GAP INDIAN JOURNAL
OF FORENSICS AND BEHAVIOURAL SCIENCES
(ISSN – 2582-8177)
Globally peer-reviewed and open access journal.

DIFFERENT METHODS OF FOOTPRINT CASTING: A CASE STUDY

Akshara Mathur[1], Adheethi B.[1], Sarita Kumari[2] and Mukesh Sharma[2]

[1]Vivekanand Global University, Jaipur
[2]Physics Div., State FSL, Jaipur

Abstract

At scene of crime and spot the footprint is important evidence in the criminal investigation. As it does not only helps identify the suspect but also establishes solid proof against the criminal. There are numerous ways for the detection, identification and collection of footprints pattern from a scene of crime. 3D prints from the crime scene are collection by its casting, which have been reported in this article. Apart from the 3D prints of footprints, there also availability of 2D footprints from the crime scene, as 2D prints are obtained using the silicone and mikrosil methods.
Further the footprints obtained from the crime scene are examined against any controlled sample taken in the laboratory under an expert. In this paper, the footprints were majorly studied through case study on different surface. Blood pattern on the shoe on scene of occurrence, were compared in the lab with old analysis pattern and computer based super imposition methods.

INTRODUCTION

Footprint evidence can be defined as the effects or impressionsleft behind by an individual strolling or running. They may either be spaces in the ground or something put onto the surface that was adhered to the lower part of the foot. The print abandoned at a crime location can give imperative proof to the culprit of the wrongdoing. Shoes have various prints dependent on the bottom plan and the wear that it has gotten – this can assist with recognizing suspects. Photographs or castings of impressions can be taken to safeguard the findings. About only 40% of the crime scenes have usable footprint impressions [1 – 3]. It can be usually found at entry and exit point, on the way, exterior area and near another footprint. Investigation of footprints and shoeprints is an expert piece of forensic science. So here, it's an overall review how footprints/ footmark impressions are taken from different surfaces and its methods [4 – 5].

INFORMATION FROM FOOTPRINT USEFUL FOR CRIMINAL INVESTIGATION

A footprint can say about many things such as a predicted number of criminals present in the crime scene, their direction of movement, sequence, manner (walking, running, limping, staggering) and their entry and exit point. we can also determine time period, from short lived impression in frost, snow, dew. It also helps to build links between crime scenes. The type, size and areas of specific wear on the shoes. Certain seasons or weather conditions lend themselves to the creation of footprint impressions than others. Soil trapped in soles can also give useful leads, such as soil pH, specific minerals or heavy metals in the soil, the presence of seeds or pollen grains [5].

DIFFERENT TYPE OF FOOTPRINTS

There are mainly two types of footprint impressions such as, 3-D footwear impressions, 2-D footprints. In 2-D footprints it can be again divided into latent footprints and patent footprints [6 – 7].

3-D FOOTWEAR IMPRESSIONS

Three-dimensionalfootwear impressions are those that have significant depth in addition to length and width. They are most commonly found outdoors in soil, sand and snow. The degree of details that can be transferred from the footwear and retained by the substrate will vary tremendously.

CASTING OF 3-D FOOTPRINTS

Casting is the process of filling a footwear impression with a material that will acquire and retain the characteristics that are left behind by the footwear. The material which we use for casting should beeasy to mix and handle with the capable of producing clearly defining caste without any dirt and should not get absorbed into the impression. It should have a long-lasting durability for a long shelf life.Dental stone is used over Plaster of Paris (POP) cast because it fails due to poor grade and using of older plaster.Dental stone has the ability to be cleaned without losing the details of impression, hardness, durability, shelf life and quality of the cast. Dental stone is made from gypsum, it is heated to get plaster of Paris Again heating it under pressure gives dental stone.

GAP INDIAN JOURNAL
OF FORENSICS AND BEHAVIOURAL SCIENCES
(ISSN – 2582-8177)
Globally peer-reviewed and open access journal.

Dental stone needs only less water for mixing. While mixing dental stone with water, the water to powder ratio should be 40 parts of water: 100 parts powders(Higher the WP the longer the setting time).After mixing the dental stone at crime scene using a zip lock bag pour the mixture into the cast from any side of the impression, forms are usually used in uneven surface therefore it should be kept 1 to 1 ½ inch from impression to form and then leave the mould for 20 to 30 minutes and after that don't disturb the mould for 48 hrs.

UNDERWATER CASTING: if the impression is under water do not try to drain away the water, simply pour the dental stone mould into it and the water will act as a releasing agent.

