

FMCB Commuter Rail Update

December 18, 2017

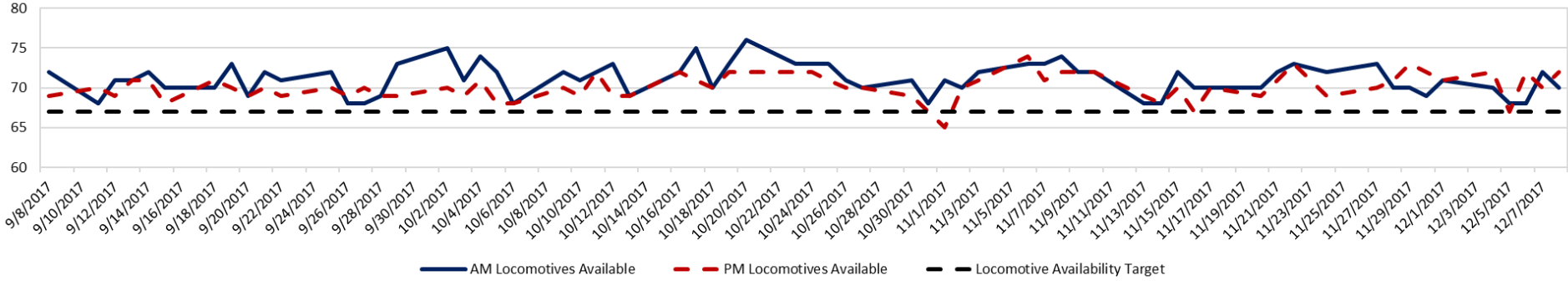




Equipment Availability: Generally stable over last 12 weeks

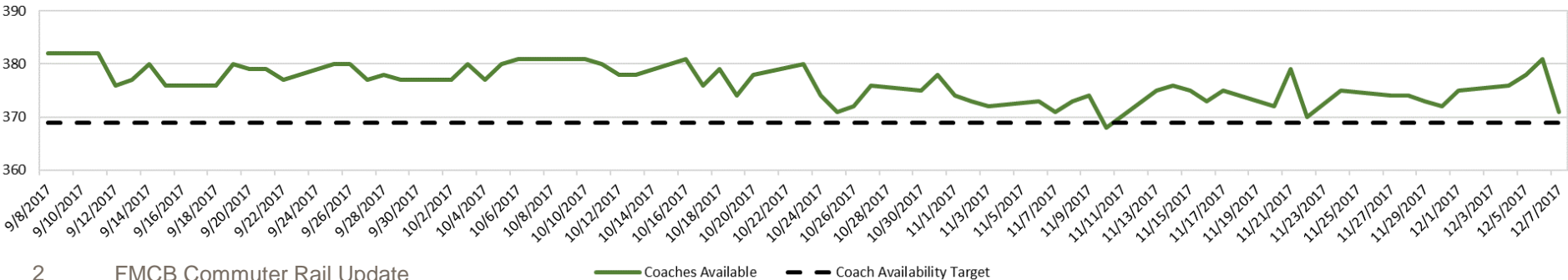
Target: 67 Locomotives Available

Locomotive Availability (last 12 weeks)



Target: 369 Coaches Available

Coach Availability (last 12 weeks)

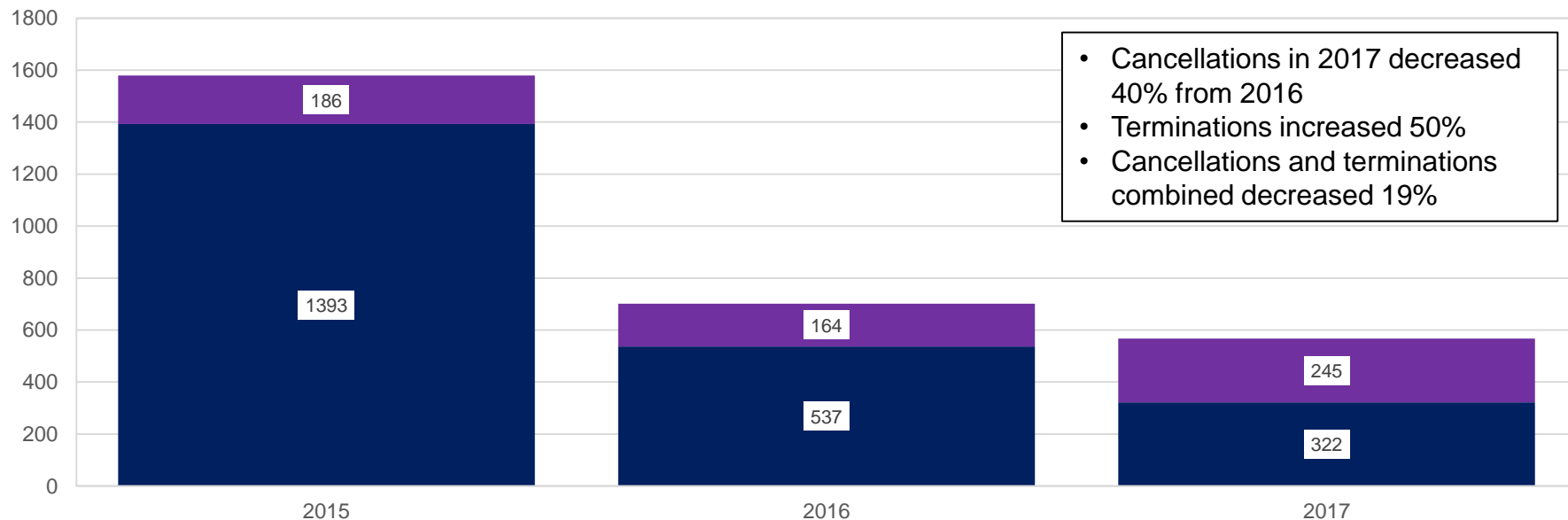




Cancellations and Terminations

2017 has had 134 fewer cancellations and terminations than 2016, a 19% reduction

Cancellations and Terminations* YTD
(through Week 48 in 2015, 2016, and 2017)



