This is only a partially complete sample document.

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General Crime Scene Contents

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Forensic-Classroom – Supplemental Material
General Crime Scene

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Role of the Forensic Specialist

Whether they are called Evidence Technicians, Crime Scene Technicians or have some other title, any person engaged in examining scenes of crimes or other incidents plays a very specific role in the criminal justice system. These individuals are expected to:

- Apply a scientific method of analysis to the examination of crime scenes for evidence.
- Be knowledgeable in a variety of areas related to evidence collection and processing.
- Collect, preserve and identify evidence for its ultimate presentation in court.
- Provide professional testimony about the evidence and its collection from the scene.
- Provide guidance to other police personnel about the value of physical evidence and the information it can provide in a criminal investigation.

Role of Physical Evidence

Physical or real evidence plays a vital role in the investigative process. Virtually any tangible item can be used to:

- Prove that a crime was committed
- Establish the elements of a crime
- Identify a suspect or victim
- Link a suspect or victim to a crime scene
- Link a suspect or victim to one another
- Support or disprove statements made by suspects, victims or witnesses
- Provide a powerful interrogation tool

Value of Physical Evidence

There is no Fifth Amendment protection against incrimination by physical evidence[1]. Unlike verbal statements or oral admissions, individuals involved in a criminal investigation can be forced (through court order) to provide samples of hair, blood, fingerprints, speech, handwriting or evidence of other personal traits.

[1] Schmerber v. California, 384 U.S. 757 (1966)

Crime Scene Defined

A crime scene is any location where evidence related to the crime may be recovered. This includes the immediate scene as well as logical access and escape routes.

- The immediate area of the crime or incident
- The area about the scene
- The victim and suspect
- Persons, locations and/or objects some distance from the scene

Scene Processing: Logical Progression

- Identification
- Protection
- Assessment
- Processing
- Review
- Release
- Follow-Up

Scene Protection: Crime Scene Management

Purpose

In its simplest sense, the phrase "crime scene management" refers to employing proper procedures in protecting a crime scene to keep it the way it was when the offender left. In reality, the moment that a witness, police officer or emergency medical personnel enter a scene, it has been altered from its original state.

"Crime scene management" then becomes a process that seeks to minimize the damage done at a scene followed by the proper application of investigative and forensic examination techniques.

First Officer on Scene

The actions of the first officer responding to a scene will often be the most critical in assuring the successful outcome of the investigation. While the first responding officer will always have the primary obligation of rendering aid and assuring the safety of others at the scene, there are certain steps that he or she can take to begin the crime scene management process.

- Control persons already on the scene; Remove or restrict the movement of family members; direct the movement of emergency medical personnel through the scene.

- Assess the legal requirements for the crime scene search. Will a search warrant be needed? (If consent has been given who gave it? Who told you about it?)

- Establish a staging or work area (safe area).

- Conduct a preliminary scene walkthrough. Take a "hard" look at the scene. Develop a scene search and processing plan.

- Assess the need for additional personnel and/or equipment.

- Conduct scene processing; maintain a line of communication with the investigators.

- Final release of scene.

- Follow-up with evidence inventory and lab submissions.

Scene Assessment: Interview the First Responding Officer

This is a basic step in the crime scene process that cannot be overlooked. The information provided by this officer or officers will guide the crime scene technician in their scene processing efforts.

Answer the following questions:

- What is believed to be the nature of the incident?
- How was the incident discovered?
- How many police officers or other personnel were at the scene?
- What were the actions of officers at the scene? (Was the building searched? Were doors opened? Were lights turned on? Was evidence moved?)
- What scene contamination is known to have occurred from other emergency responders or the person(s) discovering the incident?
- Who are the persons that were at the scene?
- Where are the persons from the scene? (Has anyone been taken to the hospital? Is an officer assigned to the person at the hospital?)
- Is there any other significant information that this officer can provide?
    - Doors – open, closed, locked?
    - Signs of forced entry?
    - Lights on or off?
    - Odors – gunpowder, cigarette, perfume?
    - Shades and drapes open or closed?
    - Mail and newspapers uncollected?
    - Vehicles in area – leaving area?
    - Items disturbed.
    - Room temperature – hot, normal, cold?
    - Statements made by victim / witnesses.

Evaluating the crime scene, interviewing and gathering information from first responders.
Science Concepts: Observing, Inferring, Communicating, Posing Questions.

Scene Processing: Evidence Collection at the Scene

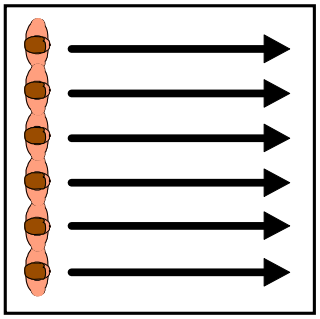
1. Preliminary scene walkthrough. Take a "hard" look at the scene. Develop a hypothesis of what has happened and determine a plan of action.

Answer the following questions:

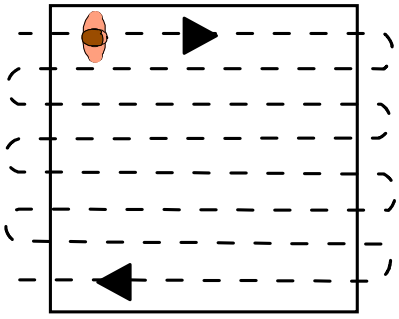
- What is the nature of the crime?
- How many persons are involved?
- What were the actions of the offenders or victim at the scene?
- How did they access the scene?
- How did the leave the scene?
- Is this a primary or secondary scene?
- What were the actions of the offenders or victim at the scene?
- Where has contact and transfer occurred?
- What types of evidence are present?
- Do you have all the resources you need to successfully process this scene? ("Resources" includes – time, manpower and equipment.)
- Is the scene safe to work in or are there hazards that exist? (Common to fire scenes.)

2. Utilize a systematic search pattern to ensure that the entire scene is covered.

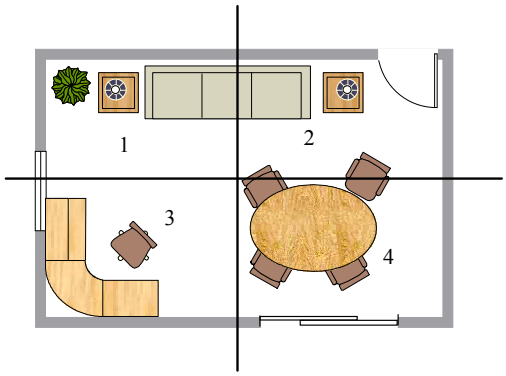
Examples of some search patterns.



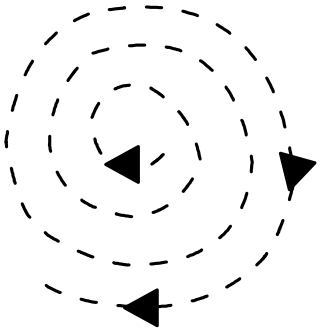
Line



Strip



Zone



Expanding Spiral

- On major cases, discussing the nature of the evidence and its role in the case will help the lab analyst understand what processes need to be performed.

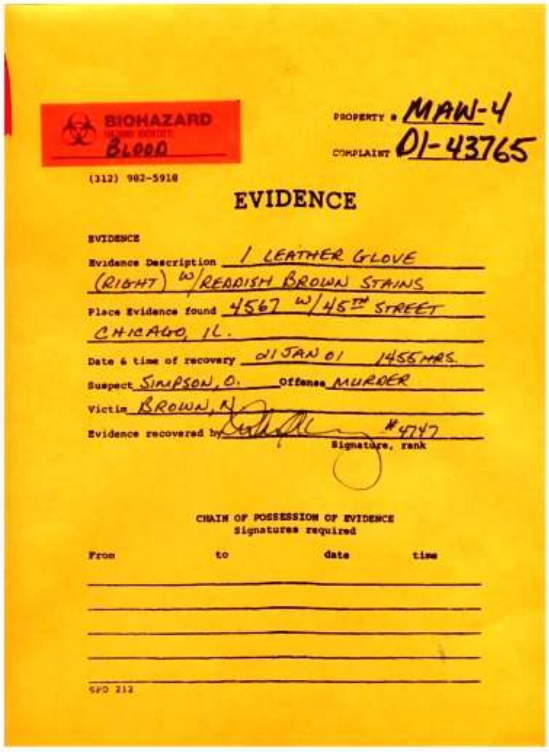
Evidence Must be Preserved for Scientific Analysis

The proper collection, handling and packaging of physical evidence are essential to the success of a criminal investigation. Physical evidence often proves that a crime occurred. This evidence can reconstruct the events, identify suspects, victims or witnesses and corroborate witness accounts. This evidence must be handled properly to protect against contamination, loss of evidence, and preserve chain of custody.

The following information does not include all types of evidence encountered at a crime scene. It is meant as a general guideline to assist the crime scene investigator.

