



August 2019
SFMTA S200 LRV4
Fleet Reliability Demonstration Monthly Report
Revision B

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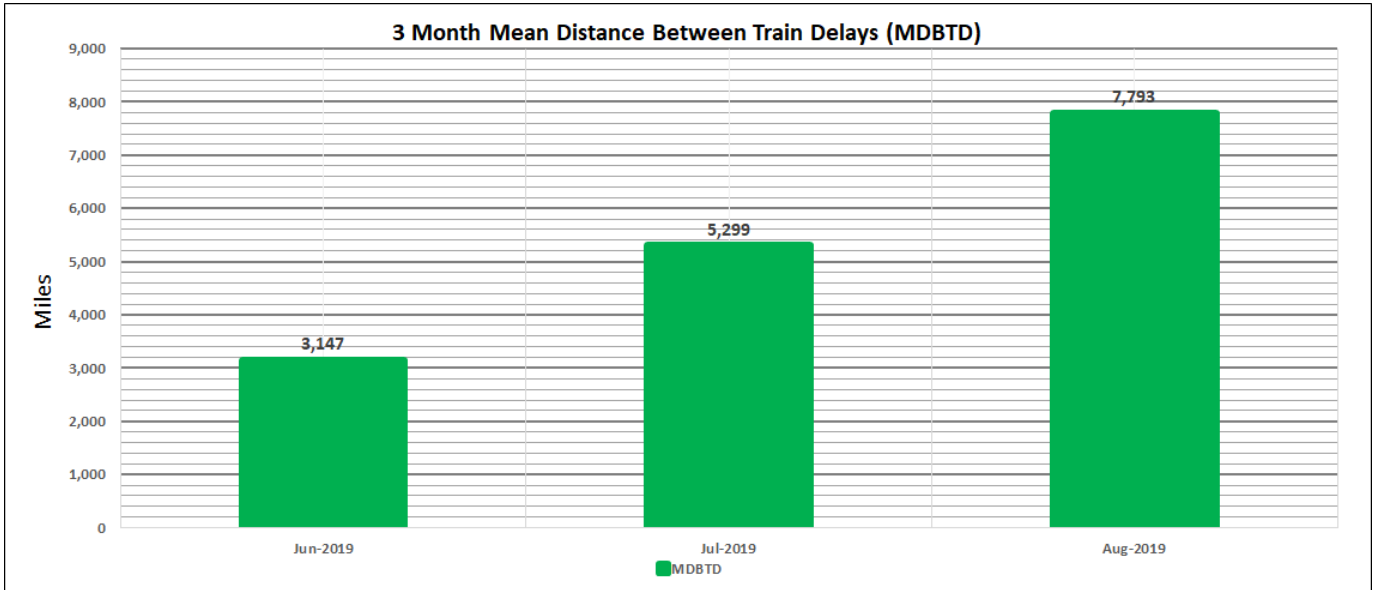
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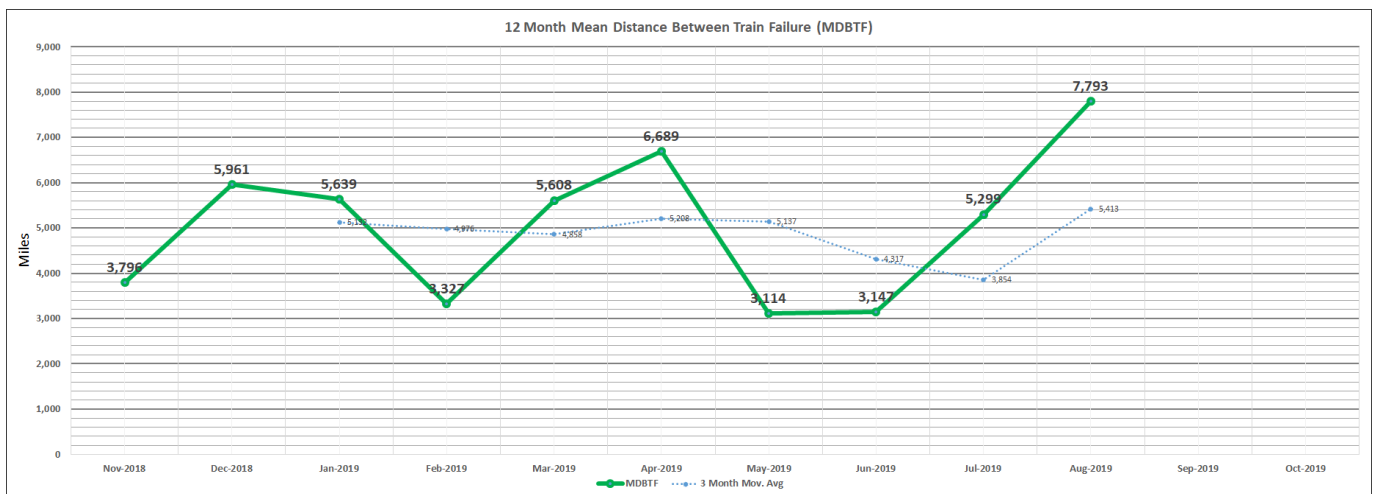
1 RELIABILITY OF CHARGEABLE FAILURES

