

# Footwear and Tire Evidence Examinations

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# Footwear and Tire Evidence Examinations

## 1 INTRODUCTION

This procedure is intended to be utilized by trained personnel to ensure consistency and transparency of methods employed during the examination of footwear and tire evidence received in the Questioned Documents Unit (QDU).

## 2 SCOPE

These procedures will be used by trained QDU personnel when conducting examinations of footwear/tire evidence.

These procedures may be used when conducting examinations of other pattern evidence, including glove evidence. However, examinations of other pattern evidence must be approved by the technical leader, unit chief or designee, and they will be evaluated on a case-by-case basis. Additional discussion with the contributor may also be required to decide whether QDU personnel will conduct the requested examinations. All substantive communications will be recorded in the communication log.

## 3 EQUIPMENT

- Adhesive lifters
- Adobe Photoshop (or comparable software)
- Alternate light sources
- Bio-foam
- Black oil-based block printing ink
- Casting material
- Clear acetate sheets
- Clear adhesive sheets
- Clear drafting film
- Crescent Board (or product equivalent)
- Disposable foot covers
- DSLR camera
- Electrostatic dust lifter and lifting film
- Fingerprint powder applicators
- Fingerprint powders
- Fingerprint roller
- Flatbed scanner
- Foster + Freeman Electrostatic Detection Apparatus (ESDA) (or comparable equipment)
- Gelatin lifters
- Hand magnifier
- Inkless test impression kit
- Roller transport film
- Saturated potassium sulfate solution
- Specialized imaging devices
- Tape lifters

#### 4 STANDARDS AND CONTROLS

Refer to the standards and controls documented in the following technical procedures for the chemical enhancement processing of footwear/tire evidence: [IMPRS-302 \(Amido Black\)](#), [IMPRS-303 \(Leucocrystal Violet\)](#), [IMPRS-304 \(Acid Fuchsin\)](#), [IMPRS-305 \(Potassium Thiocyanate\)](#), and [IMPRS-306 \(Luminol\)](#).

#### 5 PROCEDURE

- QDU personnel will utilize the photography services of the Operational Projects Unit (OPU), as needed, when conducting footwear/tire examinations.
- Any substantive communications made while using these procedures will be recorded in the communication log.
- The examiner will report the results of the footwear/tire examinations in the 'Results of Examinations' section of the FBI Laboratory Report, or within an Investigative Lead, Intelligence, or Information (i3) product.

##### 5.1 General Initial Assessment and Preparation

- A. Determine what examinations were requested by reviewing the written communication and through communication with laboratory personnel and/or the contributor.
- B. Examine the evidence and perform an initial assessment by conducting the following activities, as appropriate. Ambient lighting is generally used for all examinations. An alternate light source (including oblique lighting) and/or specialized photography [e.g., ultraviolet (UV) or infrared (IR)] may also be used, as appropriate. Record information and observations in the examination record.
  1. Record a brief description of the item and its condition, as received in the laboratory.
  2. Determine if all the relevant and available items were received in the laboratory.
  3. Determine the item's suitability for processing (i.e., chemical/physical/digital processing of the item or lifting of an impression from the item) and specialized photography to potentially enhance the impression(s).
  4. Organize the evidence into logical categories (e.g., impressions, patterns, and/or categories of evidence) for the purposes of examination and/or reporting the results of the examinations.
  5. Associate items (e.g., associate an image depicting an impression with the case of that impression or associate a test impression and the known tire from which it was prepared) to maximize an impression's comparison potential and to avoid reporting multiple results for a single impression, when possible.
  6. Attribute appropriate identifiers to the evidence (e.g., assign number designations to impressions and assign letter designations to patterns). Use evidence identifiers provided by the contributor, when appropriate.
  7. Determine the amount of time that elapsed between when the questioned impression was made and when the known items were recovered.

