

**Department of Forensic Science**

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**IMPRESSIONS -  
FOOTWEAR AND TIRE TREAD  
PROCEDURES MANUAL  
FORENSIC SCIENCE**

**TABLE OF CONTENTS**

- 1 [Introduction](#)**
- 2 [Development Techniques](#)**
- 3 [Preservation Techniques](#)**
  - 3.1 Introduction
  - 3.2 Electrostatic Dust Lifter
  - 3.3 Digital Imaging
  - 3.4 Lifts/Casts
- 4 [Known Standards / Test Impressions](#)**
  - 4.1 Introduction
  - 4.2 Preparation
  - 4.3 Equipment
  - 4.4 Minimum Standards and Controls
  - 4.5 Procedure
  - 4.6 Interpretation of Results
- 5 [Impression Examination](#)**
  - 5.1 Introduction
  - 5.2 Equipment
  - 5.3 Procedure
  - 5.4 Interpretation of Results
- 6 [Impression Comparison](#)**
  - 6.1 Introduction
  - 6.2 Analysis
  - 6.3 Comparison
  - 6.4 Evaluation – Conclusions
  - 6.5 Documentation Requirements
  - 6.6 Verification
- 7 [Footwear and Tire Tread Reference Material](#)**
  - 7.1 Introduction
  - 7.2 Procedure
- 8 [Report Wording](#)**
  - 8.1 Introduction
  - 8.2 Guidelines
  - 8.3 Wording Examples
- 9 [Quality Assurance](#)**
  - 9.1 Introduction
  - 9.2 Reagents
  - 9.3 Powders
  - 9.4 Examination Documentation
  - 9.5 Evidence Handling
  - 9.6 Equipment

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10 [Abbreviations](#)

11 [References](#)

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## 1 INTRODUCTION

Any time two objects come into contact, there is the potential for impression evidence. These procedures apply to the preservation, recovery and examination of shoe and tire tread impressions on a variety of surfaces.

Three-dimensional and two-dimensional impressions are customarily submitted for examination/comparison.

Preservation of the impression will differ depending upon the type of impression, the substrate and the receiving surface.

- Two-dimensional dust impressions occur when a shoe or tire comes in contact with a surface heavily coated with loose material such as dust or dirt. The shoe or tire will strike the surface and the dust or dirt will cling to the sole or tread; a negative impression of the shoe or tire will remain. The resulting impression has a visible length and width.
- Two-dimensional residue impressions occur as a result of residue being deposited from a shoe or tire to a surface. This will include impressions made by the transfer of ordinary residue which shoes accumulate, or impressions made after stepping in blood, grease or other fluids.
- Three-dimensional impressions occur when a shoe or tire comes in contact with a soft receiving surface. The impression is then impressed into the substrate (dirt, mud, etc.). The resulting impression has a visible length, width and depth.

Short term storage is used when evidence is in the process of examination. The length of time evidence may remain in short term storage is thirty (30) days. After this time period, evidence must be placed into long term storage according to the Quality Manual.

The Department's laboratory facilities provide sufficient environmental conditions to conduct all tests listed in the Procedures Manual with no further consideration required.

## 2 DEVELOPMENT TECHNIQUES

The techniques listed below are suitable for the development of footwear and tire impression. The procedures for preparation and use of these methods are located in the Latent Print Procedure Manual.

Chemical Processing of Porous Items

Powders

Small Particle Reagent

Cyanoacrylate Ester Fuming

Dye Stains

Blood Protein Enhancement

Adhesive Surface Processing

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### 3 PRESERVATION TECHNIQUES

#### 3.1 Introduction

- 3.1.1 All lifts, photographs, digital media, images and negatives received from an outside agency shall be treated as evidence and returned to the submitting agency.
- 3.1.1.1 Refer to the Latent Print Procedures Manual for procedures related to Submitted Digital Media.
- 3.1.2 All lifts and images made of impressions, developed by the Laboratory on items of evidence shall be treated as evidence and returned to the submitting agency.
- 3.1.2.1 Digital media (CD or DVD) containing original impressions shall be designated DM1, DM2, etc.
- 3.1.2.2 For instances where impressions were developed on more than one item, the digital media shall be returned with the first item on which the impressions were developed.
- 3.1.2.3 The examiner shall verify and document that the appropriate images are on the media.
- 3.1.2.4 The packaging for the digital media shall be sealed and labeled with the FS lab number, examiner's initials and items numbers associated with the impressions.
- 3.1.3 Lifts shall be sub-itemed according to the evidence from which the impression was removed. These sub-items shall be added to the RFLE and created in LIMS.
- 3.1.4 Photographs or digital images which serve as examination documentation shall be retained. Original and clarified images shall be retained on a CD/DVD with the case file in order to preserve the history log of clarification steps.

#### 3.2 Electrostatic Dust Lifter

##### 3.2.1 Introduction

Electrostatic dust lifters allow for impressions to be lifted from various surfaces and preserved for examination. The electrostatic dust lifter can be used at the crime scene as well as in the laboratory. It is used primarily to lift dry origin impressions.

##### 3.2.2 Preparation

The unit must be adequately charged before each use or contain a battery, and a good supply of lifting film should be stocked.

