



**VIRGINIA DEPARTMENT OF FORENSIC SCIENCE**  
**EVIDENCE HANDLING & LABORATORY**  
**CAPABILITIES GUIDE**

**IMPRESSIONS**

**Contact Information**

If you have any questions concerning the Impressions examination capabilities or evidence handling procedures, please call the Training Section or an Impressions examiner.

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## OVERVIEW

A tire or shoe impression may occur when a shoe or tire impresses or impacts a surface and characteristics or features are transferred onto the receiving surface. Just as in other forms of forensic examinations (such as firearms, toolmarks and latent prints), the unknown (crime scene impression) is compared to the known tire or shoe and areas of uniqueness in the impression are documented with the intent to identify the specific source or origin. Impression evidence at the scene can be associated with the item that made it by class characteristics or individual characteristics. With sufficient individual characteristics, a positive identification between the source and the impression can be made.

Quick recovery of impression sources such as shoes or tires is important because continuous use will alter or wear away identifying characteristics. New cuts and other identifiers will appear subsequent to the original impression which must be acknowledged in the examination. Also, foreign objects embedded in the surface and recorded in the impression may in time be removed or altered.

## CAPABILITIES AND SERVICES

### **Types of impressions examined by laboratory personnel:**

- Footwear or tire impressions
  - Three-dimensional impressions (impressions in soil, snow, sand, mud, etc.)
  - Two-dimensional prints (impressions on a solid surface – floors, counters, car hoods, paper, etc.)

### **Purpose of examination:**

- Determine if there are sufficient gross design features and clarity to conduct a comparison.
- Identify the make, design, physical size, wear/manufacturing characteristics, as well as individual characteristics of a specific tire or footwear item.
- Compare the questioned impression and known object to determine if the impression could have been made by the submitted object. Various conclusions are possible and can include individualization (a definite conclusion of identity), exclusion (definite elimination) or various levels of limited association.

## COLLECTION GUIDELINES

### ITEM - Three Dimensional Impressions (e.g., Footwear or Tire Impressions in soil)

**Note:** Due to the fragile nature of impression evidence it is recommended to practice the photography, casting and lifting techniques outlined below and seek out training in these methods prior to implementing them on evidence.

#### METHOD I - Photographic Documentation

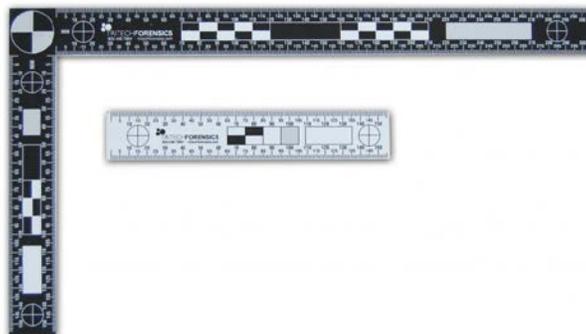
Step 1: Take overall and mid-range photographs.

Step 2: A digital SLR (single lens reflex) camera is recommended with the ability to attach an off camera flash. The highest mega pixel camera available should be used as best results will be achieved if 300PPI (pixels per inch) resolution at size (1:1) can be maintained. This may not be possible with larger impressions in which case photographing them in sections may be necessary. Step 3: Use the normal focal length on the lens, as opposed to wide angle or telephoto/close up settings.

Step 4: Position the camera on a tripod, with the digital sensor plane parallel to the impression and directly over the impression.

Step 5: Position camera to fill the frame with the impression, not cropping any of the impression.

Step 6: After photos without a scale have been made, add a scale alongside the impression containing identification information and take examination quality photographs. The ruler should be buried to approximately the same depth as the impression being photographed and positioned next to the impression without covering or obliterating the impression itself.



**Note:** *The 90° or L-shaped scale is best. If this scale is not available, use a scale that runs the length of the impression or 2 scales, at least 6 inches each, along the length and width of the impression.*

Step 7: Use low oblique lighting with the flash held approximately three feet from the impression. For best results, photograph the impression with the flash at approximately 10°, 30° and 45° angles (exact flash angle is determined by depth of impression). Several photos with the flash at a minimum of four different positions around the impression need to be made also, since each flash position highlights the impression differently. Only one of the four flash positions may highlight the individual characteristics needed for a positive identification. Make a tent to block out any ambient light (particularly on a bright sunny day) by draping a cloth or material around the legs of the tripod and direct the oblique light from the flash through the open side of the tent. Make sure that the scale is at the same depth as the impression. A large piece of cardboard can also be used as a sun shield to create this tented area.

