

National Transportation Safety Board

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LOCOMOTIVE EVENT RECORDERS

Specialist's Factual Report

January 23, 2025

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A. ACCIDENT

Location: Bordulac, North Dakota
Date: July 5, 2024
Time: 0336 central daylight time (CDT)
Train: Canadian Pacific Kansas City (CPKC) train 242-03

B. LOCOMOTIVE EVENT RECORDERS SPECIALIST

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C. DETAILS OF THE INVESTIGATION

A locomotive event recorder group was not convened. The NTSB Vehicle Recorder Division received event recorder files from the lead locomotive Canadian Pacific (CP) 8882 and the rear distributed power unit (DPU) Kansas City Southern de Mexico (KCSM) 4535.¹

1.0 Recording Description

Using the wheel sizes of 41.62 inches for CP 8882 and 40.75 inches for KCSM 4535 as provided by investigators, the locomotive event recorder data were extracted using the PowerView Playback software. The software outputted the locomotive event recorder parameters including distance and speed.

The exported data have a sampling rate of 1 hertz (one data sample per second); therefore, the data have a precision of 1 second. Only data relevant to this event are provided in this report.

1.1 Parameters

In appendix A, tables 1 and 2 list the parameters verified and provided in this report for CP 8882 and KCSM 4535, respectively. Additionally in appendix A, table 3 contains the unit and discrete state abbreviations for the parameters.

1.1.1 Distance Traveled

The default output for the distance traveled is the distance decreasing in time.

¹ In this report, the lead locomotive Canadian Pacific 8882 is referenced as CP 8882 and the rear DPU Kansas City Southern de Mexico 4535 is referenced as KCSM 4535.

1.1.2 CP 8882’s Emerg EIE, Horn, and PCS Parameters

As stated in section 1.0, the event recorder data were exported with a sampling rate of one sample per second. However, the following three parameters recorded by CP 8882 record a space when off and record a one when true/active: Emergency Engineer Initiated Emergency (Emerg EIE), Horn, and Pneumatic Control Switch (PCS). Additionally, the data for these three parameters were exported in text to indicate tenths of a second by using a combination of spaces and ones. For example, with zeros represented by spaces, the data 0100111100 indicates the parameter was active in the following tenths of a second: 0.1, 0.4, 0.5, 0.6, and 0.7. Additionally, data recorded as 1111111111 indicates the parameter is active for the entire second and data recorded as 0000000000 indicates the parameter is not active for the entire second.

Specifically, at 3:36:51 CDT, PCS recorded 0011111111; thus, indicating PCS became active at 3:36:51.2 CDT. PCS remained active until 3:40:14.1 CDT when it recorded 1100000000.

At 3:36:58 CDT, Emerg EIE recorded 1111111111; thus, indicating Emerg EIE became active at 3:36:58.0 CDT. Emerg EIE remained active until 3:40:13.8 CDT when it recorded 1111111110.

In this report and in the tabular data, if Horn, PCS or Emerg EIE were active during a second, the data is displayed as On for the entire second. Additionally, if Horn, PCS or Emerg EIE were not active for the entire second, then the data is displayed as Off for the entire second.

1.1.3 KCSM 4535’s Throttle Position Parameter

Throughout the recording, KCSM 4535’s throttle parameter intermittently recorded invalid data. Since an event recorder is not required for non-lead locomotives, the data was left as recorded in the plots and tabular data.

1.2 Recorded Timing

For both locomotives, the data were recorded in coordinated universal time (UTC). The timing was adjusted to local time, CDT, by subtracting 5 hours. Therefore, the times used in this report are expressed as CDT.

D. FIGURES AND TABULAR DATA

Figures 1 to 4 contain locomotive event recorder data from CP 8882 and KCSM 4535 recorded during the event on July 5, 2024. All the parameters listed in tables 1 and 2 are plotted except Feet Traveled.

Figures 1 and 3 show movement from 0224 CDT to 0358 CDT. Figures 2 and 4 show movement from 0328 CDT to 0339 CDT.

