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Specification

Signalling Centre Desks

Endorsement & Authorisation

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Compliance

This Network Rail Specification is mandatory and must be complied with by Network Rail and Contractors from April 2007.

When this Specification is implemented, it is permissible for all projects, which have formally completed GRIP Level 4, to continue to comply with the Issue of any relevant Network Rail Standards current when GRIP Level 4 was reached and not to comply with requirements contained herein unless the Head of Ergonomics has stipulated otherwise in the accompanying Briefing Note.

Where the Head of Ergonomics has specified that all projects will comply with the requirements, specific authority not to comply can be sought in the usual manner using the appropriate non-compliance authority processes described in Network Rail Standard, [NR/SP/STP/045](#) Managing the Process for Non-compliance Authority (formerly RT/LS/P/045).

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1 Purpose

- 1.1 Signalling centre desks are an important component in ensuring that signalling staff can perform their required tasks efficiently and safely. The desk supports access to the VDU-based Signalling Control System (VSCS) and to a variety of telecommunication and information systems. It also provides desk space for the use of forms and other documentation. Desk design is a key element in controlling the risks that can arise from long term use of Display Screen Equipment (DSE) as indicated within the HSE DSE Regulations (1992, amended 2002).
- 1.2 At the same time, signalling centre desks are items of engineering equipment that are required to be in operation continuously 24 hours a day and 7 days a week for the lifetime of a signalling system. Desks are required to provide secure housing and facilitate maintenance access to various items of safety-related equipment.
- 1.3 The purpose of this product specification is to ensure that desks for VSCS and for related equipment support safe and efficient signalling operations for the duration of their design life.

2 Scope

- 2.1 This specification is limited to seated desks that are to be provided for signallers, supervisory staff and other staff using control, communication and information systems in a signalling centre. This specification is also applicable to desks used in VSCS signalling simulators.
- 2.2 Where an existing signalling centre is extended, this document shall be applied to any new VSCS desks that are added. Where there is not a valid business case to upgrade or replace existing desks at the same, this could result in visual and physical incompatibilities between the existing and new desks. It is recognised that some deviations from this standard may be acceptable in these circumstances. Authority for non-compliances to this standard shall be sought from the Head of Ergonomics.
- 2.3 The current issue of this specification does not cover standing or sit-stand desks for use with VSCS equipment, though many of its requirements are still applicable.
- 2.4 In addition to desk furniture, this specification covers relevant aspects of ancillary control or indication panels that may be installed alongside VSCS equipment on a seated desk. However, it is not intended to address the design of signalling control panels in general.
- 2.5 This specification also addresses any linking units that may be required to join adjacent desks together, along with any integral storage provided with the desk. Operator chairs and other ancillary items of furniture to be found within a control room are excluded from this specification.

3 Reference documentation

NR/SP/ERG/24020	Incorporating ergonomics within engineering design projects: Requirements, Issue 2, April 2004.
NR/SP/ERG/24017	Control room design: specification, process and guidance, Issue 2, April 2004.
RT/E/S/10067	VDU based signalling control system, Issue 2, August 2003.
RT/E/C/11600	Signalling and Operational Telecommunications Design: Technical Guidance, Issue 1, August 2000.
RT/E/G/11710	Signalling design handbook, Issue 2, April 2001.
RT/E/S/11221	Signalling works testing, Issue 3, February 2004.
RT/E/G/11720	Signalling installation handbook, Issue 1, August 2000
NR/SP/ELP/27242	Specification of low voltage electrical installations on railway premises (including plugs, sockets, trailing leads and appliances), Issue 1, December 2005
BS 3044:1990	Guide to ergonomics principles in the design and selection of office furniture.
BS EN ISO 9241-5:1999	Ergonomic requirements for office work with visual display terminals (VDTs) – Part 5: Workstation layout and postural requirements.
BS EN ISO 11064-4:2004	Ergonomic design of control centres – Part 4: Layout and dimensions of workstations.
HSE DSE regulations	Health and Safety (Display Screen Equipment) Regulations 1992, amended by the Health and Safety (Miscellaneous Amendments) Regulations 2002
BS EN 527-2:2002	Office furniture – work tables and desks – Part 2: mechanical safety requirements.
BS EN 527-3:2003	Office furniture – work tables and desks – Part 3: Methods of test for the determination of the stability and mechanical strength of the structure.
ISO 11428:1996	Ergonomics – Visual danger signals – General requirements, design and testing.
ISO 9335-2:1999	Ergonomics requirements for the design of display and control actuators – Part 2: Displays
BS 6396:2002	Electrical systems in office furniture and office screens – Specification.
BS 7671:2001	Requirements for electrical installations. IEE wiring regulations. Sixteenth edition.
BS 4800: 1989	Schedule of paint colours for building purposes.
BS 4875-7: 1998	Strength and stability of furniture. Methods for determination of strength and durability of storage furniture.
BS 4875-8: 1998	Strength and stability of furniture. Methods for determination of stability of non-domestic storage furniture.
BS EN 13986: 2004	Wood-based panels for use in construction. Characteristics, evaluation of conformity and marking.
Adulldata	DTI: Adulldata: The handbook of adult anthropometric and strength measurements – data for design safety, 1998.