8. Determine the orientation of the source item (i.e., left or right) for a footwear impression.
  9. Determine the position of the known tire on the vehicle that either the tire was removed from, or the source of the test impression was prepared from.
  10. Determine the item's (or impression's) suitability to conduct the requested examinations.
  11. Determine if additional probative examinations can be performed on the item (or impression) beyond those requested.
  12. Determine if all other examinations have been performed on the item prior to conducting additional footwear/tire examinations since the footwear/tire examinations may be destructive.
- C. Contact laboratory personnel, as necessary, for any of the following reasons:
- o To determine if additional probative examinations can be conducted
  - o To discuss either the potential impact to other examinations by conducting the requested footwear/tire examinations
  - o To re-order the sequence of services to maximize the evidence's potential for examination.
- D. Contact the contributor, as necessary, for any of the following reasons:
- o The requested examinations cannot be performed
  - o Advise them of any probative examinations that were not requested
  - o Request additional evidence
  - o Obtain consent prior to performing any chemical processing of items (as it may be destructive and prevent future examinations)
- E. If it is determined that no examinations or comparison will be conducted on a specific item(s), a statement indicating such will be included in the 'Remarks' section of the FBI Laboratory Report.

## 5.2 Questioned Items Initial Assessment and Preparation

If known, record the following information associated with the questioned item in the examination record:

- o The date when it was recovered
- o The location where it was recovered

### 5.2.1 Casts

- A. Examine the cast and determine whether it is plaster or not and if it was cleaned prior to submission.
1. If it was cleaned, proceed to Casts, step [B](#).
  2. If soil examinations will be performed, QDU personnel will ensure that they are conducted prior to removing any extraneous material from the cast.
    - For plaster casts:
      - Using a soft bristle brush, manually clean the cast to remove extraneous material while taking care not to damage the cast.
      - Do not use water when cleaning a plaster cast since water will damage the plaster cast.

- For non-plaster casts:
      - Using a soft bristle brush and water, manually clean the cast to remove extraneous material while taking care not to damage the cast; a saturated potassium sulfate solution may be used to remove adhering extraneous material.
      - Allow the cast to dry, uncovered, for at least 24 hours.
- B. Examine the cast using ambient and/or oblique lighting to visualize impression detail. Reduce the room light, as necessary.
- C. Image the cast. Print photographs (including natural size), as needed.
- D. Package the cast appropriately to protect it from damage. Place it in an appropriate storage location.
  - If the cast is under active examination, it may be placed on butcher paper on the laboratory bench.
- E. If the cast was submitted without one or more digital image(s) depicting the impression(s) prior to casting, contact the contributor to determine if the impression(s) was photographed prior to casting. If photographed, request that the contributor submit a copy of the image(s), if available.
- F. Record any information and observations in the examination record.

### 5.2.2 Lifts

- A. Examine the lift and determine its type.
- B. Refer to sections [5.2.1.2.1 \(Electrostatic Dust Lift\)](#), [5.2.1.2.2 \(Gelatin Lift\)](#), and [5.2.1.2.3 \(Adhesive or Tape Lift\)](#) for details regarding the examination procedures specific to each lift type.
- C. Image the lift. Print photographs (including natural size), as needed.
- D. Package the lift appropriately to protect it from damage and to reduce the accumulation of additional material on the impression side of the lift. An electrostatic dust lift retains some level of static charge so it may accumulate additional dust. Place the lift in an appropriate storage location.
  - If the lift is under active examination, it may be placed on butcher paper on the laboratory bench.
- E. If the lift was submitted without one or more digital image(s) depicting the impression(s) prior to lifting, contact the contributor to determine if the impression(s) was photographed prior to lifting. If photographed, request that the contributor submit a copy of the image(s), if available.
- F. Record any information and observations in the examination record.

#### 5.2.2.1 *Electrostatic Dust Lift*

- A. Remove the lift from its original packaging and/or unroll it while taking care not to disturb any material on the black side of the film.
- B. Examine the black side of the lift using ambient and oblique lighting to visualize impression detail. Reduce the ambient light, as necessary.

