



The
Chartered
Society of
Forensic
Sciences



The COLLEGE
of PODIATRY

Code of Practice for Forensic Gait Analysis

Issue 2

Produced in association with the:



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1. Introduction

1.1.1 The Chartered Society of Forensic Sciences' Forensic Gait Analysis Working Group in collaboration with the College of Podiatry was tasked by the Forensic Science Regulator to write a code of practice for forensic gait analysis which is capable of being read as a self-contained or standalone document. The Forensic Science Regulator requires all providers of forensic gait analysis to ensure these services comply with the requirements outlined.

1.1.2 The code of practice presented here addresses issues specifically for Forensic Gait Analysis (FGA), and is referred to as the FGA Code of Practice hereinafter. Other legal requirements omitted from this text undoubtedly apply, and all practitioners governed, registered or members of other bodies are also expected to adhere to any norms or lawful requirements specified by them also. For instance the Health and Care Professions Council (HCPC) regulates and maintains a register of those working as chiropodists, podiatrists or physiotherapists in the United Kingdom. Practitioners registered with the HCPC are required to comply with the HCPC's standards and guidance at all times. This includes the 'Standards of conduct, performance and ethics, the standards of proficiency for safe and effective practice specific to their profession, and the Standards for continuing professional development'. This is in addition to the expectation that practitioners will "...act in accordance with any relevant code of practice or conduct for expert witnesses that sets appropriate requirements in respect of such matters as objectivity, the avoidance of cognitive bias and scientific validity and quality"¹. Accepting that there are other relevant regulatory bodies, for clarity in this FGA Code of Practice, the Forensic Science Regulator will be referred to as the Regulator and other regulatory bodies referred to by name. The Regulator requires that the FGA Code of Practice shall be complied with whenever forensic gait analysis is being undertaken and compliance (or otherwise) declared as part of the experts report in England and Wales² (see section 19 'The Report').

¹ Personal communication to the Regulator from Marc Seale (Chief Executive and Registrar of the Health and Care Professions Council).

² The Forensic Science Regulator formally covers quality standards in the Criminal Justice System (CJS) of England and Wales, although has been called in to investigate quality failings in other UK jurisdictions.

- 1.1.3 The Regulator has adopted the term 'Forensic Unit' which is defined as 'a legal entity or a defined part of a legal entity that performs any part of the forensic science process'. For the purposes of this document, 'Forensic Unit' will be used to refer to either a large organisation, a department within a large organisation, a small or medium-sized enterprise or a sole trader/practitioner that provides forensic gait analysis services.³ The work undertaken by the Forensic Unit is not restricted to a laboratory environment.
- 1.1.4 Whilst the term forensic gait analysis will be used throughout this document, all aspects of this process will be included, not merely those relating to 'analysis'. This term will be used to include areas within the investigative process such as initial enquiry, screening, comparison, interpretation, peer review/critical findings check and reporting.
- 1.1.5 Compliance with this document aims to ensure that Forensic Units undertaking forensic gait analysis casework will meet the relevant key requirements taken from the Regulator's Codes of Practice and Conduct for Forensic Science Providers and Practitioners in the Criminal Justice System (the Codes). The Regulator's Codes are essentially in three sections; the Code of Conduct (which is applicable to all practitioners), a Statement of Standards and Accreditation which states whether accreditation or a separate practice document such as this FGA Code of Practice applies and a general Code of Practice that can be applied to most disciplines.
- 1.1.6 The main body of this FGA Code of Practice is used to identify the specific measures that the Regulator believes shall be demonstrated. Further explanation of specific terms relating to forensic gait analysis and its provision can be found in the accompanying glossary (section 23).
- 1.1.7 Forensic Units conducting work for the Criminal Justice System (CJS) in England and Wales must also consult:
- a. Criminal Practice Directions V (Part 19); and
 - b. Criminal Procedure Rules (Part 19).

³ The term practitioner is only used in this document when the requirement can only fall on the individual.

- 1.1.8 Whilst this FGA Code of Practice is intended to be self-contained, the Forensic Unit should also consult the following documents where appropriate:
- a. FSR-I-400 (Information: Legal Obligations);
 - b. FSR-G-200 (Guidance: Expert Reports);
 - c. FSR-G-217 (Guidance: Cognitive Bias Effects Relevant to Forensic Science Examinations);
 - d. FSR-G-201 (Guidance: Validation); and
 - e. FSR-C-119 (Appendix: Digital Forensics: Video Analysis).
- 1.1.9 This document is written with references specific to the CJS in England and Wales, although the general requirements are applicable to all UK criminal justice systems. This document doesn't attempt to cover every legal obligation, merely the main ones pertaining to forensic science.

2. Scope

- 2.1.1 Forensic gait analysis is the analysis, comparison and evaluation of features of gait to assist the investigation of crime.
- 2.1.2 This FGA Code of Practice covers forensic gait analysis services from initial enquiry with the commissioning agency through to preparation and presentation of materials for court. Forensic Units commissioned by either the prosecution or the defence shall comply with this FGA Code of Practice in all aspects of forensic gait analysis work undertaken.
- 2.1.3 This FGA Code of Practice does not include forensic science activity that requires accreditation described in the Regulator's 'Statement of Standards and Accreditation section' in the Codes; for example, digital forensic services described by the Codes as 'the process by which information is extracted from data storage media rendered into a useable form, processed and interpreted for the purpose of obtaining intelligence for use in investigations, or evidence for use in criminal proceedings' require accreditation. The published requirements in the Regulator's 'Statement of Standards and Accreditation' shall be referred to should these activities be performed in the Forensic Unit. In addition, this FGA Code of Practice does not include retrieval of footage from the scene (or associated with the scene) or from custody.

2.1.4 FGA can include the analysis, comparison and evaluation of footprint or footwear mark sequences where parameters of gait (such as step length, stride length, base and angle of gait) are apparent. This document refers to 'footage' throughout as this is the predominant evidence type submitted. However, other forensic materials providing this gait information (such as life-size images displaying the sequence) may be submitted for examination.

3. Terms and Definitions

3.1.1 Subject specific terms and definitions are given in the Glossary in section 23. General terms and definitions are in line with those described in the Regulator's Codes.

4. Implementation

4.1.1 This guidance is available for incorporation into a Forensic Unit's standard practice, operating procedures and quality management system from the date of publication.

5. Modification

5.1.1 Issued on 22 September 2020, this is the second issue of the FGA Code of Practice.

6. Service to the Commissioning Agency

6.1 Confidentiality, Independence, Impartiality and Integrity

6.1.1 The Forensic Unit shall ensure all of its practitioners adhere to the Forensic Science Regulator's 'Code of Conduct' ⁴ when conducting forensic casework. ⁵ Practitioners acting as expert witnesses in England and Wales must adhere to the relevant parts of Criminal Procedure Rules (e.g. parts 1, 3 and 19) and Criminal Practice Directions V (part 19).

⁴ The Regulator's Codes of Practice and Conduct are essentially in three sections, the first section titled the Code of Conduct is applicable to all practitioners.

⁵ This is to be used in conjunction with other professional standards or relevant codes (e.g. HCPC's 'Standards of conduct, performance and ethics').

6.2 Business Continuity

6.2.1 To prevent interruption to, or failure of, business critical processes, the Forensic Unit shall develop procedures that enable services to be maintained or restored, which may take the form of Terms of Business or Terms and Conditions that ensure those instructing will have access to the records required in the relevant CJS.

6.3 Limitations of Services

6.3.1 As with other forensic processes, forensic gait analysis has limitations. The list given below is neither finite nor static and will evolve as research and practice progress. At the time of writing, examples of known limitations that shall be communicated to the commissioning agency prior to undertaking forensic gait analysis casework include the following:

- a. forensic gait analysis predominantly relies on observational analysis and comparison, rather than measurable objective techniques;
- b. features of gait in isolation have discriminatory potential but cannot currently be used to identify a person from an open population;
- c. forensic gait analysis does not include body mapping, facial analysis, clothing analysis, height estimations or any other method falling outside the Forensic Unit's documented role and scope of practice;
- d. as gait is dynamic and defined as the manner or style in which a locomotor activity is undertaken, forensic gait analysis does not involve an assessment of standing;
- e. the quality and quantity of the questioned footage;
- f. the quality and quantity of the reference footage;
- g. similar to other forensic disciplines, cognitive, confirmation and contextual bias cannot be entirely eliminated but all steps will be taken to minimise it (for subject-specific information see section 8. For general information refer to FSR-G-217); and
- h. published data regarding the commonality of gait patterns, features of gait and the inter-dependency of features of gait is currently limited.

