



Massachusetts Bay Transportation Authority

Integrated Fleet and Facilities Plan (IFFP)

Part Two: Heavy Rail – Red, Orange, and Blue Lines

November 20, 2017



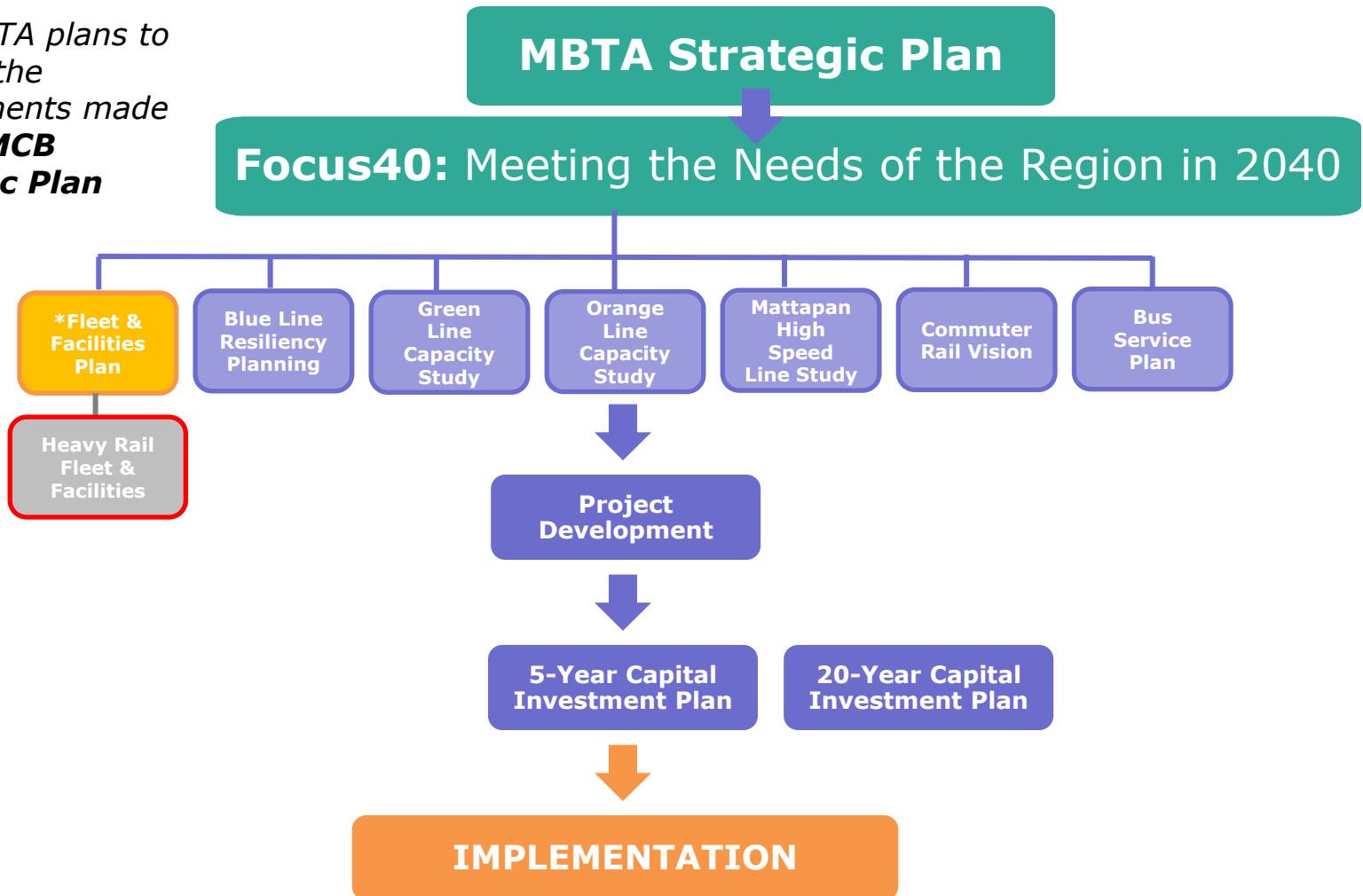
Goals of the Presentation

- Provide briefing on heavy rail fleets and facilities by line
 - Current state of assets
 - Ridership demand
 - Future capacity
 - IFFP investments
- Highlight implementation of Reliability Centered Maintenance (RCM)



Aligned with MBTA Strategic Vision - Focus40 Planning

*The MBTA plans to execute the commitments made in the **FMCB Strategic Plan**





Approach for Fleet Inventory and Condition

- Fleet and facilities inventory and condition assessment activities performed between January and March 2017
- Consistent with MBTA asset management plan and strategy (MAP-21)
- Physical assessments utilized the FTA 1-5 condition rating scale
- Report cards were prepared summarizing key findings for fleets and facilities

ASSET REPORT CARD - RAIL

Bombardier, RL #3	Property		MBTA		Average Rating:		3.1							
	Evaluation Year	2017												
	Delivered	1993-1994 (24yrs)												
	Est. Retirement	2020-2024 (27yrs)												
	Quantity	82												
	Last Overhaul	2011												
	Location(s)	Cibot												
Avg. LTD Mileage	1,501,682													
Asset Type	Fuel Type	Current Collection	Frame	Body	Ownership									
<input type="checkbox"/> Light Rail <input checked="" type="checkbox"/> Heavy Rail <input type="checkbox"/> Locomotive <input type="checkbox"/> Coach <input type="checkbox"/> Other:	<input type="checkbox"/> Diesel <input checked="" type="checkbox"/> Electric <input type="checkbox"/> Hybrid <input type="checkbox"/> N/A <input type="checkbox"/> Other:	<input checked="" type="checkbox"/> Third Rail <input type="checkbox"/> Overhead <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Carbon Steel <input type="checkbox"/> Stainless Steel <input type="checkbox"/> Aluminum <input type="checkbox"/> Other:	<input type="checkbox"/> Carbon Steel <input checked="" type="checkbox"/> Stainless Steel <input type="checkbox"/> Aluminum <input type="checkbox"/> Fiberglass	<input checked="" type="checkbox"/> Owned Outright <input type="checkbox"/> Lease <input type="checkbox"/> Contractor Owned <input type="checkbox"/> Other:									
Brakes	Cab Area	Coupler	Current Collect.	Engine / Propulsion	Ext. Body	Ext. Lights	Doors	HVAC	Pass. Interior	Roof	Trucks	Under Equip.		
3.0	2.9	3.1	3.0	3.3	3.1	3.0	3.4	3.7	3.2	-	2.7	3.4		
<ul style="list-style-type: none"> Warn operator's panels Warn passenger seat inserts Pitted and spalled wheels 														
Failures by Subsystem														
Period: 2016														
Air System	Brake System	Cooling	Doors	Elec. & Lighting	Engine	Fuel	HVAC	Steering & Susp.	Trans.	Body & Frame	Wheels & Tires			
12	27	-	8	7	9	-	2	-	-	-	-			
Total Failures			95	Total Fleet Mileage 2016			6,245,608	MMBF		65,743				
Summary														
<ul style="list-style-type: none"> A new vehicle procurement for replacement cars is in progress. 														
<i>Ratings based on FTA SGR Standard</i> 1 - Poor 2 - Marginal 3 - Fair 4 - Good 5 - Excellent														

FR0315171117005



APRIL 2017

A photograph of the front of a train car, likely a light rail or commuter train, with a white upper half and a blue lower half. The number '0727' is visible on the right side of the front panel. The train is positioned on tracks in a station or maintenance facility, with overhead structures and other tracks visible in the background. The image is semi-transparent, serving as a background for the text.

