



## Definitions for Friction Ridge Comparison

## Introduction

CanFRWG offers a list of definitions for terms used in the fingerprint comparison discipline. Agencies may wish to develop their own definitions or adapt the definitions provided in this document to best suit their operating procedures.

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**Identification:** the opinion that two friction ridge impressions originate from the same source.

**Inconclusive:** the opinion that two friction ridge impressions could not be identified or excluded.

**Exclusion:** the opinion that two friction ridge impressions did not originate from the same source.

**Source**<sup>1</sup>: an area of friction ridge skin from an individual from which an impression originated.

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**ACE-V:** is an acronym for the Analysis, Comparison, Evaluation and Verification methodology used by forensic examiners when conducting friction ridge comparisons.

**Analysis:** the first step of the ACE-V process which involves documenting the appearance of a friction ridge impression and determining its suitability.

**Anatomical Factors:** various features and shapes in an impression that assist in determining which area of friction ridge skin touched an object and may provide insight into how an object was handled. These include the location, orientation, flow of the ridges, presence of primary creases and/or adjacent impressions.

**Anchor Point:** a significant portion of either a core, delta, primary crease, or permanent scar.

**Arch – Plain:** a pattern type in which the friction ridges enter on one side of the impression and flow, or tend to flow, out the other side with a rise or wave in the center. [1]

**Arch – Tented:** a pattern type that possesses either an angle, an upthrust, or two of the three basic characteristics of the loop. [1]

**Bifurcation:** the point at which one friction ridge divides into two friction ridges.

**Blind Test:** a test where an examiner is unaware that they are being tested.

**Blind Verification:** a verification process where the subsequent examiner is not aware of the original examiner's opinion. The agency must verify all types of opinions.

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<sup>1</sup> SWGFAST Document #19, Standard Terminology of Friction Ridge Examination

**Clarity:** the visual quality of the friction ridge detail.

**Clerical Error:** when an examiner forms an accurate opinion during the comparison process; however, they fail to record or transcribe the corresponding samples when reporting their findings.

**Comparison:** the second step of the ACE-V process which involves a sequential, ridge to ridge, observation of all available friction ridge detail between the unknown friction ridge impression and the known friction ridge impression.

**Competency:** someone possessing and demonstrating the requisite knowledge, skills, and abilities to successfully perform a specific task.

**Core:** the location in a friction ridge impression where the innermost ridges form a loop, whorl, or central point.

**Corrective Action:** an action to address the cause of an erroneous opinion or other undesirable situation and to prevent recurrence.

**Declared or Open Test:** a test where the examiner is aware that they are being tested.

**Delta:** a triangular type formation where friction ridges, flowing in different directions, converge.

**Deposition Pressure:** the pressure exerted by the friction ridge skin when in contact with the substrate.

**Development Medium<sup>2</sup>:** the physical, chemical, or optical process used to provide contrast between the friction ridges and the substrate.

**Discrepancy:** the presence of friction ridge features in one impression that do not exist in the corresponding area of another impression.

**Dissimilarity:** a difference in appearance between two friction ridge impressions.

**Distortion:** variances in the reproduction of friction ridge skin caused by factors such as pressure and movement.

**Downsampling:** a process to decrease the resolution of an image. Information can be lost in an image by downsampling.

**Eccrine Glands:** glands which secrete sweat.

**Epidermis:** outer layer of the skin.

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<sup>2</sup> Sometimes referred to as "Development Technique" or "Enhancement"

**Erroneous Exclusion:** the incorrect opinion that two friction ridge impressions did not originate from the same source.

**Erroneous Identification:** the incorrect opinion that two friction ridge impressions originated from the same source.

**Evaluation:** the third step of the ACE-V process where an examiner forms an opinion based on the results of the Analysis and Comparison.

**Expected Response:** an opinion submitted by FIS personnel that conforms to the criteria established to be an appropriate response considering the observable data available and ground-truth of the test samples.

**Expert Report:** a report that summarises the Analysis, Comparison, Evaluation, and Verification (ACE-V) of the examiner's opinion(s).

**Fingerprint:** an impression made by the friction ridges of a finger.

**Fingerprint Pattern:** the general shape of a fingerprint, typically an arch, loop or whorl.

**FLS:** an initialism for Forensic Light Source. An illumination system adapted for forensic application, such as aiding in crime scene examination and fingerprint visualization. A non-laser FLS is sometimes referred to as an alternate light source or ALS.

**Forensic Identification Service (FIS):** a forensic identification entity providing forensic identification services.

**Friction Ridge:** a raised portion of the epidermis on the fingers, the palmar surfaces of the hand, and the plantar surfaces of the feet.

