NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

April 20, 2017

Cab Car Event Recorder

Group Chairman's Factual Report
By Cassandra Johnson

1. EVENT SUMMARY

Location: Hoboken, New Jersey
Date: September 29, 2016
Operator: New Jersey (NJ) Transit
Vehicle ID: Cab Car 6036 (controlling cab)
NTSB Number: DCA16MR011
Summary: Refer to the Accident Summary report, within this docket.

2. EVENT RECORDER GROUP

An event recorder group was formed.

Chairman: Cassandra Johnson
Mechanical Engineer
National Transportation Safety Board (NTSB)

Member: Randy Fannon
Primary Investigator
Brotherhood of Locomotive Engineers and Trainmen

Member: Fred Mattison
System Train & Engine Compliance Officer
New Jersey Transit

Member: William Smith
Operating Practices Specialist
Federal Railroad Administration (FRA)

3. DETAILS OF RECORDER INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following event recorder:

Device: **Ansaldo Enhanced Main Recorder Unit (EMRU)**
Part Number: **N17003402**
Serial Number: **4801004**
Vehicle ID: **Cab Car 6036**

3.1. Event Recorder Condition

The recorder was in good condition. With the guidance of the recorder manufacturer, Ansaldo, the data were downloaded using NTSB equipment (see figure 1).

Figure 1. Photo of downloading the recorder

3.2. Event Recorder Recording Description

Cab car 6036's event recorder data were extracted using the Ansaldo Playback Data Analyzer software. This software outputted the event recorder parameters including distance and speed. Only the data relevant to this event are provided in this report.

3.3. Parameters

Table A-1 lists the parameters verified and provided in this report for cab car 6036. Specifically, table A-1 lists the plot and table labels, parameter descriptions, units, and which figure(s) the data is plotted in. Additionally, table A-2 contains the unit and discrete state abbreviations for the parameters.

3.3.1. Post-Processing Distance and Speed

The distance and speed parameters from the Ansaldo Playback Data Analyzer software used the usedWhlDiameter parameter, which was manually entered to the Cab Signaling System (CSS), as 32.5 inches. However, the measured wheel size after the event was 30 7/8 inches. Therefore, speed was post processed by multiplying each speed value by 0.95 (or 30 7/8 divided

by 32.5). Distance was then calculated by taking the derivative of the post-processed speed. Only the post-processed speed and post-processed distance are provided in this report.

3.3.2. CSSDecel

The CSSDecel parameter records the deceleration force or "shock" to the CSS equipment. The baseline recorded value is not significant, but the difference in value change over time is important. The greater the difference in value and the greater the rate of change of that value, the more severe the shock.

3.4. Time Correlation

The recorded time from cab car 6036's event recorder data is independently time stamped and, consequently, the recorded times may not reflect the actual time of day. However, cab car 6036's on-board forward facing video recorder was correlated to local time, eastern daylight time (EDT), by the On-Board Video Recorder Group Chairman[1]. The on-board forward facing video recorder recorded the sound associated to the bell thus providing a common event between the event recorder data and the on-board forward facing video recorder data. The On-Board Video Recorder Group Chairman correlated the two sets of data and computed the time offset of negative 41 seconds needed to correct the event recorder time to local time (EDT = Event Recorder Time – 41 seconds). Therefore, all times in this report are referenced as EDT.

3.5. Plots and Corresponding Tabular Data

Figures 2 to 11 contain event recorder data from cab car 6036. Specifically, figures 2 to 9 have data recorded during the September 29, 2016 event. Figure 10 has data recorded during the September 28, 2016 cab signal departure test (23:47:00 EDT to 23:58:00 EDT). Lastly, figure 11 has data recorded during the September 29, 2016 Class I brake test (04:29:00 EDT to 04:50:00 EDT). Table A-1 in appendix A provides an index of which parameters are plotted in each figure.

Figures 2 and 6 cover 1 hour and 45 minutes of data from 07:00:00 EDT to 08:45:00 EDT. Figures 3 and 7 cover 15 minutes of data from 08:29:00 EDT to 08:44:00 EDT. Figures 4 and 8 cover 43 seconds of data from 08:42:09 EDT to 08:42:52 EDT. Lastly, figures 5 and 9 cover 7 seconds of data from 08:42:45 EDT to 08:42:52 EDT.