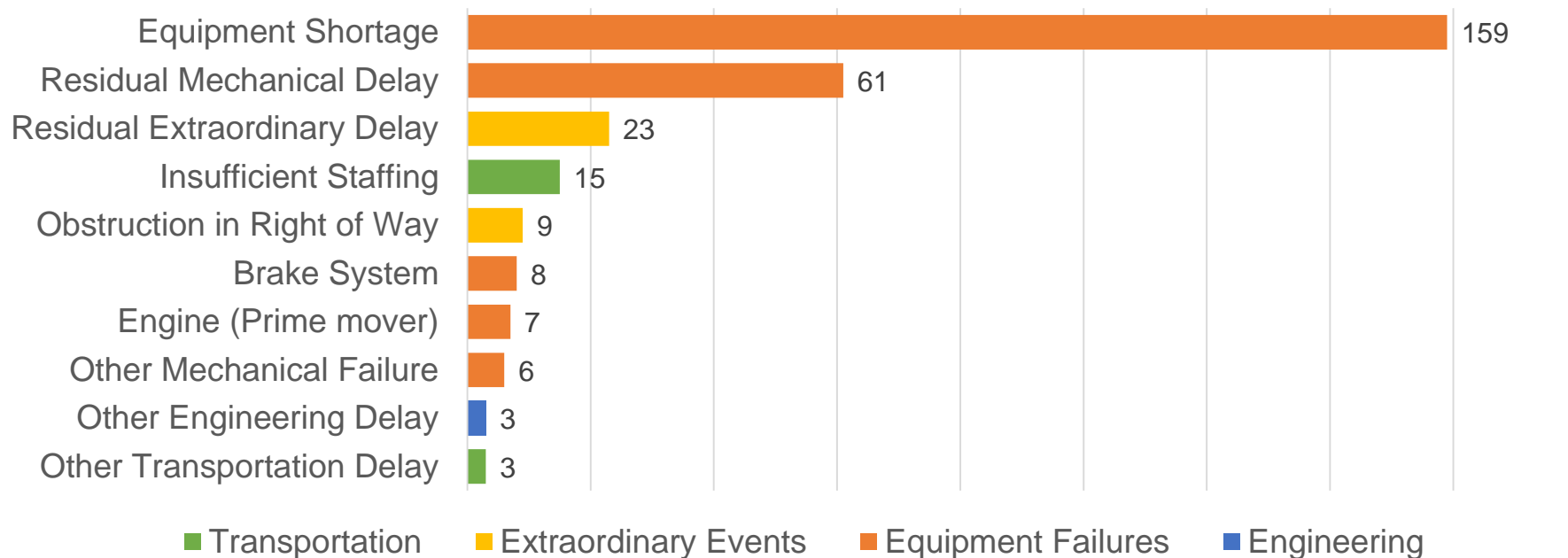
***cancellation** = train never started its trip; **termination** = train started but did not complete its trip



Causes of Train Cancellations – 2017 year to date

Cancellations are typically caused by mechanical failures

Top 10 Cancellation Causes (Frequency)





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 |
| Total | 159 |

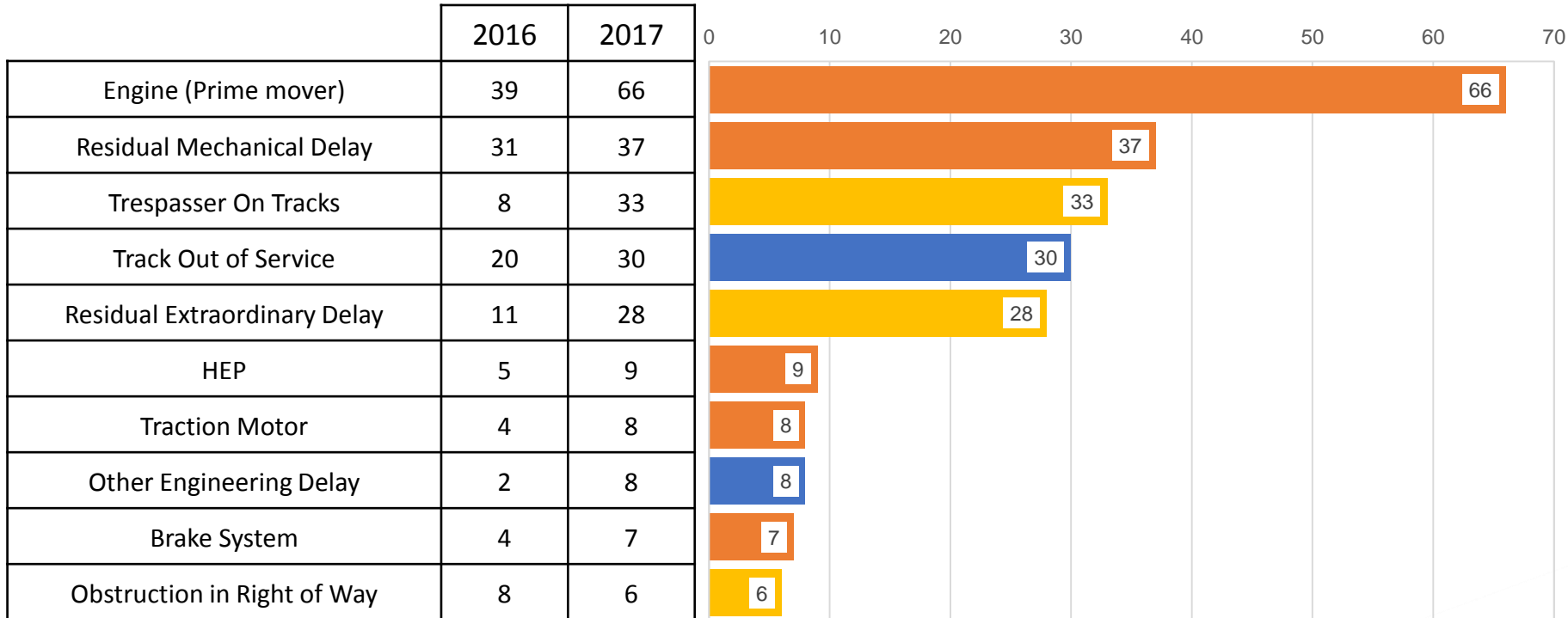


RRPictureArchives.NET Image Copyright Zach Pumphery



Causes of Terminations – 2016 and 2017 YTD

2016 and 2017 Termination Causes (Frequency)