ON SNOW SURFACE:

MELTED SULPHUR CASTING: It is done by melting a quantity of sulphur. Then re-cool the sulphur just above its crystallisation point it will change into irreversible thick, syrupy brownmass. Only 5lb of sulphur is required for casting after that rapidly pour it into the snow impression and leave it for setting.

PARAFFIN WAX: The paraffin wax cast can be done by melting paraffin wax very slowly otherwise it may explode. After melting wax pour it into the impression channel and leave it for setting.It is recommended because of its the rapid cooling property cause air entrapment between the wax and the impression. The paraffin wax cast can be twisting, sagging, distorted.

SNOW PRINT WAX: It is an aerosol spray wax, which is bright red in colour. Spray it to the impression but don't keep it too close to the surface. It should be kept away from direct sunlight because it may cause melting. Add 3-4 layer of snow print wax to the surface then allow it to dry for 1 to 2 min in each layer.Leave it for 10min and add dental stone with an additional mixture of KSO_4andH_2O.

2-D FOOTPRINTS:

MIKROSIL: it is a casting material which is used to lift 2-D impression (of blood) on textured and uneven surfaces. It need catalyst to speed up the chemical reaction hence, it sets fast.

LIQUID SILICONE: it is not so thick in consistency and need greater quantity for casting therefore, it takes time to set andto speed up the chemical reaction it need catalyst. Liquid silicone is usually in expensive side hence, it is not much preferable.

PATENT FOOTPRINT:

Patent footprint is a visible print occurs when there is a transfer of material from the shoe to the surface. This kind can be observed through naked eye without extra aids. For instance, bloody shoe prints leftward on carpet or marks left by muddy shoes on a concrete surface. Its detection can be done by photography of the particular impression using forensic measures.

LATENT FOOTPRINT:

A latent print is not easily observable to the bare eye.This is formed by static charges between the sole or tread and the surface.Investigators uses powders, chemicals and alternate light sources to observe these prints. Illustrations comprise footprints identified on a tile or hardwood ground, window sill, or metal counter, or tire tracks detected on road surfaces, driveways or sidewalks.

Its detection can be done byFluorescent Powders which are used widely as the primary method of fingerprint treatment at crime scenes, when using a Forensic or Alternate Light Source. They are available in various colours such as Red, Green, Orange, Pink, Yellow, Gold, Blue etc. Forensic light source techniques have been successfully utilized for revealing latent prints on these and many other types of textured surfaces, backgrounds surfaces which mask ridge details, fragile surfaces, and contaminated surfaces.Surfaces likeporous surfaces i.e., paper, cardboard, unfinished woods etc, these require the use of Liquid Dyes such as Ninhydrin or DFO.Rougher or highly textured surfaces can sometimes benefit from Cyanoacrylate (Super Glue) fuming.

ON DIFFERENT SURFACES:

If marks on oil and grease is on a non-porous surface then impression could be dusted with fingerprint powder and photographed. If its present on a concrete surface then you can photograph it and leave the impression or collect it (optional).Mikrosil or gelatine is used to collect blood impression. Fluorescent fingerprint powder can be used to powder on latent impression which shows fluorescence in UV. Electrostatic detection device [ESDA] is used to detect indentation of footprints.If any impression is found on the skin of the victim, then can be photographed and preserved.

ANALYSIS OF FOOTPRINT AS COMPARISON

Characteristics observed in the crime scene (unknown) impression are compared to the characteristics observed in the control impression of the known shoe by Side-by-Side comparison and superimposed comparison (overlay). Class and individual characteristics should also be compared to derive the solution. Class characteristics can be defined as the characteristics that comes from the manufacturing process such as, size, shape, design, and mould characteristics.Individual characteristics comes from the wear and tear marks such as cuts, cracks, embedded objects, unique/accidental/random damages on the outsole results in completely random shape, orientation and position of footwear [8]. There should be minimum three individual characteristics of evidence sample to be matched with the control sample to finalise that whether the evidence and control sample are matching or not.

GAP INDIAN JOURNAL
OF FORENSICS AND BEHAVIOURAL SCIENCES
(ISSN – 2582-8177)
Globally peer-reviewed and open access journal.

CASE STUDY

FAMOUS CASE: A shoe print, DNA and traditional policing helped Dyfed-Powys Police track down a dangerous offender who committed a serious sexual assault in Tenby:

A footwear mark was recovered by Crime Scene Investigators, which was believed to belong to the offender. They recovered a footwear print from the scene and processed the image allowing it to be analysed by the force's footwear specialist back at police headquarters.

