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The Use of New Technology in the Preservation of Evidence: A Valuable Tool in Claims Resolution

I. Critical Elements in the Analysis of a Collision

The definition of collision reconstruction is the application of the laws of physics to physical evidence left as a result of a collision in an effort to determine, if possible, how a collision occurred. There are three factors in all collisions, the roadway, the vehicle(s), and the operator(s). The reconstruction of a collision, therefore, necessarily involves data from all three areas.

The engineering-based process undertaken to properly reconstruct a vehicular collision includes an attempt to gather accurate data from all available sources, plot that data, to scale, and apply the laws of physics in an effort to determine how the vehicles ultimately ended up at their points of rest. Once the determination of "how" the collision occurred is complete, the analysis of the factors that may have contributed to the collision can be evaluated. The laws of physics have not changed over the years; however, the manner in which engineers and others collect data and the volume of accurate information available has progressed exponentially, often times providing the engineer with considerably more data to work with (as long as it is collected in a timely manner) than in the preceding years. The power of analysis tools has also increased exponentially allowing for a more accurate, and sometimes less time intensive analysis.

II. New Technology in Vehicles: For Data Collection, For Data Analysis (20 minutes)

A. Technology for Data Collection

1. Roadway (Laser Scanning and Drone Technology)

High-definition survey [HDS] 3D laser scanning is the "now" generation of accurate, fast and comprehensive data collection, and collects more robust data (three-dimensional point cloud data) than its older sibling, the total-station.

Newer (but more expensive) “mobile” scanners now allow for massive amounts of accurate data to be collected from moving vehicles. As more and more engineering and surveying firms purchase laser scanning capabilities, the focus is shifting from the *collection* of the data to the efficient and effective *use* of the dense “point cloud” data collected by these sophisticated instruments. The massive amount of HDS data points cannot be handled in the same manner as its “single-shot” predecessor, the total-station. As such, utilizing the collected data requires the appropriate proprietary software, high-speed processors, sufficient memory and high-level graphic video cards, along with the experience to accurately and efficiently process and work with the data. HDS laser scanning is a critical step in creating an accurate, to-scale, three-dimensional environment through which engineering analyses can be completed and engineering animations can be constructed. As with any technology used in the forensic field, the accuracy of the scan data and, just as importantly, the accuracy of the product created using the scan data must be beyond reproach and be able to withstand the scrutiny of a proper and thorough cross-examination.

Drones, otherwise known as unmanned aerial vehicles (UAV) or unmanned aircraft systems (UAS), are aircrafts that fly without a pilot onboard. A drone/UAV/UAS can be flown by pre-programmed flight paths, utilizing GPS data and onboard computers, or by a pilot who is on the ground via a simple line-of-sight approach. Drones/UAV/UAS's are frequently utilized to carry cameras, video cameras and/or 3D laser scanners into areas not accessible by terrestrial equipment. The ability of drones/UAV/UAS's to fly over an incident area and/or collect data from otherwise inaccessible areas due to their position or height is unprecedented. Drones/UAV/UAS's are considered to be the "next level" of data collection when used for professional purposes. Current Federal regulations require training and proficiency in Federal Aviation Administration (FAA) safety, communication, clearances, and weather, similar to pilot flight training. Data collected by a drone can be converted to accurate 3D data utilizing the proper software. Care must be taken when using drone data in that there can be a substantial difference in the accuracy of 3D models depending on the processing software capabilities. As with all other forms of data collection, there are cross-checks that should be performed to monitor the accuracy of any data and any product created from the data

2. Vehicle (Event Data)

Since its introduction nearly twenty years ago, the Event Data Recorder (EDR) has steadily evolved in both scope and capability. Throughout this time, several vehicle manufacturers have made access to the EDR information available to forensic investigators through the use of commercially available information. Each year, the Crash Data Retrieval (CDR) manufacturer updates its software, affording non-industry personnel the ability to “image” data from a growing number of vehicles. Thanks to the Nation Highway Traffic Safety Administration (NHTSA) Rule Part 563, the latest version of the software (Version 17.6, released December 22, 2017) now supports most new passenger vehicles and light trucks and provides coverage to some General Motors vehicles built as early as 1994. Again, it is important to note that the software does not cover all models and all years for each manufacturer. It is also noteworthy that several vehicle manufacturers such as Kia, Hyundai, Subaru and Land Rover have elected not to partner with the Bosch system for data access, electing instead to provide commercial access to their own tools as in the case of Kia, Hyundai and Subaru, or provide data imaging services, as in the case of Land Rover. Commercial vehicles also typically possess extensive EDR capabilities; however, unlike passenger vehicles, each truck manufacturer creates and controls unique diagnostic software necessary to access event-related data. One of the first questions that should be asked in any collision investigation is whether the vehicles involved have event data and whether that data is accessible by investigators, police or engineers. This can become a potential spoliation issue if your vehicle has data and the vehicle was not preserved so that interested individuals could extract and evaluate that data.

