

Footwear Impressions SOP

1.0 Background

Footwear identification may be one of the oldest forms of forensic identification in the western world, dating back to a 1786 homicide investigation. Footwear evidence may provide the type, make, description, and approximate size of a shoe, as well as the number of suspects, sequence of events, and points of entry and exit. Footwear evidence may link crimes occurring in different jurisdictions. Specialized techniques may be required to locate and document the impressions, especially if they are latent.

2.0 Scope

This SOP lists steps/procedures to be taken in evaluating footwear impression evidence. Depending on the nature of the evidence, it is unlikely that all steps/procedures listed here will apply in any one case; the examiner will make the ultimate determination since each case has its own evidence and circumstances and requires individual assessment.

3.0 Equipment, Reagents

3.1 Photography

3.1.1 A 35 mm camera.

3.1.1.1 Digital cameras may be used in some circumstances, for example outsole design, but the analyst must ensure the resulting photos include appropriate detail. Use of the tag image file format (.tif) is strongly recommended.

3.1.2 Camera tripod.

3.1.3 Film: Recommended: black-and-white T-Max ISO100; Kodak Plus-X Pan; Kodak Technical Pan 2415. In some situations a slow speed color film may be utilized.

3.1.4 Suitable light sources.

3.1.4.1 Oblique lighting.

3.1.4.2 Direct lighting. Blue full spectrum bulbs are recommended.

3.1.4.3 Alternate light source (ALS). Examine the evidence using the available filter/wavelength combinations. The combination that produces the most visible result is then used for photography.

3.1.4.3.1 Orange glasses in combination with ALS wavelengths less than 530 nm but greater than 400 nm.

3.1.4.3.2 Red glasses with 570 nm wavelength.

3.1.4.3.3 Yellow glasses with less than 400 nm wavelength (ultraviolet).

3.1.5 Suitable scales.

3.1.5.1 Metric scales are preferred. When practical, utilize the L-shaped Bureau Scale (Bodziak).

3.2 Reagents. ACS grade or better when available. With the exception of dental stone (avoid inhalation of dental stone) these should be treated as hazardous substances. Utilize a fume hood or appropriate respiratory protection.

- 3.2.1 8-hydroxyquinoline (8-quinolinol).
- 3.2.2 Ammonium thiocyanate.
- 3.2.3 Iodine and benzoflavone (alpha-naphthoflavone).
- 3.2.4 Physical developer.
- 3.2.5 Small particle reagent.
- 3.2.6 Amido black.
- 3.2.7 Leucocrystal violet.
- 3.2.8 Fingerprint powder.
- 3.2.9 Potassium sulfate.
- 3.2.10 Dental stone.

3.3 Other equipment.

- 3.3.1 Sandbox with sand or diatomaceous earth.
- 3.3.2 Biofoam.
- 3.3.3 Potter's clay.
- 3.3.4 Carbon paper.
- 3.3.5 Roller transport film.
- 3.3.6 Electrostatic dust print lifter.
- 3.3.7 Calipers.
- 3.3.8 Magnifying glasses.

4.0 Safety

The chemicals and reagents used must be considered potentially hazardous. For safety, many must be used in fume hoods or with respiratory protection. Consult the **material safety data sheets** before using any of the reagents/chemicals.

5.0 Document the evidence

5.1 Mark, photograph, and photocopy the items as necessary.

- 5.1.1 Photographs submitted by the agency may be retained in the case file. If not already submitted, request the negatives from the investigating agency.
- 5.1.2 When evidence can only be recorded or collected by photography and the image itself is not recoverable, the photograph or negative of the image must be treated as evidence.

6.0 Preliminary evidence examination and enhancement

6.1 Shoes

6.1.1 Trace or serological evidence.

6.1.1.1 Document if present, preferably with photography. Determine if the item(s) may have contributed characteristics noted in the impression evidence and/or casts.

6.1.1.2 Some trace evidence, such as small fragments of glass, may be left adhering to the footwear while test impressions are made. Consider the facts of the case and the potential significance of the trace.

