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Health Building Note 26
Volume 1
Facilities for Surgical Procedures

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HBN 26

Facilities for surgical procedures: Volume 1

Delivering Same Sex Accommodation – Review of Health Building Note Guidance

The Department of Health's Delivering Same-Sex Accommodation (DSSA) programme aims to all but eliminate mixed-sex accommodation from hospitals in England by 2010. Although DSSA is primarily an operational issue, the design and layout of healthcare facilities can help support the provision of same-sex accommodation. With this in mind, the Department's Health Building Note (HBN) series of publications has been reviewed against DSSA requirements.

Amendments have been made to this document at **paragraph 3.26**.

This review makes particular reference to the letter (PL/CNO/2009/2) from the Chief Nursing Officer and Director General NHS Finance, Performance and Operations at:

www.dh.gov.uk/en/Publicationsandstatistics/Lettersandcirculars/Professionalletters/Chiefnursingofficerletters/DH_098894

Full details of the DSSA programme are at:

www.dh.gov.uk/en/Healthcare/Samesexaccommodation/index.htm



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Executive summary

This Health Building Note (HBN) is the first of a new edition of HBN 26 that gives guidance on facilities for surgical procedures in all healthcare settings. This volume describes the facilities required to support in-patient operating theatres in an acute general hospital.

The main changes to facilities since the previous HBN 26 – ‘Operating department’ (1991) include increased space in theatres to make them flexible enough to carry out different types of surgical procedures, including minimally invasive techniques.

A new concept, recently adopted from the USA, is that of admissions lounges. This enables patients who have previously been assessed to arrive directly from home on the morning of their operation. They are only admitted to an in-patient bed post-operatively from the recovery unit, thus limiting the unnecessary use of beds.

Another recent change in practice in a few hospitals is the omission of anaesthetic rooms in the theatre suite.

The activities normally carried out in these rooms are transferred to the operating theatre. Whilst a local decision should be made on the adoption of these models, this guidance points out the advantages and disadvantages and cautions that the design of the facilities should incorporate appropriate ventilation systems for the control of infection.

This HBN is based on a department with eight operating theatres, each with an anaesthetic room and a preparation room, and one recovery unit.

There is an emphasis on providing an appropriate environment for both patients and staff. In operating facilities where staff are often unable to leave the area for several hours, it is essential that adequate rest accommodation is provided. Guidance is given on office and rest accommodation both for operating department and anaesthetic department staff.

A methodology for capacity planning is included.

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Central Manchester and Manchester Children's University Hospitals

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1 Background

1.1 This Health Building Note (HBN) provides standards on the built environment required to support clinical and diagnostic invasive procedures.

1.2 This HBN will be published in a number of parts to include:

- Volume 1: Background; general functional and design considerations; in-patient operating facilities;
- Volume 2: Day surgery;
- Volume 3: Facilities for surgical procedures carried out in primary care facilities, treatment rooms, dedicated endoscopy units or out-patient departments.

1.3 This is the first volume in the series. The second and third volumes, when published, will supersede the three volumes of HBN 52 – ‘Accommodation for day care’ and its supplements.

1.4 This guidance is relevant to operating theatres in the following specialist settings. Reference should be made to the documents in brackets for specific guidance:

- obstetric unit (see also HBN 21 – ‘Maternity department’);
- cancer centres (see also HBN 54 – ‘Facilities for cancer services’);
- cardiac unit (see also HBN 28 – ‘Facilities for Cardiac services’);
- children’s cardiac units (see also HBN 30 – ‘Cardiac facilities for children and young people’, forthcoming);
- renal transplant unit (see also HBN 53 – ‘Facilities for renal transplant units’, forthcoming);

INTENDED READERSHIP

1.5 This guidance is primarily intended for:

- project and design teams;
- estates directors and their staff;
- PFI consortia and private-sector contractors.

1.6 It may also be of interest to:

- executive directors and senior managers of acute trusts,
- Infection Control teams;
- clinicians from every profession working in operating departments, or in partnership with, surgical care teams;
- NHS Foundation Trusts (for information only).

IMPACT OF SERVICE DELIVERY ON FACILITIES

1.7 Since the publication of HBN 26 ‘Operating department’ (1991) the organisation and delivery of surgical services has changed. The NHS Modernisation Agency’s ‘Theatre Programme’ (2002–03) worked with trusts to help deliver ‘Priorities and Planning Framework 2003–2006’ targets of reduced waiting times for patients and increase capacity, by reducing cancellations and improving theatre utilisation. This in turn has produced an emphasis on day surgery and Treatment Centres (TCs).

1.8 Along with dedicated day surgery facilities, surgical procedures are taking place in a variety of settings including:

- designated ‘multi-functional treatment rooms’ (as in the A&E model; see HBN 22 – ‘Accident and emergency facilities for adults and children’);
- in primary healthcare centres in inner city, urban and rural locations where in 2001/02 more than 600,000 minor surgical procedures were completed (DH, 2003; see <http://primarycare.nhsstates.gov.uk/secure/content.asp>);
- other community settings, for example mobile operating theatres;
- at the patient’s bedside. Surgical interventions using local anaesthesia are performed in critical care areas. (see HBN 57 – ‘Facilities for critical care’). The number and type of interventions is likely to increase and in future may extend into general acute areas (see ‘Comprehensive Critical Care’ DH, 2000);

- various out-patient departments where minor surgical procedures under local anaesthesia, laser surgery and cryosurgery take place (see HBN 12 – ‘Out-patients department’ and its supplements);
- dedicated endoscopy units located within an acute general hospital (see HBN 52 – ‘Accommodation for day care, Vol 2, Endoscopy Unit’; under review, see [paragraph 1.2](#));
- in diagnostic imaging and interventional radiology departments. Interventional radiology procedures now make up almost 15% of the total workload (see HBN 6 – ‘Facilities for diagnostic imaging and interventional radiology’);
- dedicated cardiac units in tertiary hospitals;
- in Treatment Centres (TCs), independent of the acute general hospital, where patients requiring relatively minor elective surgery are being admitted as day cases (DH, 2003).

1.9 As well as changes to the settings where surgical procedures are carried out, the speed of development in technology has significant implications for the design and layout of surgical facilities. For example, fibre optic technology has revolutionised the practice of minimal invasive surgery, and the range and number of investigations have both greatly increased. The challenge for planners and architects is to design surgical facilities that are not only functional but have sufficient flexibility to adapt to the changes and rapid developments in surgical technology that will without doubt continue apace.

1.10 Possibilities for new surgical treatments and interventions continue to increase as knowledge and technology advance, for example by digitally-based image enhancement, laser technology, alternative diathermy and argon beamers.

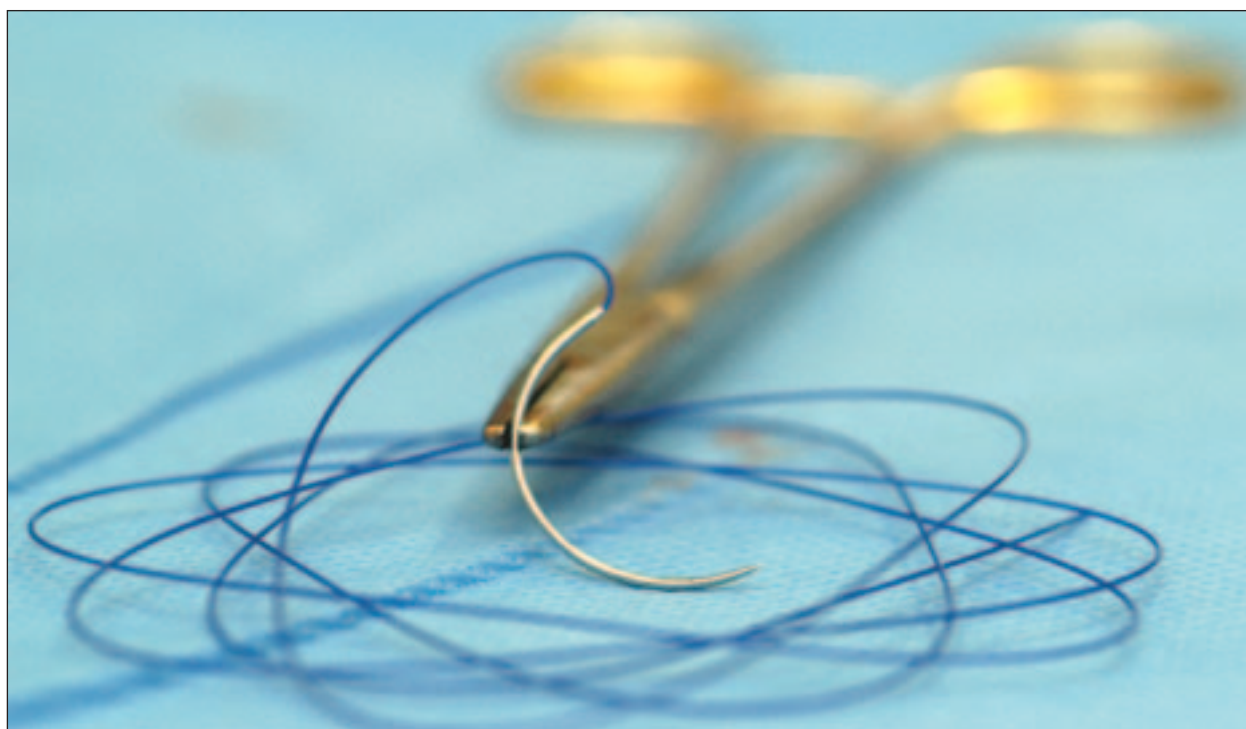
1.11 There is an increase in the use of intra-operative ultrasound, for example trans-oesophageal or echocardiography. This equipment is large and bulky. HSC 2002–2009 ‘Better Blood Transfusion’ recommends extensive use of cell savers, which require additional space in theatres.

1.12 The size of anaesthetic machines has also increased due to the number and complexity of the integral patient monitoring systems, safety features and record-keeping technology.

1.13 The use of IT and communications in an operating department has increased dramatically during the past decade, including voice-activated control of equipment and the room environment, robotic surgery, electronic patients records/smart cards, and CCTV for training and world-wide consultation.

1.14 The main implication of these developments is the need for significantly more space than previously recommended in operating theatres and anaesthetic rooms.

1.15 As well as the need for greater space, flexibility is the key to accommodating this new technology. Healthcare buildings today should be designed to enable reconfiguration to take place to facilitate flexible use (Rosin, 1999).



2 General functional and design considerations

2.1 This chapter gives guidance on general and functional design considerations related to all surgical facilities.

CONSIDERATIONS AT THE INITIAL PLANNING STAGE

2.2 When planning the provision of surgical facilities, it may be useful to consider modular construction methods. There is a range of modular methods, which lead to varying degrees of standardisation and pre-assembly. The suitability of proposed methods should be determined according to the individual circumstances of the surgical facilities required. For further information and options see [Appendix 1](#).

COMPLIANCE WITH STATUTORY AND OTHER REQUIREMENTS

2.3 This HBN takes account, as far as possible, of all statutory and other requirements and guidance in force or available at the time of publication. The following is intended only as a brief summary of compliance requirements. See also [paragraph 7.19](#).

People with a disability (Disability Discrimination Act 1995)

2.4 Authorities should comply with the provisions of the Disability Discrimination Act (1995) and the Building Regulations Approved Document M: Access to and use of buildings (Office of the Deputy Prime Minister 2003). See also BS 8300: 2001 'Design of buildings and their approaches to meet the needs of disabled people – Code of Practice'.

Manual Handling Regulations (EU Directive 1992)

2.5 Manual handling and safety laws and regulations are specific with regard to lifting and turning patients and moving heavy equipment (EU Directive 1992). Planning and design teams should take these directives into account when designing surgical facilities. The implications of these directives for the risk management of patients is under consideration by the National Patient Safety Agency (NPSA). It is likely that further guidance will be forthcoming (see <http://www.npsa.org.uk>).

Safety regulations

2.6 For fire and health and safety regulations see [paragraph 7.19](#).

Environmental Protection Act 1990

2.7 See [paragraphs 2.17–2.19](#) and [7.3–7.8](#).

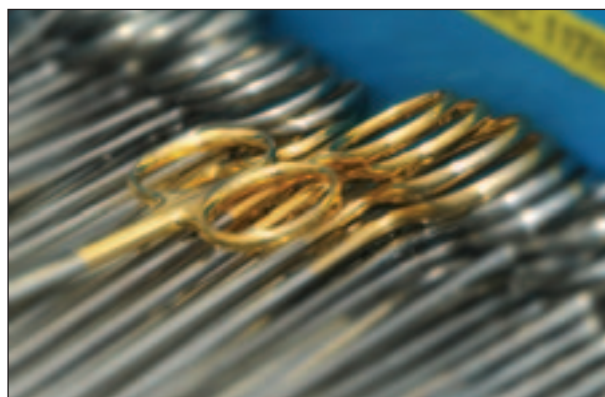
INFECTION CONTROL

2.8 Infection control teams should be consulted from the outset of any new-build or renovation project and should remain integral planning team members throughout. In a new-build project this means that they should be members of the team that develop the business case from its inception. Detailed information about the role of the infection control team in the built environment can be found in HFN 30 – 'Infection control in the built environment'. This document should be the first point of reference for planning teams with regard to infection control and its relation to design.

DECONTAMINATION

2.9 The effective decontamination of medical devices is essential in reducing the risks to patients from HCAI (see HSC 2001–05 'Governance in the new NHS').

2.10 Reference should be made to advice and guidance contained on the latest version of the 'Decontamination Guidance' CD-Rom (for details see <http://www.decontamination.nhsestates.gov.uk>). Further information can also be obtained from Medicines and Healthcare products Regulatory Agency (MHRA; see <http://www.mhra.gov.uk>).



2.11 Reference should also be made to HBN 13 – ‘Sterile services department’.

2.12 The Department of Health strategy pertaining to the reprocessing of re-usable surgical instruments is that local reprocessing should be the exception rather than the norm and that automated washing methods are preferred to manual cleaning.

2.13 The use of bench-top sterilizers in theatres is being phased out in favour of central processing in a sterile service department (SSD). Operating departments should ensure that they have adequate stocks of surgical instruments to overcome issues associated with dropped instruments.

2.14 Large volumes of disposable contaminated equipment are generated in operating departments, and their safe and secure storage prior to their disposal is paramount. See paragraphs 4.129–4.132.

PROTECTING A PATIENT’S PRIVACY AND DIGNITY

2.15 Some surgical operations necessitate exposing patients in ways that they find distressing and embarrassing. Protecting their dignity is therefore a critical function. This is even more important when the patient is unconscious, being induced or recovering from an anaesthetic. A number of measures can be taken to minimise the invasion of privacy including the design and fitting of the building. The design of surgical facilities should incorporate strategies that allow control of sound and vision. See paragraphs 6.8–6.14 for further details.

INFORMATION TECHNOLOGY (IT) AND COMMUNICATION

2.16 See paragraphs 7.129–7.135.

ENVIRONMENTAL IMPACT/SUSTAINABLE DESIGN

2.17 The environmental impact of any new healthcare facility is important and is an integral part of NHS responsibility for the health and well-being of the community. Care should be taken to contain the environmental impact of activities to a practical minimum.

2.18 Operating departments and other surgical facilities annually produce a large amount of waste. Much of this is categorised as clinical waste and should be treated in an appropriate manner as a legal requirement. A significant amount of waste is also generated that is classified as non-clinical waste. This should be recycled where possible.

2.19 For detailed guidance on all aspects of sustainability see the NHS Estates website (http://www.nhsestates.gov.uk/sustainable_development/index.asp).

DESIGN CONSIDERATIONS

2.20 An increasing number of patients undergo surgery without a general anaesthetic, remaining conscious throughout the entire procedure, and hence remain aware of their surroundings even in the operating theatre.

2.21 Designers should aim to create an environment that is conducive to making patients feel at ease and giving them confidence, thus aiding the healing process. At the same time it should facilitate efficient working, and contribute to staff morale. For patient and staff views see Appendix 2.

2.22 To assist this complex design process, the Achieving Excellence Design Evaluation Toolkit (AEDET) has been developed in collaboration with the Commission for Architecture and the Built Environment (CABE) and the Construction Industry Council (CIC). This is downloadable from NHS Estates’ website (<http://www.nhsestates.gov.uk>).

CHILD-FRIENDLY ENVIRONMENTS

2.23 The Kennedy Report recommendations for children’s services have implications for all theatre and surgical facilities (DH, 2002). In view of the small number of children that require certain types of surgery, separate facilities for them will be hard to justify. However, provision should be made for children and young people to be segregated away from adult patients, and to have their parents or carers with them, for example, in the anaesthetic room and recovery unit. The general surgical environment should address the needs of children and young people and their carers.

2.24 For further information see ‘Improving the Patient Experience – Friendly healthcare environments for children and young people’ (NHS Estates, 2003) and HBN 23 – ‘Hospital accommodation for children and young people’, which reflect the principles in the Children’s National Service Framework Hospital Service Standard (DH, 2003).

ART IN HOSPITALS

2.25 Artwork is beneficial to people of all ages providing it is selected with care and is appropriate to the environment in which it is installed.

2.26 Consultation should be made with the infection control team prior to selecting artwork in an operating department, as it is essential to ensure that it complies with cleaning and disinfection policy.

2.27 For further information see 'The art of good health: using visual arts in healthcare' (NHS Estates, 2002) and 'The art of good health: a practical handbook' (NHS Estates, 2002).

NATURAL LIGHTING

2.28 Natural light is of particular importance to the well-being of patients and staff. All surgical facilities, where possible, should have natural daylight directly from windows, or by means of borrowed light from windows across corridors. When selecting glazing, protecting the privacy and dignity of every patient is paramount (see [paragraph 4.92](#)).

2.29 The majority of the staff are unable to leave the department once they are on duty and, in a unit without windows, they may not see natural light for a number of days, particularly during the winter months. Lack of natural light is one of the most common complaints made by staff about their working environment.

2.30 Where natural light is not available through conventional means, consideration should be given to using recently-developed technology, which allows natural light to be ducted to internal rooms even in multi-storey buildings.



Figure 1 Windows providing some natural light in an operating theatre

2.31 Where possible, the following areas within the department should have natural light:

- operating theatres;
- recovery unit;
- staff rest room.

ARTIFICIAL LIGHTING

2.32 The positioning of artificial lighting should be carefully considered.

2.33 Ceiling-mounted lighting should not be installed directly overhead in patient areas in the operating department. An awake or lightly-sedated patient cannot avoid the glare when lying on a trolley or bed. If ceiling-mounted fittings are used they should be two-directional so that they can be adjusted to prevent unwanted glare. The lighting should be dimmable without flicker. Artificial lighting should include clinical task lighting in anaesthetic rooms and at each bed space in the recovery unit. This is essential for continuous clinical assessment of a patient's colour and general physical status.

2.34 In endoscopic and keyhole procedures the main lighting is often reduced to facilitate the viewing of the visual display screens. See [paragraph 7.110](#). Adequate arrangements should be made for the illumination of the anaesthetic machines and monitors.

2.35 In the recovery unit the clinical task lighting individual to each bed space can be part of the medical supply unit. Each light should be dimmable from the patient's bedside and also from the communications base.

2.36 Floor or low-level lighting is an essential resource in order that the clinical staff can monitor patient equipment situated at a low level. The light can also be used to aid movement around the recovery bed space at night.

2.37 Artificial lighting, as well as providing levels of illumination to suit activities, makes an important contribution to interior design. Designers should develop lighting schemes that will provide high-quality light for clinical activities, with non-clinical and soft environment lighting in as many spaces as possible.

2.38 For further information see 'Lighting and colour for hospital design' (NHS Estates; Dalke et al, 2004). See also [paragraphs 7.103–7.118](#).

WAYFINDING

2.39 On-call clinical staff frequently work in a variety of departments, and in an emergency situation it is essential that they can identify the correct venue immediately. Each operating theatre, anaesthetic room

and recovery bed space should be clearly numbered to avoid any possible confusion.

2.40 For further guidance see 'Wayfinding' (NHS Estates, 2004).

ACTIVITY DATABASE

2.41 The Activity DataBase (ADB) data and software assists project teams with the briefing and design of the healthcare environment.

