Massachusetts Bay Transportation Authority

Green Line Track Update:

Short term improvement, longer term plan

Fiscal and Management Control Board
November 27, 2017

Overview

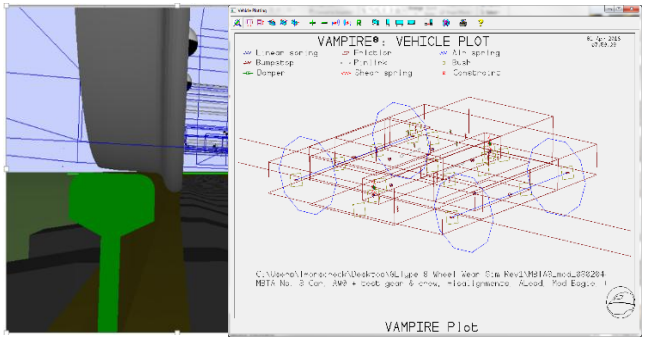
Due to significant departmental and process changes, MBTA Track Department delivering better results for customers:

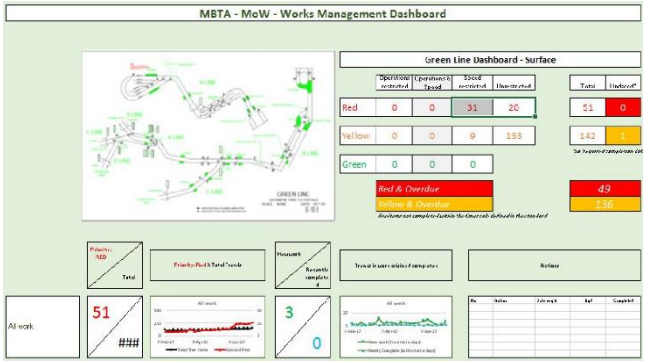
- Green Line travel time improved by 7 minutes after replacement of nearly 25,000 feet of track, reducing defects by 50 percent
- With short term improvements complete, next step is a comprehensive Green Line Track Renewal Plan

Analysis to Develop Short Term Improvement Plan

Extensive engineering work to efficiently select short term actions for Vehicles and Track utilized MBTA resources, supported by outside services from HNTB, LTK Engineering Services, MERMEC, Network Rail Consultants and STV Inc.

- Utilized proven analytical methods and sound judgement to manage short term improvements
  - Advanced vehicle dynamic analysis completed
  - Developed analytical tools to evaluate existing track data and improve data collection going forward
  - Built collaborative team of stakeholders (Track, Vehicle, Operations Safety, Contractors and Department of Public Utilities)
  - Implemented strict management controls on maintenance activities





Short Term Improvements Toward a State of Good Repair

Improved performance process ongoing:

- New Track Infrastructure Management Team
- Analysis and engineering work to develop short term improvement plan

Improvement plan included:

- Reducing wheel wear
- Accelerated rail replacement to reduce geometric irregularities

Completed Improvements

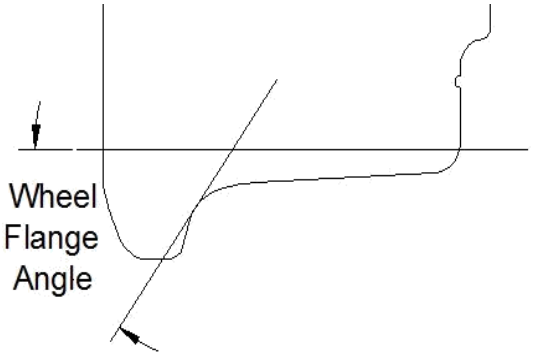
- ✓ Replaced over 24,800 ft. of rail
- ✓ Replaced more than 1,000 ties and tie plates
- ✓ Upgraded rail gauge face angle on 90,700 ft. of rail
- ✓ Upgraded crossings at Packards Cor., St. Paul, Summit Ave., Lake St.
- ✓ Initiated development of new training methods
- ✓ Director of Training engaged for Infrastructure departments
- ✓ Track renewal plans developed
- ✓ Optimized Track Geometry Collection
- ✓ Upgraded T8 Trucks Yaw Device and Primary Suspension
- ✓ Executed Contracts for Track Work
- ✓ Deployed Flange Lubricators on all Type 8 Cars
- ✓ Collected LIDAR data on the entire Green Line
- ✓ Improved our work methods that lead to a dramatic increase in lengths of continuously welded rail during a night shift

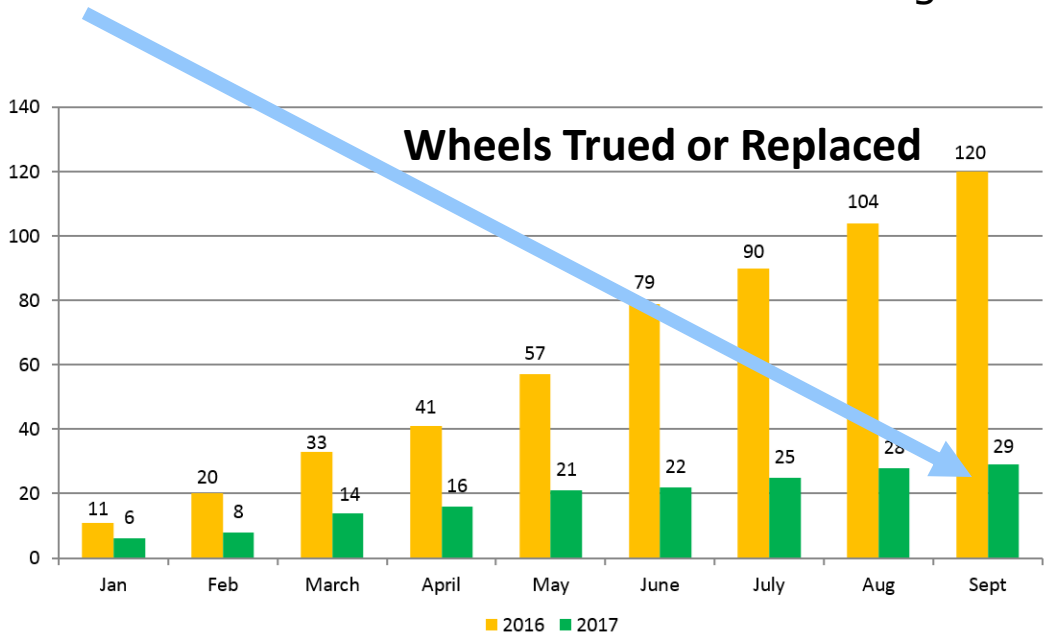
GL Track Geometry anomalies down by half since March 2016

