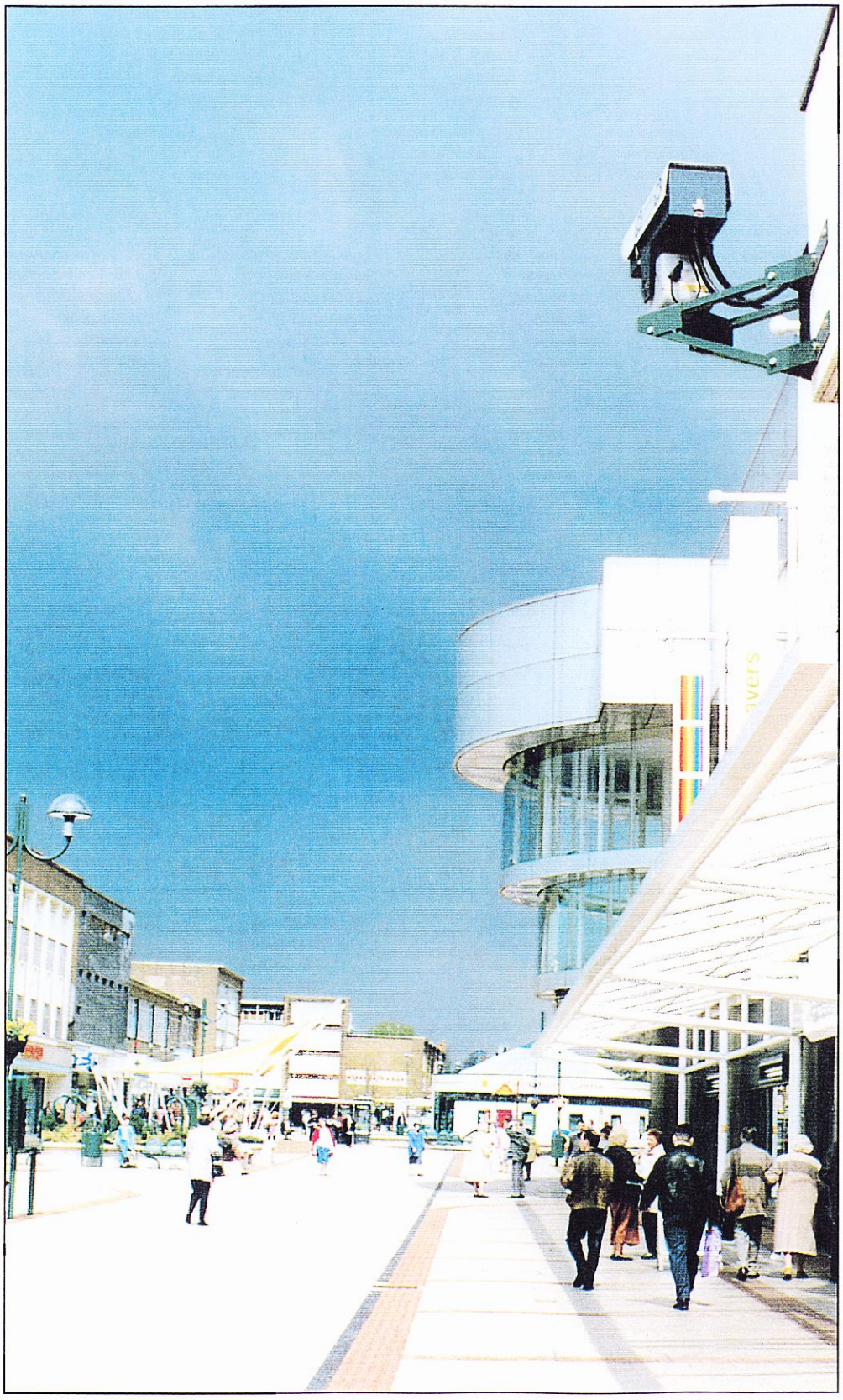
CCTV: Making It Work

CCTV Control Room Ergonomics

E Wallace and C Diffley



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Management Summary

This document provides guidance for the Police Service and local authorities on the design of Closed Circuit Television (CCTV) control rooms. The checklist in Appendix A provides a CCTV system owner with a practical tool that he or she can use to assess an existing CCTV control room, or a design specification for a new control room. PSDB research carried out with several police forces and local authorities has shown that CCTV system owners could benefit from this guidance.

