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**Best Practice Recommendation for Comparison and
Evaluation of Friction Ridge Impressions**



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Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions

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Foreword

This document has been developed to improve the quality and consistency of friction ridge examination practices.

The examination of friction ridge impressions is conducted in accordance with a methodology consisting of analysis, comparison, and evaluation. Analysis is the interpretation of observed data in a friction ridge impression in order to categorize its utility. Comparison is the search for and detection of similarities and dissimilarities in the observed data between two friction ridge impressions. Evaluation is the weighting of the aggregate strength of the observed similarities and dissimilarities between the observed data in the two friction ridge impressions in order to formulate a source conclusion.

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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.

Questions, comments, and suggestions for the improvement of this document can be sent to AAFS-ASB Secretariat, asb@aafs.org or 401 N 21st Street, Colorado Springs, CO 80904.

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Keywords: *analysis, comparison, complexity, evaluation, friction ridge, verification*

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DRAFT

Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions

1 Scope

This document provides best practice recommendations for the comparison and evaluation of friction ridge impressions as part of the analysis, comparison and evaluation examination process. These recommendations include how to categorize comparisons between two friction ridge impressions on the basis of their complexity and specifies the criteria for supporting source conclusions.

This document does not address the analysis stage of the friction ridge examination process.

2 Normative References

ASB Best Practice Recommendation 165, *Best Practice Recommendation for Analysis of Friction Ridge Impressions* (*Also posted for public comment*)

3 Terms and Definitions

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

3.1

agreement

correspondence

corresponding friction ridge detail

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

3.2

analysis

(phase of the examination process)

The interpretation of observed data in a friction ridge impression in order to categorize its utility.

3.3

blind verification

A type of verification in which the subsequent examiner(s) has no knowledge of any other examiner's decisions, conclusions or observed data used to support the conclusion.

3.4

comparison

(phase of the examination process)

The search for and detection of similarities and dissimilarities in observed data between friction ridge impressions.

**3.5
complexity
(of a comparison)**

A characteristic of a comparison in which the attributes of one or both impressions may require additional consideration and quality assurance measures relating to the evaluation of a source conclusion.

**3.6
complexity
(of an impression)**

A characteristic of an impression whose attributes may require additional consideration and quality assurance measures.

**3.7
conclusion
source conclusion**

Opinion stated by an examiner after interpretation of observed data. The opinion is the professional judgment that the observed data can offer support for one proposition over another. A conclusion is distinct from a "*proposition.*"

**3.8
consensus review**

A type of examination in which a reported decision or conclusion is determined that reflects the collective judgment of a group of examiners.

**3.9
disagreement**

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

**3.10
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.*"

**3.11
evaluation
(phase of the examination process)**

The weighting of the aggregate strength of the evidence (observed similarities and dissimilarities when considering two competing propositions) between the observed data in the friction ridge impressions being compared in order to formulate a source conclusion.

3.12
exemplar impression
exemplar or known
exemplar prints

The deliberately recorded images or impressions from the friction ridge skin of an individual.

NOTE Examples may include, but are not limited to, inked tenprints, inked palm prints, Livescan prints, powder and lift prints, casted/moulded prints, or photographs of friction ridge skin.

3.13
Forensic Service Provider
FSP

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

3.14
friction ridge detail
friction ridge features

The combination of ridge flow, ridge characteristics, and ridge structure of friction ridge skin, as reproduced and observed in an impression. The observed data used to compare and interpret similarity or dissimilarity between impressions.

3.15
inconclusive
INC

The conclusion that the observed data does not provide more support for one proposition over the other.

3.16
inconclusive with dissimilarities

The conclusion that the observed data provide 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.

3.17
inconclusive with similarities

The conclusion that the observed data provide 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.

3.18
interpretation

Explanations for the observations, data, and calculations.

3.19
minutia

The point where a friction ridge terminates, or splits into two or more ridges. A subset of the friction ridge detail/features traditionally consisting of ridge endings, bifurcations, and dots used to compare and interpret similarity and dissimilarity between two impressions.

3.20

observed data

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

3.21

questioned impression (also questioned image or questioned item)

An impression or image of friction ridge skin whose source or identity is unknown; it can include latent impressions, impressions from an unknown source or a known source.

3.22

similarity

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

3.23

source exclusion

EXC

The conclusion that the observed data provide substantially stronger support for the proposition that the questioned impression originated from a different source than the exemplar impressions compared.

