



Australia and New Zealand Police Recommendations for CCTV Systems



Introduction

This is an information document on Closed Circuit Television (CCTV) systems, where the recordings are likely to be used by police. The recommendations outlined in this document when incorporated in the design and management of CCTV systems will aid law enforcement agencies to reduce crime and maintain public safety. Compliance with these recommendations will:

- increase the likelihood of an offender being identified (e.g. due to optimised lighting and picture quality)
- aid in the successful prosecution of offenders in court
- reduce the risk of disruption and cost to business (problematic CCTV systems may result in police officers spending considerable time at the premises attempting to extract the footage, or require removal of the system from the site)
- ensure ongoing reliability of the system (through maintenance recommendations, etc).

A CCTV system becomes a powerful investigative tool for police when the recordings clearly depict events with sufficient detail to identify the person(s) or vehicle(s) involved.

Examples of desirable policing outcomes from a CCTV system include:

- the identification of a person's face at key points such as entries, exits, or sales counters
- the identification of vehicle licence plates
- the recognition of clothing
- detection or monitoring of general activity in public access areas
- sufficient frame rate to track moving targets

- the tracking of persons movement through the site with minimal gaps
- the easy extraction of recorded video/images in a readily viewable format.

Note: the recommendations and resolutions specified in this document are not applicable for CCTV systems incorporating automatic number plate or automatic facial recognition features. For those systems, it is recommended that professional advice be sought.

CCTV system objectives are identified by answering the question "What do we want to see?". Of key importance is that the individual camera views are able to achieve sufficient resolution (image resolving power) to meet the system objectives.

Figure 1 (below) depicts four recommended resolution levels relating to the manual (non-automated) CCTV observation of people. The four levels are Face Identification (120%), Face Recognition (50%), Intrusion Detection (10%), and Crowd Control (5%)¹. In these examples, the entire camera view is shown in the top row of images, whilst zooming into these images (the bottom row) reveals the reduction in quality as the target person occupies less and less of the image.

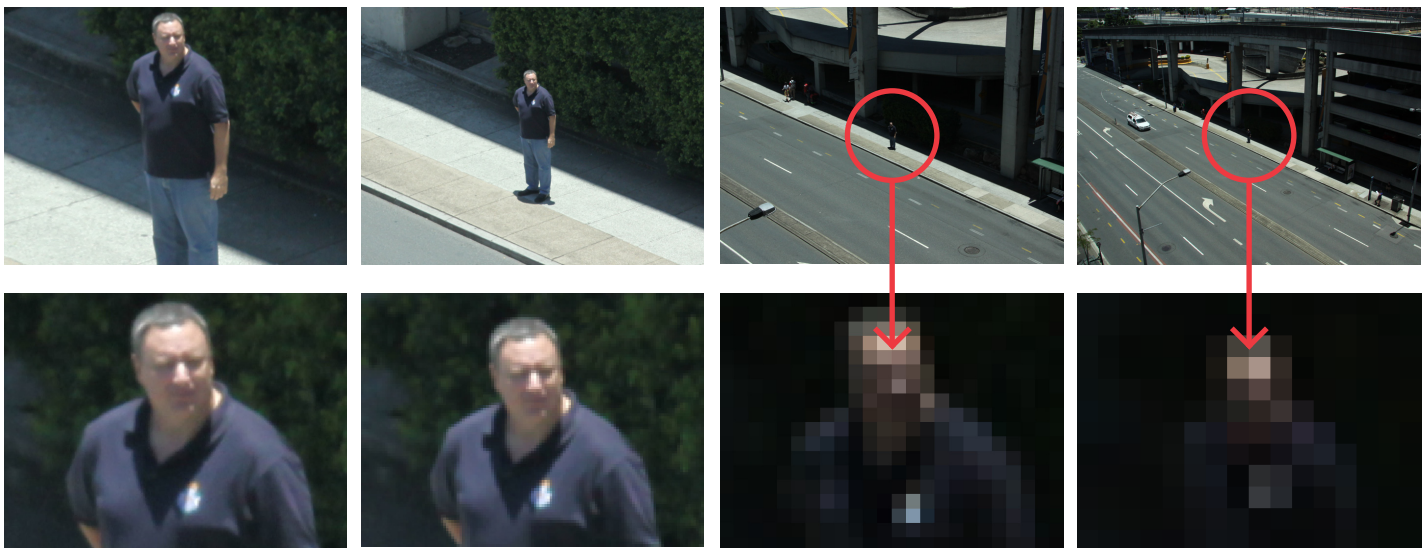
The first of these is the police recommended resolution level for Face Identification (120%), requiring a minimum resolution equivalent to 480 Lines over the height of a person. (For a 1.6 m high person, this equates to a resolution equal or better than 3.33 mm at the target). The remaining three resolutions are specified in Australian Standard AS 4806.2 – 2006 (Closed Circuit Television (CCTV): Application Guidelines) (Note: AS 4806.2 has a Face Identification (100%) resolution standard, however for police purposes, the higher standard of Face Identification (120%) is recommended).

