DCA08MR009

Metrolink and Union Pacific
Collision
Chatsworth, California
September 12, 2008

Union Pacific Event Recorder Factual Report

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

February 18, 2009

Union Pacific Event Recorder Factual Report

Specialist's Factual Report
By Cassandra Johnson

1. EVENT SUMMARY

Location: Chatsworth, CA
Date: September 12, 2008
Company: Union Pacific
Train: Union Pacific Train LOF65-12
NTSB Number: DCA08MR009

At about 4:23 p.m. Pacific Daylight Time on September 12, 2008, a Southern California Regional Rail Authority (Metrolink) passenger train collided head-on with a Union Pacific Railroad freight train in Chatsworth, California.

2. EVENT RECORDER GROUP

An event recorder group was not convened.

3. DETAILS OF RECORDER INVESTIGATION

Union Pacific Train LOF65-12 had a lead locomotive, #8495, and a second locomotive, #8491, each equipped with an onboard event recorder. Typically, these event recorders are the crew control module and are downloaded while installed in the locomotive and with the locomotive operating. Since the lead locomotive was severely damaged, on-scene investigators were unable to download the lead locomotive's recorder. Therefore, Safety Board Staff had the lead locomotive's crew control module sent to the Safety Board's Vehicle Recorder Division for downloading. However, the second locomotive was not damaged and on-scene investigators successfully downloaded the second locomotive's event recorder and saved the event recorder data to a CD.

In addition to the crew control module, the lead locomotive had another onboard recorder. It was a Bach-Simpson recorder model CHM500 with the serial number 200601006 (see Figure 1) which is a crash hardened recorder. However, the recorder was intentionally inoperative at the time of the accident because Union Pacific was performing tests, therefore, no data was recorded.

On September 16, 2008, the Safety Board's Vehicle Recorder Division received the lead locomotive's event recorder (see Figure 1) and a CD containing downloaded data from the second locomotive's event recorder. On a later date, the Safety Board's Vehicle Recorder Division received the lead locomotive's crew control module serial number 510A-0441 (see Figure 2).

Figure 1: Lead Locomotive's Event Recorder (inoperative at time of event)

Figure 2: Lead Locomotive's Crew Control Module

3.1. Recording Description

On September 29, 2008, representatives from EMD came to the Safety Board's Vehicle Recorder Division's laboratory and assisted in successfully downloading the event recorder data from the lead locomotive's crew control module.

Next, the downloaded event recorder data from both locomotives were converted to engineering units by utilizing the Wabtec Railways Electronics Event Recorder Data Analysis Version 3.9.4.2. Subsequently, all 5.0 hours of data recorded on September 12, 2008 from the lead locomotive and all 7.5 hours of data recorded on September 12, 2008 from the second locomotive were exported for further analysis. Only the pertinent data related to this accident are provided in this report.

3.2. Parameters Provided and Verified

The following table lists all of the parameters provided and verified in this report where 1UP indicates the lead locomotive's parameters and 2UP indicates the second locomotive's parameters.

Table 1: Union Pacific Event Recorder Parameters

Parameter Name	Parameter Description
1. Auto Brk_1UP (psi)	Auto Brake_1UP (pounds per square inch)
2. Auto Brk_2UP (psi)	Auto Brake_2UP (pounds per square inch)
3. Bell_1UP	Bell_1UP (discrete[1])
4. Bell_2UP	Bell_2UP (discrete)
5. Dynamic Brake_1UP	Dynamic Brake_1UP (discrete)
6. Dynamic Brake_2UP	Dynamic Brake_2UP (discrete)
7. EIE_1UP	Engineer Initiated Effort Emergency_1UP (discrete)
8. EIE_2UP	Engineer Initiated Effort Emergency_2UP (discrete)
9. Emer Brake_1UP	Emergency Brake_1UP (discrete)
10. Emer Brake_2UP	Emergency Brake_2UP (discrete)

[1] (discrete) indicates that the parameter has no units because the parameter is a discrete. A discrete is typically defined by 1-bit that can be either a 0 state or 1 state where each state is provided a definition. For example, for Bell, a 0 state equals "Off" and a 1 state equals "On".