4 Abbreviations

CCF

Control Centre of the Future

CCTV

Closed Circuit TeleVision

CSR

Cab Secure Radio

DSE

Display Screen Equipment

ESOC

Emergency Signals On Control

EMC

Electro-Magnetic Compatibility

GSM-R

GSM (voice mobile communications system) for Railways

HSE

Health and Safety Executive

IVRS

Interim Voice Radio System (used in axle counter areas in advance of full GSM-R)

LCD

Liquid Crystal Diode

MCB

Manually Controlled Barriers

NRIM

Network Rail Infrastructure Management

MDF

Medium Density Fibreboard

PC

Personal Computer

RAL

“Reichsausschuss für Lieferbedingungen” (German organisation responsible for the standardisation of a colour palette)

TD

Train Describer

TDM

Time Division Multiplexer

USB

Universal Serial Bus

VDU

Visual Display Unit

VESA

Video Electronics Standards Association

VSCS

VDU based Signalling Control System

5 Definitions

Alarm management study

Analysis of all the various alarms or alerts that will be provided by the equipment reporting or situated within a control centre to determine whom should receive each indication, what priority the indication needs to be given and on what form of user interface it will be presented.

Anthropometric limits

Smallest and largest body dimensions to be used as the basis for design (refer to BS 3044 for a fuller explanation).

Anthropometry

Study and measurement of the physical dimensions of the human body.

Back edge

Edge of desk surface farthest away from seated user.

Control room

Room that contains signalling workstations (in the context of this standard)

Design reference posture

Posture specified for the purpose of desk design to define relative positions and dimensions.

Desk

Single unit of furniture providing a worksurface, means to install displays/controls, equipment spaces, cabling and storage. Single desk may provide more than one workstation for use by a single user, or may provide space for more than one user, with each user having one or more workstations.

Front edge

Edge of desk closest to seated user.

Line-of-sight

Line connecting the point of fixation and the centre of the pupil.

Line-of-sight angle

The angle between a horizontal line and the visual axis of the eye (the line connecting the point of fixation and the centre of the pupil).

Normal line-of-sight

Inclination of the line-of-sight with respect to the horizontal plane, when the muscles assigned for the orientation of the eye are relaxed.

Percentile

Percentage of population of which specific characteristics fall below or are equal to a given value in a cumulative distribution.

Posture

Overall position of the body or body parts in relation to each other, with respect to the workplace and its components.

Sitting Eye Height

Erect eye height above floor level of a seated user.

Task analysis

Structured and documented analysis of the activities undertaken or to be undertaken by a user or by a team of users

Visual angle

Angle subtended at the eye by a viewed object e.g. a character or symbol.

Visual field

Physical space visible to an eye in a given position.

