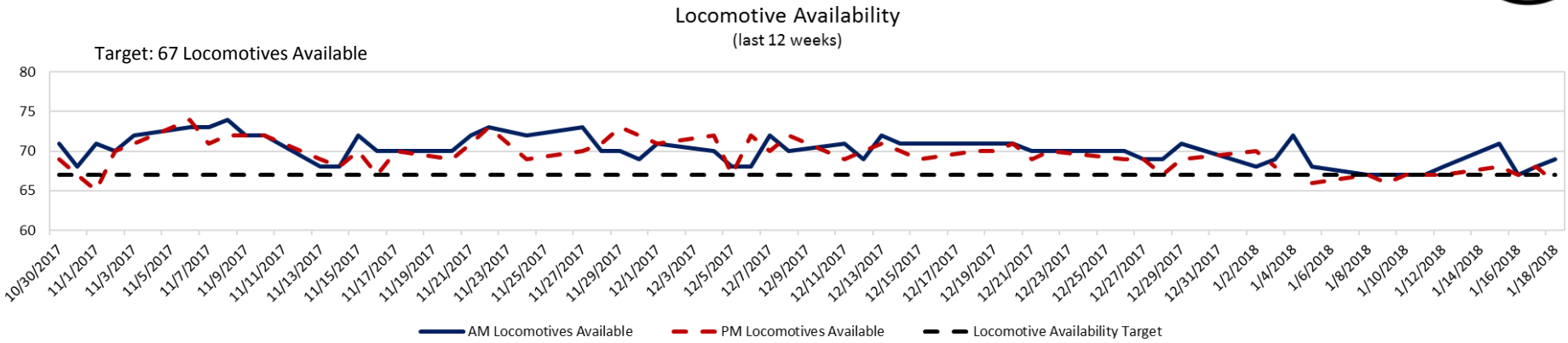
FMCB Commuter Rail Update

January 29, 2018

Contract Management

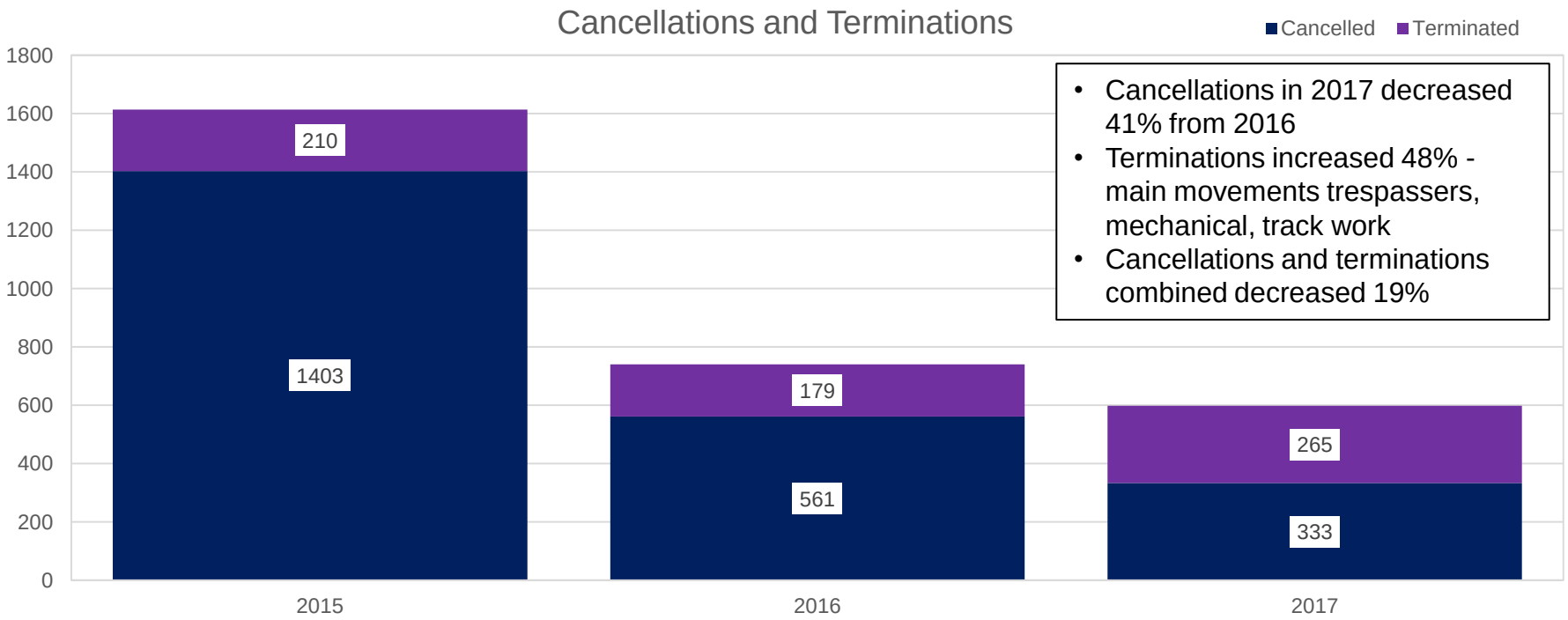
- MBTA senior leadership met with the CEO of Keolis' International division, the Director of Keolis North America, and the Keolis GM to address winter performance, discuss lessons learned, and set expectations going forward.
- Keolis established the Joint Incident Command Center (ICC), a centralized rapid response team modeled after the T's Emergency Operations Center (EOC).
- Keolis is ramping up efforts to fill key personnel vacancies deemed critical to commuter rail operations.
- MBTA and Keolis are expanding the successful line-by-line approach to other lines, applying best practices and lessons learned from Worcester and Haverhill.

Equipment Availability



Cancellations and Terminations

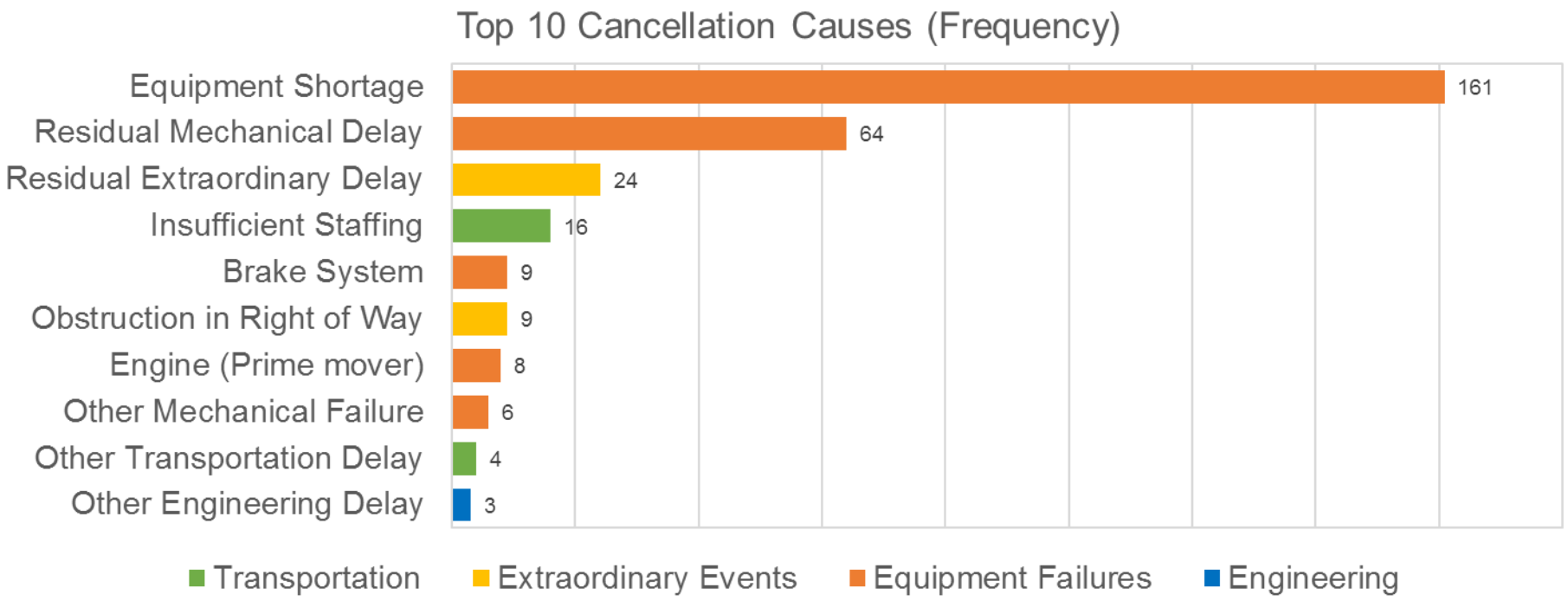
2017 had 142 fewer cancellations and terminations than 2016, a 19% reduction