Blue Line Fleet and Facilities



Inventory and Condition – Blue Line

Blue Line Fleet



<i>Fleet</i>	<i>Age (Years)</i>	<i>Total Cars</i>	<i>Condition Rating</i>
No. 5	12	94	4.0

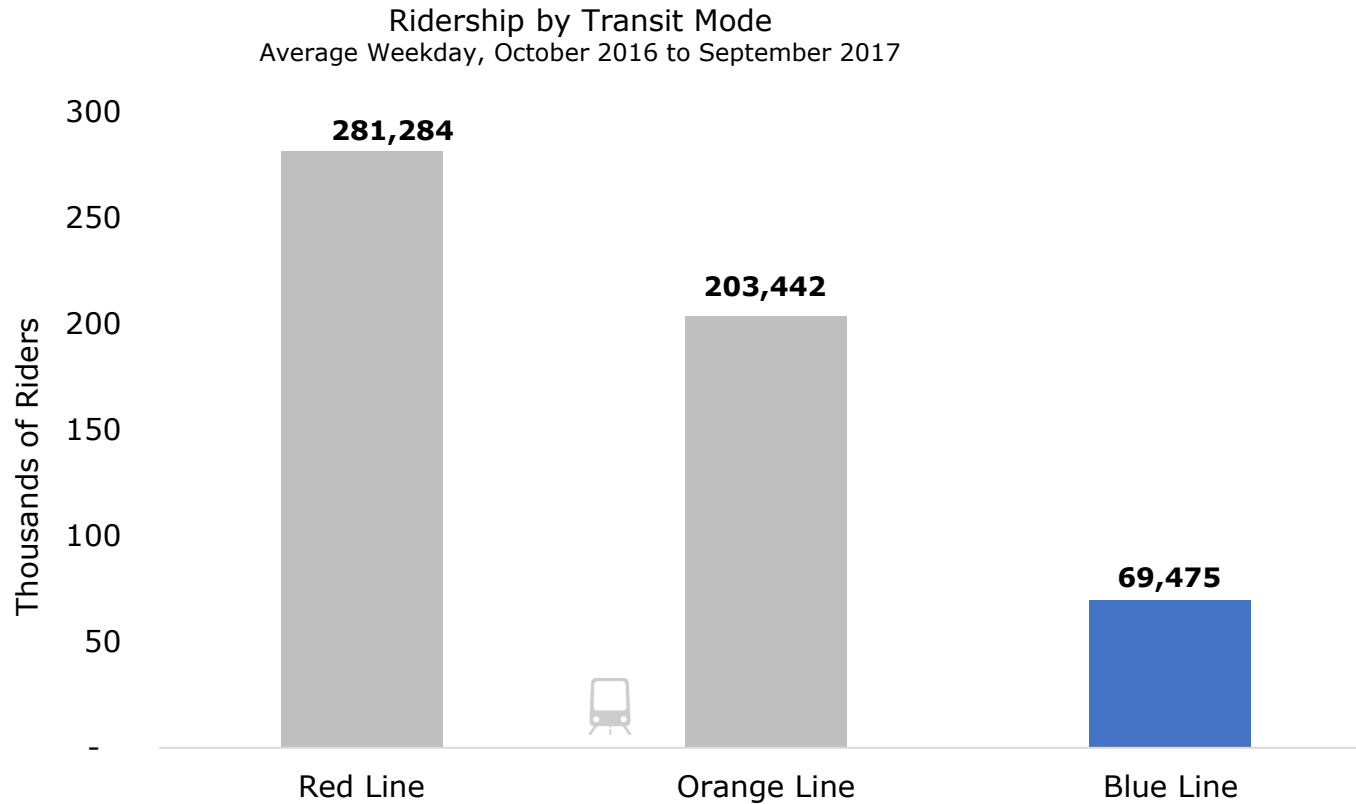
Orient Heights Maintenance Facility

<i>Facility Age</i>		63 Years	<i>Hoists</i>		4	<i>Lifts</i>		2	<i>Pits</i>		24
Interior	Shell	Substruct.	Electrical	Fire Prot.	HVAC	Plumbing	Convey.	Shop Equip.	Maint. Bays	Site	
3.4	4.0	3.5	3.1	3.0	3.6	3.0	3.0	3.2	3.5	3.2	

- Significant upgrades performed at time of Blue Line Fleet procurement (2007)
- Facility continues to be well maintained, with relatively minor issues observed



