Footwear & Tire Track Evidence

for the Crime Scene Investigator

Presented by: Imprimus Forensic Services, LLC
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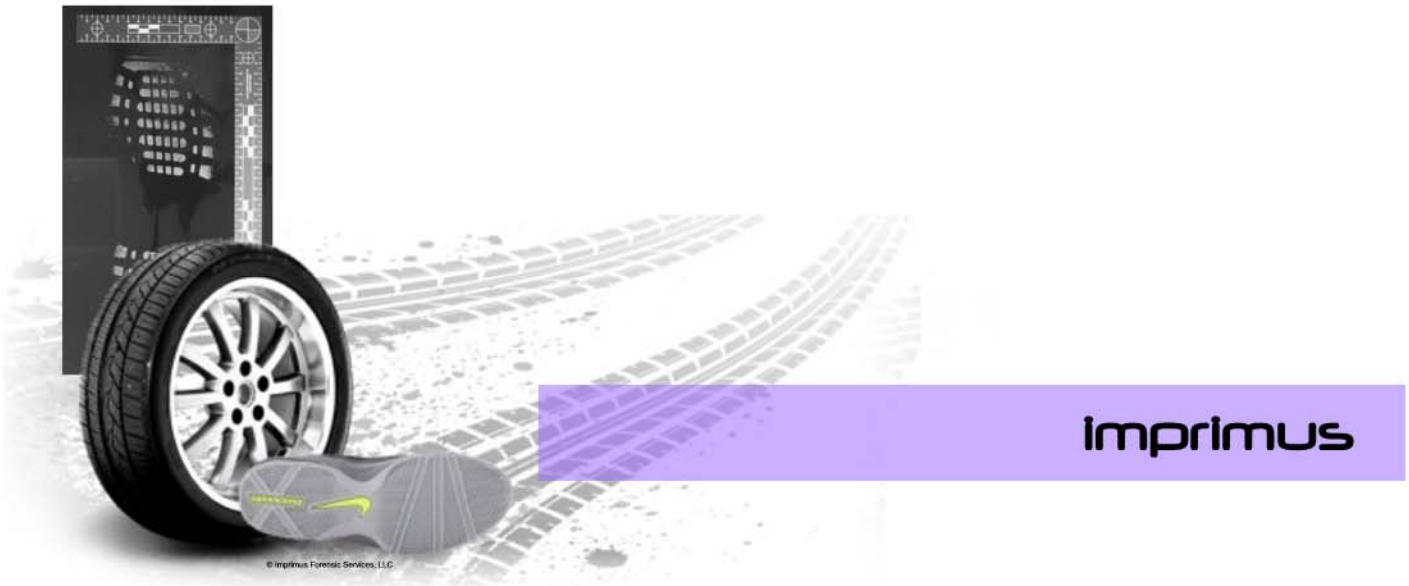

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Footwear & Tire Track Evidence

Impression 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. Direct physical contact of a shoe or tire at a scene may leave an impression that exhibits either class or individual characteristics. 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[1].

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.

Footwear and tire track evidence can provide a number of investigative leads including but not limited to,

- Type and brand of shoe or tire
- Number of persons at the scene
- Type of vehicle involved
- Path/direction of travel for persons or vehicles
- Areas to look for other evidence
- Linking a suspect to a scene

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

Additionally, impressions can aid in event reconstruction, providing answers to

- How many persons involved?
- How did they approach?
- How did they enter?
- Where did they move within the scene?
- How did they leave?

Statements of suspects, victims and witnesses may also be corroborated or refuted through study of impressions at the scene.

There are many features of footwear and tire impressions that can create linkage. Examples include

- Class Characteristics
- Mold Characteristics
- Mold Defects
- Individual Characteristics
- Individual Characteristics

While a match through individual characteristics may provide the most valuable link, other features in the pattern can help narrow the candidate pool of originating shoes or tires.

Example of Comparison Using Individual Characteristics

Development Techniques



Examples of different electrostatic or dust print lifters.