##### 3.2.3 Instrumentation

There are several versions of electrostatic dust lifters manufactured by different companies. Some of the units are equipped with a convenient carrying case, capable of storing an adequate supply of lifting film, a roller, flashlight and a measuring device, for your convenience. Some units are smaller hand-held units and are just as effective.

##### 3.2.4 Minimum Standards and Controls

If required, the electrostatic units must be sufficiently charged prior to use. Observation of the mylar being compressed during use will serve as a positive indication. The lifting film must be free of dust and other contaminants prior to use.

## 3.2.5 Procedure

- 3.2.5.1 Locate the impression to be lifted.
- 3.2.5.2 Cut a piece of lifting film that is larger than the impression.
- 3.2.5.3 Place the lifting film over the impression, black side down against the impression and the metalized side will face up.
- 3.2.5.4 Ensure the unit is properly grounded per the instructions of the particular unit.
- 3.2.5.5 Place the probe on the lifting film to charge the lifting film. Use a roller to smooth the lifting film allowing it to come in contact with the impression.
- 3.2.5.6 Turn off the unit and wait several seconds for the film to discharge. Remove the film from the evidence by lifting one end and rising to the other end, do not slide.
- 3.2.5.7 Photograph the impressions that are present on the lifting film to preserve the impression. Caution must be exercised when handling and packaging the lifting film to avoid destroying the dust impression.

## 3.2.6 Interpretation of Results

If the impressions are faint, photography can enhance and preserve the impression using various photographic techniques.

### 3.3 Digital Imaging

## 3.3.1 Introduction

Footwear and tire impression evidence may have inherent limitations due to substrate features, quality of the original impression and method of collection that affect the quality of the digital capture obtainable.

## 3.3.2 Instrumentation

Materials and equipment utilized may include all or some of the following, as determined necessary by the photographer, based on the evidence submitted.

- Digital cameras
- Lens
- Scales
- Tape measures
- Scanners
- Filters
- Appropriate light sources
- Cabling appropriate for the equipment used
- Appropriate output media and printers
- A variety of storage media
- Angle finder / leveling device
- Tripod or copy stand

## 3.3.3 Minimum Standards and Controls

- 3.3.3.1 A rigid L-shaped or 90° scale shall be placed along the length of the impression on the same plane as the bottom of the impression. For long tire impressions, in addition to a rigid scale, a long tape measure may be placed along the full length of the impression being captured.

3.3.3.2 All images shall include the following, either in the image or electronically associated with the file.

- Scale
- FS Lab #
- Examiner and photographer initials
- Item / sub-item designation

3.3.4 Procedure

3.3.4.1 Capture

3.3.4.1.1 It is not necessary to capture footwear and tire impressions at 1000ppi. It is acceptable to capture small areas at 1000 ppi if necessary due to the quality of the impression.

3.3.4.1.2 For digital camera capture utilize the TIFF Large setting.

3.3.4.1.3 For scanning utilize 24 bit color or 8 bit gray scale settings.

3.3.4.1.4 If the entire lift, cast or object is captured it is not necessary to mark the area of interest on the evidence. If sections of the lift, cast or object are captured, either through photography or scanner, then the area of interest shall be indicated by marking the item of evidence with a bracket or outline, the item # and the impression #.

3.3.4.2 Clarification

3.3.4.2.1 The original and the final version of the image shall be retained with the examination documentation. The images shall be saved to a CD/DVD to allow for the retention of the history log file of the clarification techniques used.

3.3.4.2.2 If utilizing Adobe Photoshop to clarify an image, the below log options shall be set as follows:

- Choose Edit>Preferences>General
- Check the “History Log” option (a checkmark must appear in the check box to enable the History Log)
- Select “Metadata” for “Save Log Items To” option
- Select “Detailed” option for the “Edit Log Items”
- Click OK to save settings

3.3.5 Interpretation of Results

Compare captured image to original impression to ensure necessary detail is present.

### 3.4 Lifts/Casts

3.4.1 Introduction

Adhesive coated materials or tapes can be used to lift impressions from surfaces. Lifts can be made of dust or residue impressions, wet origin impressions, and impressions developed with fingerprint powder.

## 3.4.2 Preparation

The substrate, components of the impression, and environmental conditions should be considered prior to selecting a lifting method.

## 3.4.3 Equipment

- Gelatin lifters
- Static lifts
- Adhesive lifters
- Fingerprint lifting tape
- Dental stone or other casting material
- Silicone (such as Mikrosil™)

## 3.4.4 Minimum Standards and Controls

- 3.4.4.1 Ensure the lifting material is free from foreign material prior to applying to the impression.
- 3.4.4.2 Label the lifts and casts with the case number, item number, date and initials.
- 3.4.4.3 All lifts and casts shall be digitally captured and compared to the original to ensure all detail was captured adequately.
- 3.4.4.4 All lifts and casts shall be treated as evidence and handled according to the Quality Manual.

## 3.4.5 Procedure - Gelatin Lifters

- 3.4.5.1 Select the appropriate color of lifting material.
- 3.4.5.1.1 White gel lifters provide greater contrast with impressions enhanced with dark colored powders.
- 3.4.5.1.2 Black gel lifters provide greater contrast with light colored powders or residue impressions.
- 3.4.5.1.3 Clear gel lifters normally do not provide good contrast.
- 3.4.5.1.4 Adhesive lifters are an option for lifting impressions developed with dark colored powder, however they are not recommended for lifting dust or residue impressions.
- White backgrounds are recommended for clear adhesive lifters.
  - Clear adhesive on a clear background is not recommended.
- 3.4.5.2 Cut the lifting material to a size that will adequately cover the area of interest. It is preferable to lift the entire impression with one piece of lifting material.
- 3.4.5.3 Lift the impression and adhere the appropriate backing or protective material.