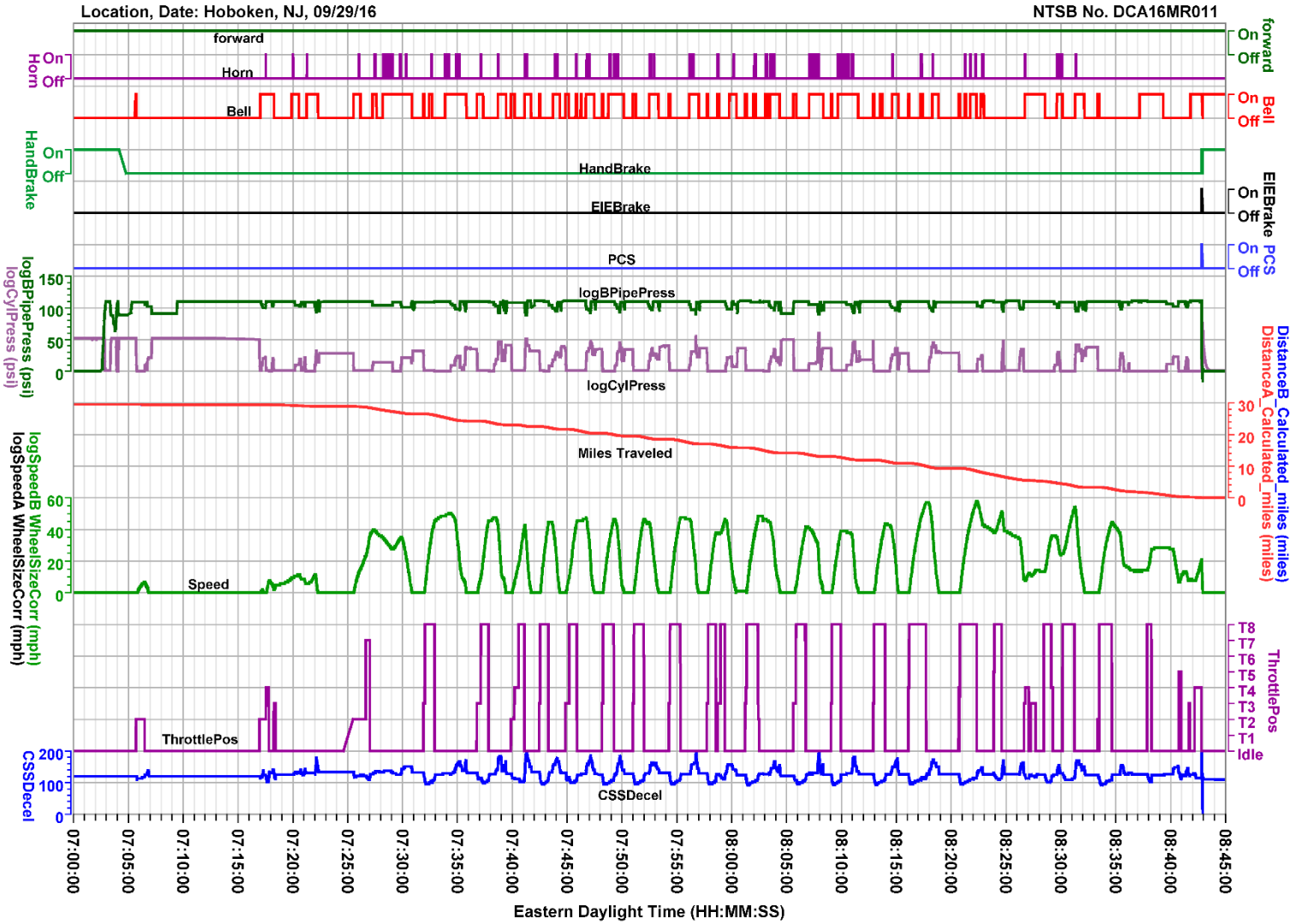
In brief, the event recorder data from cab car 6036 indicated at 07:04:48 EDT, the handbrake transitioned from on to off. At 08:42:12 EDT, 1 hour 37 minutes and 24 seconds later and 8.68 seconds before the engineer induced emergency brake (EIEBrake) transitioned from off to on, cab car 6036 had traveled about 29.3 miles. At this time, the throttle position transitioned from Idle to throttle position 4 (T4), the speed was 8 miles per hour (mph), the vehicle cylinder pressure was 0 pounds per square inch (psi), and the brake pipe pressure was 111 psi. About 38 seconds later at 08:42:50.1 EDT, cab car 6036 had traveled 721 ft. At this time, the speed increased to 20 mph, the throttle position transitioned back to Idle and remained at idle for the rest of the event sequence. Less than a second later at 08:42:50.8 EDT, cab car 6036 had traveled 21 ft. At this time, the EIEBrake transitioned from off to on, the speed increased slightly to 21 mph, and the brake pipe pressure decreased to 63 psi. At 8:42:51.1 EDT while at 21 mph,

[1] Refer to the National Transportation Safety Board's Onboard Image Recorder Factual Report.

the power control switch (PCS) transitioned from off to on, the brake pipe pressure decreased to 37 psi, the vehicle cylinder pressure increased to 15 psi, and the CSSDecel increased from a steady 115 to 123 which is consistent with the CSS experiencing a shock. Immediately following at 08:42:51.3 EDT, the CSSDecel increased to 196 which is consistent with a more severe shock to the CSS. Any event recorder data after this time are invalid due to the impact.

The tabular data for figures 2 to 9 including usedWhlDiameter are provided in electronic comma separated value (.csv) format as attachment 1 to this factual report. The tabular data for figure 10 are provided in electronic comma separated value (.csv) format as attachment 2 to this factual report. Lastly, the tabular data for figure 11 are provided in electronic comma separated value (.csv) format as attachment 3 to this factual report.

Figure 2: Select parameters from cab car 6036's event recorder (07:00:00 EDT to 08:45:00 EDT).



Revised: 9 March 2017 | Select Parameters (1 hour 45 minutes) | National Transportation Safety Board

Figure 3: Select parameters from cab car 6036's event recorder (08:29:00 EDT to 08:44:00 EDT).