The student should note that accredited forensic science laboratories will require that evidence packaging be

- Sealed with tamper resistant tape.
- Initialed and dated across the seal.
- Be appropriately labeled if a biohazard is present.



This list is not all-inclusive

Evidence	Collection	Packaging	Labeling	Miscellaneous
Arson debris	Collect evidence in the area of origin	Use clean metal cans or glass jars that can be sealed. Place evidence tape over lid.	Proper labeling*	Do not use plastic bags
Bloodstains	Submit entire sample when possible. Otherwise use sterile cotton swabs moistened with distilled water to collect as much stain as possible. Allow swabs to dry before packaging.	Unused paper products only. Package different stains separately.	Proper labeling*	Beware of bloodborne pathogens. Use clean technique† to avoid contamination.
Bullets	Do not use tweezers or other objects that may scratch the surface of the bullet.	Package in small containers to prevent movement. Package bullets separately. Avoid using cotton.	Proper labeling* on the outside of the container. Do not mark bullet.	Do not clean bullet
Cartridges or live rounds	Do not use tweezers or other objects that may scratch the cartridge.	Package in small containers to prevent movement.	Proper labeling* on the outside of the container.	
Cartridge cases	Do not use tweezers or other objects that may scratch the cartridge.	Package in small containers to prevent movement.	Proper labeling* on the outside of the container.	Do not remove from weapon if fingerprints are a consideration on the cartridge case.

***Proper Labeling**

- ☐ Your name
- ☐ Case number
- ☐ Case name
- ☐ Date Recovered
- ☐ Item description
- ☐ Location recovered
- ☐ Items suspected of biological material must be labeled with a biohazard sticker

†Clean Technique

- ☐ Change gloves frequently
- ☐ Use new pair of gloves for each item
- ☐ Bleach equipment after each use
- ☐ Bleach writing instruments
- ☐ Avoid coughing, sneezing, talking over evidence
- ☐ Package items in clean unused paper products

Evidence	Collection	Packaging	Labeling	Miscellaneous
Clothing or other objects containing biological stains	Submit entire sample. Allow evidence to air dry before packaging.	Unused paper products only. Package each item separately.	Proper labeling* in a location away from the stains or attach a tag to the evidence. Also label the outside of the package	Beware of bloodborne pathogens. Use clean technique† to avoid contamination
Documents		Package in plastic envelope	Proper labeling*	Do not handle with bare hands if fingerprints are needed.
Fibers	Collect entire object if possible or tape item for removal of fibers.	Submit fibers in small boxes or pharmacy folds. Package tapings in envelope or bag.	Proper labeling* on outside of container and on tapings.	Must collect and submit fiber standards for comparisons.
Firearms	Do not collect by sticking an instrument into the barrel. Pick gun up in a manner that will avoid destruction of fingerprints. If firearm is in water, do not remove from water.	Place in box to prevent movement especially if fingerprints are a concern. Indicate on outside of box the direction of the barrel. If firearm is in water, submit to laboratory in container of water.	Properly label* a tag and attach to firearm. Label outside of container.	If necessary to unload, mark position of cylinder and location of cartridges prior to unloading.
Glass fragments	Collect as many fragments as possible.	Package each piece separately to avoid movement and breakage.	Proper labeling* on outside of container	

***Proper Labeling**

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Scene Diagramming - Contents

Table of Contents

Forensic Classroom – Supplemental Material
Sketching & Diagramming

Produced by

Imprimus Forensic Services, LLC
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Introduction

What Is a Diagram?

Simply put, a diagram is a graphical representation of a crime or other incident scene that will help others understand the scene.

- Diagrams support photographic documentation
- Diagrams are illustrations of the scene that provide an accurate description of that scene.

In court, a diagram serves as demonstrative evidence. So long as it is a fair representation of the scene, there is no legal requirement that it be draw to scale.

Scene Diagramming – Purpose & Needs

Diagrams and sketches play a vital role in completing the proper documentation of crime and accident scenes. While diagrams are most commonly thought of as a form of supplemental information to the primary report, in reality they are an necessary complement to photographs.

Properly drawn diagrams are the only method available to correctly document the spatial relationships that exist in a crime or accident scene. These relationships occur between items of evidence and fixed or moveable objects within the scene. For both reporting and courtroom purposes, diagrams communicate information to others in a manner that would be near to impossible to do with words.

Unlike photographs or video tape, a diagram can be drawn to selectively include only the necessary and relevant items within a scene. Confusing detail can be eliminated. In this manner, the scene is presented in its most basic form.

As with other aspects of the reporting process, scene diagrams will serve to:

- Refresh the memory of investigators
- Support or refute statements by witnesses and suspects
- Explain the evidence to the reader of the report
- Prepare witnesses and present evidence at trial
- Assist in event reconstruction
- Provide the basis for 3-D models

There are many types of diagrams that may be utilized by the crime scene investigator during the scene processing effort. Some may be simple thumbnail sketches like those found on the back of a fingerprint card. Other diagrams may be computer generated or professionally prepared. However they are done, the crime scene investigator should make extensive use of diagrams. Great artistic talent on the part of the investigator is not required. The most crucial aspect in preparing a diagram is that the information be properly collected and accurately represented.

Specific benefits of diagrams include:

- Simplification of the scene – Confusing details left out
- Better overall depiction of the scene than photos
- Easy to show routes of travel by suspects, victims and vehicles
- Provide a permanent record of spatial relationships
- Can record some conditions better than any other means

The methods presented here are those most commonly used by crime scene investigators. They are not necessarily the only methods that can be employed. Any technique that allows for the proper collection and representation of this type of information can be used.

Completing a scene diagram.

<u>Science Concepts:</u> Measuring, communicating, interpreting, and creating data tables.

Engineering

This method of measurement is based on a system of ten much like the metric system. Here, a foot is broken into ten equal parts (tenths) and each tenth of a foot is again broken into ten equal parts. This results in a one foot unit of measure being divided into one hundred equal parts. Measurements are expressed in a decimal rather than a fractional form (1.76 feet). Engineers and surveyors in laying out roadways use this method of measuring. It would be more common to use this method at outdoor scenes or crash sites. These units are expressed as 1: 20 (1 inch = 20 feet) in diagrams.

Metric

In the United States, it is not common to measure the dimensions of crime scenes in metric units. Dimensions are more typically stated in architectural or engineering manner. Some aspects of crime scene documentation do however depend on the metric system. Two examples are bloodstains and tire tracks. The sizes of bloodstains are always measured and represented in millimeters. The tire track stance of a vehicle on the other hand may need to be measured in millimeters if it is to be searched through a database.

Measuring devices, including steel and fiberglass tape measures as well as sonic and laser measuring devices, can all be obtained in any of the measurement units mentioned.

Other Equipment

A complete list of recommended supplies and equipment for scene diagramming and mounting of diagrams is presented in Appendix C. In addition to the required measuring devices, the following list is the recommended minimum equipment needed to start diagramming.

- Pencils
- Cross section ruled paper pad (graph paper - minimum recommended size 11” x 17”)
- Rigid clipboard or backing for paper pad
- Straight edge or templates
- Marking crayons, paint or chalk
- Safety vest (if working in or around traffic)
- Weight for anchoring the tape measure

Measuring and documentation of large scenes should always be done by at least two persons. The individual completing the field sketch should be the one reading the measurements as they are taken.

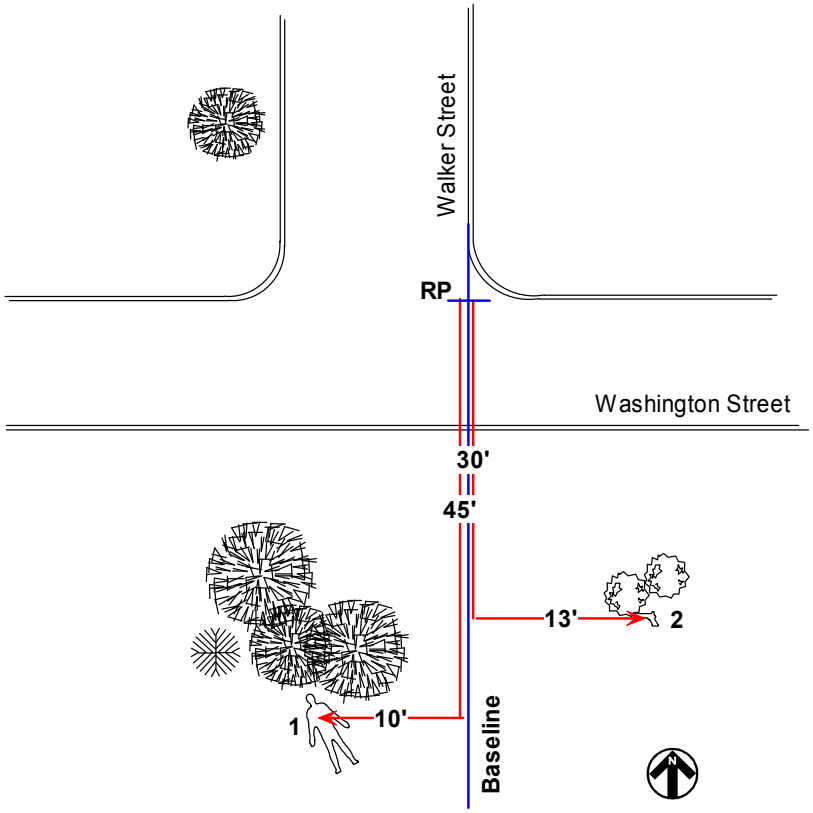
Measurement Methods

There are a number of different measuring methods available that are useful in locating evidence and documenting a scene. Some may require highly specialized equipment and some may be best suited for specific types of scenes.

