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**Best Practice Recommendation for the Preparation of
Test Impressions from Footwear and Tires**



Best Practice Recommendation for the Preparation of Test Impressions from Footwear and Tires

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Foreword

This document covers the procedure for documenting two- and three-dimensional test impressions of footwear and tires. The particular procedures and methods employed in a given case will depend on the examination needs and this document may not cover all aspects of unusual or uncommon conditions. The purpose of creating test impressions from known footwear or tires is to record the characteristics on the outsole or tread.

Forensic footwear and tire track examination is a forensic discipline that attempts to identify, exclude, or determine the degree of association/non-association between an item of footwear or tire and a questioned impression. It requires a broad range of knowledge, skills, and abilities to effectively apply appropriate scientific and technical methodologies and properly evaluate the findings in order to reach one of these appropriate conclusions. An important factor in any scientific or technical endeavor is to conduct appropriate and accurate experimentation. Making test impressions is a key part of the experimentation phase of footwear and tire track examination. This document lays out the foundational principles for making test impressions from known footwear and tires for comparison with the questioned impressions.

The American Academy of Forensic Sciences established the Academy Standards Board (ASB) in 2015 with a vision of safeguarding Justice, Integrity and Fairness through Consensus Based American National Standards. To that end, the ASB develops consensus based forensic standards within a framework accredited by the American National Standards Institute (ANSI), and provides training to support those standards. ASB values integrity, scientific rigor, openness, due process, collaboration, excellence, diversity and inclusion. ASB is dedicated to developing and making freely accessible the highest quality documentary forensic science consensus Standards, Guidelines, Best Practices, and Technical Reports in a wide range of forensic science disciplines as a service to forensic practitioners and the legal system.

This document was revised, prepared, and finalized as a standard by the Footwear and Tire Consensus Body of the AAFS Standards Board. The draft of the first edition this standard was developed by the Footwear and Tire Subcommittee of the Organization of Scientific Area Committees (OSAC) for Forensic Science.

Questions, comments, and suggestions for the improvement of this document can be sent to AAFS-ASB Secretariat, asb@aaafs.org or 410 N 21st Street, Colorado Springs, CO 80904.

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Table of Contents

1 Scope.....1

2 Normative References1

3 Terms and Definitions1

4 Recommendations.....2

4.1 General.....2

4.2 Footwear Test Impressions.....3

4.3 Tire Test Impressions.....5

4.4 Safety7

4.5 Limitations.....7

Annex A (informative) Bibliography8

Best Practice Recommendation for the Preparation of Test Impressions from Footwear and Tires

1 Scope

This document provides best practice recommendations for forensic science service providers (FSSP), for the preparation of two- and three-dimensional test impressions from known footwear and tires for use in the comparison process. The recommendations in this document are not all inclusive and may not cover all aspects of unusual or uncommon conditions. This document is not intended to replace a professional training program.

2 Normative References

There are no normative reference documents. Annex A, Bibliography, contains informative references.

3 Terms and Definitions

For purposes of this document, the following terms and definitions apply.

3.1

adhesive lifter

Any material coated with a tacky substance for the purpose of lifting impressions.

3.2

chart board

A solid laminated board with a covering of white paper on at least one side (not foam core board) used to provide a firm and smooth backing when obtaining known tire impressions.

3.3

gelatin lifter

A commercial product with gelatin applied to a pliable backing used to lift impressions.

3.4

inkless coater

A chemically infused commercial product used to coat tread in order for the tread pattern to be captured onto chemically treated paper.

3.5

known footwear or tire

An item of footwear or tire from a specific source that is compared to a questioned footwear or tire impression.

3.6

noise treatment

The mixed arrangement of tread block sizes used by the tire industry to reduce noise generated by tires.

3.7

outsole design

A specific pattern or arrangement of elements on an outsole typically associated with a manufacturer and having a name and/or style number.

3.8

questioned

An item of unknown source (impression or otherwise).