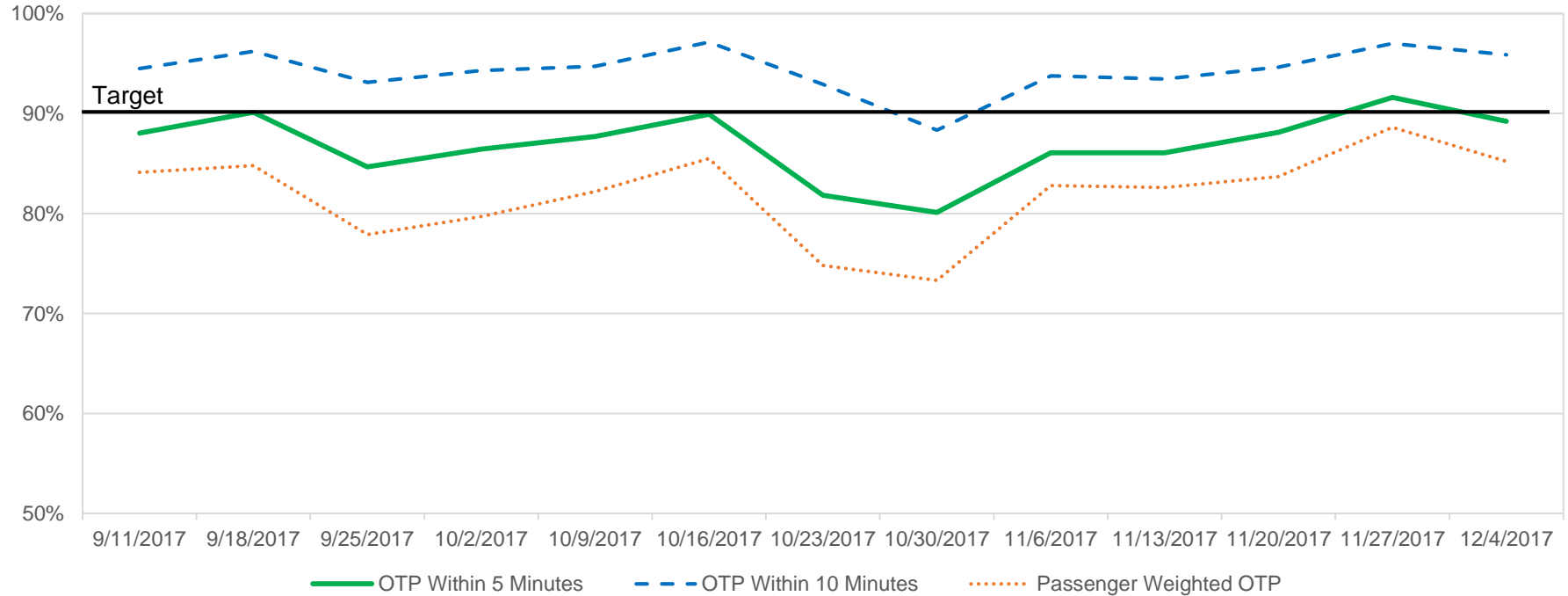
On Time Performance (OTP)



On Time Performance



On Time Performance (OTP) by Week





OTP Within 5 Minutes

| | 11-2016 | 12-2016 | 1-2017 | 2-2017 | 3-2017 | 4-2017 | 5-2017 | 6-2017 | 7-2017 | 8-2017 | 9-2017 | 10-2017 | 11-2017 | Total |
|--------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Fairmount | 96.7% | 97.5% | 97.8% | 97.2% | 96.4% | 97.6% | 95.8% | 97.3% | 98.3% | 97.3% | 97.5% | 98.0% | 96.6% | 97.2% |
| Fitchburg | 69.7% | 78.7% | 88.3% | 75.0% | 80.9% | 88.1% | 91.1% | 85.7% | 88.9% | 89.7% | 91.3% | 79.8% | 70.8% | 83.0% |
| Franklin | 76.8% | 92.7% | 91.2% | 84.9% | 89.0% | 88.7% | 91.0% | 88.7% | 88.2% | 86.6% | 88.6% | 82.5% | 85.4% | 87.3% |
| Greenbush | 98.0% | 97.7% | 97.1% | 97.7% | 94.8% | 93.9% | 94.6% | 95.0% | 97.4% | 95.3% | 95.6% | 85.3% | 95.2% | 95.2% |
| Haverhill | 83.8% | 86.3% | 89.2% | 80.4% | 85.1% | 91.9% | 90.4% | 80.6% | 79.0% | 88.8% | 81.3% | 74.7% | 78.3% | 84.0% |
| Kingston/Plymouth | 96.0% | 94.7% | 95.6% | 95.5% | 91.7% | 95.0% | 94.0% | 92.4% | 94.7% | 95.1% | 95.3% | 84.2% | 91.8% | 93.5% |
| Lowell | 88.1% | 94.7% | 92.7% | 86.5% | 90.2% | 94.6% | 96.8% | 94.8% | 95.2% | 94.5% | 89.1% | 88.2% | 85.7% | 91.7% |
| Middleboro | 95.2% | 94.1% | 93.4% | 94.7% | 92.6% | 90.2% | 93.0% | 88.7% | 92.4% | 91.2% | 90.8% | 83.2% | 88.9% | 91.4% |
| Needham | 80.6% | 94.0% | 90.6% | 83.4% | 92.6% | 92.7% | 94.7% | 91.6% | 94.1% | 92.3% | 92.0% | 90.0% | 91.0% | 90.8% |
| Newburyport | 86.4% | 90.4% | 89.5% | 81.0% | 85.0% | 90.5% | 94.1% | 87.1% | 92.5% | 87.5% | 89.1% | 88.5% | 89.3% | 88.6% |
| Providence | 86.8% | 91.5% | 88.7% | 80.0% | 87.8% | 92.2% | 89.6% | 86.4% | 89.0% | 89.3% | 89.2% | 86.6% | 87.7% | 88.1% |
| Rockport | 85.8% | 92.0% | 90.0% | 83.4% | 87.7% | 91.4% | 94.1% | 89.1% | 92.6% | 89.1% | 83.6% | 86.6% | 88.5% | 88.8% |
| Stoughton | 85.7% | 91.6% | 84.6% | 78.4% | 87.1% | 87.6% | 87.8% | 87.1% | 91.0% | 89.1% | 89.8% | 84.8% | 85.9% | 87.0% |
| Worcester | 67.6% | 85.8% | 84.6% | 82.8% | 81.3% | 74.5% | 79.3% | 69.1% | 80.2% | 82.5% | 74.5% | 79.4% | 89.5% | 79.3% |
| Grand Total | 84.5% | 91.2% | 90.8% | 85.4% | 88.3% | 90.3% | 91.5% | 87.4% | 90.3% | 90.2% | 88.4% | 85.1% | 87.2% | 88.5% |



