



An introduction to tracks, footprints and plaster casts

Shoeprints and tyre tracks can be very helpful to those investigating a crime. Prints can leave behind important pieces of information and even though you may think shoes are all the same; with some careful observation all sorts of useful information can be gained.

The prints themselves can offer information about the wearer, what shoe they wore, how often they wore it, it can indicate wear patterns (does the person have a limp or wear out a certain part of their sole more than other parts), where they have been (sometimes they drop residue from other places they have been), how tall they are and sometimes even how heavy they may be.

If shoes are found at the scene of a crime or are confiscated from suspects as evidence comparisons can be made and samples can be collected from the sole of the suspect's shoes that may link them to the location where the crime took place.

Shoes and tyres can indicate points of entry and exit at a crime scene and can reveal the movements of a criminal when undertaking a crime. Shoe prints and tyre tracks can also link crimes. The physical contact between a shoe and the surface being walked on, results in a transfer of the individual characteristics of the shoe. Shoeprints are often used to prove that suspect was present at a crime scene. A multitude of shoeprints can also indicate if one or more people were involved in the crime. Tyre prints can be just as useful as shoes for all the same reasons.

Shoeprint impressions

Shoes acquire a large amount of 'stuff' as they move through different environments such as dirt, grease, fibres and moisture. As a result they can leave both patent (visible) and latent (invisible) prints on hard surfaces and three-dimensional impressions in soft surfaces such as sand or soil.

Shoeprint impressions are often considered good evidence because often the shoe manufacturer can be tracked. They can then identify the size of the shoe and the suppliers of the shoe. All this information can assist in narrowing the search to a suspect list. Shoe sizes can also be used in anthropometric measurement, which is how some body parts can be used to calculate height and other body measurements, therefore giving a better picture of who the suspect might be. Anthropometric measurement is mentioned in more detail later in document **FSP09**. If more than one shoeprint is available at the crime scene, then gait can also be calculated, this is useful in assisting investigators in narrowing the suspect search even further.

As with fingerprints, there are three basic kinds of shoeprints that can be found at the scene of a crime:

- 1. Patent: meaning visible.** These kinds of prints are the result of walking through something that sticks to your sole and then leaving some of it behind as you walk. Substances that could be found in a patent print include dirt, paint or blood.



Photograph: Paul Ricketts, DUIT Multimedia, UWA

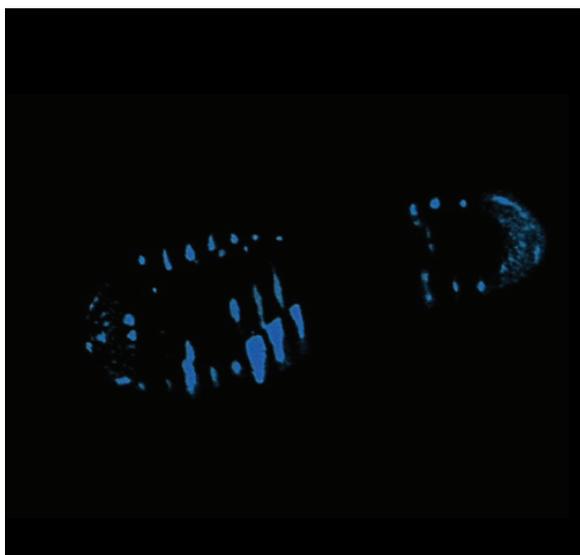


2. **Plastic: meaning three-dimensional.** When you walk through soft malleable substances (such as snow, mud, sand or other soft substances) you leave a plastic or 3D print.



Photograph: Paul Ricketts, DUIT Multimedia, UWA

4. **Latent: meaning invisible to the naked eye.** These prints often need to be exposed using different forensic techniques. When you walk you transfer a thin layer of accumulated (yet invisible) oils and grime from the soles of your shoes to a hard surface such as wooden floors, glass, tiles, paper or even concrete floors.