### 5.2.2.2 Gelatin Lift

- A. Remove the acetate cover while taking care not to stretch the lift. Retain the cover for replacement at the completion of the footwear/tire examinations.
- B. Examine the adhesive side of the lift using ambient and oblique lighting to visualize impression detail. As necessary, use an alternative light source, reduce the ambient light, and/or place the lift on a colored background.
- C. Examine the acetate cover since a portion of the impression from the lift can transfer to it. If any significant impression detail is observed on the cover, treat the cover as if it were a lift.

### 5.2.2.3 Adhesive or Tape Lift

- A. Examine the lift and determine how it was prepared (which will impact the orientation of the impression detail on the lift).
- B. If the lift has a removable cover sheet [that is opaque and prevents visualizing the impression(s)], remove the cover sheet while taking care not to stretch the lift.
  - 1. If the cover sheet has any identifying markings or labeling, retain it; otherwise, discard the cover sheet.
  - 2. Measure the lift and locate an acetate sheet that is larger than the lift.
  - 3. Apply the acetate sheet to the adhesive side of the lift while taking care to minimize bubbles and wrinkles.
    - Use a fingerprint roller to apply the acetate sheet, as necessary.
- C. Examine the adhesive side of the lift using ambient light to visualize impression detail. As necessary, use an alternate light source, reduce the ambient light, and/or place the lift on a colored background.

### 5.2.3 Original Items Bearing Impressions

- A. Image the item bearing an impression(s). Print photographs (including natural size), as needed.
- B. Visually examine the item and associated impression(s) to determine if they are suitable for chemical processing, physical processing and/or specialized photography while considering if any of the associated methods have the potential to improve the quality of the impression(s) and/or level of detail in the impression(s). This determination should consider both the substrate and matrix.
- C. If suitable for [physical processing](#), [chemical processing](#), and/or specialized photography, process and/or image the item using the appropriate methods including those detailed in the sections below.

#### 5.2.3.1 Physical Processing

- A. If suitable for physical processing, determine the appropriate method(s) to process the item to enhance the impression(s) considering the substrate and matrix. Also, consider whether the impression(s) is dry or wet origin.
- B. Process the item, as appropriate.
  - An impression may be lifted from the item using various methods including:
    - Electrostatic dust lifter
    - Gelatin lifter

- Adhesive lifter
  - Electrostatic Detection Apparatus (ESDA)
  - Casting material
- An electrostatic dust lifter should be used to lift the impression(s) prior to any other physical processing or lifting methods to prevent damaging a dry origin impression.
- A wet origin impression may be powdered using fingerprint powders and applicators prior to lifting.
- C. If an impression is lifted and/or powdered, image the lift/cast and the powdered item. Print photographs (including natural size), as needed.
- D. If an impression is lifted, the prepared lift will be treated as secondary evidence. Refer to the QDU [Quality Assurance Manual – Part II](#) for further details on handling secondary evidence.

#### 5.2.3.2 *Chemical Processing*

- A. Prior to chemically processing the item, contact the contributor to obtain consent since the processing may be destructive. Record the contributor’s consent in the communication log.
- B. If suitable for chemical processing, determine the appropriate method(s) to process the item to enhance the impression(s) while considering the substrate and matrix. Refer to the following technical procedures for the chemical processing of footwear/tire evidence: [IMPRS-302 \(Amido Black\)](#), [IMPRS-303 \(Leucocrystal Violet\)](#), [IMPRS-304 \(Acid Fuchsin\)](#), [IMPRS-305 \(Potassium Thiocyanate\)](#), and [IMPRS-306 \(Luminol\)](#).
- C. After chemically processing the item, image it. Print photographs (including natural size), as needed.
- D. An impression may be lifted from the item using various methods, including:
  - A gelatin lifter
  - An adhesive lifter
  - Casting material
- E. If an impression is lifted, image the lift/cast. Print photographs (including natural size), as needed.
- F. If an impression is lifted, the prepared lift will be treated as secondary evidence. Refer to the QDU [Quality Assurance Manual – Part II](#) for further details on handling secondary evidence.
- G. Record any information and observations in the examination record.

