NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Washington, D.C. 20594

May 30, 2017

Video Study

NTSB Case Number:
HWY17MH005

A. ACCIDENT

Location:	Palm Springs, California
Date:	October 23, 2016
Time:	5:16 a.m. PDT
Vehicle:	1996 MCI motorcoach

B. AUTHOR

Dan T. Horak
NTSB

C. ACCIDENT SUMMARY

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

D. DETAILS OF INVESTIGATION

The goal of this investigation was estimating the speed of the motorcoach shortly before it impacted a semitrailer that was stopped in the second lane due to road utility work. Two security cameras installed on a FedEx facility south of the highway recorded the motorcoach for several seconds each as it passed through their fields of view.

The two cameras were identified in the security system as “NE Mid Yard” and “West Yard South.” The accident occurred before sunrise and the cameras were located about 700 feet south of the highway on which the motorcoach was traveling. Consequently, the visibility of the motorcoach and of reference location that could be used for speed estimation were poor. The West Yard South camera provided better visibility and it was used in this study for speed estimation.

The frame rate of the West Yard South video was 7.5 fps. It provided video frames that were useful for motorcoach speed estimation for a period of about three seconds. The motorcoach impacted the semitrailer about 12 seconds after the three second period ended, assuming that the motorcoach continued traveling at the speed estimated during the three-second period.

Speed estimation was based on locating the video frames where the motorcoach was along the same line of sight from the camera as an identifiable reference point. An identifiable reference point was one visible both in a video frame and in a Google Earth aerial image. Google Earth Street View was used for confirming that the reference points visible in the aerial image were those visible in video frames. The lines of sight from the camera were extended to the highway lanes to allow pinpointing the location of the motorcoach along a lane. Since the video frame rate was known and constant, it was possible to assign a time to each location of the motorcoach along the highway. Having the locations and the times enabled the estimation of the speed of the motorcoach. The speed estimation process is described next.

Figure 1 shows an aerial view of the highway segment where speed estimation was performed as well the location of the West Yard South camera. The blue arrow indicates the direction of motion of the motorcoach. The seven yellow lines originating from the camera location are lines of sight passing through reference points. The reference points are marked a through f. These points included fence edges and light poles. Figure 2 shows a video frame on which reference point b is marked. It is the edge of a fence to which a metallic gate is attached. Figure 3 shows reference point b in Google Earth Street View.

The lines of sight in Figure 1 are extended through all the lanes of the highway. It is assumed that the motorcoach was traveling in the second lane when recorded by the West Yard South camera. Its left side would then be close to the lane line between the second and the third lanes. Therefore, motorcoach locations A through F are marked along this lane line.

The times when the front of the motorcoach was at locations A through F were determined by inspecting the video frames for alignment of the front of the motorcoach with reference points a through f. Figure 2 shows a frame where the motorcoach is approximately aligned with reference point b. Because of poor visibility, the motorcoach cannot be identified in a frame just by inspecting that one frame. However, by stepping through the video one frame at a time, the moving image of the motorcoach makes its identification in video frames possible.

Figure 4 shows a plot of the distances along the highway vs. the time when the motorcoach was at locations A through F. The distance at location A and the time at that location were both set to zero. The red line in Figure 4 is a least-squares fit to the raw data. It happens to be very close to the line connecting point A with point F. The slope of the least-squares line is 67.5 mph. To account for uncertainties involved in the speed estimation process, the estimated motorcoach speed is specified as 67.5±2 mph.