3.24

source identification

ID

The conclusion that the observed data provide substantially stronger support for the proposition that the two impressions originated from the same source rather than different sources.

3.25

suitability

utility

The usefulness of an impression for a further step in the examination process, such as comparison or Automated Biometric Identification System (ABIS) entry.

3.26

suitability decision

utility decision

A decision made by an examiner in accordance with FSP policy and/or procedure as to whether or not an impression will proceed to the next step in the examination process.

3.27

target group

A specific set of friction ridge features selected as a starting point during comparison.

3.28

verification (phase of examination method)

Independent examination by one or more examiners to ascertain if a decision, conclusion, or opinion is reproduced or is in conflict with the decision, conclusion, or opinion of another examiner.

NOTE 1 Verification may be implemented in multiple ways including blind verification, open verification and consensus review. The general term verification is inclusive of these various types.

NOTE 2 Verification is a quality assurance measure for friction ridge examination.

NOTE 3 The use of the term “independent” indicates an autonomous examination but not necessarily one without knowledge of a prior decision, conclusion or opinion.

4 General Recommendations

4.1 Comparison

4.1.1 A questioned impression, which has previously been deemed “suitable for comparison” following analysis, is selected. Selection should take the following into consideration:

- a) quality of the observed data in the impression;
- b) complexity of the impression; (see ASB BPR 165, *Best Practice Recommendation for Analysis of Friction Ridge Impressions – Also posted for public comment*).
- c) sequential or arbitrary selection.

4.1.2 An exemplar impression is selected to compare against the questioned impression. Selection of an exemplar impression for comparison should take into consideration:

- a) apparent similarity of the exemplar impression to the questioned impression;

NOTE Similarity can be determined by visual observation or automated comparison algorithms.

- b) completeness of the recording of the impression;
- c) sequential or arbitrary selection;

4.1.3 The exemplar impression is analyzed for its utility for comparison.

If poor quality is noted, or the exemplar impression has the potential for high complexity, a full analysis should be documented the analysis should be document per recommendations outlined in ASB BPR 165 (*See section 2. Also posted for public comment*) prior to comparison.

4.1.4 Comparison of features should proceed from the lower quality impression to the higher quality impression.

4.1.5 The target group in the lower quality impression identified during analysis or another target group should be selected for comparison with the higher quality impression.

4.1.6 Comparison of features should account for all of the features interpreted during analysis.

4.1.7 Features of the two impressions are assessed for agreement or disagreement in a side-by-side comparison.

4.1.8 Features assessed as corresponding should be documented for comparisons which will be evaluated for a source conclusion. Features assessed as disagreement may be documented.

4.1.8.1 Documentation should be preserved digitally. The annotations may be done manually by the examiner or with the assistance of automated comparison software.

4.1.8.2 Documentation should occur contemporaneously during the side-by-side comparison and be done in a non-destructive manner on a digital image copy of each friction ridge impression.

4.1.8.3 Documentation should continue until an accumulation of features supports a source conclusion.

4.1.8.4 Documentation should distinguish between features initially interpreted during comparison and features interpreted during analysis (prior to side-by-side comparison).

4.1.9 Once the features have been documented to support a source conclusion, the complexity of the comparison should be assessed and conform to the criteria in 4.1.9.1 through 4.1.9.3.

4.1.9.1 *Non-complex comparison:* all of the following conditions are met:

- a) both impressions have been determined to be non-complex during analysis;
- b) the observed data on both impressions provide strong indications of the anatomical regions;
- c) the observed data on both impressions provide strong indications of the orientations;
- d) the observed data in the relevant overlapping areas of both impressions necessary to support a source conclusion are designated as Category 3 (green) quality or higher during analysis (see Annex A);
- e) fewer than three features interpreted during comparison were altered from how they were documented during analysis.

4.1.9.2 *Low complexity comparison:* neither impression has been determined to be of high complexity during analysis and one or two of the following conditions are met:

- a) at least one impression has been determined to be of low complexity during analysis;
- b) the observed data on at least one impression provides a weak indication of the anatomical region(s);
- c) the observed data on at least one impression provides a weak indication of the orientation(s);
- d) the observed data in the relevant overlapping area of at least one of the impressions necessary to support a source conclusion is designated as Category 2 (yellow) quality or lower during analysis;
- e) three or more features interpreted during comparison were altered from how they were documented during analysis.