Workstation

Assembly of display equipment and input devices intended to be used in combination for a discrete and separate set of tasks. For example, one workstation may be comprised of the signalling control displays and input devices. Another workstation may consist of an office computer display and input devices. Each workstation is intended for a discrete set of tasks carried out by one or more users. It is possible that a signaller will have only one workstation position, from where the VSCS, communications and information systems are operated in conjunction from a single seated position.

Worksurface

Principal upper horizontal surface of a desk. Surface on which equipment and task materials are used.

6 General desk design principles

- 6.1 The desk design shall support the various associated monitoring, control and administrative tasks undertaken by its primary users as follows:
- Displays laid out to optimise the key monitoring tasks undertaken by the intended user population, readable at the resulting viewing distances;
 - Controls located within reach of the shortest users expected to use the workstation;
 - Adequate space on the worksurface for paperwork and for other items required to complete work tasks.
- 6.2 The key dimensions of the worksurface, leg space and layout of equipment shall allow all users (from a defined population) to use the desk in comfort.
- 6.3 The desk shall provide adequately sized, secure and well ventilated enclosures for equipment, provide suitable routing for cables and provide good access for installation and maintenance.
- 6.4 The materials and construction of the desk shall be visually attractive and selected to minimise environmental impact, whilst supporting long term, sustainable use in an intensive control room context.
- 6.5 The construction of the desk shall provide the required level of structural strength and stability and be designed to allow mid-life refurbishment of external surfaces and finishes (temporary desks excepted).
- 6.6 The desk shall be supplied with documentation to support its use and maintenance.

7 Desk dimensions and layout

7.1 User population characteristics

7.1.1 Anthropometry

- 7.1.1.1 Desks shall be designed for use by a target population of users defined by the following anthropometric limits:
- Shortest/smallest: UK 5th percentile Female (18-65 years)
 - Tallest/largest: UK 95th percentile Male (18-65 years)
- 7.1.1.2 The following sections define many of the key dimensions required for desk design. Where other dimensions are required, data should be sourced from the DTI Adultdata reference source where possible.

7.1.1.3 For any additional dimensions utilised, the data source and the specific measurements applied shall be explicitly referenced in design documentation.

7.1.2 Design reference postures

7.1.2.1 The dimensions of the workstation shall be assessed by considering four specific design reference postures that are representative of the range of postures typically adopted by seated control room operators.

7.1.2.2 The design reference postures and their scope of application are defined in Table 1. Typical task activities are provided for information only. Signallers use a much wider range of postures to complete each of the various tasks. However, these postures and tasks have been assumed in order to provide a basis for desk and equipment layout design.

7.1.2.3 No specific allowances are required for wheelchair users. Where required, it should be assumed that suitable wheelchairs will be provided that will allow users with full upper limb mobility to make use of desks that meet the dimensional requirements of this specification.

7.2 Desk under-surface clearance and surface height

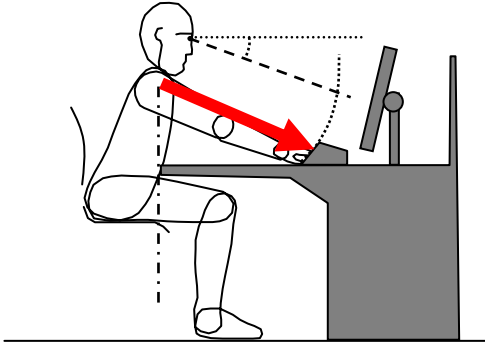
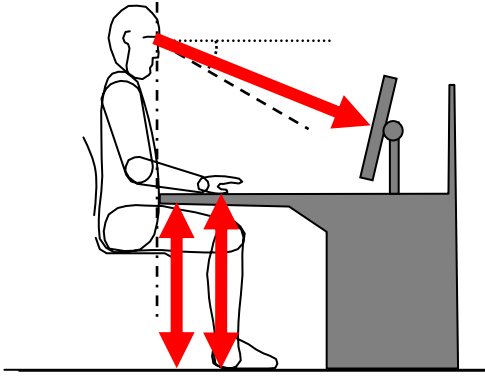
7.2.1 Fixed versus adjustable worksurface heights