3.9

roller transport film

A seven-mil Estar^a film-based material designed to wet rollers and pick up loose particles on all types of roller transport photo-processing machines, used along with fingerprint powder to produce known impressions of footwear and tires.

3.10

rolling circumference

The linear distance traveled by a tire in one revolution under load.

3.11

test impression

An impression made from a known footwear or tire used as an aid for comparison purposes.

3.12

tread design

A term used to describe a specific pattern or arrangement of design elements on a tire tread typically associated with a manufacturer and having a name and/or style number (also used to describe footwear outsoles).

3.13

tread wear indicator

Bands of raised rubber, sometimes called “wear bars”, that are $\frac{2}{32}$ of an inch above the bottom of the main grooves of a tire.

4 Recommendations

4.1 General

Prior to making test impressions, the forensic science practitioner (FSP) should recognize and preserve other relevant physical evidence as well as document and photograph the original condition of the shoes, outsoles, tires, and tread design. The FSP should select the method of making test impressions based on the known footwear or tire, case circumstances and products available. Multiple test impression methods may be used if needed.

^a This term is used as an example only, and does not constitute an endorsement of this product by the AAFS Standards Board.

4.2 Footwear Test Impressions

4.2.1 Test impressions should record fine detail with enough contrast and/or three-dimensional features to accurately depict size, shape, and clarity of features present.

4.2.2 Relevant identifying information should be recorded on test impressions, which may include but is not limited to case number, item number, make, model, size, test impression method, etc.

4.2.3 When appropriate, test impressions should be made of the entire outsole. Test impressions of specific areas of the outsole may also be made. Replicate test impressions should be made to capture variability among different impressions.

4.2.4 Excess dirt should be removed from the outsole with care so as to not damage the outsole or remove any stone holds or other objects present within the design elements before test impressions are made. In some cases, test impressions may be made prior to removal of excess dirt from the outsole.

4.2.5 The FSP should select the method of producing test impressions based on the known footwear, case circumstances, and products available. The methods in this section are suggested, but are not the only possible methods (other methods meeting the criteria of 4.2.1 may be used). Multiple test impression methods may be used if needed. Sections 4.2.6 a) through 4.2.6 f) are acceptable examples of methods used to make footwear test impressions.

Test impressions may be made by wearing the shoe and stepping or by pressing the outsole on the substrate. If the test impression is made by wearing the shoe, the person making the test impression, and their typical shoe size (e.g., US 9), should be recorded in the notes.

4.2.6 FSPs should make test impressions using one of the methods listed in 4.2.6 a) through 4.2.6 f).

a) Adhesive/gelatin lifter and fingerprint powder/printer's ink.

- 1) Apply a coat of fingerprint powder or ink to the footwear outsole.
- 2) If using powder, remove any excess powder by gently tapping the footwear onto a hard surface.
- 3) Remove the protective cover from the adhesive/gelatin lifter. Gelatin lifters can stretch when the clear cover is removed. Take care when removing the cover to limit the stretch. Allow the lifter to rest until it returns to the original size, before making the test impression.
- 4) Lay the sheet adhesive side up on the surface where the impression will be made. A semi-soft surface, such as newspaper or firm foam, can be used under the adhesive/gelatin lifter to record the outsole details.
- 5) Make an impression by stepping or pressing the outsole onto the adhesive/gelatin lifter.
- 6) Cover the impression with a clear protective cover.

b) Inkless methods

- 1) Coat the outsole by stepping or pressing it onto the inkless coater. The inkless coater may also be applied to the outsole using an applicator and ensuring an even distribution of the inkless coater onto the entire outsole while preventing excess coating.
- 2) Make an impression by stepping or pressing the outsole onto the treated paper.

c) Magnetic fingerprint powder

- 1) Lightly coat the outsole of the footwear with a selected substance (e.g., silicone spray, silicone wipe, petroleum jelly).
- 2) Make an impression by stepping or pressing the outsole on a surface such as white paper or white cardboard.
- 3) Apply black magnetic fingerprint powder to develop the impression.
- 4) Apply aerosol clear lacquer or other suitable protective coating to the test impression.