2.42 Room data sheets provide an activity-based approach to building design and include data on personnel, planning relationships, environmental considerations, design character, space requirements and graphical layouts. Schedules of equipment/

components are included for each room, which may be grouped into ergonomically arranged assemblies.

2.43 Schedules of equipment can also be obtained at department and project level.

2.44 Fully loaded drawings may be produced from the database.

2.45 Reference data is supplied with ADB which may be adapted and modified to suit the users' project-specific needs.

2.46 For further information refer to the ADB section available from a link on the NHS Estates website (<http://www.nhsestates.gov.uk>).



3 The operating theatre department for in-patients – general design considerations

INTRODUCTION

3.1 The functional unit described in this guidance comprises eight operating theatres, a recovery unit, an anaesthetic department, and facilities for staff support. This model has been adopted for operating theatre departments that care for patients undergoing elective or emergency surgery as in-patients within an average-sized new-build acute general hospital that serves a population of circa 300,000.

CAPACITY PLANNING

3.2 Appendix 3 presents a method of determining the number of operating theatres that will be needed for a new, or for a reconstructed, operating department for in-patients. The method also provides an estimate of unused capacity.

3.3 In the calculations, using the model of eight theatres, it is assumed that at least one theatre will be reserved for emergencies. The National Confidential Enquiry into Peri-Operative Deaths (NCEPOD) report recommends that hospitals admitting large numbers of trauma patients should dedicate an appropriate number of operating theatres for emergency cases (NCEPOD, 2003).

3.4 One session (half a day) per theatre each week should be reserved for planned preventive maintenance and cleaning. Many units undertake maintenance and cleaning outside session time. The project team could consider the provision of a service corridor where appropriate.

3.5 Endorsed by the Modernisation Agency and in consultation with the National Health Care Litigation Authority, the National Association of Theatre Nurses has produced a benchmark document for calculating staffing establishments in relation to patient needs in the peri-operative environment (NATN, 2003). Planning teams will find this document helpful in planning the schedule of accommodation for the staff support facilities.

SITING CONSIDERATIONS

3.6 The main in-patient operating theatre department in each NHS trust should be located centrally within an

acute hospital development. Ideally, all the operating theatres in the hospital should be in one location with one recovery unit. This helps with flexibility of operation, efficiency of staffing, clinical governance and safe management of emergencies.

3.7 Operating theatre departments that admit patients for emergency surgery should have the following services (see Figure 2) on the hospital site as a minimum standard (NCEPOD, 1997):

- emergency care (A&E department);
- 24-hour access to imaging, including scanning;
- critical care;
- laboratory services (pathology);
- in-patient acute services; and
- orthopaedic/trauma services.

3.8 In addition to the optional status laboratory within the operating department, there should also be a full laboratory service available on a 24-hour basis.

3.9 The location of the central laboratories has become less important since the widespread introduction of near-patient testing facilities sited throughout the hospital.

3.10 For best practice, sterile services should be located on the same site. If they are located in the same building, consideration should be given to the installation of clean and dirty lifts between the two areas (see HBN 13 – ‘Sterile services department’).

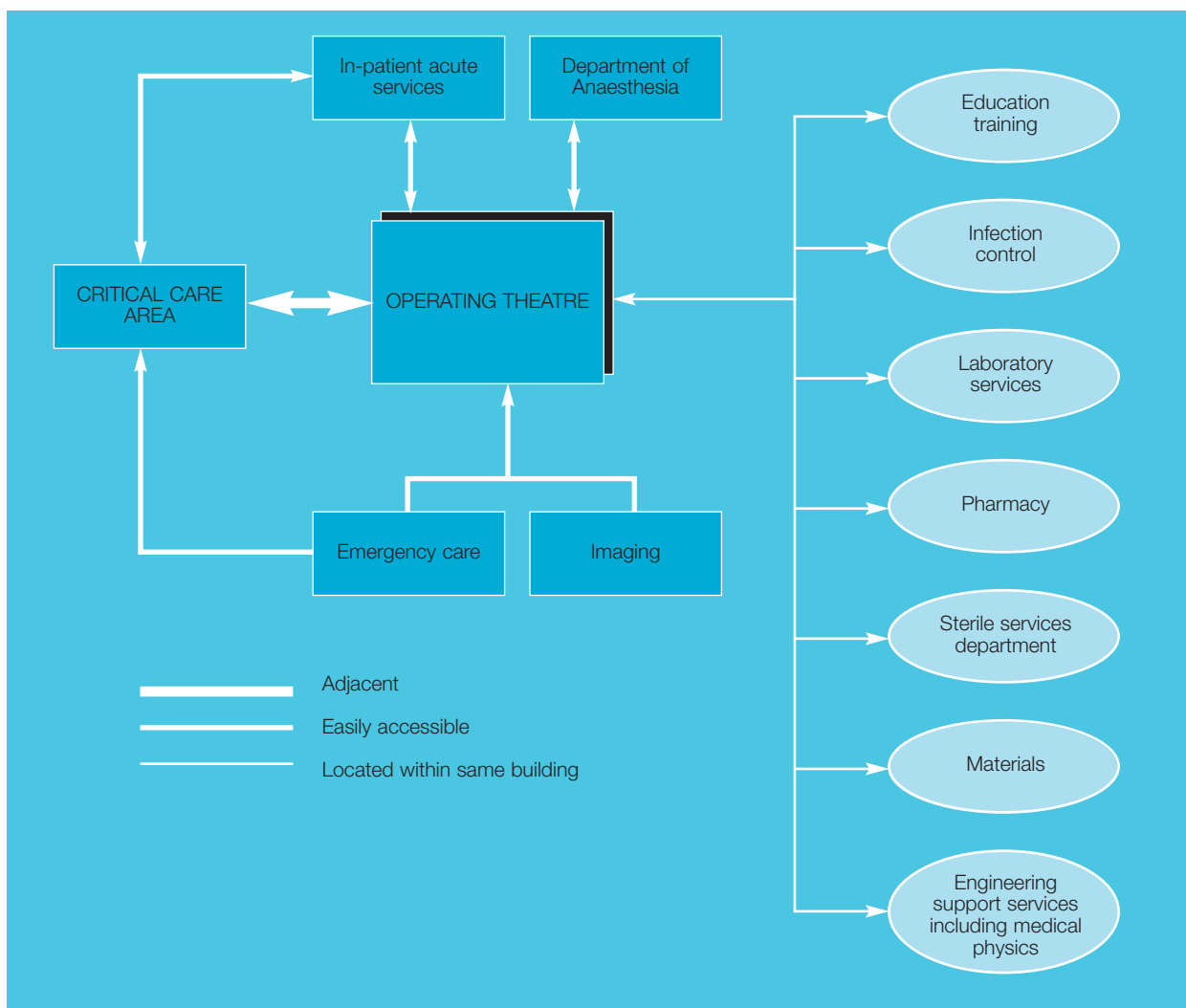
FACTORS INFLUENCING THE DESIGN OF IN-PATIENT OPERATING DEPARTMENTS

3.11 Since the publication of the previous HBN 26 (1991), there have been several changes in service delivery that have an impact on the built environment. Some of the main influences are described in the following paragraphs.

Admissions lounges

3.12 There is a trend towards admitting patients, previously assessed as fit and infection-free, for major

Figure 2 Operating theatres – relationships with on-site services



elective surgery on the day of their operation to an “admissions lounge” based in the operating department. The rationale is to preserve beds, reduce pressure on surgical wards first thing in the morning, reduce infection rates, and meet patient preference.

3.13 Using these facilities, patients arrive at a lounge area adjacent to theatres, where they are able to sit with relatives, and be interviewed by anaesthetists and/or surgeons. They change prior to their surgery and their clothes are either taken by relatives or transferred to their destination ward.

3.14 This system works extensively in other countries and is gaining in popularity in the UK, with the NHS Modernisation Agency actively promoting inclusion of these facilities in operating departments. Accommodation for an admissions lounge should be included when designing and building new operating departments (see paragraphs 4.27–4.32).

Anaesthetic rooms

3.15 In the UK it is common practice for each operating theatre to have its own anaesthetic room. The overwhelming majority of anaesthesia teams in the UK prefer to continue this model, as an anaesthetic room presents the most satisfactory environment for a patient’s calm and dignified preparation for surgery and the efficient and safe induction of anaesthesia. With the development of Anaesthesia and Critical Care Practitioners (ACCPs), to optimise skilled staffing resources and throughput, the inclusion of anaesthetic rooms will be necessary if the expected benefits are to be achieved.

3.16 It is common practice in the US and some European countries to exclude the traditional anaesthetic room from the operating department layout. Patients are prepared for their operation in the operating theatre. This has been taken up in the UK by a small number of trusts.



Figure 3 Administering gas to a patient in an anaesthetic room

3.17 Initial reports received from the staff working in these units, and the patients receiving care, indicate that in their view this is a positive development. Other clinicians are opposed to this practice. Once theatres are built without anaesthetic rooms, some anaesthetists maintain that efficiency can never be increased, even if the workforce changes, for example using an increased number of non-physician assistants. Some countries, for example the Netherlands, that have introduced anaesthesia teams, have re-introduced an anaesthetic room for every operating theatre. See [Appendix 4](#) for further information.

3.18 Excluding anaesthetic rooms has space and design implications for the operating theatre area. More significantly, the omission of an anaesthetic room will compromise the ability of a theatre suite ventilation system to maintain pressure. Where it is intended to dispense with the anaesthetic room, an ultra-clean ventilation solution should be employed within the operating theatre itself (see also [paragraphs 7.43–7.61](#)).

3.19 This guidance assumes that all theatres include a dedicated en-suite anaesthetic room. For further detailed design guidance see [paragraphs 4.34–4.53](#).

Preparation rooms

3.20 This guidance assumes one preparation room for each theatre. See [paragraphs 4.63–4.68](#) for detailed design requirements.

3.21 If the operating theatre has ultra-clean ventilation, there is an option to omit a preparation room, as instruments can be laid up in the operating theatre beneath the ventilation canopy. However, there are design implications to which robust solutions should be found. The following should be taken into account:

- In the absence of ultra-clean ventilation, the omission of a preparation room is not acceptable.
- The ultra-clean canopy of the operating theatre needs to be large enough to permit the laying-up of trolleys comfortably within its footprint.
- Where the laying-up of trolleys is undertaken under the protection of the ultra-clean ventilation canopy it is imperative that the ultra-clean ventilation system is operating at full duty.
- In the absence of a preparation room, a suitable alternative location for the storage of immediate back-up sterile supplies, supplementary instrument packs and other items such as lotions, suturing material and sterile fluids and the heated lotion cabinet should be provided (see [paragraph 4.65](#)).
- Where a preparation room is omitted, an anaesthetic room must be provided (see [paragraphs 3.15–3.19](#)), as the laying-up of instrument trolleys is not acceptable at the same time that the patient is being induced in the operating theatre.

3.22 Under no circumstances should two or more operating theatres share a single preparation room, due to the potential risk of cross-infection via the ventilation airflows. HTM 2025 – ‘Ventilation in healthcare premises’ gives a range of air movement schemes for theatres with preparation rooms.

Recovery units or PACU (Post Anaesthetic Care Unit)

3.23 The functionality and flexibility of recovery units is being extended. Currently, a number of patients require critical care for a limited period following surgery (elective or emergency). This places undue pressure on critical care beds and has led to major elective surgery being cancelled due to a lack of adequate post-operative facilities. Traditionally, with the exception of “designated emergency theatres”, most recovery units close during the night and at weekends. A number of acute hospitals have now increased the functional capacity of their recovery units to a 24-hour, seven-day per week basis. The implication for the built environment is that staff facilities need improving (see [paragraphs 5.1–5.3](#)) and facilities for visitors will be required (see [paragraphs 4.25–4.26](#)).

3.24 The majority of procedures undertaken in the main operating theatres are for patients who require in-patient facilities due to the nature of the procedure or an existing medical problem. It therefore follows that their post-anaesthetic recovery may well require additional care. An increasing number of patients are transferred on their beds from the operating theatre to the recovery unit. This will affect the size of each space, as it should be large enough to accommodate an adult bed with additional space for the monitoring equipment and to ensure immediate access for staff in case of emergency.

3.25 Provision is required for quiet dark spaces (using adjustable lighting levels) in which patients can recover from specific anaesthetics.

3.26 The need to segregate male from female patients should also be considered. Single space accommodation would allow maximum flexibility in admissions. Single space accommodation can also be utilised for patients who require isolation (for example those who are immuno-compromised). On occasions, it might also be utilised to care for a dying patient and their family.

3.27 Where a single space solution is adopted, in respect of either all or part of the recovery unit, the importance of adequate levels of ventilation to facilitate waste anaesthetic dilution should be borne in mind (see also [paragraph 7.59](#)).

3.28 A segregated area for children is essential in the recovery unit, with provision for parents to stay with them.

3.29 For further information see 'The Recovery Facility' (AAGBI, 2002). See also [paragraphs 4.147–4.157](#).

Recovery units for short-term critical care

3.30 Post-operative theatre recovery facilities that provide short-term critical care have been approved by the Department of Health (HSC 2000/17). To meet these requirements and those set out in 'Comprehensive Critical Care' (DH, 2000), and for maximum flexibility, some of the bed spaces in the recovery unit should be equipped to accommodate a critically ill patient (minimum Level 2) on a planned care, short-term basis (for further guidance see HBN 57 – 'Facilities for critical care').

Accommodation for anaesthetists

3.31 Anaesthesia is the largest of the hospital's specialties, representing 15% of hospital doctors, and the NHS Plan (DH, 2000) signalled that there should be a 6% increase in the number of consultant

anaesthetists, each of whom will require accommodation in the department. The new consultant contract (DH, 2003) emphasises the importance of providing suitable facilities for supporting professional activities (SPAs) on site.

3.32 The need for dedicated accommodation for anaesthetists has been identified for more than a decade (WMRHA, 1990). That document established standards of accommodation that were consistent with functional requirements and formed a basis for cost allowances. Since the document was published a number of organisational changes and capacity increases have taken place within the NHS, each of which adds to the space requirements within a department of anaesthesia. These include the introduction of clinical directorates, resource management and clinical audit. There has also been a significant increase in the number of consultant anaesthetists as a result of the development of acute pain services, chronic pain clinics, pre-operative assessment clinics and high-dependency units.

3.33 See also [paragraphs 5.39–5.61](#).

Imaging

3.34 Imaging plays a vital role in many clinical interventions. Currently, most imaging is completed prior to surgery, but it is anticipated that by 2010 imaging will be part of the surgical procedure itself. Current practice in theatres involves visual imaging using TV cameras, ultrasound, and X-ray fluoroscopy. Predicted developments include intra-operative and, if required, post-operative imaging and the replacement of X-ray by MRI scanning supported by ultrasound (Rosin, 1999).

3.35 See also HBN 6 – 'Facilities for diagnostic imaging and interventional radiology'.

OTHER GENERAL CONSIDERATIONS

Moving and handling equipment

3.36 There is an increasing incidence of obesity in the population and a consequential demand for products that can cope with lifting and moving much heavier patients on a regular basis (Rosin, 1999). Lifting or transferring unconscious patients (obese or otherwise) poses a particular challenge for the staff working in an operating department (RCN, 2003). Patients (most of whom are supine while others are nursed prone in an operating department) will require transfer to and from the operating table with the aid of lifting equipment. The recovery unit will also require lifting and turning equipment.

3.37 Consideration should be given to the use of hoists in the recovery unit and the crane system in the operating theatre.

Floor markings

3.38 Greater use could be made of marking of floors in operating theatres and anaesthetic rooms to show the correct and safe position for the equipment such as the operating table and anaesthetic machine. This helps the non-permanent and agency staff to ensure that patients are placed at minimal risk of injury from the equipment. See also [paragraphs 6.20–6.27](#).

Storage

3.39 Storage space is at a premium in all hospitals. The amount of storage space required is always underestimated. It will vary according to the clinical specialties.

3.40 At least two spare operating tables, additional operating table furniture, one spare anaesthetic machine, mobile microscopes, and lasers are just some of the items that are routinely required in general operating departments. Recently, surgical robots and their accompanying equipment have required large areas of additional and secure storage space.

3.41 An increasing number of UK hospitals have installed the “just-in-time” storage system, which involves a large centralised store on each site where all non-specialised clinical consumables are kept for regular distribution on a “top-up” basis to the different departments when required. Agreement should be reached at the planning stage about the minimum level of consumables that should be retained in the department.



Figure 4 Storage room for supplies and equipment

4 Operating theatre facilities for in-patients – specific functional and design requirements

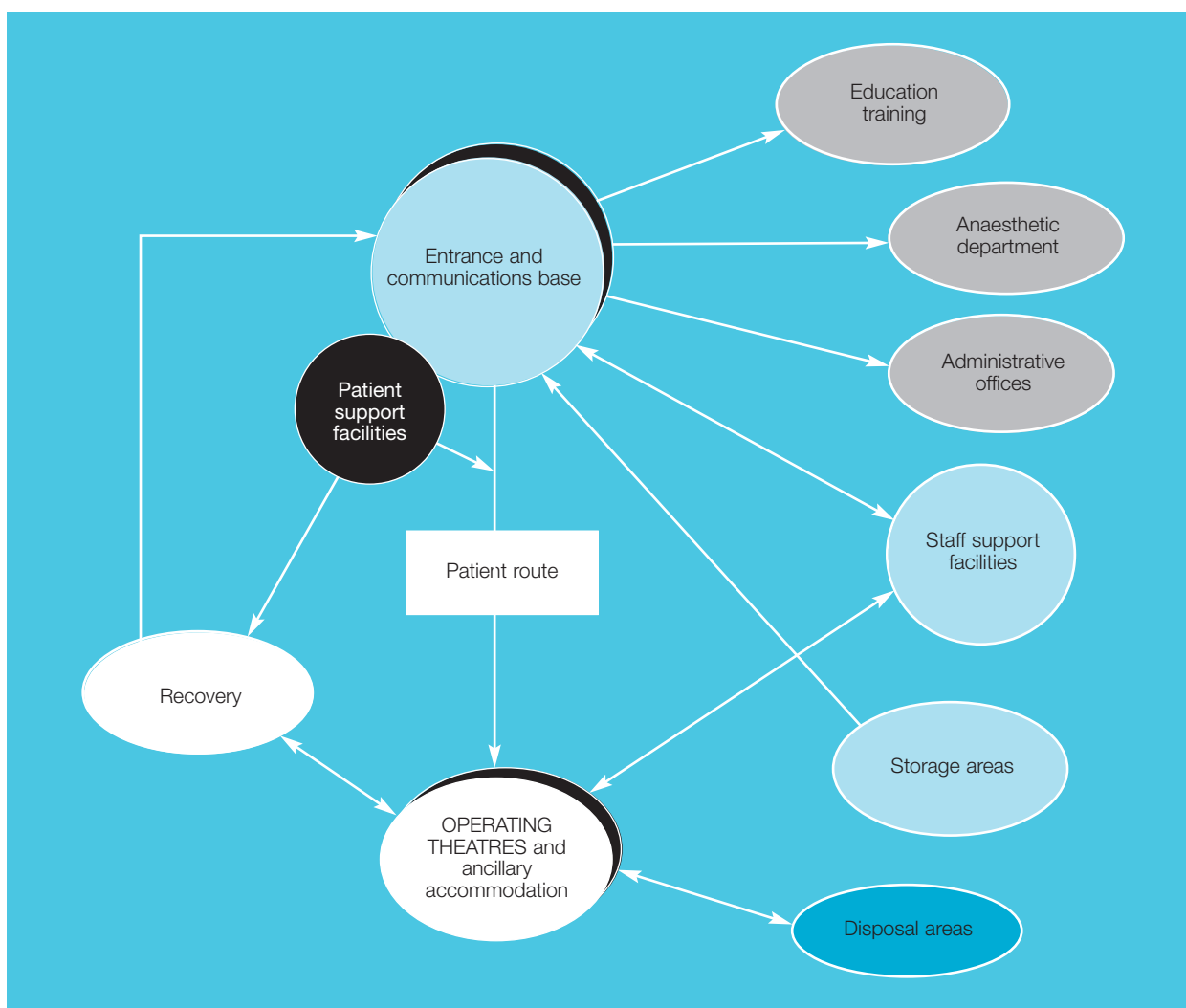
4.1 This chapter describes specific design requirements for the operating department in a new-build facility or a major refurbishment. It is suitable for most types of surgery undertaken in operating theatre facilities for in-patients. Some specialties, for example ophthalmic surgery, will require modification to the fixtures, fittings and equipment generally included as standard in an operating theatre.