6.4 Complaints

- 6.4.1 The Forensic Unit shall have policies and procedures for dealing with complaints.
- 6.4.2 The procedures shall define what constitutes a complaint in relation to the work undertaken by the Forensic Unit and shall ensure that appropriate investigations are instigated on receipt of any complaint. Complaints may be received directly from the complainant or via an alternative source (such as a professional body or the HCPC where the practitioners are registered with them). They may take various forms including telephone calls, emails, letter or in-person. Records shall be retained of all complaints, their investigation and outcome. Where a complaint relating to processes and procedures of the Forensic Unit has been upheld, corrective action or other improvement processes will be implemented in line with the process for dealing with non-conforming work detailed in section 6.5.
- 6.4.3 The policies and procedures relating to complaints shall also indicate the escalation criteria to the Regulator, the commissioning agency and any relevant bodies, such as HCPC for practitioners on their register ⁶, including the individual/role holder responsible for the notification. The Regulator should be notified via email to FSREnquiries@homeoffice.gov.uk.
- 6.4.4 Complaint investigation shall include examination of the potential impact on work that has already been undertaken by the Forensic Unit.
- 6.4.5 The policy for complaint investigation shall include:
- a. the specific information that will be received by the complainant;
 - b. when, during the investigation, the information will be delivered;
 - c. the necessary details to rectify the issue if a complaint is upheld (i.e. an identified non-conformity); and
 - d. how the requirement to be open and honest about the issue will be addressed.

⁶ Complaints about HCPC registrants should be emailed to ftp@hcpc-uk.org.

6.5 Non-Conforming Work

- 6.5.1 Non-conformity is the non-fulfilment of a requirement, either within the organisation's policies and procedures or in the specification of the commissioning agency.
- 6.5.2 The Forensic Unit shall have a system in place to evidence continuous process improvement. This system should manage and record the:
- a. potential for non-conforming work to occur and the preventative action taken;
 - b. non-conforming work that has occurred and the corrective action taken; and
 - c. recommendations that have resulted from non-conforming work and the improvement actions taken.
- 6.5.3 Where a non-conformity occurs, its significance in relation to the validity of forensic gait analysis comparisons or conclusions shall be evaluated and its root cause identified. The commissioning agency and the Regulator should be informed of any non-conforming work (as well as any other bodies which may be affected) and the corrective action taken. This shall be completed at the earliest opportunity if it has significantly disaffected the commissioning agency such that it could attract adverse public interest or lead to miscarriages of justice.
- 6.5.4 Casework already reported shall be thoroughly reviewed. Where this review process identifies that a non-conformity has significantly affected results in a reported case, the commissioning agency shall be notified immediately. The report shall be recalled where possible and an additional report will be issued by the Forensic Unit.
- 6.5.5 Preventative, corrective and improvement actions can become apparent during internal audit (see section 13). It is recommended that the Forensic Unit has mechanisms in place, in addition to internal audit, to identify areas for improvement. These may include, but are not limited to:
- a. customer feedback;

- b. results of inter-laboratory ⁷ comparisons (see 17.1.3); and
- c. when expected outcomes are not achieved (for example when a substantial difference in opinion occurs following peer review).

6.5.6 The effectiveness of the preventative, corrective and improvement actions shall also be monitored by the Forensic Unit.

7. Forensic Unit Responsibility

7.1 Quality Manager

7.1.1 The Forensic Unit shall nominate a Quality Manager to ensure all the requirements as stated in this FGA Code of Practice are met. In the case of a sole trader, the Forensic Unit and Quality Manager may be the same person.

7.1.2 The Quality Manager will ensure that the effectiveness and relevance of the quality management system is regularly reviewed and improved.

7.2 Technical Manager

7.2.1 The Forensic Unit shall nominate a Technical Manager to ensure all the technical requirements relating to forensic gait analysis are clearly documented and up to date. This may be the same individual as the Quality Manager, particularly in the case of a sole trader.

8. Cognitive Bias

8.1.1 The Forensic Unit shall recognise that stages of the forensic gait analysis process are subject to subconscious bias and is advised to consult the Regulator's publication on the topic for further information (FSR-G-217).

8.1.2 Cognition is the mental process of 'knowing' and includes awareness, perception, reasoning and judgement. It is distinct from emotion and volition. Cognitive processes include mental shortcuts, which speed up decision making. However, cognitive bias occurs when the shortcut causes inferences about other people and/or situations to be drawn in an illogical fashion. It takes on many forms, including but not limited to the following.

⁷ The term inter-laboratory in this context is the equivalent of inter-Forensic Unit.

- a. Expectation bias, where the expectation of what an individual will find affects what is actually found.
- b. Confirmation bias, whereby people test hypotheses by looking for confirming evidence rather than for potentially conflicting evidence.
- c. Contextual bias is where someone has other information aside from that being considered, which influences (either consciously or subconsciously) the outcome of the consideration.
- d. Motivational bias occurs where, for example, motivational influence on decision making results in information consistent with a favoured conclusion tending to be subject to a lower level of scrutiny than information that may support a less favoured outcome.

8.1.3 As a subconscious issue it is unlikely that an individual will know either way if they are affected and therefore it is wise that all practitioners understand the issue and take appropriate steps to mitigate against it. This often requires limiting exposure to information at certain stages of the process or recusing themselves from certain stages if appropriate. There is a requirement to declare issues that might create conflicts of interest as certain business and personal arrangements may increase some of these risks, but the declaration is not in itself a mitigation of the risk.

8.1.4 Processes and procedures detailed in section 18 shall be implemented as they are intended to manage the risk of cognitive, confirmation and contextual bias through the management of the flow of information to the practitioner conducting the analysis. Such safeguards may include but are not limited to the following.

- a. The practitioner conducting the analysis should only have information about the case that is relevant ⁸ to the analysis, comparison or peer review. ⁹

⁸ This may include the time the subject appears within the field of view, a description of the subject of interest, any time delay between the questioned and reference footage being captured, any editing, enhancements etc. undertaken previously by an imaging unit.

⁹ Controlling this information may mean a case coordinator or lead scientist receives all the case information and ensures that the practitioner receives only the information appropriate for that stage; experts in sole practice, could put the onus on the commissioning body through instruction on how to stage the disclosure to them to manage the flow of information. The expert is still likely to need the contextual or case information, it simply should be held back until certain analytical stages are complete.

- b. Reviewing the questioned footage before the reference footage. Where a forensic practitioner reviews both sets of footage on the same day, the time that the questioned and reference footage were analysed shall be documented.
- c. Requesting that the commissioning agency clearly distinguishes between the reference and questioned footage to be submitted. For example, working copy discs or electronic files shall be clearly labelled as 'reference' or 'questioned' footage; to prevent inadvertent viewing in the wrong sequence.
- d. Implementing a process for blind peer review by a competent forensic practitioner who has preferably had no prior involvement with the case.
- e. Where possible, varying the combination of the peer reviewer and reporting practitioner. ¹⁰

9. Standard Operating Procedures

- 9.1.1 Whilst this FGA Code of Practice provides subject specific key requirements, each Forensic Unit shall have standard operating procedures that describe their process and procedures in sufficient detail to:
- a. allow a competent person, such as another expert, to follow;
 - b. remove ambiguity about significant elements of the method used at the time of the case work; ¹¹ and
 - c. to facilitate continuous process improvement.

10. Document Control

- 10.1.1 This refers to documents produced by the Forensic Unit such as quality manuals, standard operating procedures, working practice guidelines and forms used as part of casework. For documents, case files and information about individuals containing personal or identifying information see 11.2.
- 10.1.2 The Forensic Unit will ensure that all in-house documents are:

¹⁰ In the case of the sole trader they will need to have agreed who carries out their peer review.

¹¹ This is particularly important where there is a protracted period between the casework and the legal proceedings, but is required nonetheless as there remains potential for the case to be subject to application to the appellate court.

- a. approved for suitability by the Quality or Technical Manager prior to issue;
- b. evidenced and/or policy based where appropriate;
- c. reviewed, updated and re-approved as necessary;
- d. version controlled and/or dated; and
- e. retained for a defined period when obsolete or superseded, usually for a period related to the nature of the case the records relate to.¹²

10.1.3 Documents shall be retained securely.

10.1.4 All documents shall be clearly identifiable and include pagination, date of issue and/or revision identification, and the Forensic Unit name if an internally generated document.