6.2 Casts

6.2.1 Dental stone casts may be cleaned by soaking in saturated potassium sulfate for approximately one hour, then rinsed thoroughly. Plaster of Paris casts must not be soaked in water; detail will be lost. Plaster of Paris casts must be hand cleaned.

6.3 Paper, dust impressions

6.3.1 Photograph with scale.

6.3.2 Electrostatic dust print lifter.

6.3.2.1 Lifts must be treated and stored as evidence.

6.3.3 Electrostatic detection apparatus (ESDA) processing.

6.3.3.1 Processed items must be treated and stored as evidence.

6.4 Other Two-dimensional impressions

6.4.1 Photograph.

6.4.2 Specialized lighting.

6.4.3 Scan the impression into Photo Shop®

6.4.3.1 The history of image processing should be printed in addition to the picture.

6.4.3.2 Save the image file in .tif format.

6.4.4 Other enhancement, as required. The method chosen will depend on the nature of the evidence.

6.4.4.1 Photocopy.

6.4.4.2 Gelatin lift.

6.4.4.3 Adhesive lift.

6.4.4.4 Brush powdering.

6.5 Chemical enhancement. Consult MSDS for hazards and proper handling of these reagents. Techniques are listed here according to the composition of the impression and/or the surface it is on. The enhanced impression should be photographed.

6.5.1 Fatty, oily, organic materials

6.5.1.1 Iodine fuming, followed by spraying with 7,8 benzoflavone.

6.5.1.1.1 Non-destructive; additional techniques may be used following iodine.

6.5.2 Blood

- 6.5.2.1 Amido black.
- 6.5.2.2 Leucocrystal violet.

6.5.3 Soils

- 6.5.3.1 8-hydroxyquinoline.
- 6.5.3.2 Ammonium thiocyanate.

6.5.4 Paper, cardboard

- 6.5.4.1 Physical developer.
- 6.5.4.2 Small particle reagent.

6.5.5 Wet origin impressions; the shoe or the receiving surface is wet or damp

- 6.5.5.1 Fingerprint powder.
- 6.5.5.2 Lift with Handiprint® or fingerprint tape.

6.5.6 Other recognized techniques may be utilized when appropriate. Consult the ISP Forensic Services Quality Manual for steps to be followed in utilizing a method not listed here.

7.0 Test Impressions

Test impressions are a valuable aid in the comparison process. They assist in the interpretation and identification of class and individual characteristics seen in the questioned impression.

- 7.1 Fingerprint powder and white Handiprint®.
- 7.2 Fingerprint powder and transparent Handiprint®.
- 7.3 Black ink and dampened roller transport film.
- 7.4 Sandbox and photography.
- 7.5 Potter's clay.
- 7.6 Biofoam.
- 7.7 Inkless shoe print kit.

8.0 Comparison

The actual comparison proceeds from the general (class characteristics) to the specific (individual characteristics). At any step an unexplained difference between the known shoe and the impression leads to elimination of the shoe.

- 8.1 Outsole design.
 - 8.1.1 Mold-related characteristics.
- 8.2 Size.
- 8.3 General wear pattern.
- 8.4 Individual characteristics.

8.5 Examination against known shoes.

8.5.1 If using photographs for the comparison, have 1:1 enlargements made.

8.5.1.1 The 1:1 enlargements are not made:

8.5.1.1.1 If immediate elimination of the shoe is possible from available photographs.

8.5.1.1.2 If the ruler (scale) in the photographs is clearly incorrectly positioned.

8.5.1.1.3 If the submitted negatives are of unsatisfactory quality.

8.5.1.2 If working with jpeg (.jpg) digital photos save them in .tif format.

8.5.2 When using an overlay ensure that the image is actual size.

9.0 Conclusions

9.1 Conclusions must be verified before a report is issued.

9.2 When appropriate the results of a search for manufacturer brand names and descriptions based on the outsole design of an impression may be reported.