CLUSTERING OF ACCOMMODATION

4.2 This guidance is based on requirements for a department that accommodates eight operating

theatres, each with an anaesthetic room and a preparation room, and one recovery unit. Some of the accommodation will need to be an integral part of the operating department but, as an option, some can be co-located. In a new-build facility, the local planning team will need to determine the configuration as part of the whole-hospital policy. When refurbishing an existing building it may not be feasible to co-locate all the accommodation together. See Figure 5 for recommended functional relationships.

Figure 5 Functional relationships



4.3 The following accommodation should be an integral cluster with access through a single, secure entrance:

- communications base;
- eight operating theatres (with associated ancillary accommodation);
- eight anaesthetic rooms;
- patient support facilities (admissions lounge with changing facilities, waiting area, interview room);
- recovery unit with 16 bed spaces (with associated ancillary accommodation);
- staff support facilities (porters' base, changing facilities, rest rooms, reporting room);
- storage areas (equipment, bulk store);
- disposal areas (dirty utility, disposal hold, housekeeping room).

4.4 The following accommodation could be integral or co-located with access through the main entrance or with its own secure entrance adjacent to the operating department:

- education and training facilities;
- anaesthetic department;
- administrative offices.

THE IN-PATIENT JOURNEY

4.5 With few exceptions, patients of all ages will follow the same route through an operating theatre department as follows:

- arrival under escort in the main reception area. The majority of patients will be escorted from a ward for elective surgery or an A&E admissions ward for urgent surgery. Some will be transferred directly from the accident and emergency department for emergency surgery (see HBN 22 – 'Accident and emergency facilities for adults and children'). It is anticipated that in the future a significant number of patients will be admitted via the admissions lounge;
- transfer to designated anaesthetic room;
- transfer to operating theatre;
- transfer to recovery unit or critical care if necessary;
- return to ward.

MAIN ENTRANCE – CONTROL OF ACCESS

4.6 Patients and staff, will all use the main entrance to the department. Supplies and disposals will also be carried through this entrance.

4.7 Security measures are needed to prevent unauthorised access to the theatre suite. It is recommended that visitor access to the suite be controlled by use of an entry-phone or intercom system with CCTV, linked to the communications base located in the entrance lobby. Programmable close proximity card, transponder or similar systems should be fitted to the entrance doors and used across the department for staff access. The programmable system should grant different patterns of access to suit the needs and privileges of authorised staff and visitors. The security measures chosen should not inhibit emergency escape from the department in case of fire (see paragraphs 7.25–7.26).

4.8 The entrance should be wide enough for the transfer of patients on beds (with sufficient additional width to enable clinical staff to accompany them), supplies, equipment and waste. An electronic automatic double door, with a minimum clear opening width of 1600 mm, will be suitable. Care should also be taken with the design of corridors in the department to ensure they are of sufficient width to allow the passage of two beds and accompanying equipment and staff simultaneously.

4.9 The main entrance lobby should contain the communications base, the administrative office, the porters' base and a waiting room for visitors to the department (including members of a patient's family if appropriate). If project teams include an admissions lounge this will also be located here (see paragraphs 3.12–3.14 and 4.27–4.32).

4.10 Secure doors are essential between the main entrance lobby of the theatre suite and the operating theatre area in order to prevent unauthorised staff or visitors gaining access.

4.11 The entrance area, including the communications base, should be warm, welcoming and well-lit (see 'Improving the Patient Experience: Welcoming entrances and reception areas', NHS Estates, 2004). Strategies for making the waiting area child-friendly are described in 'Improving the Patient Experience: Friendly healthcare environments for children and young people' (NHS Estates, 2003).

4.12 The furnishings and fittings should be easy to clean, disinfect and maintain. See also HFN 30 – 'Infection control in the built environment' and HTM 87 – 'Textiles and furniture'.

COMMUNICATIONS BASE

4.13 The communications base should be located so that it commands a clear, unobstructed view of the main entrance, the waiting room, the entrance to the main theatre corridor and the access route to the staff support areas. Entry to the operating theatre suite should be controlled from this base.

4.14 This base is the central point for all communications within the department and is used regularly for formal and informal discussions on the telephone or face-to face. The operating department receptionist will be located here.

4.15 All general information for the operating department, including fax and computer links, arrives at the base.

4.16 The design of the reception desk should be of a high quality and allow access for people with disabilities. The counter top should have two heights: one for wheelchair users and children, and the other for adults at standing height for occasional writing.

4.17 The communications base should have access to an integral administrative office.

4.18 A wall-mounted staff emergency call lamp should be located at the communications base to alert the reception staff of a problem within the department (see [paragraphs 7.140–7.141](#)).

4.19 The telephone system should be capable of use as an intercommunication system between the various areas within the operating department and divertable to another extension within the main operating department for after-hours access or in the event of an emergency.

4.20 In order to preserve privacy and dignity of patients, reduce the noise levels and reduce the risk of cross-infection, personnel who are not directly involved with patient care should be accommodated outside patient areas. This includes administrators and secretarial staff.

ADMINISTRATION OFFICE INTEGRAL TO COMMUNICATIONS BASE

4.21 This office should be large enough to accommodate two people along with computer and telecommunications equipment.

4.22 A small safe where patients' valuables can be held when necessary should be located in the office.

4.23 A wall-mounted staff emergency call lamp should be located here.

DEDICATED OPERATING DEPARTMENT PORTERS' BASE

4.24 This guidance assumes that operating department porters will use the changing, training and rest facilities in the staff support areas; however, it is acknowledged that a base is needed which gives them easy access to the main hospital street and also to the operating theatre corridors. Locating their base in the main reception area achieves this aim. It is not necessary to provide full catering facilities, as these will be accessed

in the staff rest area. A wall-mounted staff emergency call lamp should be located in the base.

WAITING ROOM

4.25 It is now common practice for parents to accompany their children to the anaesthetic room and wait for the child to be transferred to the recovery unit post-operatively. A waiting room should be provided for this purpose. Critical care and overnight step-down care has been extended into some recovery units. Patients receiving this care are also likely to receive visitors. In addition, overall visitor numbers are increasing in the department. These factors should be taken into account when planning the facilities.

4.26 The room should be large enough to accommodate up to six people at one time. The décor should be selected carefully to reflect a calm and relaxing atmosphere. People may wish to wait here for long periods of time, so comfortable seating is essential. Daylight should be provided if possible; however, soft lighting is an acceptable alternative. Beverage-making facilities should be available at all times. A television should be provided. An en-suite wheelchair-accessible WC is essential.

ADMISSIONS LOUNGE

4.27 If patients arrive in the operating department for surgery straight from their homes, the waiting room should be utilised as part of the admissions lounge. The size of the room should be increased to accommodate up to ten people at one time.

4.28 Patients arriving in the lounge will have had their pre-operative assessment and examination previously, and should only require minimal physical assessment on the day of surgery. A small number of consulting/ changing rooms with an examination couch will be required, with entry from the waiting area and a separate exit to the operating suite.

4.29 Under this system patients will be formally identified and admitted once they have entered a consulting room, in order to maintain their privacy. They will change in this room and not return to the waiting area. All doors will require secure access and should be wheelchair-accessible. The patients' clothing will be transferred to their in-patient accommodation via the recovery unit.

4.30 Each consulting/ changing room will require a clinical hand-wash basin with non-touch taps, desk with computer facilities, and internal telephone.

4.31 Shower and bathing facilities will not be required.

4.32 Patients will walk, or be taken by wheelchair, to the anaesthetic room/operating theatre. Trolleys are not required.

INTERVIEW ROOM

4.33 The general waiting room used by family and friends should not double up as a “breaking bad news room”. A small room should be designated for this purpose. In common with the general waiting room, this room should portray an area of calm and comfort. A telephone should be provided. An en-suite wheelchair-accessible WC should be included.

ANAESTHETIC ROOM

4.34 The minimum space required in each anaesthetic room is 19 m².

4.35 In most circumstances a patient will be transferred to the anaesthetic room from either the in-patient ward or the admissions lounge accompanied by a nurse escort. Initial clinical procedures, for example monitoring and the insertion of intravenous infusions, will commence in this room.

4.36 The room should be large enough to accommodate at least four people as well as the

patient. Complex invasive clinical procedures take place in anaesthetic rooms, therefore the room should be large enough to accommodate all the equipment (for example Trans-oesophageal Echocardiography (TOE) machines, fibre-optic intubation equipment) as well as ensuring adequate circulation space.

4.37 It is essential to be able to access the patient from all sides. Each anaesthetic room in the department should be identical, and not handed. It is preferable to have all the medical gas services, air, nitrous oxide, oxygen, vacuum and gas scavenging outlets wall-mounted. Ceiling-mounted medical supply units are not recommended as, in the view of the Association of Anaesthetists, access to the patient can be impeded in a relatively small space. To meet COSHH requirements, low-level extraction should be provided adjacent to the anaesthetic gas outlet (see HTM 2025 – ‘Ventilation in healthcare premises’).

4.38 Privacy, and the maintenance of an undisturbed environment, is of great importance.

4.39 This room should be constructed to provide maximum sound insulation to ensure a calm, relaxed atmosphere (see HTM 2045 – ‘Acoustics: Design considerations’). See also [paragraphs 6.8–6.14](#).



Figure 6 Anaesthetic room (with operating table)

4.40 One set of double doors should open from the corridor into the anaesthetic room, with another set opening into the operating theatre. Installing either sliding or automatic doors is a project option. Each set of doors should be wide enough to admit the patient and associated equipment, minimum clear opening width of 1600 mm, and close quietly. Obscured vision panels are required in both sets of doors. An electronic “in-use” sign should be located outside the main corridor entrance into each anaesthetic room. Automatic doors should be capable of standing in the open position.

4.41 A lockable controlled drugs cupboard is required in each room, as well as a lockable refrigerated drugs store. The ‘Risk and Quality Management System’ (NATN, 2002) sets out clear standards for the security of medicines in operating departments (see also paragraphs 7.121–7.123).

4.42 Storage units should not impinge on the working area required during the preparation and induction of the patient (see Appendix 5, Room layouts).

4.43 Local policy will determine where emergency and resuscitation drugs are conveniently stored.

4.44 An adjustable ceiling-mounted examination lamp is required for clinical procedures. All work surfaces should be lit. It should be possible to vary the level of general lighting.

4.45 A radio-controlled clock with sweep seconds hand should be located on the wall above the patient’s feet (see also paragraphs 7.124–7.125).

4.46 A clinical hand-wash basin with non-touch taps should be provided. It should be sited at the end of the room opposite to the normal position of the patient’s head.

4.47 When a child is undergoing a procedure, the anaesthetic room is the final destination for the parents escorting their child. Every anaesthetic room should be child-friendly (for specific guidance see ‘Improving the Patient Experience: Friendly healthcare environments for children and young people’ NHS Estates, 2003).

4.48 Patients of all ages report less anxiety, and are physiologically more stable, if they can listen to music pre-operatively. A music system should be provided for this purpose (Evans, 2000). See paragraphs 7.126–7.128.

4.49 Anaesthetic rooms can be sited at right-angles to the operating theatres, therefore the entrance doors to the theatre do not have to be directly opposite the anaesthetic room entrance doors.

4.50 A wall-mounted push-button staff emergency call with re-set and indicator lamp should be located in each anaesthetic room, linked to the recovery unit and the staff rest area.

4.51 A wall-mounted “repeat” staff emergency call lamp should be located outside each anaesthetic room.

4.52 A telephone capable of ring or silent/light indication should be appropriately located (see paragraphs 7.131–7.135).

4.53 See also paragraphs 7.43–7.61.

SCRUB AND GOWNING ROOM (OPTIONAL LOCATIONS)



Figure 7 Dedicated scrub room

4.54 There are three project options for the location of the scrub area (see also Appendix 5, Room layouts):

- a dedicated scrub and gowning room for each operating theatre with sufficient space for a minimum of three people (minimum size 11 m²);
- one scrub and gowning room can be shared between two operating theatres, both of which should be directly accessible with sufficient space for a minimum of six people, with three people scrubbing back to back, and space between to prevent contamination (minimum size 16 m²). Where a scrub room is shared between theatres, potential exists for the compromising of pressure gradients within and between the two theatres, with possible adverse

consequences for infection control. Specialist engineering advice should always be sought;

- a recessed scrub and gowning area in each theatre with sufficient space for a minimum of three people (minimum size 7 m²).

4.55 In an operating theatre with a recessed scrub area it is essential that it is located away from the area containing laid-up instrument trolleys in order to prevent water contamination.

4.56 The sink and furniture should be at a height that facilitates hand- and arm-washing. The design and drainage should ensure that the floor does not become wet during scrub-up procedures. The floors should be anti-slip.

4.57 Non-touch taps, scrub solution and nailbrush dispensers are required. Sensor taps are now available that allow a sufficient run-on time for the scrub protocol to be completed. The recommended length of the tap is 250 mm with a sensing range of 200–250 mm, and the run-on time should be a minimum of 20 seconds. An access panel should be sited to the side of the scrub sink to provide ease of maintenance of the thermostatic mixer valves and sensor controls to the taps. Wall-mounted paper towel holders should also be provided.

4.58 For the height of the scrub sink, refer to HTM 64 – ‘Sanitary assemblies’. The rim of the scrub sink

should not have an internal lip as this is a control of infection concern, as contaminated water during the scrub procedure drains from the elbows back into the sink. The area beneath the rim attracts debris, with a potential risk of infection. The splash-back should be a single waterproof sheet or seal mounting with polyurethane or wall glaze.

4.59 The scrub room should be large enough to enable staff to scrub, gown and circulate concurrently without risk of contamination from each other or from the surrounding fittings. Space should also be allowed for the siting of wall-mounted glove dispensers and floor-sited disposal bins (see [Appendix 5](#), Room layouts).

4.60 Shelving is required for the storage of gown packs. Most theatres now use a gowning trolley, which should not be stored beneath the storage shelves. Another project option is the installation of an easily cleanable shelf/work surface, for example laminate, on which to open the gowns and packs. This should be at a height to facilitate gowning and gloving and wide enough to allow gown packs to be fully opened.

4.61 Foot-operated disposal bins for brushes and wastepaper should be provided.

4.62 It is not essential to have a door between the scrub room and theatre. If one is provided, it should be an automatic self-closing door to prevent scrubbed staff from re-contaminating their hands.

PREPARATION ROOM

4.63 Instrument packs and other sterile supplies for the day's operating list are delivered to the preparation room of each theatre from the sterile goods area of the bulk store.

4.64 The preparation room should provide storage and suitable work surfaces for the laying-up of instrument trolleys. It should be large enough to open packs and maintain a sterile field. There will be a minimum of two members of staff (scrub and circulating personnel) in this area.

4.65 Storage in the preparation room requires special consideration. Staff, sometimes under pressure, must be able easily to locate a required item. The layout of storage for sterile instrument trays, supplementary packs and other items such as lotions, suturing material and sterile fluids should be common to all rooms. The heated lotion cabinet should be located in this room.

4.66 A room of between 12 m² and 20 m² will be required. The larger-sized room is required for operating theatres where organ transplant surgery takes place. Direct access will be required from the preparation room to the operating theatre and from the preparation room to the corridor.



Figure 8 Scrub sink with non-touch taps

4.67 The doors between the preparation room and the operating theatre and the preparation room and the corridor should be wide enough for instrument trolleys to enter without risk of contamination. The work surfaces should be of sufficient height to store 870 mm-high trolleys beneath in order to conserve space.

4.68 See also paragraphs 7.42–7.61.

OPERATING THEATRES

4.69 A standard size of 55 m² is recommended for all in-patient operating theatres (see Appendix 5, Room layouts).

4.70 Observation of the position of the surgical team and equipment suggests that the theatre should be approximately square. Once surgery is in progress, the surgical team and assisting staff occupy distinct areas of the operating theatre, centred on the patient. The patient, scrub team and anaesthetist occupy the central area, together with the equipment being used in the operative procedure.

4.71 The remaining space is used by staff supplying items to the scrub team, moving equipment into place and monitoring patient progress. Much of the equipment, and most members of the surgical team, are on either side of the table, while the anaesthetic team and the anaesthesia equipment is at the head of the table. Specialist surgery may require that the team cluster at the head or the foot of the table, but there may also be trolleys and other items of equipment at the sides.

4.72 Research for this guidance has shown that increased space in operating theatres is required for the following reasons:

- for maximum flexibility, all types of surgery can be undertaken in any operating theatre. This will prevent downtimes for certain types of surgery if a dedicated theatre has to be closed for decontamination, cleaning or maintenance;
- currently, a theatre for minimally invasive surgery is the largest at 55 m². As the number of minimal invasion procedures carried out is increasing, for flexibility it is recommended that all theatres be constructed to this same floor area of 55 m²;
- not all operating theatres need to be fully equipped for minimal invasive surgery; however, it is recommended that all the medical services are installed from the outset so that every theatre can be reconfigured in the future;
- all minimally invasive surgery theatres need to be equipped for conventional open surgery as, due to

unforeseen circumstances, patients sometimes need to be converted to open surgery;

- some types of surgery, for example orthopaedics or trauma, require as many as seven trolleys for different sets of instruments at any one time. A large flexible space is required to accommodate these comfortably in an occupied theatre. With an ageing population there will be an increased demand for joint replacement surgery, with an associated increase in waiting lists. More operating theatres equipped to meet this need will be required;
- in new developments such as robotic surgery the additional equipment (which is large and cumbersome) when in use requires a minimum of ten clinical staff in the theatre as well as the patient. This number excludes any visiting observers;
- the operating table itself has increased in size, is operated electrically rather than manually, and has many additional attachments. These have implications for storage space, as some of these attachments will be required on standby in the theatre;
- increasing numbers of patients are transferred onto their beds rather than a trolley. A bed is significantly larger than a trolley;
- in order to prevent back injuries for staff, patients should be lifted and transferred with the aid of hoists. There are a number of systems available. A manual hoist is large and requires space for manoeuvrability.



Figure 9 Minimally invasive surgery requiring space for equipment and camera screens

Standardised equipment

4.73 Each operating theatre requires the following minimum standardised services at the operating table. For maximum flexibility, medical gas and operating table electrical supplies should be located within both surgical and anaesthetic medical supply units:

- 12 socket-outlets and connection to the UPS/IPS systems (see [paragraphs 7.88–7.102](#)), where risk considerations in terms of patient safety dictate;
- PAS theatre record system networked to hospital mainframe;
- 1 oxygen outlet;
- 1 nitrous oxide outlet;
- 1 medical air outlet;
- 1 surgical air outlet;
- 2 medical vacuum points;
- anaesthetic gas scavenging points.

4.74 The following items may be located on each medical supply unit:

- anaesthetic machine located on anaesthetic medical supply unit only;
- flat-screen monitor and recording system for patient records;
- 2 infusion pumps;
- 3 syringe pumps;
- blood warmer;
- feeding pump.

4.75 The anaesthetic machine may be located on a dedicated medical supply unit. This will limit each operating theatre's flexibility, as the position of the anaesthetist will need to be predetermined at the initial design stage.

4.76 It is recommended that surgical and anaesthetic medical supply units have a tandem articulated pendant to allow cross-over of the arms depending on the procedure. If the surgical unit is provided with a single arm setup, it is recommended that the arm be installed with a double mount to allow for an additional arm to be installed at a later date.

Music system

4.77 Many patients undergo surgery without the need for a general anaesthetic and remain awake during the procedure. They may wish to listen to music. Some staff also find music beneficial in an operating theatre.

4.78 It is important that the project team consider the inclusion of a music system from the outset. Integral music systems are the preferred option, as there are potential hazards from cross-infection and interference with the existing power supply from stand-alone systems. The system should be integral to the

engineering system and be located within the fabric of the building (see [paragraphs 7.126–7.128](#)).

Doors within the operating suite

4.79 Doors through which beds or trolleys will pass should be wide enough to allow easy passage with attachments, including sterile drapes. It should be possible for them to stand in the open position. All doors should be fitted with vision panels capable of being obscured, and have laser-proof blinds. All doors should close quietly.

