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## Standard for Friction Ridge Examination Conclusions



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## Foreword

This standard practice for friction ridge examination conclusions defines the conclusions to be reported following the examination of friction ridge impressions. This document establishes the use of these five conclusions: Source Exclusion, Support for Different Sources, Inconclusive/ Lacking Support, Support for Same Source, and Source Identification. In reaching a conclusion, an examiner assesses the support that the observations offer for whether the two friction ridge impressions originated from the same source or from different sources.

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

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**Keywords:** *fingerprint, friction ridge, conclusions, decisions, expert opinions*

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# Standard for Friction Ridge Examination Conclusions

## 1 Scope

This standard defines terms and establishes qualitative expressions for the categories of conclusions that may be reached following friction ridge comparisons.

For the purpose of this document, conclusions are defined as expert opinions based on the friction ridge detail and information under observation and interpreted using acquired knowledge, skill, and experience of a friction ridge examiner.

This standard does not cover the following topics:

- conclusions derived directly from and entirely dependent upon validated probability models or quantitative processes;
- the manner by which examiners arrive at their assessments of the strength or weight of the findings with respect to the source of the questioned impression;
- suitability determinations rendered on a friction ridge impression;
- documentation of conclusions;
- how an agency or other forensic service provider (FSP) will define or validate the criteria used for selecting source conclusions.

## 2 Normative References

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

## 3 Terms and Definitions

For purposes of this document, the following definitions apply.

### 3.1

#### **conclusions**

#### **source conclusions**

Statements expressed as opinion and made by an examiner after interpretation of observed data. These statements may offer support for one proposition over another. Examiners may offer one of the following conclusions: Source Exclusion (EXC), Support for Different Source (SDS), Inconclusive (INC), Support for Same Source (SSS), or Source Identification (ID).

### 3.2

#### **correspondence**

Observation of pattern type, ridge flow, friction ridge features in sequence, of the same or similar type, in similar relative positions to each other, and/or with the same associated intervening ridge counts. An accumulation of similarities between two impressions resulting in overall conformity.

**3.3  
disagreement**

A single dissimilarity that is deemed to be outside of expected variations in the appearance of impressions from the same source or an accumulation of dissimilarities between two impressions resulting in overall nonconformity.

**3.4  
examination**

Act or process of observing, searching, detecting, recording, prioritizing, collecting, analyzing, measuring, comparing and/or interpreting.

**3.5  
dissimilarity**

An observation that two impressions have a general difference of appearance when comparing an individual feature or detail. Not to be confused with disagreement.

**3.6  
forensic service provider  
FSP**

Organization or individual that conducts and/or supplies forensic services.

**3.7  
friction ridge detail  
friction ridge features**

The combination of ridge flow, ridge characteristics, and ridge structure of friction ridge skin, as observed and reproduced in an impression. The observed data used to compare and interpret similarity or dissimilarity between two impressions. Examples may include 1st Level detail, 2nd Level detail, 3rd Level detail, macroscopic information, microscopic information.

**3.8  
friction ridge skin**

The skin found on the palms of the hands and soles of the feet.

**3.9  
impression (friction ridge impression)**

A reproduction of an area of friction ridge skin produced on a substrate by contact or transfer. Impressions may be referred to as latent/questioned(unknown) impressions, or exemplar(known) impressions (refer to those definitions for further clarification).

**3.10  
inconclusive  
INC**

Is the conclusion that the observed data does not provide a sufficient degree of support for one proposition over the other.

**3.11  
latent/questioned impression (latent or unknown)**

An impression from an unknown source of friction ridge skin, usually deposited on a substrate unintentionally. Typically latent impressions are not readily visible and may be developed or enhanced by optical, physical, and/or chemical processing techniques.

**3.12****exemplar impression (exemplar or known)**

The deliberately recorded images or impressions from the friction ridge skin of an individual. Examples may include but are not limited to inked tenprints, inked palm prints, Livescan prints, powder and lift prints, mikrosil, or photographs of friction ridge skin.

**3.13****livescan impression (exemplar or known)**

An inkless, electronic means of capturing impressions from the friction ridge skin of an individual associated with a known source or claimed identity in a digital format.

**3.14****interpretation**

Use of professional judgement to provide conclusions and/or opinions on hypotheses/propositions, based on observed data and information gathered through the forensic process

**3.15****observed data**

Any demonstrable information seen within an impression that an examiner relies upon to reach a decision, conclusion, or opinion. This not only includes minutiae, but characteristics such as quality, scars, creases, edge shapes, pore structure, and other friction ridge features.

