



**Latent Print Section**  
**Analysis, Comparison, Evaluation and Verification**  
**Methodology**  
Forensic Analysis Division



## 1. Analysis, Comparison, Evaluation, and Verification

### 1.1 Scope

- 1.1.1 This procedure details the examination of friction ridge skin impressions and applies to all Latent Print Examiners assigned to the Latent Print Unit of the Houston Forensic Science Center (HFSC).
- 1.1.2 The two basic scientific premises forming the foundation of the use of friction ridge impressions as a means of identification are permanence and individuality. That is, that the fingerprints of no two individuals are the same and they remain unchanged, barring any damage to the dermal layer of skin, from after embryonic development until after death. The fundamental principles of persistence and uniqueness have been founded through the study of the biological sciences for over a century.

### 1.2 Methodology

- 1.2.1 Friction ridge impression examinations are conducted by examiners, trained to competency, using the Analysis, Comparison, Evaluation, and Verification (ACE-V) methodology, which includes both qualitative and quantitative aspects. Application of ACE includes observations, measurements, assessments, decision-making, and documentation, which are enabled by the training, skill, and experience of the examiner. The application of "V" or Verification phase requires a second trained examiner to apply the ACE process in order to agree or disagree with the original examiner's conclusion.
- 1.2.2 There are three levels of detail that may be present within the friction ridge impressions that are used for the application of ACE:
- 1.2.2.1 Level 1 Detail:
- Overall ridge flow that includes the pattern type (loop, arch, whorl).
  - Major creases.
  - Anatomical source such as finger, palm, foot.
  - Orientation.
  - **Cannot be used alone for identification.**
- 1.2.2.2 Level 2 Detail:
- Individual characteristics or ridge path deviation to include formations defined as ridge endings, bifurcations, dots or combinations thereof.
  - Absence of ridge path deviations (i.e. continuous ridge).
  - **Used in conjunction with Level 1 detail can be used for identification as well as exclusion.**
- 1.2.2.3 Level 3 Detail:
- The unique shape, size, and position of pores (Poroscopy).



- Edges of the ridges (Edgeoscopy) to include dimensional attributes of a ridge, such as ridge path, deviation, width, and shape.
- Any fine creases.
- Incipient ridges.
- Scars.
- **Cannot be used exclusively for identification but can be used in conjunction with Level 1 and Level 2 details for identification and exclusion.**

### 1.3. Procedure

#### 1.3.1. Analysis

1.3.1.1. During the Analysis phase, the overall latent print is analyzed to determine if it is suitable for comparison. The following factors are considered when performing analysis and suitability:

- 1.3.1.1.1. The quantity of the latent print present is observed to determine how much of the friction ridge area is reproduced.
- 1.3.1.1.2. The quality of the latent print is analyzed by looking at factors such as clarity, contrast, downward pressure, lateral pressure, slippage, background noise, and focal points.
- 1.3.1.1.3. Orientation of the latent print is determined if possible.
- 1.3.1.1.4. A determination of “suitable” by an examiner indicates that there is sufficient quality and quantity of unique details present in the impression such that, when compared to another impression, a conclusion can be reached.
- 1.3.1.1.5. If the impression lacks sufficient detail to reach the conclusion of suitable for comparison, the print is determined to be of no value for comparison purposes.
- 1.3.1.1.6. Analysis is conducted on all friction ridge impressions regardless of whether comparisons will be made.
- 1.3.1.1.7. **In order for a HFSC Latent Print Examiner to determine a friction ridge impression is suitable for comparison, the impression MUST contain a minimum of eight (8) level two characteristics, positioned in sequence with no unexplainable breaks or vacant areas that prevents a continuous transition to the next characteristic.**

#### 1.3.2. Comparison



- 1.3.2.1. During the comparison phase, a direct side-by-side comparison is conducted of two or more impressions to determine the existence of discrepancies, dissimilarities, or similarities.
- 1.3.2.2. This phase progresses systematically and sequentially until all available ridge detail has been compared, events shared by both impressions are accounted for, characteristics occupy the same relative spatial relationship, and any differences can be explained, i.e. distortion, slippage, background noise.

### **1.3.3. Evaluation**

1.3.3.1 The evaluation phase is the formulation of a conclusion based on the analysis and comparison. It must be determined whether the information observed in the phases above is sufficient to form one of the three conclusions or return to the analysis phase and reassess suitability. It is during the evaluation phase that the examiner assesses the value of the ridge detail observed during the analysis and the comparison steps and reaches a conclusion. There are **four** possible conclusions Latent Print Examiners of the Latent Print Section of HFSC can reach:

- 1.3.3.1.1 **Identification** - An identification is the determination by a qualified examiner that two friction ridge impressions originated from the same source due to sufficient quality and quantity of corresponding information such that the examiner would not expect to see that same arrangement of features repeated in a print from another source.
- 1.3.3.1.2 **Exclusion** - The conclusion of exclusion is the decision by the examiner that the impressions compared had sufficient features in disagreement to conclude that the impressions did not originate from the same source.
- 1.3.3.1.3 **Inconclusive** - The conclusion of inconclusive can be used under two (2) circumstances based on observations from the examiner:
  - 1.3.3.1.3.1 A result of incomplete or unclear record finger, palm, or foot prints (lack of area of detail needed in the records to compare to the latent print or record prints are of poor quality such as over inking, distortion, etc.)
  - 1.3.3.1.3.2 Conclusion reached when the latent print has corresponding features, in sequence, but lacks sufficiency to identify. Can also apply in conjunction with the previous having dissimilar features but not enough to exclude as being from the same source.



