

**Department of Forensic Science**

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

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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.

All questioned impressions shall be photographed or scanned, with the appropriate scale, prior to any other type of preservation method.

All standards, lifts, photographs and casts created during the examination process shall be considered evidence and handled according to the Quality Manual.

- Legible copies shall be maintained as examination documentation in the case file.

Short term storage is used when evidence is in the process of examination. The length of time evidence may remain in short term storage will be 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 (DFS Document 241-D100).

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 Electrostatic Dust Lifter

##### 3.1.1 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.

##### 3.1.2 Preparation

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

##### 3.1.3 Instrumentation

There are several versions of electrostatic dust lifters manufactured by different companies. Most 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.

##### 3.1.4 Minimum Standards and Controls

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.

##### 3.1.5 Procedure

3.1.5.1 Locate the impression to be lifted.

3.1.5.2 Cut a piece of lifting film that is larger than the impression.

3.1.5.3 Place the lifting film over the impression, black side down against the impression and the metalized side will face up.

3.1.5.4 Ensure the unit is properly grounded per the instructions of the particular unit.

3.1.5.5 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.

3.1.5.6 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.

3.1.5.7 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.

##### 3.1.6 Interpretation of Results

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

##### 3.1.7 References

Footwear Impression Evidence, Bodziak, 1990, pp 101-117

## 3.2 Digital Capture

### 3.2.1 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.

### 3.2.2 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

### 3.2.3 Minimum Standards and Controls

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.

An identifier shall be included in each capture containing the case number, initial, item number and sub-item designation if applicable.

### 3.2.4 Procedure

The procedures in the Forensic Photography Procedures Manual should be followed for the capture of impressions. It is not necessary to capture footwear and tire impressions at 1000ppi, but it should be captured at the highest resolution possible.

### 3.2.5 Interpretation of Results

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

### 3.2.6 References

Scientific Working Group for Shoeprint and Tire Tread Evidence (SWGTTREAD); Guide for the Forensic Documentation and Photography of Footwear and Tire Impressions at the Crime Scene, 2006

## 3.3 Lifts/Casts

### 3.3.1 Introduction

Adhesive coated materials or tapes can be used to lift impressions from surfaces. The impression should be digitally captured prior to lifting if there is a concern that the lifting procedure would damage the impression. Lifts can be made of dust or residue impressions, wet origin impressions, and impressions developed with fingerprint powder.

## 3.3.2 Preparation

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

## 3.3.3 Equipment

- Gelatin lifters
- Adhesive lifters
- Fingerprint lifting tape
- Dental stone or other casting material
- Mikrosil™ or other Polyvinylsiloxane (PVS) casting materials

## 3.3.4 Minimum Standards and Controls

Ensure the lifting material is free from foreign material prior to applying to the impression. Compare digitally captured image to original lift to ensure all detail was captured adequately.

## 3.3.5 Procedure

3.3.5.1 Select the appropriate color of lifting material.

3.3.5.1.1 White gel lifters provide greater contrast with impressions enhanced with dark colored powders.

3.3.5.1.2 Black gel lifters provide greater contrast with light colored powders or residue impressions.

3.3.5.1.3 Clear gel lifters normally do not provide good contrast.

3.3.5.1.4 Adhesive lifters are an option for lifting impressions developed with dark colored powder, however they are not recommend for lifting dust or residue impressions.

3.3.5.1.4.1 White backgrounds are recommended for clear adhesive lifters.

3.3.5.1.4.2 Clear adhesive on a clear background is not recommended.

3.3.5.2 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.

3.3.5.3 Lift the impression and adhere the appropriate backing or protective material.

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

3.3.5.4.1 Mix approximately 2 pounds of powder dental stone with approximately 10 ounces of water.

3.3.5.4.2 The viscosity of the mixture should resemble pancake batter.

3.3.5.4.3 Mix for a minimum of 3-5 minutes to ensure homogeneity.

3.3.5.4.4 The ratio of water to powder may need to be adjusted to achieve the desired thickness.

3.3.5.4.5 Place a cardboard frame around the impression.

- 3.3.5.4.6 Pour a thick layer of dental stone over the impressions area and lift when dry.
- 3.3.5.5 Mikrosil™ or other PVS casting materials can be used to lift impressions enhanced with powder from any surface, particularly textured surfaces.
  - 3.3.5.5.1 Apply an even coating of the material over the impressions and lift when material has cured.
    - 3.3.5.5.1.1 Consult the manufacturer's recommendation for curing times.
- 3.3.5.6 Label the lift with the case number, item number, date and initials.
- 3.3.5.7 All lifts shall be digitally captured.
- 3.3.5.8 All lifts shall be treated as evidence and handled according to the Quality Manual.
- 3.3.6 References

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Scientific Working Group for Shoeprint and Tire Tread Evidence (SWGTTREAD); Guide for Lifting Footwear and Tire Impression Evidence, 2007

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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.