**3.16****probability**

Probability is an expression of the chance that a particular event occurs. Probability estimates can be calculated using an appropriate model or assigned by considering a subjective assessment that is based upon observations interpreted using the examiner's experience.

**3.17****propositions**

Propositions (hypotheses) are statements about the state of nature. Propositions are often framed in pairs with the goal of choosing between them. For that purpose, propositions have to be mutually exclusive, meaning that one can be true, the other can be true, or neither can be true and that the evidence logically only should be able to support one of the propositions (unless exactly equivocal). In addition, it is a best practice to use exhaustive propositions, meaning that one of the propositions must be true.

For example, two mutually exclusive and exhaustive propositions are that person X is the source of the latent print (H1) and that person X is not the source (H2).

**3.18****similarity**

An observation that two impressions share a general likeness when comparing an individual feature or detail. Not to be confused with correspondence.

**3.19****source**

The area of friction ridge skin from an individual.

### **3.20 source exclusion**

#### **EXC**

The conclusion that the observed data provide substantially stronger support that the two impressions originated from different sources rather than the same source. There is a strong disagreement present such that the examiner would not expect to see that level of disagreement in an impression from the same source.

### **3.21 source identification**

#### **ID**

Source identification is the conclusion that the observed data provides substantially stronger support that the two impressions originated from the same source rather than different sources. There is strong correspondence present such that the examiner would not expect to see the same arrangement of details repeated in an impression from another source.

### **3.22 substrate**

Surface or material upon which a substance is deposited

### **3.23 support for different sources**

#### **SDS**

Support for different sources is the conclusion that the observed data provides more support for the proposition that the impressions originated from different sources rather than the same source; however, there is insufficient support for a source Exclusion. There are observed dissimilarities between the impressions and a lack of correspondence present. The degree of support may range from limited to strong or similar descriptors of the degree of support.

### **3.24 support for same source**

#### **SSS**

Support for same source is the conclusion that the observed data provides more support for the proposition that the impressions originated from the same source rather than different sources; however, there is insufficient support for a Source Identification. There are observed similarities between the impressions and some correspondence present, however the examiner may also expect to see similar correspondence in another source. The degree of support may range from limited to strong or similar descriptors of the degree of support.

## **4 Source Conclusions**

### **4.1 General**

While it may be ideal to report conclusions in terms of the weight of the evidence alone, this document instead defines a categorical reporting framework.

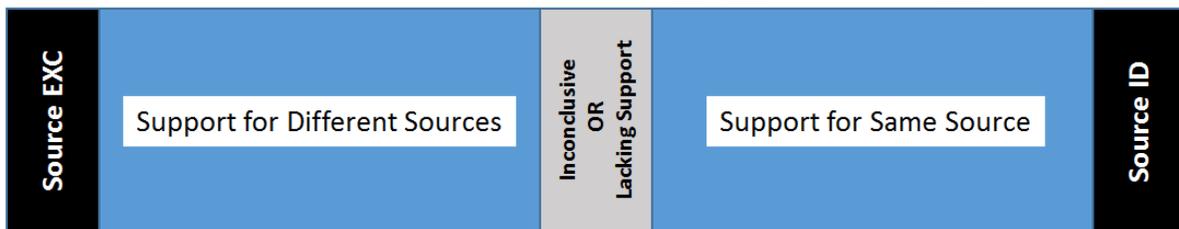
This section establishes the conclusions an examiner may reach when comparing two friction ridge impressions. In reaching a conclusion, an examiner considers the observed similarities and dissimilarities and assesses the relative support of the observations under the following two propositions: the two impressions originated from the same source or from different sources.

Similarities generally provide support for the proposition that two impressions originated from the same source, while dissimilarities generally provide support for the proposition that two impressions originated from different sources.

An examiner may utilize their knowledge, training, and experience as well as statistical or probabilistic systems to evaluate how much support the observed similarities or dissimilarities provide for one proposition over another. A conclusion shall be expressed as an opinion, not as a fact, because it is an interpretation of observed data made by the examiner.

This document defines the five conclusions that may be selected by examiners when reaching a conclusion after comparing friction ridge impressions. The FSP shall only select one of these conclusions, and only as written and described in 4.2 through 4.6.

Each one of these “slices” or delineations between the categories is as a result of a threshold being used or interpreted either by the examiner or by some probabilistic model.



**Figure 1—Graphical Representation of Source Conclusions**

#### **4.2 Source Exclusion**

Source exclusion is the conclusion that the observed data provide substantially stronger support that the two impressions originated from different sources rather than the same source. There is a strong disagreement present such that the examiner would not expect to see that level of disagreement in an impression from the same source.

