

Department of Forensic Science

Impressions – Footwear and Tire Tread Training Manual

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1 INTRODUCTION AND ORIENTATION

1.1 Overview

The goal of this manual is to provide uniform coordination and quality training in all aspects of the Science of Impression Evidence for Footwear and Tire Tread employed by the Commonwealth of Virginia. This work is intended to be used in a formal training program that will establish a certain minimum standard of professional competency throughout the Department of Forensic Science (DFS).

- 1.1.1 The Training Program will be coordinated by the Training Coordinator (TC). The TC is designated by the Section Supervisor in consultation with the Program Manager (PM).
- 1.1.2 The training period should be completed in approximately one year, which is to include successful completion of all components of the Competency Exam.
- 1.1.3 The TC will be responsible for the overall training, which will incorporate all of the listed topics, but may delegate certain duties and blocks of instruction to other examiners in the section. The TC is responsible for assuring that the Impression Training Record is completed. The various activities for the Modules will be assessed on a Pass/Fail basis.
 - 1.1.3.1 Passing for a written exam is at least 85% correct responses. See Appendix B for presentation and written paper passing criteria.
- 1.1.4 Monthly performance reports of the trainee will be prepared by the TC and then be provided to the PM and the Laboratory Director of the laboratory in which the trainee is being trained. A template for the report is located in the Quality Manual (QM). The TC is required to discuss each report with the trainee prior to providing it to the PM and Laboratory Director. Any relevant comments by either the trainee or coordinator are to be included with the report.
- 1.1.5 It is recommended that each new member of the section spend time in each of the applicable laboratories working with examiners observing casework, participating in question and answer sessions, attending court and performing supervised casework.
- 1.1.6 Documentation shall be prepared by the staff members that spent time with the trainee summarizing the activities as well as providing the TC with observations and recommendations related to the trainee's knowledge and performance.
- 1.1.7 Should a trainee demonstrate a deficiency which may impact successful completion of the training program, the TC will notify the trainee's Supervisor, who will notify the Section Supervisor (if different from Supervisor), the PM and the Laboratory Director within five working days.
 - 1.1.7.1 A deficiency can include, but is not limited to, failing to obtain an 85% on a test, not meeting expectations on a presentation, submitting assignments past a due date, not exhibiting critical thinking skills, poor decision making or unethical behavior.
- 1.1.8 Expectations of Trainee

The trainee shall maintain a notebook to document training received. This notebook should include, but is not limited to, daily training received (to include observed events), activities performed by the trainee, all completed assignments (including random weekly questions posed from the readings, discussions and lectures), and the training checklist. The Impression Training Record shall be dated and initialed by the trainee, and TC as the trainee completes each described objective and assignment.

The trainee should provide a weekly written progress report to the TC, to include activities or goals accomplished during the week (i.e. exercises completed, case work observed, lectures and presentations) as well as objectives for the upcoming week.

As designated by the TC, the trainee may assist with casework during the training, only under the direct supervision of a qualified examiner.

1.1.9 Guidelines for Competency Exam

- 1.1.9.1 Completion of the Practical Exercises listed in the following sections of this manual demonstrates competence in these processes/methods. The TC shall authorize the trainee to participate in supervised work-alongs after the review of the exercises. The TC's initials in the training record shall serve as documentation.

Section 6 Quality Assurance and Quality Control
 Section 7 Development and Recovery Techniques
 Section 8 Recording Known Impressions
 Section 9 Photography

1.1.9.2 Practical Test

The practical test is a mock case, intended to simulate an average case in difficulty and complexity. It should contain two pair of shoes to serve as knowns, two items to be processed and three scene photographs (examination quality) for comparison to the known. The photographs should contain impressions which the ground truth is known and has been validated through comparison and verification by qualified examiners.

The test shall be approved by the PM prior to being presented to the trainee.

1.1.9.3 Technical Final

The technical final examination will be given by the Laboratory's Latent Print Section Supervisor and TC in the presence of the PM and other Department management (as needed) to ascertain the technical knowledge of the individual. This examination will be limited to three (3) hours. After the examination, the TC, PM and relevant management with input from other attendees, will assess the individual's performance. The performance of the individual will be determined to be either satisfactory or unsatisfactory. The trainee must clearly demonstrate sufficient technical knowledge to perform examinations unaided and to draw correct conclusions. If the performance is deemed to be unsatisfactory, the TC, Section Supervisor, PM and Laboratory Director will determine the appropriate action. After satisfactory completion of the technical oral examination, the individual will be subjected to a final mock trial.

1.1.9.4 Mock Trial

A mock trial will follow the successful completion of the technical oral examination. The QM outlines the roles and responsibilities of the participants as well as evaluation and grading guidelines.

1.1.10 Training Documentation

The following shall be maintained and serve as the technical training file:

- written tests
- description of practical exercises, with results as applicable
- competency practical test
- signed and dated Impression Training Record
- monthly training reports

At the completion of the training the technical training file shall be retained by the trainee or supervisor and be accessible for internal and external quality audits.

1.1.11 Transition from Trainee to Examiner

The employee's Supervisor or TC shall perform technical reviews of the new examiner's casework for at least six months following certification by the Department. In addition, the Supervisor, or designee shall accompany the newly qualified examiner to court for the first three court appearances. Approximately four to six months after qualification, the trainee will complete a Training Program Evaluation form in accordance with QM.

1.2 Experienced Personnel

1.2.1 Assessment

A technical assessment interview will be conducted with the new employee, Section Supervisor, TC and PM. The interview will contain questions from each module of this training manual.

1.2.2 Individual Training Plan (ITP)

1.2.2.1 The ITP, see Appendix A for template, will address what additional training is needed for each module. The ITP is written by the TC and approved by the PM and Section Supervisor. If no additional training is required for a specific module the plan must contain documentation related to what training the new employee received in the subject matter.

1.2.2.2 At a minimum the new employee should take a written or practical test for each module, provide a presentation on how the discipline meets the prongs of Daubert and provide a presentation on the 2009 NAS report recommendations, specifically how the Department addresses them.