d) Roller transport film and fingerprint powder

- 1) Apply a heavy coat of fingerprint powder to the footwear outsole.
- 2) Remove any excess powder by gently tapping the footwear onto a hard surface.
- 3) Using water, moisten one side of a sheet of roller transport film of sufficient size.
- 4) Remove excess water with a squeegee. Make an impression by stepping or pressing the outsole onto the roller film.
- 5) Allow the impression and film to dry.

e) Three-dimensional test impressions

Make an impression by stepping or pressing the outsole into a three-dimensional substrate (e.g., BIO-FOAM^{®b} or sand).

f) Outsole casting

- 1) Apply selected silicone product to the outsole of the footwear.
- 2) Remove silicone from the outsole of the footwear when cured.

NOTE The use of outsole casting is generally reserved for small areas.

4.2.7 If known footwear outsoles are needed for elimination purposes (i.e., footwear belonging to individuals who accessed the scene, such as police officers, fire department personnel, or rescue

^b This term is used as an example only, and does not constitute an endorsement of this product by the AAFS Standards Board.

personnel), the footwear outsole may be photographed with a scale or may be documented using any of the methods listed in 4.2.6. If the footwear outsole is photographed, a scale shall be placed on the same plane as the bottom of the outsole and included in the photograph. The photograph shall also be taken at a resolution^c necessary to capture the smallest feature of interest and ideally a loss-less file format, such as RAW, NEF or TIF.

4.2.8 Test impressions made from known footwear shall be documented in the case record.

4.3 Tire Test Impressions

4.3.1 Test impressions should record fine detail with enough contrast and/or three-dimensional features to accurately depict size, shape, and clarity of features present.

4.3.2 Relevant identifying information should be recorded on test impressions which may include but is not limited to case number, item number, make, model, size, DOT number, tire location on the vehicle, rolling direction of the tire, test impression method, etc.

4.3.3 The location of the tread wear indicators and/or tire segments should be noted on the tire.

4.3.3.1 Tread wear indicators can be used for marking off the sidewall of the tire into sections and giving each section an alpha or numeric designator. The sections should be marked on the tire using the location of the tread wear indicators.

4.3.3.2 The location of the tread wear indicators and/or tire segments should be transferred to the test impression as it is rolled. This should be done by transferring the markings placed on the sidewall as stated in 4.3.3.1.

4.3.4 Test impressions should record the full and continuous circumference of a tire.

4.3.5 The test impression made for each tire should be longer than the circumference of the tire, by approximately 3 ft (0.9144 m), to ensure that the entire noise treatment pattern is collected.

4.3.5.1 Alternatively, two test impressions may be made of each tire, offset by 180 degrees of rotation, to ensure different start and end points.

4.3.5.2 Vehicles with dual tire assembly should have both tire test impressions made simultaneously as to ensure that the relationship of the noise treatment between the two tires is recorded.

4.3.6 Test impressions should be made with the tire mounted on a vehicle, preferably using the subject vehicle, while the vehicle is in neutral being pushed (not driven).

4.3.7 Excess dirt should be removed from the tread of the known tire with care so as to not damage the tread or remove any stone holds or other objects present within the design elements before test impressions are made. In some cases, test impressions may be made prior to the removal of excess dirt.

^c ANSI/ASB Best Practice Recommendation 050, *Best Practice for Photographic Documentation of Footwear and Tire Impression Evidence*, 1st Ed., 2021.

4.3.8 The FSP should select the method of producing test impressions based on the known tire, case circumstances, and products available. The methods in this section are suggested, but are not the only possible methods (other methods meeting the criteria of 4.3.1 may be used). Multiple test impression methods may be used if needed. Sections 4.3.9 a) through 4.3.9 d) are acceptable examples of methods used to make tire test impressions.