If an examiner is not excluding all the friction ridge detail of an individual it should be so stated and a conclusion of inconclusive may be more appropriate, for example the feet of an individual.

#### **4.3 Support for Different Sources**

Support for different sources is the conclusion that the observed data provides more support for the proposition that the impressions originated from different sources rather than the same source; however, there is insufficient support for a source exclusion. There are observed dissimilarities between the impressions and a lack of correspondence present. The degree of support may range from limited to strong or similar descriptors of the degree of support. Any use of this conclusion shall include a statement of the degree of support and the factor(s) limiting a stronger conclusion. (See Annex A, Section Support for Different Source).

#### **4.4 Inconclusive**

Inconclusive is the conclusion that the observed data does not provide a sufficient degree of support for one proposition over the other. Any use of this conclusion shall include a statement of the factor(s) limiting other conclusions.

#### **4.5 Support for Same Source**

Support for same source is the conclusion that the observed data provides more support for the proposition that the impressions originated from the same source rather than different sources; however, there is insufficient support for a source identification. There are observed similarities between the impressions and some correspondence present, however the examiner may also expect to see similar correspondence in another source. The degree of support may range from limited to strong or similar descriptors of the degree of support. Any use of this conclusion shall include a statement of the degree of support and the factor(s) limiting a stronger conclusion.

#### **4.6 Source Identification**

Source identification is the conclusion that the observed data provides substantially stronger support that the two impressions originated from the same source rather than different sources. There is strong correspondence present such that the examiner would not expect to see the same arrangement of details repeated in an impression from another source.

NOTE Source identification does not correspond to the meaning of identification used historically in the discipline.

### **5 Qualifications and Limitations**

When one of the five conclusions is reached the following qualifications and limitations are also held in concert with these conclusions and shall be included.

- An examiner shall not assert that two impressions were made by the same source or imply an individualization to the exclusion of all other sources.
- An examiner shall not use certainty as an expression of accuracy.
- An examiner shall not assert or imply that friction ridge examinations are infallible or have a zero error rate.
- An examiner shall not cite the number of friction ridge comparisons performed in his or her career as a measure for the accuracy of a conclusion offered in the case at hand.
- An examiner shall not use the expression ‘reasonable degree of scientific certainty’ or similar assertions as a description of the confidence held in his or her conclusion.
- Whenever categorical conclusions or “bins” are used there will be a threshold for those bins and a subjective decision is made as to what side of the threshold the decision lies.
- Likewise there might also be sub bins within the category as not all conclusions are considered the same. (e.g., basic/advanced/complex source identifications (complexity of comparisons).

## Annex A (informative)

### Examples

The following examples are informative, not an exhaustive list of all possible comparisons.

**Source Exclusion (section 4.2)** For example:



— The unknown friction ridge impression is a clear whorl pattern with a distinctive core and no distortion or interpretation issues noted. The exemplars utilized for comparison of this source contained no whorl type patterns, and I therefore concluded that the impression could not have been left by the source being compared.

(i.e., Substantial disagreement observed with high clarity level 1 detail, evidence is in support for Source EXC.)



— I was highly confident of the orientation and likely area of the anatomical source as I observed an anchor point and three clear and distinct features above the core. These were not observed in the corresponding area of the exemplars utilized for comparison, and I therefore concluded that the impression could not have been left by the source being compared.

(i.e., Substantial disagreement observed, evidence is in support for Source EXC.)

**Support for Different Sources (section 4.3):** For example:



— Two ambiguous features observed in a low-clarity area of the unknown impression to the right of the delta were being used as a target group, and were not present in the corresponding area of the exemplars. However, because I am not confident in the existence of these features in the impression, a conclusion of Source Exclusion is not supported.

(i.e. Strong evidence in support of different source, no evidence supporting same source.)



— The friction ridge impression lacks a clear focal point (core or delta) and no corresponding features were observed in the suspected area of anatomical source between the impression and the exemplars utilized for comparison.

(i.e. Strong evidence in support of different source, no evidence supporting same source.)



— There was high ambiguity concerning the likely orientation and area of friction ridge skin leaving the latent impression. There were no observable anchor points and/or orientation clues present in the latent impression, from my observations I see no correspondence in the exemplars searched, however, a conclusion of Source Exclusion is not supported.

(i.e., Weak evidence in support of different source, no evidence supporting same source.)

**Inconclusive (section 4.4)** For example:



— The suspected area of friction ridge detail was not available or represented in the provided exemplars, the provision of further exemplars may support a different conclusion. Therefore, a conclusion of inconclusive was rendered and I am requesting fully rolled exemplars from the side and tip of the right middle finger.

