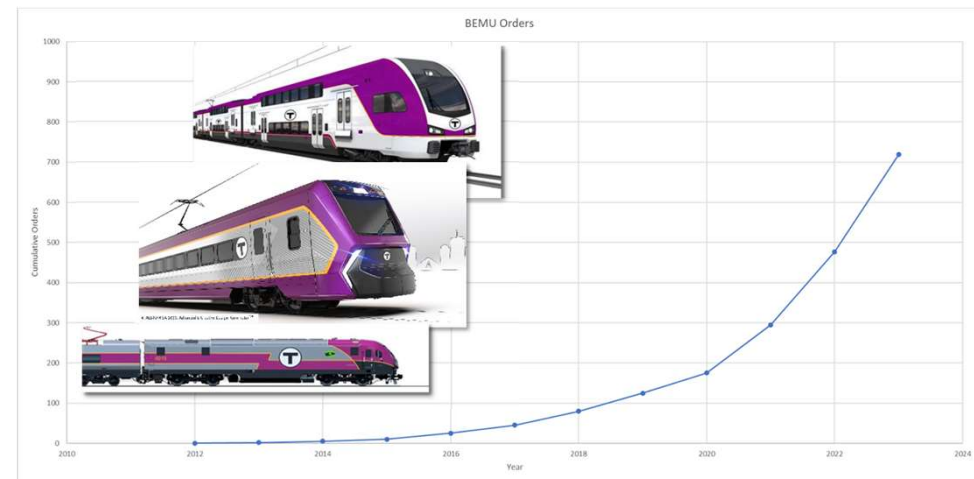
- Challenges

- No battery trains in revenue passenger service in North America
- Safety regulation now in negotiation with FRA (for San Bernadino Hydrogen-Battery hybrid due in service this summer)

- Mitigants

- Battery locomotives are in US freight revenue service
- Battery streetcars have been in operation since 2015
- Global order book for battery trains is significant and growing: 720+ trainsets in 7 countries
- Caltrain and Metra have ordered Battery variants of existing approved EMUs for 2027-30 delivery

Battery EMU Global Trainset Orders



Early Action projects

CIP funded service improvements

- Turn track projects to enable/expand urban rail services using existing Diesel locomotives
 - Haverhill Line – 30 min Reading service
 - Lowell Line – 30 min Anderson service
- Double Track projects
 - Franklin branch double track service expansion
 - Old Colony hourly service (Quincy 20 min service)*
 - Haverhill hourly service*
- Four track (electrification) project
 - Providence line – Amtrak electrification of Attleboro Station tracks – 30 minute electric service to Providence

* Funded for planning only