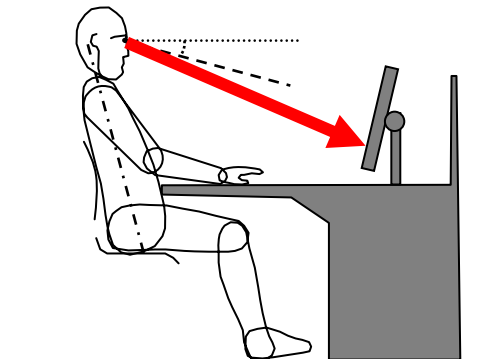
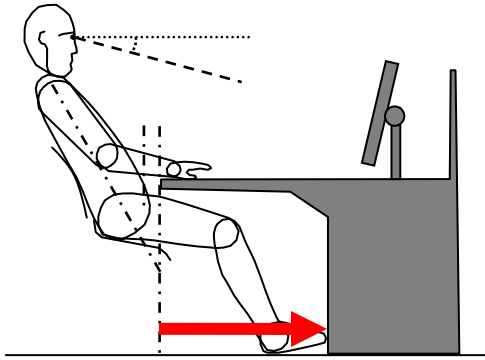
7.2.1.1 The desk height and leg room shall be designed to provide a comfortable work place for a range of sizes of users, who may be seated in a variety of postures.

7.2.1.2 The nature of intensive work at computer workstations poses a risk of injury for sedentary, seated users. These risks can be reduced by the user adopting a posture that allows their forearms to rest flat on the desk surface and regularly changing their posture shall be designed with this in mind.

7.2.1.3 It is challenging to suit the wide range of anthropometric characteristics of a user population using fixed-height desk geometry. The space under the worksurface has to be high enough to accommodate the legs of the tallest users. This then requires the shortest users to raise their chair seated height in order to sit comfortably at the workstation and to use a footrest.

Table 1: Design reference postures

Posture	Illustration	Specification
Bent Forward		User upright, trunk leaning forward such that centre of shoulder joint above front edge of desk.
		Normal Line of Sight (Inclination to Horizontal) 20 deg
	Typical Task Activities	Applies to
	Operating controls that require simple touch operation. Operating infrequently used controls. Reaching/arranging paperwork and documentation.	Maximum hand reach envelope (based on 5th percentile female anthropometry).
Posture	Illustration	Specification
Erect		User upright, eyes above edge of desk (as defined in BS EN ISO 9241 Part 5).
		Normal Line of Sight (Inclination to Horizontal) 30 deg
	Typical Task Activities	Applies to
	Signalling control operations (e.g. VSCS control inputs, CCTV level crossing operation in conjunction with traffic monitoring). Completing paperwork. Administrative computing tasks.	Maximum under desk height clearance. Desk surface height. Minimum screen viewing distance (based on 95th percentile male anthropometry).

Posture	Illustration	Specification
Reclined		Trunk reclined by 15 deg from vertical, pressed against desk front edge.
		Normal Line of Sight (Inclination to Horizontal)
		15 deg
	Typical Task Activities Monitoring movement of traffic through control area.	Applies to Maximum design viewing distance to screen displays.
Posture	Illustration	Specification
Relaxed		Trunk reclined by 30 deg from vertical, 150mm from desk front edge, legs at 120 deg knee bend and 10 deg ankle bend.
		Normal Line of Sight (Inclination to Horizontal)
		15 deg
	Typical Task Activities General monitoring and relaxing during low traffic periods. Communicating with adjacent colleagues.	Applies to Maximum under desk leg space depth requirement (based on 95th percentile male anthropometry).

7.2.1.4 Preferably, desks should be provided with worksurface heights that are adjustable. However, providing an adjustable height worksurface poses two particular challenges:

1. The rise-fall mechanism needs to be capable of being operated reliably over the target lifetime of the desk;
2. The desk needs to be designed to prevent undue mechanical strain or damage to any equipment or cabling.

7.2.1.5 Hence, desks with adjustable height worksurfaces are only permitted when suitable evidence is provided that both these aspects have been adequately addressed.