1.2.2.3 Monthly performance reports as described in Section 1.1.1.4 shall be completed for experienced personnel.

1.2.3 Training Documentation

See section 1.1.10.

1.2.4 Expectations of Experienced Personnel

See Section 1.1.2.

1.2.5 Guidelines for Competency Examination

An experienced examiner shall complete a Competency Exam as outlined in this manual for a new examiner approximately four months from their hire date.

1.3 Orientation

1.3.1 The required training listed in ¶ 19.4 of the QM shall be completed prior to or in conjunction with the Impressions – Footwear and Tire Tread training program.

1.3.2 The outline of the training program and the expectations of both the TC and the trainee will be discussed.

1.3.3 An explanation of the operation of local, state and federal law enforcement agencies and court systems will be provided.

2 HISTORY AND LEGAL ASPECTS

2.1 Purpose

To provide the trainee with a background in the historical foundations of the Impression field and the history of the use of shoe and tire impressions in the courtroom. Historical figures in the field as well as significant cases associated with footwear and tire impressions will be covered.

2.2 Objectives

Trainee will:

- Summarize the major figures and achievements in the history of shoe and tire impressions.
- Describe the chronology of the introduction and use of shoe and tire impressions in the United States.
- Explain the development of the shoe and tire impression field during the last century.
- Discuss precedent setting legal cases involving shoe and tire impression identifications.
- Be able to understand and discuss the challenges posed to the use and science of shoe and tire impression comparisons.

2.3 Mode of Instruction

2.3.1 Lectures

2.3.2 Case or practical demonstration

2.4 Assignments

2.4.1 Read the following:

- Footwear Impression Evidence, Bodziak, W. 1990, pp 1-17 (Bodziak, W. 2000, pp.1-25; 413-458)
- Footwear Identification, Cassidy, 1980, pp vii, 109-125
- Tire Imprint Evidence, McDonald, 1989, pp. 147-161
- Hamm, M. "Track Identification: An Historical Overview." Journal of Forensic Identification 39.6 (1989): 333-338.
- Geller, H. "Are We Adequately Training in Footwear/Tire Track Identification?" Fingerprint Whorld 14.53 (1988): 26-28.
- Bodziak, W. "Shoe and Tire Impression Evidence." FBI Law Enforcement Bulletin 53.7 (1984):2-12.
- Hamm, M. "Tire Tracks and Footwear Identification." Identification News 25.1 (1975): 3-6.
- Page, M. Taylor, J. Blenkin, M. "Forensic Identification Science Evidence Since Daubert: Part I—A Quantitative Analysis of the Exclusion of Forensic Identification Science Evidence." Journal of Forensic Sciences 56 .5 (2011):1180–1184.
- Christensen, A.M. Crowder, C.M. Ousley, S.D. Houck, M.M. "Error and its Meaning in Forensic Science." Journal of Forensic Science 59.1 (2014): 123-126.
- Practical Crime Scene Processing and Identification, 2nd Edition, Gardner, Ross. 2012, pp 51-54, 278-296.
- Footwear Evidence, Abbott and Thomas.
- Forensic Tire Impression Identification, Nause, L. Chapter 5.
- Tire Tread and Tire Track Evidence Recovery and Forensic Examination, Bodziak, W. Chapters 13-14
- Forensic Tire Impression Identification, Nause, L. Chapters 1 and 5

2.4.2 Provide a 15-20 minute presentation on a historical figure, significant case or current challenges facing the science.

2.5 Mode of Evaluation

- 2.5.1 Successful completion of the History and Legal written exam.

3 TERMINOLOGY

3.1 Purpose

To acquaint and familiarize the student with the terminology used for footwear and tire track examinations.

3.2 Objectives

3.2.1 The student will attain:

- An understanding of the concepts of and the terms used in describing class and individual/accidental characteristics associated with various types of examinations.
- The knowledge and understanding how these concepts and terms are applied to the different types of marks encountered in footwear and tire track examinations.
- The ability to appropriately use terminology related to the examination of footwear and tire track impressions.
- An understanding of common terminology and definitions associated with footwear, footwear manufacture, processing and comparisons.
- An understanding of common terminology and definitions associated with tires, tire manufacturing, processing and comparisons.

3.3 Mode of Instruction

3.3.1 Lectures

3.4 Assignments

3.4.1 Read the following:

- Footwear Impression Evidence, Second Edition, Bodziak W. Chapters 1, 10-11 and the glossary.
- Forensic Tire Impression Identification, Nause, L. Chapter 2 and 8.
- Tire Imprint Evidence, McDonald, P. Chapter 2, 5, 9, 17 and the glossary.
- Standard for Terminology Used for Forensic Footwear and Tire Impression Evidence, SWGTREAD website
- Tire Tread and Tire Track Evidence Recovery and Forensic Examination, Bodziak W. Chapter 1

3.5 Mode of Evaluation

3.5.1 Written exam

4 MANUFACTURING PROCESSES FOR FOOTWEAR AND TIRES

4.1 Purpose

To aid the student in understanding the various processes of the manufacturing of footwear and tires and how these processes influence the various aspects of the examinations.

4.2 Objectives

The trainee will:

- An understanding of basic footwear outsole.
 - An understanding of the molding processes.
 - An understanding of the Wellman and die-cut processes.
 - An understanding of how to recognize the manufacturing process on shoes.
- An understanding of the tire manufacturing.
 - An understanding of the various types of molds.
 - An understanding of the steps in the manufacturing process.
 - An understanding of the various tread and tire design and their uses.
 - An understanding of the tire retreading and recapping processes.
- An understanding of the different types of outsole construction of footwear and the importance it could have on the identification process.
- An understanding of how manufacturing techniques can contribute in the decision making process of an examination.
- An understanding of how design features in footwear outsoles and tire treads are used in comparative examinations.
- An understanding of key terminology used in the science of shoes and tire impression examinations.