Arrival Within 10 Minutes

| | 11-2016 | 12-2016 | 1-2017 | 2-2017 | 3-2017 | 4-2017 | 5-2017 | 6-2017 | 7-2017 | 8-2017 | 9-2017 | 10-2017 | 11-2017 | Total |
|--------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Fairmount | 97.9% | 98.7% | 99.1% | 98.7% | 98.2% | 98.5% | 98.2% | 98.6% | 98.9% | 98.2% | 99.0% | 98.8% | 98.6% | 98.6% |
| Fitchburg | 83.1% | 87.0% | 95.1% | 85.6% | 90.4% | 94.3% | 96.9% | 93.2% | 94.3% | 94.3% | 96.4% | 90.6% | 85.7% | 91.4% |
| Franklin | 85.8% | 97.5% | 96.6% | 92.2% | 96.1% | 92.9% | 96.2% | 96.2% | 93.9% | 94.0% | 95.5% | 91.4% | 92.4% | 93.9% |
| Greenbush | 99.4% | 98.9% | 98.3% | 99.0% | 97.8% | 97.2% | 97.5% | 97.1% | 98.9% | 97.6% | 98.1% | 95.4% | 97.5% | 97.9% |
| Haverhill | 93.7% | 92.4% | 94.8% | 88.9% | 92.1% | 95.8% | 96.0% | 90.4% | 90.4% | 95.7% | 90.0% | 87.1% | 88.4% | 92.1% |
| Kingston/Plymouth | 97.7% | 96.5% | 97.9% | 97.8% | 95.8% | 97.2% | 97.6% | 96.2% | 97.4% | 97.9% | 98.8% | 95.4% | 96.5% | 97.1% |
| Lowell | 94.7% | 97.4% | 96.8% | 96.8% | 97.0% | 97.6% | 99.0% | 97.4% | 98.7% | 98.7% | 97.5% | 95.3% | 95.4% | 97.1% |
| Middleboro | 97.8% | 97.4% | 96.4% | 96.7% | 95.5% | 94.4% | 96.9% | 95.0% | 97.6% | 96.8% | 95.0% | 96.3% | 96.0% | 96.3% |
| Needham | 89.4% | 97.8% | 97.6% | 92.0% | 98.5% | 97.9% | 98.2% | 95.9% | 97.2% | 95.9% | 96.6% | 96.4% | 94.6% | 96.0% |
| Newburyport | 93.4% | 96.2% | 96.0% | 91.6% | 91.1% | 95.1% | 98.2% | 93.6% | 96.5% | 95.5% | 95.0% | 95.0% | 96.3% | 94.9% |
| Providence | 93.1% | 96.6% | 94.5% | 86.8% | 93.2% | 95.1% | 94.0% | 92.6% | 94.0% | 93.8% | 95.1% | 93.4% | 94.5% | 93.6% |
| Rockport | 94.3% | 96.9% | 95.8% | 92.1% | 92.5% | 96.0% | 97.2% | 94.6% | 96.6% | 95.7% | 92.4% | 92.6% | 94.4% | 94.7% |
| Stoughton | 95.6% | 97.2% | 93.3% | 88.6% | 93.2% | 95.2% | 94.8% | 94.4% | 96.0% | 95.8% | 95.3% | 92.9% | 95.9% | 94.5% |
| Worcester | 84.1% | 95.1% | 93.7% | 92.3% | 90.2% | 89.2% | 88.1% | 84.4% | 90.4% | 91.3% | 87.7% | 90.7% | 95.3% | 90.2% |
| Grand Total | 92.3% | 96.0% | 96.1% | 92.7% | 94.2% | 95.3% | 96.1% | 93.9% | 95.4% | 95.6% | 94.9% | 93.5% | 94.3% | 94.6% |



Other Actions to Address Largest OTP Issues

| Item | Action | Status |
|--|--|--------|
| Network restrictions (Fitchburg speed restriction, Haverhill line speed restriction) | <ul style="list-style-type: none">• Fitchburg speed restriction resulting from geometry car testing repaired—affected large portion of line, causing several delayed trains daily• Haverhill rail destressed, returning track to line speed | |
| Worcester Line | <ul style="list-style-type: none">• See separate action update | |
| Winter Preparation | <ul style="list-style-type: none">• Live exercise and tabletop exercise conducted—second tabletop exercise planned | |
| Slippery Rail | <ul style="list-style-type: none">• See separate action update | |
| Mechanical failures | <ul style="list-style-type: none">• See separate action update | |