4.1.9.3 *High complexity comparison:* at least one impression has been determined to be of high complexity during analysis or at least three of the following conditions are met:

- a) at least one impression has been determined to be of low complexity during analysis;

- b) the observed data on one or both impressions provides no indication of the anatomical regions;
- c) the observed data on one or both impressions provides no indication of the orientations;
- d) the observed data in the relevant overlapping area of at least one of the impressions necessary to support a source conclusion is designated as Category 2 (yellow) quality or lower during analysis;
- e) three or more features interpreted during comparison were altered from how they were documented during analysis.

4.2 Evaluation

4.2.1 The similarities and dissimilarities are evaluated to formulate a source conclusion and should be supported by the criteria in 4.2.1.1 through 4.2.1.5.

4.2.1.1 *Source exclusion*: all of the following conditions are met:

- a) the observed data in the relevant areas of both impressions used to support the source conclusion are present and designated as Category 2 (yellow) quality or higher during analysis;
- b) the observed data between the impressions are in disagreement.

4.2.1.2 *Inconclusive with dissimilarities*: the following condition is met:

- a) the observed data between the impressions needed to support the source conclusion display dissimilarities, but a more definitive determination of disagreement cannot be made due to limiting factors; the limiting factor(s) affecting a more definitive determination should be documented.

NOTE This conclusion is applicable when the criteria for source exclusion is not supported by the observed data.

4.2.1.3 *Inconclusive*: at least one of the following conditions are met:

- a) the observed data in the relevant area of at least one of the impressions needed to support a source conclusion are not present or designated as Category 1 (red) quality or lower during analysis thus preventing a determination of agreement or disagreement, the limiting factor(s) affecting a more definitive determination should be documented;
- b) the similarities and dissimilarities of the observed data are insufficient to support either agreement or disagreement, the limiting factor(s) affecting a more definitive determination should be documented.

4.2.1.4 *Inconclusive with similarities*: the following condition is met:

- a) The observed data between the impressions needed to support the source conclusion display similarities, but a more definitive determination of agreement cannot be made due to limiting factors, the limiting factor(s) affecting a more definitive determination should be documented.

NOTE This conclusion is applicable when the criteria for source identification is not supported by the observed data.

4.2.1.5 *Source identification*: all of the following conditions are met:

- a) the observed data in the relevant areas of both impressions used to support the source conclusion are present and designated as Category 2 (yellow) quality or higher during analysis;
- b) the observed data between the impressions are in agreement resulting in overall conformity;
- c) the observed data in agreement include at least 8 minutiae designated as Category 3 (green) quality or higher and documented during analysis.

NOTE The 8 minutiae threshold is not scientifically derived but instead was developed via consensus as a best practice recommendation to ensure that lower quantity comparisons be given additional consideration.

4.2.2 Source conclusions that are not supported by the criteria specified in 4.2.1 should be subject to additional quality assurance measures, such as additional documentation of observed data, mandatory consultation, blind verification, multiple verifications, or consensus review. Documentation by a technical lead, quality assurance manager or supervisor that these measures and review were addressed should be included.

4.2.3 Features that have been documented during comparison should be retained on each impression.

4.2.4 Changes to the interpretation of observed data in the questioned impression after comparison to the exemplar impression should be documented such that they are clearly distinguished from the observed data interpreted prior to comparison.

4.2.5 The case record should include documentation of the following:

- a) each questioned and exemplar impression compared, including relevant information to uniquely identify the impressions (e.g., name, identifier, date recorded);
- b) the source conclusion reached for each comparison;
- c) the complexity determination for each comparison;
- d) the observed agreement used to support inclusive source conclusions (i.e., inconclusive with similarities' or source identification).

