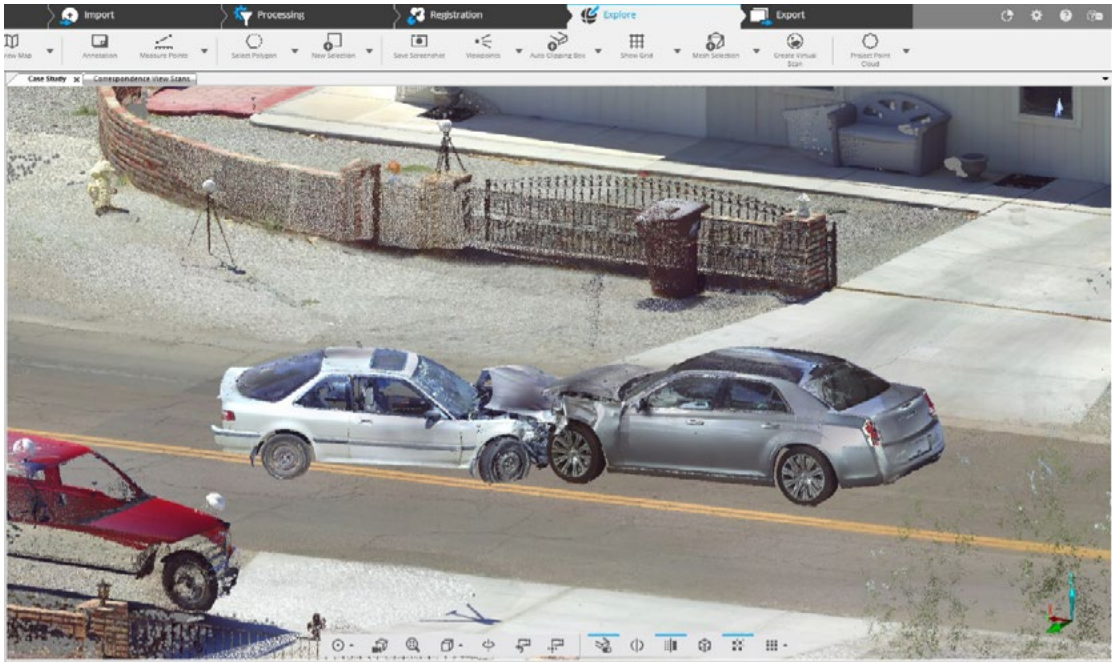
CASE STUDY

COLLISION ENGINEERING ASSOCIATES, INC.

Creating a Competitive Edge with FARO® Scanners

Wesley Grimes | President of Collision Engineering Associates, Inc

Crash Reconstruction Firm Adopts FARO Laser Scanners To Safely Capture Scenes While On Short Timelines



The completed 3D scene, as shown here in SCENE software, can be viewed from any position.

Challenge

Like many crash reconstruction firms, Mesa, Arizona-based Collision Engineering Associates previously experienced difficulty when documenting crash scenes due to the limitations inherent in using total stations and hand measurements. Because of safety issues near fast-moving traffic, staying safe and avoiding traffic during a crash reconstruction was challenging. So was capturing enough evidence, and the right evidence.

Solution

Collision Engineering Associates has acquired both a FARO Focus^{3D} X 330 and a FARO Focus^{S} 150 Laser Scanner to help them thoroughly and safely document crash scenes faster they could with previous tools. The firm also has started using drones to pick up evidence from large crash scenes and to complement evidence preserved with their FARO Laser Scanner.

Results

Collision Engineering Associates now uses laser scanning to safely capture more complete, reliable, and accurate data from crash scenes, all done from the side of the road. They have multiple FARO Laser Scanners which they use to scan crash scenes and to scan vehicles inside and out, ensuring that all the evidence is captured.

