



Recommendations for Proficiency Testing

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1. Scope

The purpose of this document is to provide Canadian Law Enforcement agencies a guideline for implementing and maintaining proficiency testing procedures for friction ridge examiners. The aim is to promote accurate and reliable forensic conclusions through a well-structured nationally standardized proficiency testing program.

2. Introduction

Proficiency testing has been a long-established quality control tool employed by various forensic service providers to ensure that their examiners are reporting accurate and reliable results suitable for the intended purpose.¹ As a component of the quality management system (QMS) by forensic service providers, friction ridge examiners initially complete an external or internal comprehensive training program that is designed to train and test the core competencies associated with fingerprint examinations.² The competency tests may include a series of oral, written and practical tests specifically suited to prepare friction ridge examiner for routine case work. Friction ridge examiners that have successfully achieved the minimum level of competency through formal training are eligible to proceed with routine independent case work.³

A friction ridge examiner that is deemed to be competently trained in fingerprint examinations and active in casework may participate in periodically scheduled proficiency tests. A robust and well-designed proficiency test that is systematically implemented on a regular basis is intended to:

- Evaluate an individual examiner's ability to apply best practices and policies according to the agencies standards
- Assess the accuracy and reliability of the individual examiner's methodology as applied
- Measure the forensic service providers overall organizational performance
- Identify vulnerabilities and promote method improvement

A national standard Ground Truth Fingerprint Dataset (GTFD) proficiency test has been developed by the Royal Canadian Mounted Police. Currently, the test consists of 3,000 digital images of friction ridge impression deposited on various surfaces and developed using a variety of development techniques similar to circumstances encountered in routine casework.⁴ A well-structured proficiency test should include domain specific criteria essential for testing the performance of friction ridge examiners. Four critically important areas include the development and design of the proficiency test, administration of the proficiency tests, how the proficiency test is evaluated, and the documentation procedures required for a Forensic Identification Service (FIS) when implementing testing programs.

In this document, the following verbal forms are used: “*shall*” indicates a requirement, “*should*” indicates a recommendation; “*may*” indicates permission; and “*can*” indicates a possibility or capability.⁵

¹ Holder; Robinson & Laub. 2011. *The Fingerprint Sourcebook* Washington, D.C.

² National Institute of Standards and Technology. 2012. *Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach*

³ Scientific Working Group on Friction Ridge Analysis Study and Technology (SWGFAST). 2012. Document #7 *Standard for a Quality Assurance Program in Friction Ridge Examinations (Latent/Tenprint)*

⁴ Scientific Working Group on Friction Ridge Analysis Study and Technology (SWGFAST). 2012. Document #13 *Standard for Friction Ridge Comparison Proficiency Testing Program (Latent/Tenprint)*

⁵ Friction Ridge Subcommittee Physics/Pattern Scientific Area Committee Organization of Scientific Area Committees (OSAC). 2017. *Forensic Science Guideline for the Articulation of the Decision-Making Process Leading to an Expert Opinion of Source Identification in Friction Ridge Examinations*

3. Terms and Definitions

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

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.

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

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.

Exclusion: the 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.

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

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.

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

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.

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.

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.

Known Fingerprint⁶: an impression of friction ridges left from a finger, recorded under controlled conditions, where the source of the impression is known.

⁶ Sometimes referred to as an "Exemplar".

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

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

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

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

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.

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.

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

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

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

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.

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

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.

Unknown Fingerprint⁷: an impression of friction ridges left from a finger where the source of the impression is unknown.

⁷ Sometimes referred to as a "Fingermark" outside of North America and in literature.

4. Development and Design of Proficiency Tests

The Royal Canadian Mounted Police (RCMP) developed a ground truth fingerprint dataset (GTFD) consisting of over 3,000 unknown fingerprint images from 62 donors.⁸ To support the development of a Canadian proficiency testing program for the various FIS organizations participating, three administrators will be responsible for the distribution and maintenance of the test material.

- One third of the GTFD has been validated by the **Canadian Police College (CPC)** and developed into test samples for any Canadian FIS outside of the RCMP and Ontario.
- One third of the GTFD is being validated by the **Ontario Police College (OPC)** and developed into test samples for Ontario FIS under the provincially mandated FIS certification program.
- The remaining third has been validated by the **RCMP** and used to develop test samples for the RCMP's FIS personnel as part of the RCMP's internal certification program.