7.2.2 Vertical clearance and depth

7.2.2.1 For a fixed-height desk, the worksurface clearance shall be designed to accommodate the tallest users (95th percentile male user) when seated in the erect design reference posture. This can be achieved by providing an under-surface clearance at the front edge of the desk of a minimum of 700mm from the floor surface.

7.2.2.2 For a desk with an adjustable worksurface height, the acceptable vertical clearance can be derived from the required desk surface height and maximum worksurface thickness as defined in Section 7.2.4.

7.2.2.3 For both fixed and variable height desks, the legroom shall be a minimum of 750mm depth at floor level.

7.2.2.4 For a fixed-height desk, the desk under-surface leg space area preferably should provide a clear volume with a cross-sectional area of at least 700 x 750mm (refer to Figure 1).

7.2.2.5 If there is a need to provide structural members or other objects (e.g. fixed trackerball units) within this space envelope, they shall be shown to be positioned far enough from the front edge of the desk surface to minimise the risk of accidental contact injury by the largest users. For this purpose, the minimum space envelope shall be as defined in Figure 2.

Note: This varies from the minimum foot space envelope given in BS EN ISO 9241 Part 5 (National Annex NA) as it allows for the range of postures applicable to control room environments. This is in accordance with the appropriate control centre standard BS EN ISO 11064 Part 4.

Figure 1: Preferred under-desk leg space clearance

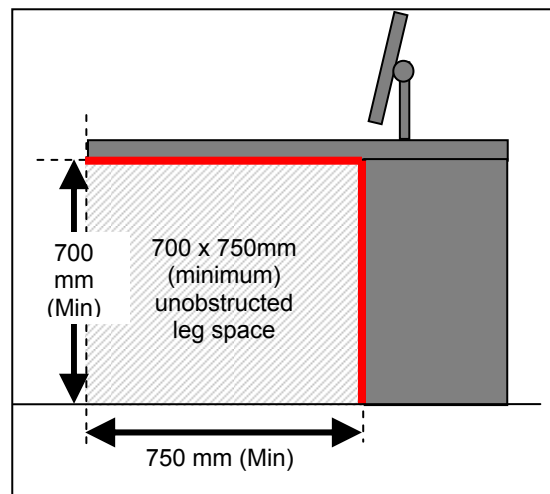
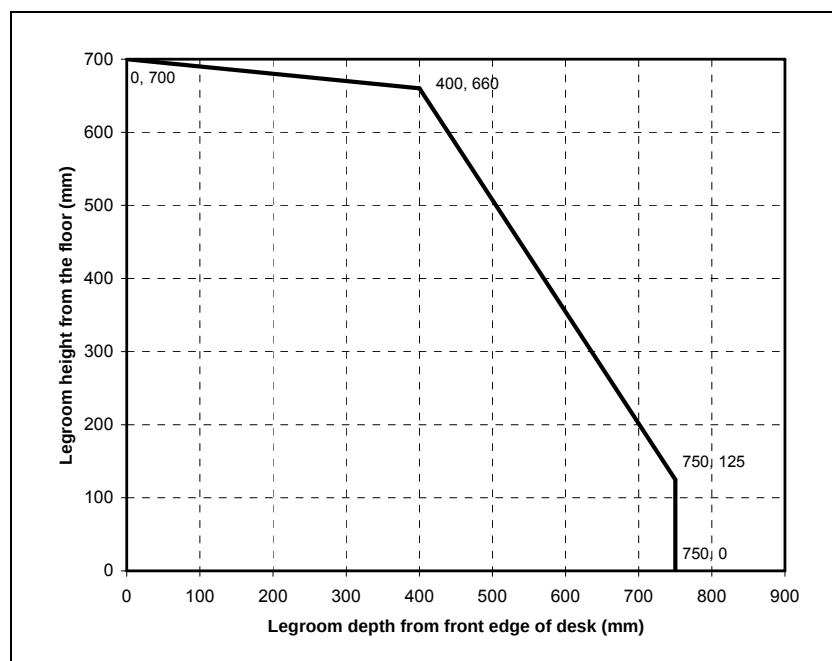