<u>Baseline Method</u>

This method is desirable because it clearly locates items based on their distance and compass direction in relation to a reference line (RL) or baseline, and a reference point (RP). It is most frequently used in situations where a straight pre-existing boundary is not present. As such, the baseline method is well suited to outdoor scenes.

Because this method uses measurements taken from the reference or origin point as measured along two axes at right angles, it is very much like a Cartesian coordinate or rectangular coordinate reference system.



Sometimes referred to as the "Transecting Baseline" method, this technique is a very desirable method to use when possible.

To use the baseline method

Establish a Reference Point

In the example above the Reference Point is the intersection of two existing curb lines. If the reference point is the intersection of two imaginary lines, mark that point before starting to measure.

Establish a Straight Reference Line

This line can be set up along an existing line (curb or roadway edge); established between two known and fixed points (utility poles); or along a known compass bearing from a known and fixed point. In the case of an interior reference line, establish the line perpendicular to an existing wall.

Collect the Needed Measurements

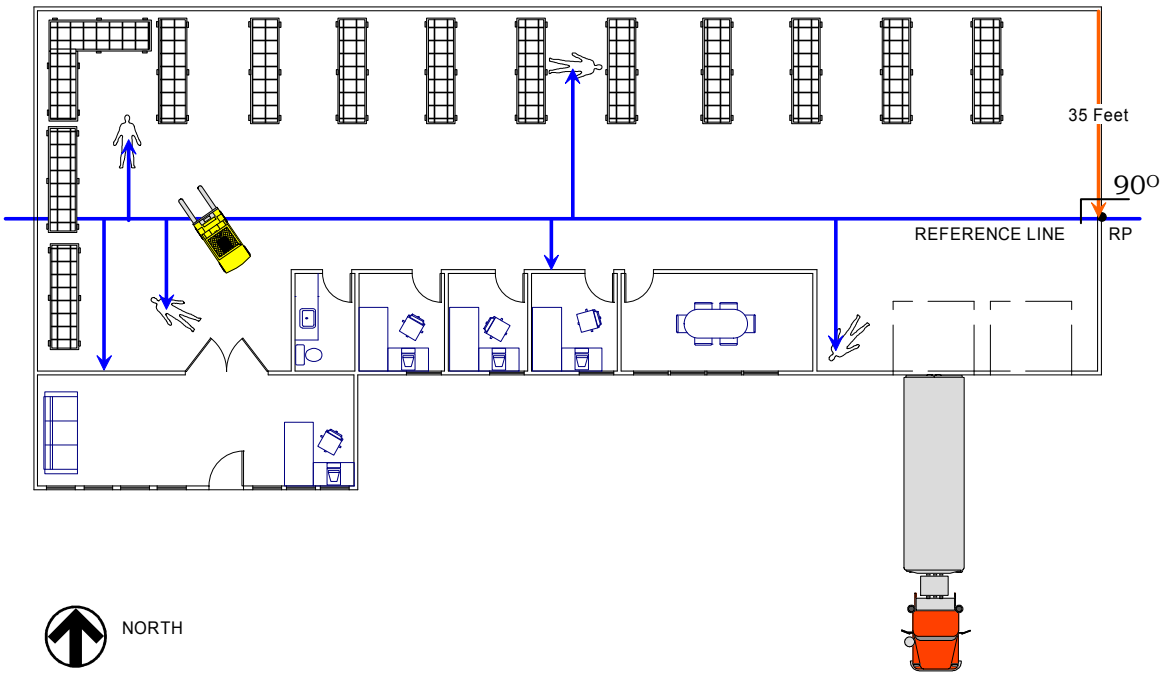
All measurements are recorded in relation to the reference point and reference line. Objects will typically be located in terms of their distance either north or

south / east or west of the reference point or reference line. The distance measured from an object to the reference line is the shortest distance possible. This results in a measurement that is at a 90^{O} intersection with the reference line. The direction indicated needs only to be the *nominal* direction involved. For example, if the reference line runs pretty much north and south even though it may not run exactly north and south, then it is a N/S line. The perpendicular distances are then west and east.
Measurements are placed into a table rather than drawing numerous arrows and lines across the diagram. Only two measurements are needed for each item.

Example of Data Collection Table

Reference Line = E curb line extension of Walker Street.			
Reference Point @ Intersection of N curb line extension of Washington Street with E curb line extension of Walker Street.			
Item #	Description	N/S	E/W
1	Victim	45º S	10º W
2	Handgun	30ºS	13º E

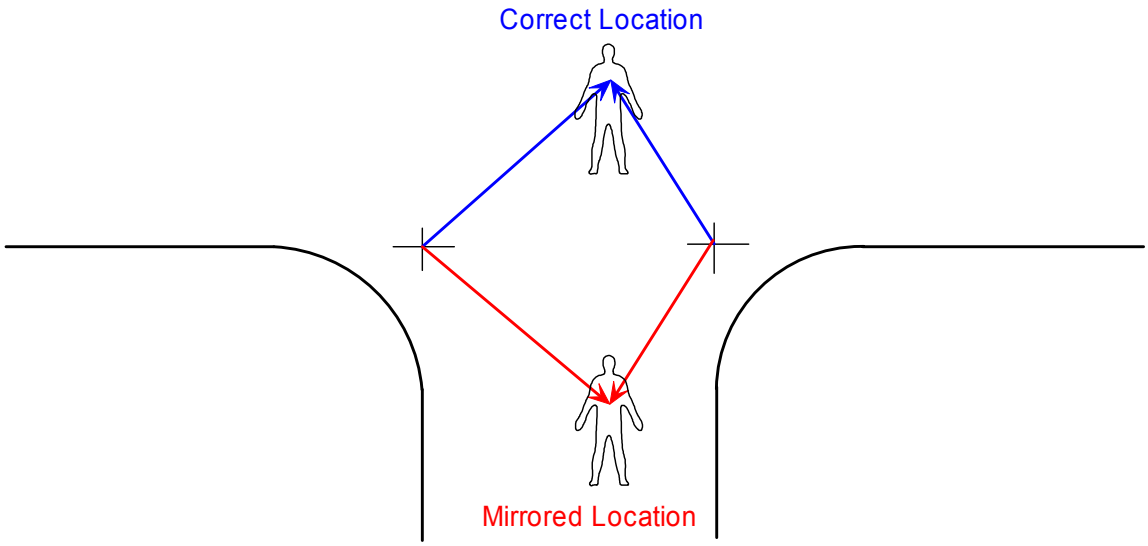
The baseline method can also be used indoors. The best use for this method indoors is a scene that covers a large area and has a natural reference line (example- a shooting inside a manufacturing plant). In the example below, the reference line is used to locate interior walls within the building as well as locations of evidence.



An Important Note About Triangulation

There are several reasons why measuring from coordinates is preferred over triangulation.

- In general, documenting items at the scene and then reconstructing their locations in a diagram, is more difficult with this method than with rectangular measurements.
- Inaccuracies can occur when the resulting triangle has very acute (small) or obtuse (large) angles.
- The number of lines and arrows drawn across a field sketch can make it hard to decipher later.
- And, as demonstrated below, every item can be located at two possible points.



Polar Coordinate Method

This method is the method typically used by surveyors and engineers. It relies on a reference point on a reference line and measures the location of an object in relation to this point by its distance from the point and the angle formed between the object and the reference line. Specialized equipment is generally required to obtain these types of measurements. A surveyor's transit or laser based measuring system is typically used.

Locating points obtained by this method in a hand drawn diagram is slightly more cumbersome than when using a method based on rectangular coordinates. However the more advanced software programs used for diagramming can accept this type of data input.

This can be an effective method to use if the required equipment is available, especially if the distances to be measured are long or over rough terrain.

What to Measure

The following lists are provided as a guide to assist the investigator in obtaining appropriate measurements at a scene. These are minimum recommended measurements. Additional measurements may be needed as dictated by the nature of the scene.