4.1 Test samples *should* include a variety of friction ridge development techniques and deposition matrices.⁹ (e.g., sweat, blood, grease, oils, dust etc.)

4.2 Test samples *should* include a variety of substrates routinely encounter in case work. (smooth, textured, rigid, malleable, non-porous and porous)

4.3 Test samples *should* include a description of development medium and substrate.



Proficiency Testing
Forensic Identification Training

Impression Information

| Substrate | Process |
|--------------|-------------|
| Glass bottle | Grey powder |

4.4 Test samples *should* include expected responses that cover the possibility of all three categorical opinions encountered in casework (e.g., identification, inconclusive and exclusion) which have been determined by expert consensus panel of competent friction ridge examiners within the administering organizations.

4.5 The designated administrator will have access to all ground truth test samples. Images of unknown and known test samples must be in focus and at a minimum contain adequate resolution for forensic feature comparison analysis. (see 5.7)

⁸ Building a ground-truth fingerprint dataset for proficiency testing and research. Forensic Science International. 2020. Hockey, Wilkinson, Kavanagh, Milchak.

⁹ Scientific Working Group on Friction Ridge Analysis Study and Technology (SWGFAST). 2012. Document #13 Standard for Friction Ridge Comparison Proficiency Testing Program (Latent/Tenprint)

4.6 Only validated test samples will be distributed for testing purposes.

4.7 Known (reference) samples shall consist of ten rolled impressions and ten plain impressions for one subject

5. Administration / FIS Test Facilitator

Friction Ridge Examiner Requirements

Only friction ridge examiners trained to competency in friction ridge examinations will be eligible to participate in the proficiency testing program.¹⁰ The test is for active friction ridge examiners and a recognized component of quality assurance for the participating FIS.

5.1 Trained to competency *should* consist of successful completion of a recognized friction ridge examiners course offered through external academic institutes (Canadian Police College or Ontario Police College), or comparable internal FIS course offered by the FIS organization or agency. Additionally, specialized friction ridge examination training by recognized private vendors *may* be considered when assessing the examiner's competency. Each administrator will review the participant's qualifications on a case-by-case basis in order to establish the minimum 'trained to competency' threshold. Current practicing friction ridge examiners in Canada are eligible to participate in proficiency testing.

5.2 Prerequisite competency *should* include various oral, written, and practical tests covering topics related to friction ridge analysis.¹¹

- Friction ridge skin structure and development
- Friction ridge history
- Application of methodology
- Bias mitigation and random noise in judgements
- Reporting conclusions and court testimony
- Signal detection and digital optimization
- Latent friction ridge preservation and development techniques
- Basic probability and statistics
- Friction ridge distortion analysis

Examiner Proficiency Testing Interval

5.3 At the discretion of FIS and depending on jurisdictional requirements, proficiency tests *should* be administered at regular intervals ranging from once every year to a minimum of at least every three years. Once the testing interval is established it *should* be administered consistently and a record of the schedule for the individual friction ridge examiner *should* be maintained by the FIS facilitator.

Testing Environment

5.4 Testing location *shall* be in an environment suitable for feature comparison analysis and similar to the conditions encountered during regular work activity. At minimum the FIS test facilitator *should*

¹⁰ Improving the Rigor of the Latent Print Examination Process. 2017. University of Lausanne, Hicklin Austin R.

¹¹ Standard for Friction Ridge Examination Training Program, Organization of Scientific Area Committee, Friction Ridge Subcommittee 2020

consider the following conditions for friction ridge examiners while undertaking the GTFD proficiency test:

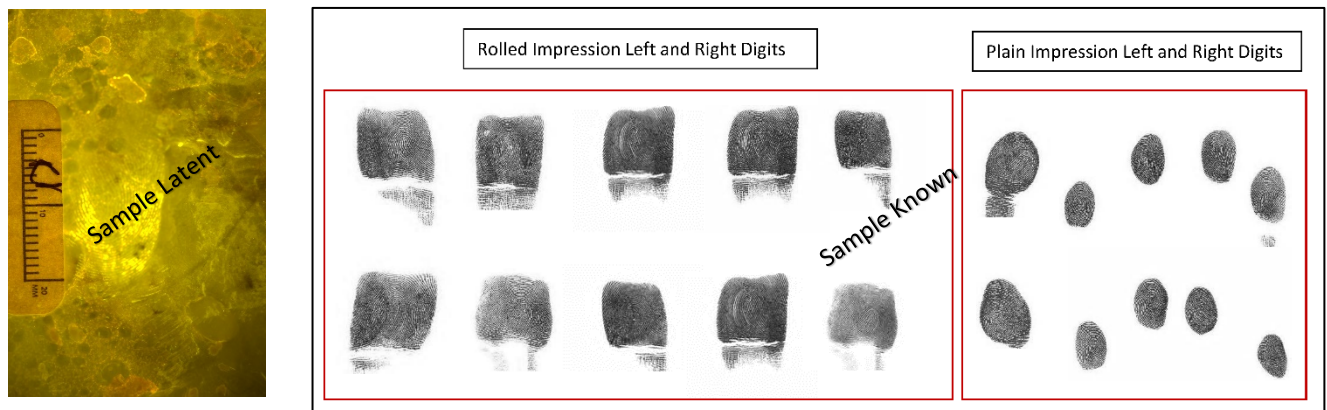
- Adequate overhead and adjustable task lighting
- Clear and uncongested workspace
- Distraction free workstation
- Comfortable desk and chair
- Appropriate temperature with proper ventilation

Testing Equipment / Material

5.5 Testing equipment and material utilized during the proficiency test *should* be similar to strategies and methods applied during routine case work. At the discretion of the FIS, various technical material may be used to perform and document proficiency test results. The following is a list of appropriate materials useful for the analysis, comparison, and evaluation of friction ridges:

- High resolution digital monitor and Learning Management System (LMS) compatible is preferred (minimum display resolution 1024 x 768)
- Photoshop or equivalent photo editing software
- Purpose built friction ridge analysis software (CSIpix, Mideo Latentworks, PiAnos, LQMetric or Latentslueth)
- Inkjet or laser printer minimum 300 DPI
- Printed enlarged calibrated images on clear acetate with free hand mark-up
- Optical side-by-side comparator used in conjunction with bench notes

5.6 The GTFD proficiency test format is a declared, open test where friction ridge examiners know they are being tested on their performance. Each package *should* contain a minimum of three separate comparisons consisting of one unknown friction ridge impression and one complete known ten-print. An example is shown below.



5.7 Unknown impression images are at a minimum 1000ppi resolution and known images from ten-print are at minimum 500ppi

- 5.8 Unknown test sample impressions *shall* include a scale for reference
- 5.9 Test sample impressions *may* require digital enhancement to improve visual quality
- 5.10 Each package *may* contain any variation of possible source outcomes
- 5.11 The appropriate source outcomes *may* include any combination of identification, inconclusive and exclusion.
- 5.12 All conclusions must be those of the individual examiner without any consultation¹²
- 5.13 FIS testing facilitator *shall* ensure that an adequate amount of time has been allotted for the completion of the test.
- 5.14 The time allotment *should* resemble routine case work expectations and will be determined by the proficiency test administrator.
- 5.15 In the event the time limit is not sufficient, the FIS facilitator *should* contact the test administrator for an extension, or the issued proficiency test *should* be returned to the FIS facilitator for destruction as per policy. A new proficiency test *should* be provided to the member when they have adequate time to complete the test.
- 5.16 Participating FIS *shall* provide their respective administrators with the total number tests required
- 5.17 Designated administrators *shall* provide the participating FIS with the desired number of test packages for their organization or agency

Minimum policy or stand operating procedures for participating Police Services

Participating Police Services should have the following policies or standard operating procedures in place prior to implementing proficiency testing.

- 5.18 Policy and protocol to rely upon if a participating friction ridge examiner has a conflict and/or error in the proficiency test
- 5.19 Quality Assurance Manager or Training Group/Team, able to complete a root cause analysis on potential errors and/or conclusion disagreements and to offer support and training to the friction ridge examiner
- 5.20 A consensus panel, consisting of a minimum of three, preferably more, qualified, competent friction ridge examiners to analyze the potential fingerprint in conflict and complete a comparison with the impression to validate a correct consensus conclusion

¹² Scientific Working Group on Friction Ridge Analysis Study and Technology (SWGFAST). 2012. Document #13 Standard for Friction Ridge Comparison Proficiency Testing Program (Latent/Tenprint)

5.21 If an organization cannot meet the above recommendations, it is recommended that the organization partner with another Police Agency that can meet the minimum requirements or have a memorandum of understanding (MOU) in place in accommodate these requirements