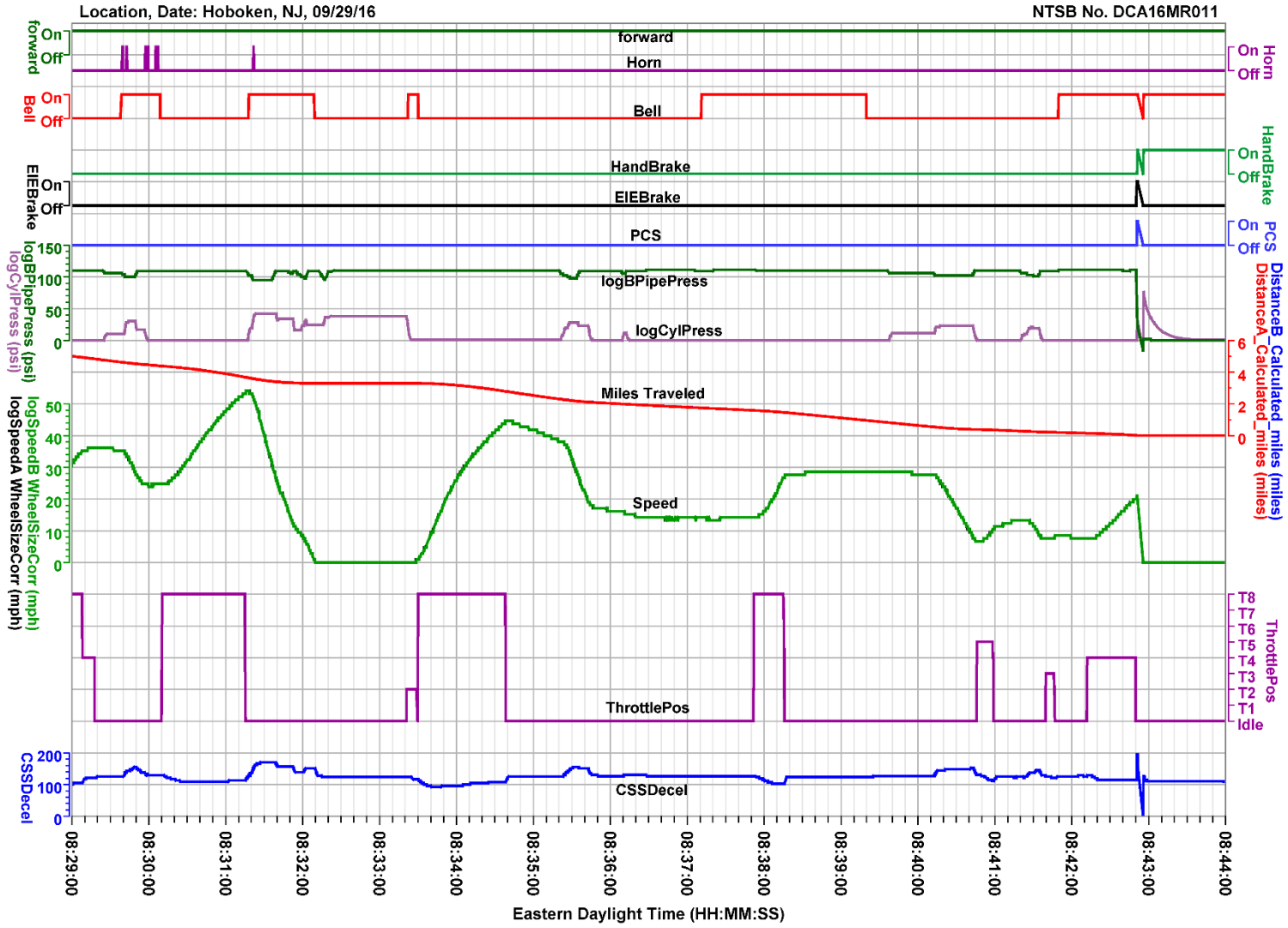
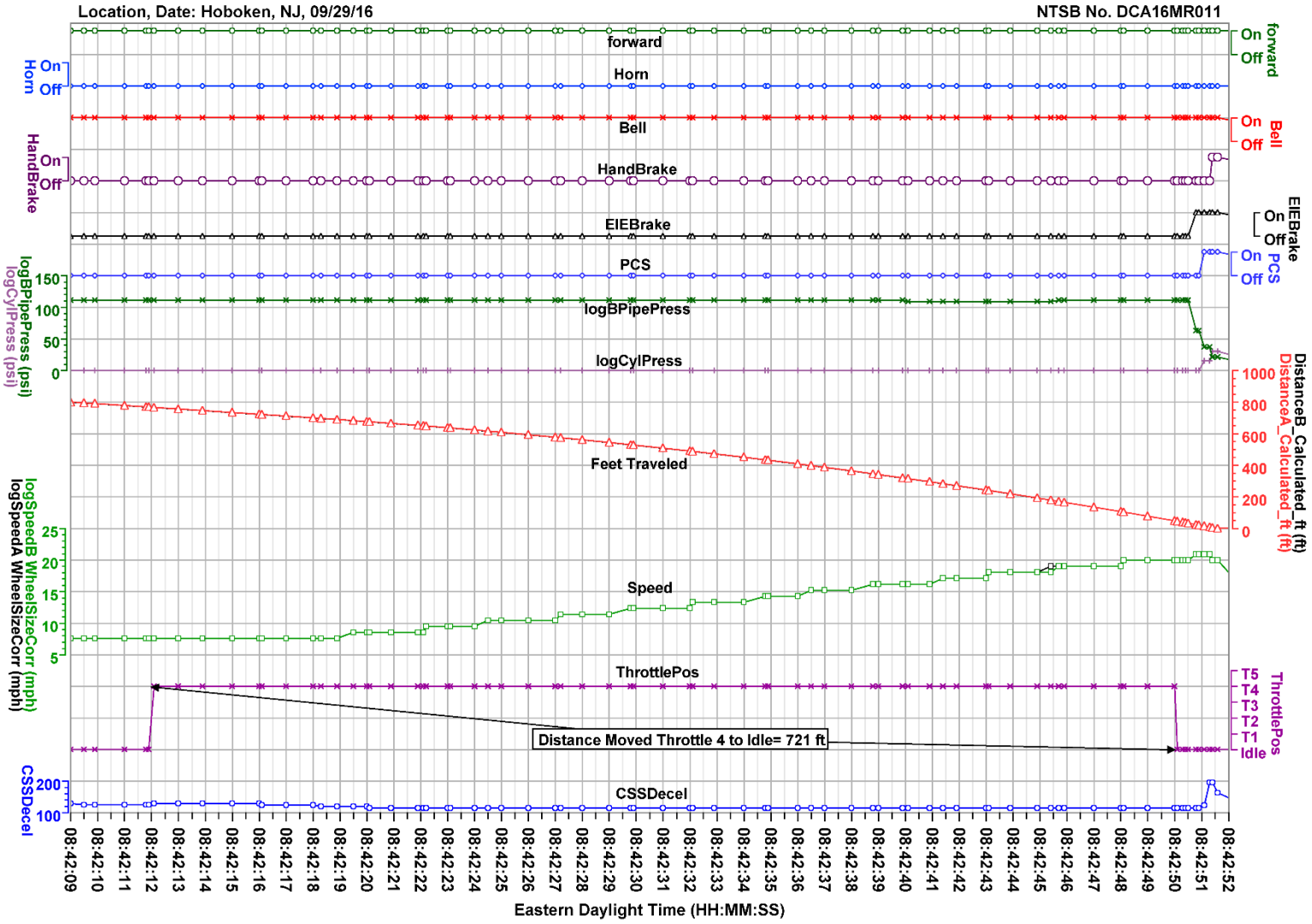


Figure 4: Select parameters from cab car 6036's event recorder (08:42:09 EDT to 08:42:52 EDT).



Revised: 9 March 2017 | Select Parameters (43 seconds) | National Transportation Safety Board

Figure 5: Select parameters from cab car 6036's event recorder (08:42:45 EDT to 08:42:52 EDT).