FARO®

Motor vehicle crashes in the U.S. every year have an economic toll of over $120 billion due to loss of productivity and traffic-related congestion[1]. No one wants to stop traffic on a busy street for long, but investigators must be able to document every aspect of a crash accurately. Crash scenes quickly change as vehicles are hauled away. There is an urgent need to capture all the data without missing key evidence. The challenge to document crash scenes is also greatly compounded by safety concerns for the investigators who must work while traffic continues to flow.

Fast Response Scenes Well-Suited for Scanning

These circumstances are very familiar to Wesley Grimes, a veteran crash re-constructionist who is president of Collision Engineering Associates. Grimes investigates many crash scenes that require him to respond within a day, or sometimes an hour, of the crash itself. The need to respond quickly and prepare for potential litigation encourages Grimes to always be on the lookout for faster and better tools to help document crash scenes. Grimes' company previously used manual measurement methods or a total station to capture individual data points at crash scenes. Now, they preserve the entire scene and document all the evidence with a laser scanner. "With a total station, I could take the time to shoot more than 100 measurements, but not more than thousand," Grimes explained. "Now, with a laser scanner, I don't think about how many measurements I need to take. I leave the crash scene with a virtual copy of the scene in my pocket."

Wes Grimes with his new, FARO Focus^{S} 150 Laser Scanner

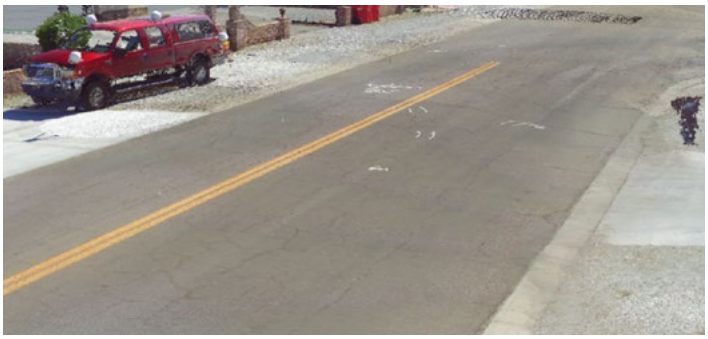
Collision Engineering Associates currently has three FARO Laser Scanners, including the latest model ---FARO Focus^{S} 150. Grimes feels confident about his ability to capture all the critical evidence when using a FARO Laser Scanner. "If I'm able to get a line of sight to the data, I know I captured all the points. I no longer have to worry about what I didn't measure," Grimes said.

FARO Scanner Works Well Around Traffic and to Establish Line of Sight

Before acquiring the new Focus^{S} 150, the Focus^{3D} X 330 Laser Scanner was the tool Grimes most often chose to document crash scenes. The scanner has been particularly helpful because it can work around the issue of continually flowing traffic. "The scanner is very useful for us when we have traffic flowing along the roadway because we can still gather critical information and evidence without impeding traffic. There is no need to go out into the roadway to take measurements," Grimes said. Grimes frequently scans crash scenes along interstate highways in Arizona, all of which are constantly busy with fast-moving traffic. On these highways, it would be impossible to safely take hand measurements of a large crash scene without closing lanes of traffic. With a laser scanner, Grimes can scan the scene and capture the necessary measurements from the side of the road. For example, Grimes offered, "We can easily pick up measurements of skid marks with the scanner while we are standing on the side of the road."

Because a laser scanner can only measure what the laser can touch, it often requires setting the scanner up in multiple positions to capture all sides of a crash. FARO's SCENE software is used to process all the scans of the crash and register them together. In this process, millions of measured data points are combined to form a dimensionally-accurate, 3D, digital model of the scene called a point cloud. Software is then used to walk through the point cloud and view it from any position, including the position of the driver or a witness.

1 *https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812013*



Collision Engineering Associates was called in to reconstruct at crash on this street in Yuma, Arizona. The scene of the crash was captured with their FARO Focus^{3D} X 330 Laser Scanner after the vehicles had been removed.