*__cancellation__ = train never started its trip; __termination__ = train started but did not complete its trip

Causes of Train Cancellations – 2017 year in review

Cancellations are typically caused by mechanical failures



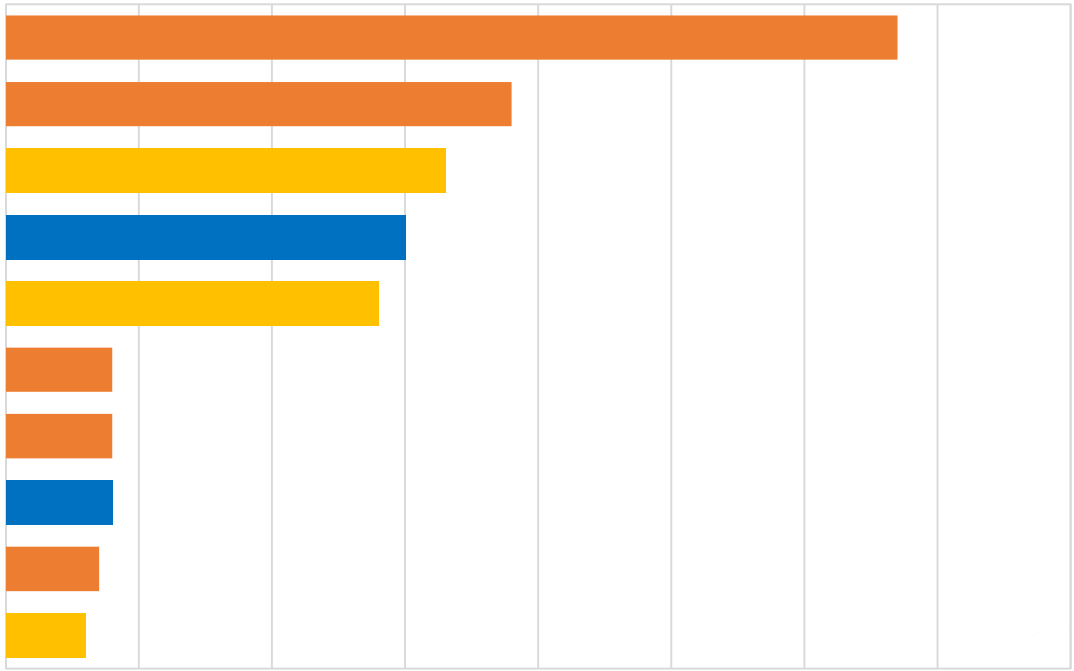
Cancellations Due to Equipment Shortages

2017 Month	Cancellations due to Equipment Shortages
Jan	2
Feb	9
Mar	53
Apr	46
May	1
Jun	13
Jul	14
Aug	5
Sep	6
Oct	8
Nov	2
Dec	2
Total	**161**

Causes of Train Terminations – 2017 year in review

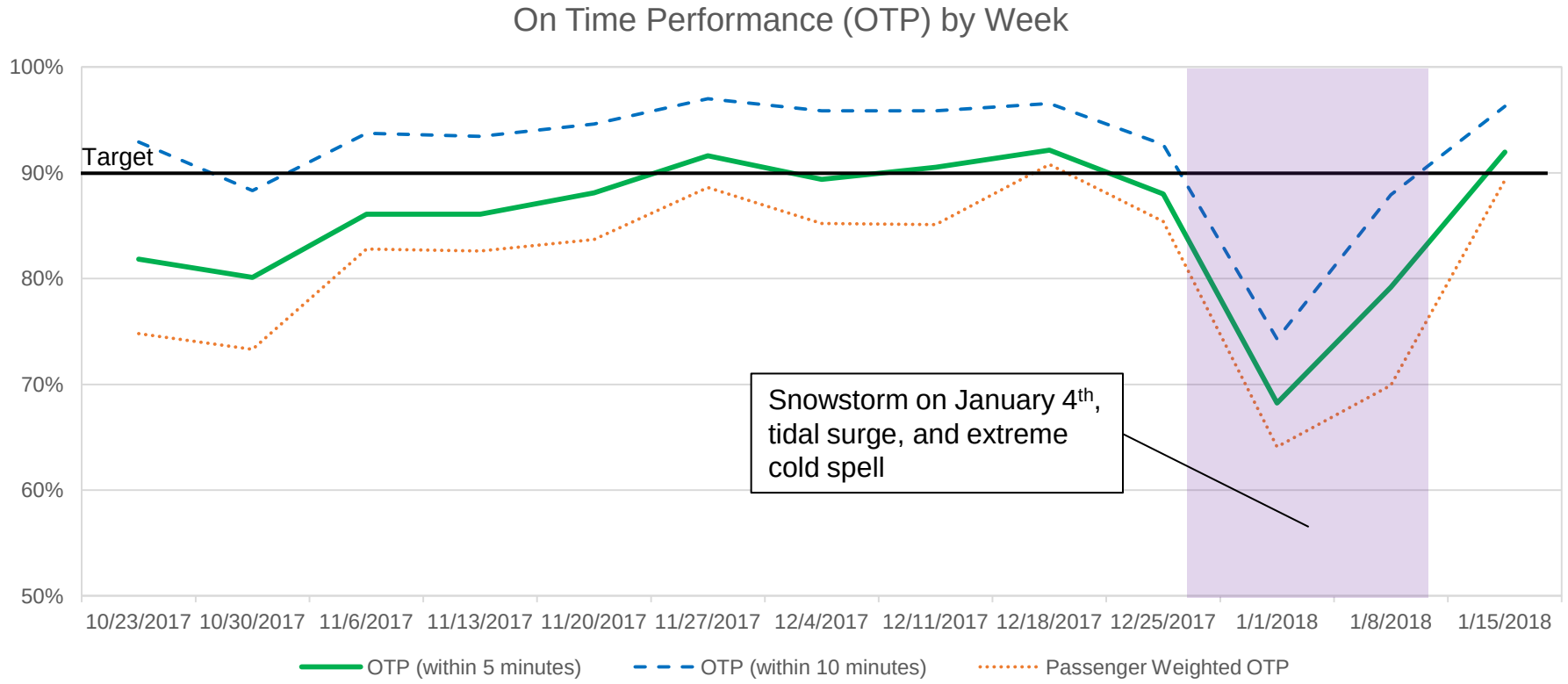
Terminations are typically caused by mechanical failures

