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A Case Study: The 3D Working Model Applied to a Head-on Collision

The 3D Working Model

A case study highlighting the use of 3D Computer Simulations and Analytical Techniques to Accurately Reconstruct and Illustrate an Event.

Challenge

Often the attorney and expert cannot obtain access to the crime, fire or accident scene, or the scene has been changed since the event. This makes it difficult or impossible to accurately reconstruct the event.

Solution

Precision Simulations, Inc. (PSI) has often been retained to develop an accurate, 3D virtual "working model" of the scene as it existed before and after the event. This computer generated visual model will include all the known physical evidence and will enable the attorney and experts to bridge gaps in evidence to reconstruct what happened, determine what could NOT have happened, and who was at fault. The working model can then be converted into a compelling animation to visualize for the jury what actually occurred.

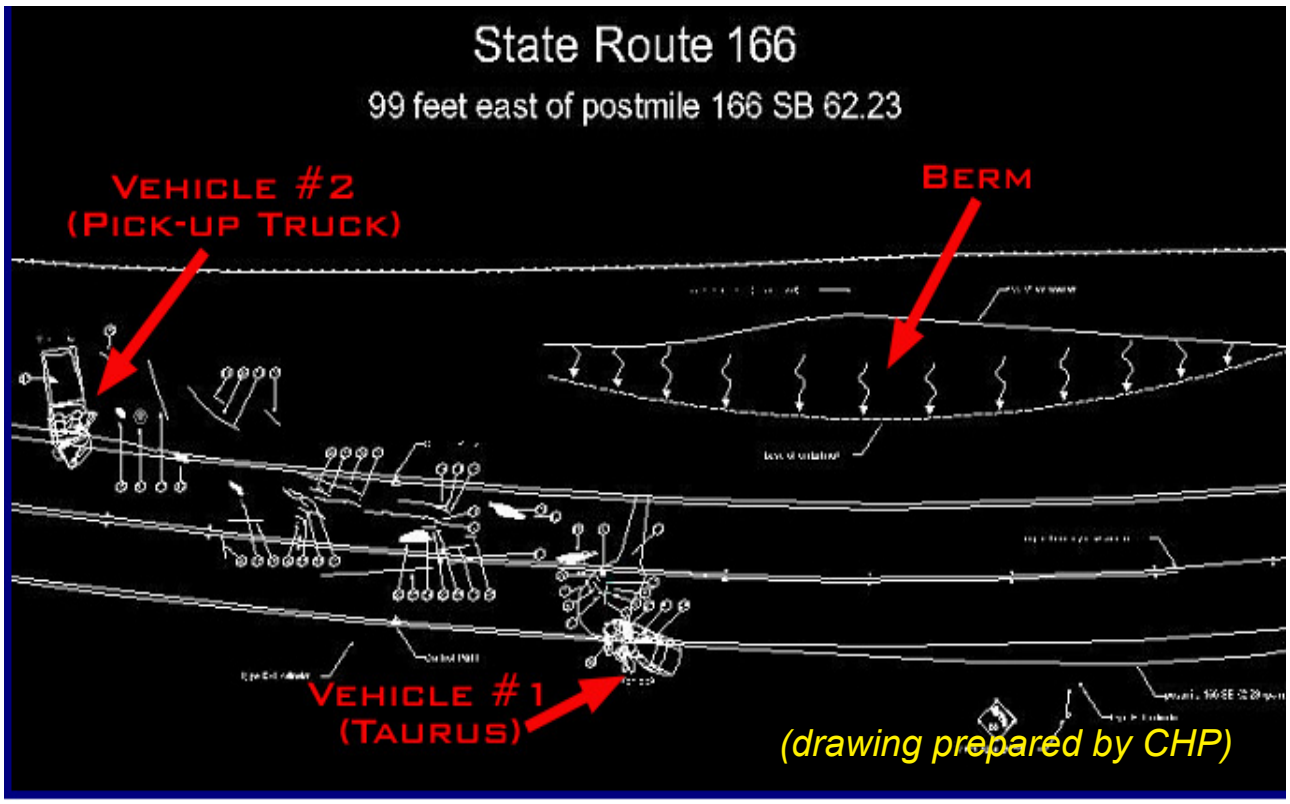
Scenario

A Taurus and a Pickup Truck collided at 50 m.p.h. around a blind curve. All occupants died immediately and there were no third party witnesses. The impact was believed to have occurred in the outside lane. An irregularly shaped berm may have blocked the line of sight.