Figure 2: Minimum legroom height and depth under desks

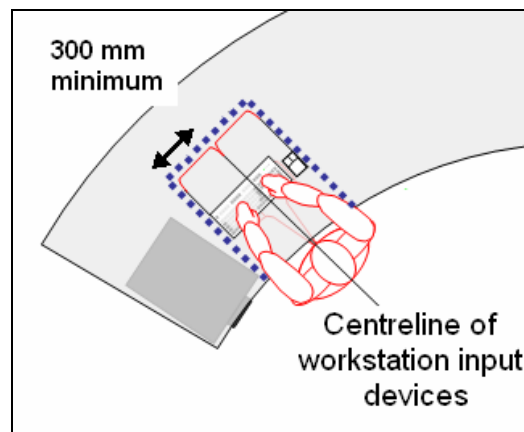


7.2.2.6 The requirements that apply to a fixed-height desk for under-surface leg space area (as defined in Figure 1 and Figure 2) shall also be applied to adjustable height desks. This can be achieved by examining the specific case where the worksurface height is adjusted to give a under desk clearance of 700mm from the floor (at its front edge).

7.2.3 Horizontal clearance

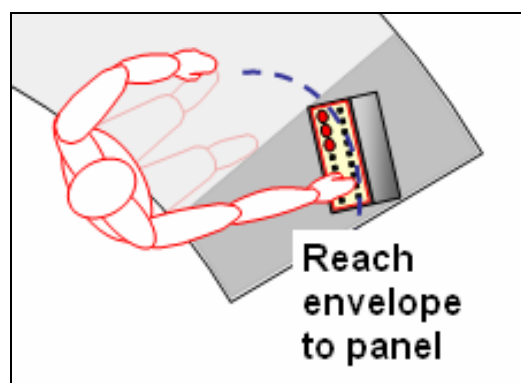
- 7.2.3.1 The under desk area shall be unobstructed by any structural members, supporting legs, partitions or other protruding fixtures that could strike a user's legs when sliding in a seated position along the length of the desk.
- 7.2.3.2 Trackerball units that protrude through the desk surface shall be provided with a cover if there is a requirement to protect against the user striking their legs against any sharp edges or corners.
- 7.2.3.3 Filing cabinets, equipment enclosures or shelving may be positioned under the end sections of a desk, or if it is a single desk unit that houses two discrete signalling workstations, in the centre section of a desk. Where this is the case, it shall be ensured that the horizontal leg clearance is sufficient as follows:
- For each seated computer or control workstation position users shall be provided with a minimum 300mm lateral leg clearance from the centre line of the related input devices (refer to Figure 3);
- Note: This is a minimum. It is expected that the horizontal leg clearance will normally exceed 500mm both the left and to the right of the centrally seated location for the main control workstation position.*
- For discrete controls or touchscreen devices (that are intended for use from a seated position), the position of any under desk obstructions shall not place such devices beyond the reach of a 5th percentile female user seated in a bent forward posture (refer to Figure 4).

Figure 3: Minimum required horizontal leg clearance to under desk cabinets



- 7.2.3.4 Communication and information systems used infrequently or for short stretches of time may be capable of being operated from the central control workstation position and not require a discrete workstation area. Hence, there would be no requirement to provide horizontal leg clearance directly in front of such equipment (in the manner shown in Figure 3). However, it would need to be demonstrated that the user could operate the relevant input devices and view the screen display from the central control workstation seating position.

Figure 4: Minimum required horizontal leg clearance to control panel with under desk cabinets



7.2.4 Surface height and thickness

- 7.2.4.1 The preferred desk surface height for a fixed-height worksurface is 720mm measured at front edge of desk with any levelling devices fully closed (e.g. such as screw feet).
- 7.2.4.2 The maximum desk surface height from floor level for a fixed-height workstation shall be 760mm as measured at front edge of desk with any levelling devices fully closed.
- 7.2.4.3 The maximum desk worksurface thickness shall be 40mm.