10.1.5 It is recommended documents shall be reviewed every two years, retention however is the same as for the casework records.

11. Records

11.1 Technical Records

11.1.1 Technical records refer to all communications, notes and continuity details that are taken in the case.

11.1.2 The Forensic Unit shall have documented procedures to create, maintain and preserve confidentiality of records relating to each case (see 11.2). These procedures should also include the mechanism for investigation of suspected breaches in maintaining records securely and the escalation to appropriate bodies (including but not limited to the Regulator, HCPC and the Information Commissioner's Office (ICO)).

11.1.3 Records shall be made at the time of the activity e.g. receipt of exhibits, observations, comparison or as soon as practicable thereafter. As a minimum, records produced by the Forensic Unit shall include:

- a. submission and receipt of physical exhibits containing footage (such as discs, hard drives, USB memory sticks etc.). Details should include the

¹² Some documents, such as standard operating procedures or validation reports, may be required for the life of the cases files. Retention periods can be 3, 7 or (in serious cases) 30 years from the last time the technique in question was used and/or reported.

name, signature and date of those submitting and receiving the footage.

The mechanism of delivery should also be documented such as 'by hand' or 'internal courier system'. Chain of custody records that detail each person or organisation that takes possession of an item/exhibit shall be maintained from the receipt of the items/exhibits through processing to storage and where applicable to return to commissioning agency, or disposal;

- b. the case examination strategy including any pre-assessment of probabilities of potential outcomes;¹³
- c. recommendations or referrals that fall outside the Forensic Unit's role and scope of practice that have come to light as part of the screening/exhibit handling process. This may include referral for facial identification, body mapping, height estimates, clothing comparisons, footwear comparison etc.;
- d. traceability of equipment used as part of the forensic gait comparison process. This should include details of the computer and software (including version) that was used to view the footage;
- e. all communication relating to each case. This includes all communication (including email face to face, telephone, Skype, etc.) relating to the initial enquiry, screening outcome, contract agreements, cancellation of work, reports, statements and points of agreement and disagreement between forensic practitioners;
- f. observations made relating to the quality of the footage and the analysis of features of gait. Screenshots that are used to aid analysis of footage quality shall also be included in the records;
- g. results of the comparison made between the features of gait observed in the questioned and reference footage;
- h. the Forensic Practitioner's rationale for arriving at the conclusions made, giving details of any data or other material on which the conclusions were based on;
- i. traceability to the forensic practitioner who undertook each section of casework including their name, and the date that the preliminary

¹³ In terms of case assessment and interpretation.

assessment, analysis, comparison, report or peer review took place. The records shall be sufficient to provide an auditable trail;

- j. appropriate protective marking; and
- k. definitions of technical abbreviations used in records.

- 11.1.4 The records will be contemporaneous, accurate, legible, complete and reliable for evidential and accountability purposes.
- 11.1.5 All case files, records and materials should be clearly identifiable, for example with a unique reference number. Each page of every document in the case file should be traceable to the case.
- 11.1.6 There should be a mechanism by which the integrity of the documentation is maintained, for example, it should be easy to detect if a document is added to the file at a later date or goes missing from the file.
- 11.1.7 Hard copy records generated by the Forensic Unit, used as part of the case file, should be paginated using a page numbering system that indicates the total number of pages and stored securely with access only limited to appropriate persons.
- 11.1.8 Electronic records and footage shall be backed up securely and appropriately on a regular basis as determined by the Forensic Unit. If records are stored electronically a mechanism should be in place to prevent files/data being removed or lost with access only limited to appropriate persons. There should be a way of knowing which records are stored in which locations. Electronic equivalents of handwritten initials or signatures are acceptable if the Forensic Unit can demonstrate that the electronic initials or signature can only be applied by the individual represented by the electronic initials or signature.
- 11.1.9 All non-electronic records produced by Forensic Unit personnel shall be retained in a clearly identifiable and secure casefile system (e.g. lockable cabinet in lockable room). Records should be made in a permanent manner; for example, handwritten notes should be in black permanent ink.
- 11.1.10 If records are amended, the original and amended versions shall be kept.

- 11.1.11 The records required to support conclusions shall be such that another competent practitioner could evaluate what had been performed, interpret the data and if necessary repeat the activity.
- 11.1.12 The Forensic Unit's record retention policy shall comply with the legal requirements in the applicable jurisdiction(s) and any stated requirements from the commissioning agency.

11.2 Control of Records

- 11.2.1 Retention times for records shall satisfy the requirements of legislation and the commissioning agencies of the Forensic Unit. Retention guidance typically involves various requirements; however the requirement of the CJS is normally tied to the potential period of imprisonment. Forensic Units should also be aware of any impact on retention following General Data Protection Regulation (GDPR), and their role (data controller, data processor).
- 11.2.2 The Forensic Unit should distinguish between records created and held by itself, and items submitted to the Unit by the commissioning agency. Items submitted may include native (original) exhibits and/or copies of analogue and digital images. Retention is a duty of the prosecution therefore any material supplied by the prosecution may be returned (if original material) or destroyed (if a copy) upon completion of the case by the Forensic Unit. Records created by the Forensic Unit may be needed for any subsequent judicial process, including an appeal and therefore need to be retained for the entire typical custodial period for that crime type. Such records should therefore be retained securely for the following periods ¹⁴, unless notified by the commissioning agency otherwise in writing:
- a. major and serious crime - 30 years minimum; and
 - b. volume crime - 6 years minimum.
- 11.2.3 Records shall be securely stored (e.g. password protected and/or encrypted electronic files, lockable cabinet in lockable room for physical files), accessed by appropriate persons and subsequently disposed of (e.g. incinerated,

¹⁴ See NPCC (as amended) 'Storage, retention and destruction of records and materials seized for forensic examination'. Available from: : www.gov.uk/government/publications/storage-retention-and-destruction-of-records-and-materials-seized-for-forensic-examination. [Accessed 17/06/2020]

shredded, deleted) in a manner appropriate to their sensitivity. These security arrangements should be subject to audit and the procedures should also include the mechanism for investigation of suspected breaches in maintaining records securely including the escalation to appropriate bodies (including but not limited to the Regulator, HCPC the ICO).

11.2.4 If information is lawfully required under the disclosure rules, protective marking does not provide exclusions.

12. Peer Review/Critical Findings Check

12.1.1 Critical findings are observations and results that have a significant impact on the conclusions reached and the interpretation and opinion provided. Peer review is a check of these critical findings and is required of all casework undertaken by the Forensic Unit in order to provide consistent, reproducible and reliable results. Forensic gait analysis utilises various methods (including interpretative methods) in its approach and in reaching its critical findings. Whichever method is used, peer review should be implemented and repeated for each and every case undertaken by the Forensic Unit.

12.1.2 The Forensic Unit shall have a procedure for carrying out peer review. The procedure should include:

- a. control of independence (e.g. cognitive bias and conflicts of interest);
- b. competency requirements;
- c. resolution of disagreement between reporting practitioner and peer reviewer; and
- d. subcontracting arrangements where applicable: including evidencing and recording compliance with the above and record security and retention arrangements.

12.1.3 Peer review should be carried out independently and blindly, with the questioned footage being viewed prior to the reference footage.

12.1.4 Peer review should follow a structured process to enable a thorough review of the original interpretations and conclusions made. The record shall clearly indicate where each critical finding has been checked and agreed, by whom and the date the checks were performed.

- 12.1.5 Where the peer reviewer is subcontracted or working on external premises, the peer reviewer shall have met competency requirements as outlined in the Forensic Unit's policy and section 15 and 16 of the FGA Code of Practice (including but not limited to record security and retention).
- 12.1.6 A procedure should be in place for resolving instances where a disagreement exists between reporting practitioner and peer reviewer in the conclusions made. Differences in opinion in the conclusion/outcome should be noted and documented in the case file. Unresolved differences require disclosing to the commissioning agency and the court.
- 12.1.7 The critical findings check is not synonymous with the clerical check of the draft report. The role profile should specify the staff competent to carry out each procedure.

