CLEARING AND DOCUMENTING INJURY AND DEATH CRASHES

Does Law Enforcement Leverage The Use of Digital Technology?

BY ROGER R. RIDER, CORPORAL - POLICE DEPARTMENT, CITY OF HURST, TEXAS

EVIDENCE DOCUMENTATION CONDUCTED BY A HIGHLY-TRAINED RECONSTRUCTION SPECIALIST IS THE STANDARD FOR CRASHES - DOES LAW ENFORCEMENT AGREE?

IN 2016, THERE WERE AN ESTIMATED 7,277,000 POLICE-REPORTED MOTOR VEHICLE CRASHES IN THE UNITED STATES, RESULTING IN 37,461 FATALITIES AND 3,144,000 PEOPLE INJURED. (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, 2016)

Nearly one in five drivers have been involved in a serious crash at some point in their lives and one in ten have been seriously injured in a crash (AAA Foundation of Traffic Safety, 2017).

A vehicle crash can occur for many reasons, resulting in various amounts of damage, injury and even death. Law enforcement are often the first responders called to formalize an evaluation of a crash scene and report their findings based on first impressions. This heavy reporting burden placed on law enforcement continues to challenge an officer's level of expertise.

Terminologies such as accidents or collisions have been used synonymously with crashes.

This paper will focus on those crashes involving the investigation of criminal charges filed with district attorneys. Crashes are quite complicated events. The use of technology and a crash reconstructionist are available to make the process smoother and to collect more accurate data. We will uncover what this technology is and if law enforcement agrees with using a reconstruction specialist as the standard for crash investigations in this paper.

Using crash reconstructionists can provide law enforcement with more accurate data.

Crash investigations start on scene with law enforcement. After securing a crash scene and checking for injured parties, the initial examination of the scene will encompass the gathering of large amounts of information including digital photography to capture scenes, vehicle locations, roadway signage, signals, and roadway markings such as skids, slides, yaws, and gouges. First, officers must provide or verify that medical assistance has been provided, and then interview vehicle occupants and surrounding witnesses. After the occupant's medical needs have been addressed, the vehicles are viewed for damage. The damage viewed on scene should correspond to occupant and witness statements. When documenting vehicle location(s), they should match statements, or be justified with basic physics analyses. Involved parties and witness statements should be obtained as soon as possible in writing and/or recorded.

The incident shall be secured as a "crime scene" once it has been established that criminal charges will be imposed. It can be determined at this point to deploy a crash reconstructionist or team for further gathering of evidence.

With the scene secured, now the process of documenting the scene for prosecution begins.

Picture: Hurst Police Mock Test Scene 3

SOLUTION

Vehicle accident reconstruction is the forensic science of determining the factors that contribute to motor vehicle accidents (Thivierge, 2015).

In order to analyze the incident, the evidence, and resting place of involved vehicles must be measured and mapped onto a visual two-dimensional drawing. Should you be submitting your evidentiary map in 3D? Let's find out.

TST and 3D Scanning

Crash investigation has evolved over time, moving from measuring tapes to photogrammetry, Total Station Theodolite (TST), and then 3D scanning. Each one of these techniques has posed significant benefits when capturing crime scene data with photo-evidence. After taking original photos of a crash scene, investigators place the measuring reference and markers at necessary evidence locations for documentation purposes. Key items identified are normally evidence of lane lines, lane dividers, edges of grass, road markings, and vehicles to later create a two or three-dimensional drawing to represent the incident.

3D laser scanning technology has been used in various industries such as surveying, automotive, and medical. This technique has recently become more popular in law enforcement due to mobility, additional data collected, reduced job time, price reduction, and availabilities of grant funding. FARO, a leading manufacturer of laser scanners for law enforcement has proven laser scanning offers an entirely new tool to the crash reconstructionist's kit.

“FARO PROVIDES 3D LASER SCANNING SOLUTIONS TO AUGMENT DESIGN AND INFRASTRUCTURE. IT IS HEAVILY RELIED UPON IN CRASH INVESTIGATIONS.”