A crash re-constructionist can use this point cloud of a crash to verify what a witness could, or could not, have seen. Grimes explains, "We can digitally put in a line of sight where a witness may have been standing to see if they could have seen what they indicated. For example, we can see if a driver might have been limited in some way by a sign, a dirt mound, or another vehicle. We can do all of these things as if we were at the real scene, but we can do it on a computer," Grimes added.

His FARO Laser Scanner was instrumental in a recent case where a vehicle backing out of a driveway was struck by a vehicle driving on the road, resulting in injuries. The police had taken photographs, but Grimes needed accurate measurements to reconstruct what happened. "We were able to scan the two vehicles in separate wrecking yards and scan the residential roadway where the crash happened. Then we were able to digitally place the scanned vehicles back into the 3D model of the roadway, matching the police photographs," Grimes explained.

This digital model, captured by the laser scanner at three different locations, made it possible to determine how markings on the roadway were made. It was also possible to use damage patterns to show how the vehicles were oriented when the impact occurred. Grimes was then able to clarify the physical evidence at the scene and verify or discredit statements made by the drivers of the vehicles involved.

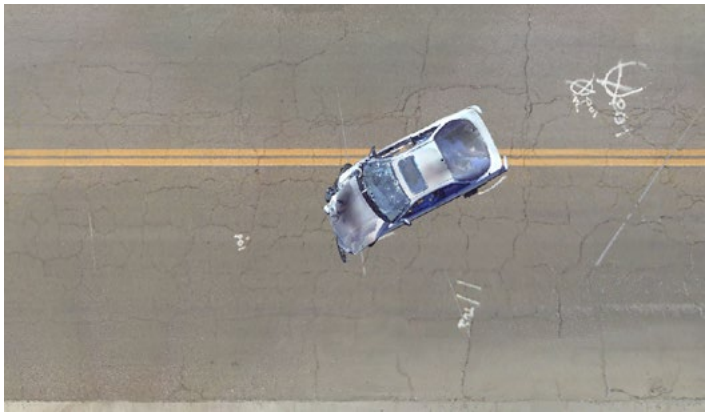
Scanning Vehicles Inside and Out Necessary for a Complete Analysis

Grimes considers reconstructing a crash scene to be like assembling a jigsaw puzzle. Putting the pieces correctly together requires physical evidence and testimony. For instance, determining how the occupants interacted with the vehicle at the time of a crash can help the investigator gain a better understanding of what happened.

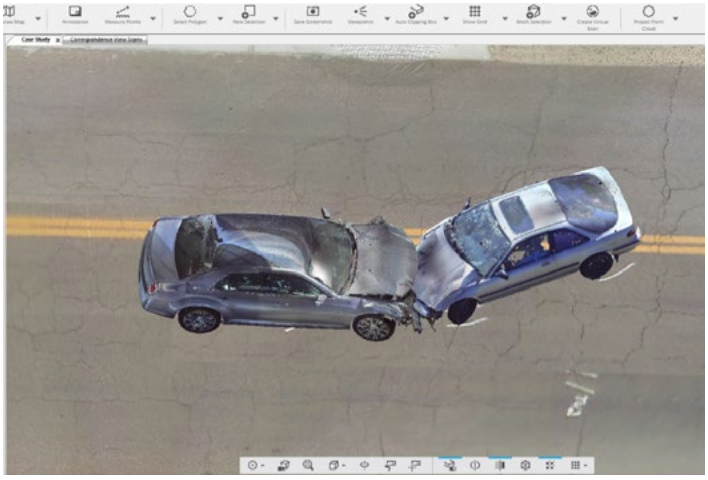
An ideal way to capture the data required for this type of biomechanical analysis is to scan the interior of crashed vehicles after they have been brought to a tow yard. "If there is a question about how occupants interacted within the crash, or how they were injured, we will work with a biomechanical engineer," Grimes said. "We scan the interior and exterior of the vehicle to create a complete, three-dimensional model. This model helps us understand the damage on the outside of the vehicles and relate it to how occupants moved within the vehicle. Then we can relate damage inside the vehicle to the occupants," Grimes added.