[i.e., Inconclusive because there is no information that tilts either way (e.g., need better standards, nothing to compare in the relevant area.)]



— There was a distinct possibility that the unknown friction ridge impression may have been left by the friction ridge detail from the feet of an individual. I did not have or compare exemplars from the feet. Therefore, a conclusion of inconclusive was rendered and I am requesting exemplars from the feet of the individual.

(i.e., Inconclusive because there is no exemplar to compare, suspected foot impression.)



— Looking at the observed detail present there is low reliability and discriminability of features such that equally weak support for both same source and different source propositions is present, effectively cancelling each other out.

(i.e., Inconclusive because the evidence in support, and the evidence against, are both weak and equally balanced.)

**Support for Same Source (section 4.5):** For example:



— There was limited correspondence observed between the tip of the left index finger (two ridge endings) and the latent impression; however, insufficient to support a Source Identification. Similar correspondence may also be observed in a different source. The lack of correspondence was due to the limited quality and quantity of information observed in the latent impression, the provision of further exemplars will not assist in supporting a different conclusion.

(i.e., Weak evidence in support, no evidence against.)



— There was strong correspondence observed between the delta area of the left index finger (five ridge endings) and the latent impression; however, insufficient to support a Source Identification. Similar correspondence may also be observed in a different source. The lack of correspondence was due to the limited quality and quantity of information observed in the latent impression, the provision of further exemplars will not assist in supporting a different conclusion.

(i.e., Strong evidence in support, no evidence against, but insufficient for a source ID due to latent.)



— There was strong correspondence observed between the delta area of the left index finger (five ridge endings) and the latent impression; however, insufficient to support a source identification. Similar correspondence may also be observed in a different source. The lack of correspondence was due to the limited quality and quantity of information observed in the exemplar, the provision of further exemplars may assist in supporting a different conclusion.

(i.e., Strong evidence in support, no evidence against, but insufficient for a source ID due to exemplar.)



— There was strong correspondence observed in the hypothenar area of the palm with six ridge endings in correspondence however there was one apparent bifurcation on the edge of the latent impression that was not present in the exemplar. The observed correspondence was not substantially stronger than the observed dissimilarity and therefore could not support a Source Identification. Similar correspondence may also be observed in a different source.

(i.e., Strong evidence in support, some evidence against, but more in support. On balance, the evidence in support is insufficient for a Source ID due to latent)



— There was strong correspondence observed in the delta area of the left index finger (six ridge endings) and the latent impression however the candidate was produced from an AFIS search in NGI. Given the higher chance of a coincidental match in a large database, and the lower discriminability of the features observed, similar correspondence may also be observed in a different source.

(i.e., Strong evidence in support but a red flag due to the large AFIS pool and low discriminability. On balance, the evidence in support is insufficient for a source ID due to AFIS)

**Source Identification (section 4.6):** For example:

— There was substantial correspondence observed between the tip of the left index finger (sixteen ridge endings and an enclosure) and the latent impression. Similar overwhelming correspondence would not be expected in a different source.

(i.e., Substantial correspondence observed, evidence is in support for a source ID.)



— There was substantial correspondence observed between the delta area of the left index finger (five ridge endings with an abundance of 3rd level detail including 30 pore structures and ridge edge shapes) and the latent impression. Similar overwhelming correspondence would not be expected in a different source.

(i.e., Substantial correspondence observed, 2nd and 3rd level detail used in concert, evidence is in support for a source ID.)



— There was substantial correspondence observed between the hypothenar area of the palm and the latent impression (a whorl type pattern and ten ridge endings). Similar overwhelming correspondence combined with this Level 1 feature would not be expected in a different source.

(i.e., Substantial correspondence observed, rare 1st and 2nd level detail used in concert, evidence is in support for a source ID.)

## **Annex B** **(informative)**

### **Bibliography**

The following bibliography is not intended to be an all-inclusive list, review, or endorsement of literature on this topic. The goal of the bibliography is to provide examples of publications addressed in the standard.

- 1] AAAS, "Forensic Science Assessments: A Quality and Gap Analysis--Latent Fingerprint Examination," *American Association for the Advancement of Science*, Sept. 2017, 63.
- 2] Modified from ANSI/NIST-ITL 1-2011 NIST Special Publication 500-290 American National Standard for Information Systems – Data Format for the Interchange of Fingerprint, Facial & Other Biometric Information and SWGFAST Document #19 – Standard Terminology of Friction Ridge Examination (Latent/Tenprint).

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