1.1 MEAN DISTANCE BETWEEN TRAIN DELAYS



Major Contributors per Month

Month	Contributor	Count	Solution	MDBTD w/o Contributor
June	HPU Failure	9	Driver Board, BCV, harness workmanship upgrades by end of Q4 2019	4813
July	HPU Failure	5	Driver Board, BCV, harness workmanship upgrades by end of Q4 2019	7338
August	APS Failure	3	Upcoming FMI and SW update to correct failures.	9918



1.2 TRAIN DELAY CAUSES AND SOLUTIONS

August Train Delay Causes and Solutions:

System	Issue	Chargeable Train Delay	Event ID	Solution	Status	Projected Start	Projected Finish	Solution Status
APS/Pantograph	Vehicle Stopped on Isolator (Single Vehicle)	1	E047057	Yes	Open	Q4 2019	N/A	James Tutt - Relay Solution
APS/Pantograph	Q51	1	E026054	Yes	Open	N/A	N/A	Under investigation. Future FMI implementation.
APS/Pantograph	T4	1	E032080	Yes	Open	Q4 2019	Q4 2019	Resolved with upcoming FMI.
APS/Pantograph	Q72	1	E025053	Yes	Open	Q4 2019	Q4 2019	New SW v997 addresses issue.
ATCS	TWR Card Failure	1	E058007	Single Incident	Open	N/A	N/A	No Solution Defined
Brakes	HPU Failure	2	E044057 E051065	Yes	Open	Q2 2019	Q1 2020	Driver Board, BCV, harness workmanship upgrades in process. Will be completed by end of Q4 2019. HPU Harness Wire Termination Inspection 53 vehicles complete. PMI for HPU PN TT17649 22 vehicles complete. 9/18/19
Propulsion	Line Contactor	2	E056034 E056037	No	Open	Q4 2019	N/A	Failure investigation ongoing.
CCTV	TDR Failure	1	E047056	No	Open	Q3 2019	N/A	Fleet failure investigation ongoing.
CCTV	Camera Failure	1	E051064	No	Open	N/A	N/A	No Solution Defined
Misc	Sibas Klip Failure	1	E051063	No	Open	N/A	N/A	No Solution Defined
Misc	MVB	1	E014090	No	Open	N/A	N/A	No Solution Defined
Step & Gap Filler	Gap Filler Timing	1	E030060	Yes	Open	Q3 2019	N/A	DCU SW upgrade being investigated.

All Time Train Delay Causes and Solutions:

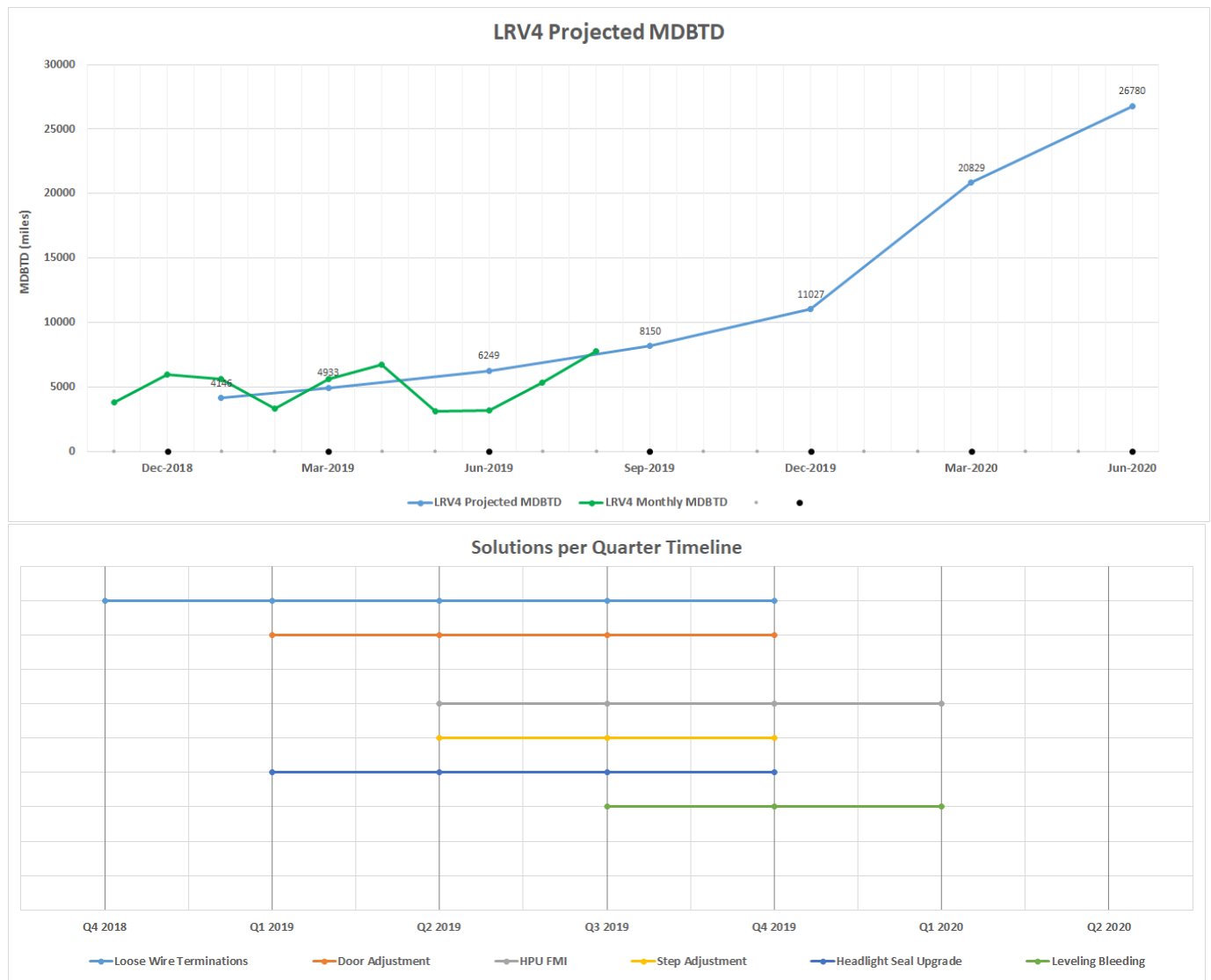
System	Issue	Chargeable Train Delay	Solution	Status	Projected Start	Projected Finish	Solution Status
APS/Pantograph	APS Choke Short	3	Yes	Open	Q4 2018	Q4 2018	FMI Choke exchange started. 7/23/19 39 vehicles completed. 9/17/19
APS/Pantograph	Battery Overtemp	1	Yes	Open	N/A	N/A	RAM LCC info sent to Hoppecke 9/17/19, in order to update scheduled maintenance times and distances in manual.
APS/Pantograph	No Power	1	Yes	Open	N/A	N/A	APS investigation nearing conclusion – SMI proposed changes include revised T4 Diode assy, new CB, wiring verification and revised SW
APS/Pantograph	Fan Blower	1	Yes	Open	N/A	N/A	Upcoming APS FMI will check for wiring conformance to prevent EMI effects. Test SW (994) with improved sequencing being tested on car 2016.
APS/Pantograph	Q51	1	Yes	Open	N/A	N/A	Under investigation. Future FMI implementation.
APS/Pantograph	T4	1	Yes	Open	N/A	N/A	Resolved with upcoming FMI.
APS/Pantograph	Q72	1	Yes	Open	N/A	N/A	New SW v997 addresses issue.
ATCS	MVB Bus fault to VOBC	2	No	Open	N/A	N/A	No Solution Defined No issue since 2/19/2019
ATCS	VOBC Timeout, No Code Reported	2	No	Open	N/A	N/A	No Solution Defined No issue since 7/24/2019
ATCS	EC 5B	2	No	Open	N/A	N/A	6/11/18 EU 1.09.00 and VCU 0.72 resolves the mandatory brake issue. 7/23/19: Two recent 5Bs occurred on cars 2039 (after VNL) and 2058 (at POR platform). Data sent to Thales for investigation. 9/3/19: Siemens-Thales to determine plan.
ATCS	TWR Card Failure	1	Single Incident	Open	N/A	N/A	No Solution Defined
Brakes	BCU Faulty	2	No	Open	N/A	N/A	No Solution Defined No issue since 7/20/2019