9.2.1 This information may aid investigators who have not submitted shoes for comparison.

9.2.2 The information would come from a database, a recognized catalog, or a retail outlet.

9.3 Examination of class and individual characteristics will lead to one of the following conclusions:

9.3.1 The impression is not suitable for a meaningful comparison.

9.3.1.1 The impression lacks class and individual characteristics.

9.3.2 The footwear did not make the impression.

9.3.2.1 Class and/or individual characteristics of the footwear and impression are different.

9.3.3 The footwear could have made the impression but others with similar characteristics cannot be excluded.

9.3.3.1 This conclusion is based on the impression and the footwear having the same class characteristics.

9.3.3.2 There is a lack of corresponding individual characteristics in the footwear and the impression.

9.3.4 An association exists between the impression and the footwear, but there are insufficient individual characteristics to associate the footwear with the impression to the exclusion of all other shoes.

9.3.4.1 The impression and the footwear share class and some individual characteristics, but these characteristics are not sufficiently unique to allow an exclusive association between the impression and the shoe.

9.3.5 The footwear made the impression to the exclusion of all other shoes.

9.3.5.1 The impression and the footwear share confirmable class and random individual characteristics that could not be repeated on another outsole with the same class characteristics.

10.0 References

- Abbott, John Reginald 1964 Footwear evidence: the examination, identification, and comparison of footwear impressions. Charles C. Thomas, Springfield, Ill.
- Bodziak, William J. 1990 Footwear impression evidence, first edition. Elsevier, New York.
- Bodziak, William J. 2000 Footwear impression evidence: detection, recovery, and examination; edition 2. CRC Press New York.
- Hilderbrand, Dwane S. 1999 Footwear, the missed evidence. Staggs Publishing, Temecula, CA.

Property of Idaho State Police Forensic Services
Uncontrolled Internet Copy
OBSOLETE DOCUMENT

**Idaho State Police
Forensic Services
Trace Section**

**History Page
Footwear Impression SOP**

Revision #	Issue Date	History
1	3/29/02	Current methodology used by ISPFPS
2	3/04	Listed ESDA (6.3) as a technique. Modified 6.3 and 6.4 regarding handling of lifts/results.

Approval:

Technical Leader: _____ **Date:** 3/04
Dave Laycock

Issuance:


QC Manager: _____ **Date:** 3/04
Rick D. Groff

**Idaho State Police
Forensic Services
Trace Section**

**History Page
Footwear Impression SOP**

Revision #	Issue Date	History
1	3/29/02	Current methodology used by ISPFS
2	3/04	Listed ESDA (6.3) as a technique. Modified 6.3 and 6.4 regarding handling of lifts/results.

Approval:

Technical Leader:  Date: 3/04
Dave Laycock

Issuance:

QC Manager:  Date: 3/04
Rick D. Groff

Tire Impression SOP

1.0 Background

The initial interest in tire marks began with traffic accident investigation in the late 1920s. One of the earliest uses of tire impression evidence was in England in the early 1940s. Today, forensic tire investigation is probably the most commonly available and effective method of arriving at a positive identification of a vehicle at a crime scene (McDonald, 1989).

2.0 Scope

This SOP lists steps/procedures to be taken in evaluating tire track evidence. Depending on the nature of the evidence, it is unlikely that all steps/procedures listed here will apply in any one case; the examiner will make the ultimate determination since each case has its own evidence and circumstances and requires individual assessment.

