

☎ 1-800-263-6351 ✉ info@kodsengineering.com



Using Video Evidence in Accident Reconstruction

Sep 27, 2016 | Accident Reconstruction, Crash Testing, Evidence Preservation, Technology



We *love* objective evidence. When forensic experts get video footage related to a collision or incident, it's like Christmas came early for us. Photos of the incident scene with the vehicles still in their final rest positions are like that sweater from

your Grandma – perhaps not as exciting or fashionable, but still thoughtful and useful. In either case, we still have to unwrap the evidentiary gifts and get some analysis done to retrieve answers. Unlike witnesses, evidence such as video footage, scene photographs, and data from black boxes don't lie – but must be carefully interpreted (see our previous blog post: ["Was the Black Box Wrong?"](#)). When properly analyzed, video can be used to extract objective information about position and time so that we can very accurately estimate speed. In this article, we answer some common questions about video evidence: ***What are sources of video evidence? What information can be gleaned from video evidence? How accurate is video analysis?***

What are sources of video evidence?

Footage of the collision itself is great, but clients are often surprised to find out what we can do with video footage of vehicles or a scene even if it only includes the moments right before or after impact. Many security systems only keep videos for a short period of time before they are overwritten, so make sure you locate any video sources early and obtain the video files quickly. Here are sources of video footage to look for:

- Security video from a nearby homes or business
- Transit vehicles often have interior and exterior security views and
- Dashcam video from an involved vehicle
- Dashcam video from a witness's vehicle
- Dashcam video from a vehicle that came upon the scene after, including Police vehicles
- Police video of the vehicles following a collision
- News media helicopter / drone
- News media photojournalists at the scene after a collision
- Involved parties taking cell phone video following a collision



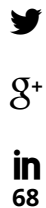
What information can be gleaned from video evidence?

Like photogrammetry, a methodology that allows us to extract measurements from photographs (see our previous blog post [“The Art and Science of Photogrammetry”](#) for more details), we can conduct a similar type of analysis on videos that can be called “videogrammetry.” What’s great about video footage is that it not only allows us to get measurements of *position(s)*, as photographs do, but it also gives us information about *time* (from the camera frame rate). With information about position *and* time, we can very accurately estimate impact speed and even calculate acceleration (a measure of impact severity) – information that is usually of great interest to our clients.

Here are some examples of what we have done with video evidence:

- Used a witness’s dashcam (which happened to catch a collision) to calculate the speed of one of the vehicle’s just before impact.
- Used a transit vehicle’s interior camera to see how time elapsed as the bus passed landmarks on the street to calculate the speed of the bus before colliding with another vehicle.
- Used photographs and videos taken after a collision by police/media/witnesses /involved parties to locate the vehicles in their rest positions.
- Used a building’s security video (which only showed us the traffic signal light colour in one direction) in combination with traffic signal timing chart to identify the traffic signal condition (colour) when a collision occurred in the opposing direction.
- Used a business’s exterior security video to analyze a pedestrian’s speed, movement, and time before and during crossing a street mid-block (“jay-walking”) before being involved in a collision.
- Used a transit vehicle’s interior camera to identify how a passenger fell while de-boarding a bus.

(Bonus: video evidence can give us information about *time* not just by its frame rate, but also from accompanying audio. For example, if the impact occurs *after* a vehicle has passed through the frame of an onlooking camera, but we can audibly hear the crash a second or two later, it’s very likely that the speed we calculate for



the vehicle as it was moving through the frame is very close to its impact speed if there was no significant accelerating or braking. And yes, that is another example of how we've used video evidence!).

The complexity of a video analysis depends on the nature and quality of the footage available. Sometimes video analysis can be done simply, but other methods require us to take detailed measurements of the scene for scaling purposes – for example, when we need to calculate precise speed based on the time taken for a vehicle to pass certain landmarks, we must know the location of those landmarks in accurate measurements.

How accurate is video analysis?

A discussion of the accuracy of video analysis should be prefaced by saying that determining vehicle speed from video analysis is almost never the *only* method we use. In fact, whether using video analysis or not, we ensure that any full accident reconstruction has supported conclusions that match even when determined several ways. For example, we have compared a speed assessed from video with information about the vehicle's speed from another source, such as the vehicle's event data recorder (EDR) or black box. We also check accident reconstruction analyses of conservation of energy and conservation of momentum with video analysis to make sure the speeds match. Having more than one source of information allows us to make conclusions with much higher certainty, which can often help settle matters early or form a strong portion of the expert evidence if matters proceed to court.

Validating the accuracy of video analysis is a matter of interest to us. During our Crash Conference, vehicles are heavily instrumented and the crash is covered by numerous video camera views. What better situation could we ask for to conduct a little experiment or two? Warning: things are about to get nerdy! You can always skip to the [conclusions](#), but read on if you want to understand how we tested video analysis accuracy.





68

Figure 1A (left): “Dashcam” video from a hood-mounted go-pro on a silver Malibu during a crash test.