4.80 If manual swing doors are used, care should be taken to prevent the possibility of repetitive strain injuries. A number of the doors to the operating suite will be lead-lined for X-ray purposes and can weigh more than 100 kg per leaf. If the door is not hung correctly with quality stainless steel hinges, to comply with BS EN 1935: 2002 minimum grade 13, the misalignment can cause considerable problems to the closer mechanism. The use of a cam-action closer is recommended. These units are adjustable, allowing minimum opening resistance.

4.81 When using automated lead-lined doors the critical factor is the weight per leaf. Mechanisms are available that can handle up to 250 kg per leaf. This maximum is application-specific, as a "slide" arm cannot handle as much weight as a "push" arm. If power operators are specified it should be ensured that they do not impede operation if the power supply fails.

Ceilings

4.82 In operating theatres a minimum clear height of 3000 mm between the finished floor level and ceiling is required to allow unrestricted adjustment of the operating luminaire and other ceiling-mounted equipment. The building structure should be capable of supporting the loads generated when the ceiling-mounted medical supply unit is installed. Powered medical supply units allow unrestricted access to the patient and enable staff of all heights to operate them easily.

Hoists

4.83 Where ceiling-mounted hoists are installed, care should be taken when calculating the correct position, as it may require ceiling reinforcement. This could conflict with the overhead operating luminaires and ductwork. Hoists may be an option in an operating theatre when combined with a medical supply unit for the delivery of medical gases. A ceiling-mounted hoist is inappropriate in a theatre with an ultra-clean canopy.

Video equipment

4.84 Surgical procedures are frequently video-recorded for litigation and teaching purposes. At an early stage in

the design process the IT requirements should be identified and agreed as part of the whole-hospital policy. All operating lamps should be fitted with provision for a video camera. See [paragraphs 7.129–7.130](#).

Lighting

4.85 Care should be taken when selecting the correct operating lamp, especially when the theatre has ultra-clean ventilation, to maintain minimal interference with downward airflow patterns. See also [paragraphs 7.112–7.118](#).

Theatre control panel



Figure 10 Theatre control panel

4.86 Additional facilities, such as lighting controls, double X-ray viewing screens, and a clock with a sweep seconds hand are usually arranged on a theatre control panel where they may easily be viewed by operating staff. Circuit monitoring details should also be present where IPS circuits are provided. See also [paragraph 7.119](#).

Computer equipment

4.87 Each operating theatre should have a clinical workstation and computer terminal so that the staff can retrieve information and input patient data without leaving the theatre. Touch-screen monitors are recommended, as keyboards present a cross-infection hazard and should be avoided (NPSA, 2003). Alternatively a flat, wipeable keyboard may be used.

4.88 If standard keyboards are used for entering patient data they should be protected with a clear plastic cover, which can be cleaned and/or disposed of between each patient.

4.89 A work surface is required for the computer and for writing purposes. It should be large enough to accommodate archived material/X-rays and a large operation record book. It should be sited close to the

theatre control panel so that the telemetry for the computer can be part of the panel.

Swab count board

4.90 A dry-wipe wall-mounted marker board at least 800 mm x 600 mm is required. This board should be fixed permanently to the theatre wall and be at a height and in a position that facilitates access and visibility during procedures. Weighing scales should be located on a trolley positioned in close proximity to the marker board. Two “kick about” stainless steel bowl stands should also be available.

Theatre warning light

4.91 Each theatre requires a light warning when laser surgery and X-rays are being undertaken. The lights should be located in the corridor above the theatre doors. See also [paragraph 7.120](#).

Windows

4.92 Whilst it is desirable to provide natural light in operating theatres, there are some instances, for example during laser surgery, when windows need to be completely blacked out. This can be achieved through the installation of electrically-controlled opaque glass or double-glazed windows with inset blinds.

4.93 Windows should be fixed non-openable. This is essential to assure the clean environment, and assist the air-conditioning by maintaining a positive/negative airflow.

4.94 See also [paragraphs 6.38–6.42](#).

Theatre ventilation

4.95 Theatre ventilation is a crucial issue at the initial design stage. The planning team should agree the principle for delivering a clean environment to each theatre.

4.96 Further information is given in [paragraphs 7.43–7.61](#). See also HTM 2025 – ‘Ventilation in healthcare premises’.

Operating microscopes

4.97 Operating microscopes are used in many types of surgery. The size and weight of the microscope and the importance of positioning it exactly where required present considerable problems.

4.98 As different surgical specialties require different types of operating microscope, each for a limited period in the working week, for maximum flexibility mobile microscopes are usually preferable to those that are ceiling-mounted. The problems presented by transportation and storage of these bulky yet delicate instruments should then be considered.

4.99 If a ceiling-mounted microscope is installed, a rigid supporting structure is required, otherwise vibration may occur. A disadvantage in this type of microscope is the downtime of the operating theatre when the microscope is being maintained.

Finishes and fittings

4.100 If laser surgery is being undertaken in the operating theatre it is important that there are no reflective surfaces or bright door handles.

EXIT BAY

4.101 An exit bay may be shared between two theatres; however, the floor layout should take into account that theatres should not be handed. Single exit bays may be more efficient because they will be less likely to get blocked with storage equipment. The area should be sufficient for the parking of two beds with additional circulating space. Walls should be protected against heavy traffic in this area.

4.102 Ideally, the controls for lighting, heating and medical gas isolation valves should be located in each dedicated exit bay.

4.103 The bay may contain a local equipment store.

REPORTING ROOM

4.104 A small room is required for surgeons to record each completed operative procedure. The room should

be located close to the operating theatres and can be shared by several people at one time. A desk with a computer terminal and external telephone is required.

IMAGING EQUIPMENT BAY

4.105 An open bay should be provided close to the operating theatres for the storage of imaging equipment and protective lead aprons. A suitable socket-outlet should be provided for charging the imaging equipment. Lead aprons should be stored vertically to maintain their protective capability. Suitable wall brackets attached to a load-bearing wall or mobile stands are required for this purpose. The bay should be 5 m² to accommodate one mobile imaging machine and a single ultrasound unit. A larger storage area (8 m²) is required if mobile image intensifiers are used. It is a statutory requirement that the regulations pertaining to the use of ionising radiation are complied with, including IR (ME) R2000 and IRR 99.

CARDIAC ARREST/EMERGENCY TROLLEY

4.106 One cardiac arrest trolley with defibrillator should be sited within easy access of all operating theatres. In addition, space will be required for a fibre-optic bronchoscope light source trolley for emergency use. Both pieces of equipment should be located within a recess of the theatre main corridor.

4.107 A second cardiac arrest trolley should be sited within the recovery unit.



Figure 11 Exit bay with sufficient space to manoeuvre beds and equipment

FLEXIBLE ENDOSCOPE CLEANING ROOM AND STORE

4.108 There are a number of factors to be considered in the design and use of space for endoscopic procedures and the cleaning, disinfection, sterilization and storage of endoscopes and accessories. Patient volume, traffic flow and the types of endoscopic procedure to be undertaken should all be taken into account during space planning. Facilities for appropriate disinfection and sterilization are system-specific, requiring early planning of appropriate facilities (Alvarado and Reichelderfer, 2000).

4.109 An endoscope cleaning room and store is required, with a “dirty” area where used equipment can be reprocessed and a separate “clean” area where reprocessed equipment can be stored.

4.110 It is recommended that all reprocessing of rigid endoscopes and accessories should be carried out by a sterile services department (SSD; see DB 2002(05), MDA, 2002).

4.111 Where practicable, single-use devices should be used. If unavailable, re-usable accessories that are autoclaveable should be purchased. It is acknowledged that some flexible endoscopes and accessories are not compatible with steam sterilization and therefore are not suitable for processing in an SSD; they should be cleaned in a designated “dirty” area.

4.112 The “dirty” area should be equipped with automated endoscope reprocessors, and a large shallow utility sink with plug, which should be large enough to accommodate the cleaning and rinsing of endoscopes. Water for rinsing should be demineralised or there should be facilities for filtration.

4.113 An easy-to-clean work surface and low-level cupboards for the storage of a supply of chemical sterilants, some of which have special handling requirements as hazardous substances, are also required.

4.114 A source of suction will be required if tubes and cannulae are irrigated. A separate hand-washing sink will be required. The area should be designed so that the workflow can facilitate sound infection control practices (Alvarado and Reichelderfer, 2000).

4.115 Automated endoscope reprocessors can be as large as 1250 mm wide x 1800 mm high. Machines require an electrical supply to support a minimum electrical power of 18 kW, and three water supplies: hot, cold and demineralised/osmosis-purified.

4.116 Many units have alternative chemical substances for disinfection in accordance with the guidance ‘Decontamination of Endoscopes’ (DB 2002(05), MDA,

2002). If still used, glutaraldehyde is a hazardous substance. It is recognised to be toxic-irritant and allergenic. Care should be taken to avoid inhalation and skin or eye contact.

4.117 Toxic vapours produced during the cleansing and disinfecting process should immediately be removed by extract ventilation at bench level, thus excluding all possibility of inhalation. See the Control of Substances Hazardous to Health Regulations 2002 (COSHH) and the guidance document published by the Advisory Committee on Dangerous Pathogens, ‘Infection at Work: Controlling the Risks’ (HSE, 2003).

4.118 Storage is required for appropriate personal protective equipment such as nitrile gloves, goggles, impermeable aprons, and respiratory protection equipment suitable for use when decontaminating endoscopes or mixing solutions of chemicals.

4.119 The “clean” area of the endoscope facilities and store should include units for the secure storage of:

- flexible endoscopes;
- flexible accessories for endoscopes;
- other sterile and non-sterile accessories for endoscopes.

4.120 Vertical cupboards are required for storage of flexible endoscopes, as they are required to hang between each use. Cupboards should be separately lockable.

4.121 Storage space is also required for procedure manuals, logging and charting supplies, and equipment manuals as well as other administrative materials (BSG Working Party Report, 2001).

4.122 Clinical hand-wash facilities with non-touch taps and pedal-operated sack-stands for the disposal of waste are also required.

THEATRE DIRTY UTILITY ROOM

4.123 There are a number of options for providing dirty utility associated with the operating theatre. It is common to provide an individual dirty utility with every theatre. As a project option, a dirty utility can be provided for every two or four theatres.

Option one: individual with all theatres =
12 m² x 8

Option two: shared between two theatres =
14 m² x 4

Option three: shared between four theatres =
18 m² x 2

4.124 The room should be large enough to enable cleaning of theatre equipment, and disposal of the contents of bedpans, urine bottles, vomit bowls, washbowls etc. A disposal unit consisting of sink and hopper with concealed cistern should be provided. Mops and buckets for immediate use in theatre are stored here, and a bucket sink is required.

4.125 Mechanical extract ventilation and hand-washing facilities should be provided.

4.126 After use, re-usable instruments are stored on a distribution trolley in the dirty utility. When the trolley is full it is taken to the disposal hold to await the return of instruments to the sterile services department.

4.127 Space is not required for holding materials for disposal or reprocessing since sacks and bags, once full, should be closed and taken to the disposal hold to await collection. The whole-hospital policy for disposal will determine the frequency of collection. It should, however, be acknowledged that volumes of waste from a single procedure may be considerable.

4.128 The dirty utility may also be used for urine testing. This should be zoned separately within the room. It can also be used as a holding bay for contaminated clinical equipment where it is cleaned prior to being taken to the equipment service room for maintenance.

DISPOSAL HOLD

4.129 In an operating department a considerable quantity of material for disposal is generated, and a central disposal hold is required. Bagged refuse, clinical waste, soiled linen and materials for recycling are held here safely and securely while awaiting collection. This lockable room should be accessible from the hospital street. Collections may then be made without the need to enter into the main circulation space.

4.130 Full “sharps” containers from the anaesthetic rooms, operating theatres and recovery unit will also be stored in the disposal hold. Project teams should also refer to the DH current decontamination policy to ensure that medical devices are stored and reprocessed or disposed of in a safe manner.

4.131 Instruments that have been used on a possible CJD or vCJD patient should not be re-used but may be quarantined by securely storing in a rigid sealed container after use, until the diagnosis is confirmed. For further guidance see ‘Advisory Committee on Dangerous Pathogens Spongiform Encephalopathy: Transmissible spongiform encephalopathy agents: safe working and the prevention of infection’ (DH, 2003).

4.132 Other distribution trolleys will be stored in the hold while awaiting collection by the SSD. These trolleys can be extremely large (1500 mm x 750 mm). When

planning the size of the hold, the approximate number of trolleys to be stored following an operating session and frequency of collection should be taken into consideration.

STORAGE AREAS

Bulk store

4.133 Packaged instrument trays and supplies are delivered from the SSD on a daily basis. Additional sterile instruments and equipment are also kept in this room. Bench-top sterilizers should not be installed, as the protocols are difficult and time-consuming to complete. Adequate instruments and an agreed turnaround time for these will obviate the need for benchtop sterilizers and reprocessing of instruments in clinical areas.

4.134 Non-sterile items are also stored here.

4.135 See HFN 29 – ‘Materials management (supply, storage and distribution) in healthcare facilities’ and HTM 71 – ‘Materials management modular storage’ for further details.

4.136 For ease of access the entrance to the store should be a minimum of 1500 mm, a door and a half width.

Clinical equipment store

4.137 Floor space within this store is needed for a variety of equipment including drip stands, monitoring equipment, ultrasound machines and haemodialysis equipment. Where possible, clinical equipment should be stored off the floor to help maintain a dust-free environment. Shelf space is needed for smaller items such as infusion pumps, ventilator accessories, monitoring equipment and suction apparatus. Electrical socket-outlets are required for charging equipment. Under-provision of storage for equipment may lead to unused equipment being kept in patient areas. This store should be located within easy access of the recovery unit and adjacent to the equipment service room.

Linen store

4.138 Storage is required for clean linen supplies, either in a linen store or on a linen exchange trolley. The amount of linen storage required depends on the linen supplies policy, the number of deliveries per day and the number of patients.

Ready-use store

4.139 A dedicated, easily accessible store for gas cylinders is required for the operating theatre. It should conform with the requirements of HTM 2022 – ‘Medical gas pipeline systems’.

LABORATORY (OPTIONAL ACCOMMODATION)

4.140 A status laboratory may be required for blood gas, electrolyte and glucose analysis and other tests carried out in the operating department. If the department is co-located with a critical care area this may not be necessary. The main requirements are:

- sink;
- impervious laboratory benching with adequate space for equipment;
- electrical socket-outlet provision;
- ready-use storage for blood gas machine;
- specimen fridge.

4.141 There should be sufficient space for staff to perform tests and use computer equipment.

4.142 A small wall-mounted cupboard for storing cleaning materials should be provided. Separate clinical hand-washing facilities are also required.

BLOOD STORAGE REFRIGERATOR

4.143 At least one blood storage refrigerator is required in the operating department. This should be located within easy access from operating theatres and the recovery unit. Personnel from the transfusion laboratories require easy access for supply and top-up purposes.

4.144 Larger departments may prefer to have two blood refrigerators, one of which could be located in the recovery unit.

4.145 The refrigerator should be wired in with central alarms and, possibly, barcode locks. Use of these refrigerators is governed by national and local blood transfusion service regulations.

SATELLITE PHARMACY

4.146 Every operating department should be serviced by a fully-equipped main hospital pharmacy located on the same site. Separate locked storage space will be required for bulk pharmacy items prior to transfer into individual drugs cupboards in each anaesthetic room and the recovery unit. The pharmacy will also store clinical lotions and intravenous fluids, which are usually dispensed in bulk and require significant and robust storage due to their weight and volume.

RECOVERY UNIT

4.147 A dedicated recovery unit is required. This should be located centrally in the operating theatre department. For a department with eight operating theatres, it is

recommended that a minimum of 16 recovery beds are provided. However, the final number will depend on local knowledge of the clinical specialties and the number of patients.

4.148 Most patients are admitted to the unit for post-operative care. Understandably, many patients find the recovery unit unpleasant, and as soon as they are clinically fit they will be discharged. It is therefore essential that the environment reflect a therapeutic atmosphere whilst continuing to meet the clinical requirements. Natural daylight enhances the feeling of well-being and is desirable.

4.149 Staff will need 360° access to a patient, therefore an island solution is required in each bed space. The main overhead lighting should be dimmable. A wall-mounted clock with a sweep seconds hand is required, visible from all bed spaces.

4.150 For best practice and to ensure the patient's privacy and dignity, every bed space should be separated by lead-lined solid partitions with a lead-lined curtain at the foot end of each bed space. This ensures that the radiation protection requirements have been met (see [paragraph 7.19](#)).

4.151 Four of the 16 recovery spaces should be single cubicles, each of which can be utilised as a normal recovery bed but is suitably equipped for caring for Level 2 patients (as defined in 'Comprehensive critical care', DH, 2000 and described in HBN 57 – 'Facilities for critical care') on a pre-planned short-term admission basis.

4.152 Consideration should be given to the use of hoists in the recovery unit. A number of options are available. For maximum flexibility, a hoist in every bed space is the ideal solution for new facilities or a major refurbishment.

4.153 A clinical hand-wash basin with non-touch taps is required at the front of each bed space.

4.154 Each bed space should be provided with:

- 12 socket-outlets, six to be located either side of the bed, which may be from IPS circuits;
- 1 medical air outlet;
- 1 oxygen outlet;
- 2 vacuum outlets;
- adjustable examination luminaire;
- push-button staff emergency call linked to an emergency call repeat lamp in the communications base and each theatre;

- flat-screen monitor with recording system for patient records.

See also [paragraphs 7.140–7.141](#).

4.155 Wall-mounted delivery points are in common use, but mobile equipment suspended from rails increases the possibilities for more flexible use of space. The recovery room should be mechanically ventilated with low-level extraction, since exhaled anaesthetic gases pollute the air. Patient scavenging masks are impractical (for further information see [paragraphs 7.43–7.61](#)).

4.156 Planning teams should also refer to ‘Immediate post-anaesthetic recovery’ (Association of Anaesthetists, 2002) which gives useful supplementary information on best practice in the post-operative environment.

Dedicated space for children

4.157 In smaller general hospitals, in the absence of a dedicated recovery unit for children, a discrete segregated area in the general recovery unit is essential. The environment should be made as child-friendly as possible (for further guidance see ‘Improving the Patient Experience: Friendly healthcare environments for children and young people’, NHS Estates, 2003). A waiting room for parents should be located in the main reception area where they can wait until they are invited by the clinical staff to the recovery area to be reunited with their child.

RECOVERY UNIT COMMUNICATIONS BASE

4.158 The recovery unit requires a dedicated communications base serving as a focal point and observation post within the clinical area. It should be enclosed in a glazed partition to reduce noise levels. The base will require a minimum of three telephone lines plus data access, computer facilities and white message board, and direct access to the clean and dirty utility rooms. A number of designs have been reviewed. Some units have a large, raised central station, enclosed by partition walls of wired fireproof double-glazed glass, from which all bed spaces are visible. Advantages of this arrangement are that people can have conversations on the telephone or face-to face, while limiting the noise levels in the clinical area. All incoming information from the operating theatres, via computer links, arrives at this central point.

4.159 The tendency to stick notices over the glass partition walls and to stack equipment on the surfaces outside the windows should be discouraged, as it greatly hampers observation of the clinical area.

LABORATORY (OPTIONAL ACCOMMODATION)

4.160 The optional status laboratory mentioned in [paragraph 4.140](#) may be located in the recovery unit.

RECOVERY UNIT CLEAN UTILITY ROOM

4.161 The clean utility provides storage for clean disposable items and equipment. It may also accommodate:

- lockable controlled drugs cupboard;
- drugs refrigerator;
- warm blanket storage facility.

4.162 Shelf space is needed for items of equipment such as infusion pumps, ventilator accessories, monitoring equipment and suction apparatus. Electrical socket-outlets are required for charging equipment.

4.163 One anaesthetic machine and a cardiac arrest trolley with defibrillator should also be located here.

RECOVERY UNIT DIRTY UTILITY ROOM

4.164 The equipment in this dirty utility room will be identical to that described in the theatre dirty utility room ([paragraphs 4.123–4.128](#)) with the exception that if disposable bedpans, vomit bowls etc are used, a macerator is required. If re-usable bedpans etc are used, a steam washer/sterilizer is necessary.

EQUIPMENT SERVICE ROOM

4.165 Separate on-site workshop facilities are required for equipment that needs regular maintenance and recharging. Technical support services should be available 24 hours a day for urgent servicing and decontamination of equipment.