The event recorder data from CP 8882 indicated the following:

- At 3:36:50 CDT, both the Enhanced Air Brake Emergency (EAB Emergency) and the Emergency Train Line Emergency (Emerg TLE) transitioned from No to Yes while the speed was 44.6 miles per hour (mph). At this time, the brake pipe pressure (Brake Pipe Press) decreased from 89 pounds per square inch (psi) to 61 psi.
- At 3:36:51.2 CDT, the PCS transitioned from Off to On. Additionally, the Brake Pipe Press decreased to 2 psi and a second later decreased further to 0 psi. The speed remained unchanged.
- At 3:36:57 CDT, the Brake Handle changed from Release to Service Zone. At this time, the speed decreased to 39.4 mph.
- At 3:36:58.0 CDT, the Emerg EIE transitioned from Off to On. Additionally, at 3:36:58 CDT, the Brake Handle changed to Emergency, the speed decreased to 38.6 mph, and the Emerg TLE transitioned back to No and remained No for the remainder of the data.
- From 3:37:00 CDT to 3:37:46 CDT, the Dynamic Brake Notch (DB Notch) changed from Off to Setup to Dynamic Brake 1 (DB1) to Dynamic Brake 1 (DB2) and then to Off. During this time at 3:37:38 CDT, the speed reduced to 0 mph.
- At 3:37:57 CDT, the EAB Emergency transitioned to No and remained No for the remainder of the data.
- At 3:40:13.8 CDT, the Emerg EIE transitioned back to Off and remained Off for the remainder of the data.
- At 3:40:14.1 CDT, the PCS transitioned to Off and remained Off for the remainder of the data.

The corresponding tabular data used to create figures 1 and 2, including Feet Traveled, are provided in electronic comma-separated value (CSV) format as attachment 1 to this report. Additionally, the corresponding tabular data used to create figures 3 and 4, including Feet Traveled, are provided in CSV format as attachment 2 to this report.

Submitted by:

Cassandra Johnson
Mechanical Engineer, Recorder Specialist

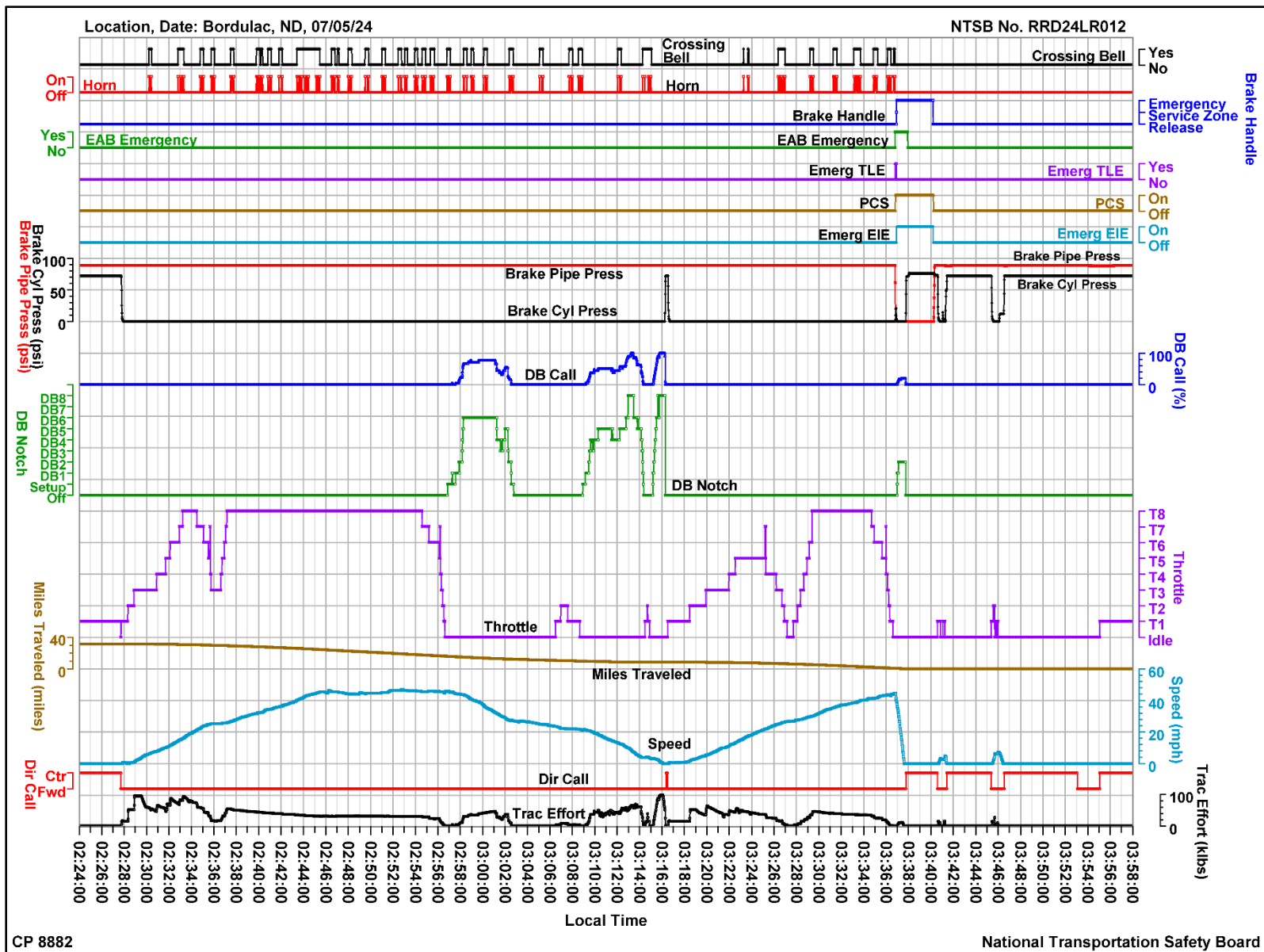


Figure 1. CP 8882's locomotive event recorder parameters (0224 CDT to 0358 CDT).