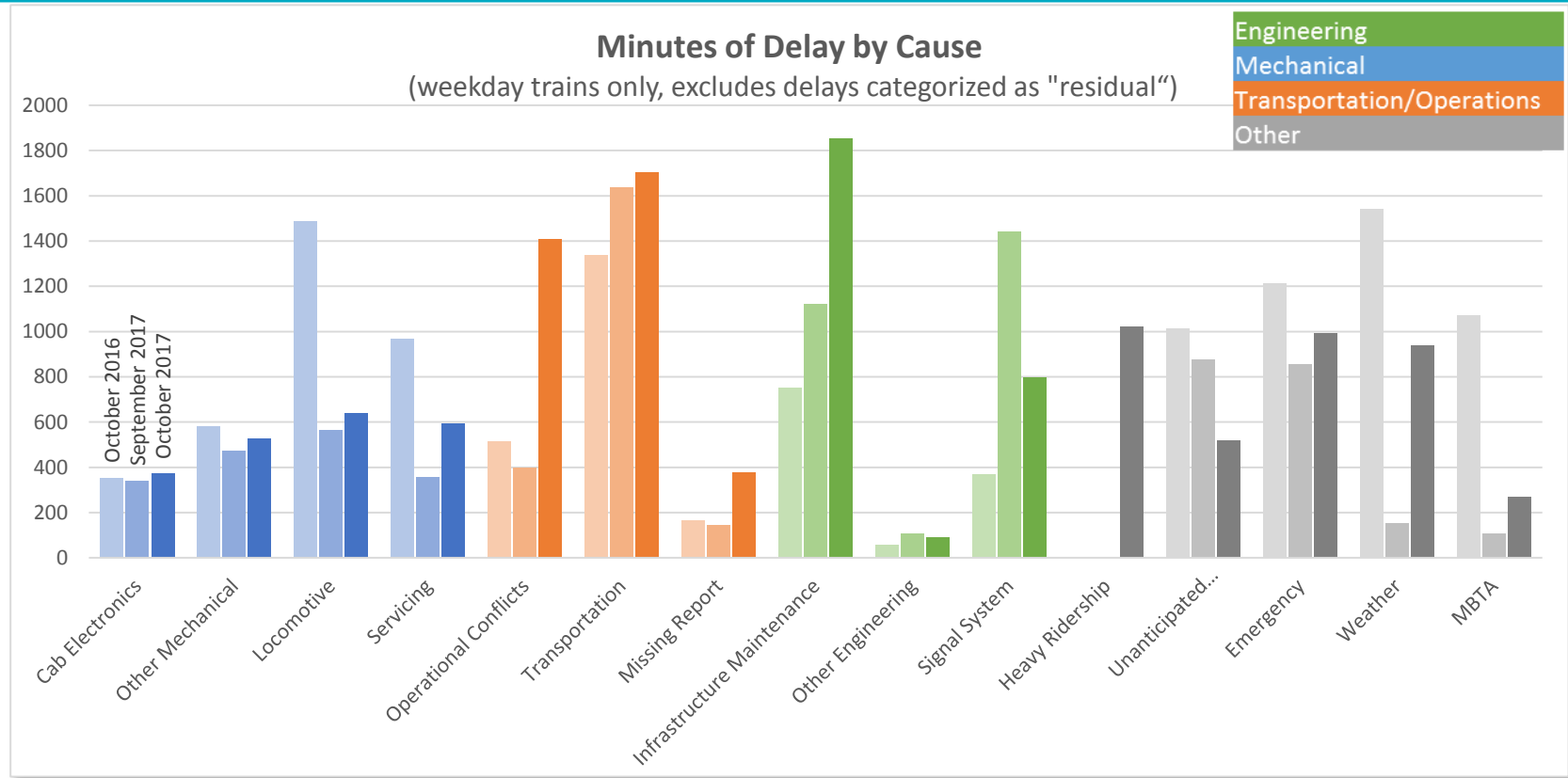
Boosting On Time Performance (OTP)

- ⦿ Data Analysis – Commuter Rail Delay Matrix
- ⦿ Line-by-Line Plan – Worcester Line

Commuter Rail Delay Matrix – October 2017



Commuter Rail Delay Matrix – October 2017





Commuter Rail Delay Matrix – October 2017

Noteworthy Causes of Delay – Engineering

| | | |
|----------------------------|--|----------------------------------|
| Signals | Signals 27% were on Haverhill Line. 19% on Worcester Line. Signal issues at the Beverly Drawbridge were classified as Infrastructure Maintenance. Although not included here, note that there were 10 delays of 7 minutes each on October 30 th . | Total Delays: 100 |
| | | Average Delay: 8 minutes |
| | | Longest Delay: 22 minutes |
| Infrastructure Maintenance | Track Out of Service Out of these 57 delays, 21 were for Green Line Extension work (37%), resulting in 167 minutes of delay with an average of 7 minutes. | Total Delays: 57 |
| | | Average Delay: 7 minutes |
| | | Longest Delay: 20 minutes |
| | Speed Restrictions (including those pre-approved by MBTA, which are sometimes denied for penalty waivers) 73% of delays (637 minutes) were related to Vic Interlocking (between JFK UMass and Quincy Center), which affects the Greenbush, Kingston/Plymouth, and Middleboro/Lakeville Lines. | Total Delays: 270 |
| | | Average Delay: 3 minutes |
| | | Longest Delay: 8 minutes |



Commuter Rail Delay Matrix – October 2017

Noteworthy Causes of Delay – Transportation/Operations

| | | |
|----------------|--|----------------------------------|
| Transportation | Insufficient Staffing | Total Delays: 58 |
| | Together with “Heavy Ridership” delays, a total of 279 delays | Average Delay: 7 minutes |
| | 28% on Worcester Line. | Longest Delay: 17 minutes |
| | Other Transportation Delays | Total Delays: 101 |
| | 20% were due to the door and trap procedure, with average of 5 minutes per delay. Suggest reviewing door and trap procedure. | Average Delay: 6 minutes |
| | | Longest Delay: 31 minutes |



Worcester Line Plan

Initiated October 23, 2017



Worcester Line Plan

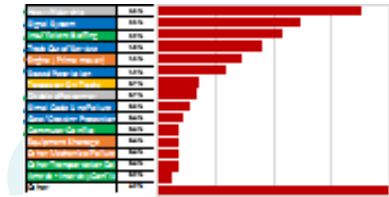
Background Statistics

- From October 2016 – October 2017 system-wide weekly OTP averaged 88.5%
- From October 2016 – October 2017 Worcester Line OTP weekly averaged 77.8%, making it the worst performing line in the network for the year.
 - The Worcester Line weekly OTP range during the October 2016 – October 2017 year was from a low of 51.0% (October 24, 2016) to a high of 92.5% (December 19, 2016).
 - During slippery rail season, performance has historically been particularly poor: 69% during October – November, 2016
- The Worcester Line is the second highest ridership line in the system with 15,500 average weekday riders. (*Providence Line is number one with 18,300.*)