## 3.4.6 Procedure – Static Lifts

- 3.4.6.1 Recommended for lifting dust impressions.
- 3.4.6.1.1 Peel off white backing to activate the charge.
- 3.4.6.1.2 Lay lift over impression, holding or taping one end down.

3.4.6.1.3 Apply pressure evenly using a roller or hand.

3.4.6.1.4 Lift and store in a manila folder or tape inside a cardboard box.

3.4.7 Procedure – Rigid Casting

3.4.7.1 Dental stone can be used to lift impressions such as mud and tire residues from surfaces such as concrete and tile.

3.4.7.1.1 Mix according to instructions or recommended ratio for the product.

3.4.7.1.2 Place a cardboard frame around the impression.

3.4.7.1.3 Pour a thick layer of dental stone over the impressions area and lift when dry.

3.4.8 Procedure – Flexible Casting

3.4.8.1 Silicone such as Mikrosil™ can be used to lift impressions enhanced with powder from any surface, particularly textured surfaces.

3.4.8.1.1 Mix according to instructions and apply an even coating of the material over the impressions and lift when material has cured.

- Consult the manufacturer's recommendation for curing times.

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## 4 KNOWN STANDARDS / TEST IMPRESSIONS

### 4.1 Introduction

Various techniques are non-destructive and not sequence dependent; it is at the examiner's discretion to choose the appropriate technique, and continue to apply additional techniques as necessary to maximize results. The recording of known standards for footwear and tire tread design can be accomplished using these procedures. Test impressions provide a recording of the characteristics already present on the outsole of a shoe or tire. The quality of the comparison directly relates to the quality of the known. It is not required to create known standards if the images of the outsole or tire tread are sufficient for comparison.

### 4.2 Preparation

Prior to making test impressions, the examiner should recognize and preserve trace evidence and digitally capture the original condition of the outsole or tire when appropriate.

#### 4.2.1 Dental Stone

Mix according to instructions or recommended ratio for the product.

#### 4.2.2 No specific preparations are needed for the other standards as the materials being used are commercially prepared.

### 4.3 Equipment

- Gelatin Lifters
- Adhesive Film
- Latent Print Lifting Tape
- Fingerprint Powder
- Hinge Lifters
- BIO-FOAM®
- Dental Stone

### 4.4 Minimum Standards and Controls

Ensure powders, dental stone, and lifting materials are suitable prior to their use. Powders should be free flowing, not caked, and the lifting materials should be flexible, not rigid.

Label all lifts with case number, item number, date, initials and designation of right or left shoe (as applicable).

All test impressions shall be treated as evidence and handled according to the Quality Manual.

### 4.5 Procedure

4.5.1 A minimum of two known standards shall be created. The standards may be created using various methods (e.g., dynamic vs. static, gel lifter vs. adhesive lifter).

4.5.1.1 Compare the standards to determine what characteristics are reproducing. Document these observations.

4.5.1.2 Verification is not required for standard to standard comparison.

4.5.2 Shoe Test Impressions

4.5.2.1 Footwear test impressions should record fine detail with good contrast and be suitable for use in the comparison process.

- 4.5.2.2 Initial test impressions should be made of the entire shoe.
- 4.5.2.3 Excess dirt should be removed from the shoe with care so as not to damage the outsole.
- 4.5.2.4 Prior to wearing the shoe in any of the collection techniques, consider contamination issues.
- 4.5.2.5 Gel Lifter or Adhesive Film and fingerprint powder
- Prior to the application of the black powder a releasing agent may be applied to the shoe, such as WD-40.
  - Apply a coat of black fingerprint powder to the outsole of the footwear.
  - Remove excess powder by gently tapping shoe.
  - Remove protective cover from adhesive sheet.
  - Lay adhesive side up on the surface where the impression will be made.
  - Make an impression, while wearing the shoe, by stepping onto the adhesive film. If necessary, press the adhesive against the shoe sole to obtain a complete recording of the outsole.
    - It is acceptable to press the adhesive film against the shoe outsole while not wearing the shoe.
    - Avoid stretching or applying excessive pressure to the gel which would distort the impression
  - Cover the impression with a protective sheet.
- 4.5.2.6 Identicator® or other inkless technique
- Make an impression by pressing the shoe onto the inkpad and then onto the treated paper.
- 4.5.2.7 Silicone spray, wipes or other suitable substance and magnetic fingerprint powder
- Coat the outsole of the shoe with the selected substance.
  - Make an impression on a chosen surface.
  - Develop the resulting impression with magnetic powder.
- 4.5.2.8 BIO-FOAM® and dental stone
- Make an impression in BIO-FOAM®
  - Use the resulting impression for comparison to three-dimensional impressions.
  - The BIO-FOAM® impression can be filled with dental stone for comparison to submitted casts.
- 4.5.3 Tire test impressions
- 4.5.3.1 Test impressions should record the area of interest.
- 4.5.3.2 Excess dirt should be removed from the tire with care so as to not damage the tread.
- 4.5.3.3 Methods for making tire impressions should record fine detail with good contrast and be suitable for use in the comparison process.
- 4.5.3.4 Record the tire brand, make, size, DOT number, and other relevant information.
- 4.5.3.5 Petroleum jelly or silicone wipes on chart board with magnetic fingerprint powder
- Prepare two pieces of chart board, each of sufficient length to record a full rotation of the tire.
  - Apply a light coat of chosen substance on the tire surface.