4.166 Visiting electronics and medical engineering (EME) technicians carry out minor scheduled or unscheduled servicing in this room. The space provided should be sufficient to park and manoeuvre equipment and to accommodate a workbench with integral lockable cupboards, preferably in a self-contained room or space. A clinical hand-wash basin should also be provided. It is recommended that manufacturers’ user manuals be kept in this room.

4.167 The supply to socket-outlets should be provided via a dedicated residual current protected circuit device, and emergency power isolation buttons should be installed at the workbench and adjacent to the room entrance. Medical gas outlets supplying oxygen, medical air and vacuum should be provided. The provision of nitrous oxide together with gas scavenging facilities is a local decision. Some items of equipment may require decontamination in the SSD prior to scheduled servicing being done elsewhere. Local policy will identify where this is undertaken (for example in the SSD and/or EME department).

4.168 Equipment should be held in the dirty utility, where it is cleaned prior to immediate transfer to the equipment service room.

HOUSEKEEPING

4.169 A designated person should supervise the cleaning of an operating department with planned preventative maintenance programmes in place as part of infection control. Cleaning should be carried out according to national standards, infection control guidelines and local policies, and this should be monitored as part of quality control. Cleaning is of major importance in the functioning of the operating suite. Adequate space should be provided for the convenient local storage of cleaning equipment and materials.

4.170 A lockable storeroom is required for the storage of cleaning supplies and domestic equipment. Extract ventilation will be required. Floor space is required for a minimum of two floor-scrubbing machines. Dry storage space is required for clean disposable cloths, new mop-heads and additional unused bags. Facilities should be provided in this space for filling and emptying cleaning equipment via a bucket sink with hot and cold running water. A sluice hopper for the disposal of soiled mop water, a sink for washing soiled mop buckets and a drainer should be provided, as well as a hand-wash basin. 'The Control of Substances Hazardous to Health – Guidance for the Initial Assessment in Hospitals' (DH, 1992) relates to the safe storage and use of chemicals and cleaning materials.

SWITCHROOM

4.171 The departmental switchroom, which houses the main isolators and distribution circuit breakers, should be:

- sited within the department;
- accessible directly from a circulation area but not generally on a route used by beds or trolleys, providing clear and safe access for maintenance staff (access space may be part of the circulation area);
- sited away from water services; and
- lockable.

4.172 Care should be taken to ensure that safety is not compromised during maintenance by passing traffic or the opening of adjacent doors.

UNINTERRUPTIBLE POWER SUPPLY ROOM

4.173 A room of at least 3000 x 3000 mm is required to house the back-up system for essential electrical supply to the operating theatres and recovery area. The room should be well ventilated, having due regard to equipment heat gain, and should be kept locked at all times, with access only for permitted staff. The room may be also used to house the data hub for the operating department. Monitoring of all the UPS status is advised – this may be connected to the communications base monitoring equipment where appropriate and/or the theatre control panel. The use of centralised rather than distributive UPS arrangements within operating theatres should be considered in view of the likely security and maintenance advantages. Due consideration should be given to resilience and the need for maintenance downtime.

5 Support facilities – general and specific functional and design requirements

STAFF ACCOMMODATION

5.1 Theatre staff work in stressful situations every day. The provision of well-designed facilities helps morale and contributes to the efficient functioning of the department. Excellent staff facilities that are located within or adjacent to the department will encourage this.

5.2 There are five main categories of staff facilities, all of which should be designated clearly as non-clinical areas:

- rest facilities;
- changing rooms and associated facilities;
- office accommodation;
- facilities for education and training;
- storage.

Areas 1 and 2 should be located within the operating department.

5.3 Ways of preventing access to staff areas other than by authorised staff, should be implemented. Security locks with close proximity card entry are the preferred option, but planners and designers should be aware of hospital policy and consult with security experts.

REST FACILITIES

5.4 Operating theatre departments employ large numbers of staff all of whom may need access to the rest and recreation facilities. These facilities may be in use 24 hours a day. The principles of good housekeeping (cleanliness and minimising the risk of cross-infection) have to be applied over the same period.

5.5 A rest room is required where staff can relax and take beverages and snacks. The room should have windows with a pleasant outlook, be comfortably furnished and have a telephone.

5.6 The room should have direct access to the beverage bay and should be located close to the operating theatres. A dining table and chairs should be provided to enable staff to eat and drink in comfort.



Figure 12 Staff rest room with telephone, television and natural light

5.7 The rest room should be designed so that staff wishing to read or talk are not disturbed by the noise from a TV or music system.

5.8 An appropriate number of male and female WCs should be located within the rest and recreation facilities as well as in the staff changing rooms. For guidance see SI 1992/3004, The Workplace (Health, Safety and Welfare) Regulations 1992.

5.9 Designated WCs per theatre are not required. WCs, including provision for disabled people, should be located at strategic points throughout the department as well as in the staff changing rooms.

5.10 Each WC will require a hand-wash basin with non-touch taps and a WC with a non-touch flush valve. Extract ventilation should be provided.

BEVERAGE BAY

5.11 Facilities are required for the safe handling of food, including the preparation of beverages and light snacks, for washing and storing crockery and cutlery, for storing a limited quantity of dry goods, and for the refrigerated storage of milk etc. A hand-wash basin should be provided. Drinking water should be supplied. The beverage bay may be provided as a separate space adjacent to the staff rest room, but is normally designed as an integral part of the rest room.

CHANGING ROOMS AND ASSOCIATED FACILITIES

5.12 Clinical staff are in daily contact with patients' body fluids, encounter infection, and handle contaminated instruments and dressings on a daily basis.

Consequently they will need to shower and change their clothes whilst on duty. It may not be feasible for all non-clinical staff to use the departmental changing facilities but it is essential that all clinical staff are able to shower and change without having to leave the department.

5.13 Changing facilities should be located close to the operating theatres to minimise the movement of staff in their theatre clothing.

5.14 Provision should be made for separate male and female changing facilities. Estimates of changing space and locker provision should take into account the peak numbers of full-time and part-time staff including students and visitors.

5.15 Steps should be taken to ensure the security of personal belongings left in the staff changing rooms. There should be adequately-sized secure lockers for sessional use, similar to those used in swimming pools, leisure centres etc. Access to the areas should be via doors with close proximity card/transponder facilities.

5.16 Compartmentalised storage space is required for theatre clothing, as it is essential that it is instantly recognisable in size and availability. Laundry skips should be provided for soiled theatre clothing. Seating is also required for dressing and undressing. Some departments may wish to consider an exchange trolley system for theatre laundry.

5.17 The sanitary and shower facilities should be provided in self-contained, full-height rooms to provide maximum privacy. Cubicle partitions are not acceptable.

5.18 Dry changing areas equipped with mirrors, hair dryers and a shaving point are required.

5.19 Separate male and female staff WCs should be provided in association with other facilities for staff. A WC should also be provided that is accessible for disabled people. For further guidance see SI 1992/3004, The Workplace (Health, Safety and Welfare) Regulations 1992.

5.20 Separate clean and dirty entrances are not required.

FOOTWEAR WASHING

5.21 Footwear should be cleaned daily, or if visibly contaminated (HIS 2002a). For obvious reasons, most footwear is personalised.

5.22 Footwear should be stored on a designated, easily-accessible boot rack in a space provided with mechanical extract ventilation to limit odours. There are a number of footwear washing machines currently available that will wash certain types of footwear.

5.23 The washer should be located near to the male and female changing facilities.

OFFICE ACCOMMODATION

5.24 Some office accommodation will be required within the department. Where space is at a premium it is suggested that a number of offices are located adjacent to, rather than within, the operating department. If the office accommodation is adjacent to the department, it will require its own door with secure entry facilities.

5.25 Planners should consider including, as an alternative to more offices, one small informal room that is comfortably furnished and can be used for interviewing staff and visitors, and one larger interview/meeting room that could be utilised by members of staff when required.

5.26 Such a strategy would ensure maximum utilisation of interview/meeting rooms, and office space would not need to be increased. All confidential meetings could take place in absolute privacy. Offices can then be used exclusively for administration and clerical work. Most offices described in this section are similar in size and can be used flexibly. Where possible, every office should have a window and natural ventilation, and should be equipped with a computer terminal with access to full IT services and internal and external telephones.

5.27 See paragraphs 5.28–5.30 for design requirements.

Single-person offices

5.28 Some clinicians and managers will require access to single-person offices. These should be sufficiently private for confidential discussions between staff.



Figure 13 Single-person office with natural light and view out

They should accommodate an office workstation, with monitor and keyboard, seating for up to three other people, and storage for books and files. The offices should be close to each other and to the secretarial office, and associated with other office accommodation.

Multi-person staff offices

5.29 Multi-person offices are required for secretarial activities and administrative work. The number of offices will depend on local policy, and should be discussed and agreed with the design team during the initial planning meetings.

Additional office space

5.30 Additional office accommodation may be required for people who may not be permanent members of staff but who may still spend substantial periods of time in the department. This accommodation should be located in close proximity to the department. Facilities are required to allow “hot-desking” by clinical staff. At least four networked computer terminals are required, with connection to IT services and points for telephone and fax transmission. This room should also provide facilities for self-education and study.

EDUCATION AND TRAINING FACILITIES

5.31 Staff should be given every opportunity to use any quiet times to undertake pre-arranged or spontaneous personal or group learning. Continuing professional development (CPD) is now mandatory for all NHS staff and is integral to the DH ‘Agenda for Change’ proposals. This implies that the number of people needing access to and use of education and training facilities in the future is likely to increase significantly.

5.32 Facilities should include a seminar room and library along with access to a large multi-functional education and training room. Where appropriate, these facilities may be shared with the anaesthetic department (see [paragraphs 5.54–5.56](#)). All staff will need access to IT facilities.

Seminar room

5.33 A seminar room should be provided within the department for teaching, tutorials, meetings, case conferences and clinical instruction. Furniture and equipment should include upright stacking chairs with writing arms, a wall-mounted whiteboard, an imaging viewer, a video/TV monitor, and a computer and keyboard.



Figure 14 Meeting room

5.34 A computer image projector is required. A ceiling-mounted screen should be provided, and efficient blackout blinds and facilities for projection of slides and overhead transparencies.

5.35 Video links are now installed between operating theatres and the seminar room for education and training purposes. In these circumstances it is essential that written consent is obtained from the patient or their guardian.

5.36 An emergency recall system will be required between the seminar room and the operating theatres/recovery unit.

Library

5.37 A separate room in the form of a small library, with adequate secure storage space for books, should be provided for the purpose of private study. Computer terminals should be provided, each with access to the IT services.

5.38 An emergency recall system will be required between the library and the operating theatres/recovery unit.

ANAESTHETIC DEPARTMENT

5.39 The Department of Anaesthesia covers a wide range of activities throughout the hospital. The majority of anaesthetists have their major clinical commitment in operating theatres and recovery units. The department should be located close to the operating theatre suite. It is an operational rather than a clinical base. Patients do not visit here. Some visitors (for example drug and equipment sales representatives) will, however, require access to the department.

5.40 Anaesthetists provide a 24-hour service to a number of clinical areas (operating theatres, pain clinics, imaging departments, obstetrics, critical care, A&E departments). Core staff require easy access to the department 24 hours a day.

5.41 Anaesthetists have to respond to clinical emergencies immediately. Communications within the department itself and on a hospital-wide basis are therefore essential. The Association of Anaesthetists consider as best practice an intercom link between the department and the operating theatres, A&E, critical care, and the obstetric unit.

5.42 In academic departments where research takes place, security and fire safety measures should be considered carefully. The doors for this department will need to be a minimum of one and a half width in order to move equipment around safely.

Accommodation required in the anaesthetic department

Reception with small waiting area for visitors

5.43 A reception is required with a waiting area for visitors to the department. The entry-phone system for the department should be located here. This area should be large enough to accommodate one person, and requires computer and telecommunications equipment.

Single-person offices

5.44 Consultant anaesthetists, like other clinicians, increasingly require access to single-person offices to carry out administrative and non-clinical activities. There has been an insufficient supply of offices for several reasons, including lack of previous specific guidance, rapid expansion in consultant anaesthetist numbers (10% increase 2001–03) outstripping infrastructure, and an incorrect perception of the extent and needs of anaesthetists (Modernisation Agency, 2003).

5.45 Single-person offices are required by consultants for teaching, preparation, research, audit, study, administrative work, appraisal activities, and discussions with colleagues. These will normally be provided on a basis of one office for every WTE consultant anaesthetist. Not all of these offices need to be large, but they should be sufficiently private for confidential discussions between staff, and should provide computer facilities with access to e-mail and the internet (AAGBI, in press).

5.46 A number of offices should be larger, for consultants with designated roles, with seating for up to three other people and storage for books and files. The offices should be close to each other and to the secretarial office, and associated with other office accommodation.

Multi-person offices

5.47 The anaesthetic department provides the base for trainee anaesthetists who require facilities for study, research, and to prepare presentations, audit projects and their own assessment and appraisal documents. Normally these offices will be provided on the basis of one for every 2 WTE Specialist Registrars.

5.48 Secretarial staff are normally required at the rate of one for every 4 WTE anaesthetic consultants. The number of multi-person offices required for secretarial and administrative activities will depend on local policy, and should be discussed and agreed with the design team during the initial planning meetings.

Additional office space/audit office

5.49 Anaesthetic departments increasingly take on a teaching role and accommodate students and trainees. Additional office accommodation will be required for these and other staff who may not be permanent members of the team but may still spend substantial periods of time in the department. Audit staff, if not permanent, will also require such facilities. See [paragraph 5.30](#).

Staff rest facilities and beverage bay

5.50 See [paragraphs 5.4–5.11](#).

Staff changing

5.51 Separate male and female changing facilities are required similar to the changing in the main operating department.

5.52 Space is required for changing, clothes storage, showers and sanitary facilities. Estimates of changing space and locker provision should take into account the numbers of full-time and part-time staff, including trainees and students.

5.53 If staff changing is provided here, the area of the changing rooms in the theatre may be reduced. See [paragraphs 5.12–5.20](#) for specific design requirements.

Library

5.54 Anaesthetic departments, with their large teaching role, will require a library appropriately sized for the department. See [paragraphs 5.37–5.38](#).

Seminar room

5.55 A seminar room that can accommodate the whole anaesthetic department should be provided for audit,

morbidity/mortality, clinical governance and unit management meetings within the anaesthetic department. See [paragraphs 5.33–5.36](#).

Meeting room

5.56 See [paragraphs 5.25–5.26](#).

Interview room

5.57 See [paragraphs 5.25–5.26](#).

Storage room

5.58 A room will be required for general storage of office supplies.

On-call facilities

5.59 Anaesthetist on-call facilities are required within the department. Facilities should include a bed, en-suite shower/WC, clothes storage, a hand-wash basin, a desk and chair, and a computer with connection to IT services. This space should be linked into the staff communication system.

Laboratory

5.60 If a laboratory is required, specific guidelines for academic departments should be followed. The laboratory should have a robust security system to ensure that no unauthorised personnel can gain access.

Housekeeping room

5.61 See [paragraph 4.170](#).

6 Other general functional and design considerations

COMMUNICATIONS

6.1 Provision of effective communication systems is essential for the efficient management of the operating department. These are described below. See also [paragraphs 7.129–7.135](#).

Telephones

6.2 In the waiting area, where public telephones are provided, at least one should be mounted at a height suitable for wheelchair users and the handset fitted with an inductive coupler to assist people using a hearing aid.

6.3 Telephones should be provided in accordance with the whole-hospital policy for telephone services. Where telephones are provided for reception use, and in theatres, anaesthetic room and recovery, consideration should be given to hands-free systems. In appropriate areas, consideration should be given to installing telephones in pairs. This will allow incoming and outgoing calls to be made at busy times (for example in theatres). Ringing telephones in and adjacent to treatment spaces are a particular nuisance at times of peak activity, and consideration should be given to the installation of a system that will enable calls to be intercepted at appropriate alternative locations.

6.4 Staff in different parts of the operating department are required to communicate with each other. Unnecessary or abortive staff movement can be reduced, and messages can be received “hands-free” of communications equipment, by provision of an intercom system. This system should utilise the standard telephone system and telephone instruments, be simple to use, and cover locations of high staff activity. It can also accommodate a wide range of functions, both routine and emergency, and enable staff to communicate rapidly and when they require assistance.

Fax

6.5 Fax equipment will be required.

Patient-to-staff and staff-to-staff call systems

6.6 Patient-to-staff call systems should be provided in all spaces where patients may be left alone temporarily, such as recovery, admissions lounge or patient WCs.

Staff-to-staff call systems should be provided in all spaces where staff consult, examine and treat patients. Due to the nature of the department it is preferable that these systems work on the principle of flashing lights rather than ring-tones. Terminals to the call systems should be located at the communications base as well as staff rest facilities. See [paragraphs 7.140–7.141](#).

CONTROLLED DRUGS CUPBOARD

6.7 See [paragraphs 7.121–7.123](#).

NOISE AND SOUND ATTENUATION

6.8 Any unwanted sound is a noise and may disturb patients and staff. Noise-sensitive areas should be located as remotely as possible from internal and external sources of unavoidable noise. Many surgical procedures should be undertaken in noise-free environments. It is therefore important that there is no transfer of noise between adjacent theatres.

6.9 Speech privacy is essential in spaces where personal and confidential discussions are held, such as interview rooms and any clinical areas. Particular care should be taken where the adjoining spaces are waiting areas.

6.10 Sound transmission can be reduced by use of sound-reducing partitions and doors. The use of soft floor coverings and acoustic treatment to walls and ceilings (where hygienically acceptable) will improve sound absorption in a space.

6.11 The current recommendation on room acoustics in HTM 2045 – ‘Acoustics: Design considerations’ states that in spaces needed for communication it is important that noise levels created in the room “do not build up”. The noise levels in the room can increase due to sound reflections on a room’s surfaces. Hard surface materials, commonly used in healthcare buildings, contribute to the acoustic problems in buildings. Therefore, sound-absorbing properties of the room surfaces are very important.

6.12 Sound absorbers, for example acoustic ceilings or walls, are able to absorb a varying percentage of the sound hitting the surface and improve speech intelligibility by reducing the spread of airborne sound in the room.

6.13 Induction loops should be fitted where necessary in waiting areas.

6.14 See also [paragraphs 7.78–7.82](#).

FINISHES

6.15 The quality of finishes in all areas should be of a high standard.

6.16 Finishes should be robust enough to withstand accidental impact, and additional protection should be provided at likely points of contact. Trolleys and items of mobile equipment that may cause damage should be appropriately buffered. Wall protection is advised in all corridor and heavy traffic areas, plus storage rooms and bays. Cleaning regimes should be considered when materials are selected.

6.17 The infection control team should advise on the appropriate finishes throughout the project (see HFN 30 – ‘Infection control in the built environment’).

COLOUR

6.18 Colours of surfaces in spaces occupied by patients should not adversely affect the colour rendering of light sources.

6.19 It should be possible to clearly define and easily identify changes to a patient’s skin tone and colour. Décor should be light and attractive.

FLOORS

6.20 Carpets are not acceptable anywhere in an operating department. Floors should be able to withstand harsh treatment, including:

- the rolling loads of heavy mobile equipment;
- frequent spillages with subsequent “mopping-up”; and
- regular hard cleaning.

6.21 Flooring should also have the following characteristics:

- hygienic finishes;
- slip-resistant;
- continuous;
- smooth;
- impervious;
- sealed joints;
- easily cleanable;
- wear-resistant.

6.22 Manufacturers’ information supplied on suitable cleaning, disinfection and maintenance procedures is important at the design stage.

6.23 There should be a continuous return between the floor and the wall, for example coved skirtings returned a minimum of 100 mm, which allow easy cleaning and avoid microbial colonisation. The skirting material used should be integral with, and have properties similar to, the floor finish. In areas where frequent wet cleaning methods are employed, the flooring material should be unaffected by germicidal cleaning solutions.

6.24 The floor finish should be properly anchored to the underlying surface, and carpets are not acceptable anywhere in the operating department.

6.25 Vinyl, linoleum or rubber are examples of slip-resistant flooring and should have welded joints. The flooring should be at least 2 mm thick. Such flooring is tolerant of small movements in the structural floor. The floor screed should be perfectly smooth, crack-free and stable. Adhesives should be powerful enough to resist the formation of “waves” in the floor finish that can result when heavy equipment is moved. Sufficient time should be allowed for the adhesive to set prior to use. Thresholds at doorways between adjacent rooms require particular attention because they are points of stress in the floor finish.