This document:

- informs CCTV system owners about ergonomics;
- provides guidance on how the physical aspects of a control room e.g. lighting, seating, workstation and CCTV monitors should be designed to promote the performance, health and safety and comfort of CCTV operators;
- describes the benefits of carrying out an ergonomic assessment of a CCTV control room;
- outlines the risks to effective operator performance and to health and safety of poorly designed control rooms; and
- provides a checklist which can be used by a CCTV system owner when carrying out an initial ergonomic assessment.

This publication is one of a series of documents being published by PSDB which provides practical advice on methods of improving CCTV system performance. These publications are listed in the introduction.

The customers for the work on which this document is based are the CCTV Police Force Liaison Officers' Forum (which is responsible to the ACPO Crime Prevention Sub-Committee) and the Crime Prevention Agency of the Home Office.

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1 INTRODUCTION

1.1 Background

The customers for PSDB's CCTV Effectiveness programme, which started in 1993, are the CCTV Police Liaison Officers' Forum (which reports to the ACPO Crime Prevention Sub-Committee) and the Crime Prevention Agency of the Home Office. This programme concluded at the end of 1996/7 and was followed by a one year programme called CCTV Making It Work. This publication is a product of these two programmes and is part of a series of publications which include:

- *Recruitment and Selection of CCTV Operators;*
- *Training Practices for CCTV Operators;*
- *Operational Requirements Manual;*
- *Police Interaction with CCTV;*
- *CCTV User Picture Detail Requirements;*
- *CCTV Technical Testing.*

This document provides guidance based on sound ergonomic practice, on the design of CCTV control rooms.

1.2 What is ergonomics?

Ergonomics aims to improve human performance, health and safety and comfort through influencing the design of the work environment, the equipment in it, the tasks performed and the working practices. The usefulness of CCTV in a safety and security system depends on the quality of information it provides. CCTV operators work in control rooms the design of which will affect their ability to achieve accurate, timely information from the CCTV system. Operators will perform more effectively if :

- they are comfortably seated in an ergonomically designed chair;
- the monitors are well positioned;
- the lighting is suitable for monitoring CCTV images as well as writing up logs.

These are some of the physical aspects of a control room which should be designed ergonomically from the initial design stage. Poor design can not only affect the performance of the CCTV operator but also put his or her health and safety at risk.

PSDB research has shown that many CCTV control rooms fall short of good ergonomic practice. CCTV system owners, who may be a local authority, the police or a private company, are usually dependent on the equipment installers for the design of a control room. Not all suppliers of CCTV control rooms or equipment take ergonomics into consideration and compliance with good practice should not be assumed even where terms such as *ergonomically designed* are used. This document describes the ergonomic design considerations for CCTV control rooms and outlines the risks to health and safety and effective performance if ergonomics is ignored. The checklist in Appendix A provides a practical tool that a CCTV system owner can use to carry out an initial ergonomic assessment.

1.3 The costs and benefits of conducting a control room assessment

There are a number of benefits to be gained from carrying out an ergonomic assessment which will:

- provide a check on whether the design of an installed CCTV control room environment and equipment, or the design specification for a new control room, is conducive to effective performance in line with current good ergonomic practice;
- identify potential problems within a control room that may adversely affect the performance, health, safety and comfort of the operator, or even cause the system to fail. An assessment will identify clearly where improvements are needed;
- promote an active health and safety culture within the control room. This will include informing CCTV operators about the possible risks to their health and safety and what they can do to protect themselves; and
- contribute towards:
  - a risk assessment as required under health and safety legislation[1];
  - meeting quality assurance requirements such as ISO 9000.

An assessment of a CCTV control room will require an investment in time and effort and may lead to additional capital and running costs. These costs should be balanced against the benefits. More detailed information on how to conduct an assessment is given later in Chapter 4.

1.4 When to conduct an ergonomic assessment

The checklist and guidance in this document provides a practical way to carry out an initial ergonomic assessment and can be used at any stage in a CCTV system's life cycle. For example, when:

- a new control room is being designed;
- a control room is fully operational;
- upgrading or refurbishing an existing control room.

The guidance given is not intended to comprehensively cover all aspects of ergonomics. For advice or a more detailed assessment, a human factors expert, such as an ergonomist or occupational psychologist, should be consulted. Appendix B lists societies that may assist in identifying professionals in this field.

2 CCTV CONTROL ROOM DESIGN CONSIDERATIONS

Based on good ergonomic practice[2], relevant health and safety legislation[3] and PSDB research[4], this chapter provides guidance on the design of the physical aspects of a CCTV control room.