Indoor Scenes

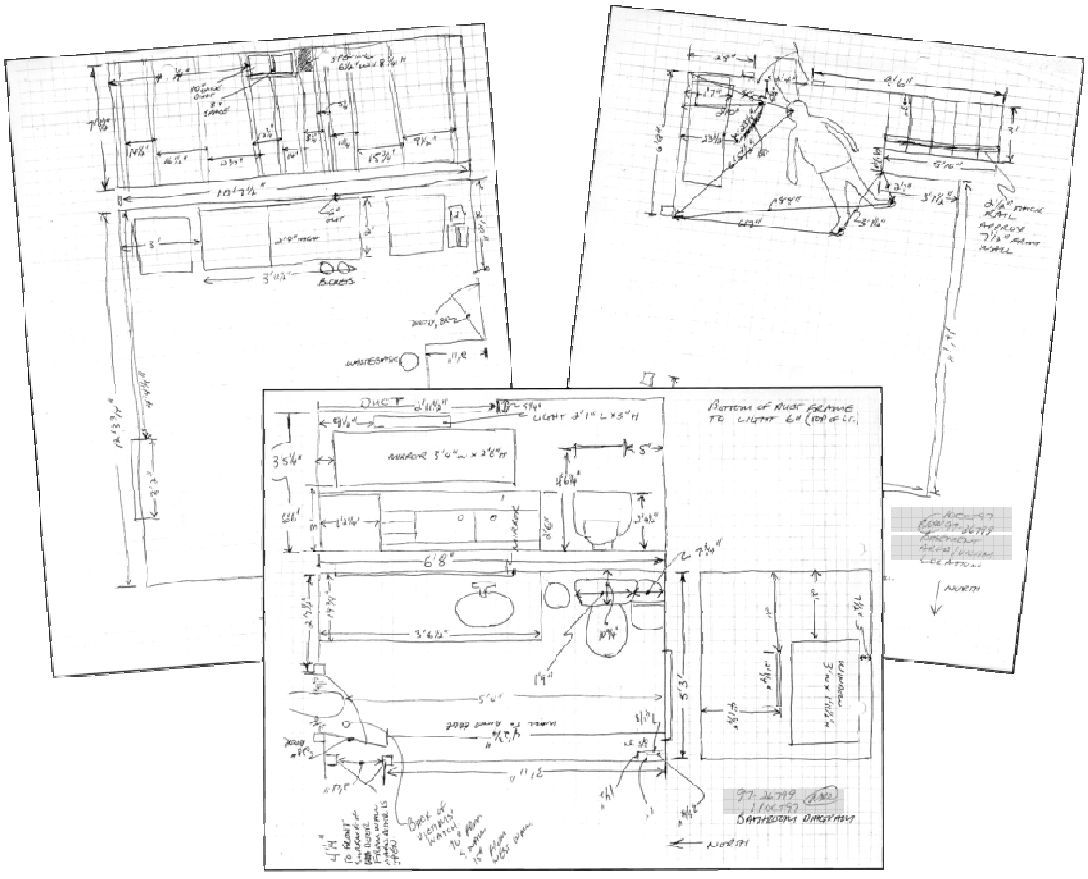
- Room Dimensions
- Ceiling Height
- Door & Window Dimensions
- Door & Window Locations Along Walls
- Window Height from Floor
- Locations of Evidence Items
- Locations of Other Relevant Items
- Stairs – Riser Height
- Stairs – Tread Depth
- Stairway – Overall Length
- Stairway – Total Number of Stairs
- Furniture Dimensions
- Locations of Reference Line Anchor Points, If Used

Outdoor Scenes

- Distance Between Reference Points (triangulation)
- Locations of Evidence Items
- Locations of Vehicles
- Locations of Other Relevant Items
- Dimensions of Relevant Items (park benches, parking spaces, etc.)
- Locations of Witnesses
- Curb Line Intersection Points (angle apex)
- Curb Line Tangent Points (where curve begins)
- Distance Between Curb Line Tangent Points
- Width of the Road
- Width of Road Lanes
- Width of Parkway
- Width of Sidewalks
- Distance Between Utility Poles
- Height of Shrubbery

Sketching & Diagrams

From rough sketches and proper measurements taken at a scene, effective diagrams and illustrations for court presentation can be prepared. These can be hand drawn or completed with the use of simple software programs.



Rough field sketches with sufficient information to complete finished diagrams.

Appendix A

Recommended Supplies

The following pages contain a list of basic materials that are recommended to help the investigator collect appropriate data at a scene and place it into a finished diagram. Also included is a list of materials that are needed to professionally mount a diagram for presentation.

Mechanical Pencils
Inking Pens
Non-Reproducing Blue Pencil
Plastic Erasers
11” x 17” Drawing Paper
Tracing Paper
Acetate or Transparency Film
Masking / Drafting Tape
Contractor’s Calculator
Templates –
- Circles
- Ellipses
- Rectangles
- Furniture / Architectural
- Vehicle / Accident
- Human Forms

Computer Software
Architectural Graphics Reference Manual

Appendix B

Example Diagrams

This section contains several examples of the types of diagrams that might be completed as part of an investigation.

Evidence Photography Contents

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Evidence Photography

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Scene Photos – General Requirements

Purpose & Needs

As with other methods of crime scene documentation, proper crime scene photography will:

- Aid in a reconstruction of events
- Refresh the memory of investigators
- Help relate the story to those that were not at the scene
- Create a permanent record of the scene
- Document the condition and location of items of evidence

Field notes, reports, sketches, videotape and photography are all interrelated in the scene documentation process. And while none can replace the other, photography is perhaps the most frequently used and readily accepted technique. Any person responsible for processing crime scenes must have a good working knowledge of photography or have ready access to someone who does.

Remember - photography is a means of communication. The goal of the incident scene photographer is to compile a photographic story that documents – from start to finish – what has happened at the incident scene.

Photography Requirements

To be introduced at trial, photographs are required to be fair and accurate representations of the scene or items of evidence, as they existed when the photos were taken. Someone that is knowledgeable about what the photographs show must introduce the photos into evidence. Generally, although not necessarily, this will be the person who has taken the picture.

There are several requirements for crime scene photography.

- Include an identifying shot in the first frame (I.D. card)
- Take photographs from a normal viewing angle
- Avoid using and extreme wide angle lens or lens setting
- Photograph from general to specific (overall & close-up photos)
- Include a scale in close-up photos of objects
- Complete a photo log

Beside the above, crime scene photos can be divided into two categories; General Scene Photos and Forensic Examination Quality Photos.

Properly taken crime scene photos should:

- Be clear and in focus
- Exhibit a good depth of field
- Be properly lit and exposed
- Not distort the evidence
- Provide correct color balance

Example – Progressive photography technique, overall, mid-range & close-up photos.



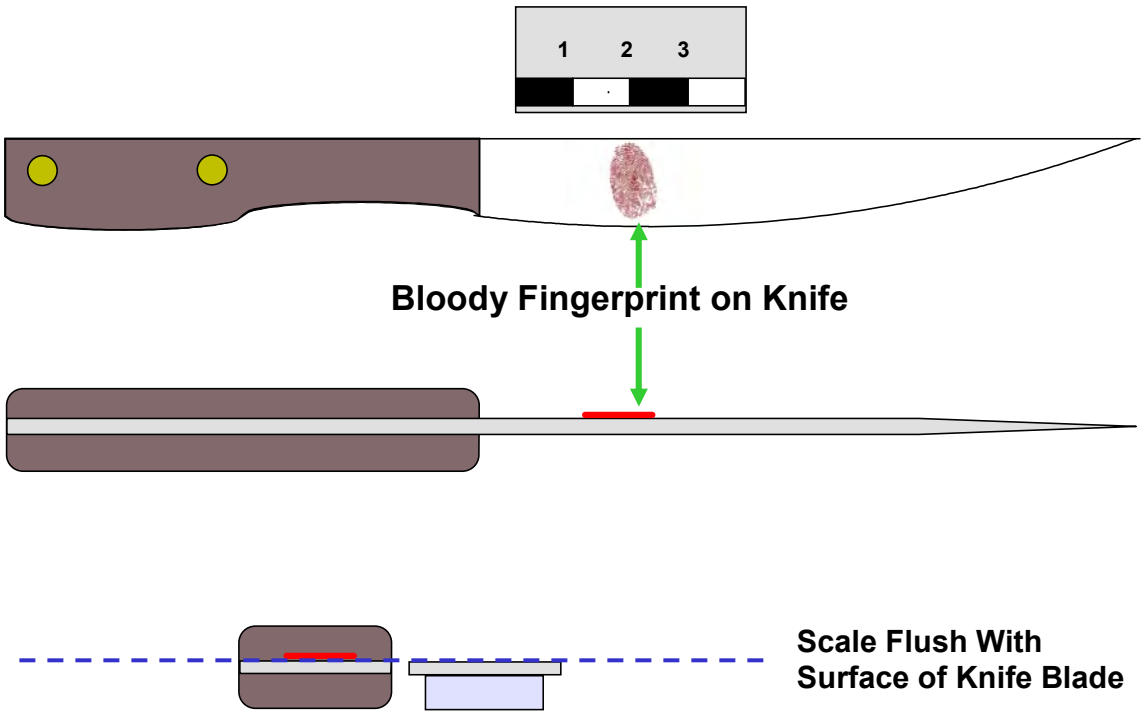

In addition to overall, mid-range and close-up photos, the photographer should strive to document the scene with 360^{O} coverage. This is accomplished by taking a series of photos that cover the scene from various angles or at least from four opposing sides. These photos should overlap in their coverage of the area or object. For indoor scenes, these photos can be taken from the four corners of a room. Significant items within a scene, such as a body, should be photographed along the axes from four sides whenever possible. A photographer not having access to a wide angle lens, may have to use more that four photos to achieve the desired coverage.