**Friction Ridge Examiner:** an individual who has successfully completed their basic training program and has demonstrated to a Forensic Identification Service (FIS) that they possess the requisite knowledge, skills and abilities to perform the tasks required of their current position. An individual authorized to conduct friction ridge examinations for the FIS by observing and interpreting data, making decisions, forming opinions, issuing reports and/or providing testimony.

**Friction Ridge Skin:** the skin that is present along the lengths of the fingers, across the palmar surfaces of the hand, and the plantar surfaces of the feet.

**Furrow:** valley or depression between friction ridges.

**Ground-Truth:** when the source of a friction ridge impression is known.

**GYRO:** a coloured coded system known to document the features during both the analysis and comparison phase. GYRO is an acronym for green, yellow, red, and orange. Features marked in green

indicate an examiner's high level of confidence in the existence of the features. Yellow and red features indicate moderate and low levels of confidence, respectively. Features marked in orange represent features only observed at the comparison phase.

**Investigative Report:** a report that details the entire involvement of the forensic examiner, including the processing of a crime scene and the treatment of any exhibits.

**Known Fingerprint<sup>3</sup>:** an impression of friction ridges left from a finger, recorded under controlled conditions, where the source of the impression is known.

**Known Friction Ridge Impression:** an impression of friction ridges, recorded under controlled conditions, where the source of the impression is known.

**Laser:** an acronym for light amplification by stimulated emission of radiation. A device that stimulates atoms or molecules to emit light at particular wavelengths and amplifies that light, typically producing a very narrow beam of radiation. The emission generally covers an extremely limited range of visible, infrared or ultraviolet wavelengths.

**Latent Impression:** impressions that are not plainly visible and require development to be visualized.

**Level 1 Detail:** the presence of distinguishable friction ridges.

**Level 2 Detail:** the specific path taken by each friction ridge and their relation with the neighbouring ridges, including the major ridge path deviations such as bifurcations and ridge endings.

**Level 3 Detail:** the intrinsic shape of friction ridges, the pore locations, alignment or misalignment of ridges.

**Loop:** a pattern type in which one or more friction ridges enter upon one side, recurve, touch or pass an imaginary line between delta and core and flow out, or tend to flow out, on the same side the friction ridges entered. Types include left slant loops, in which the pattern flows to the left in the impression; right slant loops, in which the pattern flows to the right in the impression; radial loops, in which the pattern flows in the direction of the radius bone of the forearm (toward the thumb); and ulnar loops, in which the pattern flows in the direction of the ulna bone of the forearm (toward the little finger). [1]

**Matrix:** the substance deposited on the substrate by the friction ridge skin or the substance that was on the substrate when the item was touched.

**Minutiae<sup>4</sup>:** events along a friction ridge path, including bifurcations and ridge endings.

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<sup>3</sup> Sometimes referred to as an "Exemplar".

<sup>4</sup> Sometimes referred to as "Characteristics", "Features", "Points", "Galton Details", or "Major Ridge Path Deviations".

**Missed Exclusion:** the failure to make an exclusion when an exclusion could have been made based on the information available.

**Missed Identification:** the failure to make an identification when an identification could have been made based on the information available.

**Moulded:** impressions that retain the 3D shape of the friction ridges within the surface e.g. wax, clay, chewing gum, etc.

**Non-conformity:** an assessment of work performed by the examiner that is inconsistent with best practices and deviates from standard operating procedures.

**Open Field:** an area of a friction ridge impression where there are no minutiae.

**Open Verification:** a verification process where the subsequent examiner is aware of the original examiner's opinion, and/or the agency does not verify all types of opinions.

**Opinion:** one of the three options of either: identification, inconclusive or exclusion.

**Orientation:** the estimated positioning and alignment of a friction ridge impression.

**Palmar Skin:** skin covered with friction ridges located on the palms of the hands.

**Plantar Skin:** skin covered with friction ridges located on the soles of the feet.

**Primary Crease:** creases with a predetermined position on the palmar surfaces of the hand.

**Proficiency Testing:** an evaluation of an examiner's performance against pre-established criteria.

**Quality:** the clarity of the features within a friction ridge impression.

**Quality Assurance:** a system of activities to provide to the producer or user of a product or a service the assurance that it meets defined standards of quality.

**Quality Control:** an overall system of activities to control the quality of a product or service so that it meets the needs of the user.

**Reverse Development:** when the reverse of the expected development occurs in an impression. For example, the furrows of an impression are developed when the ridges were expected.

**Ridge Ending:** the point where a friction ridge ends.

**Ridge-in-sequence:** a method for visually comparing individual ridge paths starting in a linear progression from the unknown impression to the known impression.

**Root Cause Analysis:** a method of problem solving used for identifying the origins or potential reasons that caused a problem to occur.