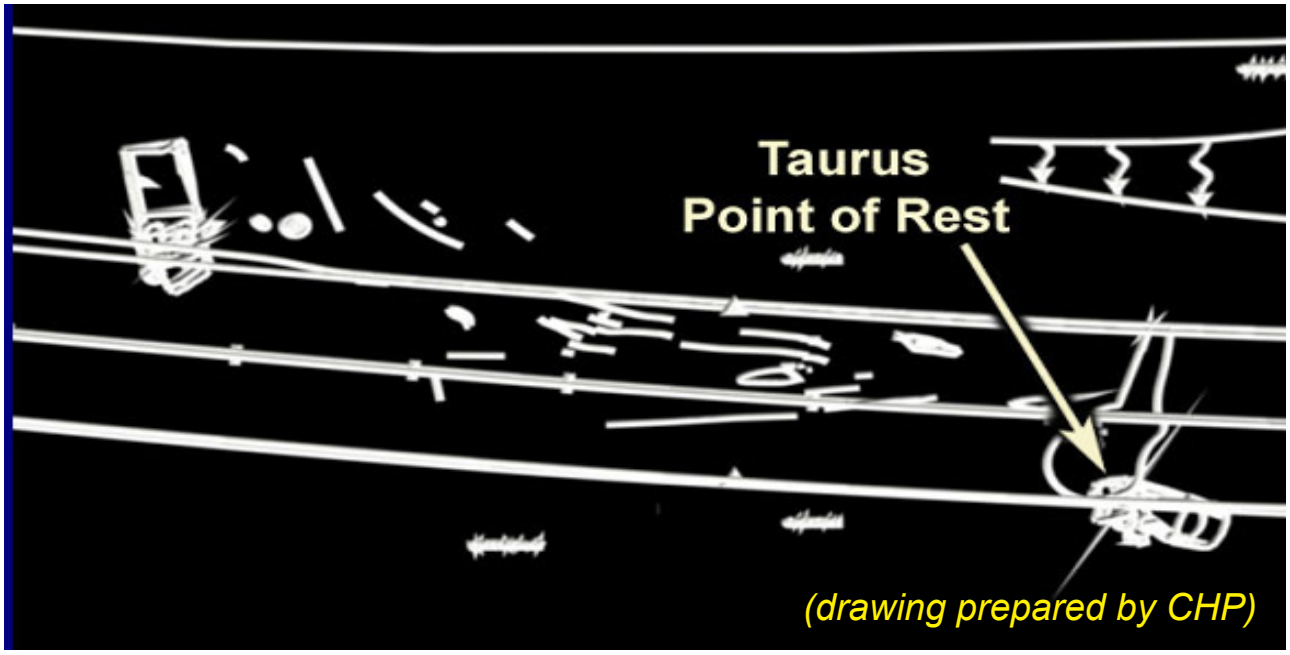
Perception and reaction question: Was there enough time to avoid an accident? Who was in the wrong lane?

Summary of Collision Scene

The following police sketches were made by the California Highway Patrol.