- Roll the tire over chart board.
- Label the chart board with relevant information regarding tire, position and direction of travel.
- Develop the impression with magnetic fingerprint powder.

4.5.4 Test impressions for elimination can include any of the methods listed above, or any other method suitable for recording design detail. Photography is suitable to record the design detail for some elimination conclusions.

4.5.4.1 Proposed significant deviations from methods of recording test impressions in this manual must be presented to the TRT for evaluation and Program Manager for approval.

#### 4.6 Interpretation of Results

Compare test impression to actual item to ensure adequate detail was captured for comparison purposes.

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## 5 IMPRESSION EXAMINATION

### 5.1 Introduction

Two-dimensional impressions are those impressions which, for all practical purposes, have the dimensions of length and width, but not a significant depth. The procedure for examining two-dimensional impressions already preserved at the crime scene usually involves photographs, lifted impressions, or the evidence itself. Three-dimensional impressions are those impressions with the dimensions of length, width and depth. Impressions shall be digitally captured and images retained as examination documentation.

### 5.2 Equipment

- Alternate Light Source
- Electrostatic Lifting Device
- Digital Capture Equipment
- Calipers, rulers

### 5.3 Procedure

5.3.1 Use appropriate lighting to examine lifts or casts. Lighting may include, but is not limited to, oblique lighting, alternate light sources, or ambient light.

5.3.2 Dental Stone Casts

Clean with a soft brush and water to remove extraneous material, taking care not to damage the cast impression; a saturated solution of Potassium Sulfate may be used to remove or dislodge debris adhered to the cast. Casts should be photographed and printed natural size.

5.3.3 Evaluate the questioned impression evidence for the following:

- Quality, clarity and comparative potential
- Enhancement potential
  - Processing done to clarify the impression shall be done after digital capture
- Presence or absence of class characteristics
  - If no class characteristics are present discontinue these procedures and report accordingly

### 5.4 Interpretation of Results

Provided the submitted impressions are of value and a known shoe/tire, etc., has been submitted, a direct or side-by-side comparison is made between the questioned and known impression. If a known shoe/tire, etc., is not submitted, any information available regarding the questioned impression becomes part of the CoA for investigative leads. Information may include the result of footwear reference materials search, information in the Tread Design Guide, Internet search, or information obtained from shoe/tire stores.

## 6 IMPRESSION COMPARISON

### 6.1 Introduction

Impression examinations are conducted using the analysis, comparison, evaluation and verification methodology, utilizing both qualitative and quantitative analysis.

The right and left shoe shall be treated as separate objects and the results shall be recorded for each analysis, comparison and evaluation separately, as applicable.

If it is not possible to examine the original evidence images, then examinations may be performed with the examination documentation images existing in the case file after a protocol deviation is approved as outlined in the Quality Manual.

### 6.2 Analysis

6.2.1 Examine the questioned shoe or tire impressions prior to the knowns to determine if there are sufficient gross design features and clarity to conduct a comparison.

6.2.1.1 Document the condition, brand and general design features, if possible to determine.

6.2.2 If there is insufficient detail in the questioned impressions, no comparison shall be conducted. The conclusion shall be verified by another qualified impressions examiner.

### 6.3 Comparison

6.3.1 Visually compare questioned impressions with known item.

6.3.2 Visual comparison of design

6.3.2.1 If design is different, document, discontinue these procedures, and report accordingly.

6.3.2.2 If design is similar, prepare test impressions and continue with these procedures.

6.3.3 Visual comparison of specific physical size and shape of design

6.3.3.1 Compare the questioned impression to the test impression.

6.3.3.2 Document the size and shape of design features present

6.3.3.3 If specific design and/or physical size and shape of design, to include noise treatment (pitch sequence) of tires, are different, document, discontinue these procedures, and report accordingly.

6.3.3.3.1 If physical size is different, consider scaling, perspective and other issues.

6.3.4 Visual comparison of wear marks

6.3.4.1 Compare the questioned impression to the test impression.

6.3.4.2 Document the degree of wear, general wear, holes, position and orientation of wear, specific location of wear, and tears, if present.

6.3.4.3 If the position and degree of wear are different, document and evaluate possible wear changes between date of crime and date shoes or tires were recovered.

6.3.4.4 If the position and degree of general wear corresponds, continue with procedure.

- 6.3.5 Visual comparison of individual characteristics
- 6.3.5.1 Compare the questioned impression to the test impression.
- 6.3.5.2 Document individual characteristic such as; cuts, scratches, tears, holes, stone holds, abrasions and the acquisition of debris from random events, if present.
- 6.3.5.2.1 Documentation shall include the position, orientation, size and shape of the individual characteristics that contribute to the conclusion.
- 6.3.5.2.2 Due to varying circumstances, not all individual characteristics will reproduce in every impression. Therefore the absence of an individual characteristic is not a basis for elimination and does not preclude identification.