Table 1: Union Pacific Event Recorder Parameters	
Parameter Name	**Parameter Description**
11. Horn_1UP	Horn_1UP (discrete)
12. Horn_2UP	Horn_2UP (discrete)
13. Ind Brk_1UP (psi)	Independent Brake_1UP (pounds per square inch)
14. Ind Brk_2UP (psi)	Independent Brake_2UP (pounds per square inch)
15. PCS_1UP	Pneumatic Control Switch_1UP (discrete)
16. PCS_2UP	Pneumatic Control Switch_2UP (discrete)
17. Speed_1UP (mph)	Speed_1UP (miles per hour)
18. Speed_2UP (mph)	Speed_2UP (miles per hour)
19. TE_1UP (klbs)	Traction Effort_1UP (kilo-pounds)
20. TE_2UP (klbs)	Traction Effort_2UP (kilo-pounds)
21. Throttle_1UP	Throttle_1UP (discrete)
22. Throttle_2UP	Throttle_2UP (discrete)
23. Total Miles_1UP (miles)	Total Miles_1UP (miles)
24. Total Miles_2UP (miles)	Total Miles_2UP (miles)
25. Latitude_1UP	Latitude_1UP (discrete)
26. Longitude_1UP	Longitude_1UP (discrete)
27. Latitude_2UP (deg)	Latitude_2UP (degrees)
28. Longitude_2UP (deg)	Longitude_2UP (degrees)

3.2.1. Speed and Distance

The Wabtec program provided distance traveled and speed. For most event recorders, the actual speed and distance values are typically not recorded. At the time the data is read out, a wheel size is usually entered into the readout station or computer. However, for these recorders, the wheel size was stored within the recorder data; therefore, the wheel size did not need to be manually entered into the Wabtec program. The Wabtec program indicated the lead locomotive's wheel size was 42.48 inches and the second locomotive's wheel size was 42.79 inches.

3.3. Event Recorder Timing Correlation

Each locomotive was equipped with a Global Positioning System (GPS) receiver which was used to time stamp the event recorder data. Each event recorder operates independently and samples data once per second. Therefore, common events on each event recorder may not be sampled by both recorders at precisely the same time. To provide a common time base, it was decided to correlate the Union Pacific event recorders to the Union Pacific lead locomotive's video recorder[2] data which was referenced to GPS time and, therefore, local time (Pacific Daylight Time).

3.3.1. Lead Locomotive Timing Correlation Details

As mentioned above, it was decided to correlate the Union Pacific locomotive event recorder data to the Union Pacific lead locomotive's video recorder data. Since the Union Pacific lead locomotive's video recorder was located on the Union Pacific lead locomotive, then both sets of data are already synchronized to each other but the video recorder had a better resolution. Therefore, the last recorded time on the lead locomotive's event recorder

[2] Refer to the National Transportation Safety Board's On Board Video Recording Factual Report.

should equal the impact time according to the Union Pacific lead locomotive's video recorder. The last recorded lead locomotive's event recorder time was 23:22:23 HH:MM:SS (or 84,143 seconds) Coordinated Universal Time (UTC) which is 7 hours ahead of Chatsworth, California's local time. The impact time according to the Union Pacific lead locomotive's video recorder time was 16:22:23.3 HH:MM:SS (or 58,943.3 seconds) local time. Therefore, the correlation is the Union Pacific lead locomotive's video recorder time of 58,943.3 equals the Union Pacific lead locomotive's event recorder time of 84,143 minus 25,199.7 seconds (Union Pacific Video Time = Union Pacific Lead Locomotive's Event Recorder Time - 25,199.7 seconds).

3.3.2. Second Locomotive Timing Correlation Details

Additionally, the Union Pacific second locomotive's event recorder time needed to be correlated to the Union Pacific lead locomotive's video recorder time. First, the lead locomotive's event recorder data needed to be aligned to the second locomotive's event recorder data. This was accomplished by aligning the two sets of throttle position data and the traction effort data from both recorders by adding 25,198 seconds to the second locomotive's recorder event data. This offset is very large because the second locomotive's event recorder data was recorded in local time, whereas, the lead locomotive's event recorder data was recorded in UTC. Therefore, when this difference is accounted for, the actual offset is only 2 seconds. Thus, the correlation is the lead locomotive's event recorder time equals the second locomotive's event recorder time plus 25,198 seconds (Union Pacific Lead Locomotive's Event Recorder Time = Union Pacific Second Locomotive's Event Recorder Time + 25,198 seconds).

Next, the Union Pacific second locomotive's event recorder time needed to be correlated to the Union Pacific lead locomotive's video recorder time. Using the correlation between the Union Pacific lead locomotive's event recorder time and the Union Pacific second locomotive's event recorder time and the correlation between the Union Pacific lead locomotive's video recorder time and the Union Pacific lead locomotive's event recorder time, the Union Pacific lead locomotive's video recorder time equals the second locomotive's event recorder time minus 1.7 seconds (Union Pacific Video Time = Union Pacific Second Locomotive's Event Recorder Time - 1.7).

