

# A Practical Guide to Shooting Scene Preservation for Crime Scene Investigators

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**Abstract:** When a dedicated shooting reconstruction team is not immediately available, the first crime scene investigators on the scene need to properly document the condition of the scene and preserve evidence that will be needed for the reconstruction. This paper offers suggested guidelines for crime scene investigators to properly document and preserve evidence in a shooting scene for later processing by a shooting reconstruction team.

**Keywords:** shooting reconstruction, shooting scene preservation, crime scene documentation

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## Introduction

In some jurisdictions crime scene investigators are equipped and trained to conduct shooting reconstructions themselves or have the expertise of specialists from their crime laboratory available to immediately respond to a scene. However, in many cases this capability needs to be called upon from a neighboring jurisdiction or another agency. For example, in most FBI cases a shooting reconstruction team would have to travel from the FBI Laboratory in Quantico, Virginia, which could take at least a day to reach a shooting scene on the other side of the country. Similar circumstances exist for many smaller police departments who rely on the FBI or their state crime lab that could be responding from many hours away. In such situations it is critical that the initial crime scene investigators are well versed in the proper preservation of

the scene for the shooting reconstruction team while remaining unhindered in the processing of other important evidence.

The following is a guide to assist crime scene investigators in processing a shooting scene that is a candidate for shooting reconstruction. These guidelines will help ensure evidence valuable to the shooting reconstruction team is properly preserved and documented by the first investigators on the scene. The authors also intend this guide to be used by shooting reconstruction specialists, such as many of the subscribers of this Journal, to provide to agencies within their jurisdictions as a training aid so they will be better prepared to handle shooting crime scenes and officer-involved shootings during their initial processing.



## General Principles

### *Initial Crime Scene Processing and Documentation*

As with any crime scene, the proper documentation of the scene through photographs and sketches is highly important. Although this guide does not cover standard documentation techniques, the authors do wish to reinforce how important initial documentation can be to the shooting reconstruction team. Photographs can help the shooting reconstruction team see the original condition and location of objects, such as locations of bodies, locations of firearms evidence, orientation of vehicles, and the original position of moveable objects. Such items may need to be moved before the arrival of the shooting reconstruction team and this initial documentation can prove invaluable.

These guidelines presume the shooting reconstruction team is not available to immediately respond to the scene. In these circumstances, much of the initial crime scene processing should go forward as normal. This is both prudent and appropriate since most dedicated shooting reconstruction teams will neither want, nor likely be equipped, to handle standard crime scene duties such as processing and collecting trace evidence, latent fingerprints, biological evidence, and impression evidence. Instead, the shooting reconstruction team should not begin their work until the standard forms of processing have been completed. Not only does this permit the shooting reconstruction team to focus on their area of expertise, but it also prevents the loss of transient types of evidence that are more easily lost or contaminated than bullet impacts.

However, even though general processing should occur before the shooting reconstruction, there are some important steps that should be taken during the ini-

tial processing of the scene that will assist the shooting reconstruction team in visualizing the original scene and may preserve evidence of value to the reconstruction.

### *Gunshot Residue Analysis*

In any shooting scene the victim's clothing should be collected and properly preserved for gunshot residue analysis. This type of evidence can be critical to a shooting reconstruction since trajectory analysis is very limited in determining the distance from which a shot was fired. The combination of the trajectory analysis and the results of a muzzle-to-target distance determination from gunshot residue patterns on the victim's clothing (Image 1) could prove key to reconstructing the events of the shooting. If first responders removed the victim, it is important that personnel be assigned to retrieve the victim's clothing since medical personnel are unlikely to consider this valuable evidence while attempting to save a life. Likewise, victims removed by the coroner or medical examiner will also require personnel to attend the autopsy and recover the evidence once removed by the pathologist.