Brakes	HPU Failure	44	Yes	Open	Q2 2019	Q1 2020	Driver Board, BCV, harness workmanship upgrades in process. Will be completed by end of Q4 2019. HPU Harness Wire Termination Inspection 53 vehicles complete. PMI for HPU PN TT17649 22 vehicles complete. 9/18/19
Brakes	No failure or repair information	1	Single Incident	Open	N/A	N/A	No Solution Defined
Brakes	Brake Caliper	2	No	Open	N/A	N/A	SMI investigating with vendor. No issue since 7/20/2019
Brakes	Brake Fault	1	No	Open	N/A	N/A	No Solution Defined
Brakes	Brake Issue	3	No	Open	N/A	N/A	No Solution Defined
Brakes	MCEB Flat Wheels	3	No	Open	N/A	N/A	Track Brakes
Propulsion	ICU Faults	2	No	Open	N/A	N/A	No Solution Defined
Propulsion	Line Contactor	5	No	Open	N/A	N/A	Failure investigation ongoing.
Propulsion	Propulsion Blower Failure	1	No	Open	N/A	N/A	No Solution Defined
Propulsion	ICU Controller Failure	1	Single Incident	Open	N/A	N/A	No Solution Defined
Cab	Cab heater Issue	1	Yes	Open	Q1 2019	Q2 2019	FMI being reworked by Jason Jaurez and James Tutt. 9/25/19
Cab	CAD/AVL Failure	1	No	Open	N/A	N/A	No Solution Defined
CCTV	Incorrect IP Configuration	1	No	Open	N/A	N/A	No Solution Defined
CCTV	Camera Misadjusted	1	No	Open	N/A	N/A	No Solution Defined
CCTV	TDR Failure	1	No	Open	N/A	N/A	Fleet failure investigation ongoing.
CCTV	CCTV Issue - Frozen Monitor	3	No	Open	N/A	N/A	DTI technician was on site on July 15th. List of topics was generated jointly with SFMTA. Supplier working to address topics.
CCTV	CCTV Fault	1	No	Open	N/A	N/A	No Solution Defined

CCTV	Monitor Failure	5	Yes	Open	N/A	N/A	Ethernet connectors and wiring being inspected.
CCTV	Camera Failure	2	No	Open	N/A	N/A	No Solution Defined
Door	Door Adjustment	7	Yes	Open	Q1 2019	Q4 2019	Door training with Ultimate completed. 47 cars adjusted doors to new specs. 9/17/19
Door	DCU Failure	1	No	Open	N/A	N/A	No Solution Defined
Door	Switch Failure	1	No	Open	N/A	N/A	No Solution Defined
Door	Door Rod Broke	1	Single Incident	Open	N/A	N/A	No Solution Defined
Door	Door Fault: Doors Still Unlocked	2	No	Open	N/A	N/A	SMI investigating issue.
Lighting	Headlight failure due to water intrusion	1	Yes	Open	Q1 2019	Q4 2019	TDG released FMI. Changing glue/seal. FMI released - implementation in process - 46 vehicles complete as of 9/17/19. Schedule released. Goal to be fully complete by end of September.
Loose Connector/Wire	Loose Wire Terminations	13	Yes	Open	Q4 2018	Q4 2019	Loose Connector Check document released. Fleet inspection 34 vehicle complete. No incidents since June 2019.
Misc	Implausible Bus Signal	1	Single Incident	Open	N/A	N/A	No Solution Defined
Misc	Relay Failure	1	Single Incident	Open	N/A	N/A	No Solution Defined
Misc	Sibas Klip Failure	2	No	Open	N/A	N/A	No Solution Defined
Misc	TDSG Failure	1	Single Incident	Open	N/A	N/A	No Solution Defined
Misc	Ethif Erased	1	Yes	Open	N/A	N/A	VCU v0.84 released and loaded onto fleet. Snapshot also checked to be disabled and Snapshot files deleted from Ethif cards. Wayside upload to be checked on site for correct operation.

