## C11 3-D Digitization for Traffic Accident Reconstruction, Simulations, and Animations

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After attending this presentation, attendees of this presentation will be exposed to the use of 3-D digitization of vehicle and scene to aide in the de- termination of the orientation and sequence of events.

This presentation will impact the forensic science community by show- ing how this technique can prove to be extremely useful in aiding the inves- tigator or reconstructionist in the sometimes difficult task of depicting the accident scenario for demonstrative purposes. This can be accomplished without the risks to safety, evidence alteration, etc. that would be associated with attempts to directly match the scene and vehicle evidence by bringing the vehicle back to the scene. Indeed, this technique can be employed even after subsequent alterations to the scene.

In order to reconstruct a traffic accident, investigators and accident re- constructionists often rely on the physical evidence left behind at the scene and on the vehicles to piece the puzzle together. One of the many ways to document the evidence is to digitize the scene and vehicle with a three di- mensional measurement system.

Once 3-D data is acquired, scaled 3-D models of the vehicle and scene are created. The digitized features and/or damage of the vehicle and scene can then be physically matched in a scaled 3-D virtual space. This can be accomplished without the risks to safety, evidence alteration, etc. that would be associated with attempts to directly match the scene and vehicle evidence by bringing the vehicle back to the scene. Indeed, this technique can be employed even after subsequent alterations to the scene.

This can prove to be extremely useful in aiding the investigator or re- constructionist in the sometimes difficult task of depicting the accident sce- nario for demonstrative purposes as illustrated in the following case studies.

Case study #1 involves a single vehicle rollover that occurred when the passenger side tires left the roadway and the driver tried to recover and rolled the vehicle. The restrained driver sustained fatal injuries as her head was partially ejected during one of the rolls. By matching the rim strikes in the roadway to the vehicle wheels, the 3-D data collected at the site and the vehicle helped to determine the number of rolls the vehicle underwent. Figure 1 shows a diagram depicting the roll sequence.

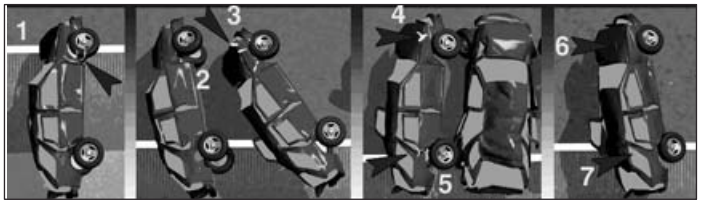


Figure 1: Matching Roadway Damage to Vehicle Features

Case study #2 involves a single vehicle accident that occurred on a steep incline in a curve during a heavy rain storm. The vehicle lost control, left the roadway to the inside of the curve, and mounted an embankment where it struck a large boulder. As a result, the rear of the vehicle quickly rotated ejecting the driver rendering him paraplegic. At issue was the vehicle's orientation at impact, and the specific boulder that was struck.

Both the boulders on the embankment and the vehicle's 3-D crush pattern were digitized. The actual involved boulder was identified as the vehicle's crush pattern matched the boulder's 3-D geometry similar to a lock and key. A 2-D rendering of this matching is shown in Figure 2.

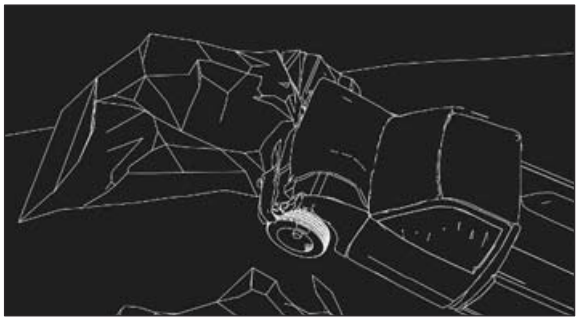

Figure 2: Matching Vehicle Damage to Scene Features

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Case study #3 involves a single vehicle rollover of a vehicle that was towing a trailer. The trailer initiated a weave, causing the vehicle to jackknife and lose control. The rollover occurred on top of a guardrail slicing into the body of the vehicle. The right rear passenger was rendered paraplegic. Once the vehicle and scene were digitized, the vehicle damage was matched up with the scene showing the orientation of the vehicle and the progression of damage throughout the rollover, as shown in Figure 3.

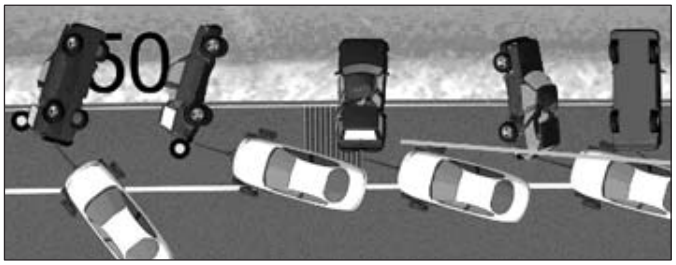


Figure 3: Vehicle Dynamics During Rollover Involving Damage from a Guardrail

**Conclusion:** As demonstrated in these case studies, having 3-D models of the vehicles and scene can prove invaluable in physically matching the evidence thereby defining the relative orientation of the vehicle and scene throughout the collision event.

Once defined, the 3-D models lend themselves to generating story boards and animations for demonstrative purposes.

**Digitization, Reconstruction, Animation**

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