Two-Dimensional Impressions *(Imprints)*

Two-dimensional impressions will most commonly exist as positive or negative impressions in dust and wet origin or contaminated impressions.

Dust Impressions

1. Photograph using oblique lighting technique
2. Static Lift / Vinyl Lift recovery *or*
3. Gelatin lifter recovery (use a lift color that provides the best contrast – usually black) ***Note: Dust impressions on gelatin lifts should be photographed after lifting as they may fade over time.***[3]

Wet Origin Impressions (not biological in nature)

1. Develop with latent print powder
2. Photograph
3. Recover object if possible
4. Gelatin or conventional tape lift recovery (object not recoverable)

   In some instances, a wet origin impression that has dried may be lifted directly with a black gelatin lifter without the application of latent print powders. Enhancement of a small portion of the impression should be tried first. If enhancement with powders does not work, attempt a gelatin lift.

Contaminated Impressions (typically blood impressions)

Object with Impression is Recoverable

1. Photograph (if impression is partly visible)
2. Recover the item bearing the impression (example – footwear impression in blood on a sheet of paper)

[3] Lightning Powder Company, "Longevity of Latent Shoe Prints", Technical Notes – Impression Evidence, 2000, P-6. [This bulletin is in the Manufacturer's Literature section of this binder]

Object with Impression is Not Recoverable

1. Photograph (if impression is partly visible)
2. Recover a sample of the contaminant for lab analysis (blood swab / Note: If the technician is uncertain as to how this should be done, then guidance should be sought from the local crime lab.)
3. Chemically Enhance
4. Photograph
5. Attempt to lift (depending on the surface involved and enhancement method used, gelatin lifters can sometimes recover an enhanced impression)

Other Impressions

Sometimes two-dimensional impressions will be created when one object forcibly comes in contact with another (example – a foot kicking in a door). When this happens consideration should be given to recovering the object bearing the impression. In the case of a footwear imprint on a door, recovery of the surface will most likely depend on the seriousness of the crime. If the surface is not going to be recovered the following protocol is suggested:

1. Photograph
2. Attempt static lift recovery
3. Attempt enhancement (generally latent print powders)
4. Photograph if enhanced
5. Lift enhancement (gelatin or conventional lifts)

Three-Dimensional Impressions *(Indentations)*

When three dimension footwear or tire track impressions are located at a scene, the following recovery process should be followed:

1. Photography
2. Casting of the impression

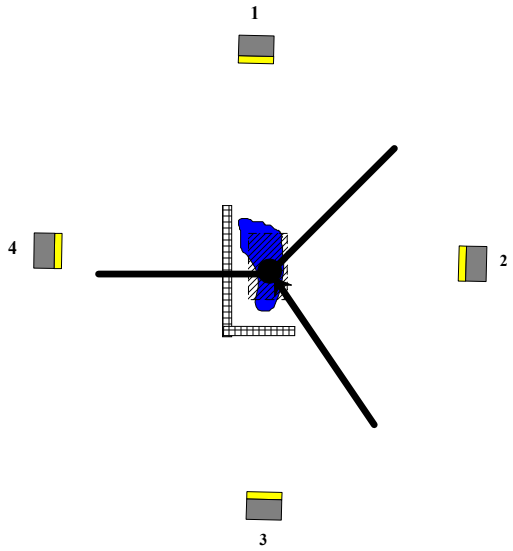
Typically, three dimensional footwear and tire track impressions will not exist at a crime scene in a medium that can be removed and preserved without casting.

Example of a properly photographed footwear impression in snow.

This photo was taken at night with oblique lighting used to bring out detail.

The fragile substrate (snow) makes photography of this impression critical for successful recovery.

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.



Specific Requirements - Tire Track Photographs

- Document one entire rotation
- Identify tire position
- Identify direction of travel
- Identify outside edge of tire

While the above photo is technically correct, a card needs to be added to at least one image to identify the tire position, outside edge and direction of travel if known. That information can be critical to helping the tire track examiner compare photos from a scene to a suspect tire. Note how using the large scale helps identify different camera positions, allowing the images to be stitched together.