Face Identification (120%)
(480 Lines over height of person)

Face Recognition (50%)
(200 Lines over height of person)

Intrusion Detection (10%)
(40 Lines over height of person)

**Crowd Control (5%)
(Monitoring)**
(20 Lines over height of person)



* Note: Digital image equivalents created using a Kell factor of 0.76.

Figure 1. Comparative representation of the four police recommended resolution levels.

1. The percentages refer to the minimum quantity of individually resolvable lines required over the height of a person, in relation to an industry standard of 400 Lines. For example, to achieve Recognition (50%) resolution, the system must be able to resolve 200 lines over the height of a person (i.e. 50% of 400 lines). This does not mean that the camera view needs to cover the entire person, or that a minimum of 200 or 400 lines is necessary! Continuing the example, if the person is 1.6m tall, to achieve Recognition (50%) resolution, the CCTV system must simply be able to resolve individual lines down to 8 mm wide at the target location (1.6m divided by 200). Recognition (50%) resolution (i.e. 8 mm wide lines) is indicated by line A on the accompanying Test Chart.

Introduction continued

All CCTV systems should be designed to achieve set goals. A CCTV system designed to monitor traffic flow will differ greatly from one used to identify patrons at a bank.

To this end, each camera within the CCTV system will have its own set of goals, including its angle of coverage, resolution, etc. A CCTV system becomes *fit for purpose* when it meets (achieves) its design goals.

Older analogue systems (e.g. VHS) can still be evaluated using this document's recommendations from a performance perspective.

A CCTV Test Chart is included at the end of this document that can be used to assess the static resolution of camera views at various target locations. As an example, a particular camera view might be designed to achieve Face Identification (120%) level of resolution when the target person is at a particular location (e.g. a sales counter).

This can be tested using the included Test Chart. Note that the distance from the camera to the target will always be a factor, as image quality decreases as distance increases.

In the design and installation of CCTV systems, professional security industry advice should always be sought. Further, local laws or legislation may require adhering to.

The following sections list recommendations that ensure the system will be *fit for police purposes*.

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A

THE SYSTEM

Objectives and Recording Parameters

A CCTV system comprises a physical installation with designed recording parameters (goals).

1. Physical Installation

The correct installation of CCTV equipment is necessary to provide on-going reliability. Install all equipment as per the manufacturer's recommendations (e.g. concerning ventilation etc).

For police purposes:

- a. House the CCTV recording equipment in a secure manner/location to avoid vandalising or tampering with recorded material.
- b. Protect the cameras against poor weather or vandal damage.
- c. Position the system to avoid dust, water, grease or the ingress of other airborne contaminants.

2. Resolution

The success of a CCTV system hinges on ensuring the captured images have sufficient resolution. For each camera view, identify the level of resolution required (see Figure 1), and assess accordingly (See Section E). The resolution must be assessed on *recorded* images and not the 'live' video feed.

For police purposes:

- a. Cover general public access areas with a resolution standard equal to or greater than Detection level.
- b. Cover entries, exits, pinch points, and point of sales with Face Identification (120%) level resolution.
- c. Cover car entry and exit points with *Manual Licence Plate Recognition* level resolution at the required target vehicle distance.