13. Internal Audits

- 13.1.1 The Forensic Unit shall conduct internal audits to confirm that all aspects of the management system are implemented, reviewed, effective and conform to standard operating procedures and the FGA Code of Practice.
- 13.1.2 Internal audits can be undertaken by staff with formal audit training employed by the Forensic Unit or external to the Forensic Unit (e.g. for sole traders, it is suggested that internal auditors are acquired using a similar resource to that of peer review). The expectation of the FSR and the HCPC is that individuals undertaking internal audits have formal training in this activity and receive on-going support. This should form part of their continuous professional development.
- 13.1.3 The internal audit procedure is essential for evidencing continuous improvement, non-conformances and associated corrective actions.
- 13.1.4 The Forensic Unit should develop a comprehensive internal audit schedule which includes:
- a. planned audits for the auditing cycle (at least once every four years for each specific method in the quality management system);
 - b. scope of the audit;
 - c. audits completed as planned;

- d. audits that are cancelled and why;
 - e. rescheduled audits;
 - f. audits completed as scheduled;
 - g. additional audits planned and why; and
 - h. additional audits completed.
- 13.1.5 Records of individual case files will be subject to internal audit. As forensic gait analysis requires forensic practitioners to form a statement of opinion, the internal audit will include a review of the process by which these opinions are formed.
- 13.1.6 Where forensic gait analysis is provided from a number of different operational sites, the internal audit shall cover all sites.
- 13.1.7 The internal audit shall be conducted objectively, and the results recorded accurately.
- 13.1.8 Non-conformances or other issues resulting from the internal audit shall be investigated as soon as possible with corrective action being implemented. The Forensic Unit shall then review the corrective action to ensure it has been effective (see section 6.5)
- 13.1.9 The Regulator, and HCPC if the practitioner is registered with them, shall be informed at the earliest opportunity when internal audits identify serious issues relating to the working practices, processes and procedures of the Forensic Unit. The Regulator can be notified of these serious issues by emailing FSREnquiries@homeoffice.gov.uk.

14. Health and Safety, Facilities and Equipment

14.1 Health and Safety

- 14.1.1 The Forensic Unit shall ensure there is a health and safety programme which covers work carried out in their facilities. This should include guidance on taking regular breaks from the screen when viewing footage over long periods.
- 14.1.2 The Forensic Unit should be aware that footage may include disturbing scenes and if affected advised to seek professional mental health support through their general practitioner and/or from websites such as www.mind.org.uk. The

practitioner shall be mindful not to disclose confidential, case specific information if such support is required. The preliminary assessor and/or reporting practitioner shall notify the reporting practitioner and/or peer reviewer of such disturbing scenes before accepting the role in the case.

14.2 Facilities

14.2.1 The Forensic Unit shall ensure that:

- a. the facilities used to conduct forensic gait analysis casework are appropriate for the practitioner and the work being undertaken;
- b. lighting does not adversely affect observations made due to screen glare;
- c. facilities cater for the safe storage of exhibits (discs, hard drives, etc.) to prevent loss, deterioration and corruption;
- d. facilities cater for the safe storage of casefiles to maintain the integrity and identity of technical records;
- e. interference with, or theft of exhibits is protected against, recommending that the Forensic Unit work from loss-less working copies of footage and that electronic data is backed up appropriately;
- f. exhibits, casefiles and confidential waste are securely disposed of after retention period is passed, if not returned to the commissioning agency; and
- g. there is controlled access to exhibits and casefiles including restriction of the area where forensic gait analysis is undertaken, with a held list of personnel permitted to enter the area that is regularly reviewed and updated.

14.3 Equipment

14.3.1 The Forensic Unit shall ensure that equipment is suitable for carrying out analysis and comparisons of footage (such as computer hardware, software and monitor clarity, dual monitors, etc.).

14.3.2 Records shall be maintained for each item of equipment and any software significant to the examinations/tests performed.

14.3.3 The equipment used in the forensic gait analysis process shall be documented in the forensic practitioner's report. This will usually include the type of

PC/laptop, monitor (including resolution) and software used, as well as how the recordings were viewed e.g. normal and slow speed as well as frame by frame.

15. Technical Requirements

15.1 Code of Conduct

15.1.1 The Forensic Unit shall ensure that all permanent, temporary and contract personnel comply with the Regulator's Code of Conduct as it is specific to the provision of scientific evidence.

15.1.2 The Regulator's Code of Conduct shall be adhered to in conjunction with any other provisions or normative documents imposed by authoritative bodies for the practitioner's discipline. For example, registrants with the HCPC shall also abide by the HCPC Standards of conduct, performance and ethics.

15.2 Personnel

15.2.1 The Forensic Unit shall carry out appropriate background checks (e.g. security checks) on all candidates for employment and contractors in accordance with relevant laws, regulations and ethical requirements. These checks shall be proportional to business requirements, the classification of the information to be accessed and the perceived risks.

15.2.2 The contracts for all staff, permanent, temporary and subcontractors shall contain confidentiality agreements, their own and the Forensic Unit's responsibility for information security and details of their expected conduct.

15.2.3 The Forensic Unit's management system shall define each role within the unit and its scope, and specify requirements for qualifications, training, experience, continuous professional development and knowledge for the tasks assigned to each role. Having qualifications, training and experience neither guarantees practical competence nor sound judgement. Therefore, the Forensic Unit shall be able to demonstrate with objective evidence that all personnel are competent, by carrying out assessments of their knowledge and skills against defined criteria (see also section 16).

15.2.4 The comparison of features of gait is a cognitive process that relies upon the competence of the practitioner to perform examinations and form conclusions

based upon their findings. The conclusions drawn will be made based upon their training, knowledge, skill, experience and awareness of subject limitations. However, the basis for these conclusions shall be traceable and justifiable.

- 15.2.5 Once a conclusion is reached, the evidential weight that can be placed on the findings should be considered to be a matter of expert opinion and not a statement of fact.¹⁵

15.3 Initial/Introductory Training

- 15.3.1 The Forensic Unit's recruitment scheme may include an assessment of forensic gait analysis capabilities. The training of new staff shall follow a defined programme. The trainee forensic practitioner should:
- a. develop subject specific knowledge of forensic gait analysis;
 - b. develop basic knowledge of the role and scope of other forensic disciplines (to aid appropriate referral and to aid recognition of when a requested task falls out of the forensic practitioner's role and scope of practice);
 - c. develop subject specific knowledge of imaging processes that may influence a forensic gait analysis comparison;
 - d. understand the role, scope and the expectations of an expert witness;
 - e. develop knowledge specific to the processes and procedures of the Forensic Unit;
 - f. include shadowing relevant personnel undertaking tasks within their role and scope;
 - g. under mentorship, assist with forensic gait analysis enquiries;
 - h. complete preliminary assessments of ground truth or archived casework providing opinion of image suitability;
 - i. complete preliminary assessments of ground truth or archived casework providing opinion of observable features of gait;

¹⁵ Jackson, G., Aitken, C. and Roberts, P. (2015) 'Communicating and Interpreting Statistical Evidence in the Administration of Criminal Justice. Nuffield Guide 4. Case Assessment and Interpretation of Expert Evidence: Guidance for Judges, Lawyers, Forensic Scientists and Expert Witnesses'. www.rss.org.uk/Images/PDF/influencing-change/rss-case-assessment-interpretation-expert-evidence.pdf [Accessed 17/06/2020]

- j. complete comparisons using ground truth or archived casework of gait and features of gait between questioned and reference footage under supervision;
- k. complete interpretations and form a statement of opinion using ground truth or archived casework under supervision; and
- l. complete court room training including the presentation and cross examination of a mock case.

15.3.2 It is recognised that the training stated above may be achieved through means other than in-house training ¹⁶ and the introductory training process may vary as a result. For example, sole traders may complete these levels via distance learning with a competent external Forensic Unit or educational establishment.

15.3.3 Whilst not exhaustive, the following list of common examples may contribute to the trainee's qualifications, ability and experience:

- a. training or experiential learning with an external Forensic Unit or mentor;
- b. completion of the Chartered Society of Forensic Sciences' competency scheme in forensic gait analysis;
- c. completion of or working towards ¹⁷ a Bachelor of Science degree related to gait analysis;
- d. completion of or working towards a Bachelor of Science degree in a forensic science related discipline;
- e. completion of or working towards postgraduate study in a forensic science or forensic gait analysis related discipline;
- f. completion of or working towards a doctorate in a subject relevant to forensic gait analysis;
- g. participating in research activity relevant to forensic gait analysis;
- h. peer reviewing manuscript submissions for research relevant to forensic gait analysis;
- i. completion of an expert witness training programme;
- j. court attendance to observe proceedings;

¹⁶ However, developing knowledge pertaining to forensic unit processes and procedures (15.3.1 v) shall be developed through in-house training.