4.3 Mode of Instruction

4.3.1 Lectures

4.3.1.1 Manufacturing processes for footwear and tires.

4.3.1.1.1 SWGTREAD Manufacturing Videos

<https://www.swgtread.org/videos/manufacturing>

4.3.1.1.2 Michelin Tire/How a tire is made

<https://www.youtube.com/watch?v=K474RYse9P8>

4.3.1.1.3 Bandag Retread shop tour <https://www.youtube.com/watch?v=8X2GMD1TPzg>

4.3.1.2 How to differentiate between defects created by the manufacturing processes and individual/accidental characteristics.

4.3.1.3 Factory tours, if possible.

4.3.1.3.1 Tire Retreading Facility

GCR Tires and Service

1627 Willis Rd, Richmond, VA 23237

4.3.1.3.2 Tire Manufacturer

Yokohama Tire Corporation
1500 Indiana Street, Salem, VA 24153

4.3.1.3.3 Shoe Manufacturer

McRae Industries
400 North Main Street (Headquarters)
Mount Gilead, North Carolina 27306

4.4 Assignments

4.4.1 Read the following:

- Footwear Identification, Cassidy, M. Chapter 4.
- Footwear Impression Evidence Second Edition, Bodziak W. Chapter, 6 and 7.
- Footwear the Missed Evidence, Hilderbrand, D.
- Forensic Tire Impression Identification, Nause, L. Chapter 9-12.
- Tire Tread and Tire Track Evidence Recovery and Forensic Examination, Bodziak W. Chapters 5-7.
- Tire Imprint Evidence, McDonald, P. Chapters 10 and 12.
- Tread Design Guides (<https://tireguides.com>), Product Book, Who Makes It and Where Directory.
- Wisbey, D. "Counterfeit Nike Sneakers." Journal of Forensic Identification 60.3(2010): 337-351.
- The Art & Science of Footwear Manufacturing, Footwear Industries of America, Inc., Philadelphia, 1983.
- Hamm, D. "The Individuality of Class Characteristics in Converse All-Star Footwear." Journal of Forensic Identification 39.5 (1989): 277-292.
- Keijzer, J. "Identification Value of Class Imperfections in Shoes with Polyurethane Soles in Comparative Shoeprint Examinations." Journal of Forensic Identification 40.4 (1990): 217-223.
- Bodziak, W. "A Forensic Evaluation of the Air Bubbles Present in Polyurethane Shoe Outsoles as Applicable in Footwear Impression Comparisons." Journal of Forensic Sciences 33.5 (1988): 185-197.
- Bodziak, W. "Manufacturing Processes for Athletic Shoe Outsoles." Journal of Forensic Sciences. 31. 1 (1986): 153-176.
- How Shoes Are Made (<http://sneakerfactory.net/>)
- Jay, C.; Grubb, M.J. "Defects in Polyurethane Soled Shoes – Their Importance to the Shoeprint Examiner." Journal of the Forensic Science Society. 25 (1985) 233 -238.
- The True Story of Shoe Sizes; product Booklet; Sterlinglast Corporation; Long Island City, New York.
- Black, J. "An interesting Case Involving Footwear Distribution Information." Journal of Forensic Identification 55.4 (2005): 499-502.
- Kainuma, Alan "Manufacturing Variations in a Die-Cut Footwear Model." Journal of Forensic Identification 55.4 (2005): 503-517.
- Yeomans, R.E. "A Non-Classic Perspective on Footwear Identification." RCMP Gazette 47.6 (1985) 7-11.

4.4.2 Provide a 10-15 minute presentation focused on a specific manufacturing technique to an audience that should include the TC and the section supervisor.

4.5 Mode of Evaluation

4.5.1 The presentation will be evaluated on if the trainee accurately and successfully presents the information within the allotted time and successfully answers questions from the audience. See Appendix B for additional criteria.

4.5.2 Successful completion of the Manufacturing written exam.

5 FOOTWEAR AND TIRE IMPRESSIONS EXAMINATIONS

5.1 Purpose

To gain an understanding of types of examinations conducted in the discipline.

5.2 Objectives

The trainee will:

- Gain an understanding of the infinite variables precluding “age” and size determination of footwear and tire impressions.
- Gain an understanding of the types of comparisons and examinations that can be done with an impression.
 - Comparison of unknown impression to unknown impression from the same scene.
 - Comparison of unknown impression to unknown impression from different scenes.
 - Comparison of unknown impression to known shoe and tires.
 - Shoe and tire search with unknown impression.
 - Vehicle search using tire track measurements.
- Gain an understanding of the investigative information that can be provided by impression evidence.
 - Point of entry to crime scene.
 - Movement through crime scene.
 - Sequence of events (overlapping impressions).
 - Point of exit from the scene.
 - Shoe types and tire types and sizes.
 - Vehicle information from tire track measurements.
- Gain an understanding of the limitations of the comparison.
- Gain an understanding of the scientific observation and uses leading to modern footwear and tire impression identification.
 - Knowledge of the sources of information available about shoes and tires.
 - Knowledge of how to search an impression for the make and model of shoe or tire.
 - Understanding the assistance a manufacturer can provide with case work and court testimony.

5.3 Mode of Instruction

5.3.1 Lecture

5.3.2 Demonstrations

5.4 Assignments

5.4.1 Read the following:

- Footwear Evidence, Abbott and Thomas. Chapters 2, 3 and 5.
- Footwear Impression Evidence Second Edition, Bodziak, W. Chapters 1, 8, 9-11 and 13.
- Forensic Tire Impression Identification, Nause, L. Chapters 1, 5, 6, 9, 10 and 13.
- Tire Impression Evidence, by Peter McDonald. Chapters 4, 6, 8, 9, 10, 14 and 16.
- Footwear Identification, Cassidy, M. Chapters 1 and 3.
- Footwear, The Missed Evidence Second Edition, Hilderbrand, D. Chapters 4 - 6.
- Raymond, J. and Sheldon, P. “Standardizing Shoemark Evidence—An Australian and New Zealand Collaborative Trial.” *Journal of Forensic Identification* 65.5 (2015): 868-883.
- Farrugia, K. J., Riches, P., Bandey, H., Savage, K. & NicDaéid, N. “Controlling the variable of pressure in the production of test footwear impressions.” *Science & Justice* 52.3 2012:168-76.