SOLUTION, CONT'D

TST and 3D Scanning

Evidence gathered at the scene normally starts with photographs. The use of digital photography to capture the scene, vehicle locations, roadway signage signals, and roadway markings such as skids, slides, yaws, and gouges have become the modern crime scene standard. This mapping may be done with a “Total Station Theodolite” (TST) commonly used for construction to survey and map location properties and their buildings. A total station is an electronic instrument utilizing a theodolite and electronic distance meter to accurately obtain precise measurements and create drawing with the assistance computer-aided design software (CAD). These horizontal and vertical measurements can be input into computer-aided design software to map the scene and evidence. This author and The Hurst Police Department researched this process and compared TST to 3D scanners in mock scenes.

AMONG REPORTED CRASHES IN 2016, LESS THAN 1 PERCENT (34,439) WERE FATAL CRASHES, CLOSE TO 30 PERCENT (2,177,000) WERE INJURY CRASHES, AND ALMOST 70 PERCENT (5,065,000) WERE PROPERTY-DAMAGE-ONLY CRASHES (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, 2016).

Picture: Hurst Police Mock Test Scene 1

Picture: Hurst Police Mock Test Scene 1

RESULTS

MOCK SCENE DEMOGRAPHICS

It takes an extended length of time to investigate crash incidents, as well as has an impact on the involved parties. The citizens in the area, the first responders, and the economy were all identified as an important aspect of research conducted. This author and the Hurst Police Department conducted mock crash incidents to compare the time necessary to document those incidents with at TST and 3D scanning equipment.

Three mock events were established to collect data to better understand the additional variable details of a crash scene investigation. The author established mock events utilizing simple scenarios with two-vehicles on residential roadways. The two and three-person TST (Topcon) teams were given instructions to document the scene and complete a diagram of the incident. The time to complete the TST map was done in CrashZone (a computerized drawing program) and the operator reports their time of completion.

The FARO Focus S350 participant was given instructions to document the scene with 4 scans to represent the scene in a digital map. This author logged times of team arrival and equipment deployment.

The parameters of the FARO Focus measurements included its time to process and register the scan into a project point cloud.

Variables collected in the field include the time to complete total station data collection and digital photographs, as well as the number of personnel needed to complete this task. The second set of independent variables consisted of the time it took to complete laser scans of the entire scene.

The mock event study showed a significant impact on the man-hours utilized in a crash event. A FARO Focus S350, due to its ability to be operated by one person, can reduce the total man hours needed to document the scene. These mock events were able to show more than an 85% reduction in man-hours needed to create a scene map. This type of reduction, over several years, can assist agencies in justifying the initial capital cost of a 3D laser device.

For example, if agency spends 200 - 1000 man hours on major crash incidents, this can be reduced by 85% the next year. Using a $30/hour rate, $5,100 - $25,500 savings in crash scene man hours alone can be shown. We show 1 (one) illustration of our demographics and findings below.

Fun fact: What do laser scanners do?

3D laser scanners have an internal device that spins. As it spins, it reflects objects off a mirror and returns with data measurement points to be stored in a "point cloud."

A FARO Focus series can collect 976,000 points per second.

Picture: Hurst Police Mock Test Scene 2

Variables collected for mock studies.

Variable		Event 1	Event 2	Event 3	Total	Increase/ Decrease
Digital photos taken		45	36	54	135	N/A
Points collected on	Topcon	36	65	36	137	Increase Very large
	FARO	553,579,040	366,700,588	56,215,883	956,816,238	
Time (Min) on scene for	Topcon	56	54	50	160	Decrease 53%
	FARO	23:30	23:10	28:45	75.42	
Time (Min) to map for	Topcon	60	44	60	164	Decrease 67%
	FARO	30	11:40	12:20	54	
Total man hours for	Topcon	5.8	3.2	5.5	14.5	Decrease 85%
	FARO	.89	.58	.67	2.14	