6.26 In theatres with ultra-clean ventilation the floor area enclosed by the hood should be marked with lines or a contrasting coloured area of flooring.

6.27 In all theatres, floor markings can be used to indicate where specific equipment should be located for different procedures within the operating theatre.

WALLS

6.28 Wall finishes in operating theatres should be durable and able to withstand wet cleaning and the accidental impact of trolleys and heavy mobile equipment. Especially vulnerable points should have additional protection. Protection measures should be considered at the initial design stage to prevent the need for regular maintenance which would require the unit to be closed for long periods.

6.29 Walls in the operating theatre should be constructed to provide radiation protection in accordance with SI 2000/1059 and SI 1999/3232.

6.30 Smooth, impervious, washable paint surfaces, not necessarily oil-based, are the easiest for cleaning.

6.31 Areas that could affect microbiological standards are:

- stability to prevent cracking and movement;

- biological attack resistance;
- mechanical damage resistance;
- hygrothermal performance;
- hygienic finishes;
- thermal performance (may affect air flow patterns); and
- suitable for cleaning, disinfection and maintenance.

6.32 Ceramic wall tiles are preferable in kitchen, shower and toilet areas.

CEILINGS

6.33 Modular ceilings are not acceptable in the operating theatre but may be required in associated areas for maintenance purposes. The ceiling in the operating theatre should also be able to withstand an occasional wash and have a completely sealed finish to maintain microbiological standards. If access hatches are required they should be of the sealable type.

6.34 The choice of ceiling construction and finish should reflect the necessary compromise between sound control and the control of infection. A modest risk analysis may be the appropriate way of addressing this aspect of design. An acoustically absorbent ceiling helps to reduce noise. While some acoustic surfaces now available do not present an infection hazard, it is essential that the architect, building services engineer, infection control officer and facilities manager together ensure that the choice of ceiling and the maintenance routines are satisfactory.

DOORS AND DOORFRAMES

6.35 Materials used for doors and frames should be able to withstand frequent impact from mobile equipment. All double-swing doors should incorporate clear glass vision panels; however, privacy, safety and other considerations may require that panels can be obscured.

6.36 Automatic door openers can be provided to aid the movement of patients through the area.

6.37 Doors should be in compliance with the Building Regulations Approved Document M: Access to and use of buildings (Office of the Deputy Prime Minister 2003) and BS 8300: 2001.

WINDOWS

6.38 In addition to the various statutory requirements, the following issues require consideration:

- daylight and natural ventilation;
- insulation against noise;
- user comfort;
- energy conservation;
- the prevention of glare; and
- the provision of a visual link with the outside world.

6.39 Windows should be completely weathertight, with the correct thermal performance so as not to affect microbiological standards and to prevent air flow pattern distortion and condensation.

6.40 All windows should be at least double-glazed as a minimum, to provide thermal and sound insulation as required by the Building Regulations, Approved Document L2 (ODPM, 2000).

6.41 Where required, blinds should be installed between the glass that can provide “black-out”, which is essential for ultrasound examinations and other imaging procedures. It may be necessary to provide triple glazing to allow the blinds to be maintained.

6.42 The windows should be easily accessible for cleaning, disinfection and maintenance. See also HTM 55 – ‘Windows’.

CLINICAL HAND-WASH BASINS

6.43 The number of hand-wash basins and their siting should be discussed and approved with the infection control team at the design stage. The basins should be placed in a prominent position to remind the staff of the importance of hand-washing.

6.44 All basins should have curved sides with no plugs, have no overflows, and be fitted with infrared non-touch taps which should not be placed over the waste outlet. Mixer taps should be used, as very hot or very cold water discourages hand-washing. There should be sufficient space around the basin to wall-mount alcohol gel, liquid soap, hand disinfectant and paper towels. The splashback should be a single waterproof sheet or seal mounting with polyurethane or wallglaze.

6.45 Non-touch taps should be mains-powered.

6.46 Non-touch soap dispensers are now available, and their use in conjunction with the non-touch taps at every clinical hand-wash basin is recommended.

6.47 The use of non-touch taps and WC flush valves helps to reduce water consumption in these areas by 30% in the short term and 50% in the long term. For further details of projects involved in water reduction see <http://www.watermark.gov.uk>.

SHELVING AND STORAGE

6.48 Clinical storage is required with movable shelves. The tops of cupboards should be fitted to ceiling height or should have sloping tops to prevent the accumulation of dust. Monitors should be fitted at a height where they can be cleaned easily. Items should not be stored on the floor. Paper towel wall dispensers are required. Sharps boxes should be wall-mounted.

6.49 All storage units and shelving should comply with HTM 71 – ‘Materials management modular storage’.

6.50 The following should be considered with regard to controlling infection:

- the performance and strength of the units so they resist surface cracking, absorbance etc (manufacturer’s data should be supplied);
- surface finishes;
- hygienic finishes;
- movable units should be easily disinfected, including the wheels.

WORK SURFACES AND BINS

6.51 All work surfaces should be smooth and easily washable, coved to the wall, and preferably unjointed with integral sink. Joints should be sealed. The surface covering should be hard-wearing and should not damage easily. Edges should be rounded. Damaged work surfaces should be replaced rather than repaired. Foot-operated bins are essential.

MAINTENANCE AND CLEANING

6.52 Materials and finishes should be selected to minimise maintenance and be compatible with their intended function. Building elements that require frequent redecoration or are difficult to service or clean should be avoided. Special design consideration should be given to corners, partitions, counters and other elements that may be subjected to heavy use. Wall coverings should be chosen with cleaning in mind.

6.53 Guidance on these aspects is given in HTMs 54–70. See [Appendix 6](#), References.

6.54 The infection control team should advise on the maintenance and cleaning of the materials and finishes (see HFN 30 – ‘Infection control in the built environment’).



7 Engineering services

INTRODUCTION

7.1 The engineering requirements in respect of facilities for surgical procedures change constantly to meet the demands of advancing surgical technology. It follows that the engineering services needed to support the facilities will also change. It is not the intent of this guidance to be prescriptive in respect of design solutions, but to provide a point of reference from which individual designs can be developed.

7.2 Designers should ensure they take care to read this document as a whole, since further engineering requirements are outlined in other sections.

ENERGY CONSERVATION AND SUSTAINABILITY

7.3 The commitment of the NHS to sustainable development is encapsulated in the document 'Sustainable development in the NHS' (NHS Estates, 2004). Whilst this document considers a wide range of sustainability issues, one area identified as having a major impact on the environment is the use of energy. The minimising of environmental impact by ensuring that energy is only used necessarily and efficiently is considered in this section with respect to:

- natural daylighting;
- natural ventilation;
- night set-back;
- building regulations;
- heat recovery.

7.4 Efforts should be made to maximise the use of natural lighting. Passive solar design (PSD) should be employed to ensure, as far as possible, that areas such as operating theatres, recovery units and office areas are located where they can benefit from natural daylight, whilst other areas, for example stores, WCs and utility rooms, are located towards the core of the facility.

7.5 Areas where glare may be a problem, for example rooms where VDUs are routinely used, should similarly be located away from direct natural daylight.

7.6 Whilst facilities for surgical procedures will, by their nature, be largely air-conditioned or mechanically

ventilated, natural ventilation of rooms should be employed wherever appropriate. Design should incorporate measures for minimising solar heat gains, which, if uncontrolled, will precipitate a need for mechanical ventilation. Measures to minimise the need for cooling should include locating temperature-sensitive accommodation away from south-facing fascias, shading windows with brise soleil, and using solar reflecting glass where this is cost-effective.

7.7 Energy-using systems including heating, ventilation, cooling and lighting should be controlled to reduce consumption when the facility it is not in use, for example at night or weekends.

7.8 Energy recovery systems should be employed on air-conditioning and ventilation systems.

SPACE REQUIREMENTS FOR SERVICES AND PLANT

7.9 A high level of availability of engineering plant and services is critical to the ability of the facility to function safely and efficiently. It is therefore essential that building design should incorporate adequate space for the installation and maintenance of plant, ductwork, pipework and cabling.

7.10 Space for plant and services should provide:

- easy and safe means of access;
- secure accommodation protected from unauthorised access;
- adequate space around plant and services to permit inspection and maintenance;
- sufficient space to permit redundant plant to be removed without the need to dismantle other major plant.

7.11 Recommended spatial requirements for engineering plant and services are contained in HTM 2023 – 'Access and accommodation for engineering services'. Further useful information regarding the provision of space for plant is contained in BSRIA Technical Note TN 9/92, and for building services distribution systems in BSRIA Technical Note TN 10/92.

7.12 Space should be allowed within walls and above ceilings to facilitate the concealment of electrical and mechanical services where possible. Securable demountable panels should be provided to allow access to control and isolation valves as well as any equipment that is necessarily concealed within the spaces. Each panel should be clearly, but discreetly, marked to identify the controls or equipment to be found behind the panel. The use of demountable panels is not acceptable in areas where sterility is paramount, for example in preparation rooms and operating theatres.

7.13 In general, but with the exception of drainage and heating pipework, engineering services should not be brought from the above-ceiling space of a floor below. Service distribution to a particular area should be contained in service spaces on that floor.

7.14 The design should ensure that the need to access services or equipment from within the theatre, anaesthetic room, preparation room or scrub room is kept to an absolute minimum. Wherever possible, access to plant and services should be from plantrooms or maintenance areas. Where this is not possible, every endeavour should be made to effect access from general circulation areas and not from clinical spaces.

7.15 In areas where wall-mounted heat emitters are installed, they should be contained within a 200 mm-wide perimeter zone. The 200 mm zone, together with the space needed for minor engineering ducts required to service the emitter, are included in the building circulation allowance. The amount of space required for wall-mounted emitters can be limited by the use of ceiling emitters as an alternative (see paragraphs 7.29–7.37).

7.16 Plantrooms, particularly for air-conditioning and ventilation, should be located as close as possible to the areas they serve, thus minimising the amount of space necessary to accommodate large ducts. Ideally, ventilation plant serving theatres should be located immediately above the theatres, allowing ductwork to drop directly to the operating theatre below.

7.17 Care should be taken to ensure that noise and structure-borne vibration cannot be transmitted beyond plantroom.

DESIGN FOR SAFETY

7.18 Health and safety legislation imposes a statutory duty on all who design, manufacture, import, supply, install or erect “articles for use at work” through a range of co-ordinated health and safety regulations enacted under the Health and Safety at Work etc Act 1974.

7.19 Key safety regulations relating to healthcare premises and equipment are:

- the Construction (Design and Management) Regulations 1994;
- the Management of Health and Safety at Work Regulations 1999;
- the Workplace (Health, Safety and Welfare) Regulations 1992;
- the Provision and Use of Work Equipment Regulations 1998;
- the Health and Safety (Safety Signs and Signals) Regulations 1996;
- the Noise at Work Regulations 1989;
- the Pressure Systems Safety Regulations 2000;
- the Pressure Equipment Regulations 1999;
- the Ionising Radiation (Medical Exposure) Regulations 2000;
- the Ionising Radiation Regulations 1999;
- the Gas Safety (Installation and Use) Regulation 1994.

7.20 The vulnerability of patients in healthcare premises, where many engineering systems impact on patient safety, introduces additional risks and calls for an increased awareness of the importance of engineering system integrity. This is particularly relevant in facilities for surgical procedures. Engineering systems should be designed to be especially robust to ensure that a failure in the quality or continuity of an essential engineering service cannot compromise patient safety.

7.21 Designers should be particularly aware of the role of engineering design in the control of infection, particularly in respect of water services (see HTM 2027 – ‘Hot and cold water supply, storage and mains services’ and HTM 2040 – ‘The control of legionella in healthcare premises – A code of practice’) and ventilation systems (see HTM 2025 – ‘Ventilation in healthcare premises’).

7.22 Clearly identified devices for the control and isolation of primary engineering services should be located in areas where they can be protected against unauthorised interference, ideally in plantrooms, engineering service spaces, or circulation areas.

7.23 The need to employ formal “Permit to Work” and “Permit to Use” procedures should be noted, particularly in respect of electrical systems. See HTM 2020 – ‘Electrical safety code for low voltage systems (Escore – LV)’ and HTM 2021 – ‘Electrical safety code for high voltage systems (Escore – HV)’. For medical gas systems see HTM 2022 – ‘Medical gas pipeline systems’.

Control of Substances Hazardous to Health (COSHH) Regulations 1999

7.24 The Health and Safety Executive publishes guidance notes, updated annually, on occupational exposure limits (Guidance Note EH40: Occupational Exposure Limits) for the control of exposure by inhalation of substances hazardous to health. The limits specified form part of the requirements of the Control of Substances Hazardous to Health (COSHH) Regulations 1988. Substances hazardous to health are in use in operating departments. Planning teams should comply with the COSHH Regulations.

FIRE SAFETY

7.25 The policy in respect of fire safety is set out in the Firecode series of documents. Additionally, the Fire Practice Notes series provides further guidance on specialist aspects of fire precautions. The trust should satisfy itself that the design meets the objectives of HTM 81 or a fire engineered solution that achieves similar objectives.

7.26 It is important to establish during the design stage those aspects of fire strategy that may affect the planning of a project. At appropriate stages of the design process the architect and engineer should discuss and verify their proposals with the relevant Building Control/Approved Inspector, and ensure that the project team and all other planning staff are fully acquainted with the fire safety strategy for the design. This will include operational aspects (staff responsibilities etc), equipment provision, and building and engineering layouts. HTMs 57–60 provide information on the selection of fire-resistant building components and materials (see [Appendix 6](#), References).

ENGINEERING SERVICES (MECHANICAL)

General

7.27 Mechanical services installation includes the distribution of the following services:

- heating;
- hot and cold water;
- ventilation systems;
- refrigeration plant;
- environmental control and building management systems;
- medical gases and vacuum;
- steam and condensate systems;
- sterilizing and washer-disinfector equipment.

7.28 For the purposes of this guidance the installation is deemed to include each system from the point of entry to the department to the final connection to service outlets or specific equipment.

Heating systems

7.29 In areas other than operating theatres, anaesthetic rooms, preparation rooms and scrub rooms (and other plenum ventilated/air-conditioned accommodation), general space heating requirements can be met either by wall-mounted low-pressure hot water radiators or ceiling-located low-pressure hot water emitters. A Building Management System (BMS) should control the heating system to ensure that it is automatically set back or turned off when the department, or zones within the department, are not in use. Heating throughout the building should be controlled to a minimum “set-back” temperature of 12–15°C during “out of use” hours. The BMS should be equipped with a manual override to permit restoration of the plant to full operational status at short notice.

7.30 Where radiators are used they should be of the low surface temperature type, and surface temperature should not exceed 43°C. Exposed heating pipework, accessible to touch, should be encased or insulated. Further information is given in the HGN – “Safe” hot water and surface temperatures’.

7.31 Radiators should normally be located under windows or against exposed walls, with sufficient clear space between the top of the radiator and the window sill to prevent curtains reducing heat output. There should be sufficient space under a radiator to allow cleaning machinery to be used. Where a radiator is located on an external wall, back insulation should be provided to prevent excessive heat transmission through the building fabric.

7.32 All radiators should be fitted with thermostatic valves of robust construction, selected to match the pressure and temperature characteristics of the system. The thermostatic valve, fitted with a tamper-proof facility for pre-setting the maximum room temperature, should be controlled via a sensor located integrally or remotely as appropriate. To provide frost protection at its minimum setting, the valve should not remain closed below a defined temperature.

7.33 Where appropriate, heating controls should be provided to modulate heating circuit flow temperatures in accordance with external temperature.

7.34 Radiators may also be used to offset building fabric heat losses in mechanically ventilated spaces. The system should be designed to ensure that the heating and ventilation systems operate in a co-ordinated manner and do not cause the space to overheat.

7.35 Ceiling heating panels can operate at higher surface temperatures than 43°C as long as the surface is not easily accessible. Heating panels should preferably run around the perimeter of the building. Panels should not be located over beds or patient trolley positions, or in other locations where they might radiate directly onto a patient or member of staff for a prolonged period.

7.36 Ceiling panels should be selected to aesthetically match the adjacent ceiling and should be sealed to the adjacent ceiling by means of a gasket or similar.

7.37 Heating loops of ceiling panels should be controlled by automatic valves located above the ceiling and actuated from room thermostats. In large spaces several loops should be provided, each controlled from its own thermostat, to serve separate zones within the space.

Hot and cold water systems

7.38 Hot and cold water storage and distribution systems should be designed in accordance with the requirements of HTM 2027 – ‘Hot and cold water supply, storage and mains services’ and HTM 2040 – ‘The control of legionellae in healthcare premises’.

7.39 Whilst cold water storage at high level will be the norm, care should be taken to ensure that all equipment proposed for the facility is capable of operation from the available static head. Where the static head is insufficient, a pressurisation set incorporating dual pumps should be installed.

7.40 All cold-water pipework, valves and fittings should be insulated and vapour sealed to protect against frost, condensation and heat gain.

7.41 The domestic hot water supply should be taken from the calorifiers installation at a minimum outflow temperature of 60°C±2.5°C and distributed to all outlets in a manner that ensures a return temperature to the calorifiers of at least 50°C. Exposed hot water pipework, accessible to touch, should be encased or insulated. See also HGN – ‘“Safe” hot water and surface temperatures’.

7.42 Where possible, automatic water-conserving taps, actuated by proximity detectors, should be used. When specifying taps for scrub sinks, consideration should be given to the use of automatic mixer units providing water at a predetermined temperature.

Ventilation systems (general)

7.43 Guidance on the design of ventilation systems for healthcare facilities may be found in HTM 2025 – ‘Ventilation in healthcare premises’. A section of the

document is specifically concerned with design considerations related to operating theatre suites.

7.44 The ventilation system in the operating theatre suite has four main functions:

- dilution of bacterial contamination;
- control of air movement within the theatre suite such that the transfer of airborne bacteria from less clean to cleaner areas is minimised;
- control of space temperature and humidity;
- to assist in the removal and dilution of waste anaesthetic gases.

Outline room ventilation strategy

7.45 The following tables suggest an outline ventilation strategy for each room.

Conventional operating suite

Room	Pressure	To
Preparation room	+ve	Theatre
Theatre	+ve	All other rooms excluding preparation room
Anaesthetic room	+ve	Corridor
Disposal	–ve	Corridor
Corridor(s)	Neutral	–

Ultra-clean operating suite

Room	Pressure	To
Preparation room	=	Theatre
Theatre	+ve	All other rooms excluding preparation room
Anaesthetic room	+ve	Corridor
Disposal	–ve	Corridor
Corridor(s)	Neutral	–

Ancillary areas

Room	Pressure	To
Clean utility	+ve	Corridor
Recovery	–ve	Corridor
Central disposal	–ve	Corridor
Offices	=	Corridor
Staff changing rooms	–ve	Corridor
WCs	–ve	Adjoining areas

Note: Not all rooms may be required

7.46 Where operational policies depart from the provision of a conventional preparation room or anaesthetic room (see [paragraphs 3.15–3.22](#)), designers should satisfy themselves that robust solutions are provided that do not compromise the ability of theatre ventilation systems to contribute to the control of infection.

Ventilation

7.47 The provision of a separate air handling plant for each theatre and its immediate support accommodation will facilitate economic operation, improved theatre availability and maintainability.

7.48 The ability to shut down plant when individual theatres are not in use will allow an overall reduction in energy consumption, whilst plant failure will only impact on the theatre served by that particular plant. Similarly, maintenance can be more easily planned when only one theatre is affected by maintenance shut-downs.

7.49 Care should be taken to ensure that the minimum standards of HTM 2025 – ‘Ventilation in healthcare premises’ and HTM 2040 – ‘The control of legionellae in healthcare premises – A code of practice’ are achieved.

7.50 Subject to control of infection considerations, the ventilation systems of theatres may be shut down during periods of non-use. When such a policy is implemented, note should be taken of the need to reinstate full ventilation well in advance of the commencement of operating sessions to allow theatres to be purged with fresh air. However, the system should ensure that the temperature within the theatre does not fall below 15°C to avoid lengthy temperature recovery periods.