Step 8: To ensure you have a proper exposure, bracket the series of photos. For example, if the original series of examination quality photos were taken with an aperture setting of f11, take two more complete series, one at f8 and one at f16. Oftentimes, f11 is a good starting point.

Step 9: With tire impressions, sufficient photos must be taken to ensure the entire circumference has been documented (at least six feet). Overlap photos for continuity of impression. If more than one tire impression is present, each must be separately documented.

Step 10: When photographing an impression in snow, after documenting the impression as is; lightly sprinkle black fingerprint powder by twirling a fingerprint brush over the entire impression to add contrast. Then re-photograph the impression. Automobile primer spray paint can be used to highlight snow impressions as well. It is best to use flat black or flat gray. Do not spray the paint directly into the impression, as this may disturb the details present. Spray the paint above the impression or against a baffle to allow it to “fall” into the impression. After the impression has been highlighted in this manner, re-photograph using the above described techniques. (These highlight techniques will aid in the contrast of the casting of the impressions).

## **DISCUSSION I:**

Photography documents evidence detail and the scale allows for a 1:1 photo for comparison to be made. The use of the normal lens setting and a parallel film plane eliminate distortion of the image. The use of a tri-pod is necessary for important detail of the impression to be in fine focus.

## **METHOD II - Basic Casting Technique**

Dental Stone casting should be used to collect the actual impression to supplement the photographs that were taken. Dental Stone is stronger, easier to use and more durable than Plaster of Paris.

Step 1: Examine the impression. **Embedded debris must be left untouched.** Removing embedded debris is likely to destroy detail within the impression. If debris is loose (i.e. a leaf that was blown on top of the impression) it can be carefully removed, but it is necessary to photograph before and after removing debris.

Step 2: Surround the impression with a form or frame. This provides a neater edge, and

enables the excess material to add to the thickness of the cast rather than be wasted.

Step 3: Impressions in wet sand or loose dirt may need to be “fixed” before casting can begin. The recommendation is to mist with a hairspray product off a baffle to firm the material of the impression. Be careful not to allow drops of hairspray to fall off the baffle into the impression.

Step 4: The ideal method of mixing the casting material and water is to have pre-measured amounts packaged in double-bagged plastic zip lock bags. Generally, about three (3) pounds of dental stone is sufficient to cover a standard shoe impression. Add six (6) ounces of water *per pound* of dental stone, then mix by kneading the bag until a uniform consistency is achieved with no lumps. One way to make sure lumps are eliminated is to place the bag on a flat surface and press sections of the bag until no lumps are felt. The zip lock bag serves as the storage container, the "mixing bowl", and the pourer.

Step 5: Pouring should begin at the highest point of the impression, inside the frame that has been placed around the impression. The dental stone mixture should be poured onto an intermediate object (spatula, paint stir stick) to soften the impact of the liquid stone onto the impression. The dental stone should be poured at a constant rate while moving the flow gently across the area of the form, allowing the mixture to flow into the entire impression. Be sure there is enough mixture to cover the impression with one pouring.

Step 6: Etch required information into the top of the cast as it is hardening or use a permanent marker to write the information on the dried cast.

Step 7: If not using pre-measured bags of the casting material, the mixing bowl method may be used. Add dry casting material to the water until the casting material peaks above the water about an inch. Stir to a uniform consistency described as either pancake batter or melted ice cream. Make sure you have mixed enough casting material to cover the impression. Apply as above.

Step 8: Once dry, usually 20-30 minutes, the cast may be lifted. Dig around the cast when lifting so pressure is not applied to the cast itself. Attempts to remove soil or debris from the bottom of the cast should be avoided.

Step 9: Package evidence properly. Be sure cast is dry and place in or wrap with newspaper or other paper. Do not package in plastic as the cast will continue to release moisture. Place in rigid container to ensure cast does not break.

### **Additional considerations for tire impressions**

When dealing with tire tracks, it is important to cast the full circumference of the tire. Since a six (6) foot cast is impractical, make four (4) consecutive one and a half (1 ½) foot casts for each tire track found. Label each appropriately so they can be realigned.

With tire tracks, it is often possible to determine which tire of the vehicle made the particular tire track. In a turn the front tires track to the outside of the rear tires. In a back-up/forward maneuver, the front tire angles will be visibly different because they can turn.

With tires, the individual defects that are important may be on the sidewalls. Make sure the full depth of the impression is cast, including the sidewalls.

## **Additional considerations for Snow Impressions**

Photograph the snow impressions as detailed above. Oblique lighting is critical to generate contrast in a white-on-white impression.