### 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 at the rate of one pound of dental stone to five ounces of water in a ziplock bag or in a plastic container that can be stirred until a pancake batter consistency is achieved (typical cast of a footwear impression requires two pounds of dental stone and ten ounces of water).

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®  
Putty

### 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 Shoe Test Impressions

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

4.5.1.2 Initial test impressions should be made of the entire shoe.

4.5.1.3 Excess dirt should be removed from the shoe with care so as not to damage the outsole.

4.5.1.4 Prior to wearing the shoe in any of the collection techniques, consider contamination issues.

## 4.5.1.5 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 heavy 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 file. 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.

## 4.5.1.6 Identicator® or other inkless technique

Make an impression by pressing the shoe onto the inkpad and then onto the treated paper.

## 4.5.1.7 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.

## 4.5.1.8 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.

## 4.5.2 Tire test impressions

## 4.5.2.1 Test impressions should record the area of interest.

## 4.5.2.2 Excess dirt should be removed from the tire with care so as to not damage the tread.

## 4.5.2.3 Methods for making tire impressions should record fine detail with good contrast and be suitable for use in the comparison process.

## 4.5.2.4 Record the tire brand, make, size, DOT number, and other relevant information.

## 4.5.2.5 Printer's ink with chart board or paper

- Prepare two pieces of chart board, each of sufficient length to record a full rotation of the tire.
- Apply printer's ink to one piece of chart board.
- Cut and position a second clean piece of chart board.
- Roll the tire so that it travels over the inked chart board and then onto the clean chart board.
- Label the chart board with relevant information regarding tire, position and direction of travel.

4.5.2.6 Petroleum jelly or silicone wipes on chart board with magnetic fingerprint powder

- 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

4.5.3 Test impressions for elimination can include photography, any of the methods listed above, or any other method suitable for recording design detail.

4.5.3.1 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.

#### 4.7 References

Scientific Working Group for Shoeprint and Tire Tread Evidence (SWGTTREAD); Guide for the Preparation of Test Impressions from Footwear and Tires, 2005

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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.

### 5.5 References

Footwear Impression Evidence, Bodziak, 1990, pp 99-133

Tire Imprint Evidence, McDonald, 1989, 39-4

## 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.

### 6.2 Analysis

6.2.1 Examine the questioned shoe or tire impressions 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 will be conducted. The conclusion will 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 Lacks sufficient detail

Insufficient detail was present in the questioned impression and no comparison is conducted.

### 6.4.2 Elimination (definite exclusion)

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

### 6.4.3 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.

### 6.4.4 Inconclusive (no opinion of association or non-association could be reached)

Details exist but features in the impression preclude a definitive opinion.

### 6.4.5 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.

### 6.4.6 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.

### 6.4.7 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.

#### 6.4.8 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.

### 6.5 Documentation Requirements

6.5.1 Record all characteristics observed during the examination process that support conclusions using the appropriate worksheet(s) (DFS Document 241-F100 and DFS Document 241-F101 (as needed)).

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

6.5.3 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

6.5.4 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.

6.5.5 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 verifying examiner shall label the images of the known and questioned impressions used to perform the comparison with the conclusion, date and initials. In addition to labeling the impressions, examination documentation shall reflect the verification with the verifying examiner’s initials and date the work was completed.

6.6.1 All identifications shall be verified by another examiner.

6.6.2 Verifications must be completed prior to communicating the information to the submitting agency, either verbally or in writing.

### 6.7 References

Bodziak, W. J., *Footwear Impression Evidence*, 2nd ed.; CRC Press: Boca Raton, FL, 2000.

Music, D., Bodziak, W.J. A Forensic Evaluation of the Air Bubbles Present in Polyurethane Shoe Outsoles as Applicable in Footwear Impression Comparisons. Journal of Forensic Sciences September 1988; 33(5)

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**7 FOOTWEAR AND TIRE TREAD REFERENCE MATERIAL**

Manufacturers of footwear websites that display known outsoles, retail re-sellers (on-line or physical store) are acceptable resources to locate a manufacturer of an unknown footwear outsole.

DFS periodically purchases, the “Tread Design Guide”, which consists of images of known tires. This reference provides manufacturer’s name and model. 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).

The results of the all searches shall be included on the CoA and the information retained as examination documentation.