3. Camera Placement

Critical to the success of a CCTV installation is the camera placement.

For police purposes:

- a. Overlap camera views with sufficient cameras and placement that maximize the continuous recording of a target person moving throughout the site.
- b. Avoid back-lit areas and bright or flashing lights in the camera's field of view. Cameras directed towards bright lights will cause target persons to become silhouetted.
- c. Incorporate one or more eye-level cameras that achieve Face Identification (120%) level of resolution in the system design. Where there is an option to further increase the size of the face within the image through (for example) using optical zoom (and where the current image periphery shows nothing of importance), the improved resolution will provide more useful detail to investigators.

- d. Remove or reposition advertising banners, rotating signs or other objects that obstruct camera views.
- e. Assess camera placements over the entire operating timeframe (e.g. 24hr for continuously recording systems) to ensure the camera view is not compromised by changing conditions such as the position of the sun, car headlights, street lights or motion sensor lights.
- f. Optimise Face Identification (120%) level camera positions at entries, exits, pinch points and point of sale areas (avoid camera positions that show tops of heads only).

4. Camera Exposure (Lighting)

Correct camera exposure is essential at all desired operating times. Deploy additional lighting where the scene is too dimly lit for correct camera exposure. Light the scene evenly, avoiding bright 'hot spots'.

Solutions may include the use of day/night cameras, motion sensor lights, or infrared (IR) cameras and illumination.

5. Frame Rate

The system's design goals determine the appropriate frame rate. Set the frame rate at a level that will capture four or more images of the target travelling at a fast pace through each camera's field of view. For example, if a person can move quickly through the field of view in half a second, then the frame rate should be at least eight frames per second (8 fps). Faster frame rates will achieve better indications of movement(s).

6. Motion Detection

Motion sensor recording options allow the system to be configured so that recording parameters can change when motion is sensed in the camera's field of view.

For police purposes:

- a. Avoid motion sensed recording in areas and times of high movement, importance or vulnerable entry / exit points.
- b. When no motion is sensed, set the system to record at a slow frame rate (e.g. 1 fps) rather than ceasing to record at all.
- c. Set the motion sensor trigger levels to respond quickly when motion is sensed.
- d. Where a pre-roll is available, use a minimum of 10 seconds.

THE SYSTEM

Objectives and Recording Parameters *continued*

7. Overwrite period

Store recordings for 31 days or more. If the system does not achieve this, the storage capacity should be increased. Avoid reducing any other system qualities (resolution, frame rates, compression quality, etc) to achieve this goal.

8. Time/Date Position on Screen

Ensure the position of time, date, camera designations and other On Screen Display (OSD) information does not cover key target areas of the view such as faces at key locations.

9. Compression Quality

Ensure that the compression used by the system does not significantly degrade the video image, or introduce unwanted distortions (artifacting). Assess compression quality by replaying recorded vision. Take particular notice to the recording of moving targets. Remember: the less compression, the better the recorded detail.

10. Power Loss Recovery

Configure the system to resume recording when recovering from a power loss. Further, to ensure continuous recording during a mains power loss, employ an uninterruptible power supply (UPS).

B

OPERATION

Procedural Recommendations

The operation of a CCTV system requires some basic procedures on the part of the owner/manager.

For police purposes:

1. Operators

Ensure that there is at least one trained operator available to assist or consult with replay and export of recorded material.

Where the system is managed by an external service provider, keep their contact details handy to the CCTV system.

2. Protection of Data

Restrict the ability to delete information from the system.

3. Passwords

Where passwords are required to export recordings from the system, these are to be made readily available.

4. Documentation

Keep the CCTV operator's manual or user's guide with the system.

5. Software

Ensure computer software required for the access or playback of recordings is readily available. Use virus protection on CCTV systems that incorporate one or more personal computers to record or store the footage.

6. Maintenance

Adherence to a simple maintenance schedule will ensure the CCTV system remains operational. For police purposes, see Section F (Maintenance) of this document.