Heavy Rail Ridership – Blue Line

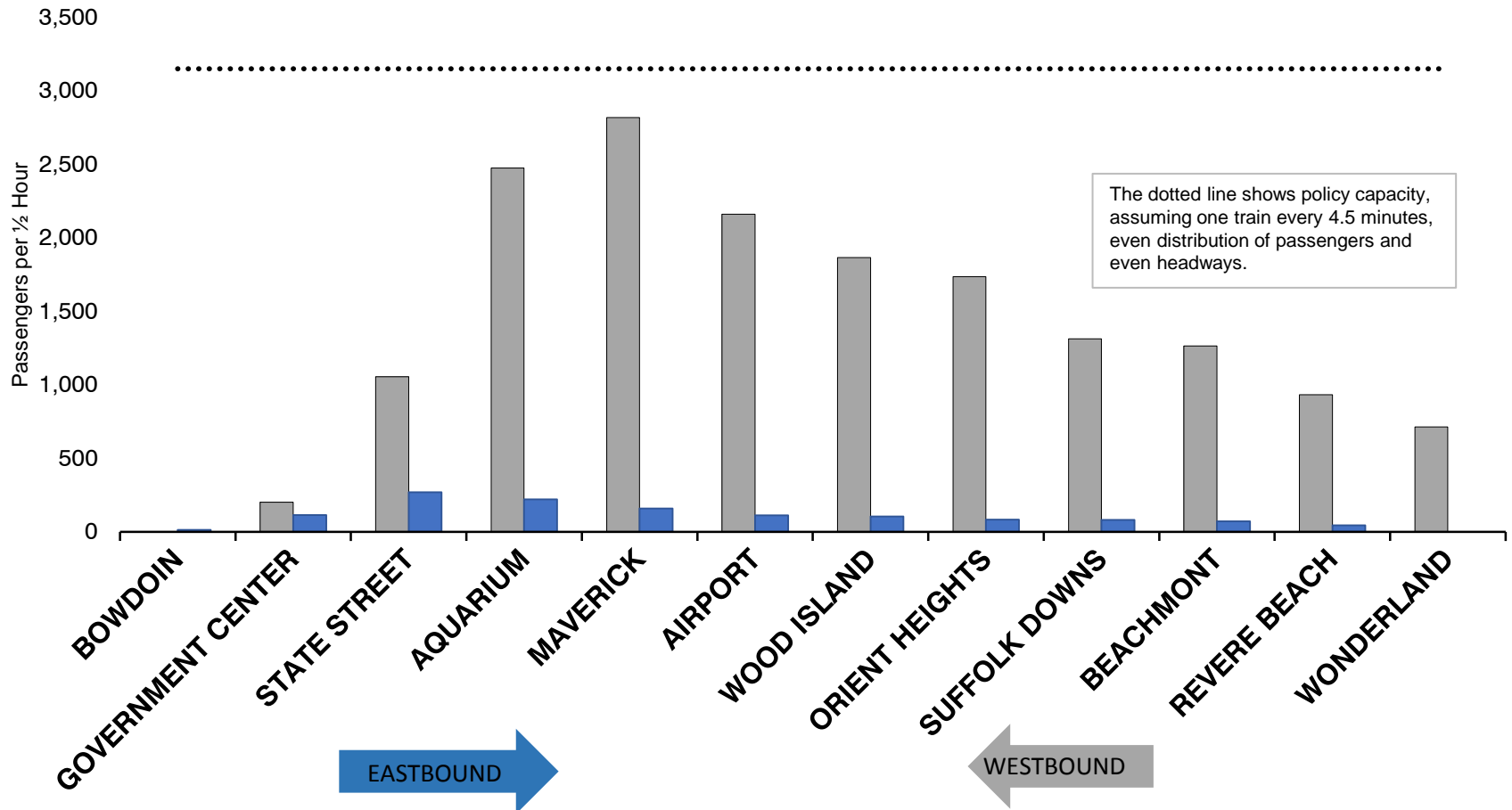


Source: MBTA Back on Track Data



Heavy Rail Peak Capacity and Demand – Blue Line

BLUE LINE PASSENGER FLOW & POLICY CAPACITY
8:00-8:30 AM, WEEKDAYS - WINTER 2017

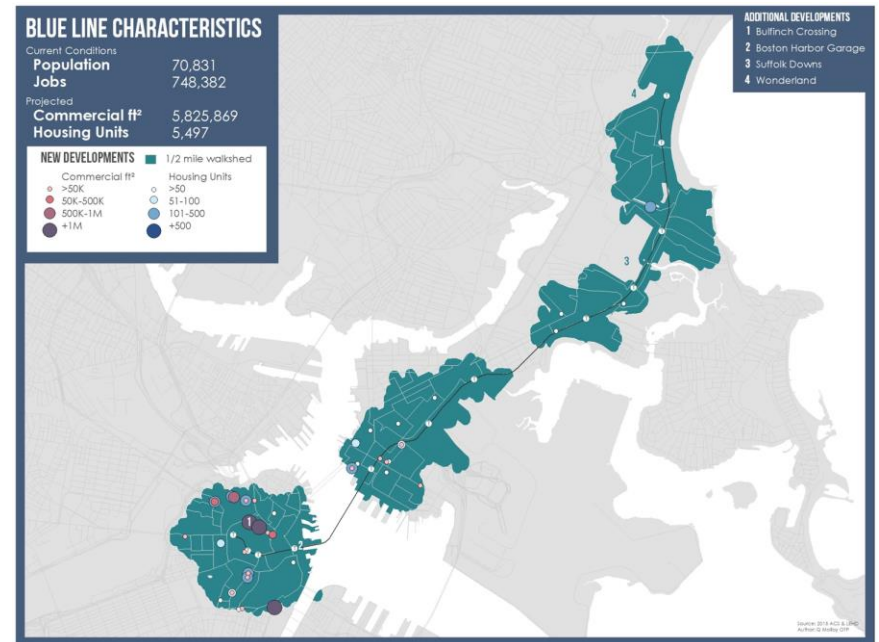


Draft for Discussion & Policy Purposes Only



Blue Line Future Capacity

- Existing operations at 4.5 minute headway provides a 10% room for capacity growth
- Utilizing the existing fleet, an additional 15% capacity could be added by:
 - Expanding trainsets
 - Further decreasing headway to 4 minutes
 - Resulting in 25% overall growth
- MassDOT Planning to monitor the pace of corridor development and ridership growth to determine if additional capacity is warranted, outside the existing scope of the IFFP





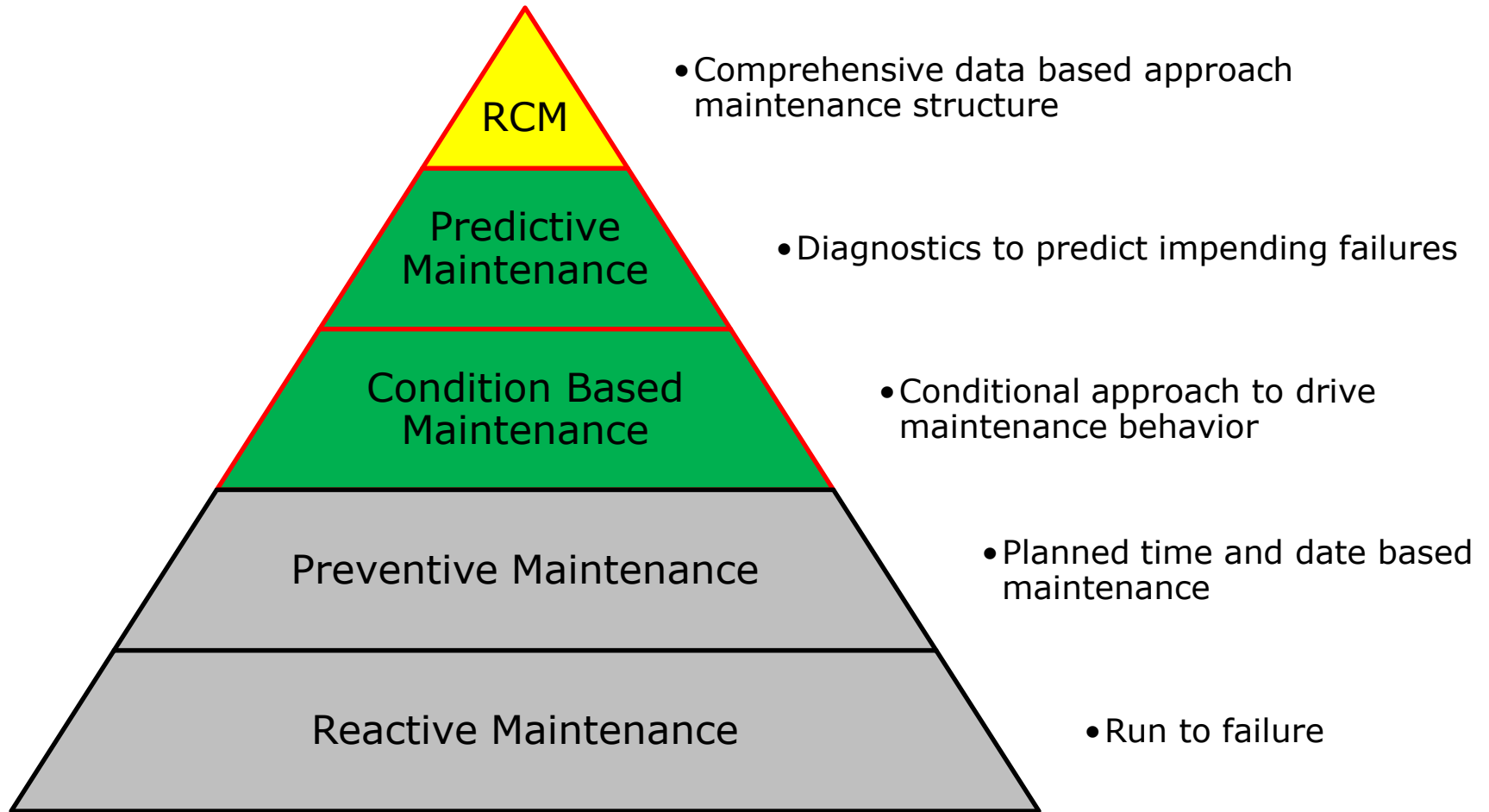
Blue Line Reliability Centered Maintenance (RCM)

- RCM has been implemented on Blue Line since 2014
 - Successful RCM program should allow MBTA to avoid a major midlife overhaul
 - Blue Line program will be a template for new fleets moving forward
 - Approach will be applied to other modes once robust processes are established

What is RCM?...