## 6.4 Evaluation - Conclusions

The following conclusions and descriptions are meant to provide context to the levels of opinions reached in impression examinations.

### 6.4.1 Elimination (definite exclusion)

Sufficient differences were noted between characteristics. Known footwear or tire was not the source and did not make the questioned impression.

### 6.4.2 Indications of non-associations

The questioned impression contains dissimilarities when compared to the footwear or tire, however, certain details or features were not sufficiently clear to permit elimination.

### 6.4.3 Limited association of class characteristics

Some similar class characteristics are present; however, there are significant limiting factors in the questioned impression that do not permit a stronger association between the impression and a known. Factors may include, but are not limited to, insufficient detail, lack of scale, improper position of scale, improper photographic techniques, distortion or significant lengths of time between the date the incident occurred and when the footwear or tires were recovered that could account for a different degree of general wear. Some association is observed, however details available for comparison preclude a more discriminating conclusion. No confirmable differences were observed that could eliminate the footwear/tire.

### 6.4.4 Association of class characteristics

The class characteristics of design, physical size and shape correspond between the questioned impression and the known footwear/tire. Correspondence of general wear is present. The known footwear/tire is a possible source of the questioned impression; however, other footwear/tires with the same class characteristics are included as possible sources.

### 6.4.5 High degree of association

Observable correspondence of class characteristics with the existence of 1) wear that by virtue of its specific location, degree and orientation, make it unusual and/or 2) one or more individual characteristics. The characteristics observed exhibit strong associations indicating the known footwear/tire is the source of the impression but are insufficient for identification. Other footwear/tires with the same characteristics could be included as the possible source only if they also display the same wear and/or individual characteristics observed in the questioned impression.

#### 6.4.6 Identification

The questioned impression and the known footwear/tire share sufficient agreement of observable class and individual characteristics to conclude the known footwear/tire was the source of the questioned impression.

#### 6.4.7 Inconclusive

Insufficient detail is present in the questioned impression and/or known standard to reach a conclusion of identification, exclusion or association.

### 6.5 Documentation Requirements

6.5.1 Record all characteristics observed during the examination process that support conclusions using the appropriate worksheet(s).

6.5.2 Annotate photographs/images or photocopies, labeling identifying characteristics on known items or test impressions.

6.5.3 The examiner shall label the images used to perform the comparison with the conclusion, date the examination was complete and their initials.

6.5.4 The following are suggested formats for annotations:

- a circle is drawn around a specific feature with a written explanation of the feature and its association or non-association with a known source
  - the written explanation should include the description of the class characteristics such as design, size or wear
- draw an outline around or brackets on each side of each impression to indicate the area that was analyzed and examined to render the reported conclusion
- label each area with a unique identifier that includes the item number and impression number as seen in the below examples
  - 5383 FW1 would be used for Item 5383 Footwear Impression 1
  - 2761 TT2 would be used for Item 2761 Tire Track Impression 2
  - 1028 PI3 would be used for Item 1028 Pattern Impression 3

6.5.5 If known shoes/tires are excluded as a source of the questioned specimen, an examination quality recorded copy of the outsole design or tread pattern must be maintained in the case documentation.

6.5.6 Examination documentation must acknowledge the existence of impressions of “no value” and also acknowledge the existence and disposition of any captured impressions which were not analyzed, compared or evaluated.

### 6.6 Verification

Verification is the independent comparison of a questioned impression with a known exemplar. The primary examiner shall provide unmarked copies of the questioned and known impressions to the verifying examiner.

6.6.1 All comparison conclusions shall be verified by another examiner.

6.6.1.1 Verifications shall be documented on the applicable Impression Verification forms.

- 6.6.1.2 The verifying examiner shall mark the characteristics used to render the conclusion on the images of the known and questioned impressions.
- 6.6.1.3 The verifying examiner shall label the images used to perform the comparison with the conclusion, date the examination was complete and their initials.
- 6.6.2 Verifications must be completed prior to communicating the information to the submitting agency, either verbally or in writing.

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## 7 FOOTWEAR AND TIRE TREAD REFERENCE MATERIAL

### 7.1 Introduction

- 7.1.1 Footwear and tire tread reference material can be used to determine the manufacturer's name and model associated with an unknown impression.
- 7.1.2 The examination documentation shall include the specific reference material used to reach the reported conclusion.
- 7.1.3 The results of the all searches shall be included on the CoA and the information retained as examination documentation.

### 7.2 Procedures

#### 7.2.1 Tread Design Guide

- 7.2.1.1 The information is categorized alphabetically by manufacturer and is divided into tire types (i.e., passenger tires, small highway and light truck tires, medium and large highway truck tires, off-the-road, agricultural, ATV, and motorcycle and truck retread designs).

#### 7.2.2 SoleMate®

- 7.2.2.1 The selection of the shape coding in the SoleMate software can affect the result of the search. If a potential match is not located, additional searches shall be performed.

- 7.2.2.1.1 A minimum of three searches shall be performed when a potential match is not found.

- 7.2.2.2 A printout depicting the search parameters and potential matches for each search shall be retained in the casefile.

- 7.2.2.3 If a potential match is not located in the SoleMate database, another qualified examiner shall perform at least one search.

- 7.2.2.3.1 In an instance where the second examiner locates a potential match, the first examiner will review the search results and report the appropriate conclusion.