EXPORT FUNCTIONALITY

Video and Image Extraction Capabilities

Exporting is the act of extracting recorded video and/or images from the CCTV system. The following system recommendations will assist in the timely and successful retrieval of footage.

For police purposes:

1. Still Image Export

Still images can be exported in an uncompressed format such as bitmap (*.bmp).

2. Video Export Selection

Video can be exported from selected cameras within user-defined time periods.

3. Processing Time and File Size

An estimated time to complete the requested export and the approximate storage space required is displayed.

4. Video Export Format

The format that the CCTV system records in is referred to as its native format. Most often the native format is a proprietary digital video format, however in some cases, the unit may record in a generic (common) digital format (e.g. AVI, MOV, etc). The native format gives the best quality, and is most suitable for forensic examination or enhancement.

For police purposes:

- a. Video can be exported in its native recording format.
- b. The associated playback software can be either exported or provided separately.

5. Metadata

The time, date and camera data associated with each camera recording is embedded into the exported video recording or image file.

6. Export Media

The system is capable of exporting directly to an industry standard external or removable media format. Options include USB storage device or optical media (CD/DVD).

7. Uninterrupted Recording

Footage can be exported from the system without interrupting the recording process.

D

PLAYBACK SOFTWARE

Replaying the Native Recordings

For the replay of generic format files, a choice of media players are available that provide the required replay features.

For replay of proprietary format recordings, police investigations are enhanced where the manufacturer supplied player software embrace the following recommendations:

1. Playback Software

The proprietary replay software does not require installation on the host computer to operate.

2. Playback Controls

Replay controls include forward and reverse viewing, frame step forwards and backwards, and variable playback speed.

3. Camera Views

The player is to be able to display single and multiple cameras where appropriate.

- a. Single camera view
Display single camera views at the same pixel resolution as the recording (1:1).
- b. Multiple camera view
When displaying multiple cameras, all cameras are to be correctly in time sync with each other. Sync should be maintained when switching between individual cameras whilst playing.

4. Aspect ratios

The system displays all cameras in their correct aspect ratio, regardless of whether single or multiple cameras are being displayed.

5. Search Facility

The player permits searching by time and date.

6. Metadata Display

There are a multitude of different approaches to dealing with metadata. As a minimum:

- a. On Screen Display (OSD) can be toggled on and off.
- b. OSD is clearly legible within the image.
- c. OSD can be re-positioned so that it does not mask key areas within the image.
- d. On replay, metadata (e.g. times, alarms, etc) maintains synchronisation with the vision when played back with any selection of camera(s).

7. Audio

Where audio is recorded, this will be replayed in correct synchronisation with any camera selected.

8. Extracting Stills

Native quality still images can be extracted from the player in an uncompressed format (e.g. bitmap). Metadata such as time, date, and venue/camera details are embedded within the export, with the option to position this data within the image.

E

RESOLUTION EVALUATION

Does the System Achieve its Goals?

The evaluation of a CCTV system assesses how it compares with the system objectives. Through this process, the performance aspects of the system can be confirmed as being fit for purpose. The following method of resolution evaluation will assist in achieving fit for police purposes goals.

1. View Recorded Images

In most CCTV systems, the 'Live' view is significantly better quality than the recorded video, as it has not been subjected to the recording CODEC (COmpression/DECompression) processes. When evaluating a CCTV system, ALWAYS view the playback of recorded information, and not the Live view.

2. Resolution

A CCTV system test chart is provided at the back of this document. This chart may be used to perform an end-to-end check. It will help to determine if the focus, image resolution and image compression are adequate to achieve the objectives of Manual Vehicle Licence Plate Recognition, Face Recognition (50%), Face Identification (100%), and Face Identification (120%).

Using the RTC-01 Test Chart

- a. Have the CCTV system running. Hold the test chart steadily facing the camera for a few seconds at the location that you wish to test. This may, for example, be at an entrance doorway or a sales counter.
- b. On the CCTV system, locate the recorded footage and review or export a still image of the test chart recording (do not simply monitor the live feed!).
- c. On the recorded image, determine the point at which the 5 black converging lines cease to be 5 independent lines. This point indicates the systems ability to resolve these separate black and white lines.