3.3.3. Timing Correlation Summary

In summary, the below time offsets were applied to the Union Pacific lead locomotive's event recorder data and to the Union Pacific second locomotive's event recorder data when these two sets of data were correlated to each other and also correlated to the impact time according to the Union Pacific lead locomotive's video recorder time of 16:22:23.3 HH:MM:SS local time (Pacific Daylight Time).

- Union Pacific Video Time = Union Pacific Lead Locomotive Time - 25,199.7 seconds.
- Union Pacific Video Time = Union Pacific Second Locomotive Time - 1.7 seconds.

Therefore, all of the times in this report are referenced as local time (Pacific Daylight Time).

3.4. Plots

The three plots provided at the end of this report contain the Union Pacific event recorder data recorded on September 12, 2008 from 16:05:30 HH:MM:SS local time to 16:23:00 HH:MM:SS local time. This time covers from the last movement of the train until the end of the lead locomotive's event recorder data. Plot 1 contains the locomotive's event recorder parameters listed in Table 1 except for the Latitude_1UP and Longitude_1UP parameters. Plot 2 contains the Union Pacific second locomotive's event recorder parameters listed in Table 1 except for Latitude_2UP and Longitude_2UP parameters. Lastly, Plot 3 contains all of the parameters plotted in Plots 1 and 2.

3.5. Tabular Data

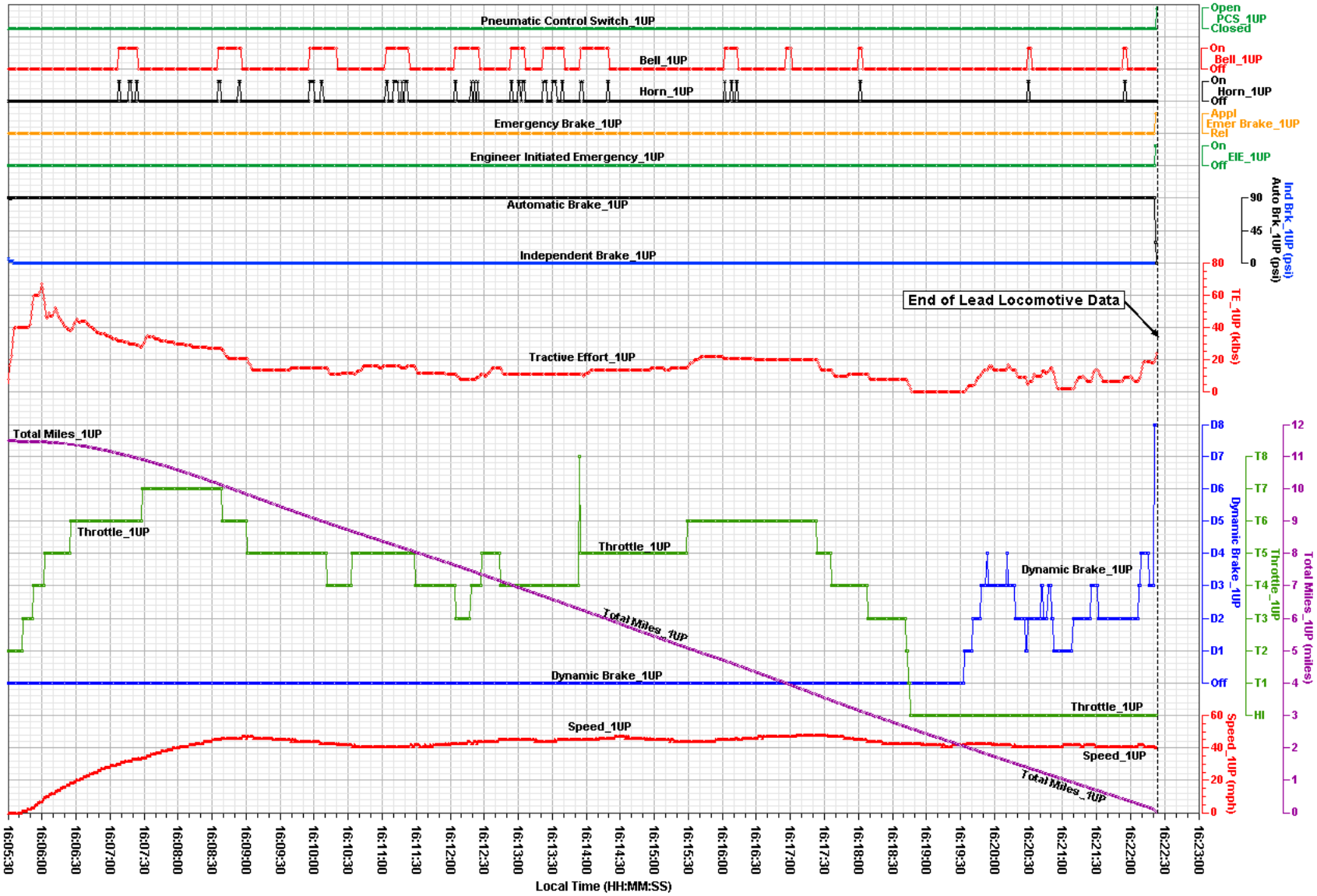
All of the corresponding tabular data used to create Plots 1, 2, and 3 including Latitude_1UP, Longitude_1UP, Latitude_2UP, and Longitude_2UP are provided in electronic (.CSV) format as Attachment 1 to this report. All of the times in this attachment are local time.