#### 5.2.4 *Images*

- A. Scan any of the following items:
  - Photograph(s)
  - Negative(s)
  - Printout(s)
- B. If a photograph is submitted without the source negative, contact the contributor to request that the negative be submitted, if available.

- C. Determine if the image is suitable for digital processing to resize it to natural size (aka 1:1), enhance the quality of its contents (e.g., increase the quality of an impression and/or the level of detail in an impression), or rectify photographic distortion (e.g., correcting the perspective distortion due to the imaging device not being plan-parallel to the impression when captured).
  - o An image may be suitable for resizing if it contains a proper scale or another dimensional object (whose dimensions are known) and was captured with the imaging device plane-parallel to the impression.
- D. If suitable, determine if digital processing would benefit the footwear/tire examinations.
- E. If both suitable and beneficial, digitally process the image using the procedures in sections [5.2.1.4.1 \(Resizing\)](#) and [5.2.1.4.2 \(Enhancement and Rectification of Photographic Distortion\)](#).
- F. Print photographs (including natural size), as needed.
- G. Record any information and observations in the examination record.

#### 5.2.4.1 Resizing

- A. Resize the image using Photoshop (or another suitable software application) and the increments on the scale (or the known dimensions of another object) depicted in the image.
- B. A digital image may be submitted to the OPU for resizing, as directed by the examiner or analyst.

#### 5.2.4.2 Enhancement and Rectification of Photographic Distortion

- A. Process the image using the appropriate Photoshop tools and techniques.
- B. Refer to section 2.8 of the QDU [Quality Assurance Manual – Part II](#) for further guidance on digitally processing an image using Photoshop.
- C. A digital image may be submitted to the OPU for digital processing, as directed by the examiner or analyst.

### 5.3 Known Items Initial Assessment and Preparation

- A. The original footwear item/tire (i.e., the physical footwear item/tire) is the preferred known item for comparison with a questioned impression. Conducting a comparison using either an image depicting the known item, or a test impression prepared from the known item may limit the comparison.
- B. Record the following information associated with the known item, if known, in the examination record:
  - o Date when it was recovered\*
  - o Location from where it was recovered
  - o Make
  - o Model
  - o Manufacturer's size
  - o Printed or molded dates
  - o Printed or molded product codes



\*If a known item is submitted without the date it was recovered, contact the contributor to request this date.

- C. For a known item, verify that it was manufactured/available for sale prior to the date of the crime, when possible.
  - o QDU personnel may consult with the manufacturer, as necessary.
  - o Printed or molded dates on footwear items and the DOT number on tires may be used for this purpose.
- D. If the known item was not either manufactured or available for sale prior to the date of the crime, discontinue any relevant footwear/tire examinations. Record this determination in the examination record and report accordingly.
- E. Record any notable features on the known item that may impact the footwear/tire examinations or other disciplines' examinations (e.g., possible blood droplets on the items, soil adhering to the outsole or notable objects attached to or embedded in the outsole) in the examination record.
- F. Prepare a test impression(s) from the known item, as appropriate. Refer to the [ANSI/ASB Best Practice Recommendations 021 \(Best Practices for the Preparation of Test Impressions from Footwear and Tires\)](#) for the procedures for preparing test impressions from known items. Generally, a test impression should be prepared when the design on the known item is similar to the pattern observed in the questioned impression. A test impression may be prepared at any time during the footwear/tire examinations.

### 5.3.1 Footwear

Record which foot that the known footwear item is associated with (i.e., left or right), if known and appropriate, in the examination record.

#### 5.3.1.1 *Original Footwear Items*

Image the outsole of the known footwear item. Image the upper of the known footwear item, as appropriate. Print photographs (including natural size), as needed.

#### 5.3.1.2 *Images Depicting Footwear Items*

If an image depicting a footwear item was submitted without the original footwear item, determine if not examining the original footwear item may limit the footwear examinations. If so, request that the contributor submit original footwear item, if available.