¹⁷ 'Working towards' in this context implies the trainee has relevant qualifications elsewhere and is undertaking additional study. For example, a biomechanist holds a BSc in human movement and is working towards a BSc in Forensic Science.

- k. continued professional development activity including relevant conference attendance ¹⁸; and
- l. workshop and short course attendance including image analysis, forensic gait analysis, expert witness training, standards of practice, etc.

15.3.4 The individual's training programme should be tailored according to their prior expertise, specialist knowledge and experience; however the trainee and mentor/supervisor should ensure training described in 15.3.1 is completed. Formative assessment of development for the trainee shall take place at each level of training as defined in the Forensic Unit's training programme. Assessments may take a variety of forms, dependent on the task(s) performed e.g. written and/or oral examinations; practical exercises; correlation of results with those obtained by other trained staff or direct observation by an appropriately qualified person (15.3.1 to 15.3.3). In many cases, a combination of assessment techniques will be the most appropriate approach. Timescales for assessment will be determined by the Forensic Unit and will take into account the trainee's pre-existing qualifications, level of ability and experience.

15.3.5 The trainee will maintain a portfolio to evidence their learning and development. The Technical Manager will determine when a trainee is suitable for assessment at a particular level of training.

15.3.6 Prior training does not automatically determine competence. This shall be verified ¹⁹ by the Forensic Unit when employing new staff even if from another FGA organisation.

16. Competence

16.1 General

16.1.1 The Forensic Unit shall define the competence requirements for staff and have a policy that ensures that all staff undertaking forensic gait analysis (including

¹⁸ Such as the Chartered Society of Forensic Sciences' Conference; British Association for Human Identification Conference; International Association for Identification Conference; the European Network of Forensic Science Institutes Conference; College of Podiatry Conference, etc.

¹⁹ E.g. through checking of qualifications, competency testing results, evidence of continued professional development, or through additional testing.

temporary staff and subcontractors) are competent to perform the work required.

16.1.2 The competency testing process shall be designed, organised, executed and assessed by a recognised independent body.

16.1.3 The competency testing process shall be cyclical to evidence continued competence of the forensic practitioner.

16.1.4 The Forensic Unit shall have policies and procedures for taking remedial action when competency is found to have lapsed or not achieved.

16.2 Continued Professional Development

16.2.1 The Forensic Unit shall have procedures for the on-going training and maintenance of competence, skills and expertise of their staff.

16.2.2 Each practitioner shall maintain an up-to-date record of the training and continued professional development they have received. These records shall include academic and professional qualifications, external or internal courses attended and any relevant training (and retraining, where necessary) received whilst working for the Forensic Unit.

16.2.3 Records shall be sufficiently detailed to provide evidence that each member of staff has been properly trained and that their competence to perform a task or test has been formally assessed on an ongoing basis. These records should be retained for an appropriate defined period according to the expectations of the commissioning agency and/or the legal system.

16.2.4 Forensic Units should support their staff in their continued professional development.

16.2.5 Forensic Units should seek and receive feedback on their practice. They should also support practitioners to reflect on their practice and use feedback for continuous improvement.

17. Validation of Methods

17.1 General

17.1.1 Validation ensures that "...a method, process or device is fit for the specific purpose intended" (the Codes). If the method is fit for the intended purpose and adhered to, the results produced can be relied upon. The same level of confidence in the results is required whether the method is to be used routinely or infrequently. Whilst the courts can consider all possible sources of evidence, they may rule scientific results inadmissible where the validity of a method cannot be demonstrated. Even when a method is considered 'standard' or 'widespread' it still requires internal validation (verification) to be carried out by the Forensic Unit. In *Lundy v. The Queen* (New Zealand) [2013] UKPC 28, the Privy Council made the following comments.

"It is important not to assume that well established techniques which are traditionally deployed for the purpose of diagnosis can be transported, without modification or further verification, to the forensic arena where the use to which scientific evidence is put is quite different from that involved in making a clinical judgement. Put simply, evidence that can properly be used to reach a confident medical verdict may not measure up to the more stringent requirements that arise in the setting of a criminal trial."

17.1.2 At the time of writing, forensic gait analysis predominantly utilises interpretative rather than measurement based methods. Interpretative methods are used to observe and compare features of gait and shall be validated following criteria outlined by the Regulator (see section 17.2).

17.1.3 Method validation requires functional and performance criteria to be identified and tested. For interpretative methods, this is achieved by focusing on the competence to perform forensic gait analysis against representative ground truth and/or archived data. Therefore, interpretative methods are validated by showing that staff can provide consistent, reproducible and reliable results that are compatible with the results of other competent staff. The Forensic Unit can meet these requirements by a combination of:

- a. blind, independent peer review. This requirement is met during the peer review phase of live casework;

- b. participating in inter-laboratory comparisons. This is equivalent to proficiency testing and compares the outcomes of different Forensic Units. For sole traders, it is suggested that this is achieved using a similar resource to that used for peer review;
- c. external acknowledgement with a recognised and relevant professional body. For example, successful completion of the Chartered Society of Forensic Sciences competency scheme in forensic gait analysis.
- d. designing frequent in-house assessments using competence tests. For example, similar archived and/or ground truth casework used as part of initial training can be used for this process (see section 15.3). For sole traders, in-house assessment is not feasible. Therefore, inter-laboratory assessments are recommended as an alternative.

17.1.4 Methods used by the Forensic Unit can be acquired by:

- a. developing a new method within the Forensic Unit;
- b. adopting a method that has been developed outside of the Forensic Unit; and/or
- c. making minor changes to a pre-existing in-house method.

17.1.5 Regardless of how the method is developed, it shall be validated for use within the Forensic Unit.

17.2 Validating a Method Within the Forensic Unit

17.2.1 When validating a method for use in forensic gait analysis the Forensic Unit shall:

- a. determine the end-user's requirements; ²⁰
- b. determine the specification of the method; ²¹
- c. conduct a risk assessment of the method; ²²
- d. review the end-user requirements and specification; ²³

²⁰ The requirements of the method from the perspective of the criminal justice system and intermediate users such as the commissioning agency.

²¹ This explains what the method will do and how it will do it.

²² This addresses perceived risks to the end-user that may result from implementing the method.

²³ Review the specification to ensure it accurately reflects the end-user's requirements. Following the risk assessment, review and revise the end-user's requirements or the specification as necessary.

- e. define the acceptance criteria for the method; ²⁴
- f. produce a validation plan for the method; ²⁵
- g. detail the outcomes of the validation exercise;
- h. independently assess the validation work to ensure the method complies with the acceptance criteria for the specification; ²⁶
- i. produce a validation report; ²⁷
- j. produce a statement of validation completion; and
- k. devise a plan for implementation and monitoring of the method.

17.2.2 The Forensic Unit is advised to consult FSR-G-201, Guidance: Validation, for further detailed information on this process. For instance, such guidance recommends a literature search be conducted to review the underpinning science that the method is based on. Such a review would also draw upon papers relating to the use of gait analysis in other contexts that consider factors such as validity and accuracy which may equally apply to the use of gait analysis in the forensic context. Such studies may give an insight into the experimental design required, whether this is a novel or an existing method being adopted by the Forensic Unit.

17.2.3 Novel methods developed entirely within the Forensic Unit will require larger developmental validation studies than those being adopted from elsewhere which require internal validation/verification. Those intending to develop such methods should consult FSR-G-201, Guidance: Validation. It is expected most Forensic Units will use variations of methods published in peer reviewed literature, but they shall be verified to show they meet the user requirements. This means all validations start with defining what the method needs to do (i.e. the creation of an end-user requirement and specification). Where validation of method studies have not been undertaken specifically relating to the use of forensic gait analysis, studies relating to the use of gait analysis in other

²⁴ This states the criteria required for the method to be accepted.

²⁵ This identifies and defines the functional and performance requirements of the method. It sets out the test to be performed and the acceptable results that should be achieved.

²⁶ For sole traders, the independent reviewer could be obtained from the resource used for peer review.

²⁷ This should include the end-user requirements, specification, risk assessment, validation plan and exercise, the results of the exercise, recommendations resulting from the validation exercise.

contexts may be drawn upon provided that the results of such studies have been peer reviewed and published by the scientific community.