6. Procedure / Documentation

Distribution of Tests

The FIS test facilitator will be responsible for managing the testing environment for their respective organization or agency. Pre-testing and testing conditions outlined in section 5 *shall* be implemented and verified prior to receiving test sample packages from the administrator. If the proficiency test is not administered via a Learning Management System (LMS) or similar interface, the FIS facilitator *shall* distribute the test sample package to the participating friction ridge examiners and provide both the administrator and the friction ridge examiner a diary date for completion. The FIS facilitator *shall* ensure that the participating friction ridge examiner has sufficient time to complete all fingerprint comparisons within the allotted time. The test sample packages *shall* include the following:

- Package containing unknown fingerprint impressions each paired with a known ten-print (digital format)
- One outcome response form used to record the participant's conclusion. The form may appear different depending on the administrator's choice.
- Depending on the administrator some proficiency test packages will be available through the Learning Management System and available to various agencies across Canada (LMS)

6.1 Completed tests with the outcome response form shall be returned electronically (PDF) to the designated administrator (Canadian Police College, Ontario Police College or RCMP) for evaluation. The result *shall* be forwarded to the FIS proficiency test facilitator. The FIS proficiency test facilitator *shall* expunge all digital records pertaining to the proficiency test packages for all successful results. Records for non-conforming responses *may* be maintained by the FIS for method review purposes only.

6.2 Sharing or distribution of test images is prohibited unless consent is given by the designated administrator. In instances where the friction ridge examiner considers digital enhancement techniques in order to visually optimize the proficiency test impression(s), the participant may share the image with the digital enhancement technician for enhancement.

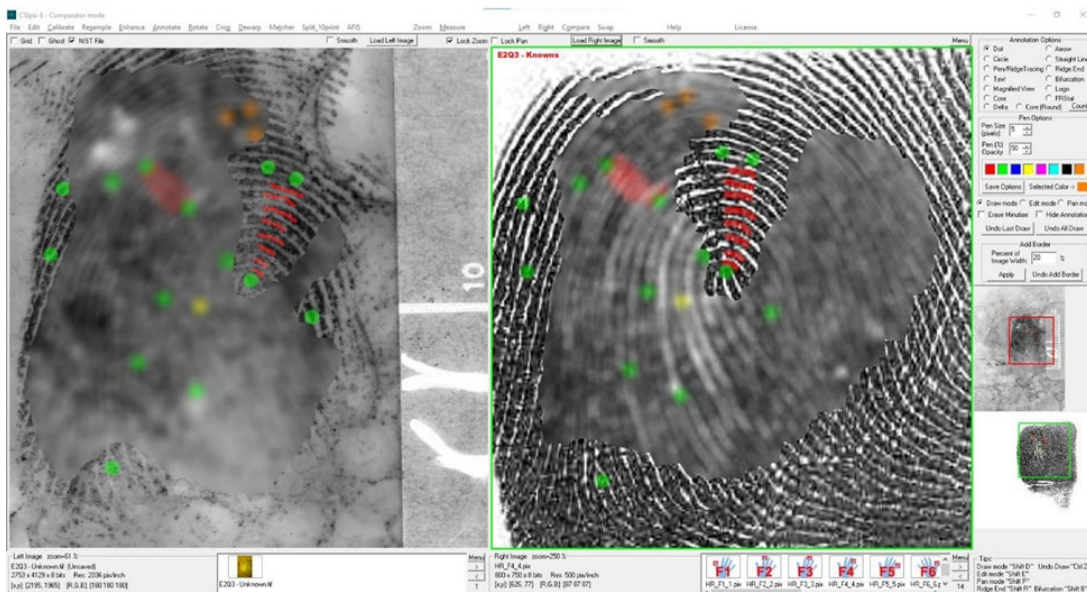
6.3 Friction ridge examiners in Canada are taught to analyze, compare, and evaluate friction ridge detail using a holistic qualitative and quantitative framework.¹³ The term is most commonly referred to as the ACE-V methodology. In order to use the GTFD proficiency test as a means to improve the performance and accuracy of FIS, friction ridge examiners are encouraged to annotate (mark-up) impressions when analyzing and comparing samples. This will allow for a technical review in the event that a non-conforming response is submitted. The FIS *should* complete a root cause analysis to

¹³ Ashbaugh. 1999. Quantitative-Qualitative Friction Ridge Analysis: An Introduction to basic and Advanced Ridgeology. Boca Raton, FL; Taylor & Francis

determine possible factors that contributed to the non-conforming work.¹⁴ A subsequent method improvement review *may* be conducted to determine how to improve the individual friction ridge examiners performance and/or improve the overall FIS procedural system. Recommended mark-up *may* include which features were used for comparison (GYRO)¹⁵, ridge-by-ridge tracing, anchor points and target groups.