The topics covered include;

- the architecture; e.g. size and shape of the control room;
- the environment; e.g. lighting and ventilation;
- the workstation; e.g. size, height and layout;
- the chair;
- CCTV monitors; e.g. size, number and positioning, image presentation;
- the control panel.

The design of the control room and equipment should take account of the capabilities and limitations of all possible users and should be derived from a *task analysis*. Likely effects on the performance, health and safety and comfort of a CCTV operator are indicated.

2.1 Architectural considerations

The choice of location for the control room may be limited but every attempt should be made to consider the architectural factors set out below:

2.1.1 Size and shape of the control room

The control room should be sufficiently large to accommodate the furniture, equipment and the people working in it. The design of the control room will be restricted if the room is too small, an awkward shape or contains pillars and/or a sloping ceiling. The latter may affect the positioning of monitor banks, be detrimental to an operator's ability to scan multiple camera images and pose a risk to health and safety.

There should also be sufficient space within the room for maintenance work to be carried out when necessary, without causing disruption to the normal running of the control room. If it is likely that the CCTV system will expand in the future, there should be enough space to arrange additional workstations and equipment in an ergonomic way. A cramped environment, where there is insufficient room to position the equipment correctly, will be uncomfortable and cause frustration for operators.

2.1.2 Entrance/exit points

Entry/exit points should be designed to allow for easy wheelchair access and for large pieces of equipment to be brought into the control room.

2.1.3 WC facilities

Toilet facilities and relaxation areas should be located close to the control room. If a single operator is on duty, the control room will be left unattended while he or she uses them.

2.1.4 Windows

A window should be present wherever practicable to provide natural light in the control room. Daylight is preferred by most people to artificial light because it gives a view of the outside world. A blind should be fitted to control the level of the incoming light and the position of a window relative to the CCTV monitors and an operators line of sight should be optimised (see later sections for details).

2.2 Environmental design

The following environmental conditions should be considered when designing a control room:

2.2.1 Lighting

Lighting within a control room should be suitable and sufficient for all tasks. Diffuse lighting is recommended rather than spot lights. Problems can occur if lighting intensity is reduced for observing CCTV images as there may not be sufficient light for other tasks being carried out during the same period, such as reading manuals and writing logs. This may result in an operator misreading instructions, writing incomplete or illegible incident logs and cause fatigue.

Reflections on the CCTV monitor(s), caused by poor lighting arrangements may obscure information in a CCTV image, preventing an operator from seeing important details in an image or missing an incident altogether.

2.2.2 Temperature

The temperature within the control room should be adjustable as operators are likely to have individual preferences regarding the temperature of the control room. This is particularly important when the control room is operated at times when the main building heating is switched off. Equipment gives off heat and this should be allowed for in the design.

2.2.3 Ventilation

The control room should be ventilated by fresh or purified air as stale air may be offensive to an operator or cause ill health. Drafts from doors or ventilation systems should be prevented as they may result in discomfort and annoyance.

2.3 Workstation design

The design of the workstation will affect the performance and health and safety of the operator so the following factors should be considered:

2.3.1 Height

The height of the workstation and the arrangement of the furniture components should provide sufficient leg room for all operators. There should be adequate clearance for thighs, knees, and lower legs to allow all operators whatever their size or shape, to regularly change their posture when seated. Sitting for prolonged periods in a cramped and/or static position can cause fatigue which will affect performance, health and safety and comfort.

2.3.2 Size of the workstation

The workstation should be of sufficient depth to accommodate all equipment and documents while observing the monitor screens. An operator will be unable to write logs clearly, position the telephone and control panel conveniently if there is not sufficient space to do so. If the operator is also unable to support his or her hands and/or arms by resting them on the workstation this can result in fatigue. There should be enough space to carry it out on-the-job training when necessary.

2.3.3 Positioning of equipment, controls and materials

All work materials, equipment and controls should be positioned within easy reach of the operator. If they are placed where an operator has to bend and stretch to reach them this may lead to physical discomfort and pain in the back, neck and shoulder area. Design in which the layout of equipment or controls is mirrored to produce a symmetrical appearance should be avoided as operators switching from one control position to the opposite side will be confused.

2.3.4 Surface of the workstation

The surface of the workstation should be made from a low-reflectance material as shiny or highly reflective surfaces cause glare and reflections which can lead to errors and visual fatigue. It should also be non-slip to prevent control panels from moving about during operation.

2.4 Workstation layout

The following factors should be considered.

