BS3 The Science Behind Traffic Accident Reconstruction With Real-World Crashes

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Learning Overview: The goal of this presentation is to share with the forensic science community the data sources and detailed methodology used in traffic collision reconstruction.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating through real-world case studies the data used and methodologies applied to the reconstruction of traffic collisions.

An analysis of four real-world crashes will demonstrate the science behind traffic accident reconstruction. Reconstructing a crash is a multidisciplinary process. The reconstructionist gathers objective and subjective information, performs case-specific research, then applies the fundamental principles of physics to determine, for example, impact classifications, vehicle heading, impact configuration, impact (closing) speed, velocity change or Delta-V (DV), rollover distance, roll count, and roll rate. The reconstruction results are important input to the injury analysis and the assessment of injury patterns, risk, and prevention.

The primary information source is the Traffic Collision Report, which may provide: (1) objective party information (e.g., occupant and vehicle year, make, model, Vehicle Identification Number (VIN)); (2) objective site information (location and roadway, intersection, and Global Positioning System (GPS) details), scene diagrams with measurements of physical evidence (tire friction marks, fractured glass, roadway scrapes and gouges, scarred tree bark, fractured signs or light posts, disturbed dirt and/or vegetation), point of impact and vehicle rest locations; (3) at-scene police photographs of site evidence and vehicle damage; and (4) subjective information (e.g., party statements, vehicle code violations, police collision summary and primary collision factor identifying party and cause).

Case-specific research may include: (1) at-scene witness photographs, which are often taken with cell phone cameras; these photographs are crucial absent police photographic documentation of site and vehicle evidence; (2) security videos that help refine the analysis by providing objective evidence of vehicle movements prior to and after the crash; (3) aerial photography from online image archives that orient and supplement scene diagrams; (4) drive-through videos that provide a street view of the roadway and/or intersection; (5) site inspections that clarify roadways, controls, and obstacles; (6) subject vehicle inspections with crush profile measurements that document property damage and reveal relative impact alignment or vehicle movement; (7) Airbag Control Module (ACM) data that quantify pre-crash vehicle speeds and accelerations, and driver actions (e.g., swerving, braking); (8) subjective information (e.g., witness statements and deposition testimony) that help qualify collision events and estimates of vehicle speeds, distances, and movements; these sources may also provide prior useful site, vehicle, or occupant history; and (9) exemplar vehicle inspections, scaled vehicle drawings, specifications, and crash test data that may be used to determine the collision severity.

An analysis of four real-world crashes demonstrate the science behind traffic accident reconstruction.

Case 1—fatal collision: vehicle crush measurements quantify collision severity.

Case 2—vehicle-motorcycle crash: download of ACM yields pre-crash data.

Case 3—wrong-way, intoxicated driver in a high-speed crash: patrol car's on-board video quantifies vehicle impact speeds.

Case 4—vehicle-motorcycle crash: stationary security videos quantify vehicle impact speeds.

Traffic Accident Reconstruction, Data Sources, Real-World Crashes

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