Photograph: Paul Ricketts, DUIT Multimedia, UWA

Recording prints

Protecting a crime scene means protecting all the evidence and this includes shoeprints and impressions. This can be difficult and investigators must be mindful not to trample evidence and to avoid areas where the criminal may have been until shoeprints are secured and recorded. There are two main ways that investigators discount their shoeprints in a criminal investigation. Firstly they may obtain exclusionary shoeprints, these are shoeprints of all the law enforcement personal working at the crime scene. Then these shoeprints can be excluded from those collected by investigators. The second method used you may have seen on TV. To avoid confusion with shoeprints at a crime scene, investigators will often slip surgical booties over their shoes while they are at a crime scene. This way they don't leave any footprints that may be confused with evidence.

Recording patent or visible prints

Patent prints can be found at a scene, left in a variety of substances. They can be found on carpet or on a hard wood floor as a print left by something (such as mud or paint). When recording these prints there are a few ways to do it and investigators choose how they will do it based on the print.

Prints left by wet shoes have clear trails and these can be photographed. Dry prints left by dust are harder to find. They can be lifted using a technique similar to lifting dusted fingerprints (and sometimes can be enhanced by powder), or they can be recorded by using an electrostatic lifter. This device uses a high voltage power source that enables the transfer of a dry impression from the surface where it was found to a special black film using static electricity. It lifts dust from the print to a black surface where it can be seen more easily. Photography remains very important in regard to patent prints. All photos of patent prints must contain a ruler for scale and be taken at a 90 degree angle to the surface the print is on so that distortion doesn't occur and measurements made from the photos back at the lab will be accurate. There are



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also chemicals that can be used to enhance the print if it has been left by oil, blood or other substances. For example, a faint shoe print in blood will be enhanced if sprayed with a chemical (luminol). It will then fluoresce under UV light and can be photographed.

Recording plastic or three-dimensional prints

Footwear impressions are influenced by the weight of the person and the surface that they are standing or walking on. The impression that is left can contain a lot of detail or may be contaminated with debris and therefore this type of print is very useful. Clay-based soil will give a much better impression than sand because of its fine particles and the fact that it is usually quite soft and sticky.

Because plastic prints can be left in all sorts of substances, investigators must be careful that they alter their recording method based on the substance that the print has been left in.

These prints are always photographed before casts are made of them. Sometimes oblique lighting (applying light on an angle) makes certain aspects of the print (such as depth and details) stand out better. Impressions in sand and snow can be difficult; because these substances are light in colour getting any contrast in an image is very difficult. Sometime investigators will spray prints with a dark spray paint to make the details stand out better and to provide contrast.

Once photographs have been taken, the next step is to make a cast of the print. This can then be used to make a better comparison or match between the print and the suspect's shoes.

When making a cast the following steps are followed:

1. A metal or wood frame is placed around the footprint to be cast.
2. Dental stone (a hard durable plaster) is then carefully poured into the impression and left to allow to set.

3. Once the stone has hardened completely, the initials of the person who made the case are recorded (by scratching) on the back to allow for easy ID when evidence is needed in court.

This sounds easy. But there are some things that can cause problems, such as making a cast in a soft substance such as sand or mud. The weight of the plaster can sometimes deform the print. This can be overcome by first spraying the print with an acrylic lacquer to protect it and provide some support.

When choosing what sort of material should be used for making a cast. The following should be considered.

The casting material should:

- Be cheap.
- Have the capacity for fine detail.
- Be easy to prepare and use.
- Be able to flow evenly into the impression but not be absorbed or pass through the material the impression is in.
- Have a reasonable setting time.
- Be easily released from the material from which the impression was made in. You don't want chunks of sand stuck in your cast covering important details.
- Be easily cleaned without loss of detail.
- Be stable – so can be stored for long periods of time without deteriorating or changing.