	2016	2017
Engine (Prime mover)	39	67
Residual Mechanical Delay	31	38
Trespasser On Tracks	8	33
Track Out of Service	20	30
Residual Extraordinary Delay	11	28
Traction Motor	4	8
HEP	5	8
Other Engineering Delay	2	8
Brake System	4	7
Obstruction in Right of Way	8	6

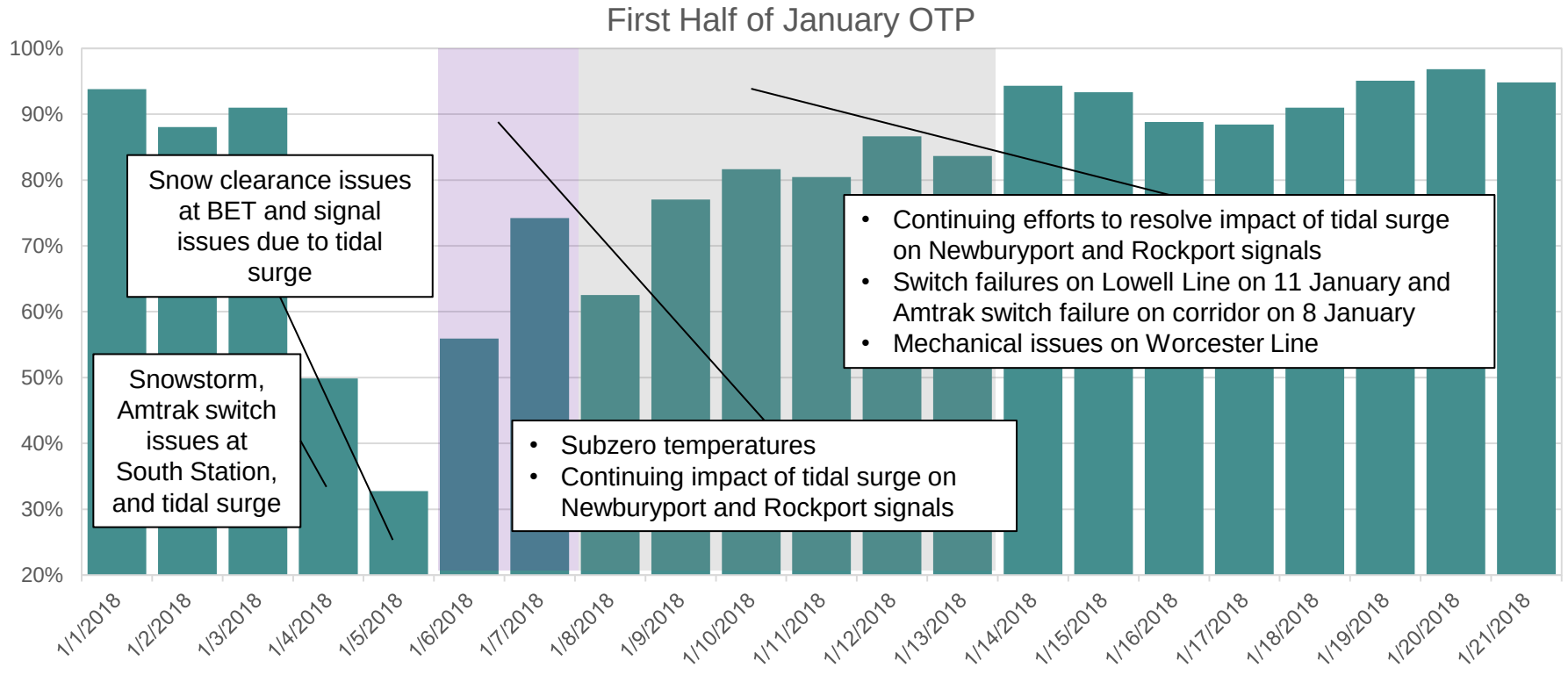


On Time Performance (OTP)

On Time Performance



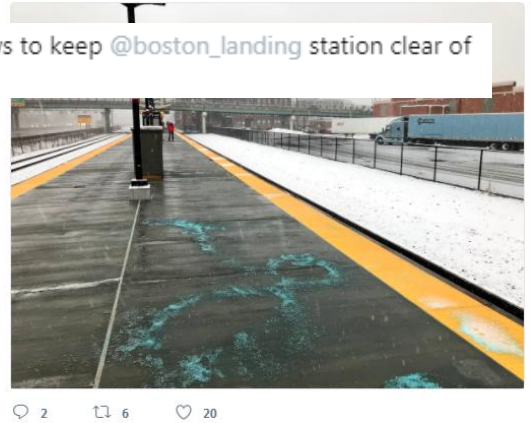
Performance During Extreme Cold & Winter Storms



Winter Resiliency Lessons Learned

What Worked

- Equipment prepared and ready
- Snow storm plan is robust and will be updated for storm surges
- Maintained strong mechanical availability during and after weather events
- Additional contract labor available for snow clearance
- Snow clearance at stations very good



What Didn't Work

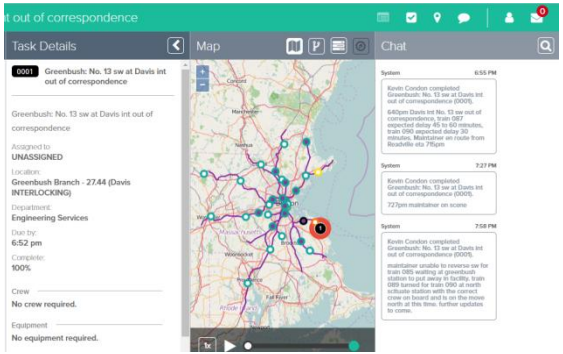
- Switch clearance at BET overnight on January 4th was delayed, causing poor Northside startup day after storm. **Solution: created clearer accountability, some org changes, better defined timelines, and improved escalation procedures. Upgrades planned to switches and heaters**
- Overnight communication and coordination less effective than daytime activity. **Solution: completely overhauled command center setup—established joint MBTA-KCS ICC allowing for rapid coordination and quick clearing of actions**
- Amtrak switch issues caused disruption at South station on afternoon of storm

Joint Incident Command Centre (ICC)

Improved Collaboration and Effectiveness of Incident Command Center

⊙ New protocol established for joint ICC:

- MBTA and Keolis co-located in one ICC
- Incident Manager web-based & app-based tool fully deployed to ensure single point of truth and live information flow from the field
- In-person continuous representation from all key departments & senior management from MBTA & Keolis
- Improved collaboration, response times, communication, solution development and effectiveness