Worcester Line: Developing and Executing a Plan

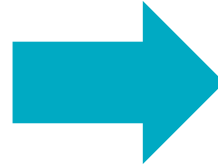
Prioritizing actions to drive a step change in performance



Data analysis to identify biggest improvement opportunities



Targeted studies by experienced managers on key trains and platforms



| ID | Department | Author | Description | Owner | 2018 | 2019 | 2020 | 2021 | 2022 |
|----|------------------|---------------|---|-----------|-----------|------|------|------|------|
| 1 | Customer Service | Robbie Palmer | Identify potential customer service gaps in order to improve the customer experience and increase safety in the event of an emergency | John Dyer | Completed | | | | |
| 2 | Performance | Colin Jones | Conduct experiments to reduce average on-board times | Pauline | Completed | | | | |
| 3 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 4 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 5 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 6 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 7 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 8 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 9 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 10 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 11 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 12 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 13 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 14 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 15 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 16 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 17 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 18 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 19 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |
| 20 | Performance | Robbie Palmer | Identify potential gaps in the current service and develop a plan to improve it | John Dyer | Completed | | | | |

Single action list targeted against biggest priorities

Selected Actions

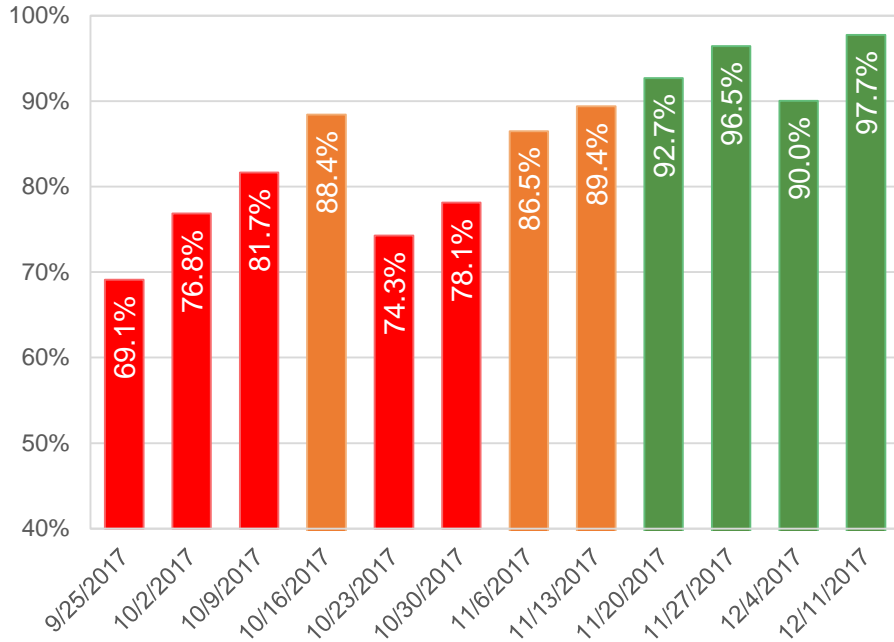
- Change to track routing of express trains during AM Peak to avoid catching signals of local trains ahead
- Increase of track speeds where possible based on safety
- Appointment of 'Worcester Line Superintendent' to lead and coordinate efforts
- First ever nine-car set on Train 508, previously one of the worst performing trains
- Changed freight train patterns in AM Peak by improving dispatching protocol
- On time departure drive to ensure trains are leaving on time
- Eliminate recurring signal issue between CP39 – CP42
- Additional staffing on key, heavy ridership trains