Recovered clothing should be air-dried before packaging to prevent putrefaction of blood and other tissues that may be present on the garment (FBI 1970). The dried clothing should then be placed in breath-

**Image 1: Example of visible gunshot residue pattern on clothing. However, all gunshot victims' clothing should be collected regardless of whether there is a visible pattern. Examination by the lab could reveal gunshot residue that is not visible to the naked eye.**

able packaging, not plastic, and without folding the garment on itself which could transfer gunshot residue from one part of the clothing to another. Such items should be labeled as biohazards and handled accordingly.

The victim's clothing should be collected and submitted for examination even in cases where there is no visible gunshot residue. Microscopic and chemical examinations conducted in the laboratory may uncover residue patterns not visible to the naked eye. This is particularly true on dark colored garments. Crime scene investigators should also be cognizant of other items in the scene that could have gunshot residue such as a pillow used to muffle a gun shot or furnishings and vehicle seats where a victim was sitting (Image 2).



It is also possible for gunshot residue to be deposited on the clothing of the shooter if the firearm was held close to the shooter when fired. These types of gunshot residue patterns are not useful for muzzle-to-target distance determinations, but they do hold important evidentiary value in demonstrating a suspect's involvement in a shooting and should be considered when a subject is taken into custody or a search of the subject's property is conducted. However, many laboratories will not accept shooter's clothing for routine analysis and this examination should be reserved for instances when there would be clear evidentiary val-

ue. Crime scene investigators should consult with their local laboratory regarding their evidence acceptance policy regarding shooter's clothing.

### *Diagramming*

When sketching a shooting scene it is important to include not just the immediate area where impacts are identified, but also the larger surrounding area in order to put the shooting scene in proper context. That could involve identifying a room in a house or the longitude and latitude coordinates of a field on a mountainside. In either case the area outside the immediate shooting scene can contribute significantly to the investigation; for example, revealing access points, witness vantage points, and path of regress.

Crime scene investigators should take care not to fall into the routine of diagramming without checking to see whether scale diagrams are already available. For example, any commercial or government property should be able to provide blueprints of their facility upon request. These existing diagrams may not be completely accurate and important dimensions should be confirmed by direct measurement. But, even if not completely accurate, having such a diagram to work from can save time.

In cases where the area of the shooting scene encompasses a larger outdoor area, investigators can utilize aerial photography, topographical maps, or even satellite imagery. Many jurisdictions have police aircraft or search and rescue aircraft that could be used as a platform for aerial photography. The leading source for topographical maps is the United States Geological Survey (USGS) who have branch offices across the country and also sell maps online ([www.usgs.gov](http://www.usgs.gov)). Satellite images can be obtained from various sources, but something as simple as the mapping and satellite features offered by [Google.com](http://Google.com) can be helpful. If

◀ **Image 2: This gunshot residue pattern (shown before chemical processing) on a headrest was used to locate the position of the shooter.**



the shooting takes place in or near a busy intersection, the local accident investigator may already have a detailed diagram of the area. Major metropolitan areas that hosted major events often have detailed three-dimensional diagrams produced by local, state, or federal agencies as part of their special event planning. In short, investigators should consider the use of all available resources that will make the processing of a scene more efficient and the end product more accurate. In most cases these resources may not be immediately available before or during the initial processing of the scene, but should be a consideration as the investigation continues and crime scene diagrams are produced.

Additional steps that should be taken at a shooting scene are outlined below and divided into three typical shooting scene types: vehicles, indoor, and outdoor. Each of these shooting scene types presents its own unique characteristics and challenges. However, real world crime scenes may not neatly fit into just one of these categories and investigators should maintain the flexibility to employ techniques from multiple scene types.

### **Vehicle Shooting Scenes**

Vehicles tend to be a very common location in shooting investigations, particularly in officer-involved shootings. Vehicles also present some of the most complicated scenes to examine due to the many angled surfaces, wide range of materials, many moveable parts, and the potential movement of the vehicle itself. Many standard practices for evidence processing of a vehicle can cause additional work or even loss of evidence valuable to the shooting reconstruction. Adhering to the following recommendations may drastically improve the condition of a vehicle for the shooting reconstruction team.