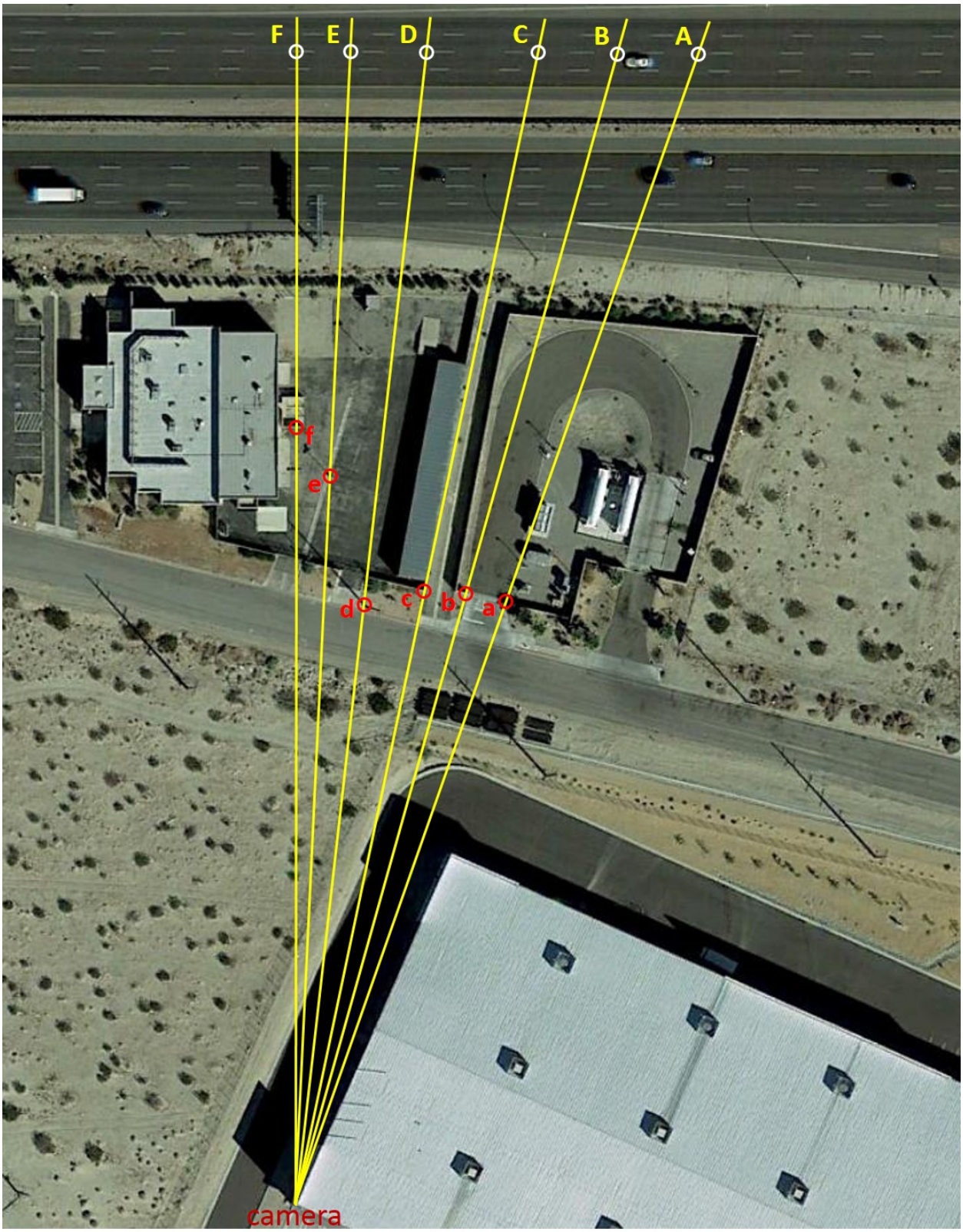

Figure 1. Aerial View of Highway Segment where Speed Was Estimated

Figure 2. Video Frame Showing Reference Point b and Motorcoach Location

Figure 3. Google Earth Street View Showing Reference Point b

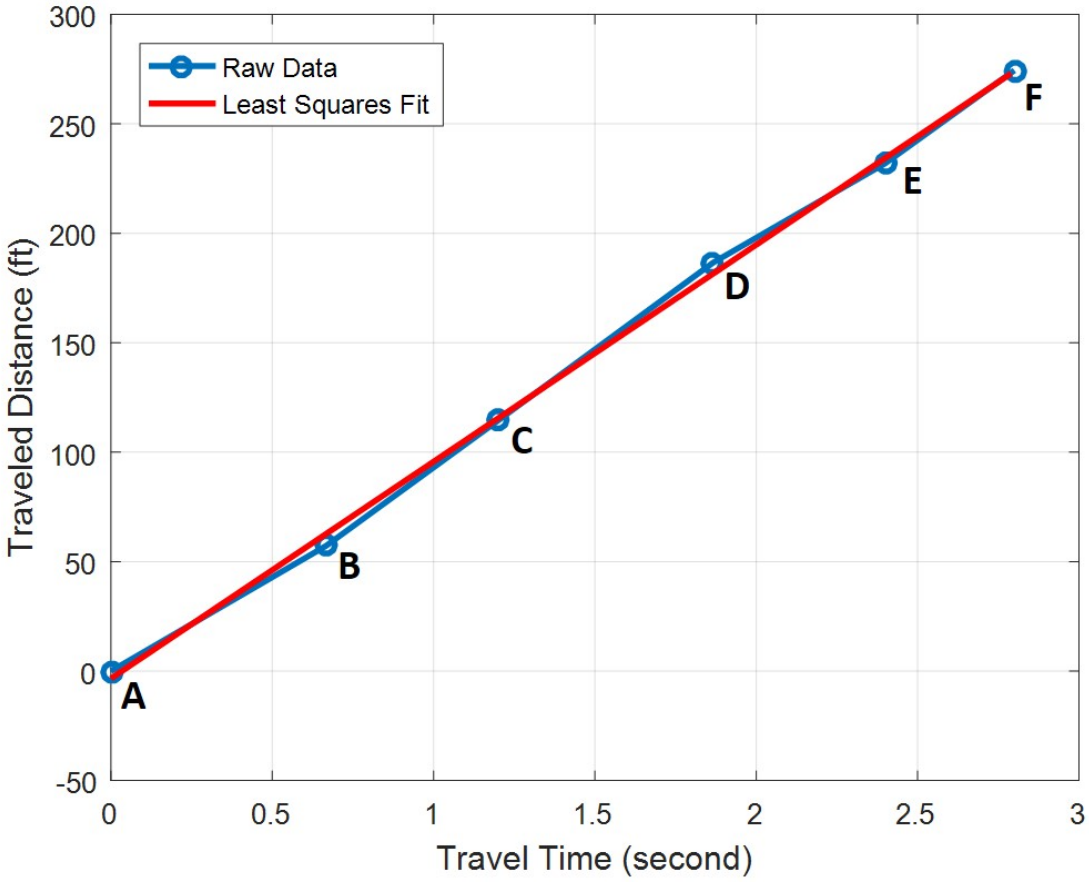

Figure 4. Distance Traveled by the Motorcoach vs. Time

The speed of 67.5±2 mph was estimated assuming that the motorcoach was traveling in the second lane. As seen in Figure 1, the estimated distances along the highway are longest if the motorcoach is assumed to be in the first lane, resulting in the highest possible speed estimate. If the motorcoach was traveling in the first lane, the speed estimate is 68.5±2 mph.

E. CONCLUSIONS

Video acquired by a security camera mounted on a building was used for estimating the speed of a motorcoach shortly before it impacted a semitrailer. The estimated speed was 67.5±2 mph, assuming the motorcoach was traveling in the second lane.