

Best Practices for Rolled Fingerprint Capture using a Livescan Device

Executive Summary

When a person's fingerprints are enrolled into an AFIS (Automated Fingerprint Identification System), it is important that the images are cleanly captured with good contrast between the ridges and the furrows. This is especially important when collecting fingerprints that may be used forensically so that criminals are properly identified. But on a more practical level, it costs time and money when the receiving AFIS (such as the FBI) won't accept the fingerprints due to low quality.

Obtaining clear, legible fingerprints requires a combination of a high quality fingerprint scanner and a good set of techniques on the correct way to capture both flats and rolls.



Figure 1.

I. ERGONOMIC STAGING OF THE SCANNER

Fingerprint experts recommend that the forearm of the person being fingerprinted is level with the floor. Placing the device too high or low places undue stress on the wrist, arm and shoulder of the person being printed, making the entire capture process uncomfortable. This often results in poor image quality due to shifting, sliding or premature lifting of the finger from the platen surface during the capture process.

If possible, a height-adjustable workstation should be used that allows the scanner to move up or down so that subjects of various heights can be accommodated. If a height-adjustable workstation is not available, the device should be placed 44 to 46 inches above the floor which is suitable for an average sized adult. See *Figure 1*.

II. SILICONE PAD¹

The quality of fingerprints can be affected by fingers that are too wet and conversely by fingers that are too dry. When fingers are wet, the resulting image is typically darker and when fingers are dry, the image is typically lighter. (See the section on 'Challenges to a Quality Capture' for examples of dark and light images.)

Instances of wet fingers occur more frequently in humid environments or on people that are sweating. To reduce moisture, subjects can wash their hands with soap or rub them with alcohol, an anti-bacterial gel or talcum powder.

Instances of dry fingers occur in arid or cold environments or on people (such as doctors or nurses) who have to wash their hands many times a day. To increase moisture, subjects can apply Corn Huskers lotion or aloe vera gel, although it should be fully absorbed before taking the fingerprint.

Additionally, HID Global[®] has developed patented silicone membrane technology to help with dry fingers and offer the following additional benefits:

Image enhancement

Silicone membranes enhance fingerprint images regardless of skin condition. The result is less distortion and higher quality images. In most cases, subjects will not need to add or remove moisture in their fingers when silicone pads are used.

Protection

When used in an abusive environment, damage such as scratches to the platen can occur during operation. Scratching the glass platen is a costly issue, often requiring the replacement of the entire livescan device. The silicone membrane adds an extra layer of protection for the scanner's glass platen and if it is damaged, it can easily be replaced with no downtime.

Low maintenance

Membranes allow for longer operational periods between cleanings as compared to a plain glass platen which may require cleaning after each use. Unlike a glass platen, cleaning the silicone membrane does not require a liquid cleaner or special cloth. Instead, special tape is used that removes dirt, oils and other debris effectively and quickly without damaging either the membrane or the platen.

Easy capture

When using livescan devices, with or without a silicone membrane, there is no difference in the fingerprint capture approach. The silicone membrane is fitted invisibly atop the glass platen and its use requires no variation of fingerprint presentation technique. Also, using the silicone membrane makes capturing rolled fingerprints easier by eliminating slippage of the fingers which sometimes occurs on a glass platen. This can also reduce the time it takes to capture prints because less retries are required.

III. IDENTIFYING A GOOD QUALITY PRINT^{2,3,6}

Necessary Elements

The FBI can reject fingerprints for a variety of reasons, but the most common reason (43%) is "The quality of characteristics is too low to be used." There are several elements that must be present in rolled fingerprint impressions for acceptance by the FBI.

All rolled impressions should be centered in the capture space and in a vertical position with no smudging.

The impressions will be rolled from nail-to-nail and include the complete pattern area, to include from the tip of the finger to approximately $\frac{1}{4}$ " below the first joint of the finger.

There should be sufficient contrast to allow the friction ridges and other minutiae in the pattern to be clearly defined and readily identifiable.

HID Global offers application software and Software Development Kits (SDKs) that can help judge the quality of a rolled impression, but the operator of the livescan equipment should be knowledgeable about what constitutes a high-quality rolled print. If any of the rolled impressions are not of sufficient quality as described, they should be re-rolled until enough information is present to allow it to be properly classified by the receiving agency.

Loop Print

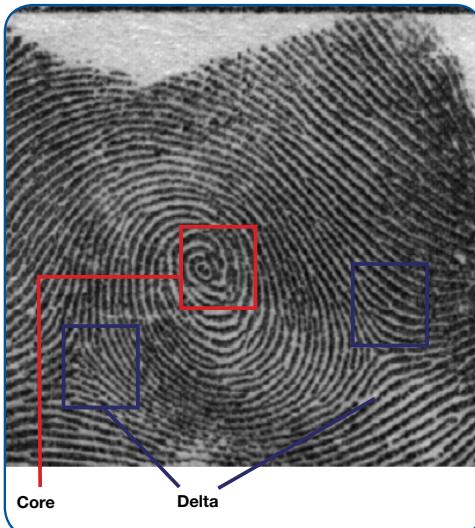
Within a Loop print, a core and one delta should be identifiable and the friction ridges between them should be clear and well defined. The contrast should be sufficient to allow the operator to accurately count the number of ridges between the two points.