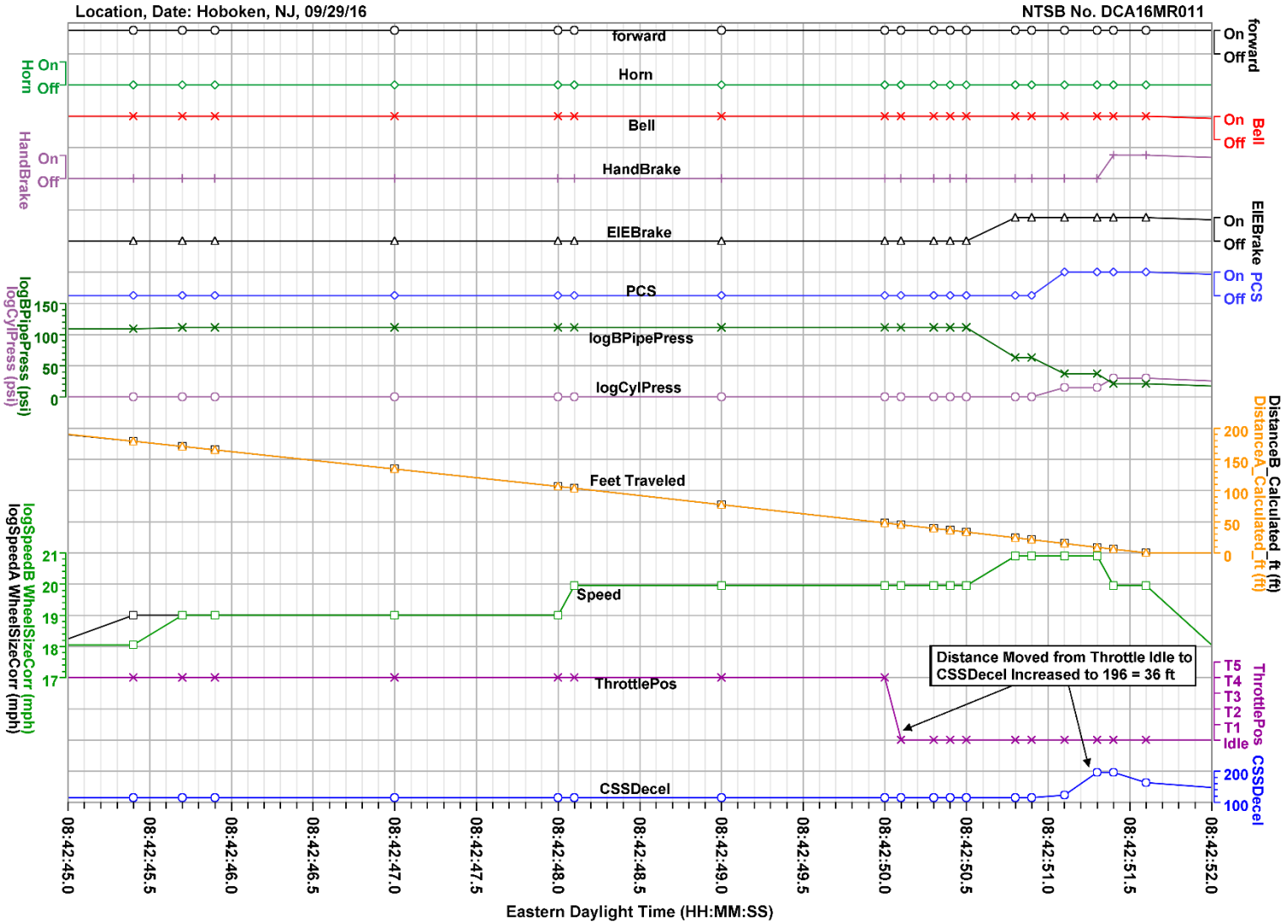
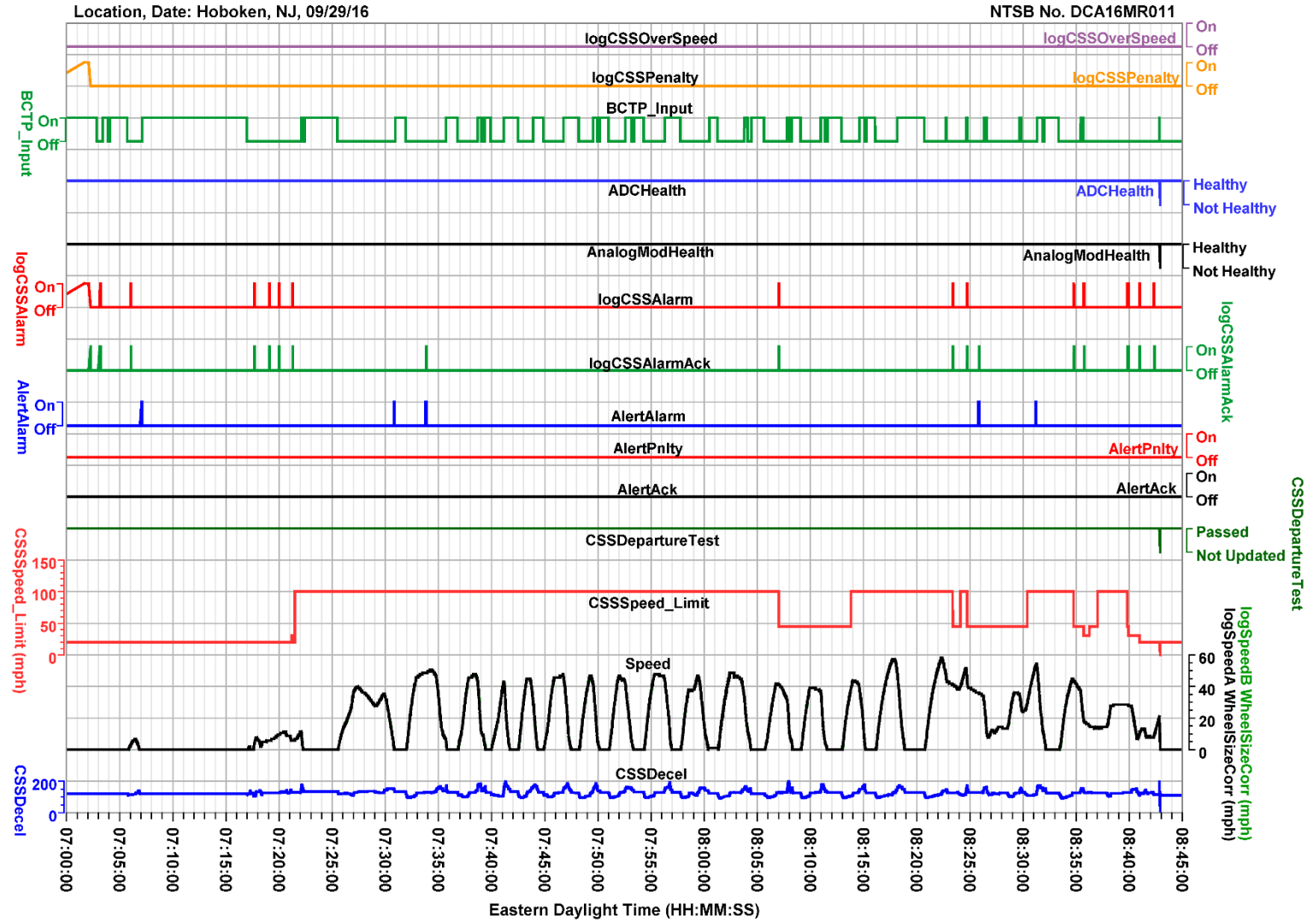
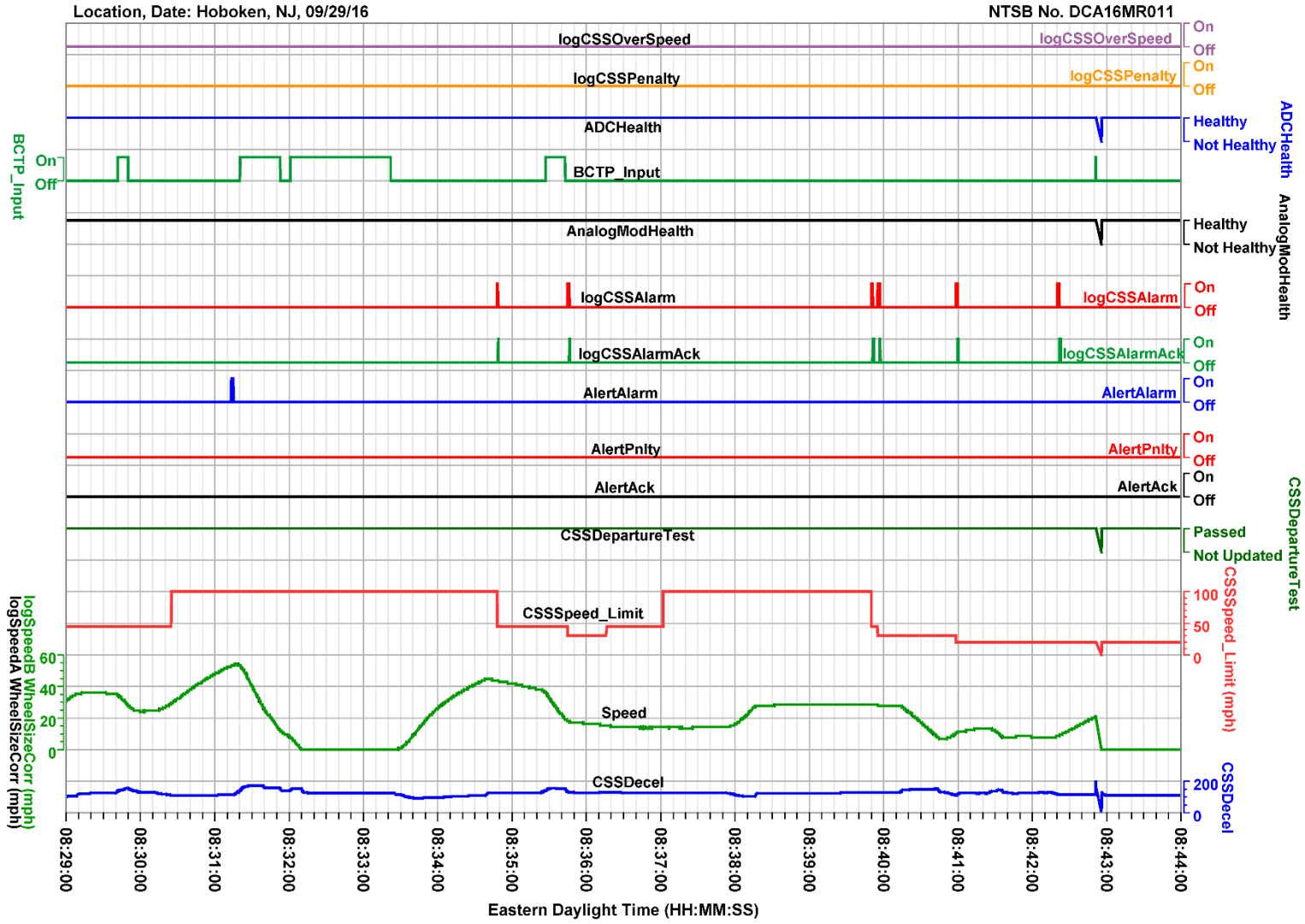


