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

May 7, 2014

Video Study

NTSB Case Number:
HWY13MH012

A. ACCIDENT

Location:	Mount Vernon, Washington
Date:	May 23, 2013
Time:	7:05 PM PDT
Vehicle 1:	2010 Kenworth truck tractor and 1997 Aspen flatbed semitrailer, hauling an oversize load
Vehicle 2:	1997 Dodge Ram pickup truck, piloting the oversize load

B. AUTHOR

Dan T. Horak
NTSB

C. ACCIDENT SUMMARY

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

D. DETAILS OF INVESTIGATION

The accident truck tractor was recorded shortly before the accident by a camera mounted on a patrol car. The camera was pointed forward and recorded video with resolution of 720x480 at the rate of 30 frames per second. The truck was traveling south on Interstate 5 while the patrol car was traveling north at 70 mph. The vehicles were approximately 2.5 miles before the bridge when the accident truck is seen in the video for approximately 7.5 seconds. The piloting pickup truck is also visible in the video for part of this 7.5 seconds long period.

Figure 1 Frame from Patrol Car Video

The last 2.8 seconds of the 7.5 second period when the vehicles were visible were used for analysis. During this time, both vehicles were closest to the camera so that accurate estimation of truck tractor speed and following distance were possible. Figure 1 shows one of the video frames that were analyzed.

The analysis consisted of two stages. First, the location of the patrol car was estimated at eight times during the analyzed 2.8 seconds. This was done using a mathematical model of the camera that was capable of mapping reference points along the highway onto frames from the video. The reference points included highway signs, highway light poles, and points on solid and broken lane lines. Their geographical locations were derived from Google Earth images of the site. About fifty reference points were used, all clearly visible both in Google Earth and in the video.

The patrol car locations were then estimated in an iterative process that varied a simulated patrol car location until the mathematical model mapped the reference points to the pixel locations in the video frames where the reference points were. When the mapped reference point locations were aligned with their actual locations in a video frame, the simulated patrol car and camera had to be at the location where the real patrol car and camera were when that video frame was acquired.

The second stage of the analysis estimated the speed of the truck tractor and its following distance behind the piloting pickup truck (measured from the rear bumper of the pickup truck to the front bumper of the truck tractor). This was done by adding thirty additional reference points along the left side of the lane in which the truck tractor was traveling. These points were evenly spaced by 20 ft and their geographic locations were known. The truck locations at the eight times when the locations of the patrol car were known were then estimated by measuring the location of the truck in the video frame using the thirty evenly-spaced reference points, mapped onto the video frames, as a ruler.

Video frames corresponding to three of the eight known patrol car locations displayed both the truck tractor and the piloting pickup truck. Using the thirty evenly-spaced reference points as a ruler, the following distance of the truck tractor behind the pickup truck was then estimated.

E. CONCLUSIONS

The analysis described above yielded the following estimates.

Speed of the truck tractor, estimated over 2.8 seconds:	53 ± 2 mph
Following distance of truck tractor behind pickup truck:	395 ± 10 ft
Based on the above estimates, the following time was:	5.09 ± 0.32 seconds