In addition to photos taken from all angles, pattern evidence located at a scene should be photographed with the camera at a 90^{O} angle to the pattern (film plane parallel to the pattern). This technique provides the most accurate documentation of the pattern. Examples of pattern evidence includes

- Footwear & tire tracks
- Burn patterns
- Bloodstains
- Crash damage to vehicles
- Injuries

(See examples – next pages)

In this example the fingerprint is on the blade of the knife which, when lying flat, is raised above the horizontal surface. To properly photograph the print, the scale must be raised to the same level.



Types of Prints

Friction ridge detail, useful for establishing the identity of persons connected with crime scenes, is typically recovered from scenes in the form of fingerprints and palm prints. Less likely to be found, although just as valuable is friction ridge detail recovered from the soles of the feet.

There are three different form of friction ridge detail that can exist at a scene

- Patent
- Latent
- Plastic

Patent Prints

Patent prints are those prints that can be viewed as they exist without any development processes being applied by the investigator. Typically patent impressions result when the friction ridge surface leaving the print is contaminated with some type of material. Examples of contaminants include dirt, dust, paint, grease and blood.

Depending on the contaminant, a patent print may be further enhanced through the application of appropriate chemicals. Recovery techniques for patent prints will include photographing the print and if possible, collecting the item that bears the print. Patent prints that exist in dust-like materials may frequently be lifted with conventional lifting mediums (e.g. tapes or putty).

Latent Prints

Latent prints are those prints that are not readily visible to the naked eye. These are the prints that require the application of various development processes (e.g. powders and chemicals). Once these prints have been developed, they can be recovered through photography, lifting mediums or retention of the item bearing the print.

The method used for developing the latent print will depend on the nature of the surface being processed. There are two types of surfaces that need to be dealt with – porous and nonporous.

Collecting and processing fingerprint evidence.

Science Concepts: Classifying, forming operational definitions, comparing & contrasting, making judgments, sequencing and problem solving.

4. Fume the items for 5-10 minutes; the sides of the chamber should be clear so the development process can be monitored.
5. Vent the chamber in an open outdoor area – DO NOT place your face over the chamber when opening.
6. Allow the fumed item to sit for about 10 minutes before attempting additional processing.

Dye Stains

Wide varieties of fluorescent dye stains are available that will stain the polymerized friction ridge detail of a CA developed print. The specific type of stain used will depend on the surface to be stained and the light source being used to visualize the print. Enhancing a print by dye-staining will increase the contrast of the print against the background making it easier to visualize. So long as the print has become fixed to the surface of the object by CA fuming, the application of the dye-stain should be non-destructive. Because of the hazards involved, dye-staining is a process typically performed in a lab environment.

Varieties of dye stains are commercially available from forensic supply companies. Like fingerprint powders, dye stains fluoresce in various colors and should be selected so that any background fluorescence of the substrate will not interfere with the fluorescence produced by the stain. Stains that fluoresce under UV light may be more desirable since these lights are typically more easily available to most agencies.

Always check the fluorescent qualities of the object that will be processed and select a stain that will contrast against the background of the object.

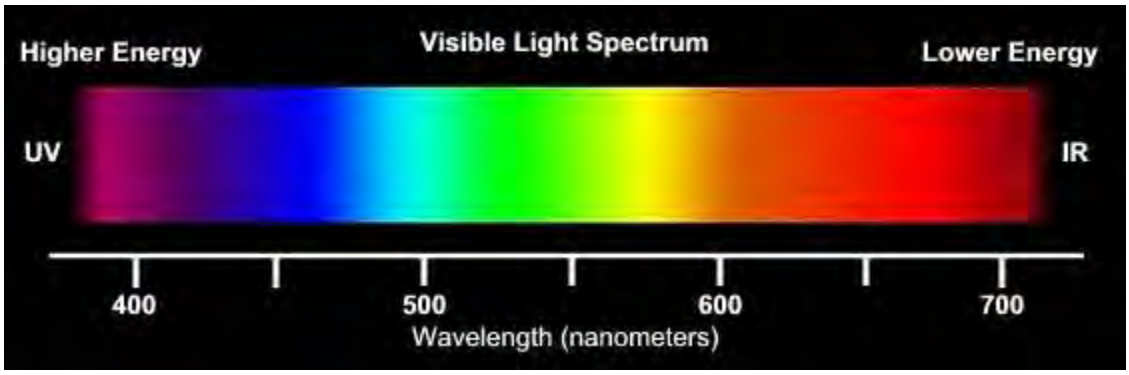
UV (365 nm) Sensitive Stains

- Ardrox (methanol or aqueous base)
- M-Stardrox
- Red-drox

Blue or Blue/Green Visible Light (400-510 nm) Sensitive Stains

- Basic Red
- Basic Yellow 40
- MBD
- M-Star
- MRM
- RAM
- RAY
- Rhodamine 6G (methanol or aqueous base)
- Saffranine O

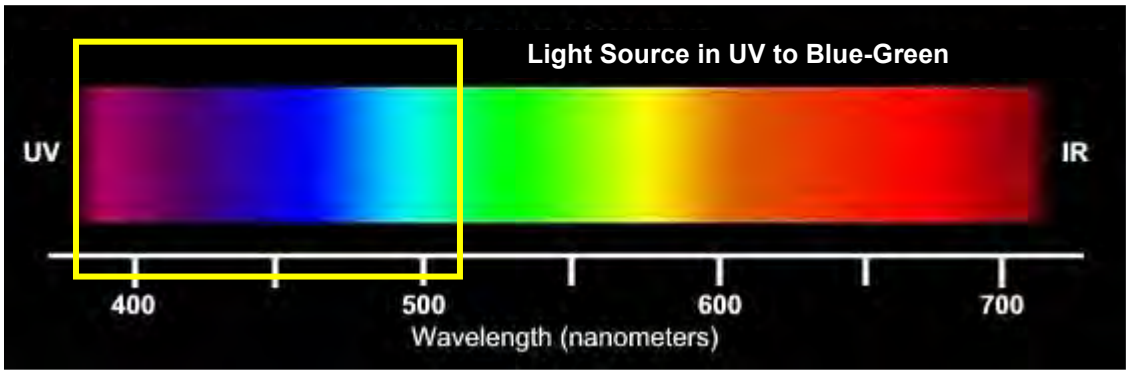
Dye stains are best applied by dipping the item being processed into the stain, or by washing the stain over the item.



Light is a form of energy. Light energy, when applied to certain materials, will cause the molecules of those materials to vibrate. This vibration of molecules in turn results in the substance re-emitting the light energy that has been absorbed. This newly emitted light has less energy than the light initially used for the excitation, and will be a different color – shifted toward the red end of the spectrum.

Substances that re-emit light only while they are being excited by light sources are said to be fluorescent. Take the light source away, and the re-emission of light stops. Fluorescent dye stains and fingerprint powders have this quality. They can be effectively used to provide contrast between the developed impression and the surface that it is on.

Typically, light wavelengths of 365 (UV) – 510nm (blue-green) are best suited for fluorescing these materials. Using a light source that can be tuned to produce a very specific wavelength within this range will generally produce better results.



Typical light wavelengths used to fluoresce latent print powders and dye stains range from long wave UV (365 nm) to 510 nm (blue-green).