Note: Hence, for a fixed-height workstation with a minimum under desk clearance of 700mm (refer to Section 7.2.1.4), a worksurface height of 720mm can be achieved using a worksurface which is 20mm thick. Alternatively, with a 40mm desk worksurface thickness and 700mm under desk clearance, the worksurface would be 740mm high. The 760mm maximum surface height may need to be used to accommodate the under desk leg clearance for a fixed trackerball along cover of enclosure.

- 7.2.4.4 For an adjustable height worksurface, the height from floor level shall be variable between 660mm and 770mm.

7.3 Equipment inventory

- 7.3.1 The desk shall be designed to accommodate all equipment that is required to support signalling activities at the desk.

Note: Typical equipment that may need to be considered can include (but is not limited to):

- VSCS screens and input devices
- Discrete alarm, control and indication panels
- Telephone concentrator and handsets
- CSR display and keyboard
- NRIM office computer screen and input devices
- CCTV level crossing monitors and control panels
- IVRS handset and flashing unit indicator lamp

- 7.3.2 Passive space provisions shall be included for future fitment of systems that are known to be under development.

Note: Examples of equipment known to be under development or not fully deployed at this issue of this document includes the fixed terminal for the GSM-R radio system and a tablet input device for signaller automated forms.

7.4 Equipment layout principles

- 7.4.1 The design of the desk shall include the layout of all displays, controls and other fixed items to be utilised on the desk.

- 7.4.2 The layout of equipment on the desk shall both meet user tasks requirements whilst satisfying the key dimensional constraints outlined in this Section and in Section 12 for panels.

- 7.4.3 The following general layout principles shall be taken into consideration for signaller desks:

- a) The signalling control screens are likely to be used the most frequently and will be the most important for the majority of safety related actions. Hence, these should generally be centrally located on the workstation. Signalling control screen should also not be interspersed with any other displays;
- b) Where CCTV level crossings are in frequent use from a workstation, the controls shall be located close enough to the signaller's seated position to be operated comfortably. The CCTV monitor shall be in a suitable position horizontally and vertically such that the image can be checked reliably. Also, when there are multiple CCTV crossings operated from a desk, the level crossing

controls should be aligned with the respective CCTV monitor to minimise any possibility of selecting the wrong controls by accident;

- c) Input devices should be located for use by either right or left handed users. This ideally should be achieved by providing controls that are capable of being moved on the desk surface. Where the position of an input device has to be fixed (e.g. fixed trackerball), this shall be placed in a central location. Where this is not possible (e.g. due to the size and design of the equipment) preference should be given to mounting equipment where it benefits the majority of the users (which may be to the right).
- d) The telephone systems are used in combination with most other displays on the desk and consideration shall be given to the proximity and location of handsets and displays/controls to other displays and control devices located on the desk.
- e) Where panels are required for discrete alarm displays and emergency controls, consideration should be given to the frequency, importance and urgency related to using the controls or identifying the alarms. Where it is not possible to mount such panels centrally, they may be mounted to one end of a desk or possibly on a worksurface behind the signaller. This is because, for alarm displays, the provision of audible alarm sounders can be used to draw the signaller's attention to any new alarms. Emergency controls are used infrequently and it may be judged that the small additional time required to access a panel at the end of a desk is not critical to the success of the emergency action.
- f) The signaller may have to manage and complete various sets of paper forms when managing possessions, or consult manuals or procedures at the same time as operating the various items of equipment. The desk space therefore is required to provide sufficient space for laying out and accessing such paperwork.
- g) Network Rail is developing an electronic tool to replace paper forms. However, it is likely that there may still be a need to use paper forms and documentation for the foreseeable future and desks should be designed accordingly.
- h) Equipment and equipment dimensions are likely to change over the lifetime of the desk. Hence, the desk layout design should not unduly constrain change or modification. Ideally, some spare space should be provided at the ends of the worksurface or over linking units to accommodate additional requirements.

7.5 Reach distances to input devices

- 7.5.1 The desk shall be designed to allow input devices to be positioned and used within an acceptable reach envelope for the smallest