Misc	Ethernet Communication Fault	1	Single Incident	Open	N/A	N/A	No Solution Defined
Misc	MVB	1	Single Incident	Open	N/A	N/A	No Solution Defined
Step & Gap Filler	Step Adjustment	4	Yes	Open	Q2 2019	Q3 2019	Siemens commissioning team and Vapor on site technician to tighten limit switches if found loose during PM inspections.
Step & Gap Filler	Gap Filler Timing	1	Yes	Open	N/A	N/A	DCU SW upgrade being investigated.
PIS	DDVCS Failure	1	Yes	Open	N/A	N/A	Plan submitted to MUNI July 10th. Planned to be completed by end of October 2019.

1.3 PROJECTED MDBTD BASED ON ROOT CAUSE SOLUTIONS



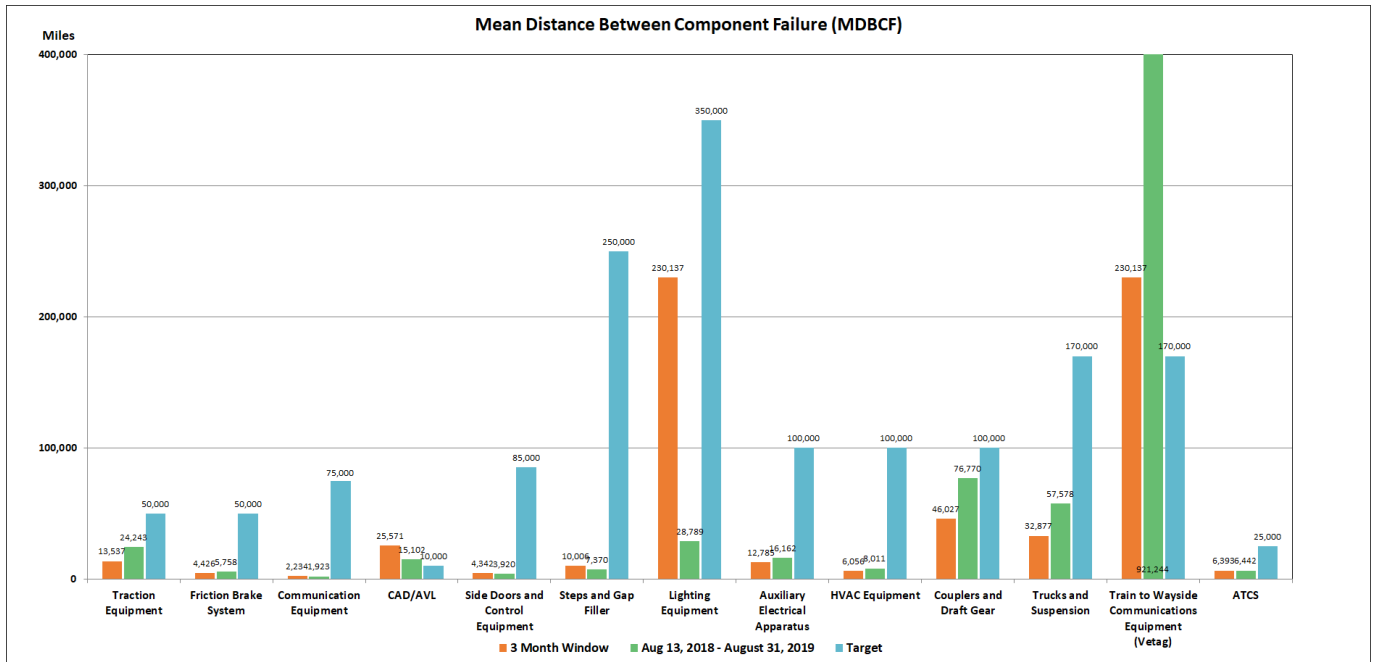
Top Issues Being Worked On

- HPU – Driver Boards, BCV valves, harness workmanship
- Loose Wire Terminations (no failures since June 2019)
- Door Adjustment (added transfer rod bolt check)
- Headlight Seal Upgraded (Failure due to Water Intrusion)
- Leveling Bleeding

Closed Issues

- Thales SW Bug (Ghost Train)
- APS Choke Containment
- Camera Upgrade (Failure due to Water Intrusion)
- Gap Filler FMI
- Coupler Shear Pin
- Draw Gear Exchange