Using specialist technology, a national database and the eye of the force's footwear specialist, the type of footwear was identified as a particular type of Fred Perry trainer,this information was passed on to officers undertaking house to house enquiries in Tenby and helped identify Check as a suspect.

Dyfed-Powys Police uses the latest advancements in footwear identification, including footwear scanning equipment, access to a national databased containing almost 38,000 images of different classifications of footwear prints and providing appropriate training and qualifications for the specialist role to be performed. However, the brand proved crucial in this investigation

Later, found a shoe that matched the various elements of the pattern and it was a particular design of Fred Perry trainer. Officers took the footwear analysis work on board and during local enquiries spotted a pair of Fred Perry trainers matching the description. While this turned out not to be the actual pair of shoes worn during the attack, it provided a substantial link to the suspect. He was arrested soon after.

Later it was concluded that, in the early hours of Monday, January 9, Andrew Edwin Check, aged 30, climbed through a window of a house, found the victim in her bed and subjected her to a serious sexual assault whilst in possession of a knife. DNA evidence of the victim was later found on a glove located in the home of Check. This evidence proved conclusively that Check was responsible for the crime and led to him submitting a guilty plea at Swansea Crown Court.

LABORATORY CASE

Case History – In this case one dead of a old was found in the farm, as a case of loot and murder, at spot having some partial blood stain pattern of footwear, which have been collected by our crime scene teams and send to Regional FSL, Kota Physics Div for analysis.

The original images of the footwear are shown in Image 1 – 3, and after 10 days the suspects were arrested by the investigating officer. Shoes have been recover from the suspect custody have been sent along with the photograph for comparison and analysis.

RESULTS OF ANALYSIS

Partial imprint of the shoe pattern made a complete shoe shape, all the dimensions, and special characteristics have been observed for the photo-prints taken from the scene of crime and taken scaled and labelled images for the print again.

When we examine the shoe, the engraved sole pattern was observed and initial measurements of the parameters were found similar. So compare to the image, we develop ink pattern on white sheet.

Superimposition method using computer based scanning was adopted for comparison, for images and ink pattern. It was observed that all the individual characteristics in both patterns were almost same, which indicate the importance of physical evidences.

GAP INDIAN JOURNAL
OF FORENSICS AND BEHAVIOURAL SCIENCES
(ISSN – 2582-8177)
Globally peer-reviewed and open access journal.

CONCLUSION

The examination concluded through the photographed and cast impressions corresponded in footwear design, dimension, and general wear with the respective shoes. Both of these shoes were belongs to similar design and pattern.

The combination of both designs in the same respective positions on both the vehicles and as evidenced in the scene tracks corresponded. In addition, the right side out, a situation that would not be frequently found on another footwear having a particular design and size. No individual characteristics were present, in part because much used either a gravel mix or grassy area, but also in part because the shoes contained very few individual characteristics.

REFERENCE

[1] Adair, T., Lemay, J., McDonald, A., Shaw, R., and Tewes, R. (2007). Te Mount Bierstadt Study. An Experiment in Unique Damage Formation in Footwear. *Journal of Forensic Identifcation* 57(6), 199-205.
[2] Bodziak, W. J. (1984). Shoe and Tire Impression Evidence. *FBI Law Enforcement Bulletin,* July1984 , 2-12.
[3] Bodziak, W. J. (1996). Some Methods for Taking Two-dimensional Comparison Standards of Tires. *Journal of Forensic Identifcation* 46, 689-701.
[4] Hueske, E. E. (1991). Photographing and Casting Footwear/Tire Track Impressions in Snow. *Journal of Forensic Identifcation* 41, 92-95.
[5] Ludas, J. M., and Leonard, J. L. (1994). Why 'No-scale' Photographs Are Not Always a Dead-end: A Homicide Case Study. Presented at the International Symposium on the Forensic Aspects of Footwear and Tire Impression Evidence, FBI Academy.
[6] Stone, R. (2006). Footwear Examinations: Mathematical Probabilities of Teoretical Individual Characteristics. *Journal of Forensic Identifcation* 56, 577-599.
[7] Zeldes, I. (1989). Footwear and Tire Track Examination in the Soviet Union. *Journal of Forensic Identifcation* 39, 367-374.
[8] Hamm, E. D. (1988). Te Value of Shadow in Footwear and Tire Track Evidence Recovered by Photographic Techniques. *Journal of Forensic Identifcation* 38, 91-97.