OTP Within 5 Minutes

	2016 Average	1-2017	2-2017	3-2017	4-2017	5-2017	6-2017	7-2017	8-2017	9-2017	10-2017	11-2017	12-2017	2017 Average
Fairmount	**95.6%**	97.8%	97.2%	96.4%	97.6%	95.8%	97.3%	98.3%	97.3%	97.5%	98.0%	96.6%	97.6%	**97.3%**
Fitchburg	**85.8%**	88.3%	75.0%	80.9%	88.1%	91.1%	85.7%	88.9%	89.7%	91.3%	79.8%	70.8%	82.8%	**84.6%**
Franklin	**85.0%**	91.2%	84.9%	89.0%	88.7%	91.0%	88.7%	88.2%	86.6%	88.6%	82.5%	85.4%	86.0%	**87.7%**
Greenbush	**96.9%**	97.1%	97.7%	94.8%	93.9%	94.6%	95.0%	97.4%	95.3%	95.6%	85.3%	95.2%	96.1%	**94.7%**
Haverhill	**86.7%**	89.2%	80.4%	85.1%	91.9%	90.4%	80.6%	79.0%	88.8%	81.3%	74.7%	78.3%	89.8%	**84.1%**
Kingston/Plymouth	**96.3%**	95.6%	95.5%	91.7%	95.0%	94.0%	92.4%	94.7%	95.1%	95.3%	84.2%	91.8%	94.9%	**93.3%**
Lowell	**93.3%**	92.7%	86.5%	90.2%	94.6%	96.8%	94.8%	95.2%	94.5%	89.1%	88.2%	85.7%	90.1%	**91.6%**
Middleboro	**94.1%**	93.4%	94.7%	92.6%	90.2%	93.0%	88.7%	92.4%	91.2%	90.8%	83.2%	88.9%	93.0%	**90.9%**
Needham	**91.4%**	90.6%	83.4%	92.6%	92.7%	94.7%	91.6%	94.1%	92.3%	92.0%	90.0%	91.0%	89.0%	**91.4%**
Newburyport	**90.9%**	89.5%	81.0%	85.0%	90.5%	94.1%	87.1%	92.5%	87.5%	89.1%	88.5%	89.3%	88.1%	**88.6%**
Providence	**86.9%**	88.7%	80.0%	87.8%	92.2%	89.6%	86.4%	89.0%	89.3%	89.2%	86.6%	87.7%	89.2%	**88.0%**
Rockport	**92.5%**	90.0%	83.4%	87.7%	91.4%	94.1%	89.1%	92.6%	89.1%	83.6%	86.6%	88.5%	86.5%	**88.6%**
Stoughton	**87.0%**	84.6%	78.4%	87.1%	87.6%	87.8%	87.1%	91.0%	89.1%	89.8%	84.8%	85.9%	84.5%	**86.7%**
Worcester	**77.1%**	84.6%	82.8%	81.3%	74.5%	79.3%	69.1%	80.2%	82.5%	74.5%	79.4%	89.5%	93.2%	**81.0%**
Grand Total	**89.3%**	**90.8%**	**85.4%**	**88.3%**	**90.3%**	**91.5%**	**87.4%**	**90.3%**	**90.2%**	**88.4%**	**85.1%**	**87.2%**	**89.9%**	**88.8%**

Below 85% | 85% - 90% | Over 90%

OTP Within 10 Minutes

	2016 Average	1-2017	2-2017	3-2017	4-2017	5-2017	6-2017	7-2017	8-2017	9-2017	10-2017	11-2017	12-2017	2017 Average
Fairmount	**97.6%**	99.1%	98.7%	98.2%	98.5%	98.2%	98.6%	98.9%	98.2%	99.0%	98.8%	98.6%	99.3%	**98.7%**
Fitchburg	**92.7%**	95.1%	85.6%	90.4%	94.3%	96.9%	93.2%	94.3%	94.3%	96.4%	90.6%	85.7%	91.9%	**92.5%**
Franklin	**93.2%**	96.6%	92.2%	96.1%	92.9%	96.2%	96.2%	93.9%	94.0%	95.5%	91.4%	92.4%	94.8%	**94.4%**
Greenbush	**98.0%**	98.3%	99.0%	97.8%	97.2%	97.5%	97.1%	98.9%	97.6%	98.1%	95.4%	97.5%	97.6%	**97.7%**
Haverhill	**93.5%**	94.8%	88.9%	92.1%	95.8%	96.0%	90.4%	90.4%	95.7%	90.0%	87.1%	88.4%	92.7%	**92.0%**
Kingston/Plymouth	**97.8%**	97.9%	97.8%	95.8%	97.2%	97.6%	96.2%	97.4%	97.9%	98.8%	95.4%	96.5%	98.8%	**97.3%**
Lowell	**97.3%**	96.8%	96.8%	97.0%	97.6%	99.0%	97.4%	98.7%	98.7%	97.5%	95.3%	95.4%	95.4%	**97.1%**
Middleboro	**97.2%**	96.4%	96.7%	95.5%	94.4%	96.9%	95.0%	97.6%	96.8%	95.0%	96.3%	96.0%	95.4%	**96.0%**
Needham	**96.6%**	97.6%	92.0%	98.5%	97.9%	98.2%	95.9%	97.2%	95.9%	96.6%	96.4%	94.6%	96.8%	**96.5%**
Newburyport	**95.9%**	96.0%	91.6%	91.1%	95.1%	98.2%	93.6%	96.5%	95.5%	95.0%	95.0%	96.3%	96.2%	**95.0%**
Providence	**93.4%**	94.5%	86.8%	93.2%	95.1%	94.0%	92.6%	94.0%	93.8%	95.1%	93.4%	94.5%	93.7%	**93.4%**
Rockport	**97.1%**	95.8%	92.1%	92.5%	96.0%	97.2%	94.6%	96.6%	95.7%	92.4%	92.6%	94.4%	94.3%	**94.5%**
Stoughton	**94.9%**	93.3%	88.6%	93.2%	95.2%	94.8%	94.4%	96.0%	95.8%	95.3%	92.9%	95.9%	94.3%	**94.2%**
Worcester	**88.7%**	93.7%	92.3%	90.2%	89.2%	88.1%	84.4%	90.4%	91.3%	87.7%	90.7%	95.3%	97.3%	**90.8%**
Railway Average	**95.0%**	**96.1%**	**92.7%**	**94.2%**	**95.3%**	**96.1%**	**93.9%**	**95.4%**	**95.6%**	**94.9%**	**93.5%**	**94.3%**	**95.5%**	**94.8%**

Below 85% | 85% - 90% | Over 90%

Boosting On Time Performance (OTP)

- Data Analysis – Commuter Rail Delay Matrix (See appendix)

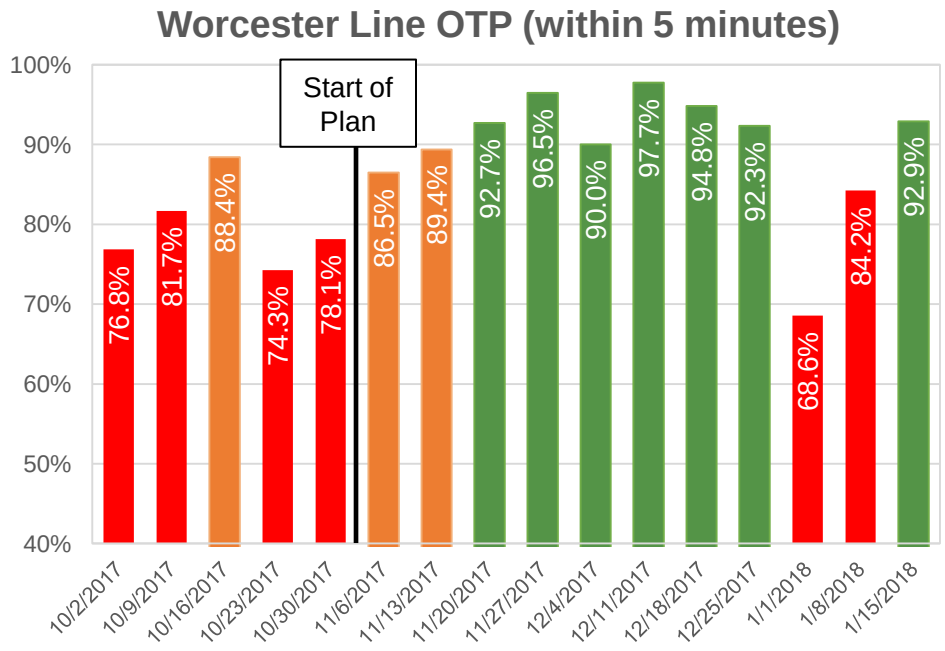
- Line-by-Line Plan
  - Worcester Line (implemented end of October 2017)
  - Haverhill Line (implemented end of November 2017)