Figure 6: Additional parameters from cab car 6036's event recorder (07:00:00 EDT to 08:45:00 EDT).



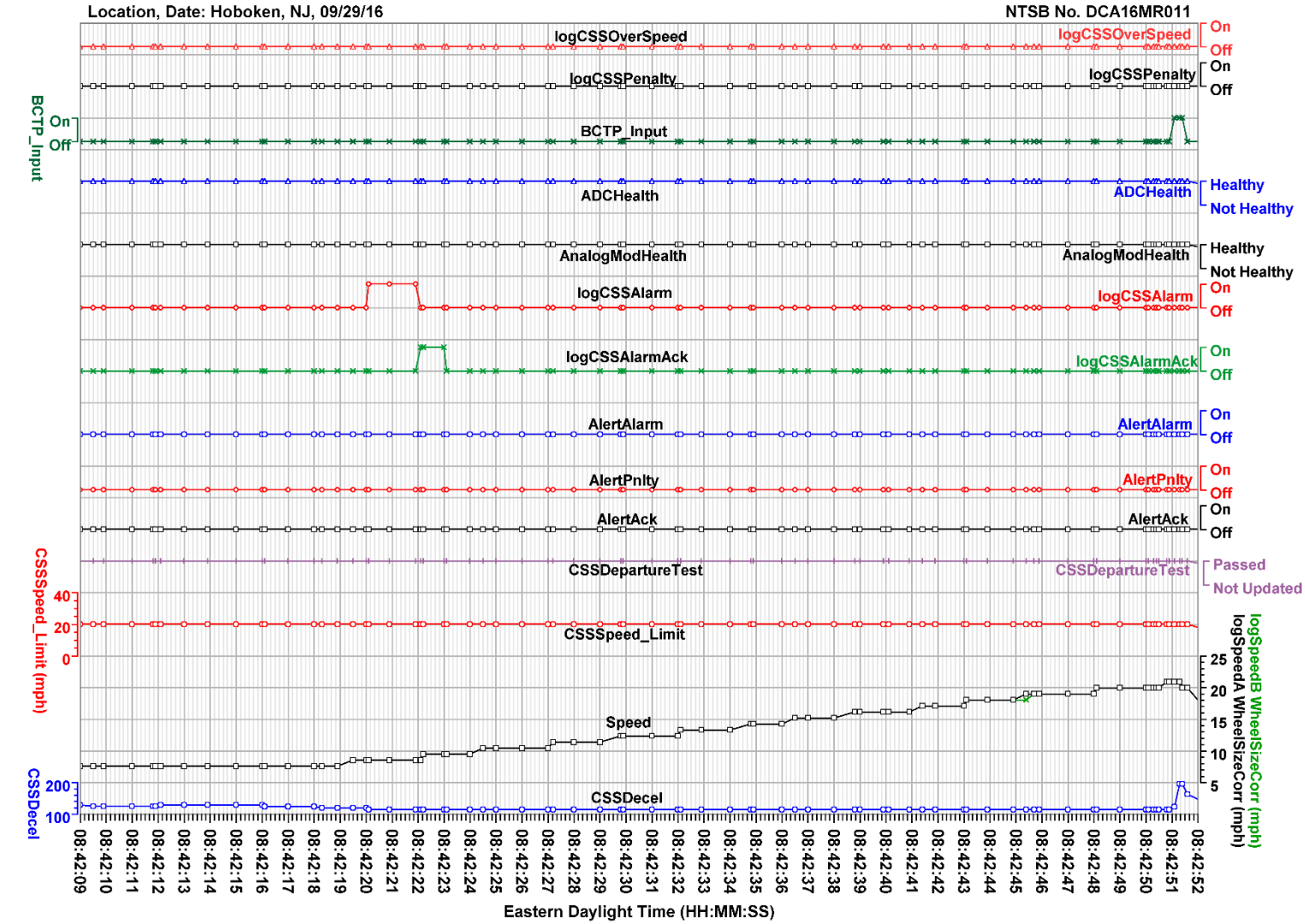
Revised: 9 March 2017 | Additional Parameters (1 hour 45 minutes) | National Transportation Safety Board

Figure 7: Additional parameters from cab car 6036's event recorder (08:29:00 EDT to 08:44:00 EDT).



Revised: 9 March 2017 | Additional Parameters (15 minutes) | National Transportation Safety Board

Figure 8: Additional parameters from cab car 6036's event recorder (08:42:09 EDT to 08:42:52 EDT).



Revised: 9 March 2017 | Additional Parameters (43 seconds) | National Transportation Safety Board

Figure 9: Additional parameters from cab car 6036's event recorder (08:42:45 EDT to 08:42:52 EDT).