2.4.1 Spacing

Where equipment is shared between operators, it and the workstations should be positioned for easy access by each operator. Stretching to reach equipment will increase the stress on the muscles and joints which can be tiring, lead to muscular fatigue and result in errors. Workstations should also be spaced so that technicians can easily access the rear panels when carrying out essential maintenance work without disrupting the daily functioning of the system.

2.4.2 Windows

CCTV monitors should be positioned so that the angle between the screen face and the window will prevent reflections falling onto monitor screens, and prevent light from the windows shining directly into an operator's eyes. Reflections on the monitor can affect an operator's ability to scan and evaluate a CCTV image, and light shining directly into the operators eyes, particularly on a bright day, may prevent her or him from seeing images and will cause visual fatigue.

2.4.3 Trailing cables

Trailing cables should be maintained safely so that operators cannot trip over them.

2.5 Chair

An ergonomically designed chair will reduce the likelihood of an operator adopting poor working postures which can result in muscular fatigue. The following guidance on the design of the chair is based on that given by the Health and Safety Executive in the Display Screen Equipment Regulations 1994. Operators should be provided with training in the effective use of the work chair.

2.5.1 Comfort

A chair should be stable and comfortable as a CCTV operator may be seated for relatively long periods. Sitting uncomfortably can lead to problems in the neck, back and head areas.

2.5.2 Height adjustment

To promote a correct seated posture an operator should be able to adjust the height of the chair to enable his or her feet to rest on the floor; a footrest should be provided if an operator is unable to do this.

2.5.3 Adjustable backrest

The backrest should be adjustable in both height and tilt because it is important to support the lower and upper back to enable the operator when seated to preserve the natural curve of the spine.

2.5.4 Armrests

An operator may be more comfortably positioned if he or she is able to support his or her upper body on the armrests, which can also provide useful support when rising from a chair.

2.6 CCTV monitors

The size, positioning and number of monitors in a control room, as well as the number of CCTV camera images that an operator is responsible for monitoring, the duration of each spell of viewing and the task being carried out will all affect his or her performance. Each CCTV monitor is capable of displaying one or more camera images with associated text data and should be positioned to maximise the likelihood of an operator seeing important information displayed in the image.

2.6.1 Size and positioning of CCTV monitors

The size of a CCTV monitor should take into account the level of detail displayed, the nature of the visual task and the distance the operator is positioned from it. An operator will not be able to resolve the detail of an image presented on a small monitor if he or she is seated too far way. This may adversely affect his or her ability to evaluate the image effectively or adjust it accurately, cause annoyance, leading to eyestrain and headaches. Any of these factors may also contribute to reduced quality of the recorded images.

Monitors should be positioned to avoid the operator adopting a poor posture when viewing them for more than a few moments at a time. If a monitor is positioned too high or wide an operator will have to crane his or her neck to see it. This can lead to muscular fatigue and there will be a tendency not to view a monitor if it is uncomfortable to do so. As with VDUs a monitor screen used for detailed work should be capable of adjustment to suit the needs of individual operators.

2.6.2 Monitors mounted on or off the workstation

Monitors that are used for close inspection of CCTV images are commonly called *incident* or *spot* monitors and positioned on the workstation. They allow for close inspection of images displayed and offer the greatest likelihood of an operator receiving accurate and timely information. Incident monitors should be positioned directly in front of the operator at between approximately 0.5 - 1.5 metres and range in size from between 9-16 inches across the diagonal[5]. Alternatively they should be placed so that the operator can easily turn his or her sitting position to face the monitors.

It can be advantageous to site two or three incident monitors on the work desk so that the operator can inspect the image displayed on the centre monitor, and use the adjacent monitors to show other high priority images.

CCTV monitors can also be positioned off the workstation in a bank or array. This can be beneficial as a greater number of images can be presented. Monitors in a bank should be positioned at a greater distance from the operator and be larger in size, i.e. between 17 - 28 inches. PSDB research[6] has shown that CCTV operators report that images displayed in banks are useful for providing a general overview of the camera scenes rather than for picking out details.

2.6.3 Structuring the information displayed on CCTV monitors

Where the task requires large numbers of images to be scanned frequently to gain a general understanding of the areas covered, or quickly to identify which camera views should be given closer attention, monitor banks, split screen views or switched images may be appropriate.

Structuring the CCTV information displayed will help an operator to scan and evaluate the images more effectively. Images displayed on a monitor bank should be grouped by site location or chosen because they show images of the 'hot-spots' and displayed in a particular area on the monitor bank. This will help cue an operator to view these images systematically rather than promoting random monitoring, which is de-motivating and a less effective way of using CCTV.