Global Positioning Satellite (GPS) technology (per the government web site), *"…is a U.S.-owned utility that provides users with positioning, navigation, and timing (PNT) services. This system consists of three segments: the space segment, the control segment, and the user segment. The U.S. Air Force develops, maintains, and operates the space and control segments."* The space segment consists of a nominal constellation of 24 operating satellites that transmit one-way signals that give the current GPS satellite position and time. The control segment consists of worldwide monitor and control stations that maintain the satellites in their proper orbits through occasional maneuvers and adjust the satellite clock. It tracks GPS satellites, uploads updated navigational data, and maintains health and status of the satellite constellation. The user segment consists of the GPS receiver equipment which receives the signals from the GPS satellites and uses the transmitted information to calculate the user's three-dimensional position and time. GPS is being used increasingly in both criminal investigation and civil litigation due to the ability of some devices to record and store information depicting driver actions and other personal behavior. A proliferation of education possibilities (i.e., those familiar with the systems teaching others what can and cannot be retrieved from GPS devices) has come about over the past few years. Previously, only after-market devices (Garmin, TomTom, Magellan) could be accessed by "outsiders". Recently, however, at least one firm has begun offering the equipment, software and training to access and utilize GPS data from "native" (built-in) systems. There are varying degrees of accuracy of GPS data. For example, land-based cellular towers can provide an additional element to positional information and thus increase system accuracy. As such, care must be taken when evaluating the data and/or when reviewing another party's evaluation of the data. To aid in evaluating system accuracy, many systems assign a numeric value to the relative accuracy of all reported data. This so-called Dilution of Precision value provides an indication of the number of satellites used to generate a given GPS signal and thus provides a means to compare data accuracy. Despite these, the data does not always provide the type of specificity that would be necessary to support some reconstruction opinions.

3. Driver (Infotainment and Telematics)
Infotainment is the combination of "information" and "entertainment". Infotainment systems in vehicles encompass hardware and software to provide audio and visual entertainment/information or functionality to the user. The hardware can include a touchscreen located in the center dashboard of the vehicle, steering wheel controls, navigation system, WiFi, USB and Bluetooth phone connectivity, and microphones used for voice control. Some examples include GMC Intellilink, Microsoft Sync, MyFord Touch, Toyota Entune, and Fiat Chrysler Automobiles UConnect.

Vehicle telematics utilize telecommunications to send, receive, and store information. Vehicles come equipped with telematic systems that are stand-alone systems or paired with an infotainment system. An example is OnStar by General Motors. These systems provide two-way communication between a vehicle and a system or database external to the vehicle usually through a cellular network.

Starting from 2008, at last count there were over 9,750 models worldwide with supported infotainment and/or telematic systems. They include FIAT Chrysler Automobiles; General Motors; Ford; Toyota; Volkswagen; Hyundai; KIA; Mercedes; and BMW. The manner in which one can check supported vehicles includes a vehicle lookup tool provided by the company that is pioneering the accessibility of this data.

The type of Infotainment/Telematic Data could include:

- Navigation data (GPS) which has locations (addresses entered by user) and tracklogs (GPS points dropped along a route taken by the vehicle).
- Events associated with time/location including door openings; light activations; gear shifts; and power cycles.
- Cell phone use data including call logs; contact lists; and SMS messages.
- Media data including pictures; videos; and social media feeds.
- Devices that have been connected to the vehicle via USB; Bluetooth; and/or WiFi.

Historic data may be linked or related to driver habits, behaviors, and patterns. During investigations, questions arise such as how many times a vehicle has travelled on a certain road, at what speeds, and when. In recent years, tools have been developed to obtain information in a vehicle's infotainment system that can now answer those and other questions such as, was the driver using their phone? Not only does the information include GPS data, there is also a potential for cell phone data relevant to call logs and messages, which are timestamped. In crime investigation, infotainment data could place a vehicle and/or cell phone at a crime scene or possibly somewhere else, perhaps exonerating the suspect. Insurance companies are already using devices such as data loggers to store, retrieve, and assess driver habits to possibly provide discounts to consumers. The quantity of electronic data in vehicles is increasing and so are the ways in which the data is utilized.

B. Technology for Data Analysis

1. Creation of Accurate 3D Environments

Technology now allows engineers and others to create accurate 3D models of vehicles, buildings, roadways and other features from a vehicular collision from a number of sources including laser scan data; aerial images from drones and other sources; and even from still 2D images (photographs).