Example results:

- If the measured point is below the 8mm line (Line A), then the system has achieved:
 - a. Face Recognition resolution as stipulated by AS 4806.2
 - b. The police recommendation for *Manual Vehicle Licence Plate Recognition* for licence plates with characters larger than 60mm (the majority in Australia).
- If the measured point is below the 4mm line (Line B), then the system has achieved Face Identification (100%) resolution as stipulated by AS 4806.2.
- If the measured point is below the 3.33 mm line (Line C), then the system has achieved the police recommended resolution of Face Identification (120%).

F

MAINTENANCE

Ensuring the System Remains Fully Functional

On-going routine maintenance should be performed to ensure the CCTV system is fully functional. Maintain equipment as per manufacturer's recommendations.

Differing environmental conditions may dictate more regular maintenance. Any faults found should be documented and rectified. To be fit for police purposes, include the following procedures as part of the maintenance schedule.

1. Confirm Operation

On a daily basis, observe the unit and display monitor to confirm the system is operational and recording. Problems may be indicated by:

- error messages are being displayed
- record LED not illuminated
- hard disc drive (HDD) LED not showing activity.
- all images having frozen with no movement on screen
- time display not progressing.

2. System Clock

Ensure the time and date is set correctly. Checking the time is most easily achieved by observing the system clock whilst listening to the speaking clock (dial 1194 from within Australia or 090045678 from within New Zealand).

Additionally:

- Ensure daylight saving settings are set correctly.
- Where multiple recorders are used, ensure they are set as closely as possible, and consider using network time synchronisation if available.
- Check the time and date after any power loss or system shutdown.

3. Cameras

Regularly review the live camera images and ensure they are in focus. Check that the camera's abilities are not being hampered by obstructions, bright lights, debris (cobwebs) etc.

4. CD/DVD Drives

Ensure any CD/DVD drives are working. Excessive dust, moisture, or greasy environment will hamper the optics of these systems. This can form part of exporting a small test recording to confirm functionality.

5. Test Export

Perform an export of a small portion of recently recorded footage to confirm full functionality of the system. Replay this recording on an un-related computer.