**Sebaceous Glands:** glands which secrete sebum, an oily substance which lubricates the skin.

**Side-by-Side:** a method for visually comparing with the unknown impression placed on the left and the known impression placed on the right.

**Spur:** a bifurcation where one of the two friction ridges ends abruptly.

**Substrate:** the surface upon which a friction ridge impression was deposited.

**Suitability<sup>5</sup>:** an examiner's decision that there is sufficient quality and quantity of information within an unknown friction ridge impression to warrant a comparison to a known friction ridge impression.

**Target Group:** a distinct group of two or more friction ridge features in sequence without significant distortion present.

**Technical Review:** a systematic quality control check on the substantive details contained within an expert report.

**Ten-Print:** a controlled recording of friction ridge detail from all ten digits.

**Testing Facilitator:** a designated person in a FIS organization or agency responsible for promoting the recommended guidelines for the implementation of a proficiency testing program.

**Tolerance:** an examiner's assessment of how much variation is reasonable in the appearance and the spatial relationships between the unknown and known friction ridge impressions.

**Tonal Reversal:** when development in a friction ridge impression changes from the ridges to the furrows, or vice-versa.

**Tracings:** an examiner's drawing of the friction ridges of either the unknown or known friction ridge impression.

**Unjustifiable Exclusion:** an unsupportable exclusion opinion in reference to a comparison where ground-truth is known.

**Unjustifiable Identification:** an unsupportable identification opinion in reference to a comparison where ground-truth is known.

**Unjustifiable Inconclusive:** an unsupportable inconclusive opinion in reference to a comparison where ground-truth is known.

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<sup>5</sup> Sometimes referred to as "Sufficient" or "Sufficiency".

**Unknown Fingerprint**<sup>6</sup>: an impression of friction ridges left from a finger where the source of the impression is unknown.

**Unknown Friction Ridge Impression**: an impression of friction ridges where the source of the impression is unknown.

**Upsampling**: a process to increase the resolution of an image. No new information is gained in an image by upsampling.

**Verification**: the application of a second ACE process as utilized by a subsequent examiner to either support or refute the opinion of the original examiner.

**Visible Impression**: impressions that are plainly visible. Usually attributed to the transfer of foreign material onto a surface e.g. blood, grease, etc.

**Whorl – Accidental:**

1. a pattern type consisting of the combination of two different types of patterns (excluding the plain arch) with two or more deltas.
2. a pattern type that possesses some of the requirements for two or more different types of patterns.
3. a pattern type that conforms to none of the definitions of a pattern. [1]

**Whorl – Central Pocket Loop**: a pattern type that has two deltas and at least one friction ridge that makes, or tends to make, one complete circuit, which may be spiral, oval, circular, or any variant of a circle. An imaginary line drawn between the two deltas must not touch or cross any recurving friction ridges within the inner pattern area. [1]

**Whorl – Double Loop**: a pattern type that consists of two separate loop formations with two separate and distinct sets of shoulders and two deltas. [1]

**Whorl – Plain**: a fingerprint pattern type that consists of one or more friction ridges that make, or tends to make, a complete circuit, with two deltas, between which, when an imaginary line is drawn, at least one recurving friction ridge within the inner pattern area is cut or touched. [1]

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<sup>6</sup> Sometimes referred to as a “Fingermark” outside of North America and in literature.



**Appendix A: Other Sources for Definitions**

- [1] SWGFAST Document #19, Standard Terminology of Friction Ridge Examination, Ver 4.1  
Link: [https://www.nist.gov/system/files/documents/2016/10/26/swgfast\\_standard-terminology\\_4.0\\_121124.pdf](https://www.nist.gov/system/files/documents/2016/10/26/swgfast_standard-terminology_4.0_121124.pdf)
- [2] Bandey, H.L. (2014). Fingermark Visualisation Manual, 1<sup>st</sup> Ed., Home Office Centre for Applied Science and Technology: Sandridge.
- [3] Bleay, S. M., Croxton, R. S., & De Puit, M. (2018). Fingerprint development techniques: theory and application. John Wiley & Sons Ltd.
- [4] Champod, C., Lennard, C. J., Margot, P., & Stoilovic, M. (2016). Fingerprints and other ridge skin impressions, 2<sup>nd</sup> Ed., CRC press.
- [5] Ramotowski, R. (2013). Lee and Gaensslen's advances in fingerprint technology, 3<sup>rd</sup> Ed., CRC press.
- [6] Triplett, M. & Everist, S. (2015). Fingerprint Dictionary: An examiner's guide to the who, what, and where of fingerprint identification, 3<sup>rd</sup> Ed., CreateSpace Independent Publishing Platform