Documentation

Proper documentation of fingerprint evidence located during the investigation of a crime is a must. This documentation will not only assist the investigator in recalling where a print was recovered, but may be instrumental in showing that a recovered print could not have been casually deposited by its owner. Fingerprint documentation should include the following:

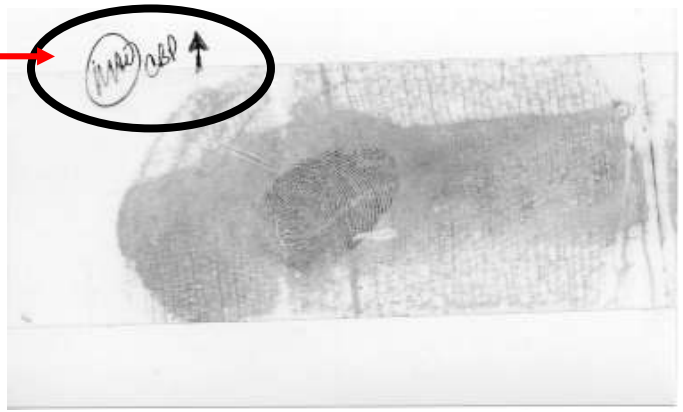
- Case Number
- Victim Information
- Incident Location
- Incident Date
- Recovering Officer Name
- Object or Location of Recovered Lift
- Method of Development
- Orientation if Needed

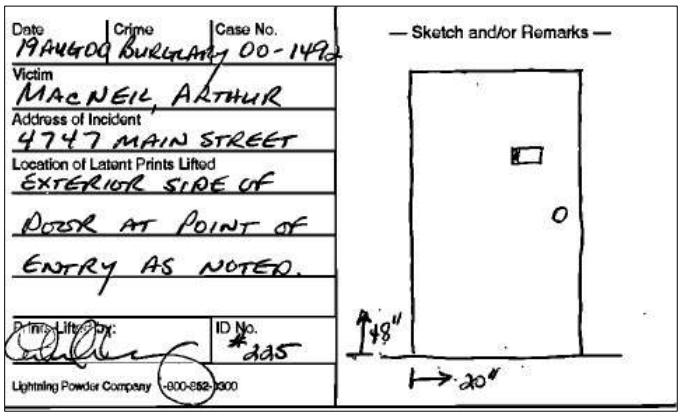
An example of a properly completed latent print lift card is shown below.

Officer Initials "MAW"

Processing Method "CBP" (conventional black powder)

and arrow to show upward orientation on a vertical surface





A Word About Gloves

If chemical processes are not being used and biological hazards are not a concern, then the primary reason for wearing gloves while processing evidence is to keep your hands clean. Evidence should always be handled in a manner that will protect any latent prints that exist. These prints can be destroyed easily by mishandling the evidence even if gloves are being worn.

Cotton gloves will be more comfortable when worn for a lengthy period.

Nitrile gloves will provide more chemical resistance than latex.

Latex gloves may cause allergic reactions over time, this can be avoided by using nitrile gloves instead.

Latex or nitrile gloves should have textured fingertip surfaces and should be “powder free”.

Equipment

Suggested Equipment

The following items are suggested as the minimum equipment needed in a latent print processing field kit.

- Black conventional powder
- Gray conventional powder
- Bi-Chromatic magnetic powder
- Orange fluorescent magnetic powder
- Fiberglass brushes (one for each color of conventional powder)
- Magnetic applicator wand
- Blue LED flashlight
- Orange glasses
- Folding magnifier
- White china marker
- Black china marker
- Transparent lifts or tape (2" wide)
- White backer cards
- Black backer cards
- Scotch brand 1 ½" plastic tape (3M Corporation – Catalog # 191)
- Hard plastic eraser
- White Mikrosil®
- Black Mikrosil ®
- 20mm self adhesive scales
- Bright light (Maglight flashlight)

For Photography

- SLR camera (film or digital)
- Close-up lens capable of focusing to lifesize (1:1 ratio)
- 1:1 lens adapter
- Tripod
- Cable release
- Dark orange lens filter (to photograph prints developed with orange/red fluorescent powders)
- Black & white film

Footwear & Tire Track Evidence

Overview

Impression evidence is the most common type of evidence recovered from scenes of crime. This type of evidence encompasses:

- Fingerprints
- Bite Marks
- Footwear
- Tire Track
- Tool Marks
- Cloth & Fabric Impressions

Anytime one object comes in contact with another there is the likelihood of a material transfer. Or, if the contact is by a hard surface against a softer surface, the formation of indentations or striations.

Footwear and tire track evidence, for many reasons, is frequently overlooked. In many instances the investigator may not be aware of the value this type of evidence has in an investigation. If not recognized and protected, this evidence is easily destroyed.

General Considerations

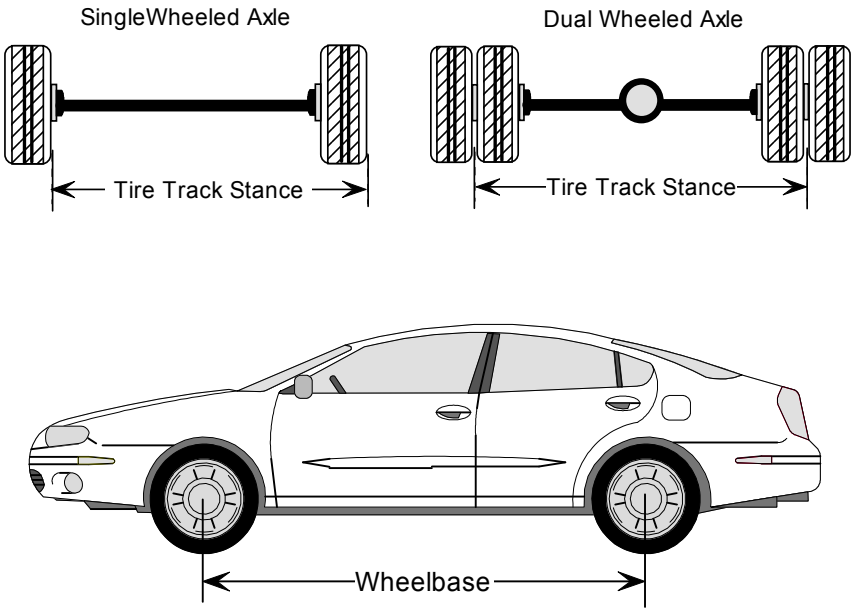
Footwear and tire track evidence impressions can play a vital role in criminal investigations. Like most types of impression evidence they may exhibit individual characteristics and unknown impressions may be matched to known items based on these characteristics. In some instances, the significance of this match may be likened to finding the fingerprint of a suspect at a crime scene[6].

Even if individual characteristics are not present in a recovered impression, the impression may supply additional information such as the manufacturer and type of a particular shoe or tire. This could lead to identifying the number of suspects present at a scene and/or their actions within a scene or potentially identifying a particular type of vehicle. The value of the information supplied by this type of evidence should not be underestimated.

Collecting and processing footwear & tire track evidence.

Science Concepts: Classifying, measuring, forming operational definitions, comparing & contrasting, making judgments and problem solving.

[6] People v. Campbell, 146 Ill. 2nd 363 (Illinois Supreme Ct. 1992)



If any footwear or tire track impressions are documented as part of the scene exam, their importance or relevance to the incident must also be documented. Reports should reflect the location and condition (e.g. wet or dry) of the impression(s). Persons or vehicles having a legitimate reason for being at the scene need to be eliminated as having made the questioned impressions. Written reports should reflect that the shoes or tire of those having a purpose on the scene, have been compared to the questioned impressions and have been eliminated as having made the impression.

In major case investigations, exemplar impressions should be collected from first responders, homeowners and others. If someone's shoe cannot be eliminated as having created a questionable impression, then that person's shoes will need to be collected and submitted to the lab for further analysis.

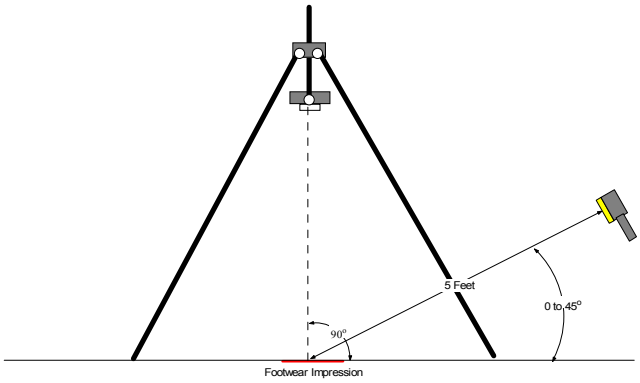
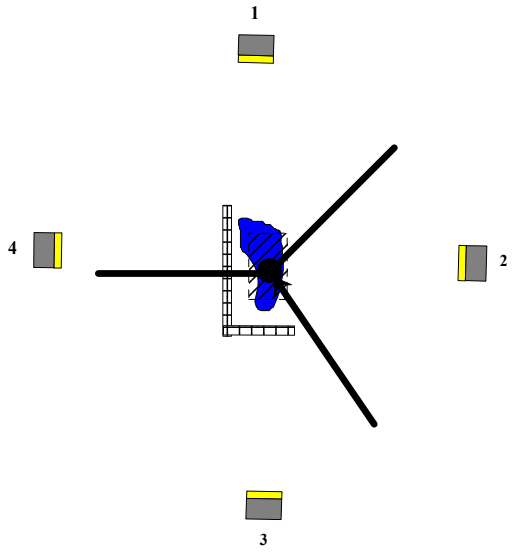


Illustration depicting the proper placement of camera and flash for footwear or tire track impression photos. Shallow impressions require the flash to be closer to the ground. Deeper impressions require a greater angle between the flash and the ground.

When possible, a minimum of four photos should be taken of the impression. The impression should be obliquely lit from each of the four sides.