Reliability Centered Maintenance – Philosophy





Reliability Centered Maintenance – Benefits

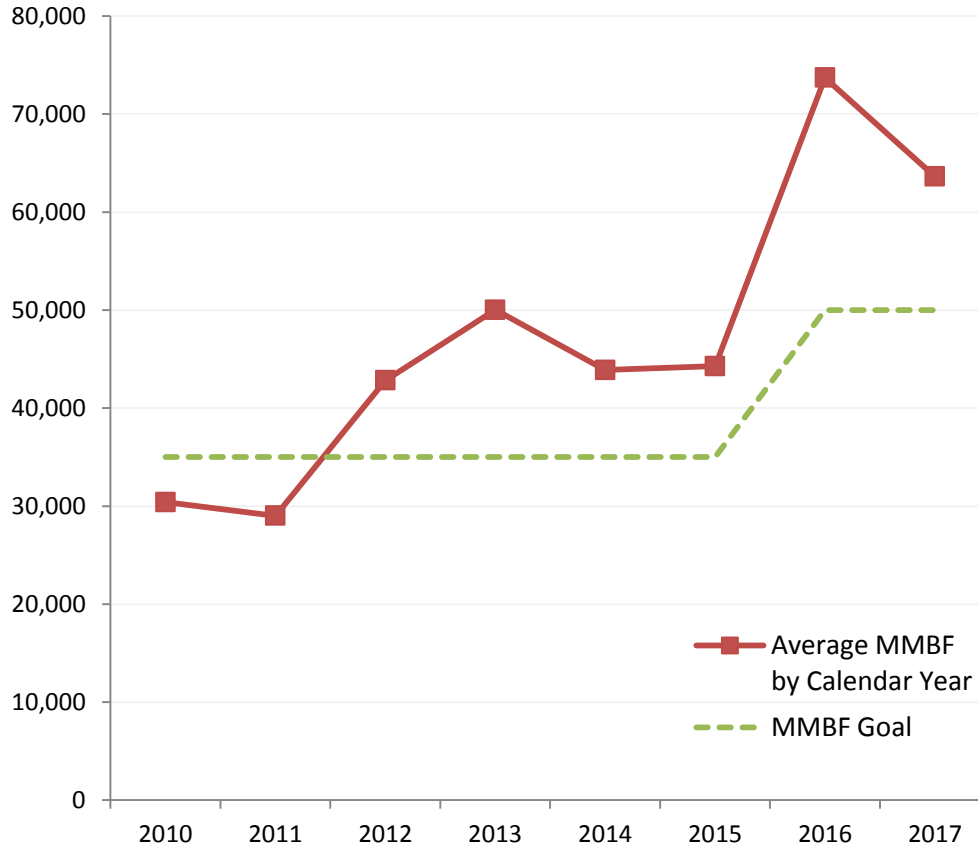
- RCM allows us to control the following
 - Scheduling
 - Planning
 - Costs
 - Monitor program performance
- RCM includes the following
 - Monitor overall fleet performance
 - Recording & evaluating Failures in Service
 - Develop mitigation programs





Blue Line RCM Impacts

Blue Line Average MMBF



- RCM implemented 2014
- Data focused approach
- Reliability increased 68% since implementation
- Failures in services reduced 40%
- Annual, 4, 8, and 10 year programs



Blue Line Fleet and Facility Investment Plan

- Delivery of 94 cars 2004 - 2005
- RCM program Ongoing
- Light Overhaul of Blue Line cars 2019 - 2021





IFFP Blue Line Investment Impact

Reliability Centered Maintenance Program

Ongoing

- Increase fleet reliability
- Reduce lifecycle costs
- Eliminate major fleet overhauls

Light Overhaul

\$54M (Unfunded)

- FY2019 – FY2021
- Targeted major systems overhaul
- Increase fleet reliability
- Reduce lifecycle maintenance costs
- Maximize asset lifecycle

A photograph of an Orange Line train car, number 5277, inside a large maintenance facility. The train is positioned on a track, and the facility's interior is visible, including a large American flag on the left wall and several workers in safety gear in the background. The text "Orange Line Fleet and Facilities" is overlaid in the center of the image.

Orange Line Fleet and Facilities



Inventory and Condition – Orange Line

Orange Line Fleet



<i>Fleet</i>	<i>Age (Years)</i>	<i>Total Cars</i>	<i>Condition Rating</i>
No. 12	38	120	2.8

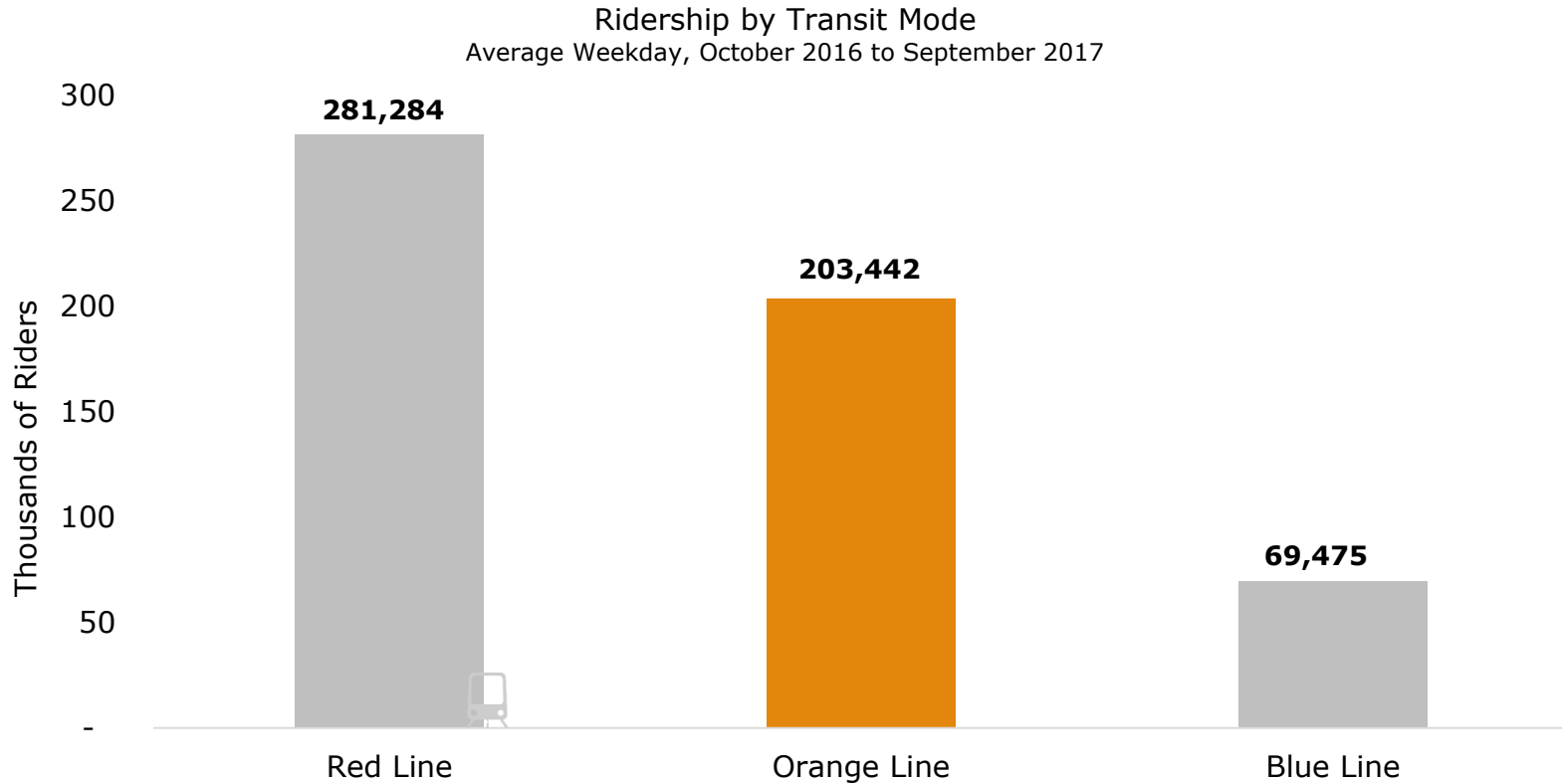
Wellington Maintenance Facility

<i>Facility Age</i>		42 Years		<i>Hoists</i>		2		<i>Lifts</i>		-		<i>Pits</i>		24	
Interior	Shell	Substruct.	Electrical	Fire Prot.	HVAC	Plumbing	Convey.	Shop Equip.	Maint. Bays	Site					
3.0	1.8	3.0	3.0	3.0	2.2	2.7	3.0	3.0	2.5	2.0					