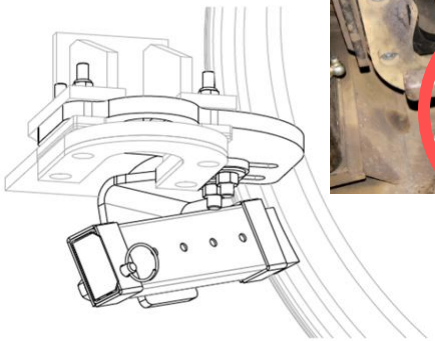
Result: Major Reduction In Wheel Wear

- Type 8 Center Trucks Flange Lubricators Installation 100% complete
- Directly contributes to increased fleet availability and reduced demand on Riverside truck shop
- Significantly reduced derailment risk

✓75% reduction in cumulative wheel flange wear





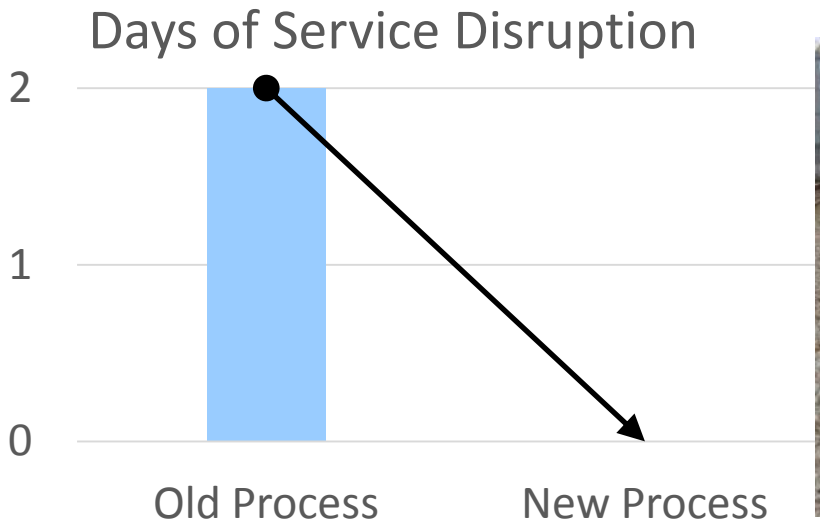


Accelerated Rail Replacement

Developed methods to install large sections of continuous welded rail on overnight shift while reducing costs, maintenance, and improving ride quality.

- Pre-welding rail to desired length
- Pre-staging materials
- Pre-installation tie and plate work
- Post installation material removal

Replacing 500+ ft. of rail used to disrupt service for a full weekend. It now requires only a single, three-hour, overnight shift.

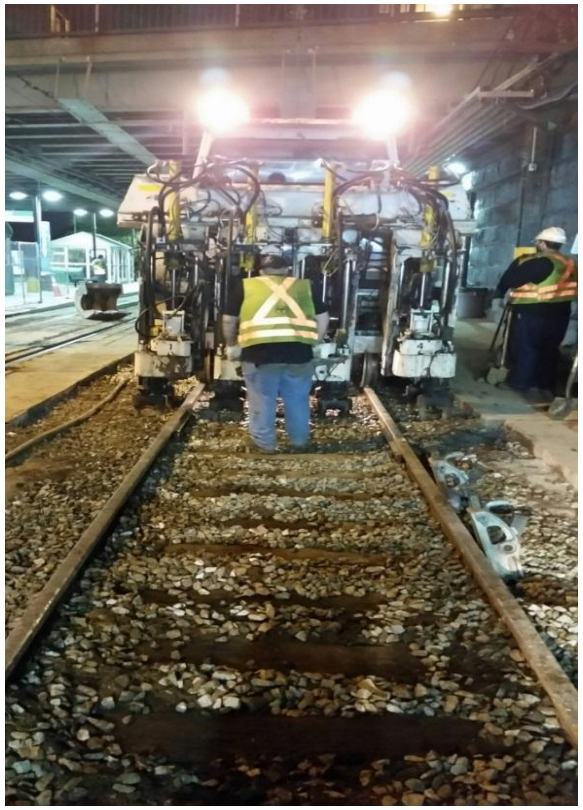


24,800 Feet of Rail Replaced, reducing travel time

Track geometric irregularities reduced 50% since March 2016

- ✓ Longwood - 2,000 ft.
- ✓ Waban - 2,300 ft.
- ✓ Charles Storage - 1,300 ft.
- ✓ Copley - 1,300 ft.
- ✓ Newton Highlands to Waban - 6,600 ft.
- ✓ Brookline Hills - 1,000 ft.
- ✓ Commonwealth Ave. - 300 ft.
- ✓ Multiple Locations Totaling - 10,000 ft.