Loop Print

Whorl Print

In a Whorl print, one core and two deltas should be identifiable and the friction ridges between them should be clear and well defined. The contrast should be sufficient to allow the operator to accurately count the number of ridges between the two points.



Whorl Print

Challenges to a Quality Capture

Prints Too Light

Indications of a print that is too light, as shown below are, poor or missing ridge detail, very little contrast and breaks in the definition of a print.



Causes

This occurs most often in older (and sometimes very young) people and those that have rough or dry skin

Remedy

Ridge detail may be improved by wiping the fingers with Corn Huskers lotion, aloe vera gel or massaging the fingers to force blood to the fingertips. When using a lotion, use it sparingly and wipe the excess off before rolling the print.

Prints Too Dark

Indications of a print that is too dark are dark black areas without ridge detail.



Causes

This occurs most often with wet/sweaty or oily/dirty fingers. It can also occur if the fingers are pressed too hard on the platen during the capture process.

Remedy

Dry fingers with a soft cloth or wipe with rubbing alcohol.

Prints Too High or Low

Prints that are too high or low on the platen will display a sharp straight line across the top or bottom of the print. This missing information should be included to capture a complete pattern area.



Causes

This is caused by placing the fingers too high or low on the scanner's platen.

Remedy

In either case, the operator should move the finger up or down on the scanner platen using the markings on the bezel as a guide.

Feathering

Indications of a feathered print are ridges that have 'feathered' as if a dry paint brush was passed over a wet canvas. It does not always appear in the same area and it can be more or less pronounced on different parts of the fingerprint. The feature can be so pronounced as to make it difficult or impossible for forensic examiners to compare or identify latent fingerprint images. The images below are examples of feathering. They are both the same impression with the one on the right giving emphasis to the feature.



Causes

Improper roll technique can pinch and trap the skin in front of the roll pattern area causing the skin to gather and wrinkle. The wrinkled skin can create breaks in the ridge flow thereby creating the feathering anomalies. Roll technique and finger features contribute heavily to this issue

Remedy

See "Center Nail Edge-to-Nail Edge" and "Nail Edge-to-Nail Edge" rolling methods in Section IV, Capture Technique.

Shifting

A shifted print is indicated by a blurred image on all or part of the fingerprint. Shifting is caused when movement occurs either vertically, horizontally or rotationally on the platen during the roll process. The series of images below are exaggerated examples of shifting with the one on the right giving emphasis to the feature.



Horizontal Shift



Remedy

See "Center Nail Edge-to-Nail Edge" and "Nail Edge-to-Nail Edge" rolling methods in Section IV, Capture Technique.



Vertical Shift



Rotational Shift

IV. CAPTURE TECHNIQUE^{4,6}

There are two methods that can be used for capturing a rolled fingerprint impression. They are “Center Nail Edge-to-Nail Edge” and “Nail Edge-to-Nail Edge.” When delivering livescan training in the field and at their training center, HID Global instructors find most operators prefer the “Center Nail Edge-to-Nail Edge” technique because of the added control it provides during the rolling process. For this reason, HID Global teaches this as the preferred method for capturing rolled impressions using livescan devices. The operator of the livescan device can use whichever method he is most comfortable with to produce the best results.

Capturing Rolled Fingerprint Impressions^{5,6}

Ensure that you have ergonomically staged the HID Global livescan device to the recommended height as stated in Section I of this document. Ensure the platen of the livescan device is free of dust, dirt and any residual fingerprints. Before capturing fingerprints, the individual’s hands should be washed, preferably with soap and water. The operator of the livescan device should position the front of the individual’s body at 90° (perpendicular) to the front of and at an arm’s length from the livescan device so the forearm is near parallel to the floor. See Figure 2.

This should be the most comfortable position for the individual and allow for the most natural movement during the capture process. The operator should take a position on whichever side of the individual is most comfortable to allow for a good capture. Instruct the



Figure 2.

individual to look away from the fingerprint device, not to assist with the capture process and to relax.

Center Nail Edge-to-Nail Edge

- Grasp the individual’s hand at the base of the finger, cupping your hand over the individual’s fingers and tucking under those fingers not being printed.
- Place the finger bulb on the center of the scanner platen as if to capture a flat impression, being sure to include the entire fingertip to about $\frac{1}{4}$ ” below the first joint.
- With your other hand, place your middle finger at the tip and the index finger just below the knuckle of the first joint of the finger to be rolled. *See Figure 3 below.
- Before beginning the roll, apply a gentle, even, downward pressure on the finger to be rolled.
- Beginning at this center position and maintaining the downward pressure, roll the hand to the nail edge on one side of the finger.



Figure 3.

*See Figure 4 below.