- 7.2.2.3.2 Documentation associated with the second examiner's search shall be retained in the casefile.

#### 7.2.3 Retail re-sellers

- 7.2.3.1 On-line or physical stores are acceptable resources to locate a manufacturer of an unknown footwear outsole and tire tread patterns.

## 8 REPORT WORDING

### 8.1 Introduction

Utilize the following report formats to the extent possible when reporting results to ensure consistency within the section. Specific report language cannot be provided to address all situations; the following examples should be used when appropriate. When drafting report wording for evidence types not listed or when specific examples do not appear for a particular type of evidence, look first to existing wording that may be applied to the current situation. If a situation is so unusual that appropriate report wording is not available in the manual, it is expected that the Section Supervisor / Examiner shall consult with other Section Supervisors / Examiners for wording that may have been previously applied to the situation, with the Physical Evidence Program Manager and/or the Director of Technical Services.

The Certificate of Analysis (CoA) shall include in the report statement the types of examinations that were conducted to reach the stated conclusions.

### 8.2 Guidelines

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- 8.2.1 **CASE INFORMATION:** Agency name, name of investigating officer, laboratory case number, agency case number, victim(s), suspect(s), and additional information found on the Request for Laboratory Examination form.
- 8.2.2 **EVIDENCE SUBMITTED:** A listing and description of items as received from an agency.
- 8.2.3 **RESULTS:** A summary of the pertinent information relating to the examination, analysis and conclusions of Items listed. The **RESULTS** section of the CoA shall be sub-sectioned into the following three parts, as applicable:
- If no impressions were recovered, it is not required to include the ANALYSIS and COMPARISON RESULT section.
  - If after analysis there are no impressions of value for comparison, it is not required to include the COMPARISON RESULT section.
- 8.2.3.1 **PROCESSING AND EXAMINATION:** This section details the processing examinations (e.g., visual, chemical and/or physical) and results for each item. The results shall include the number of impressions recovered from each item.
- 8.2.3.2 **ANALYSIS:** This section provides details related to the impressions that were concluded to be of value for comparison. Impressions captured for analysis shall be designated by a number. When possible, multiple and overlapping impressions shall be designated by a separate impression number for each impression.
- The designated number is the Item number followed by the letters “FW”, “TT” or “PI” and a number which is sequential for the series of impressions captured on the item.
- Examples:
- Three footwear impressions are preserved on Item 3-5; the impressions would be designated 3-5 FW1, 3-5 FW2, and 3-5 FW3
  - Four tire track impressions are preserved on Item 5383; the impressions would be designated 5383 TT1, 5383 TT2, 5383 TT3, and 5383 TT4
- 8.2.3.3 **COMPARISON RESULTS:** This section details the comparisons and evaluations of the impressions designated as of value for comparison in the Analysis section.

### 8.3 Wording Examples

The italicized portions in the proposed statements are examples.

There is no need to further describe the item beyond the number as that information is available in the evidence lists. It is acceptable to include the description again in the processing section if deemed necessary for clarification.

#### 8.3.1 **PROCESSING AND EXAMINATION:** Statement of the processing performed on the Item(s)

- 8.3.1.1 The below can be used for an item that was visually examined with no processing techniques applied.

No patterned impressions were visible on *Item 1*.

No impressions of value for comparison are visible on *Item 2*, therefore no comparisons were made with *Item 3*.

*Item 4* was visually examined, no impressions were located and no further processing was done due to the surface not being suitable.

- 8.3.1.2 The below can be used for an item that was processed with the intent to develop or clarify an impression.

The *footwear* impression developed on *Item 4* may be of value for comparison. Known *footwear* or test impressions should be submitted for comparison.

#### 8.3.2 **PROCESSING AND EXAMINATION RESULTS:** Statement related to the examinations performed as a result of the processing techniques performed on each Item.

- 8.3.2.1 The below can be used when impression detail is visible but is of no value for comparison:

No impressions of value for comparison were observed and/or developed.

- 8.3.2.2 The below can be used when no impression detail is visible:

No impressions were observed and/or developed.

- 8.3.2.3 The below can be used when impressions are captured. The number of impressions captured shall be documented for each item processed:

*One tire* impression was lifted.

*Two footwear* impressions were digitally captured.

*Five tire* impressions were lifted and/or digitally captured.

#### 8.3.3 **ANALYSIS:** Result statement for the analysis performed on each impression preserved and documented in the **PROCESSING AND EXAMINATION RESULTS** section.

- 8.3.3.1 The below can be used when an impression is determined to be of value for comparison:

*Item 1 – Three* impressions of value for comparison have been designated *1 FW1, 1 FW3 and 1 FW5*.

8.3.3.2 The below can be used when preserved impressions were determined to be of no value for comparison:

*Item 2* – the impressions captured were analyzed and determined to be of no value for comparison.

*Item 2* – the impressions submitted were analyzed and lack sufficient detail for comparison.

8.3.4 **COMPARISON RESULTS:** Statements related to the comparison results of the impressions designated to be of value for comparison. This section shall be organized by impression number.