2. Camera Matching Videos and Still Images

Video, including surveillance video, event video from vehicles, and other captured video data, is becoming more and more prevalent in today's society. Forensic professionals have the tools to utilize video shots from one specific angle, match it to accurate three-dimensional measurements of the area, and garner critical data such as speeds of moving objects, relative positions, and sight lines. The ability to do this is partially dependent on the quality of the video shots. Recently, software has become available that allows engineers (and others) to "scientifically enhance" raw surveillance video such that otherwise unusable video frames indiscriminately recorded by surveillance video cameras can now become a source of potentially critical data for the analysis of collisions and other events. "Super-resolution" is a mathematical term utilized by scientists to describe a set of methods of "upscaling" or "upsizing" videos or images. "Upscale" means to increase the resolution in either image processing or video editing. Most super-resolution techniques are based on utilizing information from several different images to create one "upsized" image. Algorithms try to extract details from every image in a sequence to reconstruct other frames. This multi-frame approach differs significantly from sophisticated image (single frame) upsizing methods which try to synthesize artificial details. Super-resolution (SR) works most effectively when several low-resolution images contain slightly different perspectives of the same object. Then, the total information about the object exceeds information from any single frame. The best case is when an object moves in the video. Motion detection and tracking are then employed to benefit upscaling. If an object doesn't move at all and is identical in all frames, no extra information can be collected. If an object moves or transforms too quickly, then it looks very different in different frames and it becomes too difficult to use information from one frame in reconstructing the other. Super-resolution technology has become "mainstream" to the extent that new software has become available (and usable) to those not in academia or the government. This technology has tremendous potential usage in the forensic field, expanding the potential sources for data.

Photogrammetry is the science of taking measurements ("metry" – the process of measuring) from photographs. A form of measurements from photographs is a concept called camera-matching. Camera-matching is the ability to identify, as closely as allowable with the available data, the position relative to a three-dimensional environment from which a photograph was taken. By doing this, objects within the photograph, which are no longer available, may be able to be identified and/or placed, to-scale, within an accurate replica environment. For example, if a photograph of a collision scene shows the point of rest of a vehicle that was ultimately moved, by utilizing items in the photograph that are still at the site (i.e.- houses, trees, poles), it may be possible to "camera-match", (i.e.- overlay) the photograph onto a to-scale, real world, three-dimensional computer model of the environments so that the position of the vehicle in the photograph can be accurately "placed" or "matched" within that to-scale environment. Computers allow the user to process the photograph and known objects within the photograph and develop an "X, Y and Z" coordinate system. This coordinate system helps define the origin of the photograph, creating a "virtual camera". Utilizing the robust, three-dimensional data collected by HDS 3D laser scanners, a "virtual camera" can now be utilized in a virtual X, Y and Z coordinate world created by actual, accurate data for more precise "matching" of images. This technology is also utilized in determining positions and speeds of vehicles or people from surveillance cameras, in the design and visualization of building structures, or virtually anything that can be "camera-matched" to find missing information or to add proposed information.

3. Engineering Simulations

Engineers and others have available to them scientifically accurate vehicle simulation programs that, assuming the input parameters are consistent with the collision event being evaluated, allow for scientific evaluation of how the collision occurred (i.e. a check of the basic analysis) and the ability to perform "what if" studies. For example, questions such as "what if" the left front tire did not fail, would the vehicle still have crossed the center line? Engineering simulations can be powerful tools, but care must be taken that they represent, through prior selection of input parameters, the facts of the event upon which the analysis is being conducted.

III. The Benefits of Early and Thorough Data Collection (15 minutes)

A. Increase Early Resolution Opportunities

a. Early data collection and analysis provides a pre-litigation snapshot. This early insight into questions of liability, which may not normally be answered for years after an accident, provides claims handlers and policyholders with access to hard data on which valuations can be based. Further, when submitting cases for early resolutions, including pre-suit mediations, stakeholders have scientific, non-opinionated bases to contest a claimant's assertions as to liability and to challenge eyewitness accounts.

B. Avoid Spoliation Claims

a. Many times, in litigation, sophisticated plaintiffs' attorneys seek data from vehicle electronic data recorders which overwrite themselves after certain events while driving. If a vehicle is placed back into service before this data is downloaded, it may be lost forever. Early involvement of technology experts who can access and download this data can prevent litigation headaches, including adverse inferences based on spoliation of evidence.

C. Rely on Data, not Opinion

a. Eyewitness accounts are subject to challenge based on misinformed accounts. Proper collection of data can be used to challenge a claimant's assertions or to bolster a policyholder's driver's assertions. Further, discussion of this unbiased data during witness preparation can help instill confidence in a policyholder's driver's recollection.