### *Glass*

Most vehicles will have tempered glass for the side and rear windows and laminated glass for the windshield. Any fractured side or rear window glass (tempered glass) should be considered extremely fragile. These windows may exhibit numerous cracks from an impact and can fall out from even the slightest mishandling of the vehicle. These windows have been observed to even fall out by themselves without any direct disturbance or mishandling. The following steps should be taken to document and prevent the loss of this fragile evidence.

Photograph the windows immediately. The use of a scale is advisable and the photographs should be taken straight on. Be careful that the flash from the camera does not reflect excessively off of the glass and obscure the details of the crack patterns which could become important if the glass falls from the frame before the shooting reconstruction team arrives.

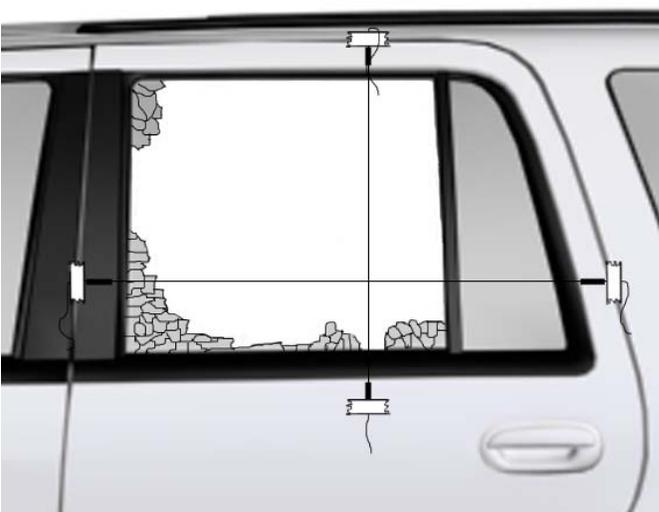
Immediately apply a liberal amount of super glue over the surface of the window. Extra super glue should be placed on the area immediately around the bullet impact(s) and evenly throughout the rest of the glass. Dribble the super glue onto the window without touching the glass which could cause the window to fail. The authors have experimented with various other techniques such as carefully placing clear tape on the glass. However, compared to the use of super glue, these other methods tend to have very poor results and are not recommended.

After super gluing is complete, an indexing technique (Adair 2005) should be used to further document the impact. Take a yard stick or other long straight edge and index the location of the impact(s) on the window frame (Image 3). Take great care not to touch the glass during this process.





◀ **Image 3: An illustration of how to place indexing marks to preserve the location of a bullet hole in fragile tempered glass.**



◀ **Image 4: Use of string to relocate the impact position.**

Side and rear windows that have an after market film tinting applied are much more resistant to complete loss of the window. However, each case should be evaluated individually and investigators should not hesitate to apply super glue to tinted windows as an additional precaution.

Front windshields are constructed of laminated glass made of a plastic laminate sandwiched between two sheets of glass. Some modern high-priced vehicles now use laminated glass in side and rear windows. Though laminated glass is much more resistant to loss than tempered glass, the additional precaution of super glue has no serious downside and can only help preserve the evidence. In the case of laminated glass, the super glue should be applied directly around the impact points to help hold together the pulverized glass and avoid loss of glass from these areas. More liberal application of super glue may be warranted if the glass has multiple closely grouped impacts or additional collision damage. However, the window-wide application of super glue recommended for tempered glass is not necessary.

This is a backup in the event that the glass falls out despite efforts to preserve it. The shooting reconstruction team can then reestablish the location of the impact using techniques such as a string indexing technique (Image 4) (Haag 2006).