Track Work Examples

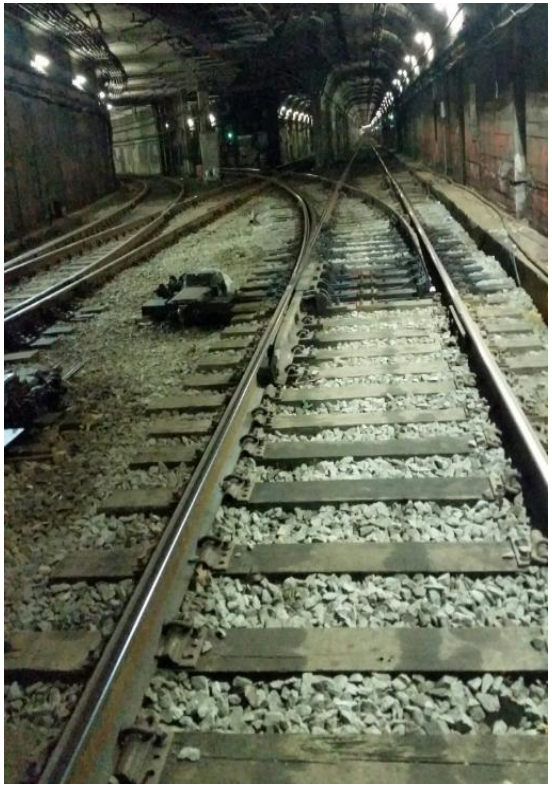


Fenway

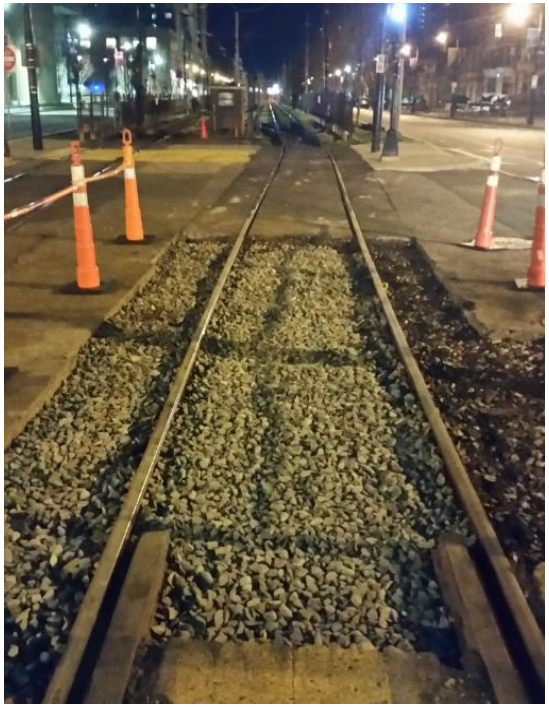
Brookline Village to Longwood 1000’

Packards Corner

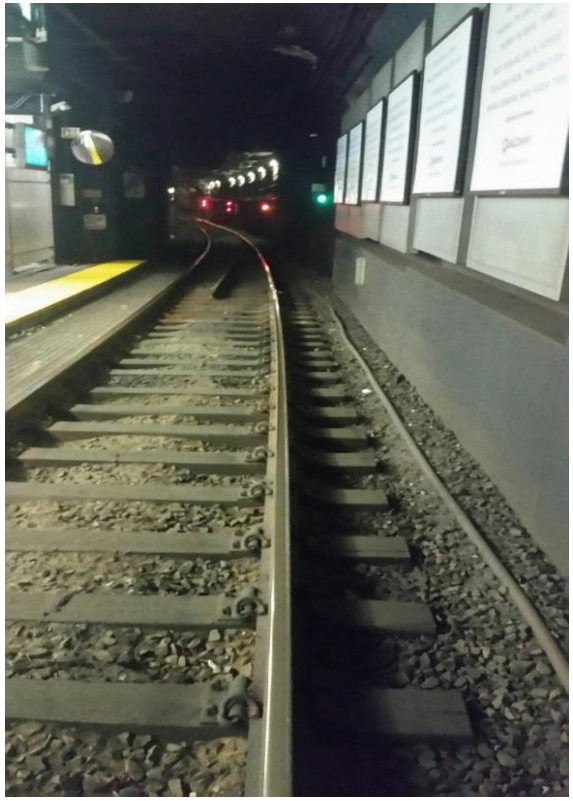
Track Work Examples



Beacon Junction



Comm. Ave – St Paul St



Park Street

The Green Line Track Renewal Plan

- Need for full depth replacement
- Renewal Plan overview
- Access to do the work
- Next Steps

We need to do more

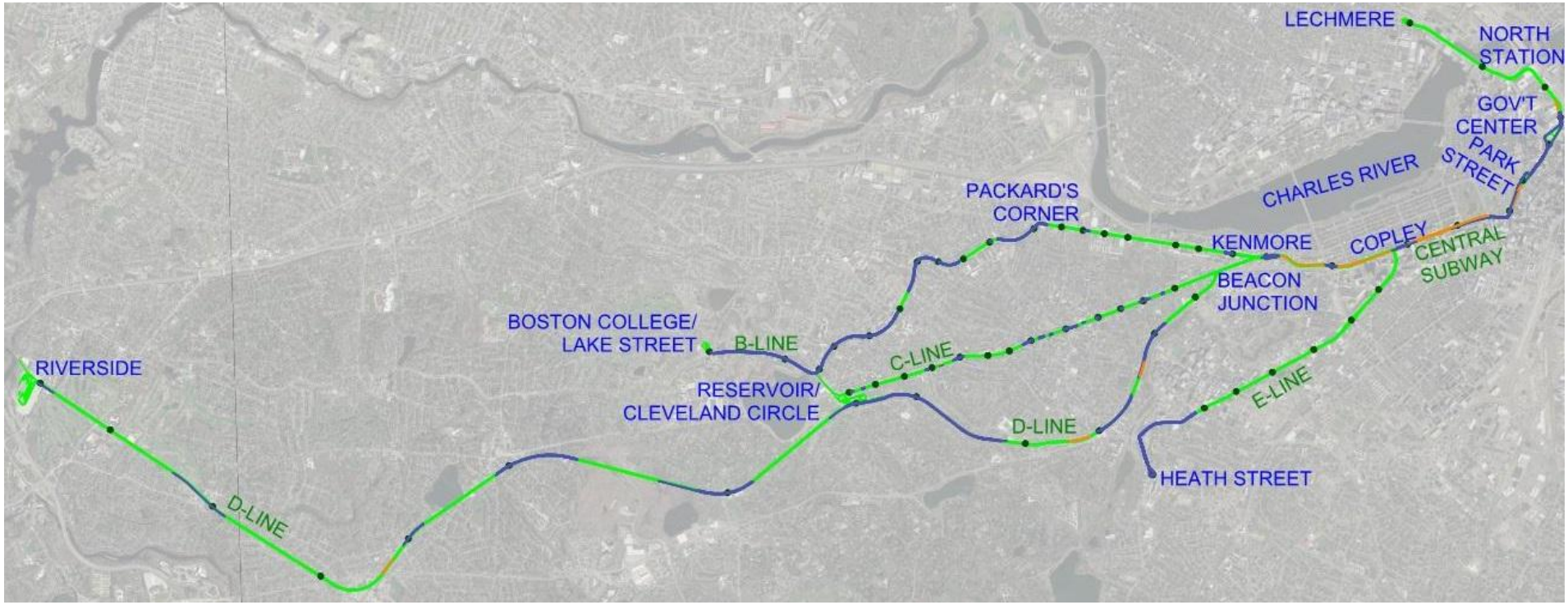
The last time the Green Line track was substantially replaced was in the 1970s and 1980s.