Worcester Line Plan

Initiated October 23, 2017

Worcester Line Plan – Update

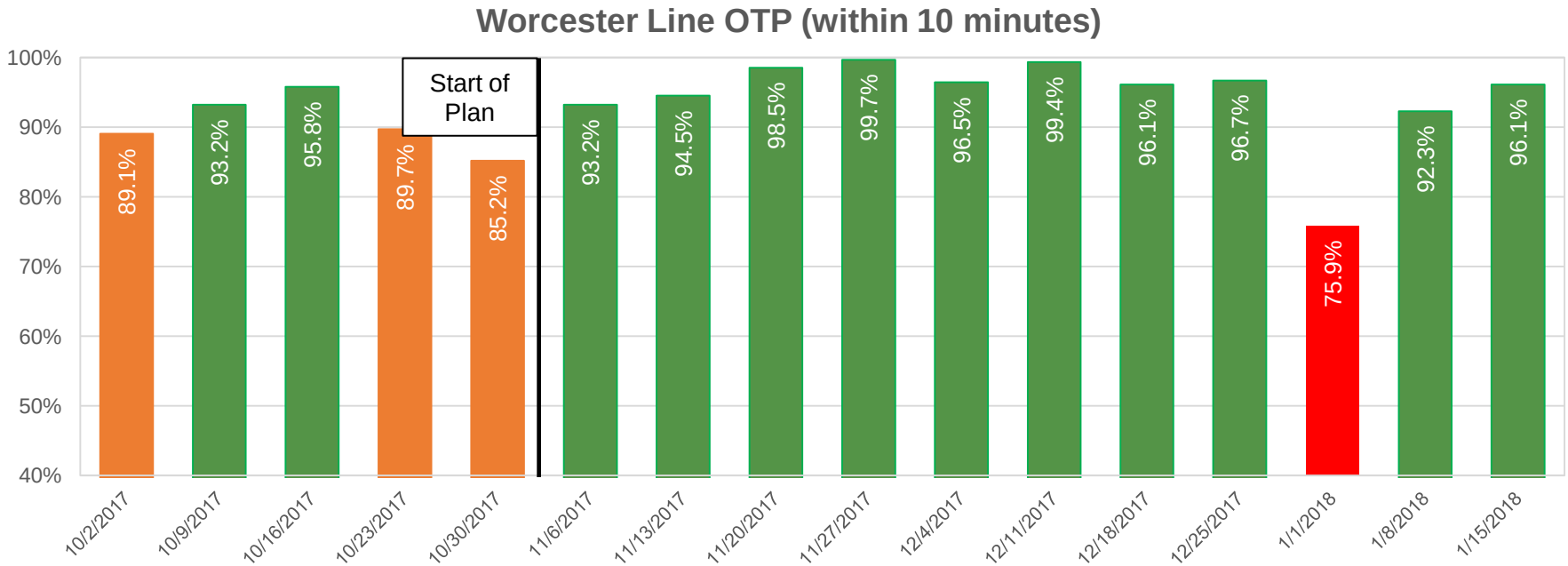
Line performance has bounced back after weather events



- Regular metrics review and sustainability meetings are ensuring that focus remains on key areas
- Since January 4 storm, have delivered:
  - Two 100% weekdays
  - Seven 100% AM peaks
  - Four 100% PM peaks
- Worcester Line ranked 5th during week after storm

Worcester Line Plan – Update

Line performance has bounced back after weather events



Worcester Line: Results

December Weekday Performance

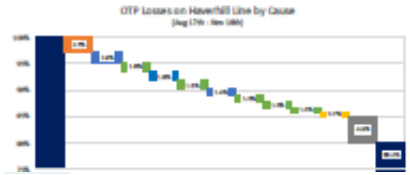
- 6% of December weekday delay events occurred on the Worcester Main Line. (down from 14% in October & 7% in November)
- 0 cancellations/terminations
- 83 delay events (down from 325 in October and 145 in November). 68 of these were of 5 minutes or more (down from 111 in November).
- 5 delay events (61 in October, 21 in November) and 53 minutes (292 in October, 129 in November) were caused by Heavy Ridership - 2 in peak
- There were 3 delays attributed to Insufficient Staffing – all on train 520.
- 69 non-residual delays were categorized as 24 Engineering, 10 Mechanical, 14 Transportation, and 21 related to unanticipated passenger accommodations or extraordinary events.

Haverhill Line Plan

Initiated November 27, 2017

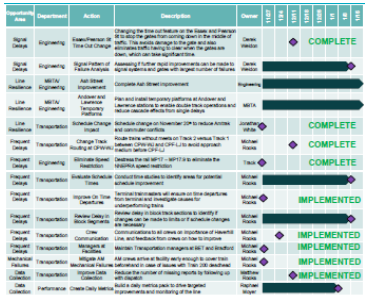
Haverhill Line Plan

Prioritizing actions to improve line performance within infrastructure constraints



Data analysis to identify biggest improvement opportunities

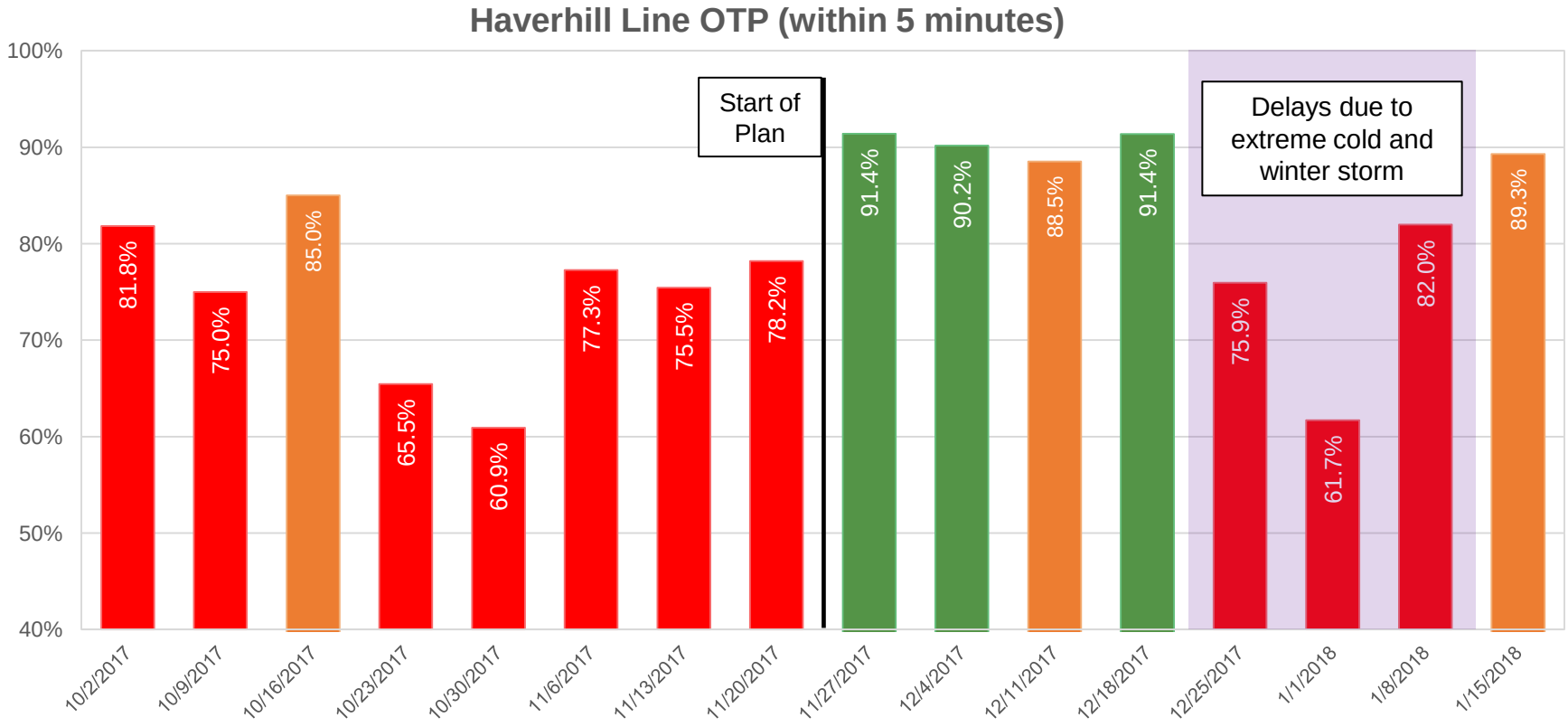
Targeted studies by experienced managers on key trains and platforms