1.4 MEAN DISTANCE BETWEEN CHARGEABLE COMPONENT FAILURES BY SYSTEM



Mileage:

August 13, 2018 – August 31, 2019 Fleet Mileage: 921,244 miles

3 Month Fleet Mileage: 230,137 miles

August Mileage: 109,101 miles

1.5 CHARGEABLE COMPONENT FAILURES MAJOR CONTRIBUTORS (AUGUST)

System	Total	Top Contributors	Solutions
ATCS	15	4 – EC 2C	9/3/19: Fixed in EU 1.12.00.
Communication Equipment	23	6 – PIS Reset	Investigation ongoing with Televic.
Friction Brake System	6	5 - HPU Failure	Driver Board, BCV, harness workmanship upgrades in process. Will be completed by end of Q4 2019.
HVAC	11	5 – HVAC Critical Fault	Corrected in SW version B5. 47 vehicles updated.
Traction Equipment	9	7 – ICU Faults	Fixed with ICU parameters version 3.1.

1.6 FLEET FAILURE

- Exterior Cameras – SII-MTA-1063
 - Failures exceed Fleet Failure Criteria
 - Vendors installed new cameras. Complete.
- TDR – SII-MTA-1065
 - TDR rev 1.3 implemented summer 2018
 - Fleet failure notice received; response provided to Muni.
- Headlights – SII-MTA-1064
 - Fleet failure notice received.
 - FMI released - implementation in process - 43 vehicles complete as of 8/7/19.
 - Schedule released. To be fully complete by end of August.
- Paint Lamination for Steps and Gap Filler Tread – SII-MTA-1074
 - Fleet failure notice received
 - Response from Vapor submitted to MUNI 7/10/19
- Step Main Actuator Leakage – SII-MTA-1075
 - Fleet failure notice received
 - Response from Vapor submitted to MUNI 7/10/19
- TDR Caddy – SII-MTA-1098
 - Fleet failure notice received
- HPU
 - New Driver Board
 - Driver Board, BCV, harness workmanship upgrades in process. Plan submitted to MUNI.
- Front Destination Sign and DDVCS
 - Plan submitted to MUNI 6/26/19.
 - Planned to be completed by end of October 2019.

1.7 POTENTIAL FLEET FAILURE

1.8 EXPERT FAULT ANALYSIS

VCU Diagnostic Code	VCU Description	Adjusted ¹ 4 Week Total	TOD Code	TOD Description	Fault Class	Solution Status
642	APS: Input circuit critical fault	18	7185	APS LVPS inverter failed	A	DC642 caused by APS code DC165. APS software being tested that will prevent nuisance fault code DC165 from occurring.
458	Battery: undervoltage	11	7046	Vehicle battery voltage problem. Mandatory brake applied.	A	Line voltage not available.
515	Power Truck A: Brake Control Unit faulty	10	7210	A truck brake control unit faulty.	A	HPU-A failures, under investigation with Siemens and Wabtec.
516	Power Truck B: Brake Control Unit faulty	8	7211	B truck brake control unit faulty.	A	HPU-B failures, under investigation with Siemens and Wabtec.
560	Power Truck A BCU: serious fault	7	7210	A truck brake control unit faulty.	A	HPU-A failures, linked to DC515

Additional Fault Codes:

VCU Diagnostic Code	VCU Description	4 Week Total	TOD Code	TOD Description	Fault Class	Solution Status
854	Door Unlock A Cancel Failure	459	8011	Doors still Unlocked	B	VCU Software Update: A 128ms DELAYOFF to be added after inputs E122_02 'SKS:Ackn DoorUnlock T/L R' and E122_03 'SKS:Ackn DoorUnlock T/L L'.
855	Door Unlock B Cancel Failure	424	8011	Doors still Unlocked	B	
824-831	Lock Switch Error Closing (DC 15) ²	63	7099-7106	Door XX serious fault	C	Under investigation, highest failing door lock switches to be checked.
404	Master/Slave Changeover Occurred	16	-	-	-	Under investigation.
739	MVB: Bus fault to VOBC (port 180)	598	7164	VOBC communication error	B	VCU Software Update: to be updated to consider the master and active VOBC signals.
227	Rollback detection.	533	-	-	-	Under investigation.

¹ Only vehicles in revenue service counted

² Subsystem fault with no location data

PIS Ethernet Cable Inspection Results:

# of PIS Faults Pre Cable Check	# of PIS Faults Post Cable Check
6090	3349