#### 5.3.1.3 *Test Impressions from Footwear Items*

- A. Image the test impression(s). Print photographs (including natural size) and/or transparencies, as needed.
- B. If the test impression was submitted without the original footwear item, determine if not examining the original footwear item may limit the footwear examinations. If so, request that the contributor submit the original footwear item, if available.

### 5.3.2 Tires

- A. Record the DOT number, if known and appropriate.

- B. Record the tire pressure, if known and appropriate.
- C. Record the year, make and model of the vehicle that the tire is associated with, if known and appropriate.
- D. Record the position of the tire on the vehicle that the tire is associated with, if known and appropriate. Use the following terminology when possible:
  - o Driver Front (DF)
  - o Driver Rear (DR)
  - o Passenger Front (PF)
  - o Passenger Rear (PR)
  - o Spare

#### 5.3.2.1 *Original Tires*

Image selected portions of the tread and sidewall of the known tire. The known tire may be imaged at any point during the tire examinations. Print photographs (including natural size), as needed.

#### 5.3.2.2 *Images Depicting Tires*

If the image was submitted without the original tire, determine if not examining the original tire may limit the tire examinations. If so, request that the contributor submit the original tire, if available.

#### 5.3.2.3 *Test Impressions from Tires*

- A. Image the test impression or selected portions thereof. Print photographs (including natural size) and/or transparencies, as needed.
- B. If the test impression was submitted without the original tire, determine if not examining the original tire may limit the tire examinations. If so, request that the contributor submit the original tire, if available.
- C. Package the known item appropriately to protect it from damage. Place it in an appropriate storage location.
  - o If the known item is under active examination, it may be placed on butcher paper on the laboratory bench.

### 5.4 **Suitability Determination**

- A. Determine if the item (or impression) is suitable to perform the requested footwear/tire examinations.
  - o An item (or impression) may be suitable if, at a minimum, it contains gross design, printed, or molded features. Ultimately, the item (or impression) is suitable if it contains enough detail to perform either a meaningful comparison with known footwear items/tires or a search of the laboratory reference materials to associate the make and model with the evidence item.
- B. If the item (or impression) is unsuitable to conduct the requested footwear/tire examinations or if no discernable impressions were observed, QDU personnel should discontinue the footwear/tire examinations.

- Record this determination, including the limitation(s) that made the item (or impression) unsuitable for examination, in the examination record and report accordingly.
- C. If the item (or impression) is suitable, perform the requested footwear/tire examinations.

## 5.5 Comparison

- A. The examiner will perform a comparison between the questioned impression and the known item to determine whether or not the known item is the source of the questioned impression or can be considered a possible source (along with other footwear items/tires).
- B. The examiner will visually examine the evidence, including reproductions of the evidence (e.g., images and test impressions) and compare the features observed in the questioned impression to the features on the outsole of the known footwear item or tread of the known tire using side-by-side comparison, superimposition, or both.
  - 1. Compare the questioned impression to the known item to determine if they correspond in design.
    - i. If the design is different, the examiner may continue the footwear/tire examinations and exclude the known footwear item/tire as the source of the questioned impression.
    - ii. If they correspond in design, the examiner or analyst may prepare a test impression from the known item and the examiner may continue with the footwear/tire examinations.
      - Refer to the [ANSI/ASB Best Practice Recommendation 021 \(Best Practices for the Preparation of Test Impressions from Footwear and Tires\)](#) for the procedures for preparing test impressions from known items.
  - 2. Compare the questioned impression to the known item to determine if they correspond in physical size.
    - i. If the physical size is different, the examiner may discontinue the footwear/tire examinations and exclude the known footwear item as the source of the questioned impression.
    - ii. If they correspond in physical size, the examiner may continue with the footwear/tire examinations.
  - 3. Compare the questioned impression to the known item to determine if they correspond in the position and degree of wear (or the general condition).
    - i. If the position and degree of wear are different and the known item exhibits less wear than the questioned impression, the examiner may discontinue the footwear/tire examinations and exclude the known footwear item as the source of the questioned impression.
    - ii. If the position and degree of wear are different and the known item exhibits more wear than the questioned impressions, the examiner must evaluate the observed differences considering the amount of time that elapsed (between when the crime occurred and when the

known footwear item was recovered) and determine if the observed differences in wear are reasonable given the amount of time that elapsed.