Crash investigators at Collision Engineering Associates always scan a crash vehicle from at least four corners, even if the damage is concentrated only a small portion of the vehicle. Grimes explains "We always want to document the entire vehicle. Many times, a surface that does not have damage turns out to be just as important as the area of damage because it helps us eliminate possible contact there."

The Chrysler® was scanned in a salvage yard, and the resulting 3D model was digitally placed into the scene at the position of impact.



Similarly, the other vehicle in this crash, this Acura®, was also scanned after the event and digitally placed back into the scene using software.



Skid marks, gouges, painted marks, and other physical evidence is all captured by the laser scanner and can be used to accurately position the vehicles in the scene.

Studying the crush of vehicles, as captured with a FARO Laser Scanner, can also reveal crucial evidence. “The depth of crush will help us determine the severity of the crash,” Grimes said. “A scanner gives both high-resolution imagery and all the measurements needed for calculations to analyze crush. We can also match the damage on one vehicle with damage on the other vehicle to understand how the vehicles interacted,” Grimes continued.

In another case, Collision Engineering Associates was called in to reconstruct a fatality crash where an SUV was hit from behind by a vehicle going too fast for the road conditions. The SUV was pushed forward upon impact, sideswiped another vehicle, rotated and traveled across the roadway, was struck again on its right rear side and then went airborne. The back rear portion of the Explorer eventually struck a retaining wall and was suspended at least three off the ground. The driver of the SUV was ejected from the vehicle and killed.

Grimes explained how scanning the scene and vehicles helped them understand how each impact occurred, “We scanned the crushed SUV and an exemplar vehicle and lined up compatible reference points between the two digital models. We could slice through the scan and look at different elevations and what components were damaged at that elevation. Trying to distinguish between all the damage patterns was very difficult, and we were not able to completely isolate them, but we were able to determine how the events occurred.”

Drone Used to Compliment Scan Data at Crash Scenes

In addition to 3D laser scanning, Collision Engineering Associates also incorporates the use of a drone for documenting large crash scenes. While the drone can capture an entire scene rapidly, it does not yield the same resolution or accuracy as a laser scanner. For these cases, Grimes uses his FARO Laser Scanner to capture the area near impact while his DJI® Phantom 4 Pro or Mavic Pro aerial drone is flown over the entire scene to photograph a large, macro view of the area.

To get three-dimensional accuracy, Grimes argues that a drone should be flown multiple times to capture a top-down view and oblique views of the scene. The oblique views will fill in the elevation views of buildings and details on other vertical surfaces. Collision Engineering Associates reconstructionists try to fly drones at 100 feet off the ground so that each pixel is covering about .004 inches. In this way, “You have a much higher resolution,” Grimes said. The drone data is combined with the data captured with their laser scanner using FARO SCENE software.

Best Crash Mapping Tools Today

Wesley Grimes and his team at Collision Engineering Associates are confident they have the best tools available today for mapping crash scenes, including multiple laser scanners and aerial drones. They can digitally preserve an entire crash scene and the individual vehicles for the data needed to accurately analyze line of sight, crush, and occupant kinematics. Best of all, these millions of data points are all safely measured from the side of the road with the push of a button on their FARO Laser Scanner.

Grimes tested the FARO Focus^S 150 in the Arizona heat, using a special cooling jacket. The jacket is designed to dramatically increase the operating temperature at which the scanner can be used.

About Collision Engineering Associates

Collision Engineering Associates of Arizona specialize in accident reconstruction using the latest simulation software and technology and provide services to the Southwestern USA. Their accident investigation team has over 116 years of combined experience in the road traffic accident investigation industry, public safety and forensic consulting. For more information, visit ***cea-az.com***.

About Wes Grimes

Wesley Grimes, the president of Collision Engineering Associates, Inc., has been documenting, analyzing and reconstructing vehicular accidents since 1981. Mr. Grimes is a registered professional engineer with a Bachelor of Science in Mechanical Engineering from Arizona State University. He is also qualified to testify in federal and state courts throughout the United States.

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