



CLM 2021 Focus: Diversity, Equity & Inclusion, Management Liability, Medical Malpractice, Product Liability, Professional Liability, Transportation, Claims & Litigation Management Conference
October 19-20, 2021
Chicago, IL

Narrative

Seeing the road ahead: The acquisition and usage of dashcam footage in accident reconstruction

I. Accidents Happen

Here's what happens next.

When calamity strikes, it rarely happens in isolation. In the case of automobile accidents, it is typical that multiple vehicles and their passengers are harmed during the accident. If the people and vehicles involved in such accidents are insured, those insurance companies are then also involved in handling the events following the accident. Therefore, such parties should be alerted when an accident happens. Additionally, it is expected that law enforcement will mobilize to ensure that the rectification of the accident will be executed properly. When involved, law enforcement will typically create a crash report, which is a summary of the vehicles involved, along with a brief narrative of the accident, as they believe it happened. In some less-common cases, an accident reconstructionist from the law enforcement agency will be utilized to perform a more extensive investigation into the accident. Either way, the law enforcement officers will typically secure the area of the accident, document the scene, collect evidence, and record statements of involved parties or witnesses. While this is occurring, tow-trucks may be used to remove large vehicles from the area so they can be securely stored elsewhere.

Therefore, while law enforcement officers are performing their duties, an insurance adjuster may be notified so they can travel to the scene as early as possible. This is critical, since the most valuable evidence is often the most time sensitive. Evidence such as tire marks, road gouges, scratch marks, fluid stains, vehicle debris, shattered glass and the final rest positions of the vehicles are all critical pieces to an investigation. Law enforcement officers have the benefit of having a secure area to document and collect evidence as

needed for their investigation. This means that insurance professionals would be wise to arrive as soon as they can, in the event that they can record photos or videos of the evidence as it was directly after the event, given that they are not getting in the way of the law enforcement investigation. Once law enforcement has completed their investigation, an insurance professional, or a technical service provider may continue their own investigation, assuming that they are complying with the laws of the area.

Here's what to look for

Post-crash evidence is vital to accident reconstruction experts because it allows them to rewind the events of the accident, so they can accurately demonstrate what events lead to such an outcome. As mentioned previously, evidence from the scene can include things such as debris, glass and final positions of the involved vehicles, all of which are movable items. Once items are moved, they no longer tell an accurate story about the previous event. Documenting the positions of movable items directly after an accident is immensely important, and can be performed by insurance professionals, or technical service providers. Post-crash evidence also includes tire tracks, fluid stains, road gouges and scratch marks, which, although not movable, will fade over time. For evidence such as this, time is still a critical factor, but for a different reason. The same sense of urgency should be taken to record such evidence as soon as possible, so that a reconstruction effort can use the most accurate evidence to its advantage.

Evidence from the scene is the most time-sensitive, and is incredibly important, however it is not the only type of evidence. Other evidence from the vehicles may also be documented or collected such as: paint scratches, dents, areas of damage, and indicators of force. On top of this, vehicles may also be equipped with onboard modules that store and record vehicle data, which can be critical to an investigation. Some passenger vehicles can store pre-crash vehicle data within their Airbag Control Module (ACM), whereas Heavy Duty Commercial vehicles typically use their Engine Control Unit (ECU) to store vehicle data. Either way, it is imperative to determine what module and what data may be available on each vehicle being investigated, so that it can be obtained properly.

Verbal statements from Law Enforcement Officers, drivers, and nearby witnesses can be used in an investigation to help piece together the sequence of the accident, especially when used in conjunction with scene and vehicle evidence. Statements from officers can be found in crash report documents, driver testimony can be given post-accident, and witnesses can be contacted directly or via information obtained from Law Enforcement.

Spoliation is bad, so do what you can to avoid it

As mentioned previously, vehicle data can be stored on both passenger vehicle ACM's and on Heavy Duty ECU's. For both ACM's and ECU's, there is a risk of vehicle data being overwritten if the vehicle is started and driven after the accident. Therefore, it is critical that after an accident, each vehicle is not powered up or driven away from the scene. Having

the vehicles towed after the event is the preferred method. Knowingly starting a vehicle that may contain data that is beneficial to a different party would be unethical behaviour.

Much like ownership of the hardware of a vehicle, a vehicle's owner is also the owner of the vehicle data that has been stored. Therefore, it is in a legal professional's best interest to document the physical state of a vehicle, as well as any recorded vehicle data that may be onboard, such as ACM and ECU data. Additionally, it is now becoming much more common for Heavy Duty Vehicles to be equipped with camera systems of various types. Therefore, it is important to understand what camera system is being used, how it operates, and where its data will be stored, so that a legal professional can ensure that they obtained all evidence and information that was available on their vehicle.

It is common for vehicle owners to want to repair their vehicles as soon as possible after a crash. These vehicles can be the livelihood of drivers, so being without their vehicle means being out of a job. The sooner they can return to operation, the better. However, this does not afford operators the authority to ignore the critical measures that shall be taken to record evidence and vehicle data. Only after the vehicle data has been recorded shall a vehicle be given an approval to be repaired.

II. Anatomy of a Heavy-Duty Commercial Vehicle

Propulsion systems

Engines are the powerplants of passenger and commercial vehicles, as they convert fuel into kinetic energy. This process requires a precise level of control over the air, oil, coolant, and fuel systems since they all must react to changing conditions and demands. Therefore, vehicles such as Heavy-Duty Commercial will use a module such as an ECU to control such systems. Therefore, an ECU is a prime candidate to store vehicle data since much of the relevant data is passing through it anyway.

