D18 Physical Evidence Used in Rollover Crash Reconstruction

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After attending this presentation, attendees will be able to catalog and illustrate physical evidence on the vehicle exterior and roadway commonly used in the reconstruction of rollover crashes.

This presentation will impact the forensic science community by identifying artifacts that are often used in determining rollover crash parameters such as roll direction, rollover count, and vehicle orientation at ground impact; examples will be drawn from real-world collision investigations.

Collision reconstruction is the scientific process of investigating, analyzing, and drawing conclusions about the causes and events of a vehicle collision. Commonly occurring crash categories are head-on, rear-end, intersection, T-bone, sideswipe, and rollover. Each crash type creates a unique set of physical artifacts related to the pre- and post-impact vehicle dynamics. Investigation of these collisions requires techniques that draw upon the quantity and quality of the observed and documented physical evidence. The physical evidence commonly observed in rollover crashes is presented and discussed.

Physical evidence used in the investigation and reconstruction of rollover crashes can be placed into two categories: (1) roadway evidence; and, (2) vehicle evidence. Additionally, roadway evidence can be divided into two subsets: (1) pre-rollover evidence; and, (2) evidence deposited during the rollover event. Examination of the vehicle may reveal evidence to suggest a roll direction or rollover count, but combining these vehicle artifacts with those observed at the collision site will yield a reconstruction of increased accuracy.

Pre-Rollover Evidence: (1) tire friction marks identify a vehicle's heading and orientation on the roadway before it rolls over. These rubber deposits are created because the tires can no longer generate the required lateral force and the tires begin to slide; and, (2) furrows are much like tire friction marks in that they establish the vehicle's path prior to the rollover event, but they are on dirt or vegetation and not on a paved roadway. A sliding tire cuts into and begins to plow the soil, creating furrows.

Evidence of Vehicle's Rollover Trajectory: (1) the trip point identifies the location where the vehicle stops sliding and starts to roll over. Oftentimes, the trip point is at the end of the furrows or tire friction marks, but sometimes an object, such as a curb, can be the tripping mechanism; (2) gouge marks are created when the vehicle has impacted or slid on the roadway. Depending upon the part of the vehicle that contacts the pavement or soil, these gouge marks will have a unique set of characteristics; (3) wheel imprints on the roadway will have a crescent shape corresponding to the wheel rim curvature. The orientation of these imprints relative to the roll path direction in conjunction with knowing the rollover leading side will determine if they are left or right side wheels; (4) fractured glass is commonly observed along the vehicle's roll path because tempered glass will break under vehicle structural deformation or by interaction with objects such as rocks. Knowing the color (clear or tinted) and thickness of the glass can help establish the window-breaking sequence during the rollover event; (5) paint, plastic, and rubber transfers occur when the vehicle has translational velocity relative to the ground and, by virtue of this sliding mechanism, paint, plastic, or rubber of the component making contact is thereby transferred; (6) component debris field can be found along the rollover path and varies with regard to vehicle type and roll distance. This field can include side view mirrors, roof racks, trim, bumper fascias, hubcaps, and vehicle contents such as handbags, blankets, and clothing; and, (7) the point of rest marks the end of the rollover event. If the vehicle does not rest on its wheels, dimple-like impressions may be observed on the vehicle exterior.

Vehicle Exterior: (1) scrapes on the vehicle exterior are indicative of ground contact. The orientation of unique collections of scrapes provides evidence for the roll count. Long scrapes suggest higher translational velocity relative to the ground; (2) wheel assemblies can reveal scrapes, gouges, or fractures. The side of the vehicle where these wheels reside will aid in determining vehicle orientation leading to and throughout the rollover phase of the collision sequence; (3) material flow to plastic components occurs when these vehicle parts impact the ground. Along with abrasions, if contact is sustained, material temperature can increase resulting in material flow in a direction opposing the vehicle's roll direction; and, (4) vegetation can become trapped in the wheel rim-tire bead junction. Observation of this material can indicate whether the vehicle rollover occurred on or off the pavement.

Thorough examination of physical evidence observed on the vehicle exterior and roadway will assist the investigator in a more accurate collision reconstruction. Commonly observed physical evidence is presented.

Physical Evidence, Rollover Reconstruction, Vehicle Artifacts