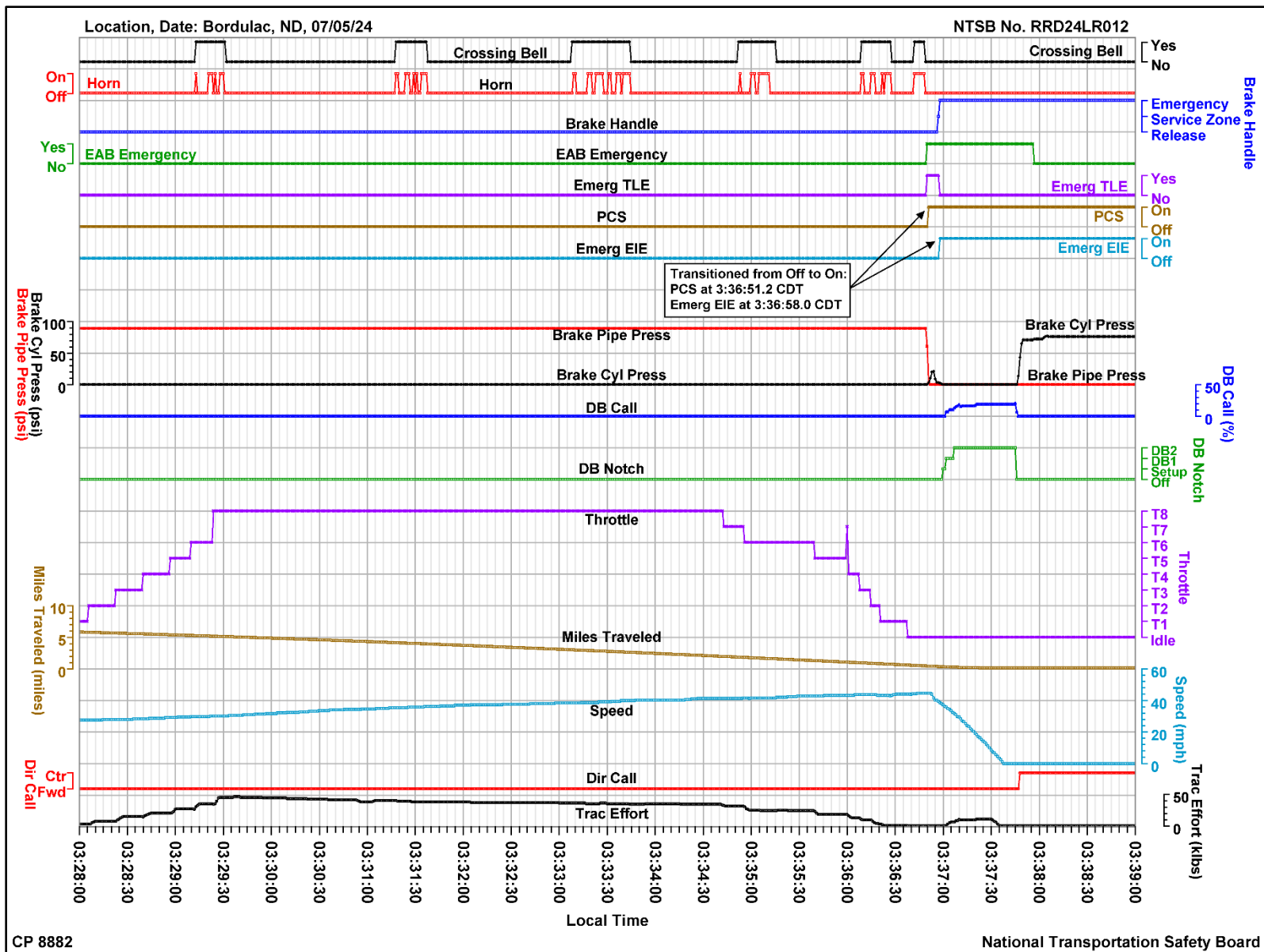


Figure 2. CP 8882's locomotive event recorder parameters (0328 CDT to 0339 CDT).