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## 8 REPORT WORDING

### 8.1 Introduction

The following report formats will be used 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) will include in the report statement the types of examinations that were conducted to reach the stated conclusions.

### 8.2 Guidelines

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 will 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. The below examination statements will directly follow the above processing statements.

- 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.

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

8.3.4.1 The *Item 2 tire* has been individualized 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 Lacks sufficient detail

Insufficient detail was present in the *Item 5 footwear* impression for a meaningful comparison.

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 Request for known samples

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

8.3.6 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.

8.3.7 Photographs / digital images / test impressions

The returned digital media, *Item DMI*, 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, *DMI* must be resubmitted.

8.3.8 Disposition of evidence

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

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## 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 (DFS Document 100-F122).
- 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.

### 9.3 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 Preservation of Impressions

- 9.4.1 Visible impressions of value for comparison shall be photographed / digitally captured prior to the application of a processing technique. Captured impressions will be checked against the original evidence for sharpness, contrast and accurate reproduction of details.
- 9.4.2 Impressions developed with powder are lifted from the surface and placed onto an appropriately labeled lift card. If lifting may damage the impression then photographs shall be taken prior to attempting the lift.

### 9.5 Lifts, Photographs and Digital Images

- 9.5.1 All lifts or photographs / digital images of an impression for which an analysis, comparison or evaluation is done shall include the following minimum information.
- Laboratory Case Number
  - The original initials of the examiner
  - Item number and sub item designation, if given, of the article from which the impression was preserved (if impression was preserved in the laboratory)
  - If an impression is individualized, the original initials of the examiner and verifying examiner shall be written on the respective images
- 9.5.2 All lifts, photographs / digital media / images and negatives received from an outside agency will be treated as evidence and returned to the submitting agency.
- 9.5.3 All lifts and images made of impressions, developed by the Laboratory on items of evidence, will be treated as evidence and returned to the submitting agency.
- 9.5.4 Lifts will be sub-itemed according to the evidence from which removed, (e.g., 1A, 1B). These sub-items will be added to the RFLE and created in LIMS.
- 9.5.5 Images will be returned on digital media to the submitting agency.

- 9.5.6 Photographs / digital images which serve as examination documentation will be retained as case file documentation. Images retained shall include all original images and the following if available; processed/enhanced, enlarged, calibrated, and annotated images.
- 9.5.7 Digital media (CD or DVD) containing the original images (RAW and TIFF if captured in RAW, TIFF only if captured in TIFF) of impressions will be designated as DM1, DM2, etc., treated as evidence, and returned to the submitting agency in the original evidence packaging with the evidence. In instances in which impressions were developed on more than one item, the digital media will be returned with the first item on which the impressions were developed. The examiner will verify and document in the notes that the appropriate images are on the media prior to returning to the submitting agency. The packaging for the digital media shall be sealed and labeled with the FS number, examiner's initials, and the notation, "The enclosed digital media contains impressions developed on the following items:\_\_\_\_\_."
- 9.5.8 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, with permanent ink, the item of evidence with a bracket or outline, the item #, and the impression #.

## 9.6 Examination Documentation

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

- Laboratory Case Number
- Examiner's name
- 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.

## 9.7 Evidence Handling

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

## 9.8 Equipment

### 9.8.1 Balances

- 9.8.1.1 Balances shall be calibrated by an outside vendor annually.

- 9.8.1.2 All balances shall be performance checked quarterly (every three months) for accuracy using ASTM Class 1 weights.
- 9.8.1.3 Record the weight displayed on the balance using the Latent Print Balance Log form 241-F104.
- 9.8.1.4 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

- 9.8.1.5 Records of calibration and performance check shall be maintained in the equipment maintenance log.
- 9.8.2 Environmental Chambers
- 9.8.2.1 A controlled combination of temperature and humidity enables rapid development of ninhydrin processed surfaces. Normal operating conditions are 80°F at 80% relative humidity.
- 9.8.2.2 Maintenance of the environmental chamber should be in conjunction with the manufacturer's specifications.
- 9.8.3 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.
Disposition	Dispo.
Elimination	Elim.
Envelope	Env.
Evidence Receiving	ER
Excluded	Exc.
Facsimile	Fax
Fingerprint(s)	Fp(s), Fgpt.
Firearms Section	FX
Footwear	FW
Forensic Advantage, Case and Evidence	FACE
Gentian Violet	GV
Environmental Chamber/Cabinet	HC
Identification	Ø, ID.
Impression(s)	Imp(s)
Inconclusive	Inc.
Latent Print Section	LX
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.
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.
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.
Western Laboratory	W

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