Plot 1 Union Pacific Lead Locomotive Unit #8495

Union Pacific, Lead Locomotive (From last movement until end of recording)

Location, Date: Chatsworth, California, 09/12/08

NTSB No. DCA08MR009

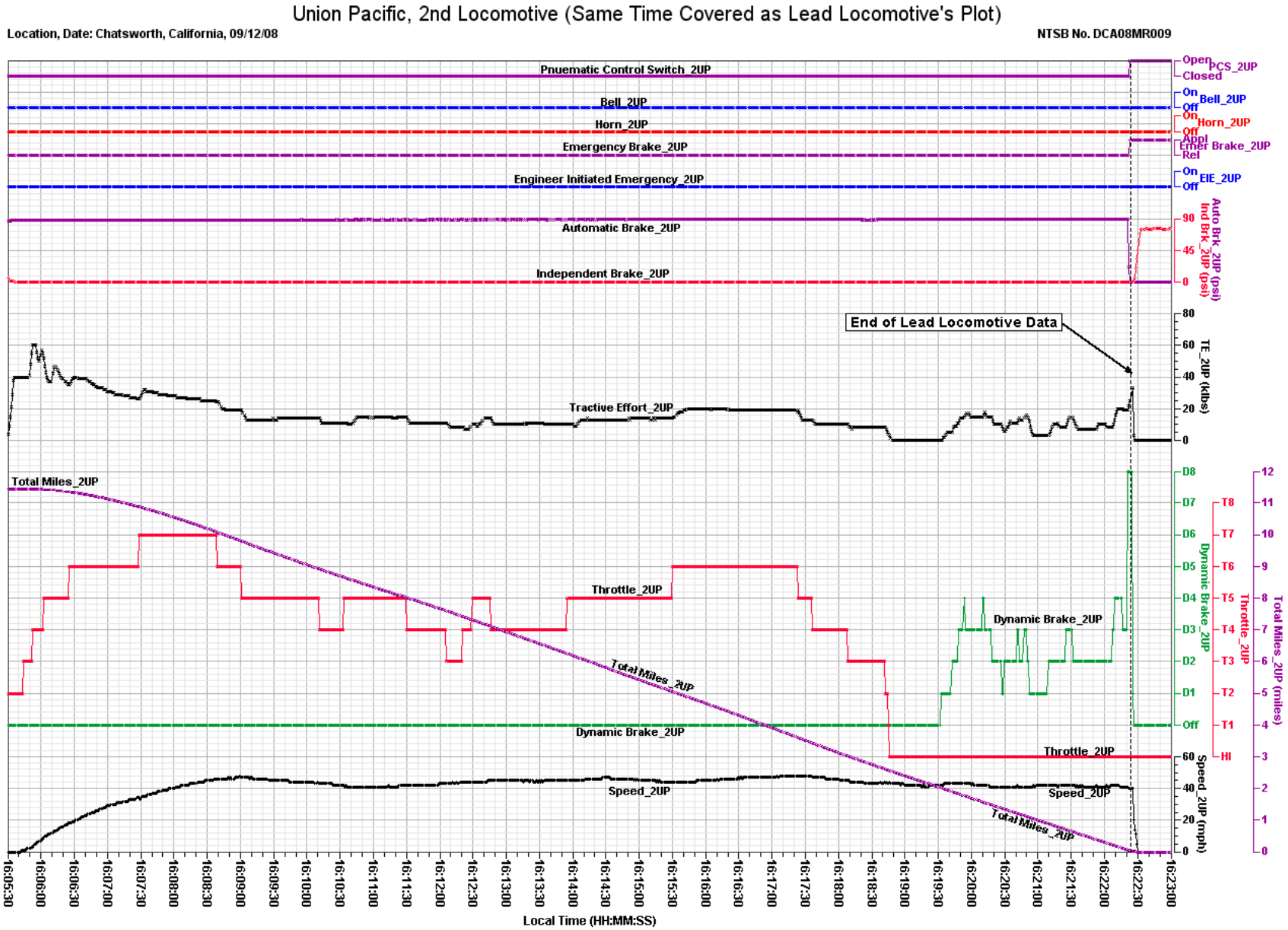