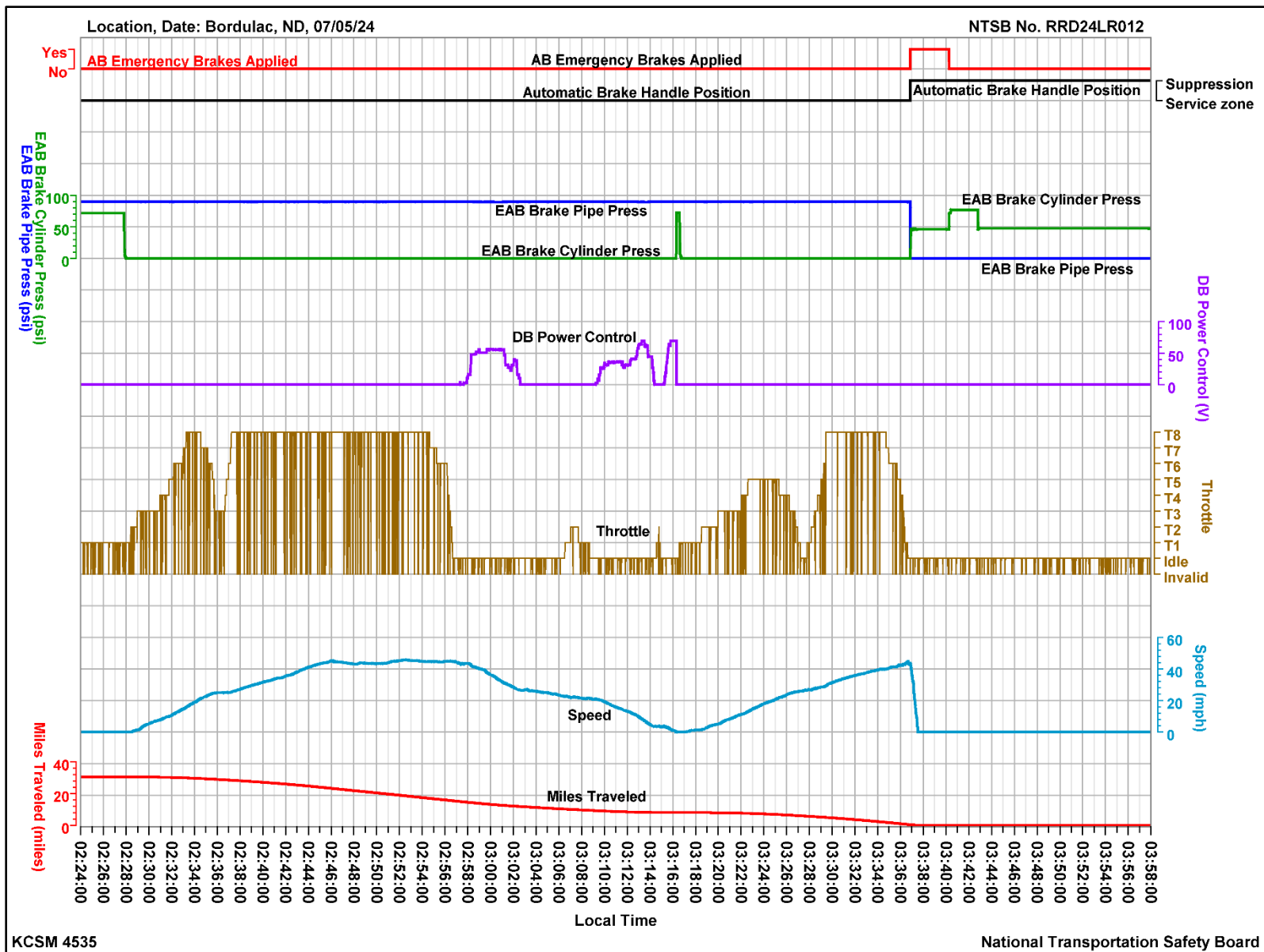


Figure 3. KCSM 4535's locomotive event recorder parameters (0224 CDT to 0358 CDT).