Figure 1B (right): “Fixed Side View” video of the same crash test from a stationary camera meant to emulate the view of a security camera or a stopped vehicle’s

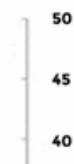
dashcam.

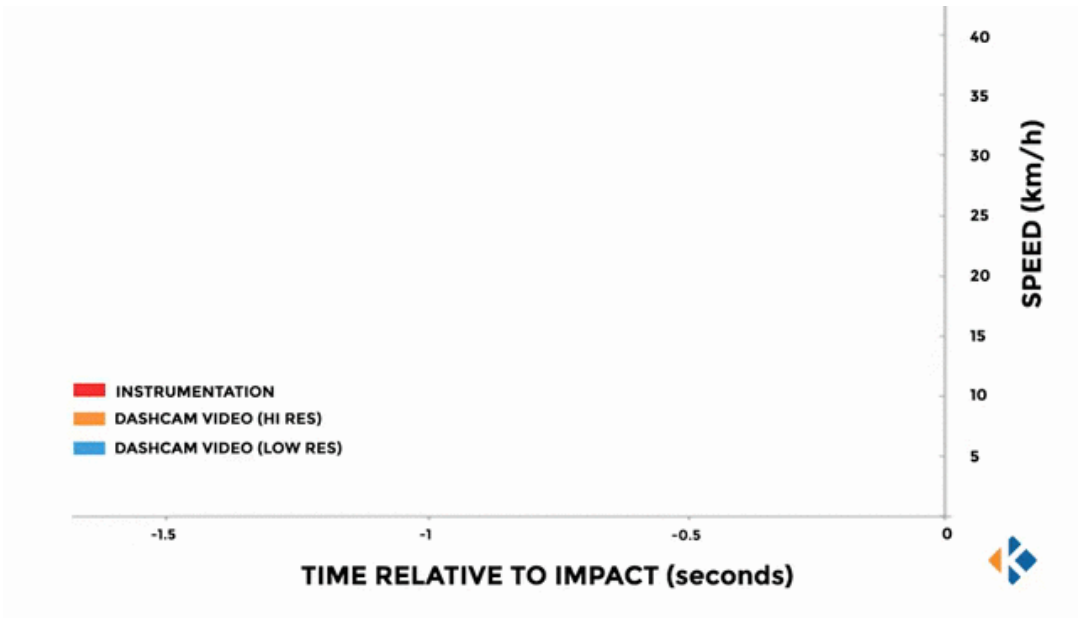
Using video analysis, we calculated the speed of the silver Malibu from a go-pro video camera mounted on its hood (Figure 1A, above left), meant to emulate moving dashcam footage. The data we calculated from the analyzing the high resolution go pro “dash cam” footage is plotted in Graph 1, below (orange line). We also calculated the speed of that same vehicle from another high resolution camera that recorded the crash test in a fixed position from the side (Figure 1B, above), meant to emulate the view a security camera or stopped vehicle dashcam might have. The data analyzed from the video of this high resolution fixed camera is plotted on Graph 2, below (green line). Since vehicle dashcams and security cameras are seldom of as high resolution as the cameras we used, we also reduced the resolution, frame rate and the quality (by increasing compression) and carried out another speed determination in the same manner in order to have “Lo Res” options to compare to from both views (blue line in Graph 1 and purple line in Graph 2). Video analysis speed determination is conducted using videogrammetry software, but may also be done using commercially available video viewing software and a computer spreadsheet. In the dashcam perspective, speed was determined by measuring the time which elapsed as the vehicle passed the measured distances between painted parking space lines. In the security cam perspective we measured distances moved based on scaling the frames to the vehicle’s wheelbase.

Whenever we conduct crash tests we get accurate speed measurements from various sources of instrumentation plugged into and mounted on the crash test vehicles. But for the sake of simplicity, we will only be comparing our video analysis data to one of our instrumentation measurements: a high-speed GPS and acceleration data logger (red line on both graphs below).