Split screen technology or multiplexing offers a variety of screen layouts with many camera scenes being displayed on one monitor. Any multiplexing will reduce the picture detail available to an operator. This makes visually demanding tasks such as accurate focus control or reading vehicle licence plates more difficult, so increasing the chance of error. A maximum of four pictures per monitor is recommended if an operator is required to pick out details in the image. The increasing use of computer based technology enables a variety of ways of displaying CCTV images but care should be taken to ensure that the impact on effective operator evaluation is clearly understood.

Autocycling or switching provides an alternative method of presenting CCTV images. This should be avoided where operators are required to detect changes in picture state, particularly on monitors positioned in the operator's peripheral vision as it may be distracting or annoying and so ignored.

2.6.4 Number of camera images per operator

An important consideration is the number of **camera images** a single CCTV operator can **effectively monitor** at any one time. Although research by PSDB and others provides no conclusive evidence on this, CCTV operators believe that the maximum number of camera views they can effectively monitor is 16 or less. Just over half of the operators say that the maximum number is between 1 and 4 camera views[7].

Experimental data showed that as the number of monitors increased, the performance of observers attempting to detect targets in town centre images decreased[8]. These findings are in line earlier research by Tickner and Poulton when they compared task performance over three conditions. With 4, 9 and 16 monitors presenting pictures showing *a great deal of movement*, their performance measures gave accuracy of detection figures of 83%, 84% and 64% respectively[9].

As this research is inconclusive, system managers should make the final decision concerning how many camera views a CCTV operator should monitor. Factors may include the purpose of the observation, the type of activity being viewed, e.g. a busy town centre or a multi-story car park; the activity of the targets within the image, e.g. damage to property/litter/graffiti, traffic; incident frequency; the length of time for which viewing is being carried out; other tasks carried out in the control room and the competence of the operator[10]. Performance evaluation is an essential element of the management of a system and, such an evaluation should aim to check that the operational requirement[11] is being met.

2.6.5 Viewing time

Although research by PSDB and others provides no conclusive evidence on the continuous period for which a CCTV operator can carry out effective surveillance, CCTV operators monitoring town centre CCTV cameras believe the longest time ranges between thirty minutes and two hours. Again this is a complex issue and the viewing time will depend on many factors not least the demands of the job. Health and Safety Executive (HSE) regulations address display screen use. Although the regulations exclude screens the main use of which is to show television or film pictures, HSE advice is relevant to any visually demanding task using screens. The display screen regulations advise that to avoid fatigue from display screen equipment:

short, frequent breaks are more satisfactory than occasional, longer breaks: e.g. a 5-10 minute break after 50-60 minutes continuous screen and/or keyboard work is likely to be better than a 15 minute break every 2 hours [12]

The working day for CCTV operators should therefore be structured so that operators can periodically take deliberate breaks away from the screens, but breaks should be planned to correspond with quieter periods when incidents are less likely to occur. Operators should be provided with health and safety training to reduce the risks

described later, that are associated with visual work. Operators should be discouraged from watching television during rest periods.

2.6.6 On-screen Information

Information about an image should be available to an operator to assist with the effective operation of the CCTV system. The number or location of the camera which identifies an image should be presented on the CCTV monitor. Without this data confusion and errors both in operation and subsequent analysis can occur. This information should be positioned so as not to obscure the picture information presented. In systems where the style and position of this on-screen information is set once for all camera views, this will need careful planning. A consistent format should be used at all times for the presentation of on-screen information.

2.7 Control panel

The control panel is the primary device used by an operator to input data. When it's design and functions are defined the needs and expectations of the CCTV operator should be taken into consideration. It's use should as far as possible be intuitive enabling an operator to learn to use it quickly, promoting a fast reaction time and few errors. Control panels should be designed to take account of both right and left handed users. The following design considerations are important.

2.7.1 Type of control

A pan, tilt and zoom (PTZ) facility may be controlled using a joystick, trackball, touch-screen or buttons. The positioning of the buttons on the panel, particularly those that initiate or stop recording or send cameras to pre-set positions, should be designed to avoid accidental errors and the most commonly used buttons, such as the camera selection and zoom, should be placed in the optimum location to avoid errors, particularly when the operator may be working under pressure. If the buttons are too small, an operator may be unable to see the labels or may accidentally press more than one button at a time. Hand/arm supports should be provided where necessary.