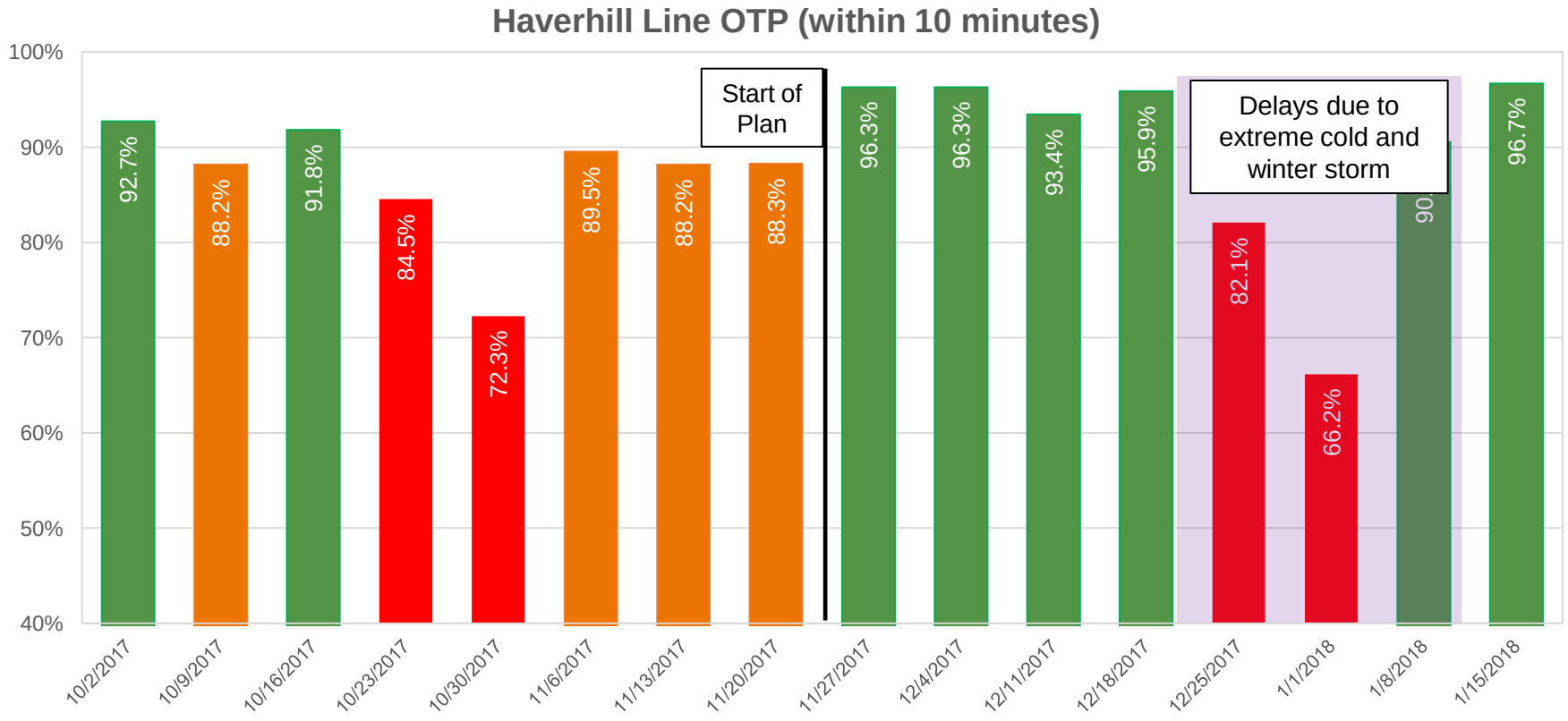
Single action list targeted against biggest priorities

- Selected completed actions
  - Improvements to Essex and Pearson St gate controls to reduce failures
  - Change in track routing to improve track speed
  - Destressing of rail to remove speed restriction
  - Additional staffing to improve resilience of morning trains from Bradford facility
  - Transportation managers stationed at BET and Bradford facility at key times to improve service
  - Development of daily metrics to improve visibility of line performance
- Further actions underway
  - Review of signal system and gate failures to identify potential improvements
  - Investigation of options for speed increases on line
  - Exploration of options to reduce infrastructure limitations on line

Haverhill Line Plan Initial Results



Haverhill Line Plan Initial Results



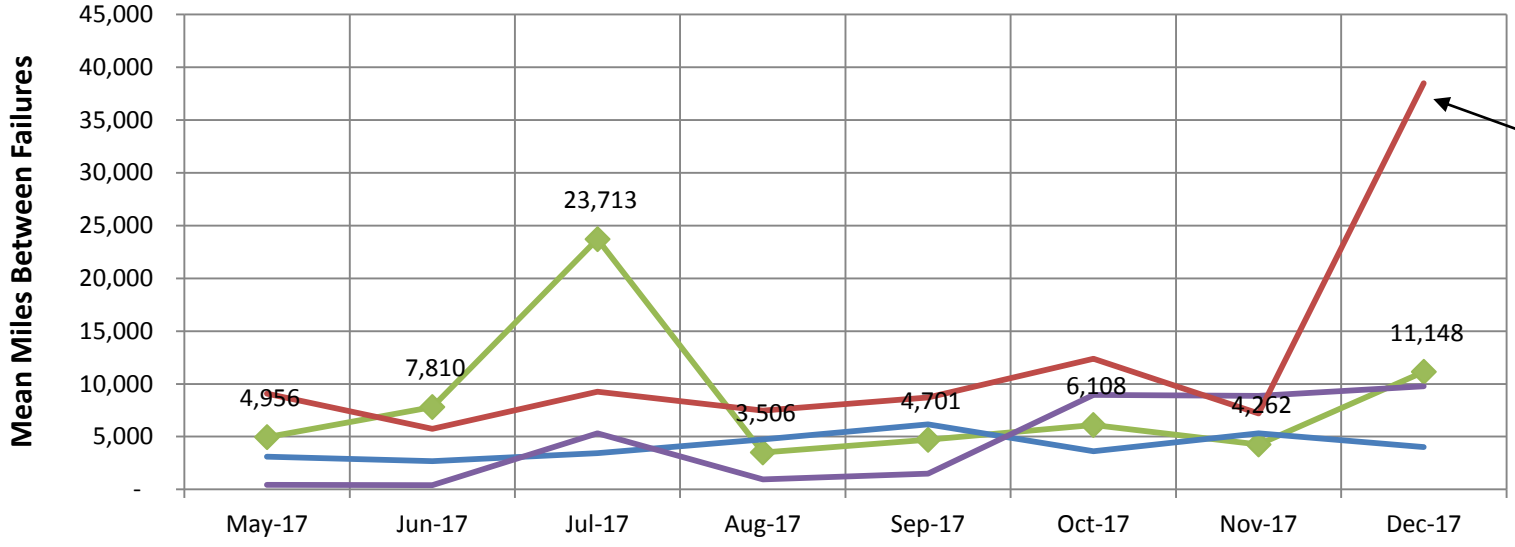
Haverhill Line: Results

December Weekday Performance

- 163 December weekday delay events occurred on the Haverhill Line – down from 374 in October & 333 in November.
- 49 delays were logged as residual, down from 88 in November
- 5 trains were terminated, 1 cancelled, and 4 originated enroute (compared to 4, 0, and 4 in November, respectively)
- 128 delays were 5 minutes or more (212 in November)
- 70 delays were 10 minutes or more (87 in November)
- 20 delays were over 30 minutes - including 10 related to switch failures (6 on 12/29). There were 7 delays over 30 minutes in November
- 10 Delays for late Amtrak trains (Downeaster), down from 16 in November