- Overhead cranes and doors are unreliable; heating system prone to frequent failures
- Failing roof system is leaking in several locations
- Significant upgrades are currently underway



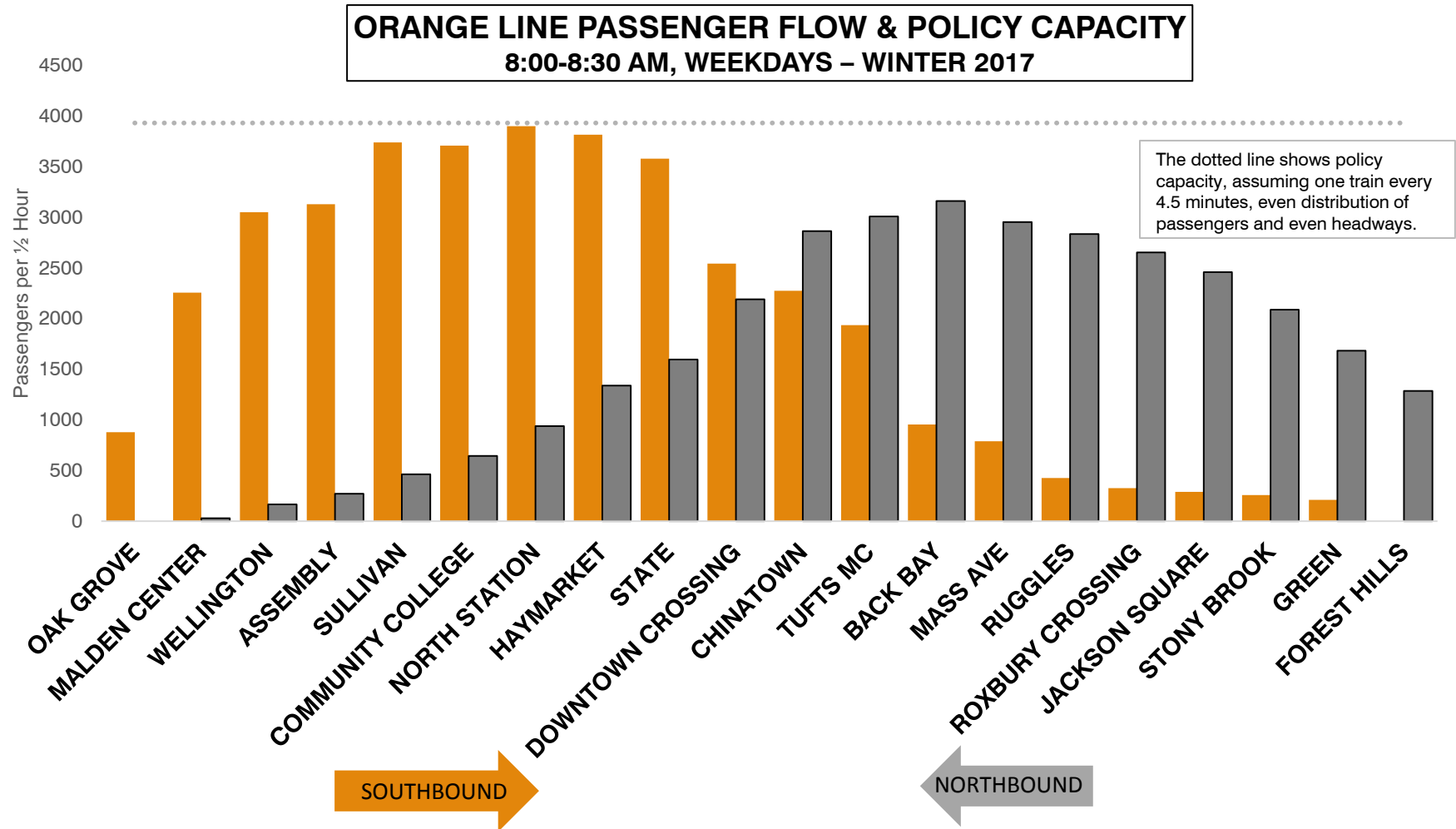
Heavy Rail Ridership – Orange Line



Source: MBTA Back on Track Data



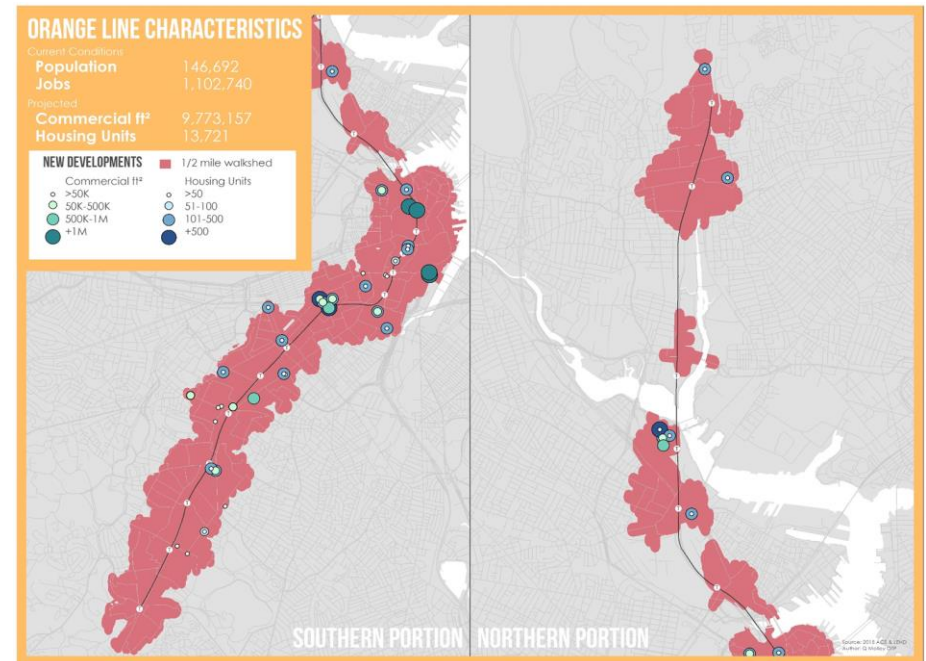
Heavy Rail Peak Capacity and Demand – Orange Line





Orange Line Future Capacity

- Existing operations at 6 minute headway
- Currently operating at or above capacity
- Delivery of new cars and infrastructure investments provides the opportunity for:
 - 4.5 minute headway
 - 10 – 14 trainsets per hour (peak)
 - 40% capacity increase





Orange Line Fleet and Facility Investment Plan

- Delivery of Pilot Cars December 2017
- Maintenance facility investment program 2018 – 2021
- Development of RCM program Underway
- Delivery of 152 new cars 2018 – 2021
- Reliability Centered Maintenance Program 2019 – 2032
- Light Overhaul of Orange Line Cars 2030+





Orange Line Infrastructure Programs

Wellington Yard Expansion Tracks 33 to 38

Scope: The project will provide additional vehicle storage at Wellington Yard for the expanded Orange Line fleet. Work includes upgrades to track, traction power and signals.