6.4 The procedure for friction ridge examiners may include any the following:

- Contemporaneous truncated bench notes in written or electronic format
- Visual annotated mark up of comparison



- Completed outcome response forms indicating (identification, inconclusive or exclusion) for all comparisons.

6.5 If the proficiency test is not administered via LMS or similar interface, the FIS facilitator *shall* submit the outcome response form to the administrator for test scoring. The completed outcome response form *shall* include a means of matching the outcome response to the friction ridge examiner for that particular test. No friction ridge examiner names *shall* be recorded on the outcome response form. The FIS facilitator shall be responsible for maintaining internal records of individual friction ridge examiner performance. The administrator *shall* provide the FIS facilitator the results for each participant. The FIS facilitator *should* maintain the following records:

- Detailed proficiency testing schedule for eligible friction ridge examiners
- Diary date indicating the expected completion of the proficiency test
- Record log assigning a number to identify the friction ridge examiner to the corresponding test

¹⁴ National Institute of Standards and Technology. 2012. *Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach*

¹⁵ Langenburg. 2012. The GYRO system- A recommended approach to more transparent documentation. *J. forensic Ident.* 61(4): 373-384

- Annotated notes and truncated bench notes of participating friction ridge examiners up until results are confirmed in the event of a non-conforming result
- Root cause analysis in the event of a non-conforming error
- Ongoing data base documenting the historical results for each participating friction ridge examiner
- Performance or method improvement review if necessary, for participating friction ridge examiner

7. Evaluation

The designated GTFD administrator *shall* mark every outcome response form and provide a “pass” or “fail” grade for the friction ridge examiner. The results *may* be returned to the FIS facilitator electronically upon completion of exam.

7.1 The FIS facilitator *shall* document and maintain an ongoing record of each friction ridge examiner for their organization or agency.

7.2 A “pass” is a successful result and acknowledges the friction ridge examiner’s proficiency in friction ridge examinations. All three conclusions were correctly assessed as appropriate responses for the overall test.

7.3 A “fail” result for the purpose of GTFD proficiency test is considered when a non-conforming response is recorded on the outcome response form. The type of non-conforming response *may* include one or a combination of erroneous identification or erroneous exclusion. These types of errors are provable incorrect determinations when mated vs. non-mated samples have prior ground truth knowledge.

7.4 Other inappropriate responses include missed identification and missed exclusion. These two potential errors occur when a friction ridge examiner misses the opportunity to render a decision of identification or exclusion when the possibility to do so was evident based on the data available for interpretation. The expected response was, or is based on the consensus of validating examiners who determined that sufficient data was present and available for the decision. Conversely, another potential error occurs when a friction ridge examiner overstates a conclusion based on insufficient supporting data. This results when the expected result should have been “inconclusive” when the friction ridge examiner overreaches and asserts a definitive categorical conclusion of either “identification” or “exclusion”. Although the examiner may be correct in determining identification or exclusion for a mated or non-mated pair in the test, the consensus decision of testing examiners determined that there was insufficient data was available in the test sample to arrive at an evidence based conclusion of identification or exclusion. In these circumstances the administrator will treat these as inappropriate responses and the outcome will be considered a “fail”. Each error must be evaluated on a case-by-case basis, which is determined by a root cause analysis by the FIS facilitator. The FIS facilitator *can* at their discretion adjust the scale of the root cause analysis depending on the type and severity of the error. Provable non-conforming responses such as erroneous identification and erroneous exclusion *may* require more inquiry as opposed to a missed identification / exclusion or an unjustifiable identification / exclusion.

7.5 To prevent clerical errors associated with the friction ridge examiner inadvertently transcribing or recording the incorrect sample to the source or vice-versa, it is recommended that the participating friction ridge examiner provide a screen view image of the final mark up that illustrates the unknown impression to the corresponding source impression used during the comparison. In the event that the friction ridge examiner does not have CS/pix software or a suitable digital recording software program available, it is recommended to print a hard copy of both the unknown and the known to be retained in file until the results are received.