Dental stone generates some heat when mixed, so applying a protective barrier between the mixture and the snow will produce better casts. Snow Print Wax is recommended for this. Three coats of the fine red wax should be applied prior to casting. When the cast is lifted the individual characteristics will be preserved in the fragile wax.

### **ITEM - Two Dimensional Impressions**

#### **METHOD I - Photography**

**Documentary photography should always be done, regardless of other collection techniques.**

Residue prints (similar to patent fingerprints) that are visible in existing light are photographed in much the same way as three dimensional impressions. The flash angle can be more oblique, but this will depend on the surface and the thickness of the impression. Use a flashlight at different angles to determine the best flash angle.

For residue prints, when possible, collect the surface the impression is on and turn it in as evidence. Packaging should be a rigid container and should be clearly marked "This end up". This ensures the total integrity of the evidence. Every detail is documented for the Lab, because they have the actual item.

With dust impressions that aren't visible in normal light, use the oblique lighting techniques explained for three dimensional impressions. With dust the best flash angle is almost parallel to the surface that bears the dust impression, since the depth isn't a factor.

**DISCUSSION I - Two dimensional impression photography documents evidence detail prior to attempts to lift or package and allows for 1:1 comparison. Collection of the item that the impression is on is usually preferred.**

#### **METHOD II - Dust Lifts**

After a two dimensional impression has been photographed, an attempt to retrieve the impression should be made. The best tool to recover impressions in dust is the Electrostatic Dust Print Lifter (EDPL).

Step 1: A special film which is metalized on one side is placed carefully over the dust print. An electrostatic charge is applied to the film which then attracts and holds the dust particles on its surface. When the film is lifted, the impression will cling to the black surface of the film, making it easily visible. Lit with oblique light, minute details and individual characteristics may be readily identifiable with this tool.

Step 2: Because the dust impression is now on a black surface, high contrast photography can be done to preserve the dust print. Since the dust transfer is not permanent, photography best

preserves this evidence.

Step 3: Successful dust lifts using the EDPL can be obtained from wood surfaces, vinyl tile, nylon pile carpeting, indoor/outdoor carpeting, cardboard, cement, metal, and paper.

Step 4: Since dust is the medium, the eventual settling of ambient dust will gradually obscure these impressions. Noticeable degradation in the quality of test dust impressions was noticed when left to sit for a week before attempting to lift them with the EDPL.

Step 5: Do not attempt to "fix" the dust lift on the EDPL film but rather package in a rigid container. Do not use plastic containers as the static generated by them can damage the dust lift.

### **METHOD III - Residue Lifts**

Step 1: Using wide fingerprint tape to lift a two-dimensional impression can also be successful, the wider the lifting tape the better. Otherwise, the multiple overlaps necessary to completely cover the impression may themselves obscure details or when lifting the tape the overlaps may separate. Once the tape is lifted, hold it over a light and a dark surface to see which provides better contrast before affixing it to either.

Step 2: Commercial shoeprint lifters are also available. These include gelatin lifters and adhesive lifters.

Step 3: Residue impressions are sometimes visible in natural light and sometimes they are not. A rubber soled or gum soled shoe may not leave a visible mark on a tiled or linoleum floor, even when lit by oblique light. Dusting these surfaces with regular black or magnetic black fingerprint powder has sometimes made these impressions visible. Then they can be photographed and lifted.

### **Dental Stone Casting**

This has been found to be successful in recovering some **visible** residue impressions. The dental stone absorbs the residue material and cleans the surface where applied. The visible residue is then clearly visible in the dental stone, having transferred completely. This includes visible impressions on garage cement floors and road shoulders or any impression where mud or another thick material has been deposited in the form of an impression.

Cast in the same manner prescribed for three dimensional impressions.

## **SUBMISSION REMINDERS**

### **Prioritize Evidence**

Impression evidence should be prioritized for early consideration since it is so easily contaminated. Search for impression evidence at the approach to the scene, at the entry and exit ways, along the path through the scene and escape route, near other impressions and on floors, walls, doors and even the roof. When located it must be protected so that it isn't destroyed by personnel at the scene and/or the elements (snow, rain, wind, heat).

### **Practice New Techniques**

It is important to practice new casting techniques on a test impression before taking them into a crime scene. Make a print or impression under similar conditions but far enough away from the evidence to protect its integrity. Once you have established a procedure that works, you can cast your evidence. This is particularly helpful with impressions in snow.

### **Use the Correct Method**

Moist or damp impressions can not be secured by the EDPL ("dust lifter"). If you can readily see an impression it would probably be suitable for casting or lifting--after photography.

### **Submissions**

Submit the photographs, negatives or original media packaged separately from any casts or lifts. Package known shoes in paper bags.