- Virginia Department of Forensic Science Impressions - Footwear and Tire Tread Procedures Manual.
- SWGTREAD Standards for Examination. (<https://www.swgtread.org/standards/published-standards>).

5.4.2 Casework Observation

- 5.4.2.1 Observe at least three shoe impression cases, record the case numbers and summary of the comparisons.
- 5.4.2.2 Observe at least three, if possible based on submissions during the training period, tire impression cases, record the case numbers and summary of the comparisons.

5.5 Practical Exercises

- 5.5.1 Search and locate the brand of ten different shoe impressions utilizing a variety references.
- 5.5.2 Search and locate the make and model of ten different tire impressions utilizing a variety of references.
- 5.5.3 Provide a presentation on the benefits and limitations of impression evidence comparisons.

5.6 Mode of Evaluation

- 5.6.1 Presentation on the Benefits and Limitations of Impression Evidence comparisons.
 - 5.6.1.1 The presentation will be evaluated on if the trainee accurately and successfully presents the information within the allotted time and successfully answers questions from the audience. See Appendix B for additional criteria.
- 5.6.2 Written exam.

6 QUALITY ASSURANCE AND QUALITY CONTROL

6.1 Purpose

To acquaint the trainee with quality assurance policies of the Department as well as section specific procedures. The trainee will be acquiring knowledge about chain of custody, maintenance, and documentation. The trainee will become familiar with forms internal to the DFS as well as those of the various services which they will come into contact with in examining evidence at the DFS. The trainee will become familiar with the Laboratory Information Management System (LIMS), Certificates of Analysis and how they are distributed.

6.2 Objectives

The student will attain:

- A working knowledge of LIMS.
- An understanding of the flow of evidence through the laboratory system and how it is documented.
- An understanding of the importance of the maintenance/reagent logs and how to properly complete them.
- A working knowledge of the various forms, records and reports related to daily operations in the sections of the DFS.
- The ability to properly complete the forms necessary to accomplish the examination of physical evidence.
- The ability to properly preserve, mark and package evidence.
- The ability to produce a Certificate of Analysis in the proper format with the appropriate content.
- The ability to perform technical and administrative reviews in accordance with policy and procedures.

6.3 Mode of Instruction

6.3.1 Lecture

6.3.2 Technical / Administrative review training

The following documents shall be read and discussed with the TC:

- Virginia Department of Forensic Science Quality Manual - Section 14 Evidence Handling and Section 17 Monitoring Results
- Virginia Department of Forensic Science Impressions – Footwear and Tire Tread Procedures Manual Sections 1.1 Examination Documentation
- Virginia Department of Forensic Science Technical and Administrative Review Form
- ISO/IEC 17025:2017 – Section 7.5 and 7.8

6.3.3 Observation

Shadow examiners as they complete all aspects of casework. The purpose of observation is for the trainee to gain understanding of documentation requirements and how the LIMS is utilized. Record observations in the training notebook.

6.4 Assignments

6.4.1 Read and understand the evidence packaging and marking criteria listed in the QM.

6.4.2 Read and understand the examination documentation requirements in the QM and the Impressions – Footwear and Tire Tread Procedures Manual.

6.5 Practical Exercises

- 6.5.1 The trainee should document the review of at least ten case files using the appropriate Technical Review Form. Case files should be generated by multiple examiners, if possible. The potential findings of the reviews shall be discussed with the TC. Technical Review Forms generated in this capacity shall be marked as Training and retained in their Training File. The case files shall be technically reviewed by an authorized examiner pursuant to QM 17 prior to release.
- 6.5.2 Complete a DFS Audit Trail Worksheet on at least one case.

6.6 Mode of Evaluation

- 6.6.1 Review of case notes to ensure completion in accordance with the QM and Section Manual.
- 6.6.2 Review the Audit Trail Worksheet to ensure each question was addressed.

7 DEVELOPMENT AND RECOVERY TECHNIQUES

7.1 Purpose

To become knowledgeable of methods for impression development and recovery techniques.

7.2 Objectives

The trainee will be able to:

- Utilize techniques to detect and recover 2-dimensional and 3-dimensional impressions.
- Properly select and utilize chemical processing techniques to include, but not limited to; ninhydrin, gentian violet, amido black, small particle reagent, cyanoacrylate ester (superglue) fuming, dyes stains, alternate light sources and physical developer.
- Prepare reagents.

7.3 Mode of Instruction

7.3.1 Lecture

- Development techniques

7.3.2 Demonstrations

Observe examiners completing casework. The purpose of observation is for the trainee to gain understanding related to how development techniques are performed.

7.4 Assignments

7.4.1 Utilize all techniques (to include different formulas of chemical processing techniques and different powders) listed in the current manual to develop impressions on mock evidence.

7.4.2 Recover impressions utilizing the electrostatic dust lifter, casting materials, static lifts and gel lifters.

7.4.3 Read the following:

- Footwear Impression Evidence, Second Edition, Bodziak W. Chapters 3- 5.
- Footwear Evidence, Abbott and Thomas. Chapter 2.
- Footwear, the Missed Evidence, Hilderbrand, D. Chapters 9 & 10.
- Forensic Tire Impression Identification, Nause, L. Chapters 2 and 3.
- Tire Imprint Evidence, McDonald, P. Chapter 7.
- Footwear Identification, Cassidy, M. Chapters 2 and 3.
- Tire Tread and Tire Track Evidence Recovery and Forensic Examination, Bodziak, W. Chapter 3.
- Cassidy, M.J. Footwear Identification; Canadian Government Printing Centre: Quebec, Canada, 1980; pp.1-6, 41-50, 57-59;61-65.
- Cayton, J. C. "Procedure for Recovery of Flooring with Shoeprints." AFTE Journal 16.3 (1984): 119-122.
- Fischer, J.F. Green, E. "A Technique for the Enhancement of Shoeprints by Paining with UV Light." Florida I.A.I. Newsletter 30. 3 (1980): 10-11.
- Snyder, C. "A Comparison of Photography and Casting Methods of Footwear Impressions in Different Sandy Soil Substrates." Journal of Forensic Identification 66.1(2016): 37-58.
- Jurgens, E. Hainey, A. Shaw, L. Andries, J. "Chemical Enhancement of Footwear Impressions in Blood Recovered from Cotton using Alginate Casts." Journal of Forensic Identification 65.3 (2015): 247-272.

