

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



RRD23FR014

EVENT RECORDER

Specialist's Factual Report

April 9, 2024

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A. ACCIDENT

Location: Philadelphia, Pennsylvania
Date: July 27, 2023
Time: 2218 eastern daylight time (EDT)
Train: Southeastern Pennsylvania Transportation Authority (SEPTA)
Trolley 9107

B. EVENT RECORDER SPECIALIST

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

C. DETAILS OF THE INVESTIGATION

An event recorder group was not convened. The NTSB Vehicle Recorder Division received an event recorder file from trolley 9107.

1.0 Recording Description

The event recorder data was provided in electronic comma-separated value (CSV) format. Only data relevant to this event are provided in this report.

2.0 Parameters

In Appendix A, table 1 lists the parameters verified and provided in this report for trolley 9107. Additionally, table 2 contains the unit abbreviations for the parameters.

2.1 Brake Cylinder Pressure

The brake cylinder pressure parameter received data from the brake cylinder pressure transducer even though the air brakes were cut out.¹

2.2 Brake Pedal Status

The brake pedal status parameter received data from the front control panel's foot pedal. When the foot pedal is pressed, the brake pedal status is on.

¹ For more details, refer to NTSB's Group Factual Report in the docket.

2.3 BRK-Signal

The data recorded from the BRK-signal parameter was measuring the operator's requested brake rate for a normal service application.

2.4 Emergency Status

The emergency status parameter is activated by pushing and holding the brake pedal past the detent at the end of the maximum brake range, or by pushing the red console emergency stop button.

2.5 P-Signal

The data recorded from the P-signal parameter was based on the power controller pedal and the brake controller pedal and varies from 20 milliamperes (mA) to 100 mA depending on the foot pedal position during normal braking application. The following three states are defined by the P-signal ranges:

- Full Power = 100 mA to 102.5mA
- Coast or Door Interlock Bypass Switch = 58 mA to 62.5 mA
- Full-Service Brake= 19.5 mA to 20 mA

2.6 Track Brake Status

The track brake status parameter is activated when the track brake is applied. This application can occur from many inputs: brake pedal, rear controller handle, emergency button or the track brake toggle switch.

3.0 Time Correlation

The recorded times from trolley 9107 is manually set during maintenance and the time is maintained by a battery. Therefore, the recorded times may not reflect the actual time of day.

Correlation of the recorded time to local time, EDT, was established by aligning the collision time of 22:20:09 EDT from the Video Files Specialist's Factual Report as the following: EDT = Recorded Time - 187.35 seconds.²

D. FIGURES AND TABULAR DATA

Figures 1 and 2 contain the event recorder data from trolley 9107 recorded during the event on July 27, 2023. All the parameters listed in table 1 are plotted. The

² For more details, refer to NTSB's Video Files Specialist's Factual Report in the docket.

P-Signal ranges that define the full power state, the coast or door interlock bypass switch state, and the full-service brake state are annotated on each figure. Additionally, figure 2 has annotated information to highlight pertinent events in the data.

In summary, the data recorded 1 minute and 24.95 seconds of data for the event on July 27, 2023. During this time, the speed started at 1.09 miles per hour (mph) and increased to a maximum of 18.21 mph at the end of the data. About 13 seconds after the data started and lasting about 25 seconds, the brake signal (BRK-signal) increased from 0 mA and settled to about 98 mA eight times. During this time, the speed started at 1.48 mph and increased to 2.97 mph. About 7.3 seconds later, there was a brake pedal application (Brake pedal status changed from off to on) lasting 9.4 seconds. During this time, the brake cylinder pressure increased from about 0 pounds per square inch (psi) to about 65 psi, the speed increased to 6.64 mph, and a full-service brake application occurred. About 30 seconds later at 20:20:09 EDT, the data ended while at a speed of 18.21 mph.

The corresponding tabular data used to create figures 1 and 2 are provided in CSV format as attachment 1 to this report.