4.3.9 FSPs should make test impressions using one of the methods listed in 4.3.9 a) through 4.3.9 d).

a) Printer's ink with clear film

- 1) Prepare two sections of chart board, each of sufficient length to record a full rotation of the tire.
- 2) Apply printer's ink to one section of chart board.
- 3) Cut, position, and tape clear film on the second section of chart board.
- 4) Roll the vehicle so that the tire travels over the inked chart board and then onto the clear film.
- 5) Mark the film with relevant information regarding tire position and direction of travel.
- 6) Allow the inked impression to dry.

b) Printer's ink with chart board

Repeat 4.3.9 a), omitting the use of the clear film, so that the inked impression will be produced directly on the chart board.

c) Clear film with magnetic fingerprint powder

- 1) Lightly coat the tire tread with a selected substance (e.g., silicone spray, silicone wipe, petroleum jelly).
- 2) Cut, position and tape clear film onto the chart board.
- 3) Roll the vehicle over chart board which has been covered with clear film to transfer the tire impression to the clear film.
- 4) Mark the film with relevant information regarding the tire position and direction of travel.
- 5) Develop the impression with black magnetic fingerprint powder.
- 6) Remove excess powder from the film.
- 7) Apply aerosol clear lacquer or other suitable protective coating to the test impression.

d) Chart board with magnetic fingerprint powder

Repeat 4.3.9 c) omitting the use of the clear film, so that the impression will be produced directly on the chart board.

4.3.10 If known tire treads are needed for elimination purposes (i.e., tires belonging to vehicles that accessed the scene, such as police officers, fire department personnel, or rescue personnel), the tire tread may be photographed with a scale or may be documented using any of the methods listed in 4.3.9. If the known tire tread is photographed, a scale shall be placed on the same plane as the bottom of the tread and included in the photograph. The photograph(s) shall also be taken at a resolution^d necessary to capture the smallest feature of interest and ideally a loss-less file format, such as RAW, NEF or TIF.

4.3.11 Test impressions made from known tires shall be documented in the case record.

4.4 Safety

4.4.1 Universal safety precautions should be taken when handling physical evidence due to potential biohazards or other hazardous materials.

4.4.2 Precautions to prevent contamination should be taken when wearing footwear during the production of test impressions, such as wearing gloves and wearing protective foot covers.

4.4.3 Precautions to prevent contamination should be taken when producing test impressions from tires using vehicles, such as wearing gloves, wearing protective suits over clothing, and providing a safe environment for all individuals involved.

4.4.4 Multiple people shall be involved when making test impressions from known tires mounted on a vehicle; one person to place the vehicle in neutral, steer and stop the vehicle, a second person to transfer markings onto the test impression as the tire is rolling, and a third person to push the vehicle slowly.

4.5 Limitations

4.5.1 Limitations most often include, but are not limited to substrate features, the method of collection, and the inability to accurately reproduce conditions under which the questioned impression was made.

4.5.2 Performing an examination without the actual footwear or tire may limit the examination.

4.5.3 Footwear and tire evidence may have inherent limitations that can interfere with the procedures in this document. Limitations, when known, should be noted and recorded.

4.5.4 Test impressions may not always fully reproduce characteristics due to inherent variability in the impression making process.

4.5.5 Other evidence (e.g., biological materials, trace evidence) that could be found on the shoe or tire shall be considered and possibly preserved prior to making test impressions from known footwear or tires. The making of test impressions may damage physical evidence present on the footwear outsole or tire tread.

^d ANSI/ASB Best Practice Recommendation 050, *Best Practice for Photographic Documentation of Footwear and Tire Impression Evidence*, 1st Ed., 2021.

Annex A (informative)

Bibliography

This is not meant to be an all-inclusive list as the group recognizes other publications on this subject may exist. At the time this standard was drafted, these were the publications available for reference. Additionally, any mention of a particular software tool or vendor as part of this bibliography is purely incidental, and any inclusion does not imply endorsement.

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^e Available from: <https://www.aafs.org/academy-standards-board>

^f Available from: <https://www.theiai.org/>



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