- McConaghey, D. "Resting Gelatin Lifters Prior to Use." *Journal of Forensic Identification* 63.6 (2013): 653-659.
- McNeil, K. & Knaap, W. "Bromophenol Blue as a Chemical Enhancement Technique for Latent Shoeprints." *Journal of Forensic Identification* 62.2 (2012):143-153.
- Lemay, J.; Adams, S.; Stephen, A. "Validation of Vinyl Static Cling Film for the Collection and Preservation of Dust Impressions." *Journal of Forensic Identification* 61.4 (2011): 317-332.
- Battiest, T., Clutter, S. W., & McGill, D. "A Comparison of Various Fixatives for Casting Footwear Impressions in Sand at Crime Scenes." *Journal of Forensic Sciences* 61.3 (2016):782-786.
- Farrugia, K., Bandey, H., Dawson, L. & Nic Daéid, N. "A Comparison of Enhancement Techniques for Footwear Impressions on Dark and Patterned Fabrics." *Journal of Forensic Sciences* 58.6 (2013): 1472–1485.
- Farrugia, K, NicDaéid, N. Savage, K. Bandey, H. "Chemical enhancement of footwear impressions in blood deposited on fabric — Evaluating the use of alginate casting materials followed by chemical enhancement." *Science & Justice* 50 (2010): 200-204.
- Farrugia, K., Savage, K., Bandey, H and NicDaéid, N. "Chemical Enhancement of Footwear Impressions in Blood on Fabric - Part 1: Protein Stains." *Science & Justice* 51 (2011): 99-109.
- Farrugia, K, Savage, K., Bandey, H. Ciuksza, T and NicDaéid, N. "Chemical Enhancement of Footwear Impressions in Blood on Fabric - Part 2: Peroxidase Reagents." *Science & Justice* 51 (2011):110-121.
- Farrugia, K. Savage, K. Bandey, H and NicDaéid, N. "Chemical Enhancement of Footwear Impressions in Blood on Fabric - Part 3: Amino Acid Staining." *Science & Justice* 51 (2011): 122-130.
- Farrugia, K. Bandey, H. Bleay, S and NicDaéid, N. "Chemical enhancement of footwear impressions in urine on fabric". *Forensic Science International* 214 (2011):67-81.
- Au, C., Jaskson-Smith, H., Quinones, I., and Daniel, B. "Wet powder suspensions as an additional technique for the enhancement of bloodied marks." *Forensic Science International* 204.1 (2011): 13-18
- Farrugia, K. J. Bandey, H., Dawson, L. & Nic Daéid, N. "Chemical enhancement of soil based footwear impressions on fabric." *Forensic Science International* 216.1-3 (2012):12-28.

7.4.4 Provide a 10-15 minute presentation focused on the following:

- What is oblique lighting and what is its purpose?
- What does casting an impression capture that a photograph does not?
- When is an electrostatic lifter typically used? Describe the general procedure and some of the safeguards that need to be taken while processing and during storage.
- Discuss alternative dust lifting techniques, including advantages and disadvantages.

7.5 Practical Exercises

Process numerous items to include, but not limited to; hard smooth surfaces, carpeted surfaces, fabric, loose soil, mud, cardboard, and surfaces containing blood impressions, with the appropriate techniques.

7.6 Mode of Evaluation

- 7.6.1 Review of the items processed during the practical exercises to determine if the appropriate techniques were utilized.
- 7.6.2 The presentation will be evaluated on if the trainee accurately and successfully presents the information within the allotted time and successfully answers questions from the audience. See Appendix B for additional criteria.
- 7.6.3 Successful completion of written exam.

8 RECORDING KNOWN STANDARDS

8.1 Purpose

To understand the materials, procedures, methods, and techniques of recording impressions from shoes and tires.

8.2 Objectives

8.2.1 The trainee will be able to:

- Utilize various methods for recording test impressions of known shoes and tires.
- Properly document known impressions, including marking and packaging.
- Follow all procedures to handle evidence potentially contaminated with bloodborne pathogens or other hazards.

8.3 Mode of Instruction

8.3.1 Lecture

- Recording Known Standards
- Attend the Forensic Science Academy class on Impression evidence.

8.3.2 Demonstration

Emphasis is placed on practical hands-on work in this training segment.

8.4 Assignments

8.4.1 Read the following:

- Footwear Evidence, Abbott and Thomas. Chapter 4.
- Footwear Impression Evidence, Second Edition, Bodziak, W. Chapter 8.
- Tire Imprint Evidence, Peter McDonald. Chapter 11.
- Footwear Identification, Cassidy, M. Pages 131-135.
- Forensic Tire Impression Identification, Nause, L. Chapter 6.
- Hilderbrand, W. "Casting Materials: Which One to Use!" Journal of Forensic Identification 45.6 (1995): 618-630.
- Bodziak, W. Hammer, L. "Evaluation of Dental Stone, Traxtone, and Crime-Cast" Journal of Forensic Identification 56.5 (2006):769-787.
- Nause L.A. and Souliere M.P. "Recording a Known Tire Impression from a Suspect Vehicle." Journal of Forensic Identification 58.3 (2008):305-314.
- Lemay, J. "Making Three-Dimensional Footwear Test Impressions with "Bubber"." Journal of Forensic Identification 60.4 (2010):439-448.
- Hueske, E.E. A Superior Method for Obtaining Test Prints from Footwear and Tires. Journal of Forensic Identification 1991, 41 (3), 165-167.
- Jay, D.R. "A Method for Preparing High Resolution Test Impressions for Footwear Comparison." Identification News 23.10 (1983):5.
- Petraco, N.; Resau,, R.; Harris, H. "A Rapid Method for the Preparation of Transparent Footwear Test Prints." Journal of Forensic Sciences 27.4 (1982): 935-937.
- Bodziak, W. "Some Methods for Taking Two-dimensional Standards of Tires." Journal of Forensic Identification 46.6 (1997):

8.5 Practical Exercises

8.5.1 The trainee will record known impressions of at least five pairs of shoes and five tires utilizing the below listed techniques.

