

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division

Washington, D.C. 20594

May 26, 2020

Event Data Recorder

Specialist's Factual Report

By Kyle Garner

1. EVENT SUMMARY

Location: Mount Pleasant Township, Pennsylvania
Date: January 5, 2020
Vehicle: 2018 Freightliner Cascadia Semi-truck with 2019 Hyundai Semitrailer
Operator: FedEx Ground
NTSB Number: HWY20MH002

For a summary of the event, refer to the *Crash Summary Report* which is available in the docket for this investigation.

2. EVENT DATA RECORDER GROUP

An event data recorder group was not convened.

3. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following electronic files:

Recorder Manufacturer/Model: **Lytx DriveCam Data Files**

Recorder Serial Number: **Unknown**

3.1. Lytx DriveCam Description

The Lytx DriveCam is a driver monitoring and recording device mounted on a vehicle's windshield that continually tracks driving performance metrics and records pertinent information when triggered by critical events, such as stability control or hard braking. The Lytx DriveCam has both an outward and inward-facing camera, an integrated omnidirectional microphone, a 9-axis accelerometer (accelerometer, gyroscope, and magnetometer), built-in motion sensor, and built-in GPS. As an option, the unit can record parameters (speed, fuel, vehicle data) from the vehicle's engine control monitor (ECM).

The DriveCam continuously records video at a resolution of 752 x 548 pixels at 10 frames per second (fps) and stores it to the device's 64GB internal memory. Unlike video, audio and parametric data are only stored to the device's internal memory when a lateral or longitudinal acceleration threshold is exceeded, referred to as an event by the manufacturer. For this device, the event threshold was a 0.6 g longitudinal or a 0.6 g lateral g-force.

Singular event records are approximately 12 seconds long, beginning at 8 seconds before the event and continuing for 4 seconds after the event. If multiple events occur within the 12 second recording period, the device creates additional data files to record at minimum 4 seconds of parametric data following the last event.

Data from the accelerometer and gyroscope are sampled at 104 Hz, while data from the GPS are sampled at 2 Hz. The speed parameter recorded by the DriveCam is derived from GPS position data. The coordinate system used by the DriveCam is x for forward/aft vehicle motion, y for left/right vehicle motion, and z for up/down vehicle motion.

3.1.1. Recording Description

This report covers only the parametric data captured on the device. For image and audio data, refer to the Onboard Image Recorder Factual Report available in the public docket for this event.

A total of six comma-separated values (.csv) files were provided to the Vehicle Recorder Division by the camera manufacturer, Lytx. Each file name, size, and duration are provided in Table 1.

Table 1. Files provided by the camera manufacturer.

Name	Size	Duration (sec)
DYMK44562.accel	91 KB	11.83
DYMK44562.gps	3 KB	11.5
DYMK44562.gyro	98 KB	11.83
DYMK44560.accel	37 KB	4.83
DYMK44560.gps	2 KB	5.0
DYMK44560.gyro	40 KB	4.83

The three files with prefix DYMK44562 were the data files created for the first event, the forward impact of the semi-truck with the motorcoach, and were approximately 12 seconds in duration. The three files with prefix DYMK44560 were the additional data files created for the second event, the rear impact of another semi-truck with the semi-truck that had the DriveCam installed, and were approximately 5 seconds in duration.

The ECM recording function was not enabled by the operator on this DriveCam installation.

3.2. Time Correlation

Time in this report is expressed as elapsed event recorder time, which is the internal system time used to timestamp the data points beginning approximately 8 seconds before the first event.

3.3. Plots and Tabular Data

Table 2 describes the parameters extracted from the DriveCam data files. Additionally, Table 3 describes the unit abbreviations used in this report.

Table 2. Parameters extracted from the device.

Parameter Name	Parameter Description	Parameter Units
accel_x	Longitudinal Acceleration	g
accel_y	Lateral Acceleration	g
accel_z	Vertical Acceleration	g
Date	Date for recorded data point	MM/DD/YYYY
gyro_x	Angular velocity – x-direction	deg/sec
gyro_y	Angular velocity – y-direction	deg/sec
gyro_z	Angular Velocity – z-direction	deg/sec
Latitude	Latitude	deg
Longitude	Longitude	deg
Speed	GPS Derived Ground Speed	mph
Time	Event Recorder Time	sec

Table 3. Unit abbreviations.

Unit abbreviations	Descriptions
deg	degrees
mph	miles per hour
sec	seconds

Figure 1 is a plot showing acceleration and angular velocity in all three axes for the duration of the event recording. GPS derived ground speed is also shown on the plot for reference.