Current Status:

Construction NTP – December, 2016
Construction Substantial Completion – June, 2018

Orange Line Test Track at Wellington Yard

Scope: Upgrade the existing Orange Line Test track to support testing of the Orange Line vehicles.

Current Status:

Construction NTP – June, 2017
Construction Substantial Completion – April, 2018

Wellington Maintenance Facility

Scope: Expand and modernize the existing maintenance facility. Work includes a new electronics room, carwash, MEP systems, lighting, doors, windows, and specialty equipment.

Current Status:

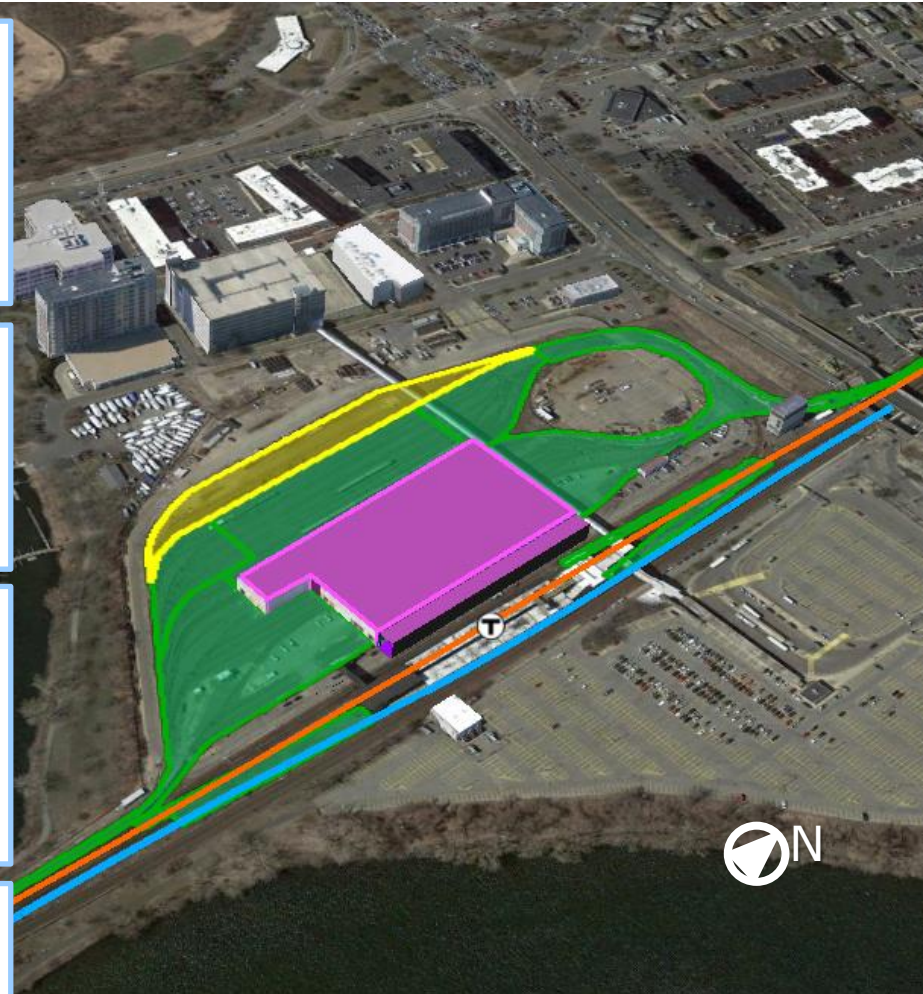
Construction NTP – June, 2017
Construction Substantial Completion – February, 2021

Wellington Yard Rebuild

Scope: Full yard rebuild; including track, traction power and signal upgrades.

Current Status:

Advertisement – December, 2017
Construction NTP - March, 2018
Construction Substantial Completion – March, 2021





IFFP Orange Line Investment Impact

152 New Cars

\$1,010M
(CIP funded, Red/Orange)

- Increase passenger capacity
- Improve headways
- Increase fleet reliability
- Improve customer experience

Maintenance Facility Modernization

\$257M (CIP funded)

- Increase fleet reliability
- Reduce maintenance costs
- Improve technical capabilities

Reliability Centered Maintenance Program

Scope under review

- Increase fleet reliability
- Reduce lifecycle costs
- Eliminate major fleet overhauls

Light Overhaul

\$232M
(Unfunded, Red/Orange)

- FY2030+
- Targeted major systems overhaul
- Increase fleet reliability
- Reduce lifecycle maintenance costs
- Maximize asset lifecycle



Red Line Fleet and Facilities



Current Inventory and Condition – Red Line

Red Line Fleet



<i>Fleet</i>	<i>Age (Years)</i>	<i>Total Cars</i>	<i>Condition Rating</i>
Type # 1	48	70	2.9
Type # 2	30	58	3.3
Type # 3	24	82	3.1
Fleet	34	210	3.1

