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VEHICLE SAFETY

Analysis of Vehicle Motion Using Aerial Photography

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Obtaining Close-Range Aerial Photographs

In 1995, Triodyne engineers developed AIRMAP (Accident Investigation and Reconstruction Mapping using Aerial Photography), an efficient, cost-effective method of obtaining low-altitude aerial photographs[1;2] useful for mapping accident sites for vehicle accident reconstruction. AIRMAP field equipment consists of a tethered inflatable helium blimp (Fig. 1) which elevates a 35 mm camera above the site to altitudes of 100 to 1,000 feet. The camera is mounted to the belly of the blimp in such a way that it remains horizontal for obtaining vertical photographs. The resulting photographs have minimal perspective distortion allowing them to be scaled, similar to conventional maps. The scale is introduced by applying chalk marks at known distances directly on the roadway. The camera's shutter is activated by radio-controlled transmitter from the ground.

Figure 1 - AIRMAP

Documenting Vehicle Motion

A vehicle's motion can be documented with AIRMAP by taking a series of aerial photographs while the vehicle is driven through the camera's field of view. Locking the transmitter in the "Shoot" mode causes the camera to take photographs one second apart, thus displaying the position and orientation of the subject at one second intervals. Utilizing the photograph's scale, defined by chalk markings on the road, the distance traveled during each time interval can be measured from the photograph. Knowing distance traveled each second allows calculation of average vehicle speed.

Case Study

A tractor trailer traveling in one of two westbound lanes was rear-ended while turning right into a parking lot. According to the truck driver's testimony he had moved to his left such that half his rig was positioned in each lane prior to turning. The other driver testified that the truck had turned in front of him from the left lane. Following the accident, the right rear corner of the trailer was positioned on the line separating the two lanes.

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The path of a similar tractor trailer turning into the subject parking lot was documented using the "Shoot" mode of AIRMAP described above. In Figure 2 the truck is driven according to the truck driver's testimony. In Figure 3 it is driven according to the other driver's account. Figures 2 and 3 demonstrate how in a turn, the rear trailer wheels would track closer to the curb than the front tractor wheels. It is, therefore, impossible under the truck driver's senario for the right rear corner of the truck to come to rest on the lane line where it was found after the accident (see Figs 2C, 2D). Figure 3 demonstrates a turn from the left lane as described by the other driver. Figure 3C shows the right rear corner of the trailer in a position consistent with its location after the accident. Sideways positioning of the tractor trailer within the lanes was documented using chalk marks placed across the lanes 1 foot apart. Vehicle speed during the demonstration was determined using chalk marks placed 10 feet apart along the lanes and the one second intervals between consecutive photographs.

A

B

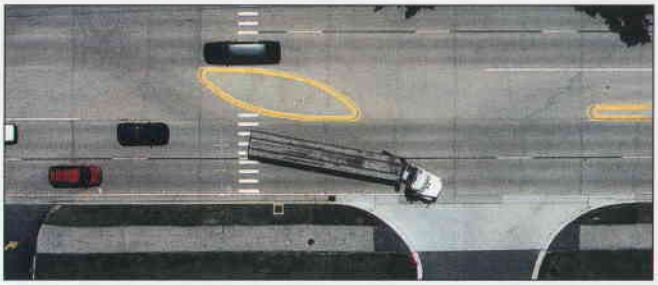
C

D

Figure 2

A

B



C

D

Figure 3

REFERENCES

[1] Michael A. Dilich and John M. Goebelbecker, "Accident Investigation and Reconstruction Mapping with Aerial Photography", SAE technical paper No. 960894.

[2] Michael A. Dilich and John M. Goebelbecker, "Accident Investigation and Reconstruction Mapping with Aerial Photography", U.S. Patent No. 5,628,033.