8.3.4.1 The *Item 2 tire* has been identified as being the source of the impression on *Item 1*.

8.3.4.2 The *footwear* impression on *Item 2* was not made by *Item 5*.

8.3.4.3 The *tire* impression on *Item 3* was not made by the *tire* producing the *Item 6* test impression.

8.3.4.4 Inconclusive

The comparison of *Item 5 footwear* impression to the *Item 6 left shoe* is inconclusive; the impression could not be associated with or excluded from the submitted shoe due to insufficient detail present in the impression.

8.3.4.5 Indications of non-associations

The impression in *Item 3* exhibits dissimilarities when compared to the *Item 6 left shoe*, however, certain details or features are not sufficiently clear to permit an elimination.

8.3.4.6 Limited association of class characteristics

The class characteristics present in the *tire* impression on *Item 5* are similar to those present in the *Item 6 tire*, however, due to *distortion* present in the test impression of *Item 6* a more discriminating examination cannot be performed. There are no confirmable differences that would exclude the *Item 6 tire* from being the source of the *Item 5* impression.

8.3.4.7 Association of class characteristics

The general wear and class characteristics present in *Item 6 left shoe* correspond with design and physical size of the characteristics present in the *Item 8* impression, therefore *Item 6* is a possible source of the *Item 8* impression. Other footwear with the same class characteristics could have been the source of the *Item 8* impression.

8.3.4.8 High degree of association

The specific location, degree and orientation of the wear present in the *Item 9 tire* corresponds with the wear present in the *Item 10* impression. In addition to the wear correspondence there exist individual characteristics in both the *Item 9 tire* and the *Item 10* impression that indicate a strong association that the *Item 9 tire* is the source of the *Item 10* impression but the characteristics are insufficient for an identification. Other *tires* with the same characteristics could be the source of the impression if they also display the same wear and individual characteristics observed in the impression.

8.3.5 **TERMINUS STATEMENTS:** All reports shall conclude with an applicable statement listed in each of the below sections.

8.3.5.1 The following statement shall be included on all reports:

Supporting examination documentation is maintained in the case file. The above listed methods are those approved for use at the time of analysis. Current methods can be found in the Impressions – Footwear and Tire Tread Procedure Manual, which can be found at [www.dfs.virginia.gov/documentation-publications/manuals/](http://www.dfs.virginia.gov/documentation-publications/manuals/).

8.3.5.2 Request for known samples

The known *footwear* should be submitted for a conclusive comparison of the *Item 1* impression.

8.3.5.3 Reference collection search

The *Tread Typer* database was utilized to determine the manufacturer of the questioned *tire* impressions is *Firestone* or any other brand of *tire* with a similar *tread* design. An image of the *tire tread* design is enclosed.

A search of the *SoleMate footwear database* and *numerous retail websites* did not yield a result that would allow for the manufacturer of the questioned *footwear* impression to be determined.

8.3.5.4 Photographs / digital images / test impressions

The returned digital media, *Item DM1*, contains images of impressions captured from *Item 1, 3 and 6*. This item of evidence is being returned in *container 2* and should be retained. Should further comparisons be required, *DM1* must be resubmitted.

8.3.5.5 Disposition of evidence

Document the disposition in the CoA according to the Quality Manual.

## 9 QUALITY ASSURANCE

### 9.1 Introduction

The purpose of this section is to provide a uniform Quality Assurance Program for the Impression Section of the Virginia Department of Forensic Science. It is to establish a baseline or reference point of reliability and system performance.

### 9.2 Reagents

- 9.2.1 Chemicals and solvents used in reagents should be of at least Certified Analytical Reagent ACS grade. Water used in reagent preparation should be reverse osmosis (RO) or deionized (DI), unless otherwise noted.
- 9.2.2 Stock solutions shall be labeled according to the Quality Manual and documented in the Reagent Preparation Log.
- 9.2.3 A performance check, ensuring the reagent is working as intended, shall be performed and appropriately documented in the examination documentation prior to use on evidence.
- 9.2.3.1 The result of the check shall be recorded.
- 9.2.3.1.1 “Positive” or “+” indicating the reagent is working as intended.
- 9.2.3.1.2 “Negative” or “-” indicating the reagent is not working as intended.

### 9.3 Powders

- 9.3.1 Powders should be of a homogenous mixture, free of clumps and foreign debris. Contaminated powders shall not be returned to stock containers.
- 9.3.2 Individual hair (or fiber) brushes should be used for different colors or types of powders.

### 9.4 Examination Documentation

Contemporaneous notes shall be taken utilizing the appropriate worksheets for all evidence submitted for impression examination and shall include the following:

- Laboratory Case Number
- Examiner’s initials
- Date started and Date completed
- Description of packaging in which evidence was received
- Item and sub-item numbers
- Description of evidence examined
- Examinations/tests performed, to include the sequence in which they were done and the result of each
- Number of impressions recovered from each item
- Result of the analysis of each impression
- Result of each impression compared
- Subsequent dates evidence was processed and transferred to/from photo if different from the start date
- Verification documentation
- All pages of notes shall contain the lab number and the examiner’s initials

Examination documentation shall include each examination activity conducted, the sequence of those activities, and the result of each. Activities can include the development techniques, quality control checks, the preservation technique (lifting and/or digitally capturing), database searches conducted to include the result, source of known test impressions, comparisons conducted, and the conclusions reached. Documentation shall be sufficient enough

that in the absence of the examiner, another competent examiner could evaluate what was done and interpret the data.

## 9.5 Evidence Handling

Evidence packaging and evidence shall be documented and marked as outlined in the Quality Manual.