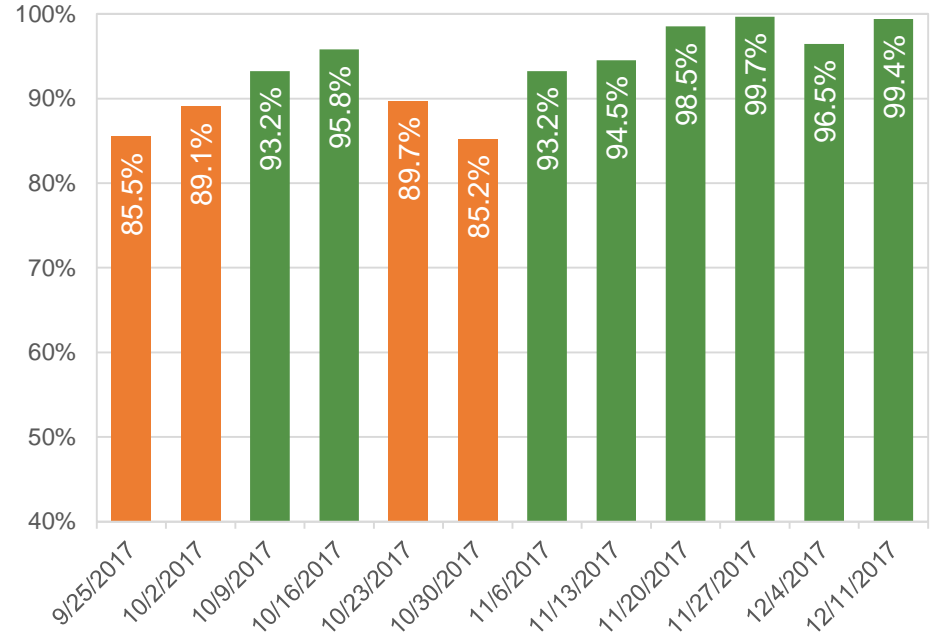
Worcester Line: Results

November 2017 was best month for OTP since January 2015—despite slippery rail

Worcester Line OTP Within 5 Minutes



Worcester Line OTP Within 10 Minutes





Worcester Line: Results

November 2017 was best month for OTP since January 2015—despite slippery rail

- ⦿ The week of November 20th's 92.7% OTP was the best weekly performance since the week of December 28, 2015.
- ⦿ The week of November 27th's 96.5% OTP was the best weekly performance since the week of January 5, 2015.
- ⦿ Monday, November 27th operated at 100% for the entire day, and was a first 100% OTP weekday since January 29, 2016. December 11, 12, 15, and 17 we had 100% OTP days.
- ⦿ Passenger weighted OTP for the week of November 27th was 97.7%.
- ⦿ 100% AM Peak OTP has been achieved 19 times since October 27, including 10/27, 11/3, 11/7, 11/9, 11/10, 11/13, 11/15, 11/17, 11/20, 11/22, 11/27, 11/30, 12/1, 12/4, 12/5, 12/11, 12/12, 12/13, and 12/15.
- ⦿ Four back-to-back consecutive weeks at or above 90%, last achieved in January, 2015



Worcester Line: Train 508

“Paying attention to high ridership trains”

- ⦿ Train 508 (*Departs 6:57AM Worcester, Arrives 8:20 AM South Station*) is the highest ridership train in the entire commuter rail network with 1,800 weekday daily passengers.
- ⦿ On 10/27/17 Train 508 consist was made 9 cars long, a first ever for the MBTA Commuter Rail. The largest consist previously was 8 cars. We have been running the train as 9 cars since then.
- ⦿ Train 508 has only been late once in the last month; it was late 20 times in October.



Worcester Line: Train 508 – First 9-car consist in MBTA history





Sustainability

Maintaining Progress

The team has established a detailed action plan to ensure that Worcester Line performance does not regress to previous levels. In terms of governance, the plan involves a weekly call to review metrics and performance, with health checks based on the performance of key metrics. If performance falls below 85% on two consecutive days, there will be a detailed analysis to understand root cause and take necessary actions. A checklist is being developed for monthly health checks in the long term to verify that the plans are still in place. We have undertaken a detailed review of the action list to ensure that each action has a clear, controlled plan.



Replicability

Applying Lessons Learned

- ⦿ Extend the lessons we are learning on the Worcester Line to other low performing lines
- ⦿ Synthesize line-by-line improvements into a plan to improve CR performance system-wide

Slippery Rail: Final 2017 Report

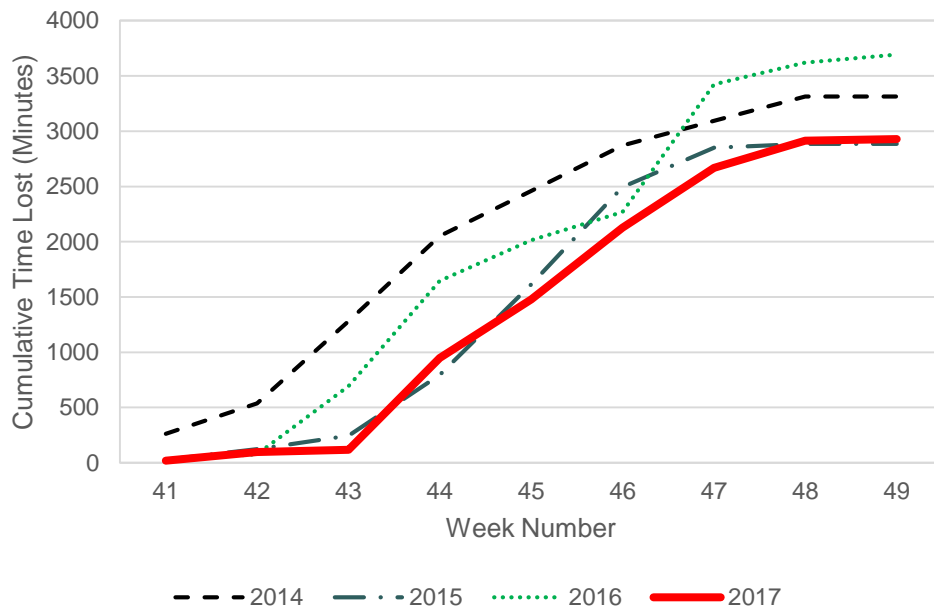




Recent Performance - Slippery Rail Losses

21% improvement in lost minutes compared to 2016

Cumulative Minutes Lost due to Slippery Rail
(October 1 - November 30)



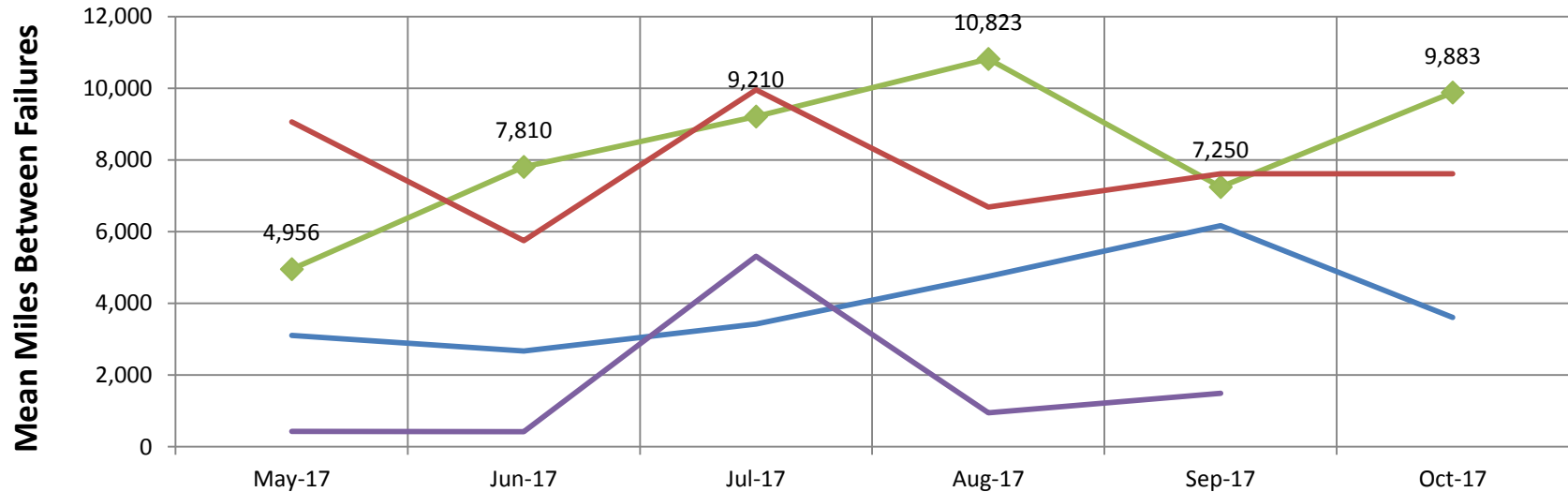
- Five fewer days below 80% from 2016 (12 days) to 2017 (7 days)
- 48% reduction in minutes lost on Newburyport/Rockport due to brush cutting (versus 2016)
- 34% reduction in reports of no sand in sanding system
- Significant improvement in wash train availability due to spare parts and testing
- Best year ever when normalizing for rainfall (2015 was a significantly drier season than 2017)