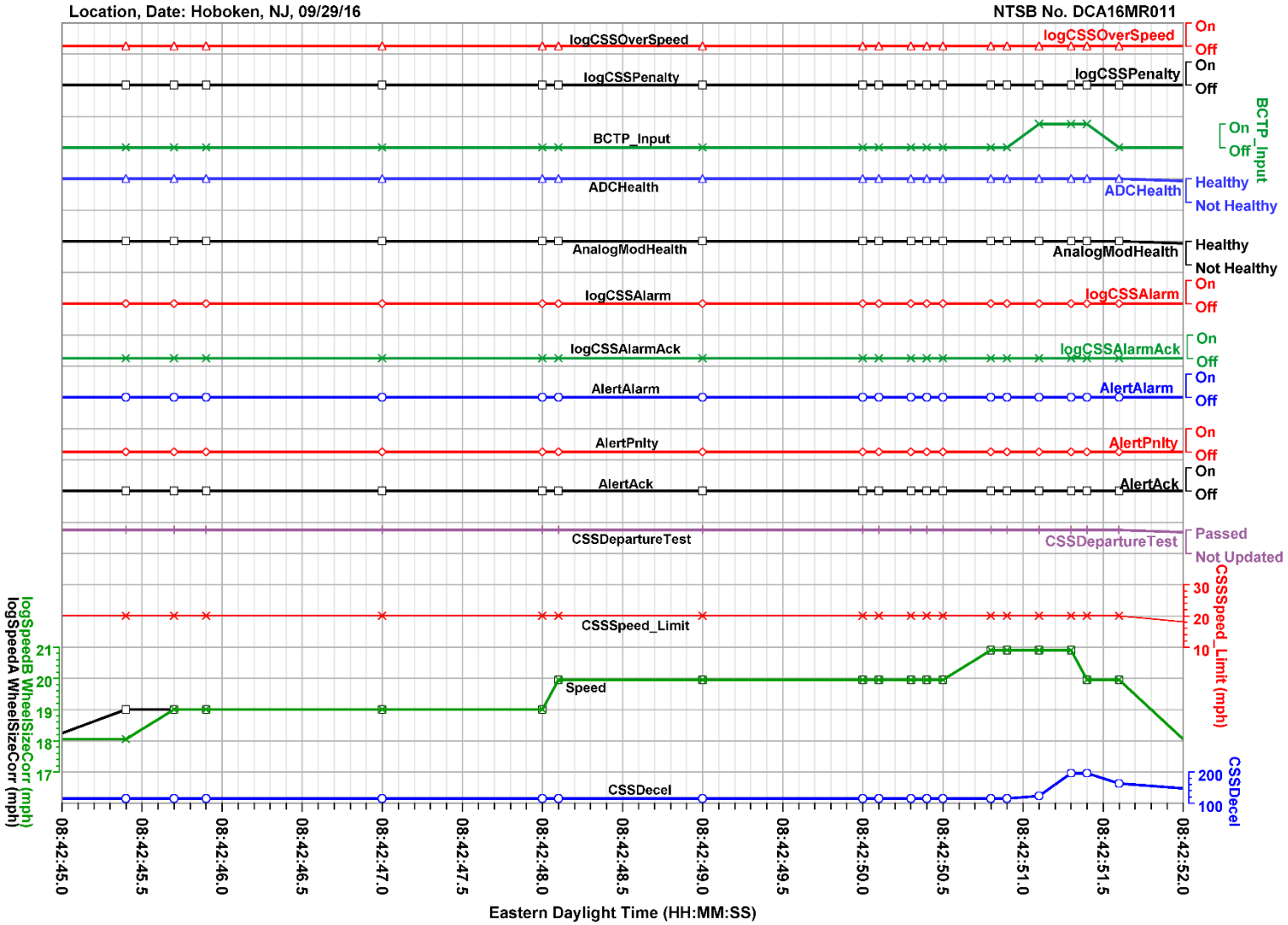
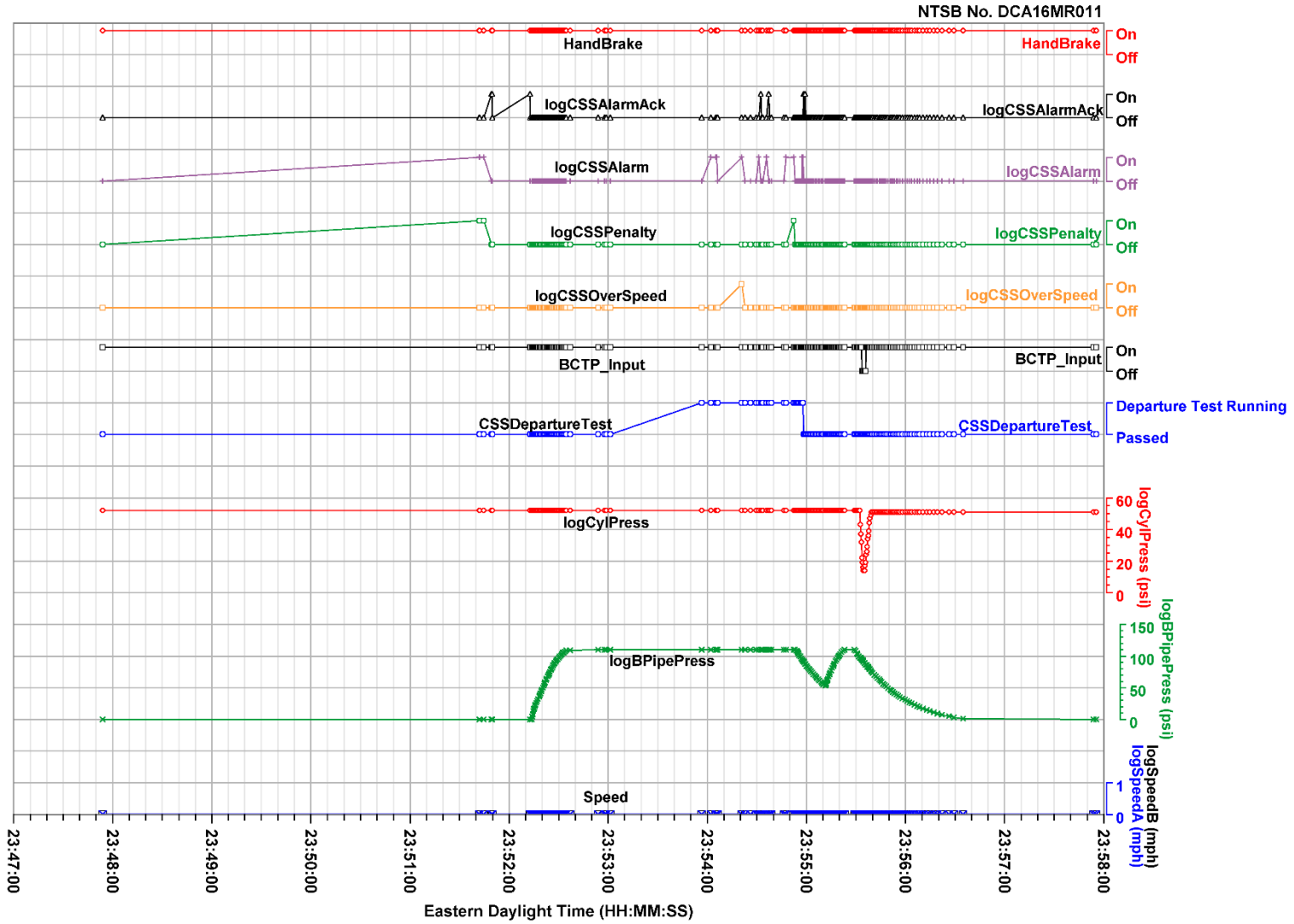