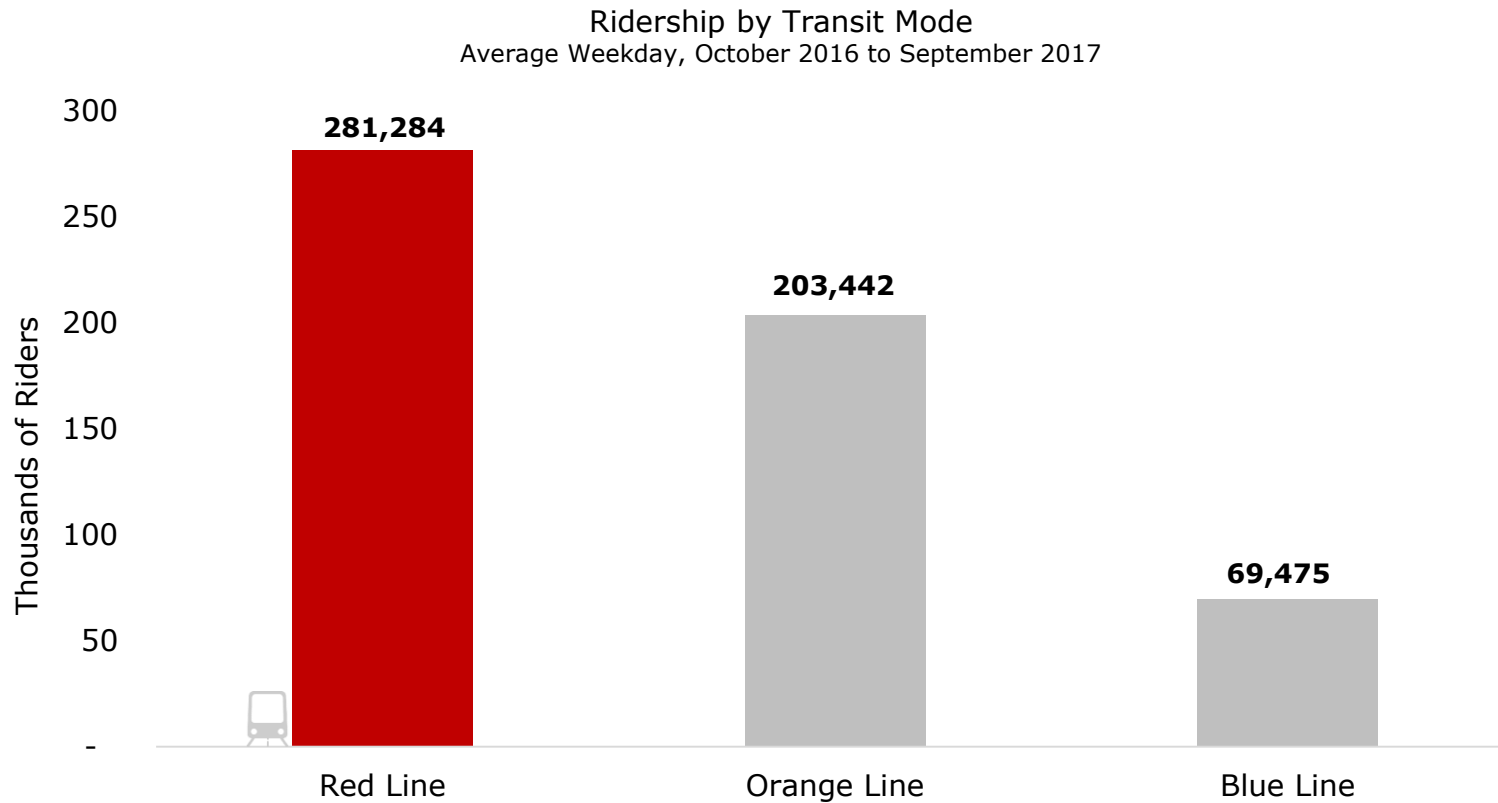
Cabot Maintenance Facility

<i>Facility Age</i>		45 Years	<i>Hoists</i>		4	<i>Lifts</i>		4	<i>Pits</i>		24
Interior	Shell	Substruct.	Electrical	Fire Prot.	HVAC	Plumbing	Convey.	Shop Equip.	Maint. Bays	Site	
3.0	2.5	2.7	2.5	3.5	2.8	2.0	3.0	3.2	2.5	3.0	

- Overhead cranes and doors are unreliable
- The facility heating and electrical systems in poor condition and unreliable
- Significant upgrades are currently underway