Casting Materials

Chemical Enhancement of Impressions

NOTE: It is always preferable to remove impressions from the scene and submit them to the lab for enhancement. There may however be instances where this cannot easily be done.

There are a number of chemical enhancement techniques available that may work to make the details of an impression easier to visualize. These techniques are dependent on the type of contaminant, if any, that is in the impression. The most commonly enhanced impressions, are those that are contaminated with blood.

When working with blood, there are three types of processes available

- Light
- Protein Stains
- Presumptive Tests

Light

Bloodstains will absorb certain light wavelengths and darken visually to the eye making them easier to view against some backgrounds. Using light in the 365 (Longwave U.V.) to 415nm – 455nm (violet to deep blue) is the most effective with the 415nm-455nm wavelengths working best against backgrounds that do not fluoresce.

The use of light does not require any application of chemicals and can be used to easily screen an area for impressions that can later be further enhanced. Light will assist in defining the general pattern characteristics of an imprint but will most likely not be the best tool for defining the individual characteristics of an impression.

Presumptive Tests

NOTE: A sample of the suspected blood should be collected from a non-critical area of the impression for subsequent DNA profiling before the application of any presumptive test as an enhancement technique.

Presumptive tests are screening tests that will indicate the possibility of blood being present. Because presumptive tests may react with other substances and give false positive reactions, additional testing and/or DNA analysis is necessary to confirm the presence of blood.

The most common types of presumptive tests used in the field are referred to as *catalytic tests*. These tests rely on the hemoglobin in blood to speed up the reaction between an oxidizer and the reagent involved in the test. The subsequent rapid oxidation of the reagent typically results in a color change of the reagent. This color change can be used to offset the blood impression against the background especially in cases where mall amounts of blood are present. Examples of catalytic presumptive tests commonly used for enhancement are

- LCV
- Luminol

Luminol is a catalytic test where a positive reaction results in the emission of light rather than a color change.

Presumptive tests are generally effective on both porous and non-porous surfaces.

Biological & Trace Evidence Contents

Table of Contents

Forensic-Classroom – Supplemental Material
Biological & Trace Evidence

Produced by

Imprimus Forensic Services, LLC
www.imprimus.net

Collection Techniques

Biological Evidence Collection Techniques

- ✓ Photograph stains prior to collection
- ✓ Collect entire object when possible
- ✓ Swab the bloodstain using sterile swabs moistened with distilled water
  The amount of water you use to moisten the swab is dependent on the size and concentration of the stain. If you have a small or dilute stain – only use one drop of water to moisten the swab. If the stain is more concentrated or large, use more water to moisten the swab
- ✓ Avoid scraping the stain
  Scraping the stain increases your exposure to bloodborne pathogens
  Scraping also increases contamination
- ✓ Collect the most amount of the stain as possible
- ✓ Collect the stain prior to any fingerprint enhancement or blood enhancement techniques when possible

Packaging Biological Evidence

- ✓ Air dry all biological evidence before packaging
- ✓ Only use clean paper products (do not "recycle" paper bags)
  This includes cardboard boxes for swabs and knives. Do not put these objects in plastic tubes
- ✓ Package each item separately
- ✓ Label each package with a Biohazard sticker
- ✓ Label each package with the case number, your initials, date, exhibit number AND the location the item was found (or from who the item was collected)

Storage of Biological Evidence

- ✓ Objects or specimens that have been air dried can be safely stored at room temperature.
- ✓ Liquid samples of blood or urine that have been collected for toxicological purposes must be refrigerated.
- ✓ Urine collected for DNA purposes and feces collected for the same reason, should be frozen. Freezing this evidence inhibits bacterial activity that can degrade the DNA.
- ✓ Metal objects having dried stains present should NEVER be stored in a refrigerator or freezer.

Evidence Retention

- ✓ Given the rapid pace of technology and constant advances being made in the area of DNA analysis, consideration should be given to retaining any evidence that holds potential for DNA examination.

Trace Evidence Terminology

Control Sample: An uncontaminated or clean sample of material from a known source.

Gunshot Residue: **GSR –** Microscopic particles of primer, gunpowder, lubricant and projectile residues. Common elements are barium, Antimony and Lead.

Known Standard: A sample of material to be analyzed collected from an identified source. The known standard is compared against the unknown to determine if they are the same.

Morphology: The form or structure of an object.

SEM: **Scanning Electron Microscope**. A method of gun shot residue analysis used to detect lead, barium or antimony. This microscope can magnify the surface of an object 100,000 times or more and produce detailed three-dimensional images by passing an electron beam over the entire sample.

Transfer Evidence: Evidence that is exchanged between two or more items that come in contact with each other. Transfer evidence may be readily visible or may exist as trace evidence.

Trace Evidence: Evidence that is usually very small or microscopic. Examples of common types of trace evidence include:

Hair	Fibers	Pollen	Gunshot Residue
Glass	Dirt	Paint	Cosmetics
Chemicals	Feathers	Debris	Building Materials

Does a blood transfusion change a person's DNA?

No. Blood transfusions – even in large quantities – do not change a person's DNA profile.

> Brauner, Paul **"DNA Typing and Blood Transfusion",** *Journal of Forensic Sciences*, Vol. 41, No. 5, 1996, pp. 895-897

Use of Luminol at a Crime Scene

Luminol was used at an outdoor location in an attempt to locate blood evidence in a homicide case for reconstruction purposes. There were 23 days of measurable rain, amounting to 7.86 inches, over a 72-day period from when the person was reported missing to when the Luminol test was to be conducted. The location processed was an asphalt parking lot. The Luminol test was conducted at night and applied using a large chemical sprayer. The sprayer was cleaned and tested for any reactivity to Luminol. Areas adjacent to the parking lot were also tested for any false positive reactions. Several weeds and small chips of metal on the parking lot gave positive reactions. A pattern of luminescence, different than the false positive reactions, was detected in an area of the parking lot. After Luminol testing, these areas were marked and examined under bright lights. The surface was old and pitted asphalt, with some areas broken into chunks. Pieces of asphalt and the underlying soil that reacted with the Luminol were tested using phenolphthalein. The phenolphthalein tests were positive. Tests conducted in the laboratory revealed the blood to be of human origin. There was not sufficient sample for any further testing.

> Waldoch, Terry **"Chemical Detection of Blood After Dilution by Rain over a 72 Day Period",** *Journal of Forensic Identification*, Vol. 46, No. 2, 1996.

Do Fingerprint Reagents and/or Light Sources Destroy DNA?

Fingerprint Reagents Tested	Light Sources Tested
Amido Black	Alternate Light Source
BY-40	Argon Ion laser
Carbon	Polilight UV
Crowle's Double Stain	Polilight green
Crystal Violet	Shortwave UV
Cyanoacrylate Fuming	Superlite
DFO	
Fluorescin	
Gentian Violet	
Hungarian Red	
Leucomalachite Green	
Leucocrystal Violet	
Luminol	
Merbromin	
Ninhydrin	

Procedures / Practices*

Crime Scene

1. Post all entrances to the scene with "Biohazard" warning labels. The warnings should indicate the nature of the hazard(s) and a phone number for a contact person. *(e)(2)(ii)(D) / (g)(1)(ii)*

2. Within or immediately outside of the scene, establish a "safe area" to be used for suiting up, removing contaminated clothing, storage / cleaning of contaminated gear, and disposal of contaminated articles. *(d)(3)(vii)*

3. Maintain the "Biohazard" burn box, first aid kit and portable eye wash station, waterless antiseptic hand cleaner and clean paper towels in the safe area. *(d)(4)(iii)(B)*

4. Decontaminate all equipment (photography gear, large scales, etc.) at the end of the day or prior to repacking in storage containers. Use a 10% bleach solution for cleaning (10ml of bleach to 90ml of water*). (d)(2)(xiv) / (d)(4)(ii)*

5. Eating, drinking and smoking are prohibited within a contaminated area. *(d)(2)(ix)*

6. Require that all personnel working within a contaminated area wear appropriate safety and protective equipment based on the nature of their work and/or degree of exposure. *(d)(3)(ii)*

7. Upon release of the scene, the owner/occupant shall be notified of the hazards present (biological and chemical) and shall be referred to a professional resource for recommendations on how to properly decontaminate the scene. The fact that this notification has been made shall be documented in a supplementary report. *(e)(2)(ii)(K)*

Evidence Items

1. The outside packaging of any item suspected of being contaminated with a bodily fluid shall be clearly labeled using an appropriate "Biohazard" label. *(g)(1)*

2. Sharp items or items that pose a risk of puncturing or tearing ordinary packaging materials shall be packaged in a puncture resistant container. *(d)(2)(viii)(A) / (d)(2)(xiii)(C)*