1.3.3.1.4 **Preliminary Association** – This conclusion is used only as a result of a Preliminary AFIS Association and reported as an investigative lead only. (See FAD-LP-AFIS Operations)

1.3.3.1.4.1 A Preliminary Association is the result of searching an image of a latent print impression in AFIS and the conclusion is reached, based on comparing the returned candidate records onscreen, that the two friction ridge impressions have corresponding characteristics contained within that are sufficient to conclude they **MAY** have originated from the same source.

1.3.3.1.4.2 Official identifications are **NEVER** reported from Preliminary AFIS Association results alone.

#### **1.3.4. Verification**

1.3.3.2 The independent application of the ACE process is utilized by a subsequent examiner to either support or refute the conclusion of the original examiner.

1.3.3.3 All identifications, exclusions, inconclusive, and preliminary association conclusions declared by the original examiner will be confirmed or refuted by a second examiner.

1.3.3.4 The Latent Print Examiner will submit the original image and record prints to the verifying examiner through proper transfer of custody when dealing with physical evidence (i.e. latent lifts) or through secure electronic means when verifying identifications that are documented utilizing digital imaging.

1.3.3.5 Verifications of Preliminary AFIS Associations are conducted as outlined in the FAD-LP-AFIS Operations SOP.

1.3.3.6 All verifications must be conducted prior to sending the case to Technical/Administrative review. Additionally, verifications must be conducted prior to issuing any conclusions of identifications to a submitter as part of a preliminary report.

#### **1.4. Consultation between Examiners**

1.4.1. During normal casework, examiners may consult with other examiners when applying the ACE methodology. Refer to the **FAD-LP-Conflict Resolution and Consultation** for further information.

#### **1.5. Conflict Resolution**

1.5.1. Conflict resolution will be initiated if the verifying examiner contests the examiner's conclusion. This procedure is outlined in **FAD-LP- Conflict Resolution and Consultation**.



## **1.6. Erroneous Conclusions in Friction Skin ACE**

### **1.6.1. Erroneous Identification**

- 1.6.1.1. An Erroneous Identification occurs when an identification has been declared and it is determined that the friction ridge impression did not originate from the same source.
- 1.6.1.2. An Erroneous Identification is considered the most serious error a latent print examiner can make.
- 1.6.1.3. An erroneous verification of an Erroneous Identification is considered an Erroneous Identification.
- 1.6.1.4. When an Erroneous Identification occurs, the primary concern is to conduct an immediate assessment to determine the extent of the situation and impact on the customer.
- 1.6.1.5. Immediate action must be taken to ensure corrections are made and the comparisons in question are completely re-examined. A corrected report will be issued and the customer/affected parties notified of the correction if a final report has been issued.
- 1.6.1.6. If an Erroneous Identification occurs, the Quality Director will be notified, regardless if a final report has been issued.

### **1.6.2. Missed Identifications**

- 1.6.2.1. If a laboratory report is issued and it is determined that an examiner has failed to make an identification when in fact both friction ridge impressions are from the same source then a Missed Identification has occurred.
- 1.6.2.2. **Missed Identifications are an inevitable aspect of latent print examinations.** When a Missed Identification occurs, the primary concern is to conduct an immediate assessment to determine the extent of the situation and impact on the customer. Immediate action must be taken to ensure corrections are made, a corrected report is generated and the customer/affected parties are notified of the correction if a final report has been issued.
- 1.6.2.3. If a Missed Identification occurs, the Quality Director will be notified if a final report has been issued.

### **1.6.3. Erroneous Exclusions**

- 1.6.3.1 An Erroneous Exclusion occurs when an examiner incorrectly determines that two impressions of friction skin did not originate from the same source and it is later determined that the impressions are from the same source.
- 1.6.3.2 When an Erroneous Exclusion occurs, the primary concern is to conduct an immediate assessment to determine the extent of the situation and impact on the customer.



1.6.3.3 Immediate action must be taken to ensure corrections are made, a corrected report is generated and the customer/affected parties are notified of the correction if a final report has been issued.