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.

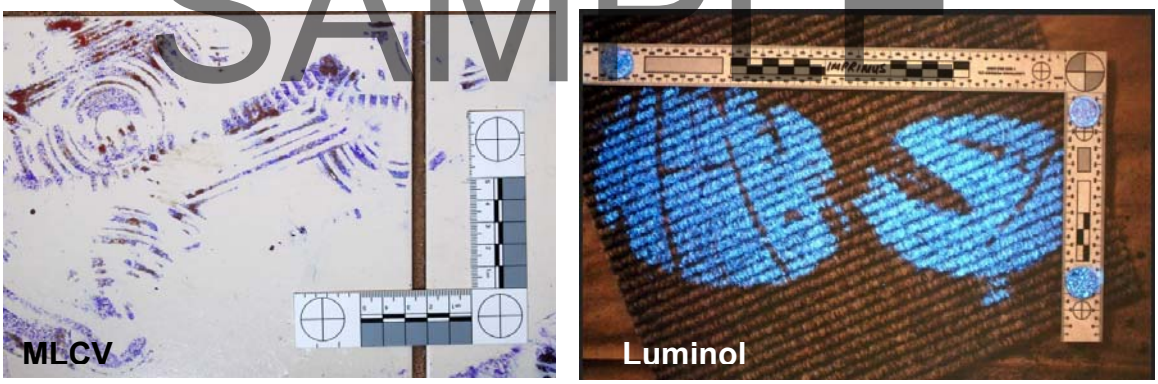
Presumptive tests are screening tests that will indicate the possibility of blood being present. Because presumptive tests may react with other substances and give false positive reactions, additional testing and/or DNA analysis is necessary to confirm the presence of blood.

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.



The above images show several blood contaminated footwear impressions enhanced using reagents that also act as presumptive tests. On the left are footwear impressions in blood on a ceramic tile floor enhanced using Modified Leuco-Crystal Violet (MLCV). Note that the light areas of blood transfer enhance better than the heavier stained areas.

On the right is a footwear impression on carpet enhanced using Luminol. Because it does not involve a color change, Luminol might be a better choice for enhancements on dark surfaces.

Because these impressions reacted with the reagents (MLCV or Luminol) the presumption is that the impressions are in blood. While neither MLCV nor Luminol will destroy DNA, an uncontaminated sample of material should be collected before applying either reagent.

Amido Black: A common protein stain used to enhance the appearance of bloodstains against a substrate. Amido black will dye the stain a dark blue-black color and is best suited for light backgrounds.

Arc Width See "Tread Design Width"

Catalytic Presumptive Test: A presumptive test for blood that relies 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.

Class Characteristic A common feature shared by many items (the overall pattern of a shoe or tire).

Cross Slots See - *Slots*

Footprint The shape and area of that portion of a tire in contact with the ground.[5]

Groove On a tire, the space between the ribs.

Imprint A two dimensional impression.

Indentation A three dimensional impression.

Individual Characteristic A unique identifying mark made at random to the surface of a shoe or tire that is subject to wear.

Insole The inner material of the shoe that is between the upper and the outsole of the shoe.

LCV: Leuco Crystal Violet; A catalytic presumptive test for blood also frequently used to enhance blood contaminated impressions (footwear or fingerprint).

Luminol: A catalytic presumptive test for blood. The most sensitive of the catalytic tests. Luminol may give false positive reactions with a number of substances including strong oxidizers (bleach), copper and metals that are copper alloys, and decaying vegetation.

Unlike other catalytic tests where a positive reaction is indicated by a color change in the reagent, Luminol gives off a soft blue-green light when it is oxidized.

[5] McDonald, Peter "Tire Imprint Evidence", CRC Press, Boca Raton, FL 1993.

Appendix B – 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
- LCV
- Luminol

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.
Obtaining Materials