3.0 Equipment, Reagents

3.1 Photography

- 3.1.1 A 35 mm camera. Digital cameras are not currently capable of the resolution required for evidential photography but may be used elsewhere.
- 3.1.2 Camera tripod.
- 3.1.3 Film: Recommended: black-and-white T-Max ISO100; Kodak Plus-X Pan; Kodak Technical Pan 2415. In some situations a slow speed color film may be utilized.
- 3.1.4 Suitable light sources.
 - 3.1.4.1 Oblique lighting.
 - 3.1.4.2 Direct lighting. Blue full spectrum bulbs are recommended.
 - 3.1.4.3 Alternate light source (ALS). Examine the evidence using the available filter/wavelength combinations. The combination that produces the most visible result is then used for photography.
 - 3.1.4.3.1 Orange glasses in combination with ALS wavelengths less than 530 nm but greater than 400 nm.
 - 3.1.4.3.2 Red glasses with 570 nm wavelength.
 - 3.1.4.3.3 Yellow glasses with less than 400 nm wavelength (ultraviolet).
- 3.1.5 Suitable scales.
 - 3.1.5.1 Metric scales are preferred. When practical, utilize the L-shaped Bureau Scale (Bodziak).

3.2 Reagents. ACS grade or better when available. Utilize a fume hood or appropriate respiratory protection. See the appendix for formulations.

- 3.2.1 8-hydroxyquinoline (8-quinolinol).
- 3.2.2 Ammonium thiocyanate.
- 3.2.3 Iodine and benzoflavone (alpha-naphthoflavone).
- 3.2.4 Physical developer.
- 3.2.5 Small particle reagent.
- 3.2.6 Amido black.
- 3.2.7 Leucomalachite green.
- 3.2.8 Fingerprint ink.
- 3.2.9 Potassium sulfate.
- 3.2.10 Dental stone.

3.3 Other equipment.

- 3.3.1 White poster board or equivalent
- 3.3.2 Calipers.
- 3.3.3 Magnifying glasses.

4.0 Safety

- 4.1 The chemicals and reagents used must be considered potentially hazardous. For safety, many must be used in fume hoods or with respiratory protection. Consult the material safety data sheets or NFR/NFPA data before using any of the reagents/chemicals.
- 4.2 The preparation of tire test impressions frequently requires the Criminalist to crawl partially under the vehicle. **Never** rely solely on a jack to support a vehicle; use additional support. Beware of attempting to jack up a vehicle on a sloping surface.

5.0 Document the evidence

- 5.1 Mark, photograph, and photocopy the items as necessary.
 - 5.1.1 Photographs submitted by the agency may be retained in the case file. If not already submitted, request the negatives from the investigating agency.
 - 5.1.2 When evidence can only be recorded or collected by photography and the image itself is not recoverable, the photograph or negative of the image must be treated as evidence.

6.0 Preliminary evidence examination

6.1 Tires

- 6.1.1 Trace or biological evidence.
 - 6.1.1.1 Document if present, preferably with photography. Determine if the item(s) may have contributed characteristics noted in the imprint evidence and/or casts.
 - 6.1.1.2 Some trace evidence, such as small fragments of glass, may be left adhering to the tires while test impressions are made. Consider the facts of the case and the potential significance of the trace.

6.2 Casts

6.2.1 Dental stone casts may be cleaned by soaking in saturated potassium sulfate for approximately one hour, then rinsed thoroughly. Plaster of Paris casts must not be soaked in water; detail will be lost. Plaster of Paris casts must be hand cleaned.

6.3 Paper, dust impressions

6.3.1 Photograph with scale.

6.3.2 Electrostatic dust lift.

6.4 Other Two-dimensional impressions

6.4.1 Photograph. Refer to 3.1.

6.4.2 Physical enhancement, if required. The method chosen will depend on the nature of the evidence.

6.4.2.1 Photocopy.

6.4.2.2 Electrostatic dust lift.

6.4.2.3 Gelatin lift.

6.4.2.4 Adhesive lift.

6.4.2.5 Brush powdering.

6.5 Preliminary pattern examination against known items.

6.5.1 Have 1:1 enlargements of the photographs made if the vehicle is in custody and the tread design(s) correspond to what is present in the photos.

6.5.1.1 The 1:1 enlargements are not made:

6.5.1.1.1 If immediate elimination of the tire is possible from available photographs.

6.5.1.1.2 If the ruler (scale) in the photographs is clearly incorrectly positioned.

7.0 Chemical enhancement, if required Consult MSDS or NFR/NFPA data for hazards and proper handling of these reagents. Techniques are listed here according to the composition of the impression and/or the surface it is on. See the appendix for formulations.