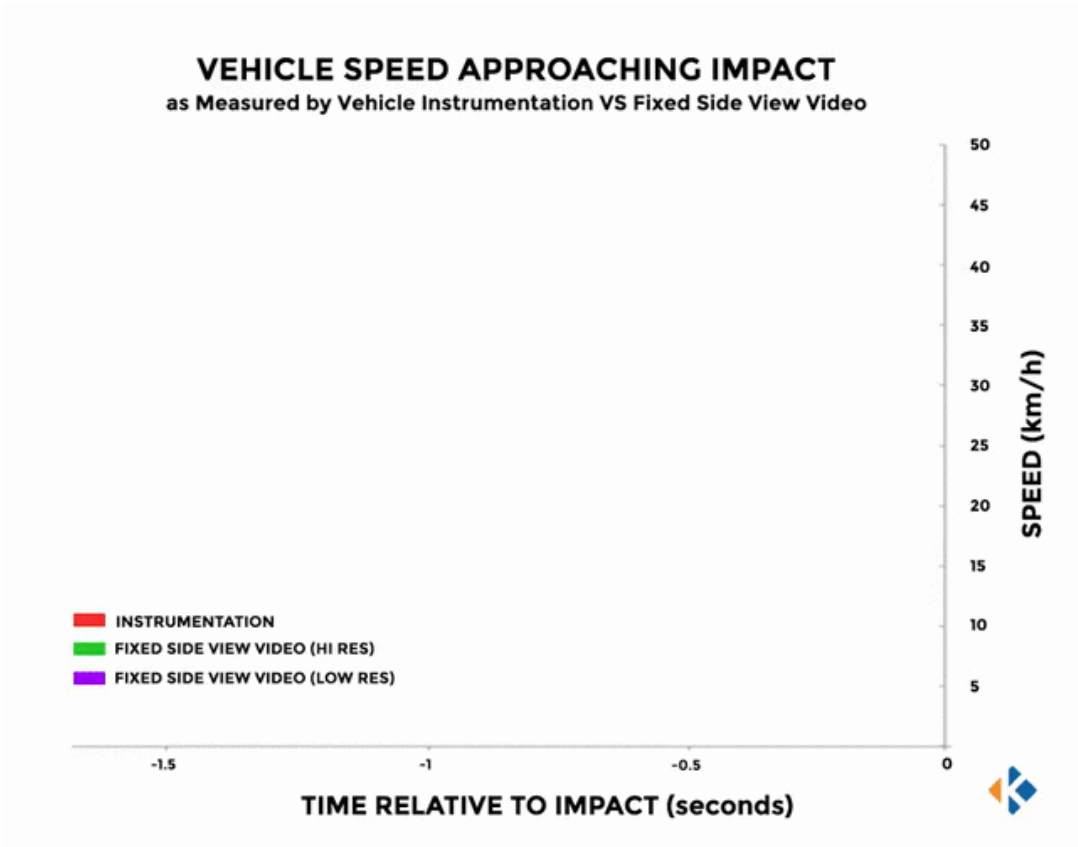
The graphs below summarize our findings:

VEHICLE SPEED APPROACHING IMPACT
as Measured by Vehicle Instrumentation VS Dashcam Video





Graph 1: Pre-impact speed of an instrumented crash test vehicle compared to speeds calculated by conducting video analysis on “dashcam” footage.



Graph 2: Pre-impact speed of an instrumented crash test vehicle compared to speeds calculated by conducting video analysis on “fixed side view video” footage.

calculated by conducting video analysis on video from a fixed camera with a side view of the crash. Note: For both video data lines, data points are only plotted from just under 1 second before the crash because that is when the vehicle entered the video frame.

Conclusions

In general, all four tests of the calculation of vehicle speed from video analysis closely matched the vehicle speed from instrumentation. There are some limitations to analysis from videos; the dashcam perspective had more variability on either side of the instrumented speeds compared with the fixed camera perspective due to the larger spacing of the visible landmarks. There was also more variability in the findings when we used the lower quality and lower frame rate video. But the average numbers still match the instrumentation well.

In conclusion, video evidence can be quite accurate, especially if the footage includes more detail and is of a higher quality. So, be sure to reference our list above and gather any relevant sources of video evidence you can, while they are still available. As discussed above, video evidence can contain a goldmine of information that is incredibly useful to experts who can conduct video analysis, and therefore can help you get the answers you need.



68

Share this article:



68

Sign up for our quarterly newsletter:**Subscribe****Browse by category:**

Browse by category:

Recent Posts

Black Box Lunch and Learn Video Highlights

Effect of Climate Change on Property Claims & Forensic Investigations

Now Offering Fixed Rates for Evidence Preservation in the Fredericton, Saint John, and Moncton areas!



Welcoming Kenneth Cowie to the Kodsi Forensic Engineering Team



Reconstructing Night-time Visibility



The Evolution of Crash Reconstruction in a Driverless World: A Forensic Expert's Observations over the last 20 Years

The Reconstructionator: Computer-Assisted Engineering Mechanics for Law Enforcement Crash Reconstruction Professionals

Our Team Is Growing: Meet Our New Talent!

Kodsi & DIALOG collaborate to offer Forensic Structural Engineering & Remediation Services

Happy Holidays!

[Recent articles from The](#)

Client Resources

- Submit New Assignment
- Black Box Information
- Evidence & Documents to Submit to Us
- Process of working with a forensic expert
- Seminars for legal and insurance professionals

Kodsi Post

- Black Box Lunch and Learn Video Highlights
- Effect of Climate Change on Property Claims & Forensic Investigations
- Now Offering Fixed Rates for Evidence Preservation in the Fredericton, Saint John, and Moncton areas!
- Welcoming Kenneth Cowie to the Kodsi Forensic Engineering Team
- Reconstructing Night-time Visibility

Connect With Us



Newsletter signup:

Subscribe

Contact Us

Phone: 1-800-263-6351

Fax: 416-977-6622

Head Office:

1- 225 Traders Blvd. E.
Mississauga, ON, L4Z 3L8

Email: info@kodsiengineering.com

To contact any of our experts directly, please call or find their email address on the experts page.