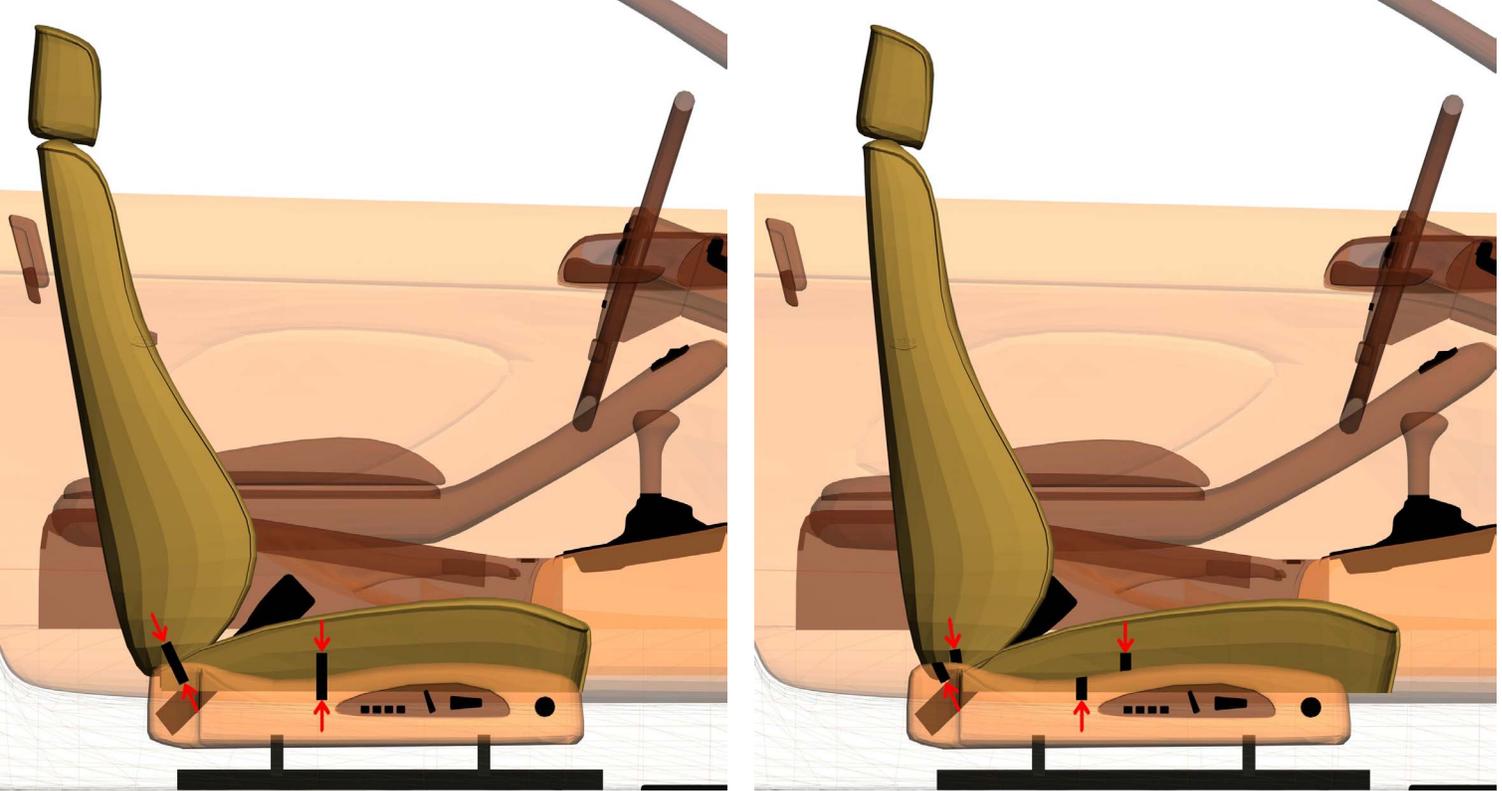
The initial crime scene investigators should take great care not to slam doors or jar the vehicle in any way when there is fractured, but intact, tempered glass. When accessing a vehicle for standard processing, try to enter through a door with an undamaged window or a window that has already fallen from the frame and close doors very gently with slow pressure rather than swinging the door shut. This may seem obvious, but experience has proven it can be quite easy to get caught up in processing and slam a door shut through muscle memory.