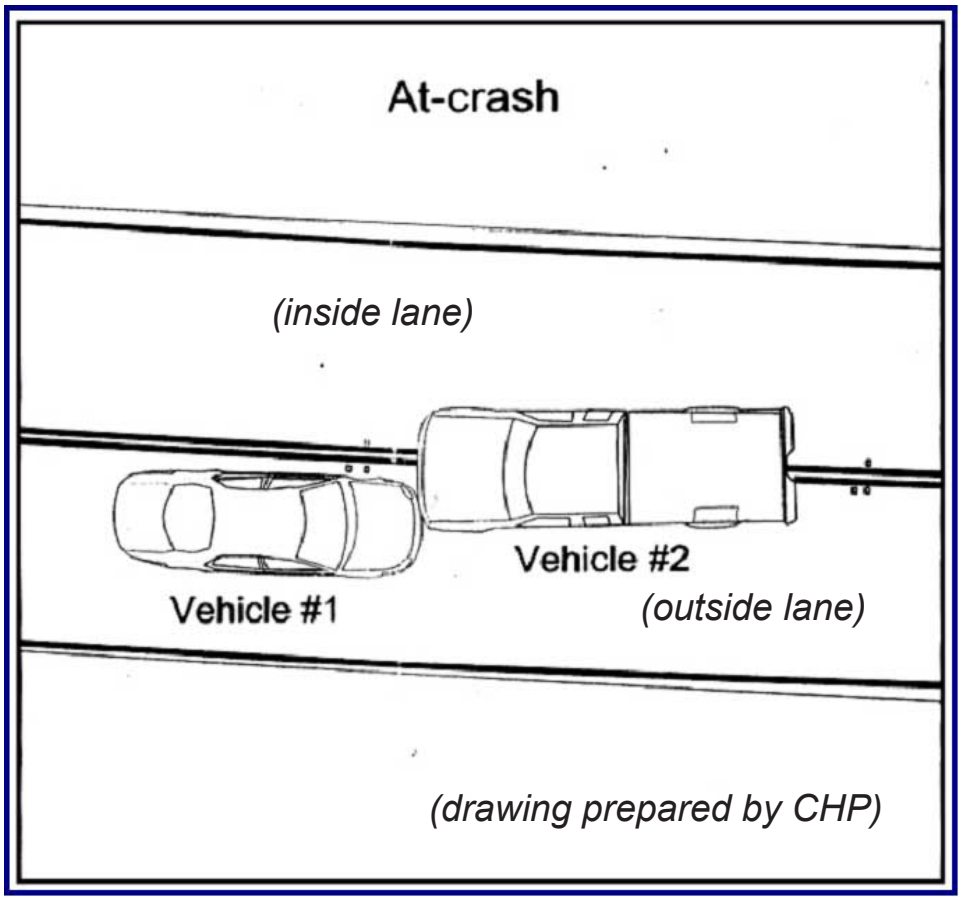
As can be seen from the above police drawing, the collision occurred on a curve and a large berm obstructed both drivers line-of-sight.



CHP Scene Analysis

Although drugs found at the scene belonged to the driver of the Taurus, the CHP determined the impact occurred in the outside lane (the lane the Taurus correctly traveled in).

Therefore, the CHP concluded the Pickup driver was at fault.



CHP Conclusions:

"V-2 (Pickup Truck) was entering the same curve from the eastbound lane. For unknown reasons driver allowed V-2 to drift north across the double yellow lines into the path of V-1 (Taurus). Due to their closure space in time and distance, V-1 had little if any time at all to react to V-2's illegal position in the roadway."

"V-2 caused this collision as a result of his driving to the left of the double yellow lines."

Competing Theories

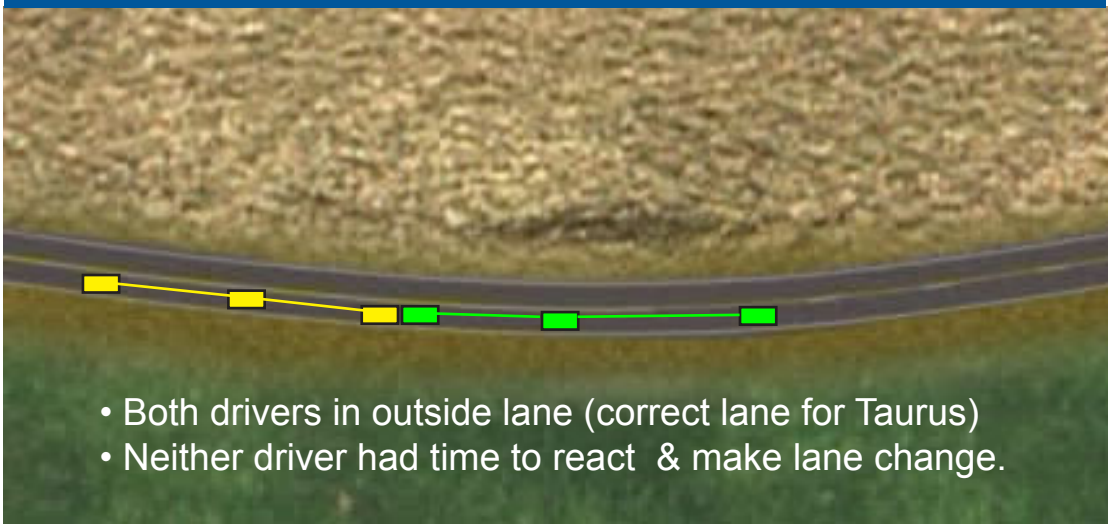
Although the CHP determined the pickup driver was at fault, the attorney for the pickup driver claims that the Taurus was driving in the wrong lane (inside lane) and that each vehicle turned into the outside lane simultaneously to avoid collision. The deceased driver of the Taurus - whose lane the impact occured in - is now the Defendant in the case.