Submitted by:

Cassandra Johnson
Mechanical Engineer

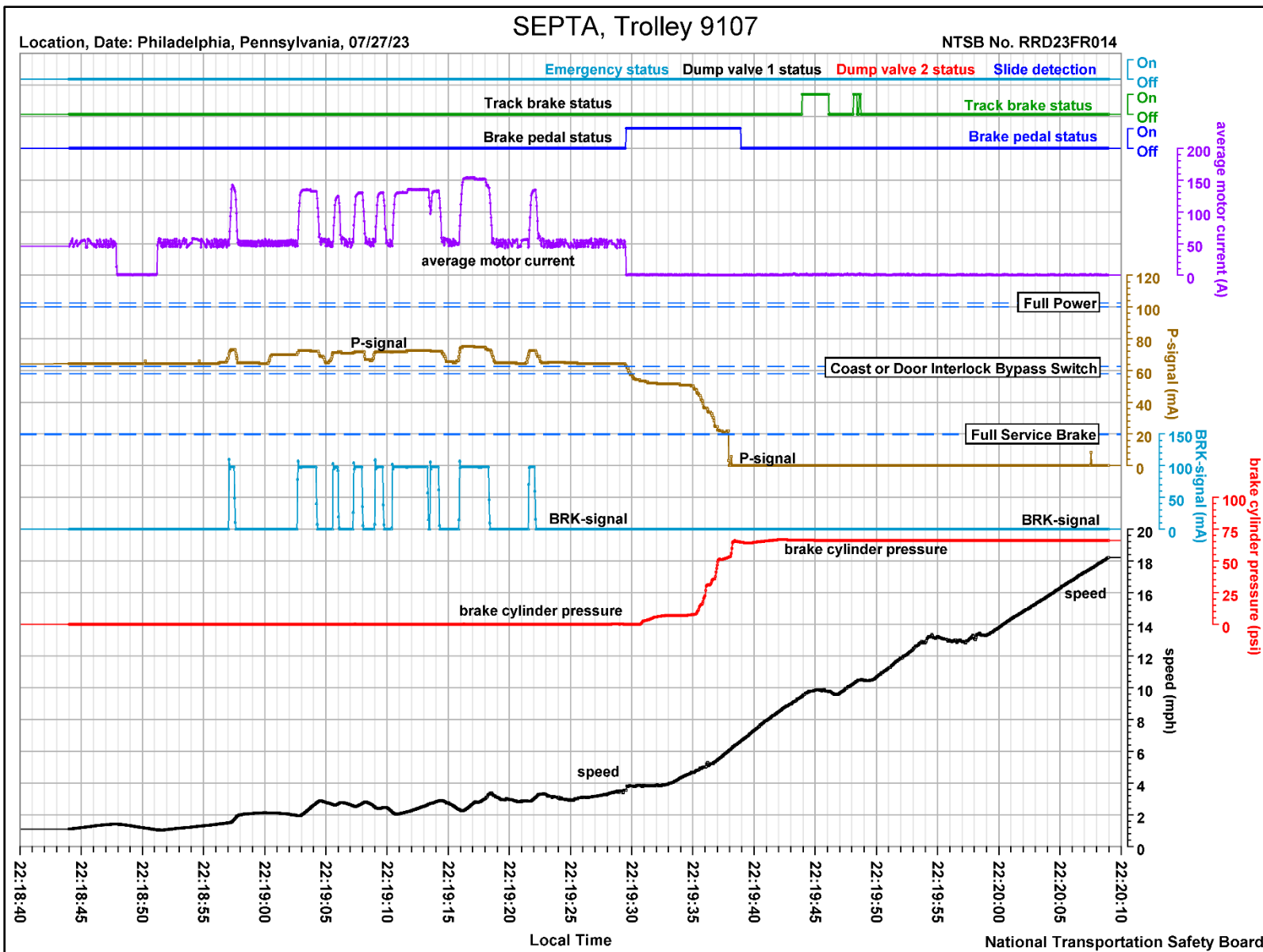


Figure 1. Trolley 9107's recorder data from 22:18:44.05 EDT to the end of the data at 22:20:09 EDT.