### *Seats and Other Moveable Parts*

After the glass has been properly preserved, crime scene investigators should index all adjustable vehicle seats (Adair 2005). Index all seats and seat backs to document their positions at the time of the shooting. This is very important since seats are commonly moved during the initial processing of the vehicle in order to gain access to different parts of the vehicle to conduct a thorough search. These indexing marks will make any adjustment of the seats obvious and easy to return to their original position (Image 5). In many vans and sport utility vehicles the rear seats may be adjustable and should also be indexed.

Crime scene investigators should also be





▲ Image 5: An illustration of indexing marks (left) and how they would appear after the seat is moved (right).

cognizant of other moveable objects whose original position may be important. Examples include open doors, partially open windows, and adjustable steering columns. Such items should also be indexed in a similar fashion as the seat indexing described above. This, of course, assumes that first responders have not moved these items in order to reach victims to provide medical attention. If this is the case, the shooting reconstruction team should be advised the scene was altered so they can adjust their processing and conclusions accordingly.

### *Diagramming*

Proper diagramming of a vehicle shooting is always important. However, if a vehicle needs to be moved to a secure location, whether for practical reasons or at the request of the shooting reconstruction team, proper diagramming of the scene will be essential. The location and orientation of the vehicle in the crime scene is of particular importance. At least three points on the vehicle, such as the centers of at least three wheels, should be triangulated from fixed points in the scene. If possible the location of all the tires should be marked on the pavement with spray paint. This will allow

the shooting reconstruction team to return to the shooting scene and take measurements to incorporate elevation variations into the final reconstruction. Even a relatively moderate slope to the orientation of the vehicle can have dramatic differences in the way the trajectories from the vehicle lie within the overall crime scene.

### *Moving Shootings*

It is not uncommon for shooting incidents to involve moving vehicles. When a scene involves a moving target vehicle, objects left behind by the car can be important to the reconstruction of the shooting. For example, glass left on the roadway may indicate the last possible position of the vehicle when the window was shot. That same glass may also indicate the approximate path a vehicle might have taken through a scene. Likewise, other objects such as trim or insignia could become detached from a bullet impact and their location in the vehicle's path could be important. The locations of all such items should be measured and included in the scene diagrams.

A scene may also involve a shooter in a moving vehicle, such as a “drive by” shoot-

ing. In these cases the positions of cartridge cases ejected from the vehicle can be important in the reconstruction and should be carefully measured and included in the diagram.

In any situation involving a moving vehicle and a shooting there may be collision damage and other evidence of defensive or offensive driving. Any collision damage in the scene should be carefully documented. Additional evidence, such as tire marks on the pavement, may also offer valuable information to the reconstruction team. In some cases the services of an accident reconstruction specialist may help in proper interpretation of this evidence.

### *Collection of Firearms Evidence*

Firearms-related evidence such as cartridge cases, bullets, and bullet fragments should be photographed in place and have their locations carefully measured and included in the diagram before recovery. All evidence collection should stop when the crime scene investigators reach a point where collection of bullets or other evidence will require any disassembly of the vehicle. The remaining evidence will be recovered during or after the shooting reconstruction.

### *Removal of the Vehicle*

In some cases the shooting reconstruction team may prefer to conduct their examination of the vehicle in a secure garage facility that provides a more controlled environment. In such cases, the tow truck operator should be instructed to take great care in handling the vehicle to prevent loss of any additional glass. If any side or rear windows were shot and are still intact, the vehicle should not be moved until the glass is photographed, super glued, and indexed, as described above. Also, the position of seats and other moveable parts should be

indexed before moving the vehicle.