During the first event, the forward impact of the semi-truck with the motorcoach, longitudinal acceleration varied between -2.6 g and 0.6 g, lateral acceleration varied between -0.2 g and 0.4 g, and vertical acceleration varied between -1.2 g and 0.9 g. During the second event, the rear impact of another semi-truck with the semi-truck that had the DriveCam installed, longitudinal acceleration varied between 2.2 g and -0.6 g, lateral acceleration varied between -1.0 g and 2.3 g, and vertical acceleration varied between -0.8 and 1.4 g.

Figure 2 is a map overlay created in Google Earth of the GPS data extracted from the DriveCam. The GPS derived speed for the first data point and the last data point are also shown for reference. Weather, atmospheric conditions, and vehicular traffic in the overlay are not representative of conditions at the time of the event.

The corresponding tabular data used to create Figures 1 and 2 are provided in compressed electronic comma-separated value (*.csv) format as Attachment 1 to this report.

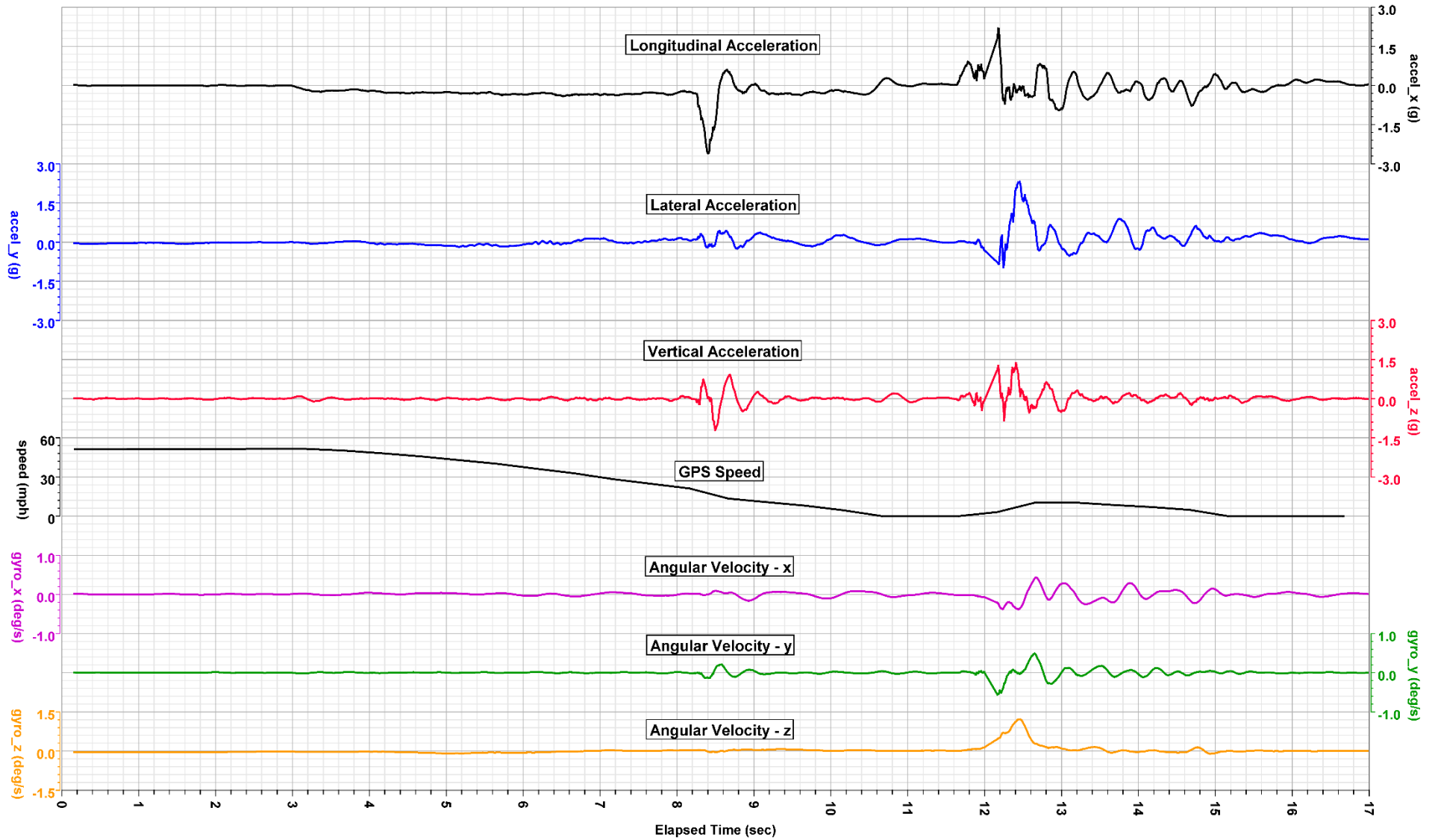


Figure 1. Acceleration, angular velocity, and GPS derived speed data recorded during event.



Figure 2. GPS data recorded during event.