8.5.1.1 Chemical (inkless)

8.5.1.2 Printers ink

8.5.1.3 Adhesive sheets and powder

8.5.1.4 Three dimensional (casting)

8.6 Mode of Evaluation

8.6.1 Successful completion of written exam.

8.6.2 Demonstration of obtaining known impressions.

9 PHOTOGRAPHY

9.1 Purpose

To familiarize the trainee with the photography techniques in regards to impression examinations.

9.2 Objectives

9.2.1 Understanding of impression photography to include:

9.2.1.1 Different types of cameras utilized by the section.

9.2.1.2 Lighting techniques (oblique, transmitted, diffused).

9.2.2 Photographic procedures

9.2.2.1 Adjusting exposure settings, including aperture, shutter speed and ISO

9.2.2.2 Use of lenses

9.2.2.3 Use of scales

9.2.3 Photography of chemically developed impressions.

9.2.4 Photography of impressions developed with powder.

9.2.5 To understand the theory and correct procedures for:

9.2.5.1 A depressed (three-dimensional) impression

9.2.5.2 A residue (two-dimensional) impression

9.2.6 Fluorescent photographic techniques

9.2.6.1 Use of filters

9.2.6.2 Use of dye stains

9.3 Modes of Instruction

9.3.1 Lectures

- Exposure / Depth of Field / Focus/ Shutter Speed
- Photographic Theory for the Crime Scene Investigator (VADFS Forensic Training Section)
- Nikon Familiarization (VADFS Forensic Training Section)

9.3.2 Demonstrations

9.4 Assignments

9.4.1 Read the following:

- Loll, A. "Understanding Digital Enhancement Processes." Journal of Forensic Identification 66.1 (2016):3 -12.
- Blitzer, H. Hammer, R. Jacobia, J. "Effect of Photographic Technology on Quality of Examination of Footwear Impressions." Journal of Forensic Identification 65.4 (2015):699-715.

- Brown C., Bryant, T., and Watkins M. D. “The Forensic Application of High Dynamic Range Photography.” *Journal of Forensic Identification* 60.4 (2010):449-459.
- Police Photography, Miller .
- Close-up and Macro Photography for Evidence Technicians, McDonald
- SWGTREAD Guide for the Forensic Documentation & Photography of Footwear and Tire Impressions at the Crime Scene (3/2006).
- SWGIT, General Guidelines for Photographing Footwear and Tire Impressions, 2013.
- SWGIT, Best Practices for Forensic Photographic Comparison (2013).
- Footwear Impression Evidence, 2nd Edition Bodziak, W Chapter 2 and pp. 135-142.
- Tire Tread and Tire Track Evidence Recovery and Forensic Examination, Bodziak, W. pp. 52-67.
- Hamm, E.D. “The Value of Shadow in Footwear and Tire Track Evidence Recovered by Photographic Techniques.” *Journal of Forensic Identification* 38.3 (1988):91-97.
- McBrayer, W.S. “Dust Shoe Prints on Plexi-Glass.” *AFTE Journal* 13.4 (1981):26-28.

9.5 Practical Exercises

Mock evidence will be processed with all techniques listed in the Latent Print Procedures Manual and images of impressions photographed on a variety of surfaces, including, but not limited to those listed below.

- Dust impression on non-porous surface light colored surface.
- Dust impression on non-porous surface dark colored surface.
- Blood impression on non-porous surface.
- Blood impression on carpet.
- Three-dimensional impression in dirt.
- Cast of impression.
- Inked known impression.
- Shoe outsole.
- Tire tread.

9.6 Mode of Evaluation

9.6.1 Written exam

9.6.2 Practical exam

10 COGNITIVE FACTORS IN COMPARATIVE ANALYSIS

10.1 Purpose

To familiarize the trainee with the cognitive process, to have an understanding of how the brain “sees” images and how one’s view can be influenced by outside factors or extraneous information. The trainee will develop an awareness of how the brain affects what is seen and the implications this can have on the decision making process when conducting comparisons.

10.2 Objectives

The trainee will:

- Understand the role the brain plays in the comparative analysis process.
- Develop an awareness of various factors, physical and psychological, that can influence the decision making process when making comparisons.

10.3 Modes of Instruction

10.3.1 Lecture

- Cognitive Factors in Forensic Decision Making

10.4 Assignments

10.4.1 Read the following:

- Dror, I. Charlton, D. “Why Experts Make Errors,” Journal of Forensic Identification 56.4 (2006):600-616.
- Dror, I. “Practical Solutions to Cognitive and Human Factor Challenges in Forensic Science,” Forensic Science Policy & Management 4.3-4 (2013):1- 9.
- Kassin, S. Dror, I. Kukucka, J. “The Forensic Confirmation Bias: Problems, Perspectives, and Proposed Solutions.” Journal of Applied Research in Memory and Cognition 3 (2013):42 -52.
- Kerstholt, J. Eikelboom, A. Dijkman, T. Stoel, R. Hermesen, R. Van Leuven, B. “Does Suggestive Information Cause a Confirmation Bias in Bullet Comparison?” Forensic Science International 198 (2010):138 -142.
- Nickerson, R. “Confirmation Bias: A Ubiquitous Phenomenon in Many Guises,” Review of General Psychology 2.2 (1998):175 -220.

10.4.2 Write a 3-4 page paper explaining how the brain “sees” things, the role of the brain in the comparative analysis process, and factors that can influence the comparison process. Address the potential ramifications of different types of errors and specific steps one can implement into daily work habits that will help prevent negative influences.

10.5 Mode of Evaluation

10.5.1 The paper will be evaluated on the accuracy of the explanations provided. See Appendix B for additional criteria.

10.5.2 Successful completion of written exam.

11 COMPARISON EXAMINATIONS

11.1 Purpose

To provide the trainee with an understanding of the scientific methodology and its application to impression examinations, and the ability to evaluate an impression to determine its potential for comparison to known shoes or tires.