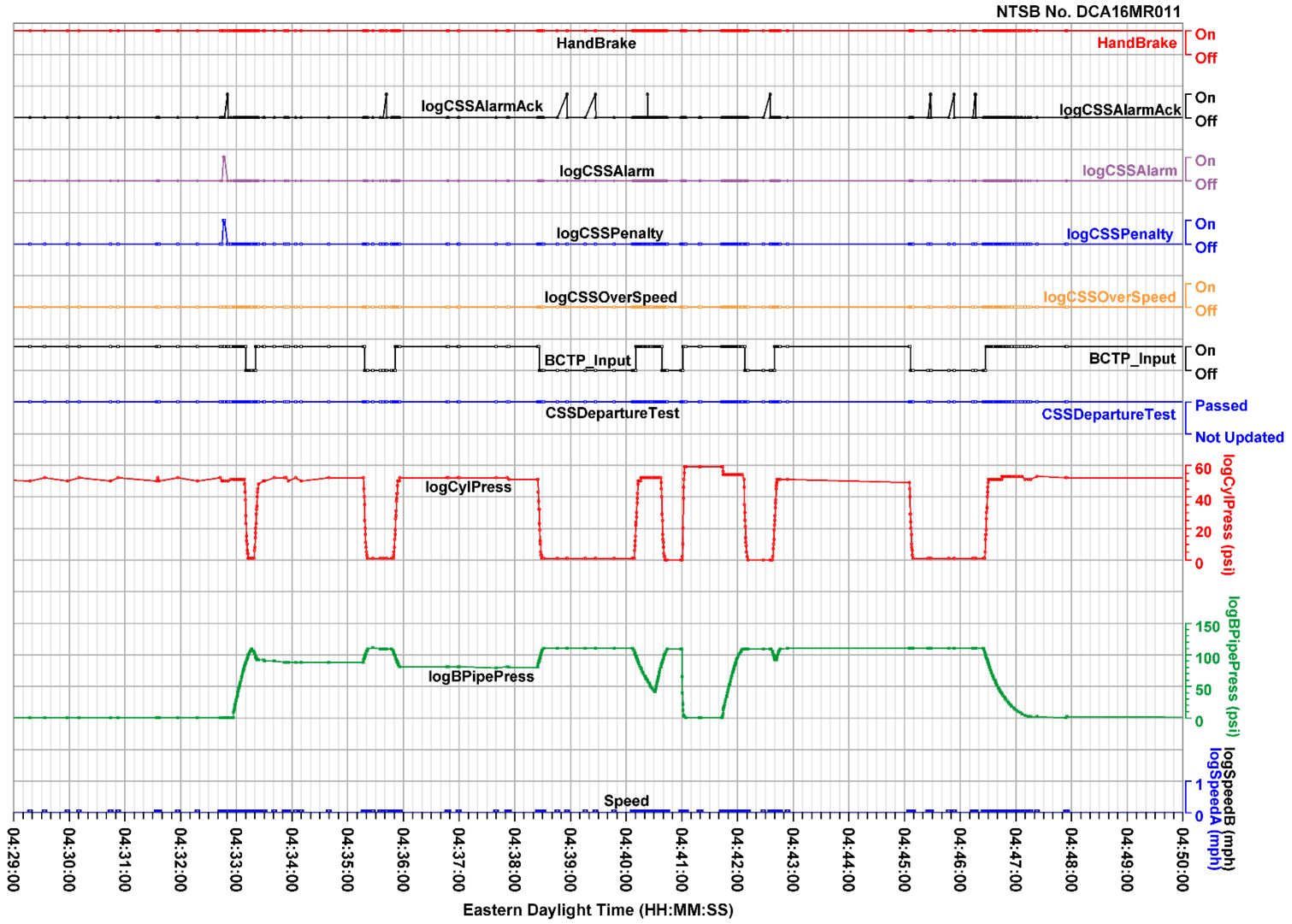