Ventilation (operating theatres – ultra-clean)

7.51 Ultra-clean ventilation systems (also referred to as laminar flow systems) relate to the operating theatre only, and rely on the provision of large quantities of filtered air introduced through a canopy positioned over the operating table and the areas immediately adjacent to it.

7.52 The major volume of the air discharged into the operating theatre in an ultra-clean theatre will be recirculated with at least 20% fresh air being introduced.

7.53 The recirculation fan of the ultra-clean unit can be located either in the canopy itself or in a remote plantroom. Whilst units with integral fan reduce need for ductwork and the amount of space required in plantrooms, they suffer from the necessity to enter the operating theatre to service terminal filters and fans. They are more difficult to deal with acoustically and result in higher noise levels in the theatre. The preferred option is for fans to be located in a plantroom with recirculation cooling.

7.54 As with conventional systems, the provision of a separate air handling plant for each operating theatre and its immediate support accommodation will facilitate economic operation, improved theatre availability and maintainability.

7.55 The ability to shut down plant when individual theatres are not in use will allow an overall reduction in energy consumption, whilst plant failure will only impact on the theatre served by that particular plant. Similarly, maintenance can be more easily planned when only one theatre is affected by maintenance shut-downs.

Ventilation (operating theatres – plant control and indication)

7.56 Theatre ventilation systems should be controlled by a Building Management System (BMS) which, in conjunction with an occupancy detector, will automatically set back or turn off plant when a theatre is not in use. Ventilation systems should be controlled to ensure a minimum “set-back” temperature of 15°C during “out of use” hours to facilitate rapid warm-up if necessary, and the BMS should be equipped with a manual override to permit restoration of the plant to full operational status at short notice.

7.57 There is no demonstrable clinical benefit in the use of an ultra-clean theatre ventilation system other than when orthopaedic procedures are being undertaken, although many surgeons use the ultra-clean ventilation system if it is available. Consideration should be given to the provision of a facility on the theatre control panel that will allow the operating team to switch the ultra-clean unit fans to set-back when not undertaking orthopaedic procedures. This reduces in-theatre noise, draft and energy consumption. When the ultra-clean system is set back, the air-handling unit of the fresh air system should be capable of maintaining theatre pressurisation in accordance with the standard of a conventional theatre (see HTM 2025 – ‘Ventilation in healthcare premises’).

7.58 The theatre control panel in each theatre should indicate the status of the associated ventilation plant. The panel should indicate the actual theatre temperature and humidity, and controls on the panel should allow for adjustment of both.

Ventilation (recovery units and anaesthetic rooms)

7.59 Recovery units and anaesthetic rooms should be ventilated to ensure dilution of anaesthetic gases. Where compartmentalisation of the recovery unit is envisaged to provide one or more critical care beds, care should be taken to ensure that air input to the partitioned area maintains an adequate air change rate.

Ventilation cooling systems

7.60 Refrigeration loads for theatre suite ventilation systems should be met by a water chiller plant. Direct expansion systems are not advocated unless the refrigeration load is small, since direct expansion plant can only be controlled in steps (unlike chilled water, which can be continuously modulated).

7.61 Heat rejection plant should consist of air-cooled condensers. Wet cooling towers should not be used.

Building management systems

7.62 All engineering plant and equipment associated with the internal environment should be monitored and regulated by a Building Management System (BMS) in accordance with the provisions of HTM 2005 – ‘Building management systems’. The BMS should also monitor, measure and record energy consumption for the facility.

7.63 If the main site already has a BMS, the operating department should be set up as an outstation of the main BMS so that systems serving the department can be monitored and controlled at a central station. Management of the engineering systems within the facility should be capable of control both from the central station and from the outstation itself.

7.64 Links from the outstation to the central station can be achieved by, for example, hard wire, modem or radio communication. It is important to ensure that sensitive medical equipment is not adversely affected by radio communication interference.

Piped medical gases

7.65 Piped medical gases, in compliance with HTM 2022 – ‘Medical gas pipeline systems’, should be provided to the operating theatre, anaesthetic room, recovery unit, and to the medical equipment maintenance area if required.

7.66 In a conventionally ventilated operating theatre, medical gases should be provided to medical supply units located at each end of the operating table. One medical supply unit will be located at the end of the table normally occupied by the anaesthetist and will carry oxygen, nitrous oxide, medical (400 kPa) air, vacuum, anaesthetic gas scavenging and, as an option, surgical (700 kPa) air.

7.67 The provision of surgical air at both ends of the operating table will allow greater flexibility in the use of the theatre. However, this flexibility may be compromised if it is policy to use docking anaesthetic machines that attach to the anaesthetist’s medical supply unit, thus committing the anaesthetist to working from one end of the table.

7.68 If docking medical supply units are to be used, the structural engineer should be consulted so that appropriate structural support can be provided.

7.69 A second medical supply unit at the opposite end of the operating table will carry oxygen, nitrous oxide, medical (400 kPa) and surgical (700 kPa) air, vacuum and anaesthetic gas scavenging.

7.70 When providing piped medical gases to anaesthetist and surgeon positions in an ultra-clean theatre, consideration should be given to the location of medical gas supply outlets in the support framework of the canopy, thus obviating the need for medical supply units which cause turbulence in the air flow.

7.71 When providing piped medical gases to an anaesthetic room, these should be provided via wall-mounted units (see [paragraph 4.37](#)).

Steam

7.72 The requirement for steam within the facility will be limited to humidification equipment associated with the air-handling plant, and that required for the sterile services department. If available, steam from the hospital’s main supply should be used, subject to the requirements set out in HTM 2031 – ‘Clean steam for sterilization’.

7.73 In the absence of a central steam supply, local steam generators – preferably powered from a “firm” gas supply – should be employed, subject to the requirements of HTM 2031.

Internal drainage

7.74 A system of soil and waste drainage including anti-siphon and ventilation pipework should be provided in accordance with BS 5722. Where plastic pipework materials are used, suitable intumescent collars should be fitted when breaching fire compartments, and acoustic wrapping should be applied where drainage runs above wards and other sensitive areas.

7.75 The gradient of branch drains should be uniform and adequate to convey the maximum discharge to the stack without blockage. Practical considerations such as available angles of bends, junctions and their assembly, as well as space constraints, will normally limit the gradient to about 1:50 (20 mm/m). For larger pipes, for example 100 mm diameter, the gradient may be less, but this will require high-quality workmanship if an adequate self-cleaning flow is to be maintained.

7.76 Bedpan washers or macerators should discharge with a short branch to a vertical stack or horizontal drain. The waste should not be installed above or close to heating or hot-water mains. If a bedpan washer or macerator discharges to a 100 mm drain, frequently-used large-volume appliances should be situated upstream of its connection to provide additional flushing.

7.77 Provision for inspection, rodding and maintenance should ensure “full bore” access and be located outside user accommodation. The location of manholes within the building should be avoided.

Noise

7.78 Excessive noise in individual areas, whether generated by plant or by external sources such as passing traffic, can be intrusive and impact adversely on operational efficiency.

7.79 Ventilation systems should be designed so that noise from air-handling plant is not transmitted into working areas and that ductwork itself neither generates nor amplifies sound. Ventilation systems should not be able to breach confidentiality by transmitting conversation from area to area.

7.80 Consideration should be given to the containment of noise from the anaesthetic gas scavenging plant.

7.81 A suitable acoustic enclosure may be required to effect compliance with the noise levels deemed acceptable in HTM 2022.

7.82 Noise levels within the theatre suite generally should be in accordance with the requirements of HTM 2025.

ENGINEERING SERVICES (ELECTRICAL)

General

7.83 In general, electrical services will include:

- incoming supply and distribution board;
- emergency electrical supplies;
- small power distribution systems;
- lighting systems;
- IT cabling systems;
- telephone systems;
- security systems;
- staff call, public address systems;
- entertainment systems;
- lightning protection.

7.84 Electrical installations should comply with BS 7671 (IEE Regulations – 16th edition) together with BS 7671 (IEE Regulations – 16th edition) Guidance Note 7 (Special Locations), and HTMs 2007, 2011, 2020, and 2021.

7.85 Care should be taken to avoid mains-borne interference and electrical radio frequency interference affecting diagnostic and monitoring equipment, computers or other sensitive electronic equipment. Guidance on the avoidance and abatement of electrical interference is given in HTM 2014.

Incoming supply and distribution board

7.86 The point of entry for the electrical supply will be a switchroom housing the main isolators and distribution equipment. This space will also be the centre for subdistribution electrical services. Wherever possible, all equipment should be mounted at a height to give easy access from a standing position. Further guidance is given in HTM 2023.

7.87 All switchgear should be capable of being locked in the “off” position.

Emergency electrical supplies

7.88 Emergency electrical provision should comply with the requirements of HTM 2011 – ‘Emergency electrical services’ with automatic changeover to generator supply in the event of mains failure.

7.89 The emergency generator providing electricity in the event of a main supply failure should be capable of providing full (100%) backup to the operating department to the exclusion of refrigeration plant serving air-conditioning and comfort cooling plant.

7.90 If an existing generator is to be used, the ability to provide 100% emergency coverage will be dependent on the spare capacity available. If this minimum requirement cannot be met it will be necessary to either replace the existing generator with a larger set, provide an additional generator that can be run in parallel, or provide an additional generator dedicated to the surgical procedures facility.

7.91 Equipment and systems that cannot tolerate the delay inherent in bringing an emergency generator supply online (including theatre operating lights, physiological monitoring equipment, computer systems, and clocks on the theatre control panel and in anaesthetic rooms and recovery areas) should be further protected against generator start-up delays by the provision of uninterruptible power supplies. See also [paragraph 4.173](#).

7.92 In the event of a main supply or local final circuit failure, escape routes should be illuminated by self-contained, battery-powered luminaires charged continuously from the main supply and capable of providing illumination for a period of three hours.

Small power distribution systems

7.93 The particular requirements of BS 7671 Guidance Note 7 (Special Locations) in respect of medical locations and associated areas should be adhered to in respect of operating theatres, anaesthetic rooms, recovery units and any other treatment areas identified as “medical locations”. Consideration should be given to socket-outlets in critical areas, for example recovery and

critical care, to be unswitched, thus avoiding the possibility of essential equipment being accidentally switched off.

7.94 Circuit protection should be achieved either by using a residual current device or from an isolated power supply as defined in Guidance Note 7. Monitoring panels should be installed within the treatment area and may be an integral part of the theatre panel. Consideration should also be given to the use of two circuits per area supplied for resilience.

7.95 In non-medical locations, 13-amp switched and shuttered socket-outlets should be provided in accordance with the normal requirements of BS 7671 (IEE Regulations – 16th edition).

7.96 Wherever possible, cables and cable containment systems should be concealed behind walls and ceilings.

7.97 Where equipment is permanently installed or where there is a possibility of equipment theft, for example televisions in staff rest rooms, switched double-pole 13-amp spur outlets should be used in preference to socket-outlets. The spur outlet should incorporate a red neon lamp indicating when the supply to the equipment is live.

7.98 Equipment requiring a three-phase supply should be permanently connected to a separate sub-circuit. The sub-circuits, incorporating a circuit breaker, should be fed from the distribution board and terminate in a local isolator. Care should be taken to ensure that earth bonding is carried out in accordance with BS 7671.

7.99 Guidance on the power supply requirements for fixed and mobile radiodiagnostic equipment is contained in 'Technical Requirements for Supply and Installation of Equipment for Diagnostic Imaging and Radiotherapy (TRS 89)'. For guidance on engineering requirements for this equipment see HBN 6 – 'Facilities for diagnostic imaging and interventional radiology'.

7.100 Adequate provision should be made in circulation areas, for example corridors and lobbies, to permit the use of domestic cleaning equipment with flexible cords up to 9 metres long.

7.101 Isolation switches should be provided immediately adjacent to all engineering plant and equipment, clearly labelled to identify the equipment that they relate to.

7.102 Heating appliances and automatic equipment should be provided with red neon lamps indicating when they are energised. The neon lamps should be incorporated in the control panel of the equipment, in the control switch, or in the socket-outlet or spur unit from which the equipment derives its supply.

Lighting (general)

7.103 To achieve energy efficiency, lighting systems should be designed to:

- maximise natural daylight;
- avoid unnecessarily high levels of illumination;
- incorporate efficient luminaires, control gear and lamps;
- incorporate effective controls.

7.104 For further information see CIBSE Guide – Energy Efficiency in Buildings. The CIBSE Lighting Guide LG2, 'Hospitals and Health Care Buildings' should be consulted to obtain detail regarding illumination levels.

7.105 Lighting within the facility should be co-ordinated with architectural design. In particular there should be collaboration to ensure that decorative finishes are compatible with the colour-rendering properties of lamps and that the spectral distribution of the light source is not adversely affected.

7.106 Lighting switches should be provided in easily accessible positions within each area, and at appropriate locations in corridors and general circulation areas. In areas with multiple luminaires, switching should allow the selection of luminaires appropriate only to that area requiring illumination.

7.107 Where local circumstances permit, the provision of time switches or occupancy controls using infrared, acoustic or ultrasonic detectors should be considered.

7.108 Generally, luminaires should be fitted with fluorescent lamps equipped with low-loss or high-frequency control gear. Where luminaires are infrequently used, or where the design intent of the architect in respect of ambience dictates, compact fluorescent or LV lamps or tungsten lamps may be used. Where necessary, general lighting should be supplemented with dedicated task lighting.

7.109 Anaesthetic rooms should be provided with adjustable ceiling-mounted examination lamps. The emergency electrical provision to the examination lamp should include a battery backup to cater for the delay in a generator supply becoming available and also to provide short-term protection against possible failure of the generator.

7.110 In areas where visual display terminals are in use, lighting should be designed to avoid any bright reflections from the screen. Generally, the lighting in such circumstances should comply with the guidance given in CIBSE Lighting Guide LG3.

7.111 Safety escape lighting should be provided on primary escape routes in accordance with the provisions of HTM 2011 and the CIBSE Lighting Guide LG2 – ‘Hospitals and Health Care Buildings’.

Lighting (operating theatres)

7.112 Detailed guidance regarding the provision of lighting in operating theatres is given in the CIBSE Lighting Guide LG2, ‘Hospitals and Health Care Buildings’. General lighting, which should be supplied by at least two independent circuits, should give an even distribution of illumination throughout the theatre.

7.113 Luminaires should comprise high-efficiency fluorescent units selected to ensure correct colour rendition. The luminaires should be recessed or semi-recessed units protected against the ingress of moisture. See BS EN 60598-2-25:1995, IEC 60598-2-25:1994, ‘Luminaires for use in clinical areas of hospitals and healthcare buildings’. Luminaires should be easily accessible to facilitate lamp changing, maintenance and cleaning.

7.114 Operating theatre luminaires should be individually or collectively dimmable.

7.115 One or more operating table luminaires should be installed to comply with the requirements of BS EN 60598 and selected to meet the clinical function of the particular operating theatre. In a conventionally ventilated theatre the design of the lamp casing(s) is relatively unimportant other than it should be easily cleanable. Operating luminaires for ultra-clean ventilation applications should be selected to minimise the creation of turbulence in the air flow (see HTM 2025).

7.116 It should be noted that operating table lighting systems that do not require the provision of suspended luminaires are in an advanced state of development and should be considered as a possible alternative to conventional operating lamp provision.

7.117 Operating luminaires should be designed to operate at low voltage (24V AC/DC), with the main supply being backed up both by an essential supply and by a battery and associated equipment to provide continuity of supply. The battery capacity should be able to provide power to the operating luminaire(s) for a period of at least one hour. Automatic changeover facilities should be incorporated to ensure that there is no perceptible break in supply.

7.118 Where more than one operating luminaire is provided, each luminaire should be separately supplied with no commonality of transformer, rectifier, battery equipment or control equipment.

Theatre control panel

7.119 Each theatre should be equipped with a control panel to accommodate environmental controls, alarms and instrumentation, clocks, X-ray viewing screens, and lighting controls. The control panel should be fully recessed and ideally should be accessible for maintenance from outside the theatre. All internal cabling should be LSF insulated.

Use of lasers in the operating theatre

7.120 Where lasers are to be used in an operating theatre, safety precautions in accordance with BS EN 60825 should be employed, including the provision of warning lamps at the entrances to the theatre and door interlocks preventing entry to the theatre when the laser is in use. Project planning teams may wish to ensure that some of their new theatres are suitable for laser use. These will need to have specified modifications including caution on siting of pressure stabilisers. When used with a laser, the pressure stabilisers will need to be shielded to prevent sight lines. For further information see ‘MDA Safety Warnings – DB 9602 Guidance on the safe use of lasers in medical and dental practice’ (MHRA, 1996).

Controlled Drugs (DDA) cupboard

7.121 Drug cupboards should be provided to BS 2881 – ‘Specification for cupboards for the storage of medicines in health care premises’. The controlling pharmacist should confirm the position, type and size.

7.122 Each Controlled Drugs cupboard should be fitted with a red lamp indicating when the cupboard is unlocked. A repeater lamp should be sited outside the doorway of the room in which the cupboard is located. If appropriate, a secondary repeater should be taken to a permanently staffed station.

7.123 The normal supply for each cupboard should be backed up by a battery to cover the short period between mains failure and the essential standby supply becoming available.

Clocks

7.124 Clocks in theatres and the associated anaesthetic room should show identical times and be radio-controlled with sweep seconds hand. In these rooms, synchronous clocks connected to lighting circuits with fuses local to each clock should be employed, with back-up to ensure continuity of operation during the changeover delay at times of power failure.

7.125 Other clocks in the department may be either synchronous clocks connected to lighting circuits with fuses local to each clock, or powered by an internal battery.

Background music systems

7.126 It has become common to have background music in operating theatres to improve the working environment. Where such provision has been embraced, a wired-in system should be provided, with the player unit, compact disc or audio tape being located in an adjacent non-sterile area, for example the clean corridor immediately outside the theatre.

7.127 The player should be contained in a lockable enclosure and should be wired into an adjacent spur outlet to discourage unauthorised removal.

7.128 Speakers within the theatre should be ceiling-mounted and moisture-resistant.

Information technology (IT) systems

7.129 The approach to provision of IT and telephone infrastructure within the operating department may be conditioned by existing systems within the hospital. However, where possible a structured wiring system as described in HGN – ‘Structured cabling for IT systems’ should be provided. This will permit a unified approach to the provision of cabling for:

- voice systems;
- data systems;
- imaging systems;
- CCTV;
- alarm systems.

7.130 In determining the nature of the IT system to be provided it is necessary to identify:

- rooms to be served;
- whether structured cabling will be used;
- what density of outlets is to be provided (not fewer than two per work station);
- whether wiring will be on a “flood” or “as required” basis.

Telephone systems

7.131 As stated in the above paragraphs, it may be beneficial to integrate voice cabling with the structured wiring system for IT if provided. Where a cabling system supporting voice/data is not available, the existing hospital block wiring should be extended to serve telephones within the department.

7.132 Telephones with visual indication (no bell) are required for rooms directly adjacent to operating theatres. Telephone handsets should be capable of hands-free operation, and theatre telephone instruments

should be equipped with amplifiers and a volume control.

7.133 The telephone system should be capable of use as an intercommunication system between the various areas within the operating department using abbreviated dialling code techniques.

7.134 Each theatre should be equipped with a splash-proof telephone socket.

7.135 Coin- and/or card-operated payphones should be provided in the reception area for waiting relatives and visitors. Payphones should incorporate acoustic hoods to facilitate privacy. The payphone should be positioned to facilitate use by disabled people.

Security systems

7.136 The entrance(s) to the operating department should be protected by one of the variety of electronic access control systems available.

7.137 Points of ingress and egress from the department should be monitored by high-definition, closed-circuit television cameras equipped with pan and tilt facility and capable of producing high-quality images at low levels of light. Positioning of cameras should be determined with care, selecting optimum positioning for maximum field of coverage. Monitors should be sited at a location that is permanently staffed whilst the department is in use.

7.138 Rooms in which members of staff are likely to be alone with adult members of the public, for example relatives, should be equipped with panic alarm buttons that can signal difficulty to a location that is permanently staffed whilst the department is in use.

Fire detection and alarm systems

7.139 A fire detection and alarm system complying with HTM 82 – ‘Alarm and detection systems’ should be installed throughout the department.

