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

April 30, 2018

Locomotive Event Recorder – Ancillary Data

Specialist's Factual Report
By Cassandra Johnson

1. EVENT SUMMARY

Location:	Graettinger, Iowa
Date:	March 10, 2017
Company:	Union Pacific
Locomotive:	UP8376 (2nd locomotive)
Locomotive:	UP8037 (distributed power unit located at the end of the train consist)
NTSB Number:	DCA17MR007
Summary:	Refer to the Accident Summary report, within this docket.

2. DETAILS OF LOCOMOTIVE EVENT RECORDER ANCILLARY DATA

In support of the investigation, the National Transportation Safety Board (NTSB) Vehicle Recorder Division received locomotive event recorder data files from UP8376 and UP8037. UP8376 was the second locomotive in the train consist (located behind UP5666, the lead locomotive). UP8037 was the distributed power unit (DPU) located at the end of the train consist.

3. Locomotive Event Recorders Recording Description

Using the wheel size of 42.40 inches for UP8376 and 40.80 inches for UP8037 as provided by investigators, the locomotive event recorder data were extracted using the Wabtec Railway Electronics Event Recorder Data Analysis Software. The software outputted the locomotive event recorder parameters including distance and speed. The exported data have a sampling rate of one second; therefore, the data has an accuracy of +/- 1 second. Only the data relevant to this event are provided in this report.

3.1. Event Recorder Timing

The recorded times from UP8376's locomotive event recorder data and from UP8037's locomotive event recorder data are independently time stamped and, consequently, the times may not reflect the actual time of day.

Using UP5666[1] (lead locomotive) as the time base, select locomotive event recorder parameters from UP5666, UP8376, and UP8037 were plotted. To align the three sets of data, 21,599.5 seconds was subtracted from UP8376's event recorder time and 45

[1] For more information regarding UP5666's locomotive event recorder, refer to the Locomotive Event Recorder Specialist's Factual Report located within this docket.

seconds was subtracted from UP8037's event recorder time. (See figures 1 and 2.) Therefore, the event recorder times for UP8367 and UP8037 are provided in central standard time (CST).

Figure 1. Locomotive event recorder data overlay for time alignment (1.5 hours).