## **Indoor Shootings**

### *Moveable Objects*

Crime scene investigators should be mindful of moving or removing items that may impact the shooting reconstruction. Even objects that were not impacted could become relevant during the reconstruction if they block or limit a shooter's line of sight or provide cover or concealment. Make every effort to avoid moving objects in the scene, even those that do not immediately appear to have impact damage. If an object, such as furniture, must be moved, that object's location should be carefully diagramed and indexed by marking its location directly on the floor or wall with tape. This will assist the shooting reconstruction team in returning the object to its original position. In situations where something must be moved, it is important the shooting reconstruction team is informed, regardless of whether it was returned to its original position or not.

### *Collection of Firearms Evidence*

Firearms-related evidence such as cartridge cases, bullets, and bullet fragments should be photographed in place and have their locations carefully measured and included in the diagram before recovery. All evidence collection should stop when the initial crime scene investigators reach a point where collection of bullets will require cutting into walls or other objects. The remaining evidence will be recovered during or after the shooting reconstruction.

If possible, mark the floor at the location of recovered firearms-related evidence with a piece of tape labeled with the item number and a brief description of the item, such as "Item 39, 9mm Luger cartridge case" or "Item 40, bullet jacket fragment" (Image 6). This will allow the shooting recon-





▲ **Image 6: Direct labeling on the floor where evidence was recovered.**

struction team to associate the locations of the evidence with their trajectory analyses without the need to continually refer to diagrams and evidence logs.

### *Glass*

Glass surfaces encountered in buildings will most typically be plate glass; however, laminated and tempered glass may be present. In the event there are bullet impacts in glass, refer to the handling instructions found in the “Vehicle Shooting Scenes” section above. This is of particular concern if the glass is tempered glass, which is commonly encountered in vehicle side and rear windows. Tempered glass can be readily identified because it is designed to instantaneously fracture across the entire pane of glass into many tiny cube-like pieces (Image 7). In such cases it is very important the same steps described for tempered glass in vehicles are immediately performed due to the fragile nature of the

▶ **Image 7: An example of a typical fracture pattern in tempered glass, commonly referred to as dicing.**



fractured tempered glass. Namely, photographing the window with a scale, application of super glue, and indexing of the impact. These steps are also an advisable precaution to take with other types of glass.

## **Outdoor Shootings**

### *Medium/Long Range Shots*

If processing of the scene does not reveal any indications of the position of the shooter, consider the possibility that the shots could have been fired from a more distant position. The search perimeter should be extended in the direction determined by the trajectory analysis in an effort to locate the shooting position and secure evidence as quickly as possible. As searchers walk along the trajectory, they should fan out to encompass at least a five degree margin for error on either side of the trajectory. The searchers should be looking for evidence of a shooting position that could include cartridge cases, footwear impressions, or other evidence left behind by the shooter. They should also look for any disturbed area such as flattened grass, cleared ground cover, or objects moved in order to provide a line of sight to the victim’s location. Once the shooting position is identified the searchers should secure that area



◀ Image 8: Examples of just a few of the many types of components that can be found in shotshells to include projectiles like bird shot (left), 00 buck shot (center), and a rifled slug (right). Also pictured are an assortment of shot cups and wads. All of these components have a forensic value.

and extend their search to look for evidence of how the shooter accessed or regressed from the position.

Searchers should also be aware of other firearms evidence that could be located between the shooting position and the target. Firearms evidence such as shotshell wadding (Image 8) can be located along the flight path of the projectile. These items of evidence can hold critical value to a reconstruction. Wadding and other shotshell components can be used to identify the manufacturer of the ammunition, gauge, and shot size (Desjardins 2001). In some rare cases such as sawed off shotguns (Wright 2003) and rifled shotguns, wadding could even be used to identify the firearm.