11.2 Objectives

The trainee will be able to:

- Prepare questioned and known impressions for comparative examinations.
- Understand the importance and need for comparative standards.
- Prepare transparent, opaque two-dimensional and three-dimensional comparative standards.
- Conduct side-by-side and superimposition examination methods.
- Identify class characteristics (outsole or tread design, size and general wear) and how they may be utilized in the comparison process.
- Identify individual characteristics and how they are utilized in the comparison process.
- Identify color reversals (entire impression) and changes (within the same impression) and the ability to properly analyze these occurrences.
- Understand the effects of distortion, slippage, overlays, pre and post deposit artifacts (surface scratches, soil, brush strokes, etc.) and the ability to properly document such disturbances or distortions.
- Recognize consecutive footwear impressions and simultaneous tire impressions of different design and an understanding of their value for identification.
- Understand of the necessity for verification.
- Render proper conclusions including identification, association and exclusion.
- Document all conclusions according to policy and procedure.
- Articulate how the conclusion decision is reached.
- Understand that different policies and standards exist regarding what constitutes impression identifications in the US and other countries.
- Understand why no minimum number of characteristics can be defined to effect an identification (i.e. positive opinion based on personal empirical experience in examining and comparison impressions)

11.3 Mode of Instruction

11.3.1 Lectures

11.3.2 Demonstration

- 11.3.2.1 The trainee should observe experienced examiners conducting comparisons. The purpose of this observation is for the trainee to obtain knowledge regarding an efficient workflow to accurately conduct and document impression comparisons.
- 11.3.2.2 The trainee should be observed by experienced examiners conducting comparisons. Feedback should be given to the trainee during this process.

11.4 Assignments

11.4.1 Read the following:

- LeMay, J. "Accidental Characteristics in a Footwear Outsole Caused by Incomplete Blending of Fillers in the Outsole Rubber." *Journal of Forensic Identification* 63.5 (2013):525-530.
- Hammer, L., Duffy, K., Fraser, J Nic Daeid, N. "A Study of the Variability in Footwear Impression Comparison Conclusions." *Journal of Forensic Identification* 63.2 (2013):205-218.
- Wilson, H. "Comparison of the Individual Characteristics in the Outsoles of Thirty-Nine Pairs of Adidas Supernova Classic Shoes." *Journal of Forensic Identification* 62.3(2012):194-203.
- Bodziak, W.; Hammer, L.; Johnson, G.; Schenck, R. "Determining the Significance of Outsole Wear Characteristics During the Forensic Examination of Footwear Impression Evidence." *Journal of Forensic Identification* 62.3 (2012):254-276.
- LeMay, J. "If the Shoe Fits: An Illustration of the Relevance of Footwear Impression Evidence and Comparisons." *Journal of Forensic Identification* 60.3 (2010):352-356.
- Adair, T. W. Lemay, J. McDonald, A. Shaw, R. Tewes, R. "The Mount Bierstadt Study: An Experiment in Unique Damage Formation in Footwear." *Journal of Forensic Identification* 57.2 (2007):199-205.
- Petraco N.D.K. Gambino C. Kubic T.A. Olivio D. Petraco N. "Statistical Discrimination of Footwear: A Method for the Comparison of Accidentals on Shoe Outsoles Inspired by Facial Recognition Techniques." *Journal of Forensic Science* 55.1 (2010):34-41.
- Sheetsa, H. D. Gross, S. Langenburg, G. Bush, P. J. Bush, M. A. "Shape measurement tools in footwear analysis: A statistical investigation of accidental characteristics over time." *Forensic Science International* 232.1-3 (2013): 84-91.
- Skerrett, J. Neumann C. Mateos-Garcia, I. "A Bayesian approach for interpreting shoemark evidence in forensic casework: Accounting for wear features." *Forensic Science International* 210.1-3 (2011):26-30.
- Stone, R. "Footwear Examinations, Mathematical Probabilities of Theoretical Individual Characteristics." *Journal of Forensic Identification* 56.4 (2006):577-599.
- http://treadforensics.com/images/swgtread/standards/current/swgtread_10_conclusions_range_201303.pdf
- Fruchtenicht, T.L. Herzig, W.P. Blackledge, R.D. "The Discrimination of Two-Dimensional Military Boot Impressions Based on Wear Patterns." *Journal of Forensic Identification* 42.2 (2002):97-104.
- Wyatt, J.M. Duncan, K Trimpe, M.A. "Aging of Shoes and its Effect on Shoeprint Impressions." *Journal of Forensic Identification* 55.2 (2005):181-188.
- Richetelli, N. Nobel, M. Bodziak, W. Speir, J. "Quantitative assessment of similarity between randomly acquired characteristics on high quality exemplars and crime scene impressions via analysis of feature size and shape." *Forensic Science International* 270 (2017): 211-222.

11.4.2 Compare at least 25 impressions developed from the development processing practical exercises and seek feedback from the TC or designee. Complete examination documentation should be completed for each comparison.

11.4.3 Compare 25 impressions obtained from actual casework and seek feedback from the TC or designee. Complete examination documentation should be completed for each comparison.

11.4.4 Complete at least 10 cases under the direct supervision of the TC or designee.

11.4.5 Provide a 15-20 minute presentation, to an audience that should include the TC and the section supervisor, discussing the following topics:

- Explain a class association and provide an example.
- Explain distortion as it applies to impressions and provide possible causes.
- Define each level of association.
- Discuss how the time line between incident and recovery of a known item can affect a comparison or conclusion.
- Give an example of a conclusion statement where a correspondence of class characteristics is present but a difference in wear is observed.

11.5 Practical Exercises

11.5.1 Complete comparison packets 1 through 20. Examination documentation should be completed for each comparison.

11.6 Mode of Evaluation

11.6.1 The presentation will be evaluated on if the trainee accurately and successfully presents the information within the allotted time and successfully answers questions from the audience. See Appendix B for additional criteria.

12 TESTIMONY

12.1 Purpose

Upon completion of this section the trainee will possess the knowledge and understanding of the legal aspects of forensic identification as it pertains to shoe and tire impression evidence and be able to effectively present expert testimony.