1.6.3.4 If an Erroneous Exclusion occurs, the Quality Director will be notified if a final report has been generated.

#### **1.6.4. Preliminary AFIS Associations**

1.6.4.1. **If a confirmatory comparison and verification of a released preliminary association report is requested and upon a full official confirmatory comparison it is determined that the friction ridge impression did not originate from the same source, this does not constitute an error. The preliminary AFIS Association Reports are generated as investigative leads only and never indicate an official identification has been effected.**

1.6.4.1.1. It is recognized that performing on-screen comparisons utilizing AFIS search software does not offer the examiner nor the verifying examiner the full capacity to declare that an official identification has been effected. Potential loss of quality due to compression of the image(s), monitor resolutions, capture resolutions, limited enhancement tools, etc. are all possible utilizing various AFIS software comparison tools.

1.6.4.1.2. As a presumptive examination, it is recognized that due to the factors stated above, although rare, false positive AFIS Associations may be discovered upon performing an official confirmatory examination with the original latent images and record finger and/or palm prints.

#### **1.6.5. Administrative Errors**

1.6.5.1. Administrative Errors are considered non-technical and include transcription and typographical errors. (Example: Improper spelling of names of individuals in final reports; improper reporting of fingers(s) identified i.e. Right Middle instead of Left Middle).

1.6.5.2. When an Administrative Error occurs, the primary concern is to conduct an immediate assessment to determine the extent of the situation and impact on the customer. Immediate action must be taken to ensure corrections are made, a corrected report is generated and the customer/affected parties are notified of the correction if a final report has been issued.

### **1.7. Quality Assurance/Quality Control**

#### **1.7.1. Technical Review/Administrative Review (TR/AR)**



1.7.1.1. A TR/AR will be performed on all casework before the final report is released.  
Procedures and documentation are found in **FAD-LP-TR/AR**  
**Technical/Administrative Review Standard Operating Procedures.**

### **1.7.2. Quality Control/Quality Assurance Review**

1.7.2.1. Random sampling (a minimum of one completed case per examiner) of the Latent Print Section's overall case output will be reviewed on a monthly basis by the Section Manager or his/her designee to ensure Technical Review/Administrative Review procedures are being followed.

### **1.8. References**

SWGFAST, *Document #16 Standard for the Technical Review of Friction Ridge Examinations (Latent/Tenprint)* 11/16/12 Ver. 2.0

SWGFAST, *Document #7 Standard for a Quality Assurance Program in Friction Ridge Examinations (Latent/Tenprint)* 9/11/12 Ver. 5.0

SWGFAST, *Document #8 Standard for the Documentation of Analysis, Comparison, Evaluation, and Verification (ACE-V)* 9/11/12 Ver 2.0

SWGFAST, *Document #10 Standards for Examining Friction Ridge Impressions and Resulting Conclusions (Latent/Tenprint)* 3/13/13 Ver. 2.0

Defense Forensic Science Center, *CILA LP 11.0 Analysis, Comparison, Evaluation and Verification Methodology* 11 March 2014

Langenburg, G., (2009) *A Performance Study of the ACE-V Process: A Pilot Study to Measure the Accuracy, Precision, Reproducibility, Repeatability, and Biasability of Conclusions Resulting from the ACE-V Process*, *Journal of Forensic Identification* 59(2): 219-257.

Ashbaugh, D.R., (1999) *Quantitative-Qualitative Friction Ridge Analysis*, CRC Press.

Pacheo, I; Cerchiai, B; and Stoiloff, S., (2014) *Miami-Dade Research Study for the Reliability of the ACE-V Process: Accuracy & Precision in Latent Fingerprint Examinations*, NIJ Report (Award 2010-DN-BX-K268)

Ulery, B.T.; Hicklin, R.A., Roberts, A.R.; Buscalia, J., (2014) *Measuring What Latent Fingerprint Examiners Consider Sufficient Information for Individualization Determinations*, *PLOS ONE* (DOI: 10.1371/journal.pone.0110179)





Swofford, H.; Steffan, S.; Warner, G.; Bridge, C.; Salyards, J.; (2013) *Impact of Minutiae Quantity on the Behavior and Performance of Latent Print Examiners*, Journal of Forensic Identification 63 (5), 2013 pg. 571.

Langenburg, G.; Champod, C.; Genessay, T.; (2012) *Informing the Judgments of Fingerprint Analysts Using Quality Metric and Statistical Assessment Tools*, Forensic Science International 219 (2012) 183 - 198

SWGFAST, *Document #12 Standard Friction Ridge Automation Training (Latent/Tenprint)* 11/14/12 Ver 2.0

SWGFAST, *Document #101 Limited Examination Considerations for Latent Print Sections (Latent) Position Statement* 09/11/12 Ver 1.0

Ulery, B; Hicklin, R. A.; Buscaglia, J.; Roberts, M.A.; (2011) *Accuracy and Reliability of Forensic Latent Fingerprint Decisions*, PNAS May 10, 2011, Vol. 108, No. 19, 7733-7738.