2.7.2 Consistent design

If more than one control panel is used, the design of each should be selected so as to reduce the likelihood of errors which may occur when the operator is switching from one control panel to another, particularly under pressure. All control panels should be finished with non-reflective coating to prevent reflections and glare.

2.7.3 Positioning

The control panel is used extensively to control images whilst monitoring and should be positioned within easy reach of the operator so to avoid the need to bend and stretch to reach it. This will improve effectiveness through more accurate selection and adjustment of images, particularly when the operator is under pressure. If a control panel is not placed in a convenient position, an operator may lose vital seconds reaching for it and he or she may not be in the best position to observe the images while controlling it. The control panel should not be fixed to the workstation as this will prevent the operator from positioning it to suit his or her needs.

3 HEALTH CONDITIONS ASSOCIATED WITH POOR CONTROL ROOM DESIGN

A control room that is designed without a consideration of ergonomics is likely to put a CCTV operator's health and safety at risk, as well as adversely affecting performance. A range of physiological and psychological health conditions associated with poorly designed control rooms are outlined below.

3.1 Postural

Muscles, ligaments and joints work together to promote the maintenance of posture and movement; poor posture and movement can lead to musculoskeletal problems. Posture can be adversely affected by the design of the control room, e.g. if a CCTV operator has to continuously maintain or assume an awkward or twisted working posture, because the workstation, equipment and/or chair is poorly designed, this can lead to a range of physiological problems associated with the upper body, i.e. the head, neck, shoulders, arms, wrists and hands. In the short term, he or she may experience temporary fatigue, pain or discomfort in the limbs and tingling sensations in the fingers, which in the longer term, may lead to more serious disabilities known as work related upper limb disorders (WRULDs).

3.2 Visual

Many of the CCTV operators' tasks are visually demanding, so it is important to ensure that the control room is designed to promote visual performance. Factors affecting visual performance and comfort include lighting (artificial and natural), quality and positioning of CCTV displays and the properties of surfaces within the control room, e.g., on the workstation, monitor surrounds and the control panel. Visual fatigue, red or sore eyes and headaches can result if an operator is exposed to poor lighting conditions during a shift. This may lead to a drop in visual performance as well as discomfort for the operator.

3.3 Occupational stress

If the control room environment, the equipment used and tasks undertaken are not ergonomically designed, this may result in an operator feeling anger, frustration, anxiety, depression and fatigue. These psychological effects can be detrimental to health and have been associated with gastro-intestinal and cardiovascular conditions. Occupational stress can also lead to a loss of motivation and commitment, conflicts between colleagues and a decrease in performance.

3.4 Professional assistance and training

Ensuring that a CCTV control room is designed by people who are trained to do so and providing a CCTV operator with adequate health and safety training will help to prevent these risks impacting adversely on performance, health and safety and comfort[13].

4 HOW TO ASSESS A CCTV CONTROL ROOM

The checklist in Appendix A provides a practical tool that can be used to assess an existing CCTV control room, or a design specification for a new control room. The checklist is divided into sections covering each of the ergonomic design considerations listed in chapter 2. An assessment can address all the issues on the checklist, or only items of particular interest.

4.1 Scoring system

The checklist is accompanied by a simple *yes/no* scoring system and the guidance provided in chapter 2 should be used when scoring each of the items. To increase the validity of an assessment of an existing control room the person carrying out the assessment can:

- observe a CCTV operator carrying out the job; and/or
- interview a CCTV operator, asking him or her questions about various aspects of the control room design.

This will provide valuable insight into any problems he or she may be experiencing whilst working in the control room.

Assigning a *yes* score to an item in the checklist indicates that this particular aspect of the control room design, or specification, has taken ergonomics into consideration.

If a *no* score is assigned to an item, this will indicate that it is not designed ergonomically and remedial action should be considered to improve it.

In cases where items in the checklist are not relevant to the control room being assessed the *not applicable* box should be used.

4.2 Planning and implementing design solutions

If problems are identified during the assessment, corrective action should be planned to ensure that appropriate solutions are implemented. Certain problems may be easily solved without the need for further advice for example, by rearranging the workstation. However professional assistance may be needed from a human factors specialist particularly where changes to improve the CCTV performance might adversely affect other control room functions.

4.3 Promoting continuous improvement

Once the design solution has been implemented, CCTV system owners should review at regular intervals the effectiveness of any changes made by conducting ergonomic assessments and taking appropriate action. This would serve to demonstrate an on-going commitment to promoting a safe and effective CCTV control room.

