



COLLISIONS – MATCHING THE DAMAGE

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When vehicles collide, damage is created on one or both. The damage patterns indicate the vehicle's position relative to each other during the collision. A recent case involved a nighttime same direction collision on an interstate highway.



Fig. 1 Accident scene with the overturned tractor trailer and automobile

The passenger side of an automobile contacted the driver side tires of a tractor-trailer. As both vehicles veered off the roadway to the right, the tractor-trailer rolled over the top of the automobile fatally injuring the automobile driver.



Fig. 2 Accident scene shows the highway and the vehicles off the edge of the travel lanes

There was extensive damage on the hood and roof of the automobile from the tractor-trailer rolling over the top. There was also damage on the passenger side of the automobile consistent with contact with a truck tire at two locations.



Fig. 3 Accident scene showing the passenger side of the automobile

The contact locations were:

- (a) **passenger front fender and wheel**
- (b) **passenger rear fender**

The Highway Patrol special investigation team concluded that the truck moved left and collided with the automobile. The Highway Patrol depicted the initial collision as shown in Fig. 4.

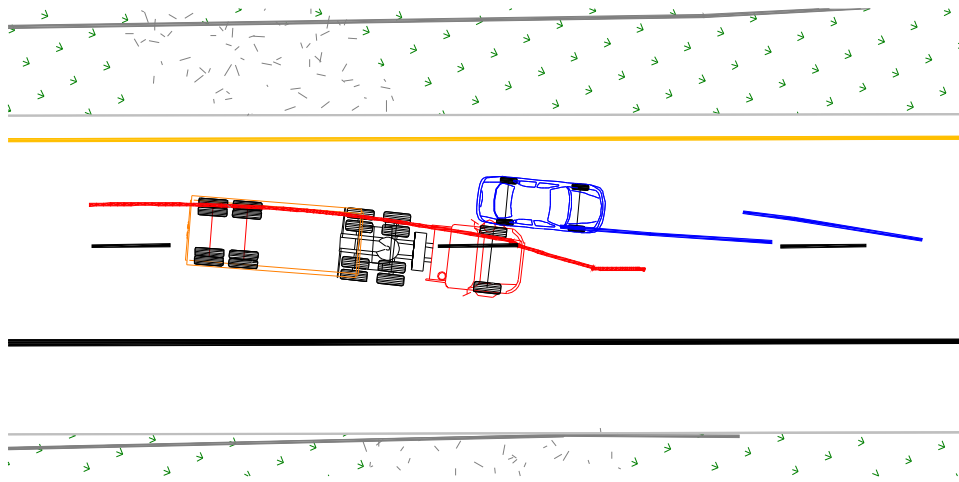


Fig. 4 Illustration depicting the Highway Patrol special investigation depiction of the initial collision

There were several problems with the Highway Patrol special investigation team's analysis. These included:

- a) **The tire mark patterns on the roadway were incompatible with the Highway Patrol collision sequence.**
- b) **The Highway Patrol depicted a collision position that would create contact between the truck's front bumper and the side of the automobile. There was no evidence of the bumper contact on the end of the bumper or on the side of the automobile.**

- c) **The damage at the passenger rear of the automobile was not compatible with the protruding lug nuts of a steer axle wheel. The rear fender had only scrape marks and rubber transfer from a tire.**
- d) **It was obvious that the damage at the front of the automobile was caused as the left front wheel of the truck and the passenger front of the automobile collided. The truck lug nuts protrude from the wheel and left a distinct pattern on the passenger front fender Figs. (5 - 7).**

Therefore, it was concluded that the accident could not have occurred as indicated by the Highway Patrol special investigation team.



Fig. 5 Left front wheel of the truck; note the protruding lugs



Fig. 6 Damaged automobile after it was towed from the scene



Fig. 7 Damage on the passenger front fender of the automobile

With the vehicles relatively parallel, contact at the right rear of the automobile by either drive axle of the tractor would have produced damage on the side of the automobile from the truck steps (Fig. 8). No damage from the steps is observed on the automobile nor was there any damage to the steps of the tractor.



Fig. 8 Exemplar vehicles positioned in a "sideswipe" configuration

Measuring the damage pattern on the passenger front fender showed that the contact occurred with the vehicles approximately 20° away from parallel (Fig. 9). A normal "sideswipe" would be very close to parallel. The significant angle indicated that the automobile was already "out of control" when this damage occurred. This conclusion was also consistent with the tire mark patterns observed on the roadway.