Attorney for Pickup Truck

= *Taurus*

= *Pickup Truck*

Attorney for Taurus



Who is to BLAME?

- No third-party witnesses
- Both drivers are deceased
- Accident in uninhabited rural area

Reaction Times Analyzed

The Defense's human factors expert determined that 4.5 seconds was required, once the drivers began to perceive each other as a threat, to realize that they were both in the inside lane, to decide to turn to the outside land, and then to complete the turns.

How Much Time is Needed to Execute Lane Change?

[as claimed by the attorney for the pickup truck]

Perception/Reaction = 2 Seconds Minimum

Lane Change = 1 Second Minimum

PickUp Truck 2nd Lane Change = *1.5 Second Minimum

*CHP concluded pickup was correcting BACK into its lane at time of impact.

TOTAL TIME NEEDED = 4.5 Seconds Minimum

Did the drivers have 4.5 seconds once they perceived the threat that they were in both the same lane to execute the claimed lane changes? How could we determine and prove to a jury how much time was available to the drivers before the collision?

The berm was large and irregular making it difficult to mathematically determine when the drivers were able to see each other. The police would not allow the highway to be closed and the highway had been modified since the accident.

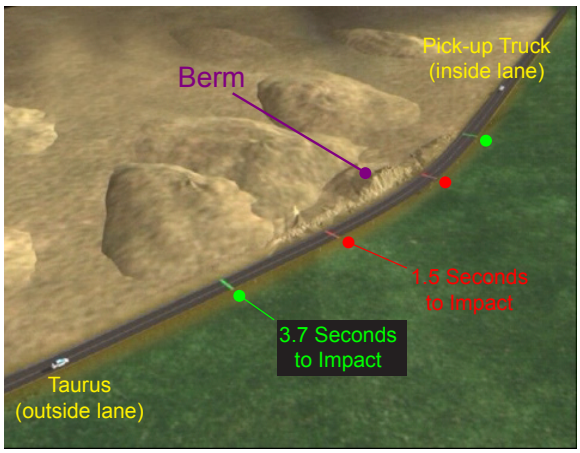
It was therefore impossible to physically simulate and videotape the accident.

The Tools

PSI was asked to develop an accurate computer generated model which would allow the re-constructionist to virtually simulate the accident. PSI used state-of-the-art technology and its proprietary software to develop an accurate 3D model of the roadway, cars & visual obstruction at the collision site.

First, the berm which was thought to obstruct the drivers views of each other had to be accurately measured and depicted in the 3D working model. To capture the data needed and fill in the CHP analysis, PSI employed the CYRA 3D Scanning Laser to take accurate and very dense measurements of the berm. The 3D Scanning Laser allowed PSI to capture over 4 million data points of the scene and berm to within 6 mm accuracy and from the safety of the adjacent field, without the need to enter the roadway or close the highway to oncoming traffic! Compare this to the traditional measurement method which requires access to the roadway and results in much fewer and less accurate data.

PSI then used construction plans and photos of the original highway, combined with additional analytical software, to modify the working model to accurately recreate the roadway as it existed during the collision and before it had been remodeled. PSI then programmed the vehicle motion up to and after impact using the expert's calculations developed from the physical evidence at the site.



Beginning of animation: Please note that the green bars indicate when the drivers can see each other around the berm. The red bar is the point where they realize they are both in the same lane and begin Perception and Reaction. Once the 'working model' was complete, the expert could virtually recreate all the possible paths the vehicles could have taken, and determine when the drivers were able to see each other for each path. Using the working model the expert determined the maximum amount of time the driver could have had to execute the lane change maneuver claimed by the attorney for the Ford pick-up.

Conclusion

*The minimum time needed, once the threat was perceived, to complete the manuever claimed by the pickup truck attorney was **4.5 seconds**. The expert determined from the working model that the time available was a **maximum of 1.5 seconds**.* ***It was therefore impossible for the Taurus to be driving in the inside lane (wrong lane) while the accident occurred in the outside lane.***

CONCLUSION:

Time needed for pickup truck to perceive the threat and complete lane change = ***4.5 Seconds.***

Actual Time available once threat perception had begun = ***1.5 Seconds.***

Therefore Pickup Truck Attorney's Theory is IMPOSSIBLE

Settled Case

After the computer generated 3D working model had assisted the experts to determine the time available, it was used to develop a compelling and admissible simulation of what actually happened at the collision. The animation of the accident was shown at the deposition and shortly thereafter the case settled to the satisfaction of the Taurus attorney.