Locomotive Performance





Legacy Locomotive Fleet Performance



| | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 | Oct-17 |
|---------|--------|--------|--------|--------|--------|----------|
| UTEX | 4,956 | 7,810 | 9,210 | 10,823 | 7,250 | 9,883 |
| GP40MC | 3,105 | 2,676 | 3,425 | 4,757 | 6,167 | 3,611 |
| MP36-3C | 430 | 420 | 5,313 | 947 | 1,492 | Not Run* |
| F40's | 9067 | 5747 | 9957 | 6686 | 7613 | 7613 |

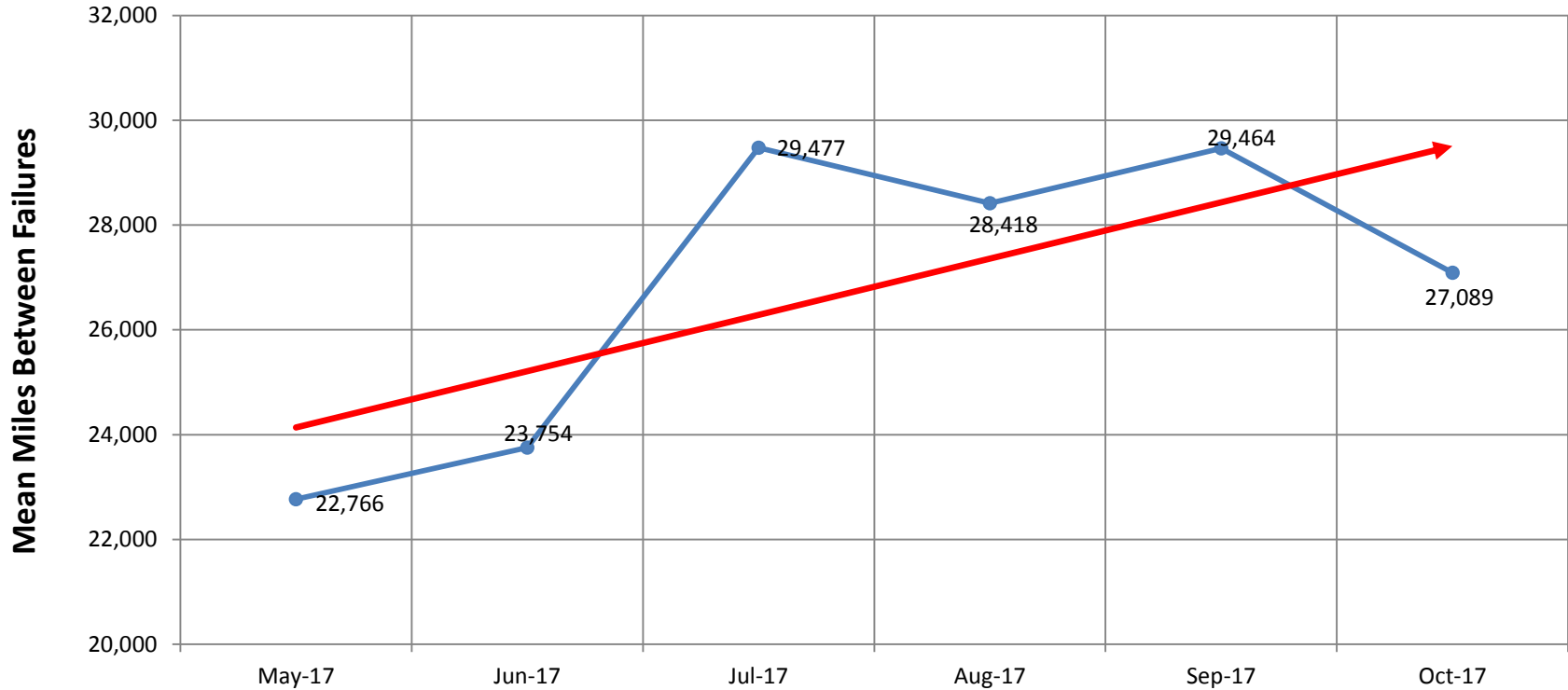
*Out of service for actuator replacement

UTEX Update





HSP-46 (MPI) Locomotive Fleet Performance





Near-Term Fleet Plan – Moving Forward

| Program | # of Locos | Cost | Anticipated Completion | Service Life Extension |
|------------------------|------------|--------------|------------------------|------------------------|
| Short-term Recovery | 14 to date | \$2M to date | Ongoing | Return to Service |
| UTEX Phase I | 5 | \$6M | Dec. 2017 | 6 years |
| UTEX Phase II | 5 | \$6M | Jun. 2018 | 6 years |
| F40 Overhaul | 10 | \$27M | Jun. 2019 | Up to 20 years |
| GP40 Overhaul | 4 | \$6M | Dec. 2018 | Up to 20 years |
| MP36 Top Deck Overhaul | 2 | \$2M | Dec. 2018 | Up to 10 years |

Winter Resiliency: Brief Update



Revenue Share Initiative: Keolis presentation next