New, full depth rebuilt track should last 20 to 25 years.

Eventually rail, ties and other components cannot continue to be maintained to standard; they require replacement

Example of Existing Conditions Still In Need of Improvement

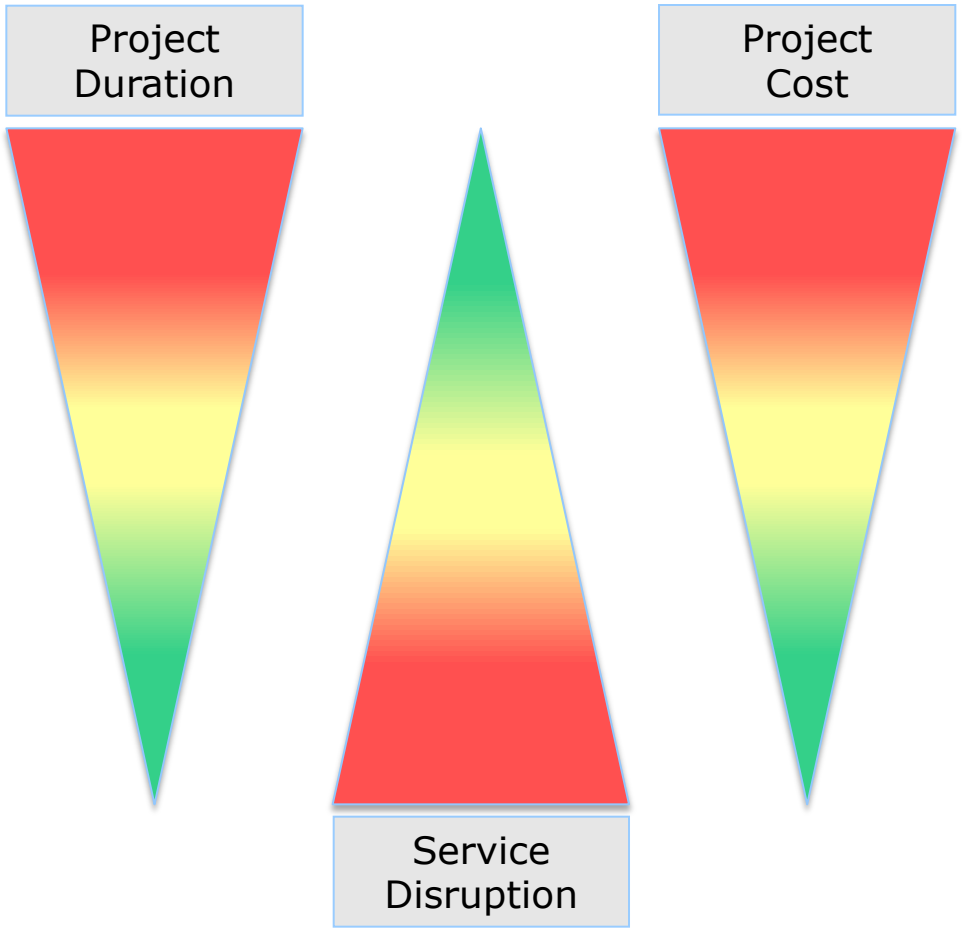
Green Line Track



No Work:
Full Depth Rail:
Rail Only:

Construction Access Options

- Night-time access only
- Early access for night-time work
- Sunday closures only (29hrs)
- Weekend diversions (53hrs)
- Full closure: 6 day daytime work (6AM – 10 PM)
- Full closure: 24/7 work



Construction Access Options

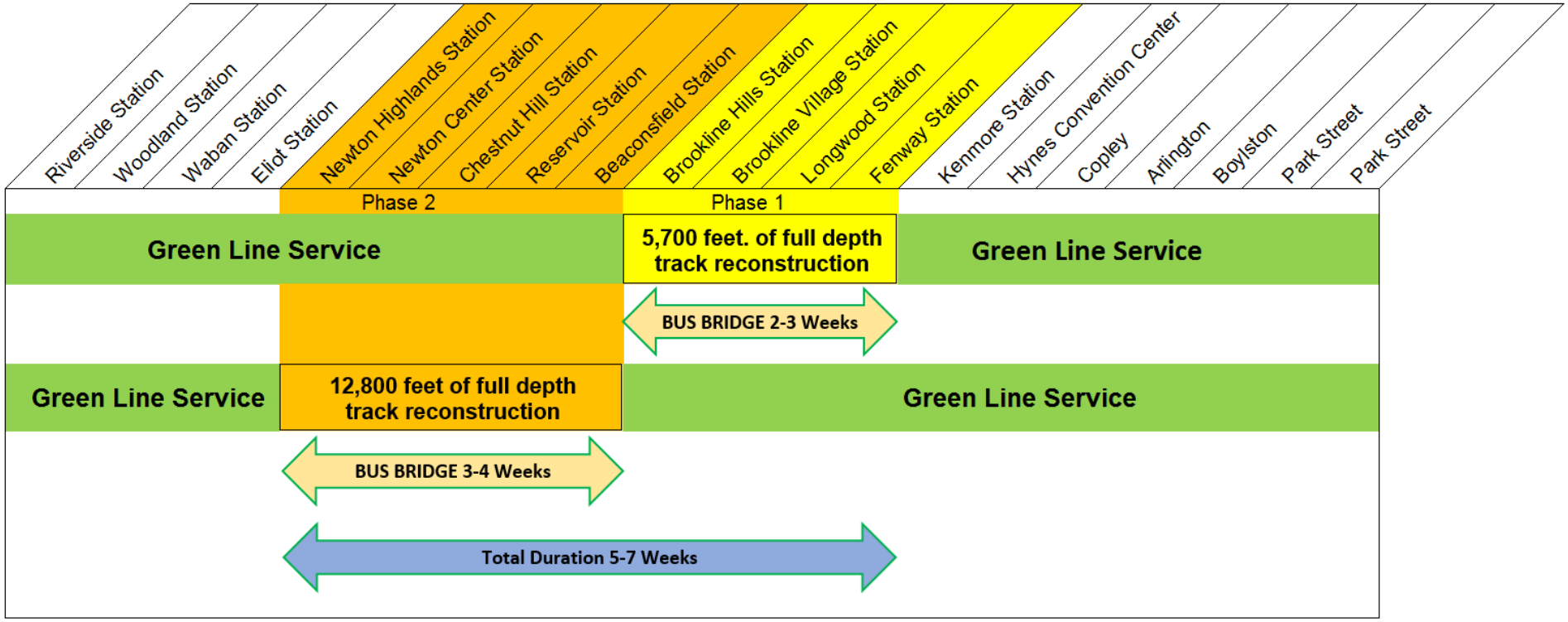
Option	Replace Rail	Full-depth renewal	Switch renewal
Night-time access only	Possible	Not possible	Not possible
Early access for night-time work	Possible	Difficult in tunnels	Not possible
Sunday closures only (29hrs)	Possible	Possible	Not possible
Weekend diversions (53hrs)	Possible	Possible	Possible
Full closure: 6 day daytime work (6AM – 10 PM)	Possible	Possible	Possible
Full closure: 24/7 work	Possible	Possible	Possible