Locomotive Performance

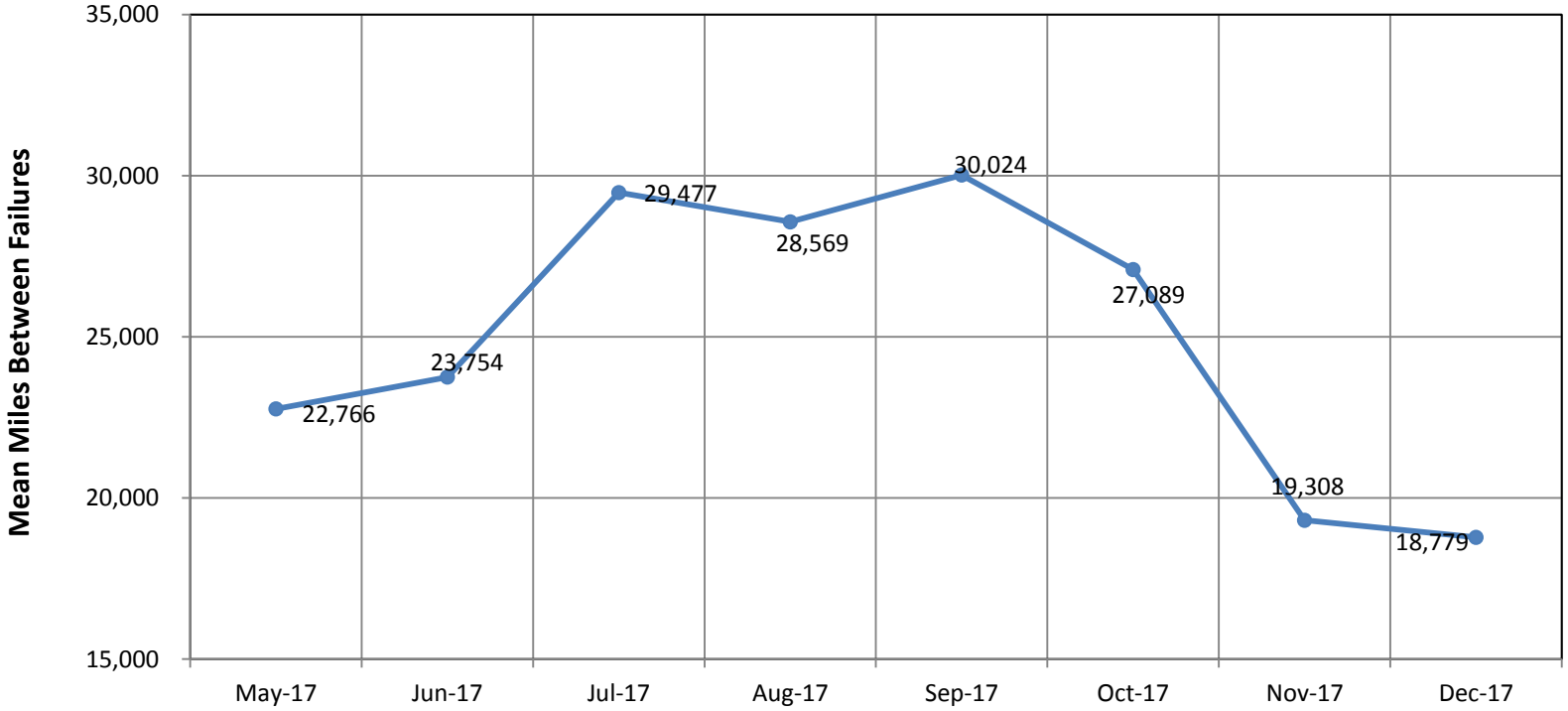
Legacy Locomotive Fleet Performance



	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
UTEX	4,956	7,810	23,713	3,506	4,701	6,108	4,262	11,148
GP40MC	3,105	2,676	3,425	4,757	6,167	3,611	5,318	4,022
MP36-3C	430	420	5,313	948	1,492	8,970	8,875	9,789
F40's	9,067	5,747	9,253	7,465	8,699	12,375	7,196	38,491

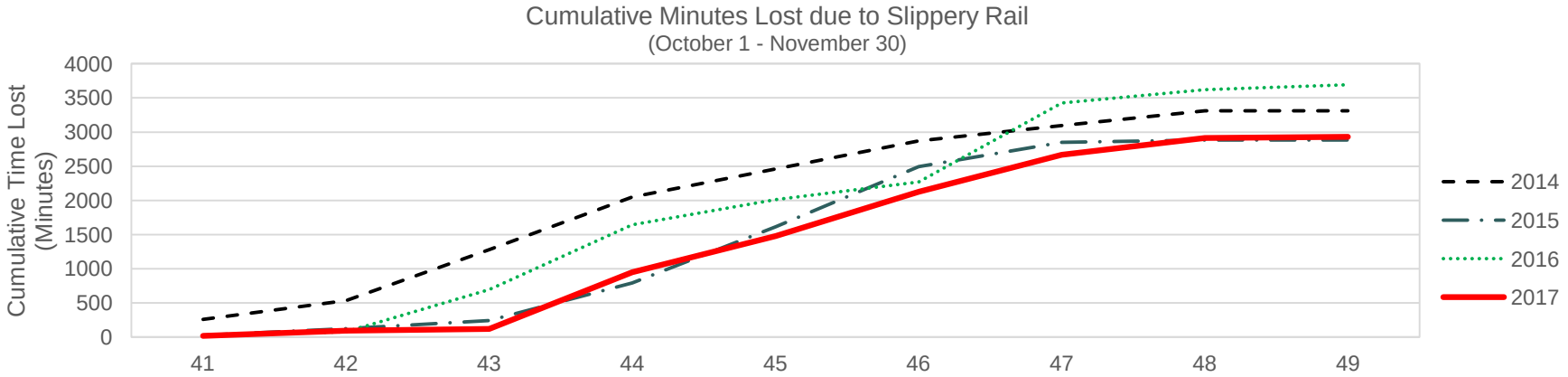
Note:
Of the 37 F40s, 16 of the worst performers are out for overhaul work.