Figure 10: Select parameters from cab car 6036's September 28, 2016 cab signal departure test (23:47:00 EDT to 23:58:00 EDT)



Revised: 28 March 2017 | September 28, 2016 Cab Signal Departure Test | National Transportation Safety Board

Figure 11: Select parameters from cab car 6036's September 29, 2016 Class I brake test (04:29:00 EDT to 04:50:00 EDT)



Revised: 28 March 2017 | September 29, 2016 Class I Brake Test | National Transportation Safety Board

APPENDIX A

This appendix describes the event recorder parameters provided and verified in this report for cab car 6036. Table A-1 lists the plot and table labels, parameter definitions, units, and which figure(s) the data is plotted in. Table A-2 contains the unit and discrete state abbreviations for the parameters.

Table A-1. Verified and provided locomotive event recorder parameters for cab car 6036.

Plot/Table Label	Parameter Definition	Unit	Figures
1. ADCHealth	Data acquisition unit analog digital converter module health status		6-9
2. AlertAck	Indicates operator acknowledges alarm		6-9
3. AlertAlarm	Indicates alarm is on		6-9
4. AlertPnlty	Indicates penalty brake is applied		6-9
5. AnalogModHealth	Data acquisition unit analog module health status		6-9
6. BCTP_Input	Indicates enough brake cylinder pressure is applied to start departure test		6-9, 10, 11
7. Bell	Bell is on		2-5
8. CSSDecel	Cab Signaling System decelerometer value		2-9
9. CSSDepartureTest	Cab Signaling System Departure test status		6-11
10. CSSSpeed_Limit	Cab Signaling System maximum speed allowed	mph	6-9
11. DistanceA_Calculated_ft	Distance traveled in feet (data source tachometer A) and corrected to measured wheel size	ft	4,5
12. DistanceA_Calculated_miles	Distance traveled in miles (data source tachometer A) and corrected to measured wheel size	miles	2,3
13. DistanceB_Calculated_ft	Distance traveled in feet (data source tachometer B) and corrected to measured wheel size	ft	4,5
14. DistanceB_Calculated_miles	Distance traveled in miles (data source tachometer B) and corrected to measured wheel size	miles	2,3
15. EIEBrake	Engineer induced emergency brake is set		2-5
16. forward	Forward movement		2-5
17. HandBrake	Hand brake is applied		2-5, 10, 11
18. Horn	Horn is on		2-5
19. logBPipePress	Brake pipe pressure	psi	2-5, 10, 11
20. logCSSAlarm	Cab Signaling System alarm is on		6-11
21. logCSSAlarmAck	Cab Signaling System operator acknowledges alarm		6-11
22. logCSSOverspeed	Cab Signaling System train speed exceeds allowable speed		6-11
23. logCSSPenalty	Cab Signaling System penalty brake is applied.		6-11
24. logCylPress	Vehicle cylinder pressure	psi	2-5, 10, 11
25. LogSpeedA WheelSizecorr	Calculated speed using tachometer A and corrected to measured wheel size	mph	2-11
26. logSpeedB WheelSizecorr	Calculated speed using tachometer B and corrected to measured wheel size	mph	2-11
27. PCS	Power control switch is on		2-5
28. ThrottlePos	Throttle position for locomotive		2-5

Plot/Table Label	Parameter Definition	Unit	Figures
29. usedWhlDiameter	Vehicle wheel diameter in tenths of inches manually entered in the Cab Signaling System	in	-

NOTE: Parameters with a blank unit description in table A-1 are discretes. A discrete is typically a 1-bit parameter that is either a 0 state or a 1 state where each state is uniquely defined for each parameter.

NOTE: Parameters with a - in the figures column in table A-1 means the parameters are not plotted but are provided in the tabular data.

Table A-2. Unit and discrete state abbreviations.

Abbreviation	Description
ft	feet
in	inches
mph	miles per hour
psi	pounds per square inch
T1	Throttle Position 1
T2	Throttle Position 2
T3	Throttle Position 3
T4	Throttle Position 4
T5	Throttle Position 5
T6	Throttle Position 6
T7	Throttle Position 7
T8	Throttle Position 8