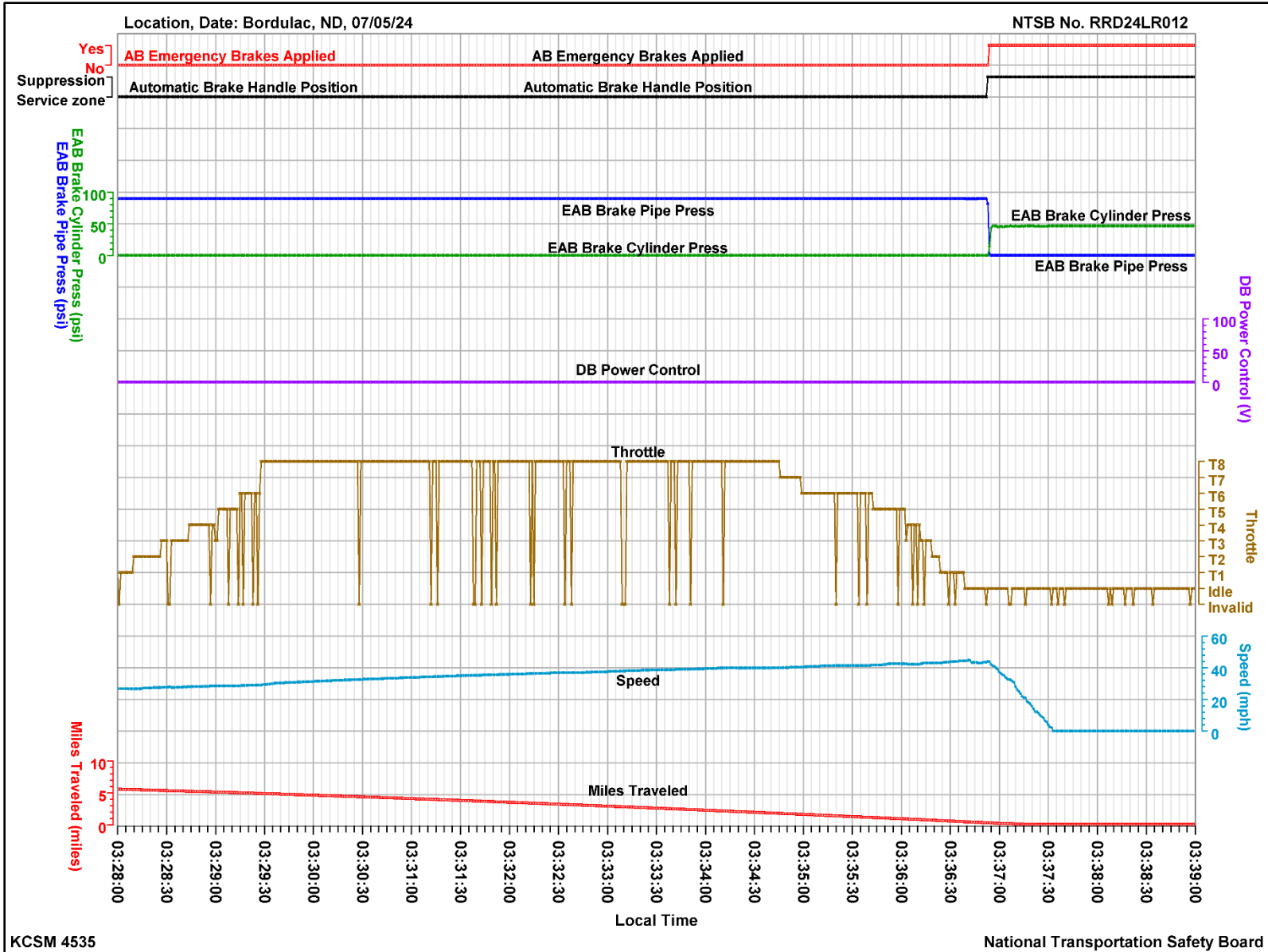


Figure 4. KCSM 4535's locomotive event recorder parameters (0328 CDT to 0339 CDT).

APPENDIX A. VERIFIED AND PROVIDED PARAMETERS

This appendix describes the locomotive event recorder parameters provided and verified in this report for CP 8882 and KCSM 4535. Tables 1 and 2 list the parameters, parameter descriptions, and units for CP 8882 and KCSM 4535, respectively. In tables 1 and 2, parameters with a blank unit description are discretely. 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. Additionally, table 3 contains the unit and discrete state abbreviations for the parameters.

Table 1. Verified and provided locomotive event recorder parameters for CP 8882.

Parameter	Parameter Description	Unit
Brake Cyl Press	Brake Cylinder Pressure	psi
Brake Handle	Brake Handle Position	
Brake Pipe Press	Brake Pipe Pressure	psi
Crossing Bell	Crossing Bell	
DB Call	Dynamic Brake Effort	%
DB Notch	Dynamic Brake Notch	
Dir Call	Direction of Travel	
EAB Emergency	Electronic Air Brake Emergency	
Emerg EIE	Emergency Engineer Initiated Emergency	
Emerg TLE	Emergency Train Line Emergency	
Feet Traveled	Feet Traveled	ft
Horn	Horn	
Miles Traveled	Miles Traveled	miles
PCS	Pneumatic Control Switch	
Speed	Speed	mph
Throttle	Throttle Position	
Trac Effort	Tractive Effort	klbs

Table 2. Verified and provided locomotive event recorder parameters for KCSM 4535.

Parameter	Parameter Description	Unit
AB Emergency Brakes Applied	Automatic Brake Emergency Brakes Applied	
Automatic Brake Handle Position	Automatic Brake Handle Position	
DB Power Control	Dynamic Brake Power Control	V
EAB Brake Cylinder Press	Electronic Air Brake - Brake Cylinder Pressure	psi
EAB Brake Pipe Press	Electronic Air Brake - Brake Pipe Pressure	psi
Feet Traveled	Feet Traveled	ft
Miles Traveled	Miles Traveled	miles
Speed	Speed	mph
Throttle	Throttle Position	

Table 3. Unit and discrete state abbreviations.

Unit and Discrete State Abbreviation	Description
Ctr	Center
DB1	Dynamic Brake 1
DB2	Dynamic Brake 2
DB3	Dynamic Brake 3
DB4	Dynamic Brake 4
DB5	Dynamic Brake 5
DB6	Dynamic Brake 6
DB7	Dynamic Brake 7
DB8	Dynamic Brake 8
ft	feet
Fwd	Forward
klbs	kilo pounds
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
V	Volts