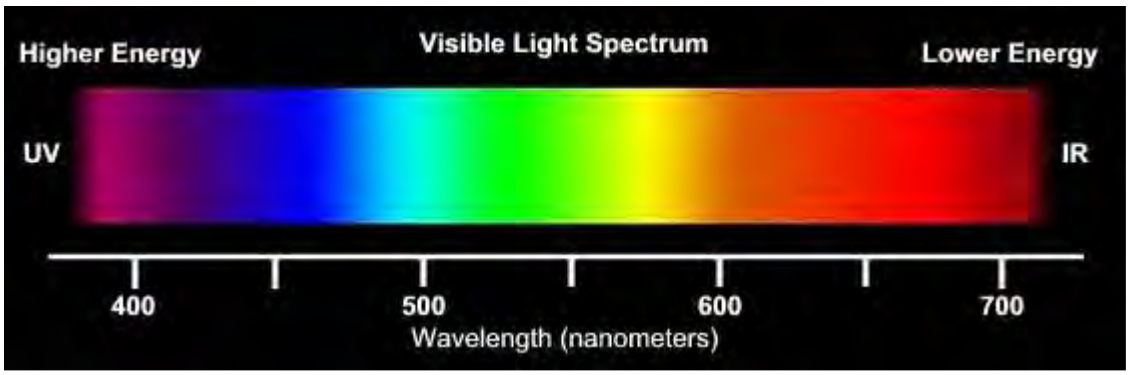
3. Items wet with blood (e.g. clothing) that have the potential to soak through paper containers, shall be transported in a closed red plastic biohazard bag and brought to a facility where they can be appropriately dried. A suggested practice would be to place the item in a paper bag and then place the paper bag inside the plastic biohazard bag. If needed the paper bag can be retained for any trace materials that might have come loose from the clothing. *(g)(1)(i)(E)*

Overview

Forensic light sources can be used as an aid in locating biological fluids. The reader must be aware however that in most cases, the best and cheapest light source to use for locating suspected stains, is a bright flashlight.

Theory of Light Application

Biological fluids can be broken into two categories; those that fluoresce or brighten under certain wavelengths of light and those that absorb or darken under certain wavelengths. Success in using light to locate biological fluids is generally dependant on the intensity of the light source and the ability to select a specific wavelength of light.



Fluorescence

Light is a form of energy. Light energy, when applied to certain materials, will cause the molecules of those materials to vibrate. This vibration of molecules in turn results in the substance re-emitting the light energy that has been absorbed. This newly emitted light has less energy than the light initially used for the excitation, and will be a different color – shifted toward the red end of the spectrum.

Substances that re-emit light only while they are being excited by light sources are said to be fluorescent. Take the light source away, and the re-emission of light stops. Body fluids that may fluoresce when illuminated with certain wavelengths of light are:

- Semen
- Saliva
- Urine
- Vaginal Secretions
- Sweat

Chemical Enhancement of Blood Impressions Located at Scene

NOTE: It is always preferable to remove impressions from the scene and submit them to the lab for enhancement and analysis. There may however be instances where this cannot easily be done.

There are a number of chemical enhancement techniques available that may work to make the details of a blood contaminated impression easier to visualize. The technique selected will depend on the nature of the surface (porous vs. non-porous), the amount of blood present and the reaction or color change needed to create contrast with the background.

When working with blood, there are three types of processes available

- Light
- Protein Stains
- Presumptive Tests

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Bloodstains will absorb certain light wavelengths and darken visually to the eye making them easier to view against some backgrounds. Using light in the 365 (Longwave U.V.) to 415nm – 455nm (violet to deep blue) is the most effective with the 415nm-455nm wavelengths working best against backgrounds that do not fluoresce.

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- LCV
- Luminol

Luminol is a catalytic test where a positive reaction results in the emission of light rather than a color change.

Presumptive tests are generally effective on both porous and non-porous surfaces.

Appendix A – Chemical Formulations

Chemical Enhancement Techniques / Protein Stains & Presumptive Tests

The following pages contain information on various chemicals that can be used to enhance bloody patent impressions or other impressions that are barely visible to the naked eye.

In many cases, these products are available in a ready to use form from the larger crime scene supply companies.

Safety Precautions

The technician using these products should be familiar with their associated hazards. All chemical suppliers should provide the purchaser with a copy of the MSDS (Material Safety Data Sheet) for each product. The purchaser should read the MSDS carefully and take appropriate safety precautions. Safety equipment that the end user should have available includes gloves, eye protection, splash resistant clothing and respiratory protection if appropriate.

Chemical Formulations

Chemical formulations are provided for the below listed enhancement techniques. These formulations as well as additional latent print development techniques can be found in the FBI's Processing Guide for Latent Prints. The complete processing guide can be found in PDF format on the Imprimus website – Downloadable Files page. (www.imprimus.net)

- Amido Black – Methanol Base
- Amido Black – Water Base
- Amido Black – Water Base – Fischer 98
- Coomassie Brilliant Blue
- Crowle's Double Stain
- LCV

Selecting a Process

With the exception of Luminol, all other processes will enhance the impression with a color reaction. The process selected should be selected in order to develop maximum contrast between the enhanced impression and the background. Alcohol based processes are not recommended on some surfaces. The methanol in the mixture will act as a solvent and will most likely damage varnished, painted, lacquered and some other surfaces. If possible, test any alcohol-based solutions on a non-critical area of the substrate first.

Other Precautions

Partial patent impressions (footwear, fingerprint or other type) that are going to be enhanced should be photographed using appropriate forensic photography techniques prior to applying any type of enhancement process. They should be photographed *again,* after application of the enhancement process.

Amido Black (Methanol Base)

(Protein Stain – Enhancement Technique)

Caution must be exercised when applying the methanol-based formula to painted surfaces. This formula may destroy the latent print(s) as well as the surface beneath the latent print(s). All blood must be dried prior to application. Cyanoacrylate fuming may be detrimental to this process.

Equipment

Scales, beakers, graduated cylinder, magnetic stirrer and stirring bar, squirt bottles or sprayer, clear or dark storage bottles.

Materials & Chemicals

- Naphthol blue black (dye content ≥ 85%)
- Glacial acetic acid
- Methanol

Mixing Procedure

The amido black process consists of two solutions – a developer and a rinse – and a final rinse of distilled water.

Developer Solution

Naphthol blue black	2 g
Glacial Acetic Acid	100 mL
Methanol	900 mL

Combine the ingredients and mix using a stirring device until all the naphthol blue black is dissolved. This should take approximately 30 minutes.

Rinse Solution

Glatial Acetic Acid	100 mL
Methanol	900 mL

Combine the ingredients.

Final Rinse

Distilled water is preferred; however, if not available, tap water can be used.

Processing Procedure

Apply the developer to the specimen(s) by dipping, spraying or using a squirt bottle. Leave the developer on the specimen for approximately 30 seconds to 1 minute, then apply the rinse. These steps can be repeated to improve contrast. Apply the final rinse of distilled or tap water, the dry the specimen(s).

Storage

Clear or dark bottles

Resources & Forms

This section includes useful resources for crime scene supplies and other materials. It also includes forms that can be used in the classroom. These forms may be reproduced for educational purposes only.

Also included are:

- Illinois State Science Standards
- Sample Student Forensic Portfolio Exercise

Illinois Science Standards

Science

The *Illinois Learning Standards for Science* were developed using the 1985 State Goals for Science, the National Science Education Standards, various other state and national works, and local education standards contributed by team members.

Science is a creative endeavor of the human mind. It offers a special perspective of the natural world in terms of understanding and interaction. The aim of science education is to develop in learners a rich and full understanding of the inquiry process; the key concepts and principles of life sciences, physical science, and earth and space sciences; and issues of science, technology, and society in historical and contemporary contexts. The National Science Education Standards present these understandings and their interactions with the natural world as eight science content standard categories. The *Illinois Learning Standards for Science* integrate these categories into a powerful resource for the design and evaluation of science curricula taught in Illinois schools.

The *Illinois Learning Standards for Science* are organized by goals that inform one another and depend upon one another for meaning. Expectations for learners related to the inquiry process are presented in standards addressing the doing of science and elements of technological design. Unifying concepts connect scientific understanding and process and are embedded in standards spanning life science, physical science, and earth and space science. The importance of this knowledge and its application is conveyed in standards describing the conventions and nature of the scientific enterprise and the interplay among science, technology and society in past, present and future contexts.

Applications of Learning

Through Applications of Learning, students demonstrate and deepen their understanding of basic knowledge and skills. These applied learning skills cross academic disciplines and reinforce the important learning of the disciplines. The ability to use these skills will greatly influence students' success in school, in the workplace and in the community.

Solving Problems

Recognize and investigate problems; formulate and propose solutions supported by reason and evidence.

Asking questions and seeking answers are at the heart of scientific inquiry. Following the steps of scientific inquiry, students learn how to gather evidence, review and understand their findings, and compare their solutions with those of others. They learn that there can be differing solutions to the same problem, some more useful than others. In the process, they learn and apply scientific principles. They also learn to be objective in deciding whether their solutions meet specifications and perform as desired.

Communicating

Express and interpret information and ideas.