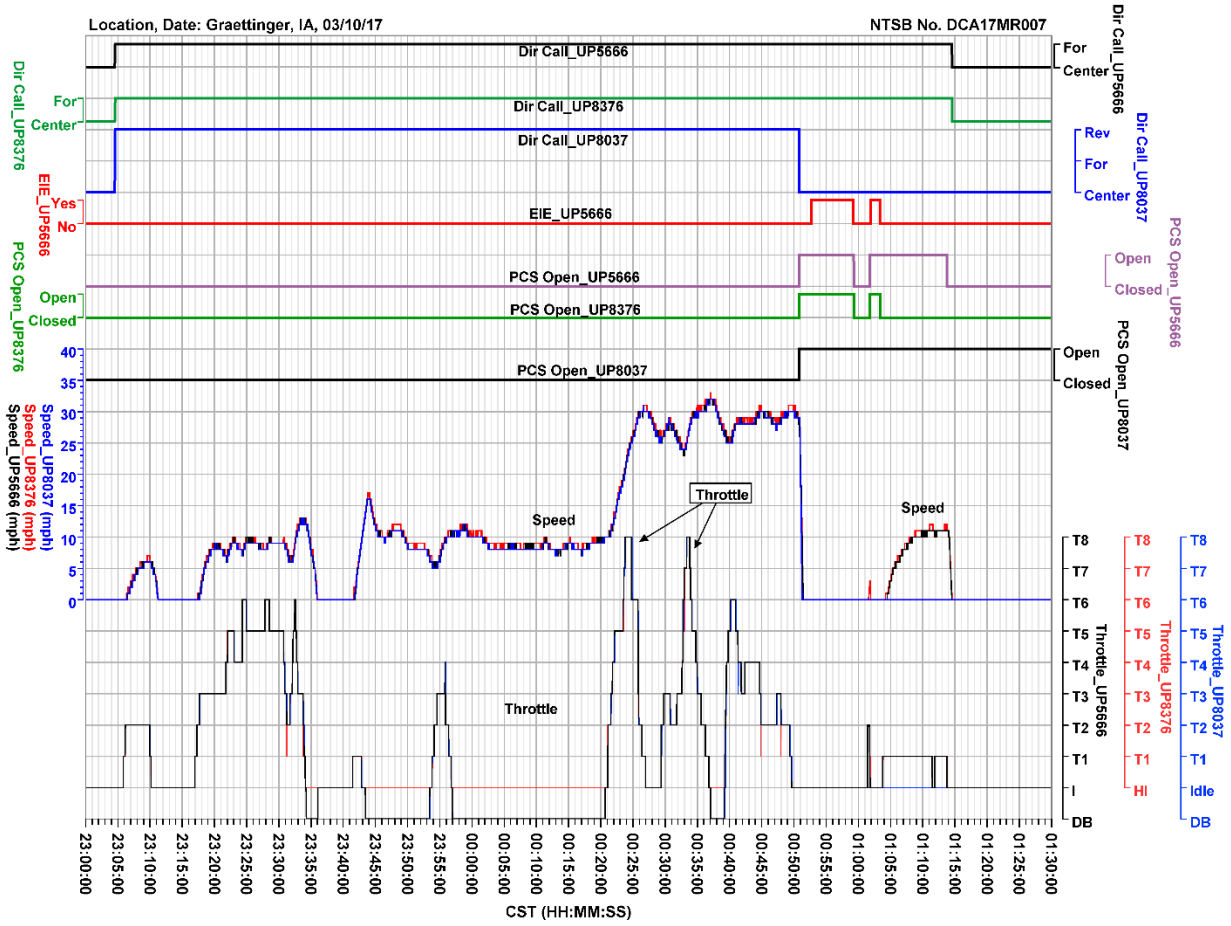
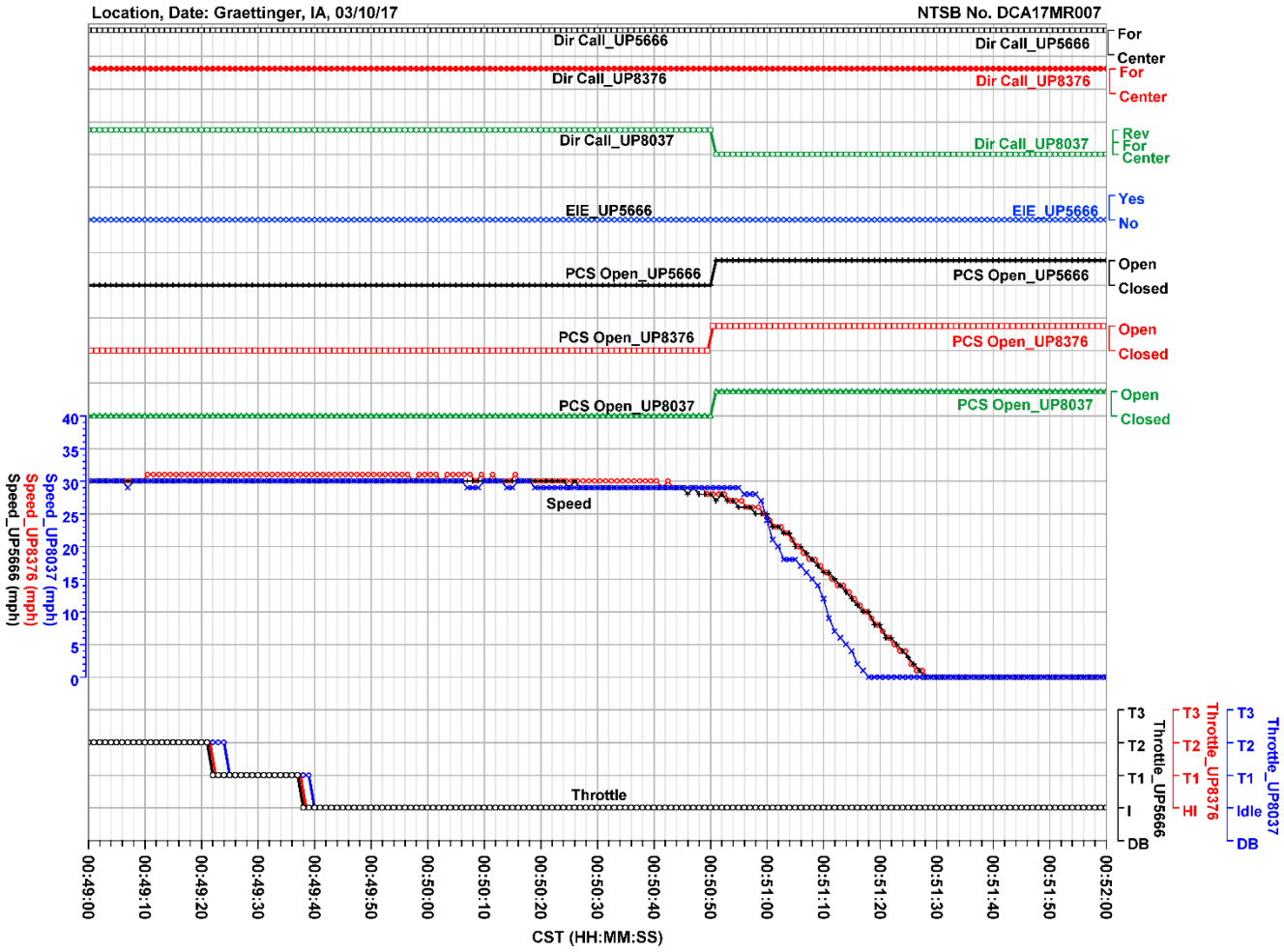


Figure 2. Locomotive event recorder data overlay for time alignment (3 minutes).