Heavy Rail Ridership – Red Line

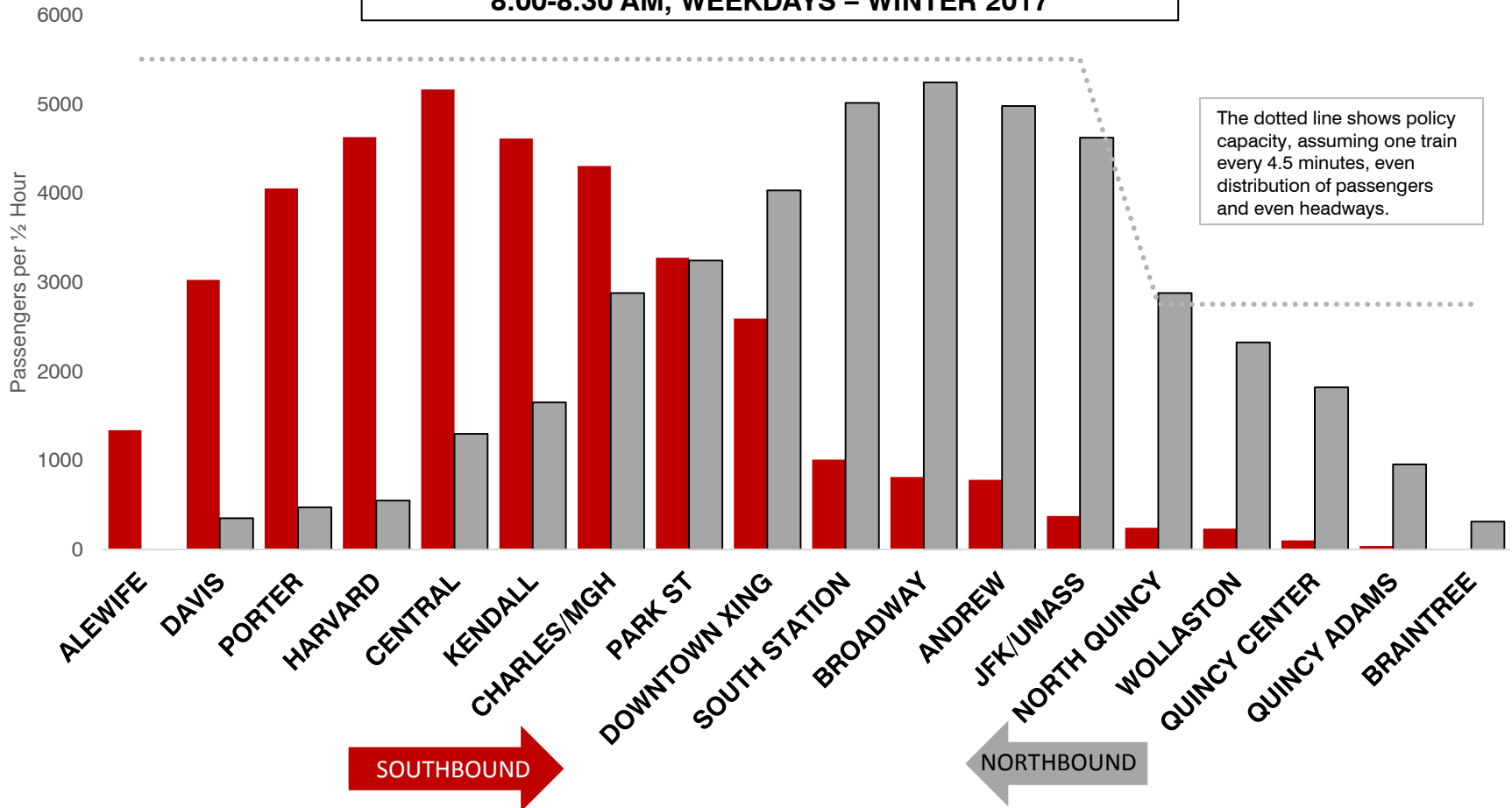


Source: MBTA Back on Track Data



Heavy Rail Peak Capacity and Demand – Red Line

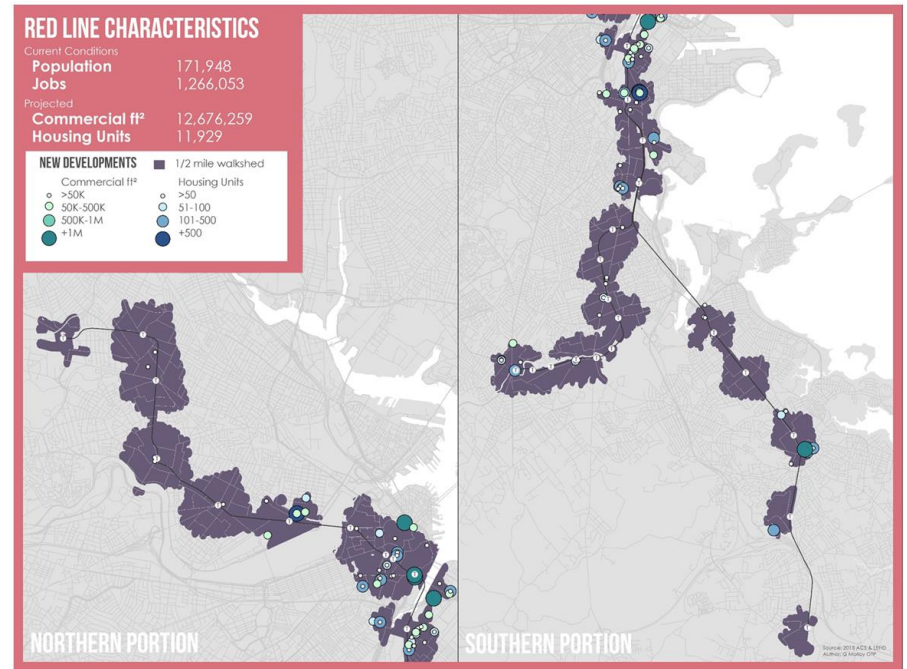
RED LINE PASSENGER FLOW & POLICY CAPACITY
8:00-8:30 AM, WEEKDAYS – WINTER 2017





Red Line Future Capacity

- Existing operations at 4.5 minute headway
- Currently operating at or above capacity
- Delivery of new cars and infrastructure investments provides the opportunity for:
 - 3 minute headway
 - 13 – 20 trainsets per hour (peak)
 - 50% capacity increase





Red Line Fleet and Facility Investment Plan

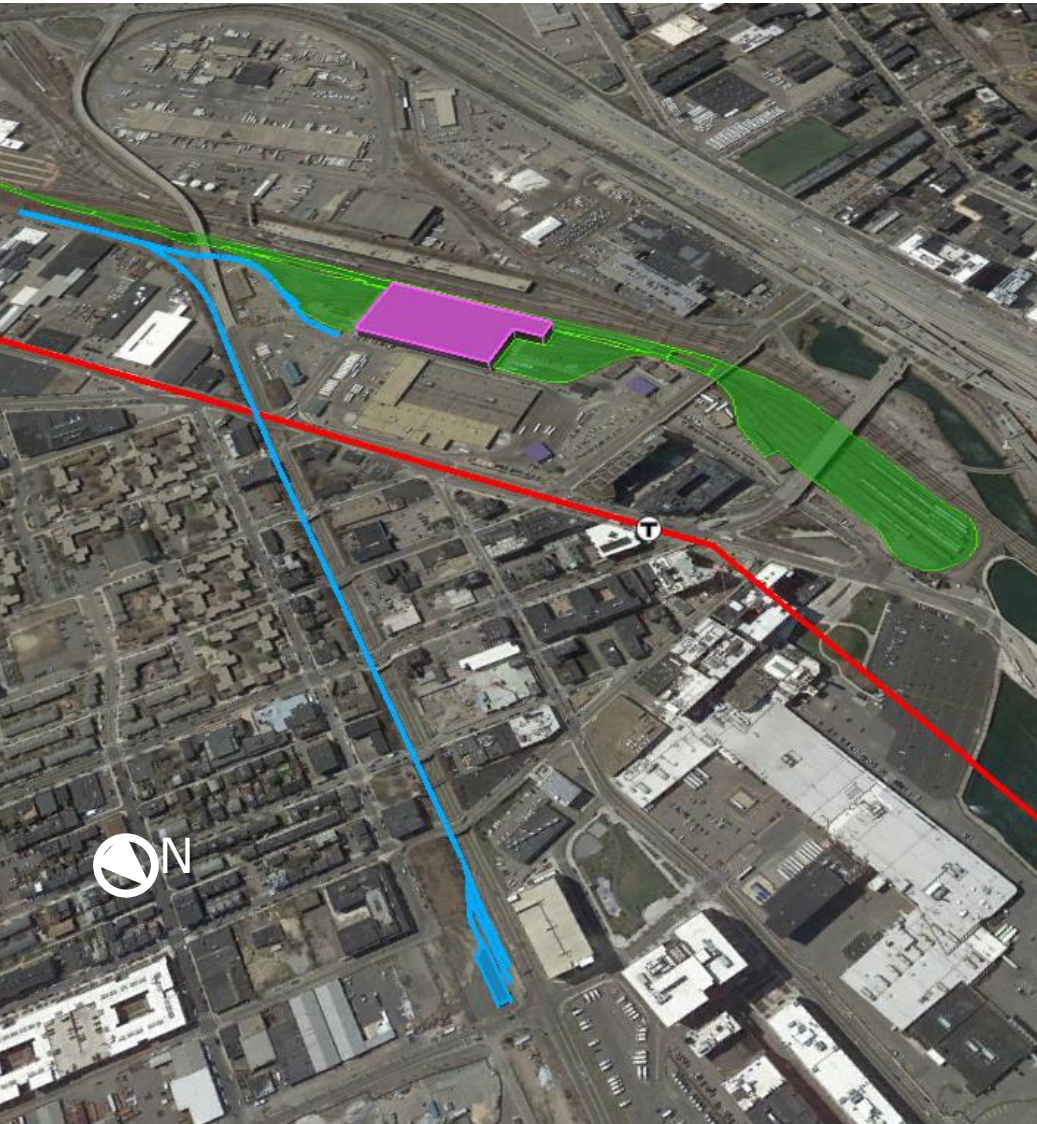
- Delivery of Pilot cars March 2019
- Maintenance facility investment program 2019 – 2022
- Development of RCM program Underway
- Delivery of 252 new cars 2019 – 2023
- Reliability Centered Maintenance Program 2020 – 2032
- Light Overhaul of Red Line cars 2031+



Draft



Red Line Infrastructure Investment Programs



Red Line Test Track ■

Scope: Construct a 2,500' Test Track to support the testing of the new Red Line vehicles. Work includes new track, traction power and a Vehicle Testing Facility.

Current Status:
Construction NTP – December, 2017
Substantial Completion – March, 2019

Cabot Maintenance Facility ■

Scope: Modernize the existing maintenance facility. Work includes a new electronics room, carwash, MEP systems, lighting, doors, windows, and specialty equipment.

Current Status:
Advertisement – January, 2018
Construction NTP – April, 2018
Substantial Completion – December, 2021

Cabot Yard Rebuild ■

Scope: Full yard rebuild; including track, traction power and signal upgrades.

Current Status:
Advertisement - January, 2018
Construction NTP - April, 2018
Substantial Completion – May 2022



IFFP Red Line Investment Impact

252 New Cars

\$1,010M
(CIP funded, Red/Orange)

- Increase passenger capacity
- Improve headways
- Increase fleet reliability
- Improve customer experience

Maintenance Facility Modernization

\$242M (CIP funded)

- Increase fleet reliability
- Reduce maintenance costs
- Improve technical capabilities

Reliability Centered Maintenance Program

Scope under review

- Increase fleet reliability
- Reduce lifecycle costs
- Eliminate major fleet overhauls

Light Overhaul

\$232M
(Unfunded, Red/Orange)

- FY2031+
- Targeted major systems overhaul
- Increase fleet reliability
- Reduce lifecycle maintenance costs
- Maximize asset lifecycle



Key Takeaways

- Red and Orange Line fleet and facility assets are in need of significant investment, which are being addressed by programs currently underway
- Red and Orange Line programs will increase fleet size and help to address current capacity constraints and Focus40 projections
- Potential future growth on Blue Line based on Focus40 projections. Some capacity can be added using existing assets
- Blue Line RCM program has resulted in improved fleet reliability and will be used as a model for future vehicle programs
- Critical maintenance system updates at Wellington and Cabot will improve maintenance efficiency and capacity to support new fleets



Upcoming Presentations *(Update)*

- Bus – December 4th
- Commuter Rail, Ferry, and Paratransit – December 11th
- Light Rail (Green Line and Mattapan) – December 18th