Though rare to encounter, sabots used in some rifle cartridges, shotshell slugs, and muzzle-loading rifles can also be encountered between the shooter and target. Sabots are lightweight carriers, usually plastic, that center a sub-caliber bullet being fired from a larger caliber

barrel (Images 9 & 10). The bullet itself will be devoid of rifling impressions because only the sabot will come in direct contact with the barrel and falls off of the bullet after leaving the muzzle. Only recovery of the sabot will allow microscopic comparison to the barrel of a suspect firearm.

Before the arrival of the shooting reconstruction team, the initial processors can make an unofficial interpretation of the visible bullet impacts to help point searchers in the general direction of a distant shooting position. However, the initial responders to the scene should never probe any bullet impacts since this could alter the evidence.

### *Bullet Impacts*

Locating impacts in an outdoor scene can be a daunting process. During the processing of the scene, crime scene investigators should flag any defects they come across that may be bullet impacts. However, these potential bullet impacts should not be probed or altered in



◀ Image 9: An example of a sabot, a lightweight collar that allows a sub-caliber bullet to be fired from a larger caliber barrel.

▼ Image 10: A sabot after it was fired.



any manner. Bullet impacts could be found some distance away, so all structures, vehicles, trees, and even the ground in the area should be inspected for impacts. This should include not only the backdrop of the shooting victim, but also the backdrop of any suspected shooting positions since locating or eliminating return fire could be of importance. If nearby property owners are present, they should be interviewed to determine if they noticed any impacts or other evidence related to the shooting on their property and the perimeter expanded as needed.

Bullet impacts can often be surprisingly small perforations or other easily overlooked defects. Searchers should mark any suspect defects and let the shooting reconstruction team filter the bullet impacts from other defects that are not related to the shooting. The shooting reconstruction team will assess the impacts and may perform chemical tests to determine if a defect is consistent with a bullet impact.

As previously mentioned, crime scene investigators should never probe any defects they locate. They should simply be flagged to assist the shooting reconstruction team.

### **Description of the Scene to the Shooting Reconstruction Team**

Even a police officer with no training in shooting scene processing will be able to provide the shooting reconstruction team with valuable intelligence about what type of scene they can expect. Though most shooting reconstruction teams have a response kit ready to handle 95% of the situations they are likely to encounter, specific information about the scene may assist them in determining if additional resources or equipment are necessary.

Valuable information that can be provided by personnel on the scene includes the following:

- Type of scene (i.e. indoor, outdoor, and/or vehicle)
- Location of scene (i.e., in a house, in a mall, on the side of a steep wooded mountain)
- Security/safety issues (Is the scene in a hostile or dangerous environment?)
- Time elapsed since shooting
- Number of known shooters
- Approximate number of shots fired (a quick estimate can be made by counting the ejected cartridge cases)
- Close, medium, or long range shots
- Year, make, and model of any vehicles involved in the shooting
- Availability of secure garage facilities to process vehicles
- Surveillance, news, or police dashboard video of the shooting incident
- Unusual circumstances that may require other expertise such as blood-stain pattern analysis, accident reconstruction, aerial photography, or surveying equipment.

This information will be of greatest value to the shooting reconstruction team if received prior to their departure to the scene. Therefore, once the investigating agency decides to request the services of a shooting reconstruction team, they should be promptly put in contact with someone at the scene. This individual should be able to brief the shooting reconstruction team on what to expect before they leave, giving them the opportunity to bring additional resources or equipment.

### **Conclusion**

It is contingent upon the crime scene in-



investigator to be knowledgeable about the handling of a wide variety of evidence types since the potential success of any forensic examination hinges upon the quality of the collection and preservation of the evidence. This holds equally true for the reconstruction of shooting scenes. The procedures set forth in this paper provide the crime scene investigator with the background information and detailed procedures that should be taken to preserve a shooting scene until a shooting reconstruction team can arrive to conduct their examinations.

By following these procedures, the crime scene investigator provides an invaluable service to the shooting reconstruction team that will almost certainly result in more conclusive results and the ability to provide a more detailed reconstruction of the shooting.

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