## 9.6 Equipment

### 9.6.1 Balances

- 9.6.1.1 Balances shall be calibrated by an outside vendor annually that is accredited to ISO/IEC 17025:2005 and whose scope of accreditation covers the calibration performed. New balances shall be calibrated prior to being placed into service. Calibration certificates shall be evaluated by the Section Supervisor, Group Supervisor, or designee prior to placing the balance into service.
- 9.6.1.2 All balances shall be performance checked quarterly (every three months) for accuracy using ASTM Class 1 weights.
- 9.6.1.2.1 Weights used to check balance accuracy shall be re-certified every three years by an ISO/IEC 17025:2005 accredited vendor whose scope of accreditation covers the certification performed.
- 9.6.1.3 Record the weight displayed on the balance using the Latent Print Balance Log form 241-F104.
- 9.6.1.4 If the accuracy of a weight is outside the acceptable range listed in the table below, ensure the balance is level and clean prior to rechecking. If, after these actions, the weight check is still outside the acceptable range it shall be taken out of service and labeled as such until maintenance and/or calibration is performed by a qualified vendor.

BALANCE TYPE	BALANCE EXAMPLES	CHECK WEIGHTS
Toploading ( $\pm 0.01$ ) gram	Mettler PE 1600 Mettler PB302 Ohaus Scout Pro SP202 Sartorius BP21005	1.00 ( $\pm 0.02$ ) gram, 10.00 ( $\pm 0.05$ ) grams, 100.00 ( $\pm 0.05$ ) grams
Toploading ( $\pm 0.001$ ) gram	Ohaus Explorer Mettler PB303	0.100 ( $\pm 0.002$ ) gram 1.000 ( $\pm 0.002$ ) gram 100.000 ( $\pm 0.05$ ) grams

- 9.6.1.5 Records of calibration and performance check shall be maintained in the equipment maintenance log.

### 9.6.2 Environmental Chambers

- 9.6.2.1 A controlled combination of temperature and humidity enables rapid development of ninhydrin processed surfaces. Normal operating conditions are 80°F at 80% relative humidity.
- 9.6.2.2 Maintenance of the environmental chamber should be in conjunction with the manufacturer's specifications.

### 9.6.3 Alternate Light Source (ALS)

Maintenance of the light source should be in conjunction with the manufacturer's specifications.

## 10 ABBREVIATIONS

The following is a list of abbreviations and acronyms commonly used by examiners in the Impression Section of the Latent Print Section. This list has been generated to assist in the interpretation of case file notes and is not a standardized list of required abbreviations. The abbreviations are appropriate written in either lower or upper case and they are appropriate with or without punctuation such as periods. Common chemical formulas, chemical, mathematical and shorthand abbreviations are equally acceptable and will not be listed here.

Alternate Light Source	ALS
Amido Black	AB
Aqueous Leuco Crystal Violet	LCV
Bearing the Name	BTN
Black Powder	BP, blk. pdr.
Blind Verification	BV
Brown	Brn, BN
Central Laboratory	C or CL
Compared	Comp.
Comparison(s)	Comp(s)
Container	Cont./C
Crimescope	CS
Designated	Desig.
Developed	Dev.
Digital	Dig.
Digital Media	DM
Disposition	Dispo.
Elimination	Elim.
Envelope	Env.
Eastern Forensic Photographer	E/FP
Evidence Receiving	ER
Excluded	Exc.
Facsimile	Fax
Fingerprint(s)	Fp(s), Fgpt.
Firearms Section	FX
Footwear	FW
Forensic Advantage, Case and Evidence	FACE
Forensic Photographer	FP
Gentian Violet	GV
Environmental Chamber/Cabinet	HC
Identification	Ø, ID.
Impression(s)	Imp(s)
Inconclusive	Inc.
Individual characteristic	IC
Latent Print Section	LX
Left	L
Luma-Lite	LL
Magnetic	Mag.
Manila	Man.

Negative(s)	Neg(s)
Ninhydrin	Nin
No Value	NV
Northern Laboratory	N, NOVA
Of Value	OV
Pattern Impression	PI
Physical Developer	PD
Pick-up	PU
Possible	Poss.
Present	Pres.
Previous	Prev.
Print(s)	Prt(s).
Processed	Proc.
Randomly Acquired Characteristics	RACs
Received	Rec.
Registered	Reg.
Remaining	Rem.
Reported	Rept'd.
Retained	Retn'd.
Returned	Ret'd.
Reverse	Rev.
Reverse position	Rev. pos.
Reverse color	Rev. col.
Right	R
Schallamach	SM
Sealed Brown Box	SBB
Sealed Envelope	SE
Sealed Manila Envelope	SME
Sealed paper bag	SPB
Sealed brown paper bag	SBPB
Sealed plastic bag	SPLB
Sealed White Box	SWBX
Sealed yellow envelope	SYE
See Other Photo	SOP
Separate	Sep
Forensic Biology Section	SX
Silver Nitrate	SN
Submitted	Sub.
Small Particle Reagent	SPR
Superglue	SG, Cyano
Suspect	S or Susp.
Eastern Laboratory	T, EL
Tire Impression	TI
Tire Track	TT
Trace	TE

Victim	V or Vic.
Visible	Vis.
Wear	W
Western Laboratory	W

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