17.2.4 The efficacy of the method will be determined using the criteria listed in 17.2.1. The amount of work required to verify a method that has been developed and validated externally to the Forensic Unit depends on the following:

- a. the adequacy of the available existing validation data; and
- b. the familiarity and experience the Forensic Unit has with the techniques, equipment and facilities involved.

17.2.5 Prior to use, an up-to-date literature search should be conducted to ensure the method is still reputable and has not been superseded by a more reliable, validated method.

17.2.6 The literature review underpinning the method shall be maintained. It shall be disclosed when the literature critiques the method or a range of opinion on the accuracy or applicability of the method arises. Where the literature review indicates issues with the method or that change is required for good practice, the policy should consider changing or replacing the method. Significant method changes and replacements will require a new validation (see 17.2).

17.3 Verifying Minor Changes to Pre-Existing In-House Methods

17.3.1 A full re-validation of minor changes made to an existing method used within the Forensic Unit should not be required. The impact of the proposed changes shall be risk assessed, verified against the original validation and authorised in line with other validation studies.

17.3.2 A revalidation is required when a proposed change is risk assessed and is shown to have a potential influence on the results obtained from using the amended method.

17.4 Validation Library

17.4.1 Once a method has been approved for use within the Forensic Unit and a statement of validation completed, the standard operation procedure for the method will be retained in the validation library along with supporting scientific literature. The validation library shall include:

- a. the specification for the method approved;
- b. the risk assessment for the method approved;
- c. the validation plan for the method approved;
- d. the validation report;
- e. the record of approval; and
- f. the statement of validation completion.

17.4.2 If each of these sections is present in the validation report, they do not need to be added individually to the validation library.

17.4.3 Where the method relies on a reference collection or database, their nature, access and availability should be described.

17.4.4 The information in the validation library shall be disclosable. Disclosure to the courts takes precedence over intellectual property requirement.

18. Process of Forensic Gait Analysis

18.1 Principles of the Process

18.1.1 Prior to reviewing the footage, the Forensic Unit must establish the requirements of the commissioning agency, taking into account relevant circumstances pertaining to the case and the facts in issue. Such requirements include preliminary (quality) assessment, investigative opinion and/or evaluative opinion.

18.1.2 The commissioning agency may request a preliminary assessment of:

- a. the questioned footage (section 18.3) with a subsequent report (section 19) detailing the assessment findings. The content of this report may include the suitability of the footage for use in forensic gait analysis; or
- b. the questioned footage (section 18.3) with a view to progressing to investigative opinion; or
- c. both the questioned and reference footage (section 18.3) with a view of progressing to evaluative comparison if the footage is suitable for use in forensic gait analysis.

18.1.3 The commissioning agency may request an investigative opinion regarding questioned footage that may or may not have undergone previous quality

assessment by the Forensic Unit or commissioning agency.²⁸ Examples of investigative requests may include, but are not limited to:

- a. whether a figure of interest observed in questioned footage demonstrates unusual features of gait; or
- b. whether a figure of interest observed in multiple clips of questioned footage shows features of gait that can be used to associate or disassociate the clips with one another.

18.1.4 The process for investigative opinion shall incorporate the following stages in the following order.

- a. Preliminary assessment of the suitability of the questioned footage for use in forensic gait analysis (section 18.3).
- b. Observation and analysis of features of gait exhibited by the figure/s in the questioned footage (section 18.4).
- c. Generation of explanations for the observations.
- d. Consideration of the limitations of the analysis (section 18.6).
- e. Generation of an expert report explaining investigative opinions (section 19).

18.1.5 The commissioning agency may request an evaluative opinion. This usually involves the analysis, comparison and evaluation of features of gait displayed between a figure in questioned footage and a subject in reference footage. This footage may or may not have undergone a previous quality assessment. In such instances, the following stages will be undertaken in the following order.

- a. Devising a case examination strategy.²⁹
- b. Preliminary assessment of the suitability of the questioned footage (section 18.3).
- c. Preliminary assessment of the suitability of the reference footage by a different individual³⁰ than will perform stages iv-ix (see section 18.3).

²⁸ The commissioning agency may screen the footage prior to submitting to an external forensic science provider.

²⁹ For example, the commissioning agency's forensic strategy may determine which footage is submitted/used/compared as part of the process and this should be documented. The case examination strategy may also be developed using the outcome of the quality assessment. Footage of greater quality and/or providing more gait information may be prioritised over footage that is of poorer quality or provides less gait information.

³⁰ This is to assist control of cognitive bias by ensuring that the individual analysing the questioned footage has not already seen the reference footage.

- d. Observation and analysis of features of gait exhibited by the figure/s in the questioned footage (section 18.4).
- e. Observation and analysis of features of gait exhibited by the subject/s in the reference footage (section 18.4).
- f. Comparison of the features of gait exhibited by the figure in the questioned footage and the subject in the reference footage (section 18.5).
- g. Consideration of the limitations of the quality of the footage, the analysis and comparison. Incorporation of these considerations into an evaluation of the strength of the findings (section 18.6).
- h. Generation of an expert report explaining evaluative opinions (section 19).
- i. Peer review by another forensic practitioner (section 18.7).

18.2 Provision of Footage

- 18.2.1 Suitable video footage will be provided by the commissioning agency to the Forensic Unit in a secure manner. The commissioning agency should be made aware of any arrangements to control the flow of information to individual practitioners as well as what information should be disclosed at what stages.
- 18.2.2 Video footage submitted for preliminary assessment, investigative or evaluative opinion should be a direct copy of the original footage, ideally in a native format. Working copy discs or electronic files shall be clearly labelled as 'reference' or 'questioned' footage, to prevent inadvertent viewing of the reference before the question footage.
- 18.2.3 Where the format of the video footage submitted to the Forensic Unit has been changed to aid recovery or playability, or is suspected to have been changed, a sample of the footage in its original format shall be requested from the commissioning agency. Where a sample of the footage in its original format is not provided:
 - a. the potential impact of any changes in the quality of the footage on subsequent analysis shall be made clear to the commissioning agency;
 - b. this shall be clearly stated in the final report, together with a statement to the effect that any changes in the quality of the footage that may have impacted on analysis and comparison of features of gait could not be visually assessed.

- 18.2.4 Where a sample of the footage in its original format is provided, this sample should be viewed to enable an estimation to be made of any changes to the quality of the footage that may impact on subsequent analysis and comparison. The outcomes of such comparison and estimation shall be recorded in the final report.
- 18.2.5 The software/firmware used to undertake the analysis and comparison of the footage shall be recorded in the final report, including details of the version of the software/firmware.
- 18.2.6 Any changes to the format of the footage and/or enhancements of the footage made by the Forensic Unit within the scope of their expertise shall be recorded.

18.3 Preliminary Assessment of the Suitability of the Questioned and Reference Footage for use in Forensic Gait Analysis

- 18.3.1 The preliminary assessment aims to prevent the case proceeding to detailed viewing, to only then find that the footage supplied is unsuitable, expending time, resources and incurring avoidable additional costs to the commissioning agency. Whilst this practice is recommended, it is not compulsory.
- 18.3.2 To prevent false rejections of the casework during preliminary assessment, the preliminary assessment shall be undertaken by an individual deemed competent in forensic gait analysis. However, as the individual will be viewing all of the footage and therefore exposed to potential cognitive bias, this should not be the same individual who will later undertake the forensic gait analysis and comparison. Therefore, if the preliminary assessment cannot be performed in this manner, the reference footage shall not be viewed at this stage and the commissioning agency shall be informed that the reference footage has not been assessed for suitability for use in forensic gait analysis. The commissioning agency shall be informed that a preliminary assessment of the reference footage will only commence once the questioned footage has been fully analysed and that proceeding may have financial implications for the commissioning agency. A record of this advice shall be documented in the case file.
- 18.3.3 The method used for the preliminary assessment shall be:

- a. specified in the standard operating procedures and management system;
- b. standardised to ensure that all submitted footage is assessed against the same criteria; and
- c. recorded for future reference, and the information stored with other case related materials.

18.3.4 The method used for the preliminary assessment shall include consideration of factors such as, but not limited to:

- a. distortions of the image inherent in the footage;
- b. the resolution (sharpness), lighting and frame rate of the footage;
- c. the locomotor activity being undertaken by the figure/subject;
- d. the number of consecutive mid gait steps seen in the footage;
- e. the position of the camera relative to the figure/subject;
- f. the direction in which the figure/subject is moving relative to the camera;
- g. the relative size of the image of the figure/subject in the field of view;
- h. the possible impact on gait associated with the figure/subject's footwear or lack of footwear; and
- i. the possible impact on gait associated with the figure/subject's environment.