While it is important for a vehicle to propel itself forward, its ability to stop is equally, if not more, important. This is why braking systems are a main focus during post-accident investigations. The sizing and selection of brake components must all comply with the design best-practices to ensure robust operation of braking systems for vehicles of all types. On Heavy Duty Commercial vehicles, you will find drum brakes and disc brakes of various size, both of which rely on friction to slow the vehicle down. To ensure the wheels don't lock-up during a hard braking event, Anti-lock Braking Systems (ABS) have been used by different manufacturers. Much like how an ECU monitors the conditions of an engine, and ABS system monitors the condition of the wheels and brakes. Therefore, ABS data can also be collected after an accident for investigation.

Advanced Driver Assist Systems (ADAS)

As technology improves, it has become easier to implement smarter systems on products such as vehicles of all types in the interest of improving safety. One way this has been accomplished is through the usage of Advanced Driver Assist Systems (ADAS). Features such as active lane keep and emergency braking warnings are both ADAS systems

implemented with the goal of avoiding accidents. Active lane keep is a technique that utilizes a forward-facing camera and RADAR combination to recognize the position of the lane lines with respect to the vehicle. This way, the system can recognize if the vehicle is traveling over either one of the lines, and the system can compare this state to the input of the turn signal to determine whether or not crossing said line was intentional. If not, the system is capable of giving a “nudge” to the steering wheel in order to place the vehicle back between the lines.

Emergency braking also relies on the same forward-facing camera and RADAR systems as mentioned previously. However, instead of looking for lane lines, the system is looking for objects within the vehicle’s lane of travel. Therefore, if the system determines that there is a collision threat imminent. If so, the system may be capable of warning the driver with sound, light, or vibration to spur them into action.

III. Onboard video systems

Dashcams

As mentioned, ADAS systems can utilize forward-facing cameras to collect video data that is relevant to each system. However, just because a forward-facing camera is being used to detect objects or lane lines in real time does not guarantee that the system is storing the video data. It is possible, but not always guaranteed that an ADAS system will be capable of storing video data. Additionally, even if the hardware is in place for the recording of such data, this feature may or may not be turned off by a vehicle owner or fleet manager. Therefore, to ensure that a professional has done everything to look for the available data, it is best to attempt to recover video data, if the hardware indicates that this may be possible.

Other than cameras from an Original Equipment Manufacturer (OEM) ADAS system, it is also reasonable to inspect a vehicle with an aftermarket add-on camera system. Such systems usually contain a forward-facing camera in the cabin and may also be complimented by a driver-facing camera on the passenger side of the cabin interior. Such systems are intended for recording video and can store the data locally in the cabin, or remotely via an internet connection to an offsite server. It is important to note that memory limitations create the need for a “rolling window” of recording information. For instance, it may be that a camera system is only programmed to record a total of one hour of video (where old footage is replaced by new, incoming footage). This is relevant because if this camera is allowed to record continuously, the event of the accident may be recorded over with non-relevant video if not stopped. Some camera systems are equipped with buttons that are intended to be used after an accident in order to stop the continuous recording, and to ensure the previous footage was saved.

Where is the data stored and how to access it.

Since there are different combinations of camera and memory storage systems, it is helpful to look for the typical video data storage locations. For an OEM ADAS system, this

video can be stored in a Safety-Direct Processing Unit (SDPU). This unit can be imaged directly from the vehicle, or it can be mailed to the manufacturer for imaging. The inclusion of an SDPU indicates that the hardware is capable of recording data, however such function can and may be switched off.

For aftermarket dashcams (both forward and driver-facing), it is possible that the data is stored in a Secure Digital (SD) card attached within one of the cameras. Such an SD card can be accessed and imaged relatively easily. For cloud storage, a vehicle owner or fleet manager should be contact in order to see if there was any relevant footage uploaded and saved to the serer.

IV. Here is what the recovered video shows

Forward Facing

A forward facing dashcam (either from an ADAS system or an aftermarket dashcam) can show a forward-facing perspective of the vehicle from a range or heights between the top and bottom edges of the windshield. From this perspective, much can be learned about the actions of the vehicle itself, as well as any other vehicles surrounding it.

It is important to note that images are not equivalent to measurements. Therefore, one should not look at a video and expect that the footage alone will allow for a highly accurate speed determination. Additionally, it is common to see such footage with a distorted "fish-eye" lens perspective, which allows the observer a chance to see more of the surrounding area. This can give the footage viewer a warped sense of the area of the video.

Driver Facing

Driver facing footage can shed light on the actions of the driver leading up to, during and after the accident. If needed, the timing of the actions of the driver can be investigated from this. This way, the previously acquired verbal testimony can be compared to the video for corroboration. Additionally, some driver-facing cameras are capable of seeing images from the rear-view mirrors, which may be relevant to an investigation

V. Here is how the video evidence can be used

Compare to testimony

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Apply camera matching techniques

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Legal Concerns

Driver scoring and coaching is almost always integral to video recording systems. Be aware of how this data is used, kept, or disposed of by the motor carrier. Be aware of ways video can be separated for portability from the video recording system/application (i.e., portability of "just the video," without gauges, diagnostics displays, or coaching data).

Be aware of who from the motor carrier is "connected" to a particular video and whether or not anyone on the defense side would want that person deposed.

Be aware of "unwanted" video from inward-facing cameras and be prepared to act accordingly with this kind of video (example: driver in a no-fault accident is caught on video holding a phone) – this is most often with inward-facing cameras, but can happen with in-cab activity or images caught in windshield reflection by outward-facing cameras as well. Knowingly disposing of such data would be unethical behavior.