APPENDIX A CCTV CONTROL ROOM ERGONOMICS CHECKLIST

A1 CCTV control room design considerations

A1.1 Architectural considerations

	✓	✗	N/A
• Is the size of the room large enough to accommodate furniture and equipment and people working in it?	❑	❑	❑
• Is the control room large enough to allow for future expansion?	❑	❑	❑
• Are the exit/entry points wide enough to allow for easy access by a wheelchair if necessary, or for large pieces of equipment to be brought into the room?	❑	❑	❑
• Is a window present within the control room?	❑	❑	❑
• Are blinds provided for control of daylight?	❑	❑	❑

A1.2 Environmental factors

• Is the lighting suitable for all tasks?	❑	❑	❑
• Is diffuse lighting used?	❑	❑	❑
• Are CCTV operators able to adjust the temperature?	❑	❑	❑
• Is the room ventilated by fresh or purified air?	❑	❑	❑
• Are drafts prevented?	❑	❑	❑

A1.3 Workstation design

• Is there adequate clearance for the thighs, knees, lower legs and feet under the work surface and between the furniture components?	❑	❑	❑
• Is the workstation sufficiently large to accommodate tasks, equipment and documents?	❑	❑	❑
• Is there enough room for operator on-the-job training to be carried out?	❑	❑	❑
• Are work materials and frequently used equipment or controls positioned within easy reach of each operator?	❑	❑	❑
• Is the workstation surface made of low reflectance material (i.e. is it non shiny)?	❑	❑	❑

	✓	✗	N/A
A1.4 Workstation layout			
• Is shared equipment easily accessible from each operator's workstation?	❑	❑	❑
• Does the layout take full account of maintenance requirements and access space for technicians?	❑	❑	❑
• Are the displays (CCTV monitors and/or VDUs) positioned at a 90 degree angle to the windows?	❑	❑	❑
• Are the displays (CCTV monitors and/or VDUs) positioned such that windows are not within the same visual field of view?	❑	❑	❑
• Are all trailing cables safely maintained?	❑	❑	❑
A1.5 Chair			
• Is the chair stable and comfortable?	❑	❑	❑
• Does the chair have an adjustable height facility?	❑	❑	❑
• Is the chair back adjustable in both height and tilt?	❑	❑	❑
• Are arm rests provided?	❑	❑	❑
• Is foot rest provided?	❑	❑	❑
A1.6 CCTV monitors			
Monitors positioned on the workstation			
• Are incident monitors used for close inspection of CCTV images?	❑	❑	❑
• Is the size of the incident monitor(s) appropriate to the visual task? (e.g. 9-16 inches diagonal).	❑	❑	❑
• Is the viewing distance to the monitor(s) appropriate to the visual task, and monitor size? (e.g. 0.5 -1.5 metres).	❑	❑	❑
• Are the monitors positioned to avoid postural problems?	❑	❑	❑
• Are the monitors positioned to maximise the likelihood of an operator seeing important information in the image(s) displayed?	❑	❑	❑
• Can the screen angle be adjusted to suit individual operators?	❑	❑	❑

	✓	✗	N/A
Monitors in banks or arrays			
• Is the size of the monitor(s) suitable to the visual task? (e.g. 17 -21 inches diagonal).	❑	❑	❑
• Is the viewing distance to the monitor(s) suitable to the visual task and monitor size?	❑	❑	❑
• Are all monitor pictures equally visible without extreme postural changes?	❑	❑	❑
Structuring the displayed information			
• Where multiple images are presenting in a bank or array, are the images arranged systematically to help cue the operator?	❑	❑	❑
• Where multiple images are presented using split screen technology, is the size of the monitor appropriate for the number of split images presented and the visual task?	❑	❑	❑
• Is the number of images presented appropriate to the level of detail needed by the operator?	❑	❑	❑
• Is autocycling or switching avoided as a method of presenting town centre images?	❑	❑	❑
Number of camera images per operator			
• Is the number of camera images an operator is expected to monitor based on the:			
• purpose of the observation;	❑	❑	❑
• type of activity being viewed;	❑	❑	❑
• activity of the targets within the image;	❑	❑	❑
• incident frequency;	❑	❑	❑
• length of time the viewing is being carried out;	❑	❑	❑
• other tasks carried out in the control room;	❑	❑	❑
• competence of the operator?	❑	❑	❑
Viewing time			
• Is the working day structured so that the operator can take short frequent breaks away from the screen?	❑	❑	❑
• Is health and safety training provided to reduce risks to an operator's health and safety?	❑	❑	❑