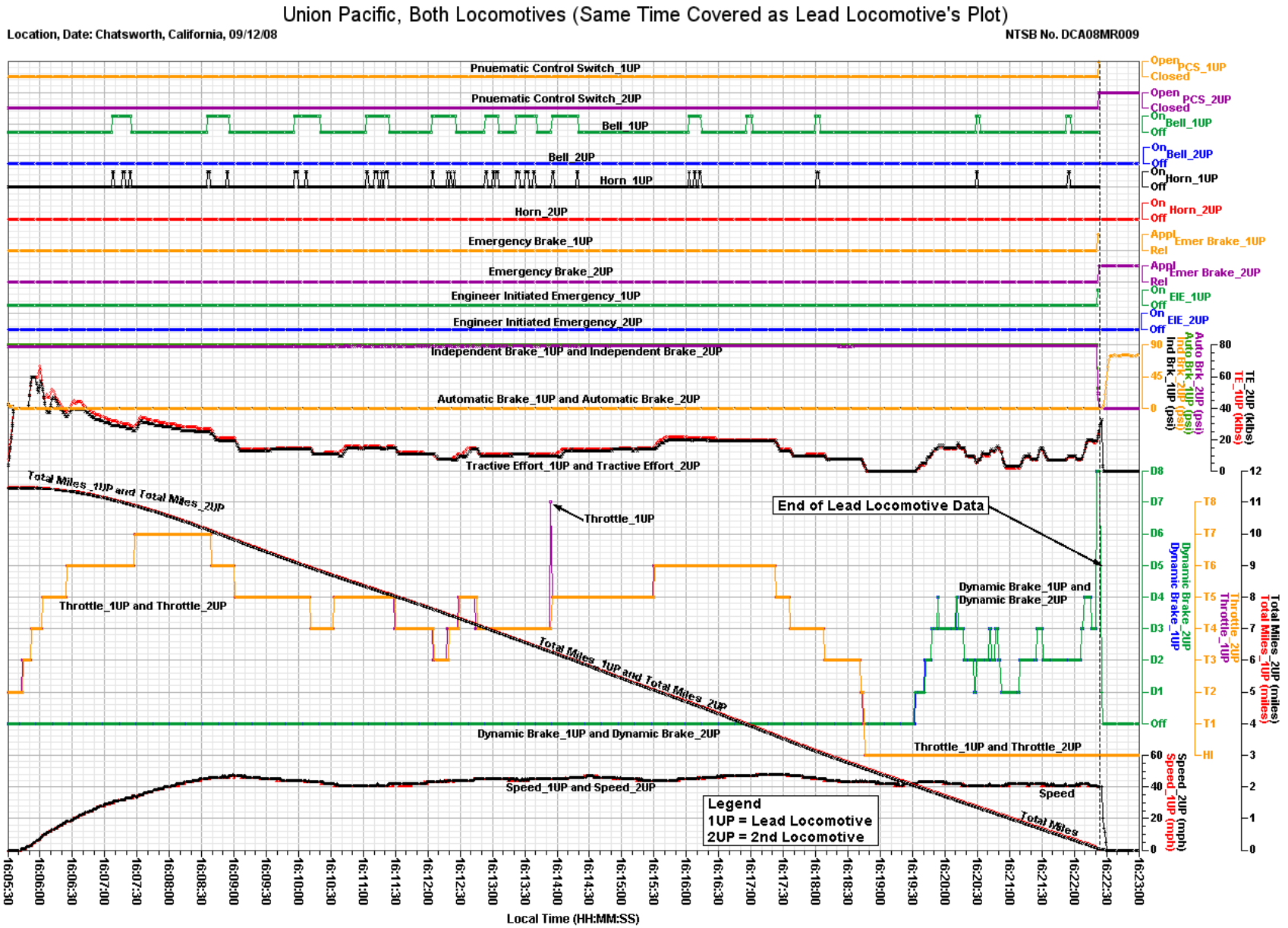


Revised: 8 December 2008

UP 1Lead Plot1

National Transportation Safety Board

Plot 2 Union Pacific 2nd Locomotive Unit #8491



Plot 3 Both Union Pacific Locomotives