Plaster of Paris is no longer used professionally, because it is quite soft and difficult to clean. Dental impression material (known as dental stone) is now used instead.

Recording latent or invisible prints

Latent prints are usually left by shoes that are relatively clean and as a result these prints are hard to see with the naked eye. The soles of your shoes are constantly picking up and dropping off material you've walked through such as oil, soil, dust and other fine particles. Even when your shoe comes in contact with a clean surface it will leave a faint print. Dry, clean shoes have also been known to leave



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prints on glass, floors, tables, bench tops and other polished surfaces.

Searching for latent prints is hard, similar to searching for latent fingerprints. The investigator has to be patient and methodical. The areas near the victim, scene of the crime, entry or exit are typically the spots where a search for footprints will be successful and these are the areas that investigators will generally focus on.

Latent footprints are often treated in a similar way to latent fingerprints, they may be dusted and photographed or dusted and lifted using special forensic sticky tape. If there is blood residue left behind, the footprint may have been cleaned up or may not be visible to the naked eye, but by spraying the area with certain chemicals, such as luminol, blood will be exposed as it glows under UV light. This can then be photographed. Some oils and other residues also glow under UV light, making photography of them possible.

Wear patterns and other information gained from shoes

Wear patterns on shoe soles can be very handy because everyone wears out the soles of their shoes in a distinct manner. Some people walk on the outside of their feet, some shuffle and some favour the balls of their feet. How your foot strikes the ground establishes how the sole of your shoe will wear. Another factor that affects wear is what you walk on. Someone who works in an office and spends a lot of time walking on carpet will have a different wear pattern to their shoes than someone who wears the same shoes but works on a concrete sales floor or works in a bituminised car yard. These are useful differences that can be compared between shoes and may assist in solving a crime.

On top of wear patterns; cuts, nicks, scratches, gouges and pebbles can all create a unique shoeprint, creating a very distinctive, traceable piece of evidence. Of course, if the shoe that is worn during a crime is continually worn after the crime, then tread patterns and distinguishing features may wear away and disappear. So if possible, evidence such as this must be acted on quickly if it is to be useful for identifying the criminal.

If more than one footprint is left in a row at a crime scene then it may be used to determine gait. This can also assist with working out the criminals walking style, length of stride and stance. Sometimes it can even assist investigators in identifying if the criminal is pigeon toed or has a limp! By working out stride length, sometimes other calculations can be made. Stride length can help investigators estimate height and build of a criminal. A fat, tall person is not likely to leave a thinly spaced, short stride length.

Finally, shoes can bring all sorts of materials with them on their soles. You can traipse all sorts of things into a crime scene on the bottoms of your shoes. Things like carpet fibres, soil, oils and other fibres and clues can be collected by shoes and can indicate where the criminal may have been before the crime that could help with identifying suspects. Every little clue helps!



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Tyre impressions and tyre tracks

Tyre impressions can be just as important as shoeprints, for all the same reasons. Tyre tracks can reflect the tread design and dimensional aspect of individual tyres that can then be compared with impressions from a suspect vehicle. Tyre tracks show the relative dimensions between two or more tyres and can provide all sorts of useful information about the vehicle.

Tyre treads are made of many design elements. Some are arranged around the circumference of the tyre while others are separated by grooves. Tyres also have sidewalls that hold information such as the tyre label and a serial number that contains information about the brand, style and size of the tyre.

The tread wear of the tyre can be retained in three dimensional impressions and to assist investigators even further there are published manuals with information about tyre tread patterns and brands.

Track evidence may also be found at a scene. Information about track width, wheelbase (centres of the hubs between the front and back wheels) and turning diameter can help in the identification of the type of vehicle used in the crime.

When tread patterns are examined for evidence; design, dimension, wear features and random individual characteristics are all analysed. Random characteristics may be things like pebbles, cuts in the tyres, missing parts of tread and other non-factory marks. Tyre tracks can provide investigators with a lot of useful information.