

## Appendix

### Shoewear/Tiretrack SOP

#### Reagent Formulas

##### 1. 8-Hydroxyquinoline

**Synonym: 8-Quinolinol**

Dissolve 0.5 g 8-hydroxyquinoline with stirring in 100 ml 90:10 v/v acetone:water.

Application: View in 254/365 nm UV light.

Theory: fluorescent chelates formed with certain metal ions such as  $Mg^{++}$  and  $Ca^{++}$ .

Quality assurance: Test with known marks made with chalk dust. A purple fluorescence within the chalk indicates positive reaction.

##### 2. Iodine

Place iodine crystals in airtight chamber, along with the item to be fumed. A source of heat, approximately 37° C, and humidity must be included. The reaction should occur within a few minutes. Photograph the developed impression to preserve the enhancement.

##### 3. 7,8-benzoflavone 0.2%

**Synonym: alpha-naphthoflavone**

Dissolve 0.2 g 7,8-benzoflavone in 2 to 3 ml chloroform. Make up to 100 ml with petroleum ether.

Application: An enhancement for iodine fuming. First fume the item with iodine crystals in a sealed tank. Follow with a 10-second dip in the benzoflavone reagent, or spray.

Theory: Absorbed by a range of organic materials.

Quality assurance: Spray a known mark in starch. Positive result is a purple color.

#### 4. Ammonium thiocyanate 2 %

Dissolve 2 g ammonium thiocyanate in 90 ml of acetone. Add 10 ml concentrated nitric acid.

Application: Spray. Use a fine mist or spray. The reaction product is water-soluble; great care required with non-absorbent surfaces.

Theory: Soluble deep red product with  $Fe^{+++}$  ions.

Quality assurance: Spray a known mark made with iron salts. Red reaction indicates a positive result.

#### 5. Small particle reagent

**Nonporous surfaces; especially effective for use on wet items**

Note: This reagent is described as "extremely messy".

Reagent: 30 g molybdenum disulfide added to one liter distilled water. Add 2 (no more) drops of Kodak Photo Flo 200; shake the mixture well. It may be necessary to shake for 3 to 5 minutes; it is not ready to use if any powder is floating on the surface.

Application: Tray immersion, 2 minutes, or spray. Rinse with water, allow to dry.

Theory: Particles adhere to oily material in the impression.

Quality assurance: Test against an oily deposit.

#### 6. Physical developer

**Porous surfaces, especially paper**

**May be used after iodine or ninhydrin processing**

Reagent: May be mixed in the laboratory, see Bodziak, 2<sup>nd</sup> edition, or purchased commercially from Lightning<sup>®</sup> Powder Company.

Application: Metal forceps, rubber gloves, or bare fingers may leave deposits on the item; handle with non-serrated plastic forceps or cotton gloves.

Theory: Reacts with fats, oils, waxes present in the impression.

## 7. 5-Sulfosalicylic acid for fixing bloody impressions

Reagent: 20 g 5-sulfosalicylic acid in 1 liter water.

Application: Immerse the item in the solution for 10 minutes; then immerse in distilled water for 5 minutes.  
Large areas such as floors may be sprayed.

Theory: Chemical fixing ensures the bloody impression is not washed away during chemical enhancement.

## 8. Leucomalachite green

Reagent: 0.06 g leucomalachite green (kept in dark, room temperature)  
0.2 g sodium perborate  
20 ml alcohol  
10 ml glacial acetic acid

Wrap a stopper with parafilm, stopper flask tightly, shake vigorously for one minute. Add  
100 ml 1,1,1-trichloroethane; mix well.

Application: Spray surface lightly 2 or 3 times, holding sprayer 14 inches or more from surface.  
Photograph the developed prints; they will fade.

Theory: Green reaction with blood. Doesn't color background.

Quality assurance: Spray a known blood spot. Positive result: green color.

## 9. Amido black

Synonym: Naphthalene black  
Non-porous surfaces

Reagents (three solutions): Dye solution: Amido black 0.2 g  
Glacial acetic acid 10 ml  
Methanol 90 ml

Rinse solution 1: Glacial acetic acid 10 ml  
Methanol 90 ml

Rinse solution 2: Glacial acetic acid 5 ml  
Methanol 98 ml

Application: Fix the impression with 5-sulfosalicylic acid.  
Apply the dye solution, allow to react for 2 minutes.  
Apply rinse solutions.

Theory: This is a protein stain that reacts with blood.

Quality assurance: Test against known blood.

#### 10. Fingerprint Powders

**Smooth, waxed, polished, non-porous surfaces**

**Not suitable for porous or textured surfaces**

Conventional powders

Fluorescent powders, applied while using ALS/UV light

#### 11. Dental stone

##### Casting material

The amount of water to be added to the dry powder is indicated by the manufacturer as ml water/100 g powder. Our pre-weighed bags of dental stone contain approximately 700 g powder. If no information is readily available, start with 26 ml water/100 g powder, mix for 3 minutes. If the mixture is still too thick for easy pouring, add 15ml additional water.

#### References

- Bodziak, William J. 2000. Footwear impression evidence: detection, recovery, and examination; Edition 2. New York: CRC Press.
- Chesapeake Area Shoeprint and Tire track website: <http://members.aol.com/varfee/mastssite/home.html>
- Oregon State Police Forensic Services Division, 1999. Procedures manual for comparison of impression evidence.

**Idaho State Police  
Forensic Services  
Trace Section**

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**History Page  
Tire Impression SOP**

<b>Revision #</b>	<b>Issue Date</b>	<b>History</b>
1	4/19/02	Current methodology used by ISPFS

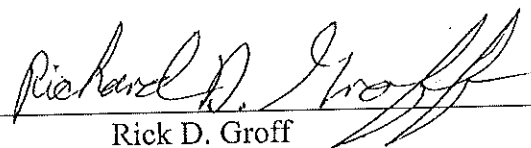
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**Approval:**

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

**Issuance:**

QC Manager:  Date: 4/19/02  
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 (ISO 100); 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).

## 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.

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.

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**Idaho State Police  
Forensic Services  
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**Approval:**

**Technical Leader:** \_\_\_\_\_

*Dave Laycock*  
Dave Laycock

**Date: 4/19/02**

**Issuance:**

**QC Manager:** \_\_\_\_\_

**Date: 4/19/02**

**Validation**

**Shoe Print/Tire Track SOP**

This SOP is an updated, reformatted formal organization of the various steps in handling shoe print and tire track cases. These procedures have been in use in this laboratory since 1987, and are intended for use during training and by examiners that have completed their formal training in shoe wear identification.

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