18.3.5 Where a decision cannot be made as to the suitability of questioned and/or reference footage for use in forensic gait analysis, a second opinion may be sought from another forensic practitioner with expertise in forensic gait analysis, who will not be involved in subsequent analysis or peer review of this case.

18.3.6 The commissioning agency should be informed of the outcome of the preliminary assessment of the footage as soon as possible, together with feedback regarding the reasons for the outcome, and where appropriate guidance on remedial actions.

18.3.7 The outcome of the preliminary assessment of the footage shall be recorded and stored with other case related materials.

18.3.8 The commissioning agency may request a report detailing the outcome of the preliminary assessment (section 19).

18.4 Analysis of the Questioned and Reference Footage

- 18.4.1 For both investigative and evaluative opinion, the questioned footage shall be analysed and contemporaneous notes made regarding observable features of gait demonstrated by the figure(s). Where reference footage is available, such as in requests for evaluative opinion, the questioned footage shall be viewed before the reference footage. Where both sets of footage are reviewed on the same day, the time that the questioned and reference footage were analysed shall be documented.
- 18.4.2 Where reference footage is available, it shall be analysed and the features of gait demonstrated by the subject(s) recorded. This shall be completed without reference to either the questioned footage or the features of gait documented as being exhibited by the figure(s) seen in the questioned footage.
- 18.4.3 The forensic practitioner shall use all suitable footage for analysis, unless otherwise specifically determined in the case examination strategy developed in liaison with the commissioning agency.
- 18.4.4 The sections of footage used for the observation of features of gait shall be listed in the final report.
- 18.4.5 The sections of footage not used for the observation of features of gait shall also be listed, and a record kept of the reasons why it was not used.
- 18.4.6 The method used to observe features of gait from the footage shall be stated in contemporaneous notes and in the final report.
- 18.4.7 The method used shall be systematic and transparent, and shall be applied in the same way to all pieces of footage, in all casework (see section 17).
- 18.4.8 The method used should be supported by:
- a. documentation as outlined in 17.4.1; and/or
 - b. peer reviewed published research.
- 18.4.9 Where research into the application of methods in the forensic context is scarce, research can be drawn from the wider field of gait analysis. The practitioner should recognise that research findings from another discipline may not be valid for the intended purpose, and further verification of the method may be required.

- 18.4.10 Where there is a range of opinion on application of the method in the literature, this shall be recorded and included in reports intended for court (see Criminal Procedure Rule 19 and Criminal Practice Direction V 19A.5).
- 18.4.11 Where the expert provides an opinion solely based on their experience, it is important that the statement makes clear, in detail, the experience which allows the expert to proffer that opinion.
- 18.4.12 Wherever possible reference should be made to relevant peer reviewed publications that have investigated and established the reliability and limitations with which features of gait can be observed using the methods employed by the forensic practitioner.
- 18.4.13 A summary of the features of gait derived from the footage shall be recorded in the final report.

18.5 Comparison of the Features of Gait

- 18.5.1 Where reference footage is available and required for requests of evaluative opinion, the method used to compare features of gait derived from different pieces of footage shall be stated in the final report.
- 18.5.2 The method used shall be systematic and transparent, and shall be applied in the same way to all casework.
- 18.5.3 Features of gait should only be compared if the locomotor activity being undertaken in the questioned footage is the same as that being undertaken in the reference footage, for example walking should be compared with walking.
- 18.5.4 The comparison should consider, although not necessarily be limited to, features of gait that:
- a. are exhibited by both the figure in the questioned footage and the subject in the reference footage;
 - b. would preclude the figure in the questioned footage from being the subject in the reference footage;
 - c. are exhibited by the figure in the questioned footage, but not the subject in the reference footage, but do not preclude the figure in the questioned footage from being the subject in the reference footage; and

- d. are exhibited by the subject in the reference footage, but not the figure in the questioned footage, but do not preclude the subject in the reference footage from being the figure in the questioned footage.

18.6 Evaluation of the Limitations of the Analysis and Comparison and Determination of the Strength of the Findings

- 18.6.1 Where factors may have affected the ability of the practitioner to observe features of gait from the footage, those factors should be clearly listed in the final report. Such factors may include, but are not limited to those described in 18.5.4 above.
- 18.6.2 Such factors shall be taken into consideration by the reporting practitioner when determining the strength of evidence provided by the forensic gait analysis.
- 18.6.3 A database can be used to assist in the determination of the strength of evidence by the forensic gait analysis; however, its admissibility may be questioned if the database does not meet all of the following criteria.
 - a. It is available for use by both the prosecution and defence.
 - b. States the size of the population used.
 - c. States the appropriateness³¹ to the case of the population used.
- 18.6.4 The likelihood of such a database being deemed admissible may be boosted if:
 - a. it is also in the public domain; and/or
 - b. has been peer reviewed and published.
- 18.6.5 If a database has been used to assist in the determination of the strength of evidence provided by the forensic gait analysis this shall be made clear in the final report, and the database identified.
- 18.6.6 In the absence of the use of a database the final report shall contain a statement to the effect that the determination of the strength of evidence provided by the forensic gait analysis is an opinion based conclusion, and is not predicated on numerical data or statistical calculation.

³¹ E.g. ethnicity, sex, age.

- 18.6.7 Where the expert provides an opinion based solely on their experience it is important that the statement make clear, in detail, the experience which allows the expert to proffer that opinion.
- 18.6.8 The strength of evidence provided by the forensic gait analysis should be expressed using a published scale of verbal expressions of strength of evidence in support of one of two opposing propositions. Generally, the prosecution's proposition would take the form of 'the figure in the questioned footage is the subject in the reference footage'. The alternative proposition is determined by the defence but in the majority of cases takes the form of 'the figure in the questioned footage is not the subject in the reference footage'.³²

18.7 Peer Review by Another Forensic Practitioner

- 18.7.1 All casework shall be peer reviewed by another forensic practitioner, who is competent and experienced in forensic gait analysis.
- 18.7.2 In the absence of objective measurements for features of gait derived from footage, the role of the peer reviewer is crucial in establishing the validity of the observations. The Forensic Unit should refer to their Quality Management System and sections 15 and 16 of this document to determine which of their personnel is suitable to conduct this role.
- 18.7.3 The role of the peer reviewer is to undertake a critical findings check (section 12) by reviewing whether:
- a. the processes used by the reporting practitioner are appropriate;
 - b. the features of gait recorded as being identified by the reporting practitioner are robust;
 - c. the comparisons made of features of gait are robust; and
 - d. the strength of evidence determined by the reporting practitioner is justified and appropriate.
- 18.7.4 If in the opinion of the peer reviewer the four conditions listed in 18.7.3 are not met, the peer reviewer shall communicate that fact to the reporting practitioner. Discussion will then be undertaken between the peer reviewer and the reporting

³² This proposition can also be used in cases in which the defendant provides a 'No comment' interview, although it should be made clear in any report that this is a default position for the alternative.

practitioner until agreement is reached as per the procedure. Any change of opinion during these discussions should only occur in the face of a compelling argument from the other examiner involved in the case.

- 18.7.5 Once agreement is reached between the peer reviewer and the reporting practitioner the final report shall be signed and dated by both the reporting practitioner and the peer reviewer.
- 18.7.6 If no agreement can be reached, or there are areas of disagreement, the areas of disagreement should be documented and kept with other case related materials (see 6.5.5 iii).
- 18.7.7 The peer reviewer may comment on other aspects of the final report, but the final report, other than the conditions listed in 18.7.3, is the sole responsibility of the reporting practitioner.

19. The Report

- 19.1.1 Forensic Units in England and Wales are directed to part 19 of Criminal Procedure Rules and section 19B of the Criminal Practice Directions V regarding statements of understanding and declarations of truth in expert witness reports.
- 19.1.2 Reporting practitioners who believe they comply with this standard, should insert the following in the report, in accordance with Criminal Practice Direction V 19B.1.13; 'I confirm that I have acted in accordance with the code of practice or conduct for experts of my discipline, namely the Forensic Gait Analysis Code of Practice and the Forensic Science Regulator's Code of Conduct for Forensic Science Providers and Practitioners in the Criminal Justice System'.
- 19.1.3 Part 19.4 of the Criminal Procedure Rules 'Content of Expert's Report' lists some of what an expert witness must include in their report in England and Wales.³³ This details the requirement to clearly set out any limitation or qualification to a finding or opinion given and include such information as the court may need to decide whether the expert's opinion is sufficiently reliable to

³³ These are not the only requirements, the Regulator has published additional guidance for the contents of expert reports in England and Wales available from: www.gov.uk/government/collections/fsr-legal-guidance. [Accessed 17/06/2020]

be admissible as evidence. Departure from the requirements set out in this FGA Code of Practice must be set out in the report; non-disclosure of any relevant information could seriously undermine the credibility of the evidence presented and the expert presenting it (see also the Criminal Procedure and Investigations Act 1996 disclosure obligations).