7.1 Fatty, oily, organic materials

7.1.1 Iodine fuming, followed by spraying with 7,8 benzoflavone.

7.1.1.1 Non-destructive; additional techniques may be used following iodine.

7.2 Blood

7.2.1 Amido black.

7.2.2 Leucomalachite green.

7.3 Soils

7.3.1 8-hydroxyquinoline.

7.3.2 Ammonium thiocyanate.

7.4 Paper, cardboard

7.4.1 Physical developer.

7.4.2 Small particle reagent.

7.5 Wet origin impressions; the tire or the receiving surface is wet or damp

7.5.1 Fingerprint powder.

7.5.1.1 Lift with Handiprint® or fingerprint tape.

7.6 Other recognized techniques may be utilized when appropriate.

7.6.1 Consult the ISP Forensic Services Quality Manual for steps to be followed in validating a method not listed here.

8.0 Tire Search

Trace the design from the cast or photograph onto clear plastic. This may be used as an aid in searching the tread design guides and/or the tread assistant software.

9.0 Test Impressions

The tires should be mounted on the vehicle. Photograph the vehicle and tires. On the test impressions mark the inside and outside of the tire, tire location on the vehicle, direction of rotation, and manufacturing information. Use a jack stand or equivalent to support a jacked-up vehicle. **Relying solely on a jack for vehicle support is dangerous.**

9.1 Black fingerprint ink, white poster board or white cardboard.

9.2 Vaseline and white poster board or white cardboard.

9.3 Black ink and dampened roller transport film.

9.4 Sandbox, photography equipment, casting materials.

10.0 Comparison

The actual comparison proceeds from the general (class characteristics) to the specific (individual characteristics). At any step an unexplained difference between the known tire and the impression leads to elimination of the tire.

10.1 Tread design, width.

10.2 Noise treatment.

10.3 Mold-related characteristics.

10.4 General wear pattern.

10.5 Individual characteristics.

11.0 Conclusions

11.1 Examination of class and individual characteristics will lead to one of the following conclusions:

11.1.1 The tire did not make the impression.

11.1.2 The tire could have made the impression but others with similar characteristics can not be excluded. This conclusion is based on the impression and the tire having the same class characteristics.

(continued next page)

11.1.3 An association exists between the impression and the tire, but there are insufficient individual characteristics to associate the tire with the impression to the exclusion of all other tires.

11.1.4 The tire made the impression to the exclusion of all other tires.

11.2 When appropriate the results of a search for manufacturer brand names and descriptions based on the tread design of an imprint may be reported.

12.0 Case File contents

The following should be present in the case file:

- 12.1 Copies of photographs that were examined and/or used in the comparison process.
- 12.2 Photographs of submitted evidence and any photographs taken in the laboratory. Photographs should be labeled with the laboratory case number and Criminalist initials.
- 12.3 Original case notes.
- 12.4 Copies of correspondence.
- 12.5 Copy of the photo log.
- 12.6 Printout of the results of a computer tire search.

13.0 References

- Given, Bruce W.; Nehrich, Richard B.; Shields, James C. 1977. Tire tracks and tread marks. Houston: Gulf Publishing Co.
- McDonald, Peter. 1989. Tire imprint evidence. New York: Elsevier Science Publishing Co.

Property of Idaho State Police Forensic Services
Uncontrolled Internet Copy
OBSOLETE DOCUMENT

**Idaho State Police
Forensic Services
Trace Section**

**History Page
Tire Impression SOP**

Revision #	Issue Date	History
1	4/19/02	Current methodology used by ISPFSS

Approval:

Technical Leader: _____ **Date:** 4/19/02
Dave Laycock

Issuance:

QC Manager: _____ **Date:** 4/19/02
Rick D. Groff