Annex A (informative)

Markup Instruction for Friction Ridge Quality

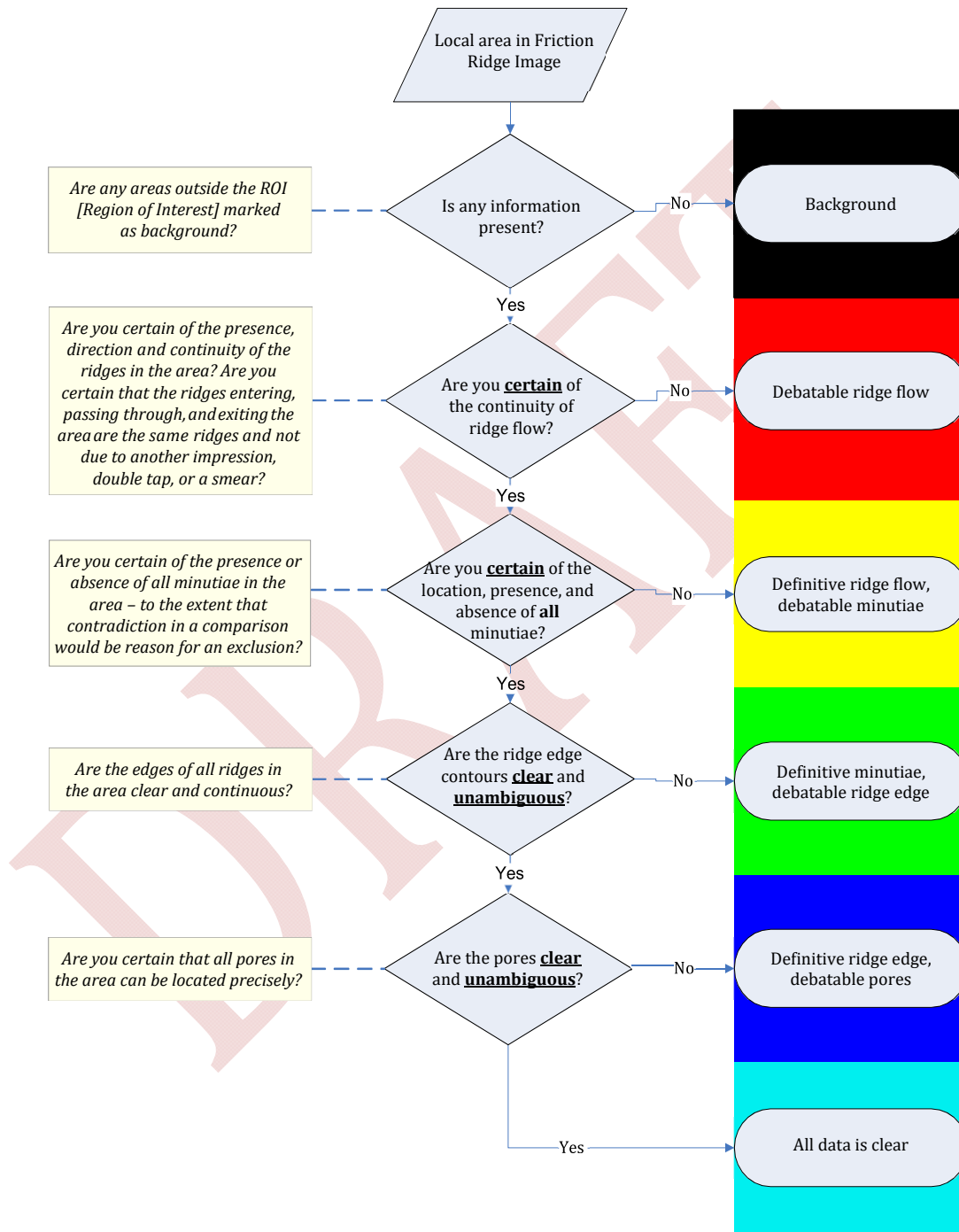


Figure 1—Decision Process for Local Friction Ridge Quality

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			Ridge flow	Minutiae	Dots	Incipients	Ridge edge features	Pores
Black	0	Background			X			
Red	1	Debatable ridge flow	?			X		
Yellow	2	Definitive ridge flow, debatable minutiae	✓	?			X	
Green	3	Definitive minutiae, debatable ridge edges		✓		?		X
Blue	4	Definitive ridge edges, debatable pores			✓			?
Aqua	5	All features definitive			✓			

✓	Definitive and unambiguous	Presence, absence, and location are definitive. Contradictory presence or absence of definitive features in a comparison is cause for exclusion.
?	Debatable or ambiguous	Features may be marked, but presence, absence, and location are debatable. Corresponding/contradictory features in a comparison are supporting evidence for individualization/exclusion.
X	Not discernible or unreliable	Features should not be marked and are ignored if present. No evidence for individualization or exclusion in a comparison exists.

Figure 2—Friction Ridge Quality Designations and their Relation to Feature Confidence
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