RESULTS, CONT'D

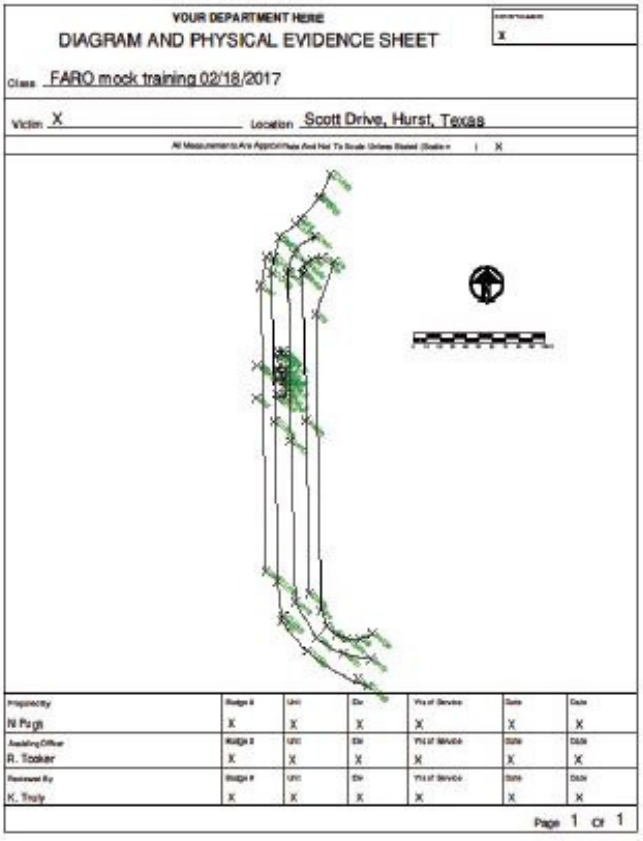
MOCK SCENE DEMOGRAPHICS

The number of major crash incidents researched in this study are limited, but normally end with the involved subjects on the scene, injured, and unable to leave without emergency assistance. These incidents also resulted in large amounts of evidence such as road markings, vehicle damage, involved party injuries, and data from vehicle computer modules. Due to these factors, numerous first responders are involved in the incident; resulting in many man hours as well as resources being deployed. When these incidents occur, they have the potential of affecting the first responders as well as those traveling through the area of the incident. The most significant impacts of reducing major incidents from 30 minutes to 1 hour are seen in the reduction in time spent by first responders in a dangerous environment, as well as, the decrease for citizens in both the amount of time spent in traffic congestion and the number of secondary crashes due to hectic crash scenes.

3D laser measuring equipment can collect millions of data points to create a 3D digital crime scene. With this change in technology, the law enforcement crash profession can review the crime scene at any time after the incident. Many crash scenes have been challenged on measurement accuracy that can affect minimum speed calculations of vehicles. 3D laser measuring equipment can address this challenge by assisting law enforcement in documenting this evidence in its original state. This same concept of collecting data and photographs can reduce the number of scene pictures needed to document the scene around the incident. Crime scene pictures can be focused on the evidence, vehicles, and area around the vehicles. The 3D and panoramic view obtained by the 3D laser measuring equipment can be used to replace the process of area pictures taken to assist in describing the “big picture” of the crash scene.

These mock event studies of this research showed an impact on the man-hours utilized in a crash event. They were able to show more than an 85% reduction in man-hours needed to create a scene map. This type of reduction, over several years, can assist agencies in justifying the initial capital cost of a 3D laser device.

TOPCON DIAGRAM FOR EVENT THREE



FARO S350 DIAGRAM FOR EVENT THREE

REDUCE MAN-HOURS BY LEVERAGING 3D SCANNERS ON CRASH INVESTIGATIONS!

CITATIONS

01 AAA Foundation of Traffic Safety. 2016 Traffic safety culture index (2017).

02 National Center for Statistics and Analysis. (2018, March). Police-reported motor vehicle traffic crashes in 2016. (Research Note Report No. DOT HS 812 501). Washington, DC: National Highway Traffic Safety Administration.

02 James, W., McKinzie, S., Benson, W., & Heise, C. (2016). Crash Investigation and Reconstruction Technologies and Best Practices. Washington D.C.