12.2 Objectives

- 12.2.1 To familiarize the trainee with the functions of a courtroom criminal proceeding.
- 12.2.2 To have the trainee prepare a current curriculum vitae and convey *voir dire* questioning during testimony.
- 12.2.3 To familiarize the trainee with proper methods for presenting expert testimony.

12.3 Mode of Instruction

- 12.3.1 Lecture
 - Expert Witness Testimony presentation
- 12.3.2 Observation of expert testimony

12.4 Assignments

- 12.4.1 Read the following:
 - Izraeli, E. S., Wiesner, S. Shor, Y. "Computer-Aided Courtroom Presentation of Shoeprint Comparison." *Journal of Forensic Identification* 61.1 (2011): 549-559.
 - Tire Tread and Tire Track Evidence Recovery and Forensic Examination, Bodziak, W. Chapter 11
 - Footwear Impression Evidence, Bodziak, W. Chapter 12
 - Footwear, The Missed Evidence Hilderbrand, D. Chapter 7
- 12.4.2 Completion of curriculum vitae.
- 12.4.3 Provide a presentation to the TC and the PM focused on how the discipline meets the challenges (prongs) of Daubert and Virginia's admissibility standards.
- 12.4.4 Provide a presentation to the TC and the PM focused on how the Department addresses the challenges of the 2009 NAS report and the issues specific to the discipline discussed in the 2016 PCAST report *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature Comparison Methods*.
- 12.4.5 Provide written responses to the following questions:
 - Describe the role of the following during a trial:
 - Expert witness
 - Judge
 - Prosecutor
 - Defendant
 - Defense counsel
 - Jury
 - Define the following:
 - *Voir Dire*

- Direct Examination
 - Cross Examination
 - Redirect
 - Chain of Custody
 - Objection
 - Sustained
 - Overruled
- Describe the characteristics of an effective expert witness (i.e. appearance, speech, non-verbal communication, etc.).
 - Describe the accreditation process and the benefits of being an accredited laboratory.

12.5 Practical Exercises

12.5.1 Participate in at least one mini-mock trial with the TC focusing on the following aspects of testimony:

- *Voir Dire*
- Chain of Custody
- ACE-V methodology
- Sufficiency
- Scientific certainty
- Bias
- Error rate

Additional sessions may be necessary if deemed appropriate by the TC. This mini-mock is intended to be one-on-one training with the trainee and TC in order to gain practice in verbalizing concepts and to identify areas that may need to be refined prior to the final mock trial.

12.5.2 Conduct at least one mini-mock trial which will encompass all aspects of a potential trial setting.

12.5.3 Provide verbal responses to following questions:

- What is your name?
- What is your occupation? For whom do you work?
- How long have you been so employed?
- What are your duties in this occupation?
- What education and training do you possess that qualifies you to perform your duties?
- What specific courses have you taken that are directly related to impression comparisons?
- Do you consider yourself an expert in shoe and tire impression comparison?
- What is the definition of an expert witness?
- Is the university/college you graduated from accredited, and if so, by whom?
- Who conducted your training?
- What are their qualifications?
- Are you certified? If not why?
- What literature do you read relating to your job?
- How many shoe or tire impression comparisons have you performed?
- Do you belong to any professional organizations?
- Explain the examination and comparison process.
- What is the error rate of the impression comparison discipline?
- What are the factors affecting the development of a shoe or tire impression?

12.6 Mode of Evaluation

12.6.1 Mini-mock trials and responses to qualifying questions will be used to evaluate the candidate's ability to

clearly articulate his/her qualifications, to clearly explain aspects of testimony listed in 12.5.1 and to present and defend the practical test results in a manner that meets the Department testimony standards. See Appendix B for additional criteria.

- 12.6.2 Successful completion of a final mock trial (as defined in the QM final competency testing requirements).

13 REFERENCES

Bodziak, W (1990) Footwear Impression Evidence. Boca Raton: CRC Press

Bodziak, W. (2016) Forensic Footwear Evidence. Boca Raton: CRC Press

Cassidy, M (1980) Footwear Identification. Public Relations Branch of the Royal Canadian Mounted Police

McDonald, P (1992) Tire Imprint Evidence. Boca Raton: CRC Press

Lemay, J. (2009) The Complete Forensic Footwear & Tire Track Examiners Dictionary. Greeley: Weld County Sheriff's Office

Virginia Department of Forensic Science Quality Manual

Virginia Department of Forensic Science Impressions – Footwear and Tire Tread Procedures Manual

ISO/IEC 17025:2017

Appendix A - Individual Training Plan (ITP) Template

For each section listed below include the following information:

- List previous documented training received
- Provide detailed plan, including assignments, exercises, exams and presentations to be completed with dates, for each section.

The objectives listed in the Impressions – Footwear and Tire Tread Training Manual should be used as a guide for questions during the assessment to determine the individual's knowledge level.

History and Legal Aspects

Terminology

Manufacturing Processes for Footwear and Tires

Footwear and Tire Impression Examinations

Quality Assurance and Quality Control

Development and Recovery Techniques

Recording Known Impressions

Photography

Cognitive Factors in Comparative Analysis

Comparison Examinations

Testimony

The expected completion of this training plan is _____.

Appendix B - Presentation & Paper Evaluation Criteria**Presentations**

Trainee	
Appearance	
Presentation:	
Introduction	
Organization	
Graphics	
Typos	
Succinct	
Accuracy	
Presenter:	
Eye Contact	
Use of fillers	

Comments:

Paper

Introduction	
Content	
Grammar	
Typos	
Professional Nomenclature	
Organization	
Conclusion	
Bibliography/References	
Use of tables, pictures, etc.	

Appendix C - Guidelines for Practical Finals

Final Comparison Packet

Contains three unknowns and two sets of knowns, which have been previously vetted and agreed upon by the Impressions Technical Resource Team.

Practical Impression Photography Competency

- Consists of the following items:
 - Gel lift
 - Shoe
 - Tire
 - Cast of shoe impression
 - Developed impression on fabric
 - ESDL