HSP-46 (MPI) Locomotive Fleet Performance



2017 year end round-up

- OTP over the year at 88.8% compared to 10 year average of 86.9%
- Lowest level of train cancellations in the last 3 years delivered in 2017
- Worcester line performance improvement program successfully deployed
- Successful Slippery Rail season improvement plan implemented



Appendix

Commuter Rail Delay Matrix – November and December 2017

Commuter Rail Delay Matrix – November 2017

Noteworthy Causes of Delay – Transportation Operations and Other

Weather	**Slippery Rail** 66 of these events (approximately 1/3) were on the Fitchburg Line. Another 25% were on the Haverhill and Franklin Lines. This is similar in quantity and duration to November 2016.	Events:	204(10%)
		Total Minutes:	1,505(10%)
		Average Delay:	7.4minutes
		Longest Delay:	38minutes
Transpor-tation	**Other Transportation Delay** 15 (19%) list door and trap procedure - typically 4-6 minutes per delay. 11 of these were on train 217, the 5:35 departure from North Station to Haverhill, one after 11/20 new crew schedule.	Events:	80(4%)
		Total Minutes:	483(3%)
		Average Delay:	6.0minutes
		Longest Delay:	20minutes
Operational Conflicts	**Amtrak, Commuter, Freight & Terminal Congestion** 58% due to conflicts with other commuter rail trains, split almost evenly between "Commuter Conflicts" and "Terminal Congestion". 36% due to conflicts with Amtrak, and 6% due to freight conflicts.	Events:	179(9%)
		Total Minutes:	1,040(7%)
		Average Delay:	5.8minutes
		Longest Delay:	22minutes

Commuter Rail Delay Matrix – November 2017

Noteworthy Causes of Delay - Mechanical

Other Mechanical	**Other Mechanical Failure** 4 due to the air system - e.g. leaks or parted hoses 3 each due to fumes in cab (3 separate sets), no sand, & flat spots.	Events:	34(2%)
		Total Minutes:	417(3%)
		Average Delay:	12.3minutes
		Longest Delay:	61minutes
	Brake System 5 longest delays were 66, 54, 25, 24 and 19 minutes. Locomotive 1056 had three brake-related delays on three separate dates.	Events:	14(1%)
		Total Minutes:	248(2%)
		Average Delay:	17.7minutes
		Longest Delay:	66minutes
Locomotive	**Engine (Prime mover)** 32 (56%) of these events were on F40 locomotives 11 (19%) of these events on GP40s 10 (18 %) were on HSPs, (6 due to locked axle or wheel slide)	Events:	57(3%)
		Total Minutes:	787(5%)
		Average Delay:	13.8minutes
		Longest Delay:	90minutes
	HEP 17 (55%) on F40s - 9 events on loco 1062 over 6 days 7 (23%) on GP40s 5 (16%) on HSPs	Events:	31(2%)
		Total Minutes:	326(2%)
		Average Delay:	10.5minutes
		Longest Delay:	26minutes

Commuter Rail Delay Matrix – November 2017

Noteworthy Causes of Delay – Engineering

Signal System	**Signal System** Spread throughout the system & throughout the month. 8 delays were due to a lightning strike.	Events:	72 (4%)
		Total Minutes:	681 (4%)
		Average Delay:	9.5 minutes
		Longest Delay:	34 minutes
Infrastructure Maintenance	**Gate/Crossing Protection** 23 (37%) on Haverhill Line 17 (27%) on Fitchburg Line 7 (11%) on Stoughton Line	Events:	63 (3%)
		Total Minutes:	446 (3%)
		Average Delay:	7.1 minutes
		Longest Delay:	16 minutes
	Track Out of Service 28 (47%) on Lowell Line for GLX project. 16 (27%) on Fitchburg line for tie project & brush cutting.	Events:	59 (3%)
		Total Minutes:	399 (3%)
		Average Delay:	6.8 minutes
		Longest Delay:	14 minutes
	Speed Restriction (not pre-approved) 67 (78%) on Fitchburg Line, these restrictions spanned most of the month and were largely related to CPF-330.	Events:	86 (4%)
		Total Minutes:	363 (2%)
		Average Delay:	4.2 minutes
		Longest Delay:	10

Commuter Rail Delay Matrix – December 2017

Noteworthy Causes of Delay - Engineering

Infrastructure Maintenance	**Switch Failure** 66 (74%) on North Side Lines. 48 (54%) occurred at just 13 North Side switches, plus 4 more (4%) "enroute" on Haverhill Line 9 (10%) at Tower A alone - affects all North Side Trains	Events: Total Minutes: Average Delay: Longest Delay:	89 (6%) 1,621 (12%) 18.2 minutes 69 minutes
Signal System	**Signal System** 57 (73%) on Newburyport/Rockport Line 21 (27%) between Wonderland and Mcnall 12/12-12/13. 9 (12%) at Chelsea	Events: Total Minutes: Average Delay: Longest Delay:	78 (6%) 646 (5%) 8.3 minutes 31 minutes
	Signal Code Line Failure 22 (52%) Amtrak Responsibility 12 (29%) Pan Am or Other 3rd Party Responsibility 8 (19%) Keolis responsibility	Events: Total Minutes: Average Delay: Longest Delay:	42 (3%) 570 (4%) 13.6 minutes 48 minutes

Commuter Rail Delay Matrix – December 2017

Noteworthy Causes of Delay – Transportation Operations and Other

Operational Conflicts	**Amtrak, Commuter, Freight & Terminal Congestion** 52% due to conflicts with other commuter rail trains, split evenly between "Commuter Conflicts" and "Terminal Congestion". 37% due to conflicts with Amtrak, and 11% due to freight conflicts.	Events: Total Minutes: Average Delay: Longest Delay:	162 (11%) 889 (7%) 5.5 minutes 37 minutes
Transpor-tation	**Insufficient Staffing** 14 delay events on Franklin Line, 6 delay events on Needham Line. 12/4 Train 520: delayed 12 mins waiting for engineer in Worcester, then held 25 mins at Framingham for train 519 to recrew an engineer.	Events: Total Minutes: Average Delay: Longest Delay:	38 (3%) 264 (2%) 6.9 minutes 25 minutes

Commuter Rail Delay Matrix – December 2017

Noteworthy Causes of Delay – Mechanical

Other Mechanical	**Brake System**	Events:	30 (2%)
	12 (40%) occurred on 12/28 and 12/29 - high temperatures in teens.	Total Minutes:	548 (4%)
	11 (37%) on GP40s	Average Delay:	18.3 minutes
	Can't build air pressure, a frozen hand brake, and a parted air hose.	Longest Delay:	87 minutes
Locomotive	**Engine (Prime mover)**	Events:	32 (2%)
	12 (38%) on F40s - five on 1075 12/5 - 12/8, including blown piston	Total Minutes:	229 (2%)
	9 (28 %) on HSPs	Average Delay:	7.2 minutes
	9 (28%) on GP40s	Longest Delay:	31 minutes
	HEP	Events:	21 (1%)
	14 locos had delays due to HEP: 5 F40s, 8 GP40s, 1 HSPs.	Total Minutes:	188 (1%)
	Loco 1062 delayed 4 trains on 12/7, 3 of those caused residual delays.	Average Delay:	9.0 minutes
	1128 caused 3 delays on 12/4-12/5 (PC Hits & HEP)	Longest Delay:	40 minutes
Servicing	**Equipment Shortage**	Events:	23 (2%)
	Caused 23 delays over 20 regular service days in December. (more than 1 per regular weekday)	Total Minutes:	248 (2%)
		Average Delay:	10.8 minutes
	20 of 23 delays were on North Side Lines	Longest Delay:	35 minutes
	Jumpers, Cables & Hoses	Events:	5 (0%)
	All 5 delays due to parted hoses. On 12/29, train 743 caused extensive delay due to air hose issues, including a residual delay of 128 minutes which was 2nd longest delay of December – see page 2 for details.	Total Minutes:	80 (1%)
		Average Delay:	16.0 minutes
		Longest Delay:	34 minutes
Cab Electronics	**PC Hit**	Events:	17 (1%)
	13 (76%) on North Side, 8 (47%) on Newburyport/Rockport Line	Total Minutes:	132 (1%)
	9 (53%) on GP40s	Average Delay:	7.8 minutes
	5 (29%) on Locomotive 1128 - on 4 separate days 12/4-6 & 12/19.	Longest Delay:	21 minutes

KEOLIS