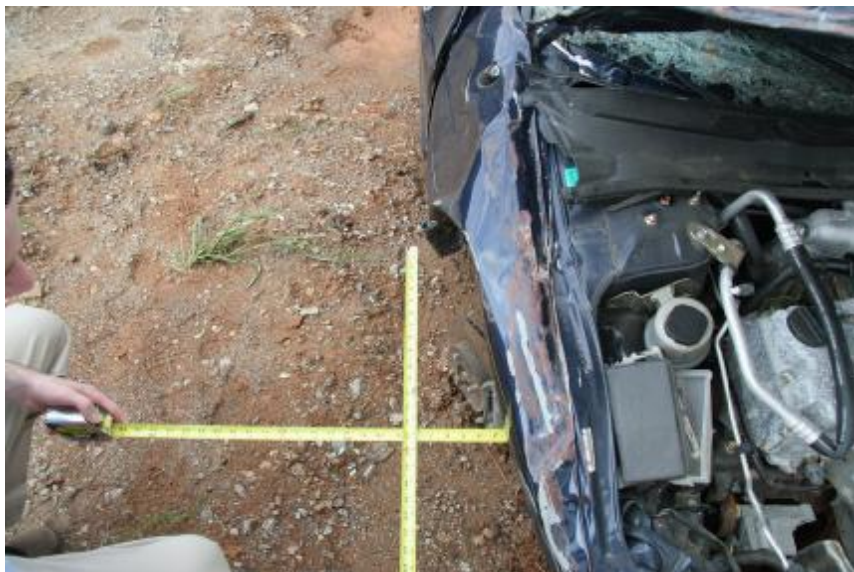


Fig. 9 Measuring the damage at the passenger front of the automobile

The remaining issue was whether the damage at the rear (Fig. 10) occurred during an initial sideswipe contact or as the tractor-trailer began to overturn as it veered off the roadway.



Fig. 10 Passenger rear fender of automobile

A large profile gauge was constructed using wooden dowels and perforated tubing. The “homemade” profile gauge was then matched to the side of a truck tire (Fig. 11). Using the gauge and an exemplar undamaged automobile illustrated that the contact at the passenger rear of the automobile had to have been made after the tractor-trailer had begun to overturn (Fig. 12). This eliminated the rear damage pattern as the initial contact.



Fig. 11 Matching a "homemade" profile gauge to a truck tire



Fig. 12 Matching the profile gauge to the rear fender of an exemplar automobile

A parallel/vertical contact would have brought the truck tire into direct contact with the wheel face on the automobile. No such contact was observed. The profile of the automobile tapered inward toward the rear, but the contact overlap was greatest at the rear, opposite of what would be expected if the truck drifted left or the automobile drifted right (Figs. 13 – 14).



Fig. 13 Using the profile gauge to show the contact pattern if contact had occurred before the truck began the overturn



Fig. 14 Exemplar vehicles in a "sideswipe" position

It was concluded that the initial collision resulted from a loss of control of the automobile. The automobile rotated clockwise and created a yaw mark as it traveled from the left to the right lane. The damage pattern on the passenger front of the automobile confirmed a significant angle between the vehicles at the time of the collision. The collision is illustrated in the Fig. 15.

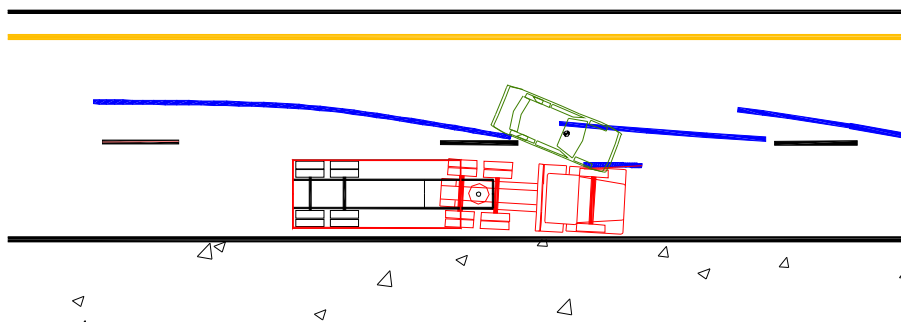


Fig. 15 Illustration of collision position and orientation based on the tire marks and damage +

The primary collision "steered" the truck abruptly to the right and initiated the overturn. The damage on the rear render of the automobile occurred just before the tractor trailer overturned onto the automobile. There was no evidence that the tractor trailer had ever moved out of the right lane.