	✓	✗	N/A
On-screen information			
• Is the camera identification clearly presented with the image?	❑	❑	❑
• Is primary information displayed at the top of the image?	❑	❑	❑
• Is the overall area of screen occupied by on-screen information reasonable?	❑	❑	❑
• Is a consistent format used at all times for the presentation of on-screen information?	❑	❑	❑

A1.7 Control panel

• Does the control panel take account of the needs of both left and right handed operators?	❑	❑	❑
• Are the controls designed in such a way that unintentional button pressing is avoided?	❑	❑	❑
• Are the button sizes suitable for all operators?	❑	❑	❑
• Are the labels and numbers on the controls sufficient in size?	❑	❑	❑
• Can the labels be read from the normal operating position?	❑	❑	❑
• Where joy-stick, touch screens etc. are used, is adequate hand/arm support provided?	❑	❑	❑
• Are control panels finished with a non-reflective coating?	❑	❑	❑
• Are control panels designed in a consistent format?	❑	❑	❑
• Are control panels positioned within easy reach of the operator?	❑	❑	❑
• Is the control panel moveable to allow for flexible methods of operation?	❑	❑	❑

APPENDIX B CONTACT ORGANISATIONS

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The Ergonomics Society
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Security Industry Training Organisation (SITO)
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British Standards Institute

389 Chiswick High Road
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Local Government Association
26 Chapter Street
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APPENDIX C REFERENCES AND ENDNOTES

[1] The Management of Health and Safety Regulations 1992 state that all employers are obliged to assess the nature and scale of the risks to health in their workplace and base their control measures on it.

[2] Including information contained in the international standard on control room ergonomics: *ISO/FDIS 11064: Ergonomic design of control centres 1998.* The other draft parts of this standard are listed in the bibliography.

[3] Relevant parts of health and safety regulations that apply to all places of work where the Health and Safety at Work Act 1975 is enforced; this includes CCTV control rooms.

[4] PSDB conducted research in CCTV ergonomics; this included experimental work aimed at providing preliminary data for CCTV control room design and survey work to establish good practice.

[5] Wallace, E., Diffley, C., Baines, E., and Aldridge, J. 1997. Ergonomic Design Considerations for Public Area CCTV Safety and Security Applications. Proceedings International Ergonomics Association Congress, July 1997.

[6] Wallace, E., Diffley., and Aldridge, J. 1996. Good Practice for the Use and Management of Town Centre CCTV. Proceedings International Carnahan Conference on Sec Tech., IEEE.

[7] see reference 6.

[8] Wallace, E., Diffley, C., Baines, E., and Aldridge, J. 1997. Ergonomic Design Considerations for Public Area CCTV Safety and Security Applications. Proceedings International Ergonomics Association Congress, July 1997.

[9] Tickner, A, H., and Poulton., E.C., 1973. Monitoring up to 16 Synthetic Television Pictures Showing a Great Deal of Movement. Ergonomics 14(4).

[10] For details on the competencies needed by a CCTV operator see, *Recruitment and Selection of CCTV Operators PSDB publication 8/98*, and *Training Practices for CCTV Operators PSDB publication 9/98*, both part of the *CCTV Making it Work* series.

[11] An operational requirement is *a statement of needs based on a thorough and systematic assessment of the problems to be solved and the hoped for solutions* (Aldridge 1994).

[12] Health and Safety (Display Screen Equipment) Regulations 1992: Regulation 4.

[13] For further information on training for CCTV operators, see *Training Practices for CCTV Operators PSDB publication 9/98* as part of the *CCTV Making it Work* series.

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HSE Health and Safety at Work Act 1974.

HSE Health and Safety (Display Screen Equipment) Regulations 1992.

HSE Management of Health and Safety at Work Regulations 1992.

HSE Provision and Use of Work Equipment Regulations 1992.

HSE Workplace (Health, Safety & Welfare) Regulations 1992.

ISO/FDIS 11064 Ergonomic Design of Control Centres:

Part 1: Principles for the design of control centres
Part 2: Principles for control suite arrangement
Part 3: Control room layout
Part 4: Workstation layout and dimensions
Part 5: Displays and controls
Part 6: Environmental requirements for control rooms
Part 7: Principles for the evaluation of control centres
Part 8: Ergonomic requirements for specific applications

Wallace, E., and Diffley, C., CCTV Making it Work: Recruitment and Selection of CCTV Operators. 1998. PSDB Publication 8/98.

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