7.6 In the event of an error, the FIS facilitator will be responsible for completing a root cause analysis. The FIS facilitator shall review the non-conforming error and provide the friction ridge examiner sufficient opportunity to review the root causes of the erroneous outcome. Each FIS agency or organization will be responsible for internal policy regarding the number of attempts to pass a proficiency test and the suitability of the examiner to continue with, or return to casework.

7.7 Each FIS organization or agency *shall* be responsible for policy and protocol dealing with any corrective action taken in order to improve the performance of the individual friction ridge examiner or the overall performance of the FIS organization or agency. The corrective action is intended improve the overall method of the FIS and for quality assurance. Risk management is a necessary consideration in the event FIS personnel fail to meet the requirements of the GTFD proficiency test. The following list below suggests various procedures that *may* be considered and implemented within the routine operations of individual friction ridge examiners.

1. Review of FIS policy and protocols
2. Online Decision Threshold Training (ACEV-DT - Canadian Police College)
3. Mentorship
4. Analysis of distortion training
5. Methodology literature review
6. Practice proficiency examinations
7. Review of exclusion policy and protocol
8. Temporary suspension of active casework until “pass” mark is attained in GTFD proficiency test
9. Case work audit
10. Visual acuity examination
11. Form blindness test (pattern recognition) NIST fingerprint examiner test

At the discretion of the relevant administrator a retake proficiency test will only be assigned after consultation with the FIS proficiency test facilitator to ensure that some measure of root cause analysis was conducted and if necessary, corrective action has been taken.

8. Court Testimony

Recommendations for Friction Ridge Examiners to include the Canadian proficiency testing program on a Curriculum Vitae (CV) and testimony considerations

In 2009 the National Academy of Science (NAS) provided a list of recommendations which included “Developing tools for advancing measurement, validation, reliability, information sharing, and proficiency testing and to establish protocols for examination, methods and practices.” Implementing the Canadian

proficiency testing program as well as following the suggestions outlined in this paper will help to provide strong underpinnings to meet this recommendation by the NAS.

Friction ridge examiners are encouraged to highlight their participation in the Canadian proficiency testing program by including this quality control and assurance metric on their Curriculum Vitae (CV). Each time a friction ridge examiner completes the proficiency test, their CV should be updated to demonstrate to the court their proficiency with friction ridge analysis and comparisons.

In court, friction ridge examiners are encouraged to adduce in evidence that they completed the Canadian proficiency test and the dates during the Voir Dire for friction ridge analysis and comparison expert status. Best practice would be to meet with the assigned Crown Attorney prior to the friction ridge examiners testimony so the proficiency test and other important facts can be presented in an organized, logical manner.

9. Conclusion

CanFRWG recommends that all friction ridge examiners within Canada participate in a regularly scheduled proficiency testing program. The GTFD proficiency test is designed to assist FIS with implementing best practices and improving the overall performance of the organization and the individual friction ridge examiner actively conducting forensic feature comparison examinations. The proficiency test is not intended to be a substituted for an overall predictive false positive or predictive false negative error rate for Canadian friction ridge examiners and the discipline as a whole. Canadian courts should carefully consider the cost versus benefit of allowing the results of individual proficiency test scores to be introduced in court testimony in such a manner that may inaccurately represent the accuracy of the fingerprint conclusion for the case at hand. It will be the friction ridge examiner's responsibility to inform the courts prior to trial and possibly during the trial that proficiency test scores are not representative of case work but rather a quality assurance measure designed to promote accurate decisions for forensic feature comparisons.¹⁶

Although the GTFD proficiency test samples resemble the quality and quantity of friction ridge impressions in case work, several variables such as no verification, lack of consultation, time constraint and awareness of being tested may limit the utility of using proficiency test scores as an all-encompassing error rate for the fingerprint discipline.¹⁷

¹⁶ AAAS, Forensic Science Assessments: A Quality and Gap Analysis- Latent Fingerprint Examination, 2017. (Report prepared by William Thompson, John Black, Anil Jain, and Joseph Kadane)

¹⁷ Gardner et al. Journal of Forensic Science. 2019. Latent Print Proficiency Testing: An Examination of Test Respondents, Test-Taking Procedures and Test Characteristics.