C15 Determination of Driver Identity in a High-Speed Vehicle Rollover: Vehicle Occupant Injury Patterns and Vaulting Velocities Correlated With Safety Defects and Accident Reconstruction

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After attending this presentation, attendees will understand forensic science techniques for determining vehicle occupant trauma pattern and vehicle collision damage, and correlation of this with scene evidence, vaulting velocities and vehicle dynamics, to assist in determination of driver identity. Attendees will also understand the application to general biomechanics, accident reconstruction, vehicle safety investigation, static and dynamic test techniques and evaluation.

This presentation will impact the forensic community and/or humanity by demonstrating a new method of utilizing static and dynamic testing as well as previously conducted non-case-related tests to determine critical factors in accident reconstruction, especially for determination of driver identity. Determination of driver identity is a well-recognized

demand for law enforcement, prosecutors, insurance companies, accident investigators, and medical examiners. A wide variety of forensic evidence identification and analysis techniques were utilized in this investigation, which occurred several years after the event.

LEARNING OBJECTIVES: The authors will present reliable forensic science techniques in analyzing trace evidence from photos, medical records and physical examination of a vehicle and accident scene. Via the scientific method, demonstrate vehicle safety failures, as well as how to utilize available test information to determine performance of vehicle subsystems and components in a unique collision.

PROPOSITION: Via the scientific method, show correlation between specific vehicle damage, occupant vaulting energy, and occupant injury, at specific points during a high-speed rollover event, as a reliable means to determine vehicle occupant identity.

SYNOPSIS: A forensic case study is evaluated which involves a single-vehicle high-speed fatal rollover accident with both occupants ejected. It was initially unknown which occupant was driving the vehicle, despite investigation by the state police and the regional medical examiner. The surviving occupant was severely brain injured with no memory of the accident. There was no witness to the rollover, which involved extensive off-road vehicle travel with significant vertical increase in elevation, followed by falling down a rocky cliff. No fingerprints, hair, blood, skin smears, fibers, fabric transfer, or other organic samples were positively identified.

Mud deposits on the vehicle interior and the lack thereof on one occupant's shoes, as well as specific evidence (or lack thereof) involving steering column, dash, control pedals, windshield, seats, seat belts, door interiors, side and rear windows, and headliner were analyzed and identified by the authors on the vehicle interior. Evidence (or lack thereof) on door latches, door structures, door window openings, exterior sheet metal, exterior mirrors and trim, axles, and numerous other exterior vehicle structures was analyzed and identified by the authors.

The occupants were ejected from different vehicle portals, at different locations, as a synergistic result of restraint system failure, seat failure, and door latch failure, correlated with vehicle collision and rollover dynamics. Occupant trauma pattern and severity was determined from photographs and review of autopsy and medical records. Occupant trauma pattern/severity and vehicle dynamics were accurately matched to vehicle interior and exterior evidence, occupant vaulting velocities, as well as occupant and vehicle final rest positions. The foregoing was correlated to evidence deposited by the vehicle, as well as each of the vehicle safety failures, to determine which occupant was ejected from which portal, at a specific place and time.

Static and dynamic testing by the authors and others was correlated with dynamic vehicle collision and rollover mechanics to also prove occupant ejection dynamics, occupant injury or lack thereof, and occupant location within the vehicle. This involved use of: A) Static and dynamic seat tests to determine that a specific seat was unoccupied at a certain point in the rollover event. B) Dynamic crash and sled tests to prove restrained and unrestrained occupant kinematics, injury level and restraint system failure. C) Static seat belt tests with human surrogates to determine likelihood of restraint system use by a specific individual.

The vehicle rollover path was accurately matched with location and type of each significant collision/ground contact, vehicle exterior damage, and vehicle parts/debris deposits. Each significant collision/ground contact was then correlated with vehicle velocity and safety failures as well as occupant ejections, vault velocities and trauma patterns.

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SUMMARY/CONCLUSION: Reliable, positive identification of the driver was made via multiple cross-correlation of all the foregoing evidence with biomechanical and vehicle dynamics analysis. What may be a new technique of correlating static and dynamic test data to a specific real-world crash event was developed.

Biomechanics, Reconstruction, Rollover

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