3.2. Parameters

Tables 1 and 2 lists the parameters verified and provided in this report for UP8367 and UP8037, respectively. Parameters with a blank unit description 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. Table 3 contains the unit and discrete state abbreviations for the parameters.

Table 1. Verified and provided locomotive event recorder parameters for UP8367.

Parameter Name	Parameter Description	Unit
Auto Sand_UP8376	Automatic Sanding	
DB Excit_UP8376	Dynamic Brake Excitation	
DB Only_UP8376	Dynamic Brake Only	
DB Setup_UP8376	Dynamic Brake Setup	
DB Warning_UP8376	Dynamic Brake Warning	

Parameter Name	Parameter Description	Unit
Dir Call_UP8376	Direction of Travel	
Dist per Update_UP8376	Distance per Update	ft
Dynamic Brake Cut-In_UP8376	Dynamic Brake Cutin	
EAB Bail_UP8376	Electronic Air Brake - Bail	
EAB BC_UP8376	Electronic Air Brake - Brake Cylinder Pressure	psi
EAB BP_UP8376	Electronic Air Brake - Brake Pipe Pressure	psi
EAB Handle Release_UP8376	Electronic Air Brake - Handle Release	
EAB Ind Handle_UP8376	Electronic Air Brake - Independent Handle	
Emer Brake Appl_UP8376	Emergency Brake Application	
Feet Traveled_UP8376	Feet Traveled	ft
GPS Latitude_UP8376	GPS Latitude Position	deg
GPS Longitude_UP8376	GPS Longitude Position	deg
IPS_UP8376	Independent Pressure Switch	
Isolated_UP8376	Isolated	
Local WS_UP8376	Local Wheel Slip	
Manual Sand_UP8376	Manual Sand	
Miles Traveled_UP8376	Miles Traveled	miles
Overspeed Enabled_UP8376	Overspeed Enabled	
PCS Open_UP8376	Pneumatic Control Switch	
Run_UP8376	Run	
Speed_UP8376	Speed	mph
Throttle_UP8376	Throttle Position	
Trac Effort_UP8376	Traction Effort	klbs
Wheel Slip_UP8376	Wheel Slip	

Table 2. Verified and provided locomotive event recorder parameters for UP8037.

Parameter Name	Parameter Description	Unit
Air Flow_UP8037	Air flow	cfm
DB Call_UP8037	Dynamic Brake Handle Position	%
DB Setup_UP8037	Dynamic Brake Setup	
DB Start_UP8037	Dynamic Brake Start	
Dir Call_UP8037	Direction of Travel	
EAB BC_UP8037	Electronic Air Brake - Brake Cylinder Pressure	psi
EAB BP_UP8037	Electronic Air Brake - Brake Pipe Pressure	psi
EAB Brake Handle_UP8037	Electronic Air Brake - Brake Handle	
EAB Brake Setup_UP8037	Electronic Air Brake - Brake Setup	
EAB ER_UP8037	Electronic Air Brake - Equalizing Reservoir	psi
EAB IBS_UP8037	Electronic Air Brake - Independent Brake System	
Emergency Brake_UP8037	Emergency Brake	

Parameter Name	Parameter Description	Unit
Ft Traveled_UP8037	Feet Traveled	ft
MC Handle_UP8037	Master Control Handle	
Miles Traveled_UP8037	Miles Traveled	miles
PCS Open_UP8037	Pneumatic Control Switch Open	
Speed_UP8037	Speed	mph
Throttle_UP8037	Throttle Position	
TLEM_UP8037	Train Line Emergency	
Trac Effort_UP8037	Traction Effort	klbs

Table 3. Unit and discrete state abbreviations.

Units Abbreviation	Description
Appl	Applied
B1	Brake Position 1
B2	Brake Position 2
B3	Brake Position 3
B4	Brake Position 4
B5	Brake Position 5
B6	Brake Position 6
B7	Brake Position 7
B8	Brake Position 8
C/O	Cutout
cfm	cubic feet per minute
DB	Dynamic Brake
deg	degrees
For	Forward
Frt	Freight
ft	feet
HI	High Idle
klbs	kilo pounds
LCO	Lead Cutout
mph	miles per hour
psi	pounds per square inch
Rel	Release
Rev	Reverse
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

3.3. Tabular Data

The tabular data for UP8367 for all the parameters listed in table 1 from 23:00:00 CST (March 9, 2017) to 01:30:00 CST (March 10, 2017) are provided in electronic comma separated value (*.csv) format as attachment 1 to this factual report. Additionally, the tabular data for UP8037 for all the parameters listed in table 2 for the same time range are provided in electronic comma separated value (*.csv) format as attachment 2 to this factual report.