19.1.4 Where there is a range of opinion on the matters dealt with in the report, Part 19.4(f) of the Criminal Procedure Rules requires the practitioner to summarise the range of opinion and give reasons for the expert's own opinion in their report. This includes any scientific literature at odds with the approach taken or authoritative guidance issued, including but not limited to, courtroom science primers provided by the Royal Society.³⁴

19.1.5 The Royal Society courtroom science primer on forensic gait analysis reproduced the Association of Forensic Science Providers' verbal scale, including likelihood ratios. Likelihood ratios from the table should not be quoted in reports unless this probabilistic approach has been used, the expert is competent in the application of likelihood ratios, data used to support the approach is disclosed and approach is admissible for that evidence type in the jurisdiction the report is intended.

20. Presentation of Evidence

20.1 General

20.1.1 Forensic Units in England and Wales are directed to the Criminal Procedure Rules (Part 19) and the Criminal Practice Directions V (Part 19), particularly in terms of admissibility of evidence (section 19A.5).

20.2 Presentation of Footage in Court

20.2.1 If footage is to be played in court, consideration should be given to the methods by which the footage will be played, the limitations of the available equipment, the positioning of the equipment in the court, how the equipment will be operated and who will operate the equipment. Certain Wi-Fi based applications

³⁴ Available from: <https://royalsociety.org/about-us/programmes/science-and-law/>. [Accessed 17/06/2020]

that allow simply sharing of still images and presentations in court rooms may affect video quality and framerates. If the methods by which the footage would normally be played in that court are unsuitable, alternatives should be sought.

- 20.2.2 If footage is to be played in court every effort should be made to meet with the person who will be operating the equipment, and check the feasibility of playing, and controlling the playing, of the footage prior to the presentation of the evidence in the court where the evidence is to be presented.
- 20.3.3 The footage played in court should be as close to the format used during the analysis as possible.
- 20.3.4 Where the format and/or the quality of the footage played in court is different to that used in the forensic gait analysis, this should be made clear to the court.
- 20.3.5 Where the format and/or the quality of the equipment being used to play the footage is different to that used in the forensic gait analysis, this should be made clear to the court.

21. Review

- 21.1.1 This document is subject to review in accordance with the Codes and other appendices published by, or produced in association with, the Forensic Science Regulator.
- 21.1.2 If you have any comments please send an email to:
FSREnquiries@homeoffice.gov.uk

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23. Glossary

Casefile

An electronic or physical folder that contains all records relating to a particular case.

Closed Population

A population not able to exchange members with different populations over time.

Commissioning Agency

The organisation or individual that requests and funds the forensic gait analysis.

Critical Findings

Observations and results that have a significant impact on the conclusions reached and the interpretation and opinion provided. They include those observations and results that could be interpreted differently by different forensic practitioners or observations and results that require the exhibit (or the original item examined as part of the initial comparison) to be accessible by the peer reviewer.

Developmental Validation

The validation process that shall take place when a new method has been developed for use within the Forensic Unit.

Enhancement

A transformation of footage that seeks to accentuate the information of interest, but may potentially diminish other information. Enhancement reduces the information content of imagery but can aid its interpretation. Examples include brightness and contrast adjustment, cropping, sharpness filters and noise reduction filters.

Feature of Gait

A kinematic attribute of the gait of a person that can be seen in video footage. Features of gait include angular relationships, segmental orientations and temporal and spatial displacements.

Figure

The person of interest seen in the questioned footage.

Forensic Gait Analysis

The analysis, comparison and evaluation of features of gait to assist the investigation of crime.

Forensic Gait Practitioner

A practitioner that undertakes the analysis of footage; identifies, compares and evaluates features of gait and combinations of features of gait for the purposes of assisting the investigation of crime.

Forensic Unit

A legal entity or a defined part of a legal entity that performs any part of the forensic science process. For the purposes of this document, the term 'Forensic Unit' refers to any provider of forensic gait services whether a large organisation, a department within a large organisation, a small or medium-sized enterprise or a sole trader. The work undertaken by the Forensic Unit is not restricted to a laboratory environment.

Gait Analysis

The systematic study of human walking or running. Such study can be carried out using the eye and brain of experienced observers, and/or by the use of instrumentation for measuring body movements, body mechanics and the activity of the muscles³⁵.

Gait

The manner or style in which a locomotor activity is undertaken.

Ground Truth Data

Data collected from a known source, in a controlled environment that offers accurate and reliable information that can be used to validate a method or process or inform levels of uncertainty.

³⁵ Levine, D., Richards, J. & Whittle, M. (2012) Whittle's Gait analysis. 5th ed., Churchill Livingstone Elsevier, Edinburgh.

Internal Validation

Verifying that a method developed outside of the Forensic Unit is relevant to its intended use within the Forensic Unit and meets the end user requirements. Internal validation requires the Forensic Unit's own competent staff to perform the method at a given location.

Locomotor Activity

A method of moving from one location to another using the musculoskeletal system e.g. walking or running.

Method Validation

The process of providing objective evidence that a method or process is fit for the specific purpose intended.

Mid Gait Step

A step taken in a sequence of steps during which there is no significant deviation from usual gait such as acceleration, deceleration or change of direction.

Non-conformity

The non-fulfilment of a requirement, either within the organisation's policies, procedures or in the specification of the commissioning agency

Objective

Based on fact.

Open Population

A population that is able to gain and lose outside members over time.

Peer Reviewer

A forensic gait practitioner that undertakes an independent critical findings check of the analysis, comparison and evaluation of, and the methods used by, the reporting practitioner.

Preliminary Assessment

The assessment of footage that has been submitted for use in forensic gait analysis, the purpose of which is to determine the suitability of the footage as a source of gait information that can be used for investigative or evaluative purposes. A commissioning agency may request a report detailing the outcome of the preliminary assessment.

Preliminary Assessor

A forensic practitioner that undertakes the assessment of footage, the purpose of which is to determine the suitability of the footage as a source of gait information that can be used for investigative or evaluative purposes.

Proficiency Testing

Tests to evaluate the competence of forensic gait analysts and the quality performance of a forensic unit including:

- Open or declared proficiency test: a test in which the analysts are aware that they are being tested.
- Blind or undeclared proficiency test: a test in which the analysts are not aware that they are being tested.
- External proficiency test: a test conducted by an agency independent of the analysts or laboratory being tested.

Questioned Footage

Footage related to the crime under investigation showing the figure or figures of interest, the identity of whom is unknown.

Reference Footage

Footage showing the subject or subjects of interest, the identity of whom is known.

Reporting Practitioner

A forensic gait practitioner that writes an expert witness report detailing for example, descriptions of exhibits, results, limitations, conclusions and a declaration of truth.

Running

A locomotor activity in which one foot is placed in front of the other in such a way that there is a period in each gait cycle when neither foot is in contact with the ground.

Step

The initial contact (usually heel strike) of one foot to the initial contact (usually heel strike) of the other foot.

Subject

The person of interest seen in the reference footage.

Subjective

Based on opinion.

USB

Universal Serial Bus, a standard/specification for cables and connectors, mainly for computers.

Verification (linked with Internal Validation)

Confirmation, through the assessment of existing objective evidence or through experiment, that a method or process is fit (or remains fit) for the specific purpose intended. The Forensic Unit's competent staff shall evidence that they can perform the method at the given location.

Video Format

A computer file format used to store video footage.

Walking

A locomotor activity in which one foot is placed in front of the other in such a way that one foot is always in contact with the ground.

Wi-Fi

A radio technology allowing computers, smartphones, or other devices to connect with one another wirelessly within a particular area.

Published on behalf of the Chartered Society of Forensic Sciences and the College of

Podiatry by:

The Forensic Science Regulator

5 St Philip's Place

Colmore Row

Birmingham

B3 2PW

www.gov.uk/government/organisations/forensic-science-regulator