- a. If the examiner determines that the observed wear differences are unreasonable, the examiner may discontinue the footwear/tire examinations and exclude the known footwear item as the source of the questioned impression.
  - b. If the examiner determines that the observed wear differences are reasonable, the examiner may continue with the footwear/tire examinations.
4. Compare the questioned impression to the known item to determine if one or more of the features in the questioned impression correspond to randomly acquired characteristics (RACs) on the known footwear item. The examiner must evaluate the position, size, shape, and orientation of each RAC while considering its quality and reproducibility.
- i. If no RACs correspond, the examiner may include the known footwear item as a possible source of the questioned impression (along with other items with features indistinguishable from the known item).
  - ii. If one or more RACs correspond, the examiner may identify the known footwear item as the source of the questioned impression.
- C. The examiner will record any observations, findings, and conclusions in the examination record.
- D. The examiner will report the results using one of the approved conclusions in [IMPRS-901 FBI Approved Standards for Scientific Testimony and Report Language for Forensic Examination of Footwear and Tire Impression Evidence](#).

## 5.6 Make/Model Determination

- Examiners and analysts may conduct examinations to determine the make and model associated with, or to learn more about, an item of footwear/tire evidence (including both questioned and known items) under any one of the following conditions:
  - A contributor, or other relevant party requested that the laboratory provide the make and/or model associated with an evidence item (or the source of that item).
  - An examiner excluded the submitted known item(s) as the source of a questioned impression during a comparative examination.
  - An examiner required additional product information associated with an evidence item during a comparative examination.
- Make/model determination examinations may be conducted under conditions outside of those provided above, but the examination must be approved by the technical leader, unit chief, or designee, and will be evaluated on a case-by-case basis. Additional discussion with the contributor may also be required to decide whether QDU personnel will conduct the requested make/model determination examinations.
  - All substantive communication will be recorded in the communication log.

- Common evidence items that may be submitted for make/model determination include:
  - Original items bearing footwear/tire impressions
  - Images depicting footwear/tire impressions
  - Original footwear items/tires
  - Images depicting footwear/tires
- Refer to [IMPRS-301 Footwear and Tire Make/Model Determinations](#) when conducting a make/model determination examination.

## 6 LIMITATIONS

- A conclusion provided in a Laboratory Report is ultimately an examiner's decision and is not based on a statistically derived or verified measurement or comparison to all other footwear items/tires.
- There may be other footwear items/tires with characteristics that are indistinguishable from the known item that could have also made the questioned impression when one of the two 'inclusion' conclusions, either an 'inclusion based on class and randomly acquired characteristics' or an 'inclusion based on class characteristics', is provided in a Laboratory Report.
- The examinations may be limited by one or more of the following factors:
  - The condition or age of the evidence item
  - The amount of time that elapsed between when the questioned impression was made and when the known item was recovered
  - The quality of the detail of the source item's features as reproduced in the impression
  - The quantity of the source item's features as reproduced in the impression
  - The improper placement or lack of a scale in images depicting an impression
  - Processing of the evidence prior to submission
  - The way that the evidence item was recovered
  - The way that the evidence item was packaged
  - The way that the impression was photographed
  - The absence of original evidence items

## 7 SAFETY

Standard precautions should be followed for the handling of chemical and biological materials. Chemical and biological materials that are hazardous or potentially hazardous will be maintained and examined in specifically designated areas within QDU space. QDU personnel may refer to the [FBI Laboratory Safety Manual](#) for additional guidance.

## 8 REFERENCES

[ANSI/ASB Best Practice Recommendation O21 \(Best Practices for the Preparation of Test Impressions from Footwear and Tires\)](#)

## 9 REVISION HISTORY

Revision	Issued	Changes
10	01/14/2022	Reformatted the entire document to meet new requirements. Section <a href="#">5</a> – Added information regarding i3 products.