For Example

- 3000’ of full depth renewal could take…
  (BU West station to Babcock station)

Duration	Access Regime	Relative cost	Mitigation
0.4 weeks (3 days)	Full week closure	**Base Line**	Bus bridge
2 weekends	Weekend diversions	**Plus 30%**	Weekend bus bridge
38 nights of	Early access night-time work	**Plus 50%**	Nightly bus bridge

Example of a Rolling Section Shutdown D – Line



Board Guidance Needed

The total duration and cost of Green Line track renewal is dependent upon the access we are allowed to have to do the work.

Next Steps

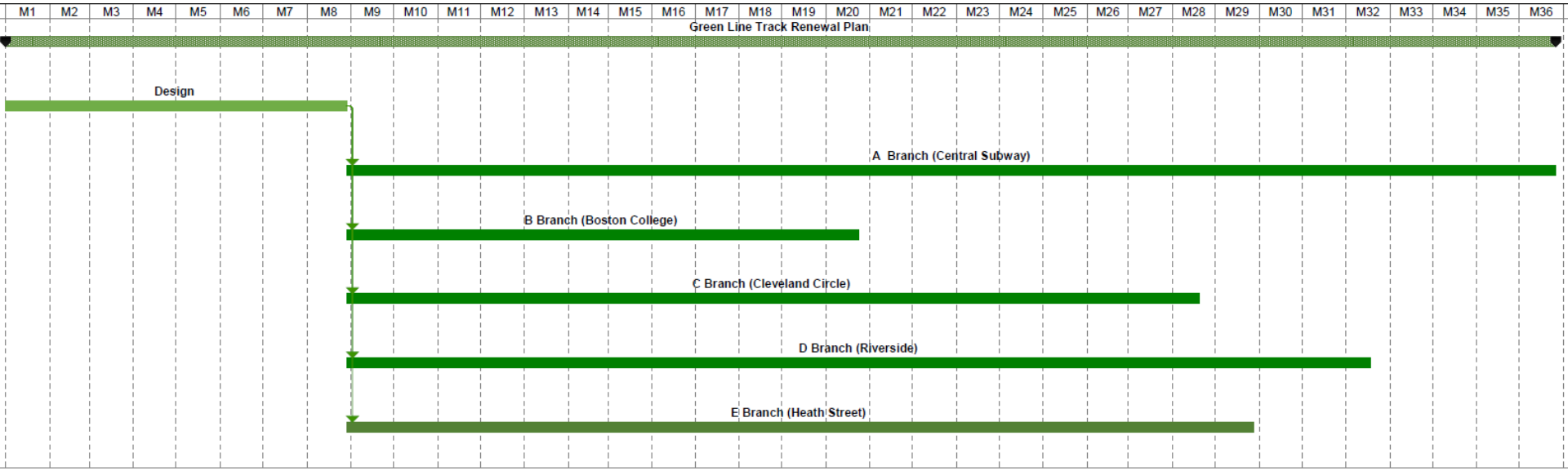
- Finalize Green Line Track Renewal Plan
- Finalize Access Plan for Rapid Renewal - Board Acceptance
- Develop Contingency Access Plans
- Integrate MBTA and Other Stakeholder Activity to maximize work efficiency and minimize disruptions
  - Green Line Power and Signal programs
  - Green Line Train Protection
  - Comm. Ave Bridge
  - GL surface stations accessibility
  - Station Consolidation
  - Fenway Portal Flood Protection
  - Others