- Before beginning the roll to the opposite nail edge, exert a gentle, lateral pressure in the direction of the roll. This will serve to stretch or tighten the skin through the pattern area and help to minimize or eliminate feathering. *See Figure 5 below. Also see



Figure 4.

Feathering defined in Section III, under Challenges to a Quality Capture.

- Without lifting the finger and in one steady, continuous motion, roll the hand until the finger is at the opposite nail edge. Then lift straight up to avoid smudging. Use your middle and index fingers to guide the finger and maintain its contact with the platen throughout the roll. The entire roll process should take 2 to 3 seconds. *See Figure 6 below.



Figure 5.

- To take advantage of the natural movement of the forearm, the hand should be rotated from the more difficult position to easiest. This requires the thumbs to be rolled toward and the fingers away from the center of the individual's body.
- Inspect the completed rolls to ensure all required elements exist before transmission to the destination agency. Any images the

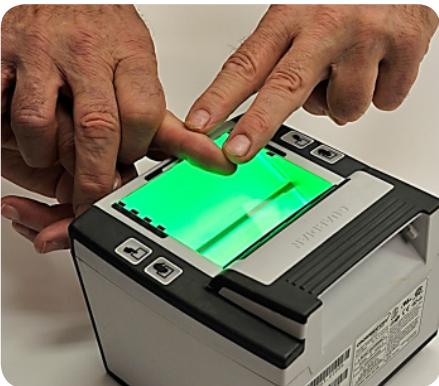


Figure 6.

operator feels are not acceptable should be deleted and retaken.

Nail Edge-to-Nail Edge

- Grasp the individual's hand at the base of the finger, cupping your hand over the individual's fingers and tucking under those fingers not being printed.
- Place the side of finger bulb on the scanner platen far enough to include about $\frac{1}{4}$ " below the first joint. Use the marks on the device bezel as a guide.
- With your other hand, place your middle finger at the tip and the index finger just below the knuckle of the first joint of the finger to be rolled. *See Figure 7 below.
- Before beginning the roll, exert a gentle, lateral pressure in the direction of the roll. This will serve to stretch or tighten the skin through the pattern area and help to minimize or eliminate feathering. * See Figure 8 below. Also see Feathering defined in Section III, under Challenges to a Quality Capture.



Figure 7.

- While maintaining lateral pressure, keep the individual's finger in contact with the platen and roll the hand in one steady continuous motion to the other side until the finger faces in the opposite direction. Then lift straight up to avoid smudging. Use your middle and index fingers to guide the finger and maintain its contact with the platen throughout the roll. The entire roll



Figure 8.

process should take about 2 seconds. * See Figure 9 on the following page

- Take care to ensure the bulb of each finger from tip to about $\frac{1}{4}$ " below the first joint, is rolled evenly while maintaining contact with the platen. Generally, the weight of the finger is the maximum pressure needed to clearly record a fingerprint.



Figure 9.

- To take advantage of the natural movement of the forearm, the hand should be rotated from the more difficult position to easiest. This requires the thumbs to be rolled toward and the fingers away from the center of the individual's body.

Additional Benefits

While good techniques during capture are important, HID Global devices and software offer some technological assistance that can greatly improve the quality of fingerprints:

- **Automatic Capture:** Software can detect when a fingerprint is the correct quality and automatically record the image.
- **Quality Check:** Threshold settings can be set that allow various levels of quality depending on the scenario or use case. If a certain threshold isn't met, the software can be set to force one or more retries and then allow a manual override while giving the quality score to the operator.
- **Silicone Pad:** As described in previous sections, a silicone pad can help to improve wet and dry fingerprints.
- **Moisture Discrimination Optics:** In addition to the silicone pads, the Guardian 200 and 300 include advanced (blue-light) optics that are able to produce a high-quality image even when fingers are very wet.
- **Shifting Check:** The software can automatically detect shifting, even when it isn't visible to the user. This is also controlled by threshold settings.
- **Flex Roll:** This feature allows the user to roll a fingerprint on different parts of the platen. The software automatically detects where the roll is occurring, even if it's not in the exact center.
- **Flex Flat:** Similarly, the software can detect where a finger or set of fingers is placed on the platen, so they don't have to be in a particular position on the platen.
- **Touchscreen Display:** The HID Global Guardian 300 offers a touchscreen display that provides user feedback directly to the subject being fingerprinted in addition to the operator who may be looking at a monitor faced away from the user.
- **Illuminated Pictograms:** The HID Global Guardian 200 offers illuminated feedback that can also help the subject.
- **High-Resolution Scanners:** HID Global offers a full range of 500 ppi scanners, but it also offers a 1000 ppi palm scanner, the L Scan 1000. This takes the highest resolution images of any scanner on the market.

V. CONCLUSION

Collecting fingerprints is only useful if the resulting images are high quality and able to be examined forensically and ultimately matched against latent prints or other enrolled prints.

Capturing effective fingerprint images requires training in good techniques for obtaining, identifying and improving the image quality when necessary. The benefits of advanced technology support the training and knowledge of the device users. When hardware, software and people work together the data collected is reliable and useful.

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