6. Power Outage Recovery

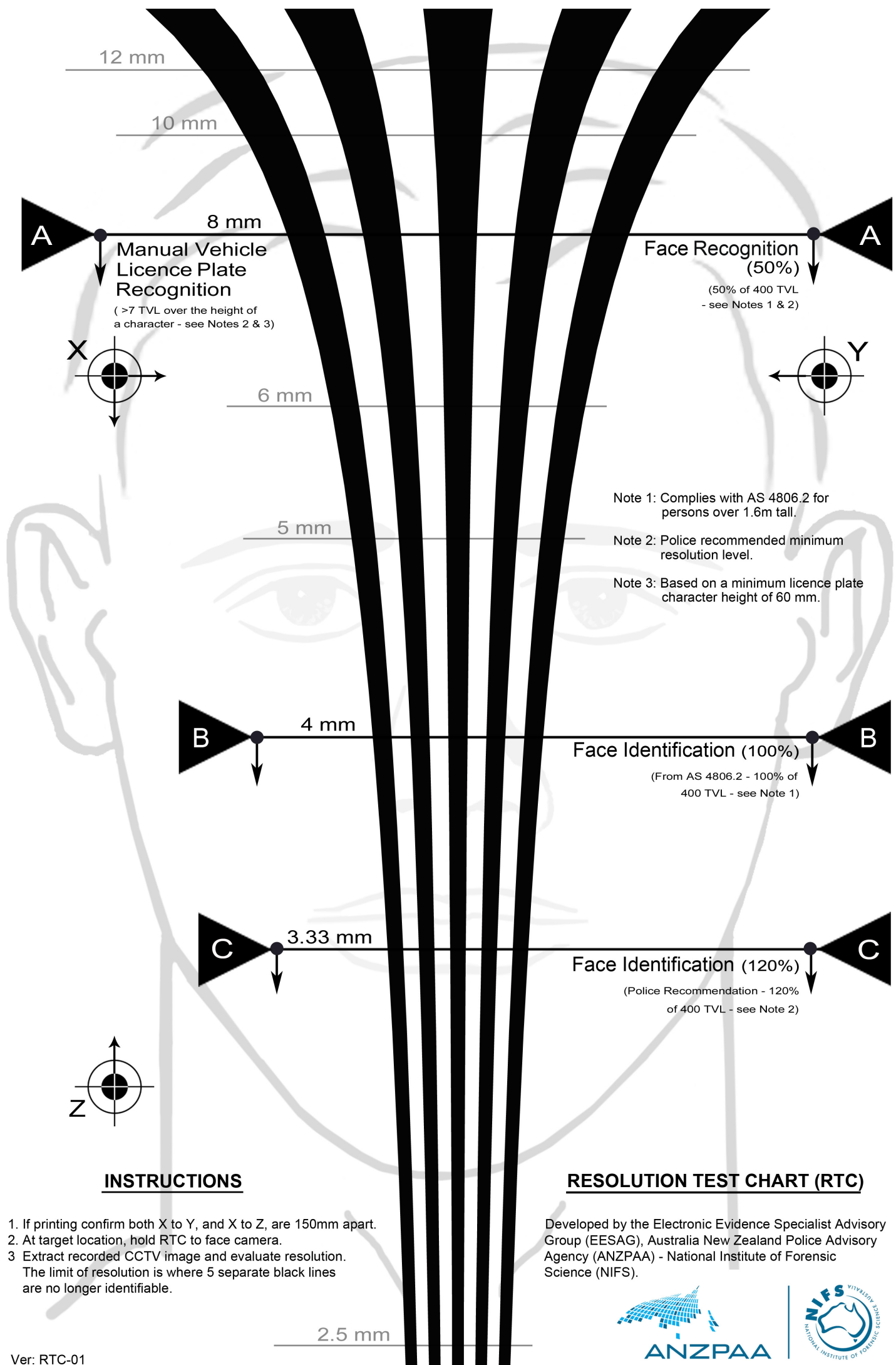
Switch the unit off at the power point to simulate a power outage, and ensure that the system fully recovers back to a recording state. Confirm this procedure is acceptable with your security provider BEFORE you perform this to ensure alarms are not inadvertently set off.

Professional Advice

When seeking advice concerning the design, installation and maintenance of CCTV systems, you should always use an appropriately licensed security professional.

The Australian Security Industry Association Limited (ASIAL) is a national body for the security industry and promotes a high level of service within the industry.

To become a member, a security company must meet the highest standards of quality and service. Members can be located via the website www.asial.com.au



12 mm

10 mm

8 mm

Manual Vehicle Licence Plate Recognition

(>7 TVL over the height of a character - see Notes 2 & 3)



6 mm

5 mm

4 mm

Face Identification (100%)

(From AS 4806.2 - 100% of 400 TVL - see Note 1)

3.33 mm

Face Identification (120%)

(Police Recommendation - 120% of 400 TVL - see Note 2)



INSTRUCTIONS

1. If printing confirm both X to Y, and X to Z, are 150mm apart.
2. At target location, hold RTC to face camera.
3. Extract recorded CCTV image and evaluate resolution.
The limit of resolution is where 5 separate black lines are no longer identifiable.

Note 1: Complies with AS 4806.2 for persons over 1.6m tall.

Note 2: Police recommended minimum resolution level.

Note 3: Based on a minimum licence plate character height of 60 mm.

RESOLUTION TEST CHART (RTC)

Developed by the Electronic Evidence Specialist Advisory Group (EESAG), Australia New Zealand Police Advisory Agency (ANZPAA) - National Institute of Forensic Science (NIFS).



2.5 mm

This document was prepared by the Electronic Evidence Specialists Advisory Group (EESAG) for the Senior Managers of Australia and New Zealand Forensic Laboratories (SMANZFL) with assistance from the Australia New Zealand Policing Advisory Agency National Institute of Forensic Science (ANZPAA NIFS).

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