Thank you

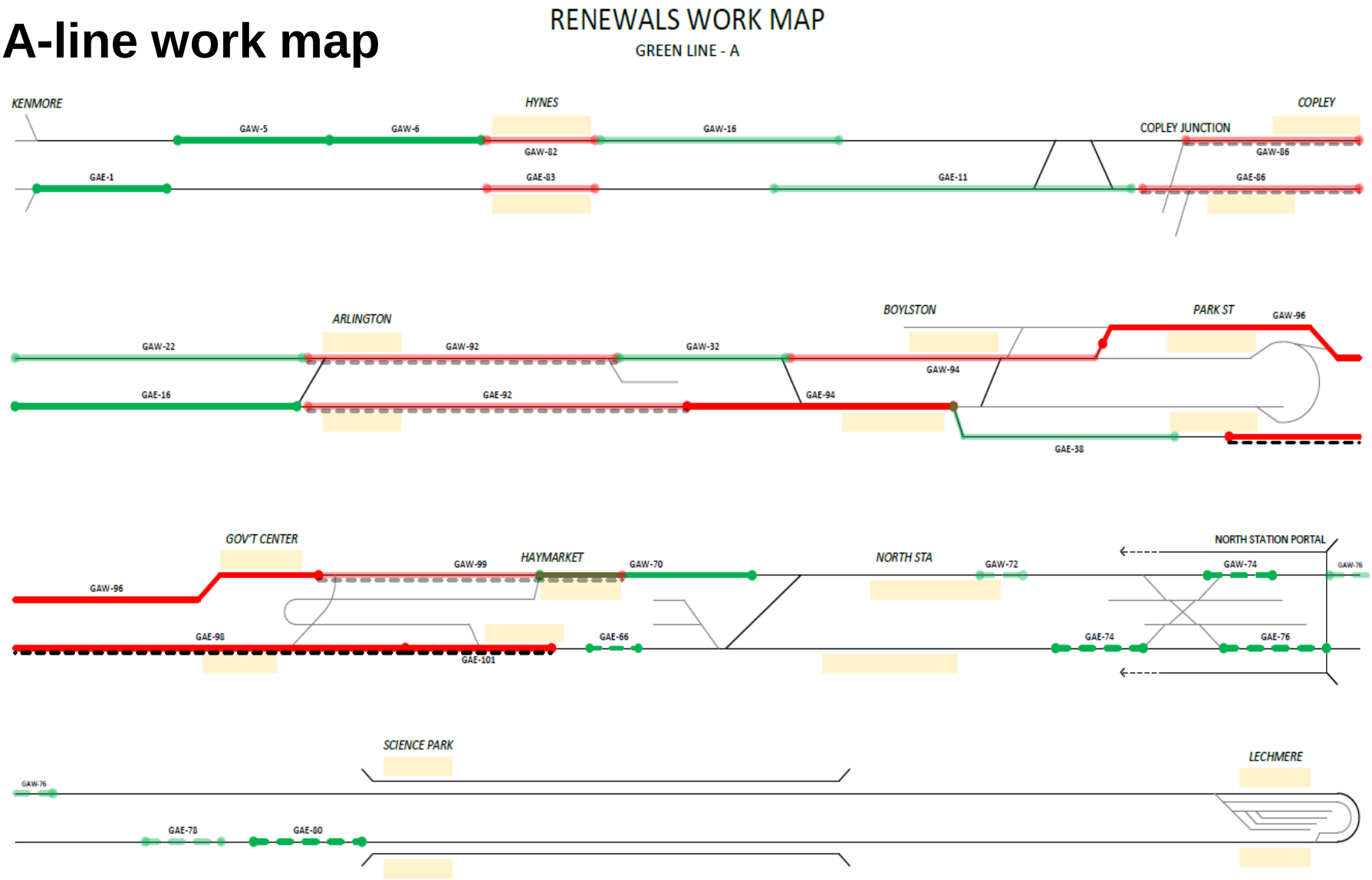
Expected Cost and Schedule Renewal

Estimated Project Construction Cost: $120M

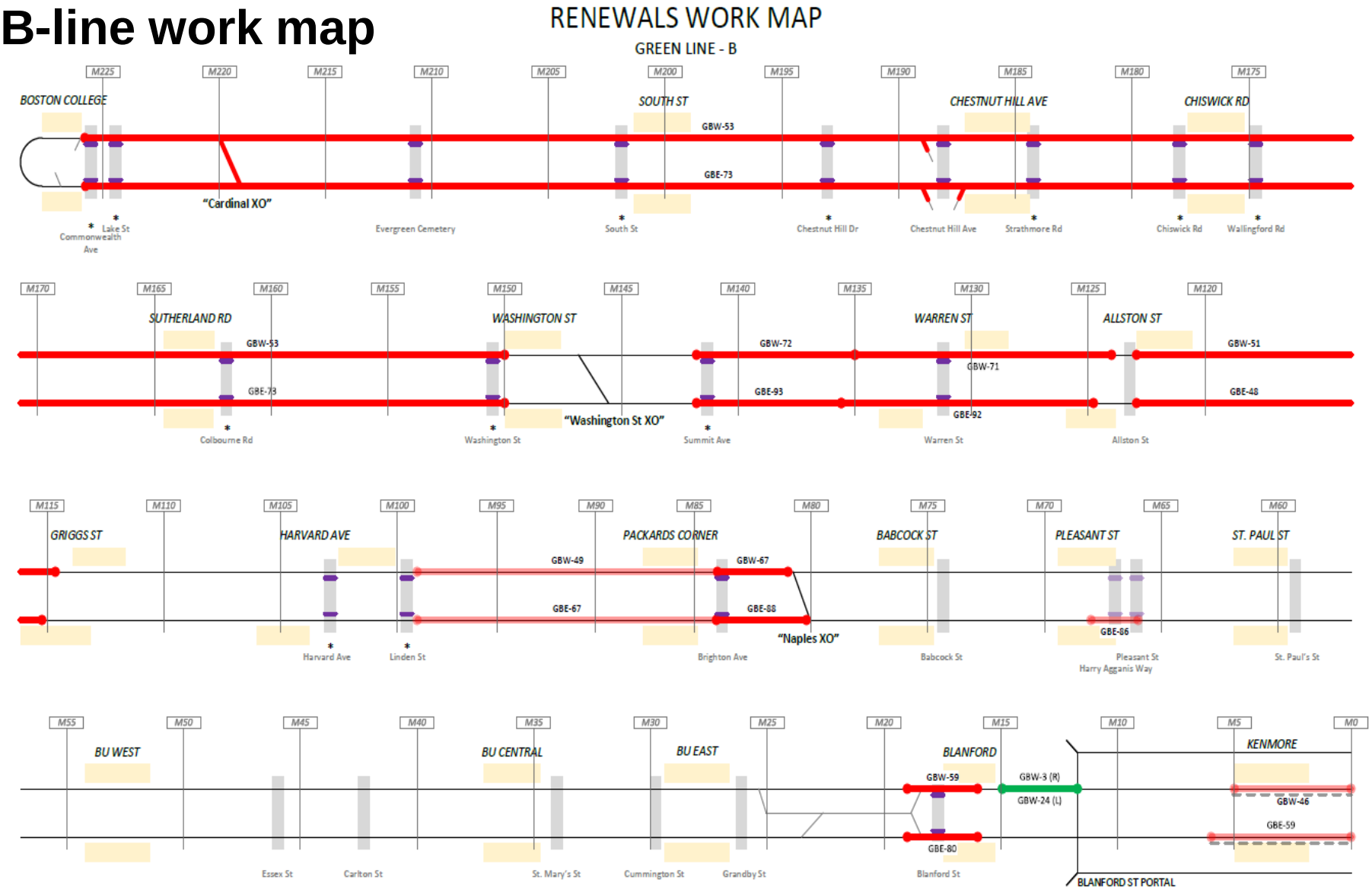
Estimated Duration: 36 Months



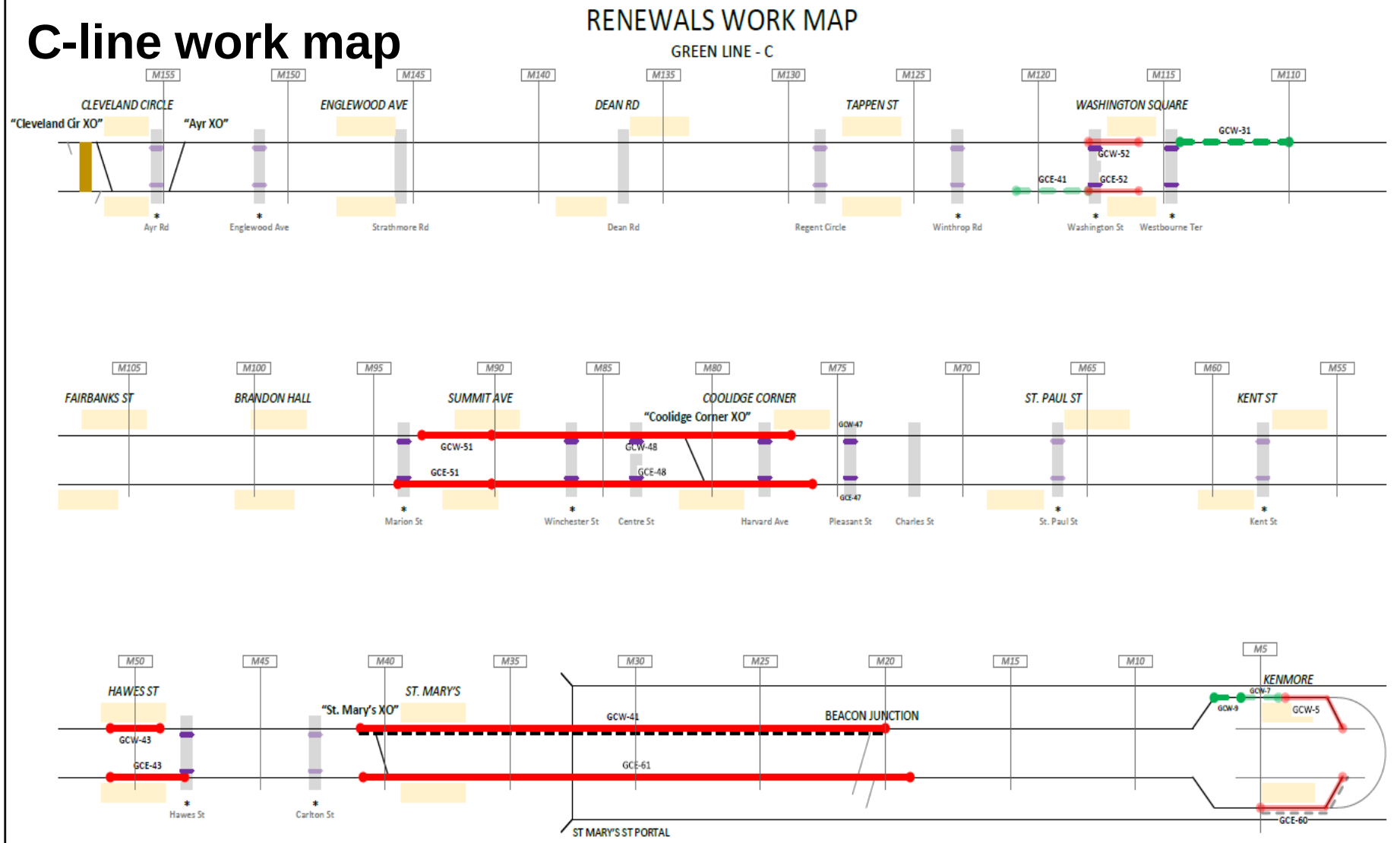
A-line work map



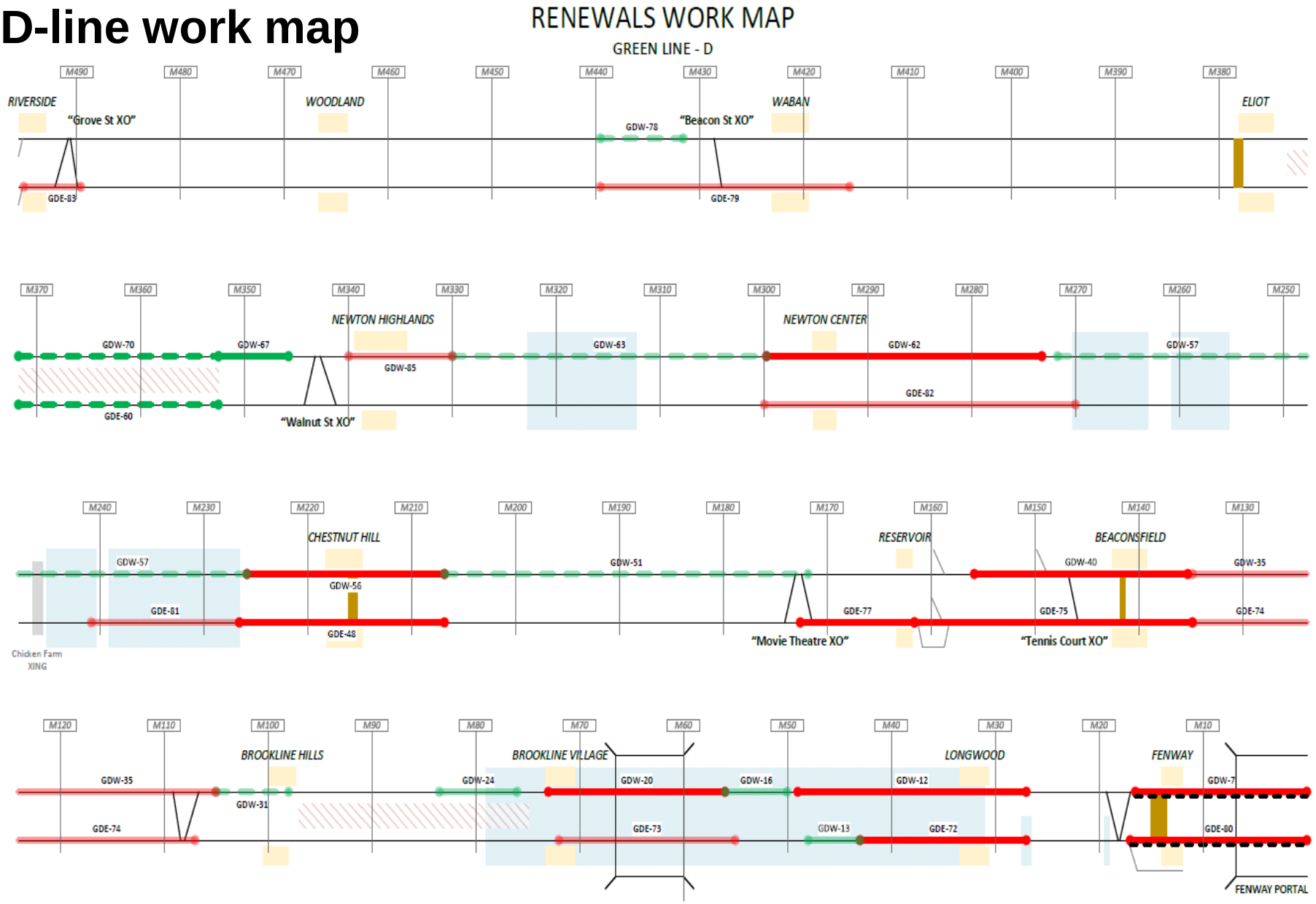
B-line work map



C-line work map



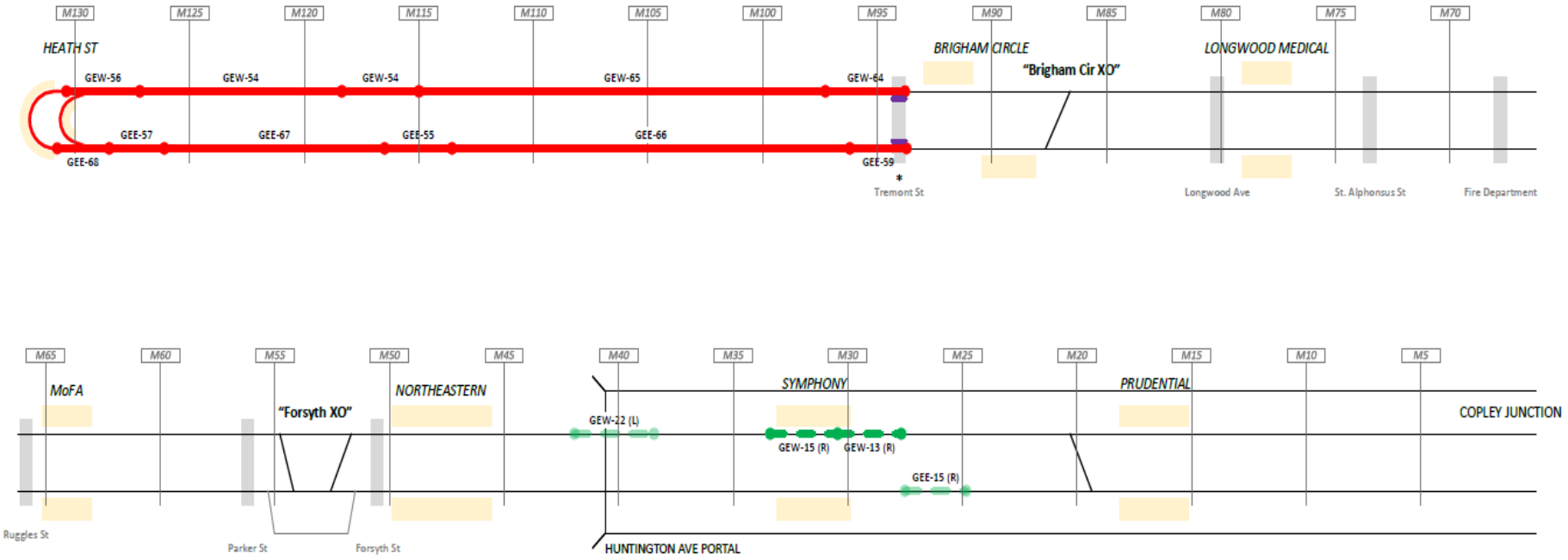
D-line work map



RENEWALS WORK MAP

GREEN LINE - E

E-line work map



LEGEND:

- Rail
- Rail (MOW)
- Rail & Ties
- Rail, Ties, Ballast
- Ties
- Ballast
- Grade xing renewal
- Drainage
- Speed restriction
- Mainline track
- Yard lead/other track
- Station platform
- Level 1 area
- Gr x-ing/truckpad

2-YEAR PLAN ('17-'19)

5-YEAR PLAN ('20-'23)

(Transparent)

*Planned/funded as part of $22M grade crossing contract.

Westbound (to Heath St)

Eastbound (to Kenmore)

RENEWALS PLANNING NETWORK DIAGRAM

2-YR/5-YR Renewals Scope

Major Achievement : Continuous Weld Rail (CWR) on the Overnight

1014 feet near Longwood approaching wear standards

Splice welded sections of rail to fabricate Continuous Welded Rail into two 507 ft. sections on the Fenway Siding

Using MBTA Equipment relocated the 2-507 ft. CWR sections in tow on rollers from Fenway to Longwood.

Unclip existing rail with rail hoisting equipment and remove 1,014 ft. of worn rail and set in new rail into tie plates and at proper gauge.

Destress the 1,014 ft. of new CWR with rail puller to ensure proper neutral position and install clips

Remove old rail, inspect and return to passenger service

Longwood Station