D49 3D Animation Applied to the Analysis of Pre-Impact Visibility Obscurement

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The goal of this presentation is to illustrate the need for careful analysis of potential sight-line obscurements. While aerial and ground-based 2D still photographs may carefully document the available evidence used in collision analysis, 3D animation of the moving interaction fully illustrates the lack of objects that were suggested to have blocked potential advance warning of an impending collision hazard.

This presentation will impact the forensic science community by highlighting the benefits of 3D animation when used as a tool to accurately and clearly demonstrate driver visibility and sight lines. This case study evaluates a utility truck driver's sight line in the moments before a tragic collision that killed an adolescent bicyclist.

Driver detection and perception of roadside hazards and subsequent collision avoidance maneuvers are commonly evaluated in traffic accident-cause analysis. Tragedy often strikes when a traffic collision involves small children on bicycles. Collisions can occur when children suddenly ride into the roadway from between parked vehicles, giving alert drivers little if any time to avoid impending disaster. Likewise, inattentive drivers may have limited resources available to avoid similar tragedy. Collision analysis uses physical evidence to assist in the determination of cause; however, only after thorough evaluation of the available information can a correct conclusion be made.

A telephone repair technician in search of a customer's residence was driving his utility truck in an alley. The alley provides access to trash collection services and apartment building tenant parking. It is not uncommon for children to play nearby. The technician proceeded south at what he estimates was approximately 1mph-2mph, his foot resting on the brake pedal. After passing a few vehicles parked to his right, he heard a sound at the right front of his truck. He rolled forward another 33ft, stopped, and checked his mirrors. In the right side mirror, he observed a bicycle on the ground behind his truck. The fatal victim was a 6-year old girl who had just started riding the bicycle not more than 125ft away.

Law enforcement personnel secured the alleyway, marked and photographed the physical evidence, including the bicycle, utility truck, pavement, parked vehicles, a small circular gouge to the pavement, a 4.75ft-long tire friction mark, corresponding rear bicycle tire abrasion, and a rub mark to the outer sidewall of the utility truck's right front tire. The investigators determined that the child was riding the bicycle on a path between two apartment buildings toward the alley. After entering the alley and applying the coaster brake that locked the bicycle's rear tire, the child continued forward another 14ft and struck the utility truck. The rub mark was caused by the bicycle's front tire where it impacted the utility truck. The child then fell to the ground where she was subsequently run over by the right rear dually tires. The investigators concluded the utility truck speed was not excessive nor was a collision factor, but that the child failed to yield the right-of-way to alley traffic.

Careful forensic analysis of the conditions in the alley was used to determine the time during which the child was visible before impact. The alley was measured with a total station. Using photographs, the location of the parked vehicles, point of impact, and the tire friction mark, the child's trajectory on the bicycle was modeled using 3D software. The child's height (4ft, 8in) was found in the coroner's report. The child's speed between buildings (9.5mph) was approximated with surrogate testing of a similar bicycle in the alley. Her speed at impact after skidding on gravel/asphalt was 7.9mph. Truck speeds of 6mph and 10mph were used. Based on a time-position history analysis of the truck and bicyclist, two impact scenarios were animated. Two camera views were modeled, one from the perspective of the driver inside the utility truck cab and another overhead view tracking the forward progress of the truck leading toward the impact. At a truck speed of 6mph, the bicyclist was in view of the technician for 2.2-2.4sec. At 6mph and using a 1.5sec perception/reaction time, the technician had sufficient time and distance to stop his truck and avoid impact. At a truck speed of 10mph, the bicyclist was in view of the technician for 1.8-2.0sec. At 10mph and using a 1.5sec perception/reaction time, the technician had sufficient time and distance to slow his truck to avoid running over the bicyclist.

The results of the collision analysis highlighted with 3D animation show with graphic clarity the lack of timely response by the truck driver, who in one scenario could have completely avoided the impact, while in the other, after the bicyclist struck his truck, could have braked in time to avoid running over her.

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