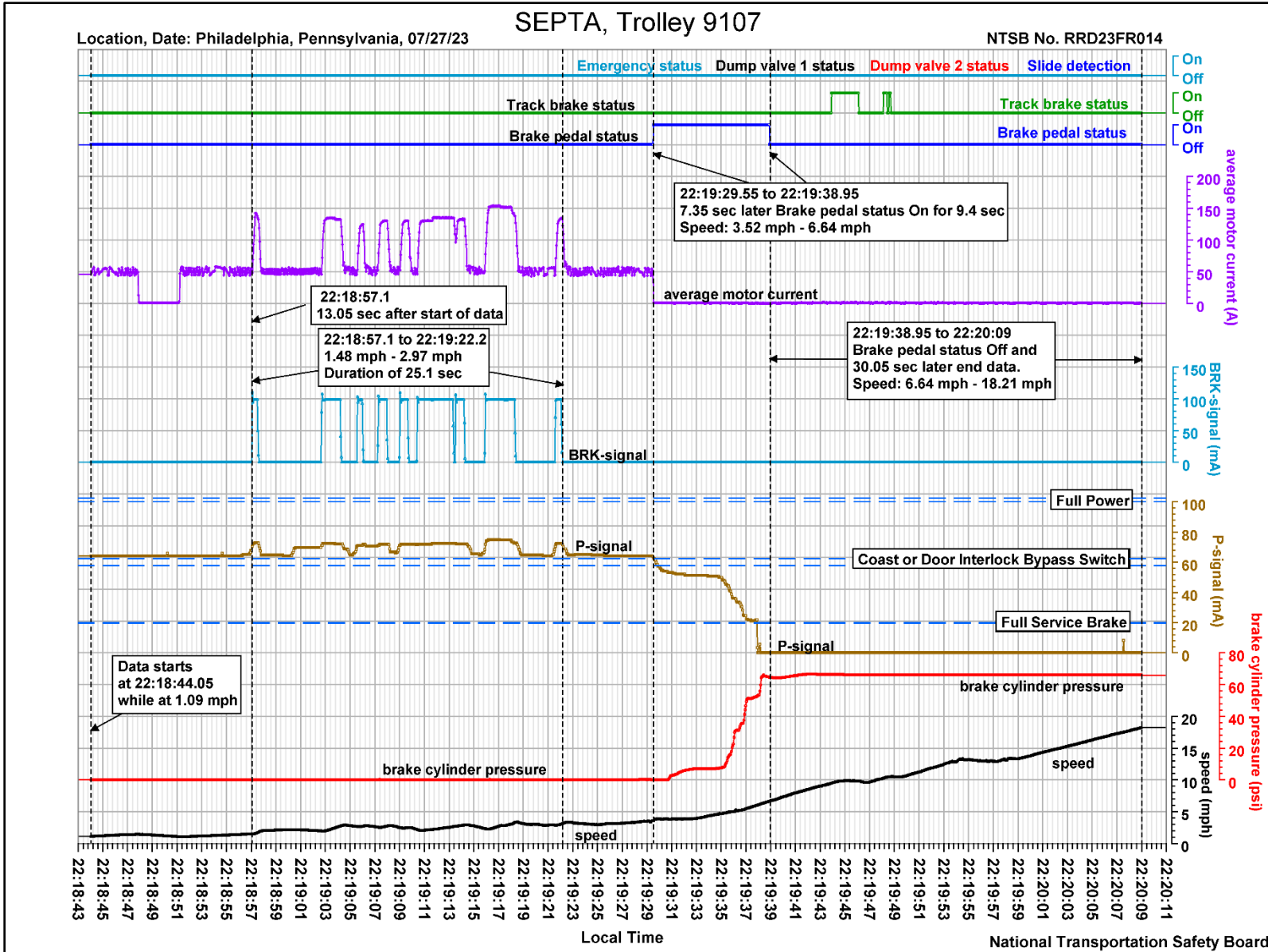


Figure 2. Trolley 9107's recorder data from 22:18:44.05 EDT to the end of the data at 22:20:09 EDT with pertinent events annotated.

APPENDIX A. VERIFIED AND PROVIDED PARAMETERS

This appendix describes the locomotive event recorder parameters provided and verified in this report for trolley 9107. Table 1 lists the parameters, parameter descriptions, and units. Table 2 contains the unit abbreviations for the parameters.

Table 1. Verified and provided locomotive event recorder parameters for trolley 9107.

Parameter	Parameter Description	Unit
average motor current	Average motor current for 2 traction motors per truck	A
brake cylinder pressure	brake cylinder pressure transducer	psi
Brake pedal status	Brake pedal application	
BRK-Signal	Brake pedal activation	mA
Dump valve 1 status	Dump valve 1 status	
Dump valve 2 status	Dump valve 2 status	
Emergency status	Emergency brake pedal application	
P-signal	Power pedal activation	mA
Slide detection	Wheel slide detection	
speed	vehicle speed	mph
Track brake status	Track brake application	

Note: Parameters with a blank unit description in table 1 are discretetes. 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.

Table 2. Unit abbreviations.

Unit Abbreviation	Description
A	amperes
mA	milliamperes
mph	miles per hour
psi	pounds per square inch