Staff call systems

7.140 Each recovery bed position should incorporate a bedhead unit providing the following:

- 13-amp switched and shuttered socket-outlets supplied from an IPS circuit as appropriate;
- medical oxygen, air and vacuum outlets;
- bedhead luminaire switch;
- nurse call button/indicator lamp;
- staff/staff emergency pull switch;
- socket for patient handset;

- IT connection(s).

7.141 Where patients may temporarily be left alone, for example in WCs, a staff call system should be provided to permit the summoning of assistance if required. The alarms should be capable of operation by a disabled person.



8 Cost information

8.1 For all types of health building, it is important that building costs and revenue expenditure are best value and consistent with acceptable standards. In applying the guidance in this document to determine a detailed design, the need for economy should always be of prime concern, and the activities should be carefully considered so that, where appropriate, space can be shared for similar activities which are programmed to take place at different times. The solution should not be detrimental to the proper functioning of the spaces involved nor to the needs of the users. Within this general context, this series of documents provides a synopsis of accommodation for health buildings, which the Department of Health recommends for the provision of a given service.

DEPARTMENTAL COST ALLOWANCE GUIDES

8.2 Departmental Cost Allowance Guides (DCAGs) related to this HBN are officially notified in 'Quarterly Briefing', published by NHS Estates. A full listing of all DCAGs is published in the Healthcare Capital Investment document, a hard copy of which can be obtained from NHS Estates; copies can also be downloaded from <http://www.nhsestates.gov.uk>. Further information on this can be obtained from NHS Estates; telephone 0113 254 7070.

8.3 The attention of the project team is drawn to guidance given in the Capital Investment Manual (Business Case Guide) published by The Stationery Office. This new process is intended to reduce unnecessary and often expensive planning work that may subsequently prove to be abortive, and emphasises the necessity for a sound business case in support of both the capital and the revenue expenditure involved. The Capital Investment Manual also states that the capital works estimate of the intended scheme must be based, wherever applicable, on industry norms such as the DCAGs plus a percentage to cover for on-costs.

8.4 The DCAGs for this HBN reflect the total building and engineering requirements and accommodation that the operating theatre accommodation will require when incorporated into an acute general hospital, where the common use of services will be available. Costs are based on a typical two-storey new-build unit, on a greenfield site with no planning constraints.

8.5 DCAGs are exclusive of VAT, Building and Planning Fees and all Local Authority charges, and are based on a Location Factor of 1.

ON-COSTS

8.6 It is important to bear in mind that an allowance for on-costs should be added to the DCAGs for all units, this element being for external works, external engineering services and abnormals etc. The abnormals will largely be determined by the characteristics of the site, such as an inner-city location or poor ground conditions, or the condition and type of the existing building if refurbishment is the only option.

8.7 It is important that project teams should assess at the earliest opportunity all the likely on-cost implications of individual sites and schemes.

LOCATIONAL FACTORS

8.8 Locational factor adjustments may be applied to the Works Costs (that is, the total of the DCAGs plus established on-costs) to take into account the local market conditions. For further information regarding these, please refer to the latest Regional Location factors in 'Quarterly Briefing', published by NHS Estates.

SCHEDULES OF ACCOMMODATION

8.9 The schedules are split into three distinct elements as follows.

The schedule of room/space types

8.10 This lists all room/space types and major options covered by the document giving a range of provision, when appropriate, together with a nominal area. These are grouped by the functional use of the spaces.

The schedule of suites/modules

8.11 This lists functional groupings of spaces. These form complete suites/modules of accommodation and can be provided either separately or as grouped accommodation with shared supporting accommodation. SUITES/MODULES are functional associations and not physical groupings.

8.12 Accommodation solely related to any suite/module is listed under the **Core Requirement** for that suite/module whilst accommodation that can either be provided for a particular suite/module or shared between two or more suites/modules is listed under **Essential Complementary/Shared Accommodation (ECA)**. The area allowance given may form part of a larger activity area. Where there is an option to include accommodation within a suite/module or a major option on how that accommodation is provided, it is listed under **Optional Accommodation**.

8.13 These schedules include the appropriate nominal area taken from the schedule of room/space types above, together with a suggestion for the number of spaces required.

8.14 Percentage allowances covering planning, engineering and circulation are also included in the totals.

8.15 These percentage increases to the nominal areas are included in ECA and Optional gross area allowances.

8.16 The functional groups used for this document are as follows:

- Entrance facilities
- Entrance facilities with admissions lounge suite: 2 consulting/examination rooms
- General operating theatre suite: 1 theatre
- Ultra-clean operating theatre suite without anaesthetic room: 1 theatre
- Recovery unit/PACU (Post Anaesthetic Care Unit): 8-bed spaces
- Recovery unit/PACU (Post Anaesthetic Care Unit): Additional 4-bed spaces
- Support facilities based on an eight operating theatre department with 16-bed recovery unit
- Staff support facilities based on an eight operating theatre department with 16-bed recovery unit
- Department of anaesthesia facilities based on 10 consultant anaesthetists (Note: Department of anaesthesia laboratory facilities are project-specific and not detailed within these schedules)

Departmental examples

8.17 These schedules show example notional whole department accommodation for a facility with eight operating theatres and a recovery unit to highlight the scope for sharing accommodation. **The examples are**

not to be taken as ideal provision for any particular project.

8.18 The examples included area as follows:

Example 1 – Integral theatre and anaesthetic department facilities comprising:

- Theatre and anaesthetic department shared entrance
- Admissions lounge suite: 2 consulting/examination rooms
- 8 general operating theatres with anaesthetic rooms
- 16-place recovery unit
- Theatre and anaesthetic department shared staff and support facilities
- Integral anaesthetic department

Example 2 – Co-located theatre and anaesthetic department facilities comprising:

- Theatre-specific and anaesthetic department-specific entrance
- Admissions lounge suite: 2 consulting/examination rooms
- 4 general operating theatres with anaesthetic rooms and 4 ultra-clean operating theatres without anaesthetic rooms
- 16-place recovery unit
- Theatre-specific and anaesthetic department-specific staff and support facilities
- Co-located anaesthetic department

Example 3 – Co-located theatre and anaesthetic department with shared facilities comprising:

- Theatre and anaesthetic department shared entrance
- Admissions lounge suite: 2 consulting/examination rooms
- 8 general operating theatres with anaesthetic rooms and shared dirty utility rooms
- 16-place recovery unit
- Theatre and anaesthetic department shared staff and support facilities
- Co-located anaesthetic department.

DIMENSIONS AND AREAS

8.19 In determining spatial requirements, the essential factor is not the total area provided but the critical

dimensions, that is, those dimensions critical to the efficient functioning of the activities which are to be carried out. To assist project teams in preparing detailed design solutions for the rooms and spaces, studies have been carried out to establish dimensional requirements in the form of critical dimensions. The results of these studies appear as ergonomic diagrams in HBN 40 Volumes 1–4 (NHS Estates, 1995).

8.20 For development planning and at the earliest stage of a design, it may be convenient for designers to have data available which will enable them to make an approximate assessment of the sizes involved. For this reason, the areas prepared for the purpose of establishing the cost allowances are listed in the schedules of accommodation at the end of this chapter.

8.21 It is emphasised that the areas published do not represent recommended sizes, nor are they to be regarded in any way as specific individual entitlements.

8.22 Planning of the building efficiently may also necessitate variation of areas. For instance, in the refurbishment or conversion of older property:

- rooms tend to be larger than the recommended area;
- some rooms may be too small or in the wrong location for efficient use;
- circulation space tends to form a larger-than-normal proportion of the total area.

CIRCULATION

8.23 Space for circulation, that is, all internal corridors, small vertical ducts and spaces occupied by partitions and walls, is included.

8.24 Provision is also made for a 5% planning zone and a 3% addition for an engineering zone adjacent to the external walls. These areas are all included and therefore costed in the DCAGs.

8.25 It is also important to remember that the circulation figures included in the DCAGs for this type of accommodation are those anticipated for new purpose-built premises with no constraints. Where constraints are encountered, for example in refurbishment or conversion of older types of property, this circulation figure would be likely to increase accordingly, and therefore some adjustment may be necessary to the circulation figure.

COMMUNICATIONS

8.26 Staircases and lifts are not included in the DCAGs relevant to operating theatre accommodation. Costs related to these elements, along with a suitable space allowance, should be made in the on-costs.

LAND COSTS

8.27 As is the norm for DCAGs, costs are exclusive of all land costs and associated fees. However, the project team's attention is drawn to the fact that costs associated with these should be included in the Business Case submission, all as detailed in the Capital Investment Manual, and could therefore be an important part of the overall cost viability of the scheme.

ENGINEERING SERVICES

8.28 The following engineering services, as described in Chapter 7 and exemplified in Activity DataBase (see paragraphs 2.41–2.46), are included in the cost allowances. Primary engineering services are assumed to be conveniently available at the boundary of the department.

Mechanical services

- a. heating – low-pressure hot water system;
- b. ventilation – mechanical supply and extract to all clinical areas and areas requiring extract owing to type of room, that is, WCs, showers etc;
- c. air-handling units to operating theatres. The allowance includes for separate supply plant per theatre, one extract plant per two theatres, refrigeration plant and local steam generators (humidification);
- d. cold water service – centrally supplied to service points including drinking water. Storage tanks are excluded;
- e. hot water service – supplied from a central system. Storage and generator are excluded;
- f. piped medical gases oxygen, medical and surgical air and vacuum;
- g. automatic anaesthetic gas scavenging (AGS) in the operating theatre.

Electrical services

- a. departmental distribution boards;
- b. general lighting as required by task;
- c. examination lighting (examination lamps);
- d. emergency luminaires as appropriate;
- e. socket-outlets and other power outlets for fixed and portable equipment. Standby and safety installations;
- f. supplementary equipotential earth bonding;
- g. UPS supplies and equipment;

- h. fire alarm system;
- j. TV/radio wireways only;
- k. staff/staff and patient/staff call system;
- m. telephone internal cabling distribution and outlets – handsets are excluded;
- n. data wireways only included;
- p. entertainment systems;
- q. security systems;
- r. radio controlled clocks.

Equipment (Group 1)

- a. operating table luminaires, mobile services pendants which include medical gases and gas scavenging, and socket-outlets;
- b. service beams with articulated medical supply units at each bed, which incorporate medical gas and vacuum outlets together with electrical sockets and nurse call;
- c. controlled drugs cupboards;
- d. X-ray viewers;
- e. ventilation plant and alarm indicator panels.

HBN 26 FACILITIES FOR SURGICAL PROCEDURES

DH Gateway Review, Estates and Facilities Division Schedules of Accommodation Version 3.0 August 2007						
HBN 26 Volume 1 Facilities for surgical procedures (October 2004)						
E.g. 1: Facilities for surgical procedures, 8 general theatres comprising						
Entrance facilities	Shared 2 consulting/examination rooms 8 Number - 16 places Shared Integral					
Admission lounge suite facilities						
Operating theatres facilities: general with anaesthetic room						
Operating theatres facilities: ultra-clean without anaesthetic room						
Recovery unit facilities						
Staff & support facilities (Theatres/Anaesthetic Department)						
Anaesthetic department						
Description	Quantity	Area(m2)	Total Area(m2)	HBN Para.	Notes	ADB Code
Entrance, reception & waiting facilities with admissions suite						
Entrance lobby: controlled access	1			Para 4.6	Circulation allowance	J0130
Reception, administration office & communication base: 4 staff	1	24.0	24.0	Para 4.13, 4.21		J0610
Duty room: 2 porters	1	5.0	5.0	Para 4.24		M1707
Waiting room with beverage & snack preparation bay: 10 persons including 1 wheelchair user	1	20.0	20.0	Para 4.25, 4.157		D1417
WC & handwash: accessible, wheelchair assisted	1	4.5	4.5	Para 4..26	Waiting room en-suite	V0904
Consulting, examination & changing room	2	16.5	33.0	Para 4.28		C0105
Interview, counselling & quiet room: 5 persons	1	9.0	9.0	Para 4.33		M0712
WC & handwash: accessible, wheelchair assisted	1	4.5	4.5	Para 4.33	Interview room en-suite	V0904
Public telephone: single booth, accessible	1	2.0	2.0	Para 7.135		G0705
Operating theatre suites facilities						
Operating theatre: general	8	55.0	440.0	Para 4.69		N0106
Anaesthetic room: bed space	8	19.0	152.0	Para 4.34		N0316
Scrub-up & gowning room: 3 places	8	11.0	88.0	Para 4.54		N0216
Preparation room	8	12.0	96.0	Para 4.63		T0526
Exit/parking bay: theatre, 1 bed/trolley	8	12.0	96.0	Para 4.101		G0405
Store: equipment, local to theatre	8	1.0	8.0	Para 4.103		W0108
Dirty utility: serving 1 theatre	8	12.0	96.0	Para 4.123		Y0420
Recovery unit or Post Anaesthetic Care Unit (PACU) facilities						
Recovery bay: post anaesthetic, 1 place	12	13.5	162.0	Para 4.147		B2417
Recovery room: post anaesthetic, 1 place	4	26.0	104.0	Para 4.151		B2418
Staff & communication base, enclosed: 3 staff	1	15.0	15.0	Para 4.158		T0203
Clean utility	1	14.0	14.0	Para 4.161		T0537
Dirty utility: bedpan disposal & urine test	1	12.0	12.0	Para 4.164, 4.123		Y0302
Support facilities						
Office: medical reporting, 1 staff	1	10.5	10.5	Para 4.104	Surgical staff	M0306
Blood bank refrigerator bay	1	3.0	3.0	Para 4.143		W0650
Near patient testing/status laboratory	1	8.5	8.5	Para 4.140, 4.160		L1305
Utility: cleaning & store room, flexible endoscope	1	14.0	14.0	Para 4.108		Y0416
Service room: equipment	1	21.0	21.0	Para 4.165		L1803
Parking bay: mobile x-ray & ultrasound unit	1	5.0	5.0	Para 4.105		G0142
Parking bay: resuscitation trolley	1	1.0	1.0	Para 4.106		G0103
Parking bay: fibre optic bronchoscope light source trolley	1	1.0	1.0	Para 4.106		G0150
Store: satellite pharmacy	1	6.0	6.0	Para 4.146		W0254
Store: bulk supplies	1	80.0	80.0	Para 4.133		W0115
Store: clinical equipment	1	30.0	30.0	Para 4.137		W0110
Store: linen	1	6.0	6.0	Para 4.138	Store or linen exchange trolley options	W1592
Store: ready to use medical gas cylinders	1	4.0	4.0	Para 4.139		W1306
Hold: disposal	1	15.0	15.0	Para 4.129		Y0615
Cleaners (Housekeeping) room	1	7.0	7.0	Para 4.169		Y1501
Switchgear room	1	4.0	4.0	Para 4.171		K0101
UPS & IT hub room	1	9.0	9.0	Para 4.173		K0107
Staff support facilities						
Rest & dining room with beverage & snack preparation bay: 20 staff	2	28.0	56.0	Para 5.4, 5.11		D0453
Utility: footwear washing	1	4.0	4.0	Para 5.23		Y0510
Office: 1 staff	3	10.5	31.5	Para 5.28		M0219
Office: 3 staff	1	18.0	18.0	Para 5.29		M1012
Office: 4 staff	1	24.0	24.0	Para 5.30	Office & IT study	M1014
Shared support facilities: Theatre & Anaesthetic department						
Staff changing room including boot change: 40 places	1	30.0	30.0	Para 5.13, 5.51	Male staff	V0218
Staff changing room including boot change: 30 places	1	25.0	25.0	Para 5.13, 5.51	Female staff	V0216
Staff changing room including boot change: 40 places	1	30.0	30.0	Para 5.13, 5.51	Female staff	V0218
WC & wash: ambulant	13	2.0	26.0	Para 5.8, 5.19		V1005
WC & handwash: accessible, wheelchair assisted	1	4.5	4.5	Para 5.9		V0904
Shower: ambulant (non patient)	6	2.5	15.0	Para 5.17		V0801
Interview/meeting room: 6 persons	2	14.0	28.0	Para 5.25		M0713
Seminar room: 30 persons	1	55.0	55.0	Para 5.33, 5.55		H0504
Library & study room: 10 persons	1	30.0	30.0	Para 5.37, 5.54		H0336
Anaesthetic department facilities						
Office: 1 staff	1	16.0	16.0	Para 5.44	Clinical director	M0218
Office: 1 staff	1	16.0	16.0	Para 5.44	Chairman/college tutor	M0218
Office: 1 staff	1	16.0	16.0	Para 5.44	Audit lead	M0218
Office: 1 staff	1	16.0	16.0	Para 5.44	Clinical governance lead	M0218
Office: 1 staff	8	10.5	84.0	Para 5.44	Consultants	M0219
Office: 1 staff	2	10.5	21.0	Para 5.44	Managers	M0219
Office: 1 staff	2	10.5	21.0	Para 5.44	Specialist registrars	M0219
Office: 2 staff	1	13.0	13.0	Para 5.47	Trainee anaesthetists	M1002
Office: 3 staff	1	18.0	18.0	Para 5.47	Secretarial staff	M1012
Office: 1 staff	1	10.5	10.5	Para 5.49	Additional office space/audit	M0219
Rest room with beverage & snack preparation bay: 20 staff	1	28.0	28.0	Para 5.50		D0207
Store: general & stationery	1	9.0	9.0	Para 5.58		W1556
On-call overnight stay room	1	13.0	13.0	Para 5.59		D1504
Shower, WC & wash: ambulant (non patient)	1	5.0	5.0	Para 5.59	On call bedroom en-suite	V1301
Net Allowance			2273.5			
5% Planning Allowance			113.7			
Total			2387.2			
3% Engineering Allowance			71.6			
25% Circulation Allowance			596.8			
Total Allowance			3055.6			
Optional accommodation						
Preparation room	1	20.0	20.0			T0528
Scrub-up & gowning bay: 3 places	1	7.0	7.0			N0217
Dirty utility: serving 4 theatres	1	18.0	18.0			Y0422
Store: bulk supplies	1	100.0	100.0			W0116
Store: clinical equipment	1	39.0	39.0			W0113

DH Gateway Review, Estates and Facilities Division Schedules of Accommodation Version 3.0 August 2007						
HBN 26 Volume 1 Facilities for surgical procedures (October 2004)						
E.g. 2: Facilities for surgical procedures, 8 theatres (4 general theatres & 4 ultra clean theatres) comprising						
Entrance facilities Admission lounge suite facilities Operating theatres facilities: general with anaesthetic room Operating theatres facilities: ultra-clean without anaesthetic room Recovery unit facilities Staff & support facilities (Theatres/Anaesthetic Department) Anaesthetic department		Specific 2 consulting/examination rooms 4 Number 16 places Specific Co-located				
Description	Quantity	Area(m2)	Total Area(m2)	HBN Para.	Notes	ADB Code
Entrance, reception & waiting facilities with admissions suite						
Entrance lobby: controlled access	1			Para 4.6	Circulation allowance	J0130
Reception, administration office & communication base: 4 staff	1	24.0	24.0	Para 4.13, 4.21		J0610
Duty room: 2 porters	1	5.0	5.0	Para 4.24		M1707
Waiting room with beverage & snack preparation bay: 10 persons including 1 wheelchair user	1	20.0	20.0	Para 4.25, 4.157		D1417
WC & handwash: accessible, wheelchair assisted	1	4.5	4.5	Para 4.26	Waiting room en-suite	V0904
Consulting, examination & changing room	2	16.5	33.0	Para 4.28		C0105
Interview, counselling & quiet room: 5 persons	1	9.0	9.0	Para 4.33		M0712
WC & handwash: accessible, wheelchair assisted	1	4.5	4.5	Para 4.33	Interview room en-suite	V0904
Public telephone: single booth, accessible	1	2.0	2.0	Para 4.135		G0705
Operating theatre suites facilities						
Operating theatre: general	4	55.0	220.0	Para 4.69		N0106
Operating theatre: ultra clean	4	55.0	220.0	Para 4.69, 7.51		N0108
Anaesthetic room: bed space	4	19.0	76.0	Para 4.34		N0316
Scrub-up & gowning room: 3 places	8	11.0	88.0	Para 4.54		N0216
Preparation room	8	12.0	96.0	Para 4.63		T0526
Exit/parking bay: theatre, 1 bed/trolley	8	12.0	96.0	Para 4.101		G0405
Store: equipment, local to theatre	8	1.0	8.0	Para 4.103		W0108
Dirty utility: serving 1 theatre	8	12.0	96.0	Para 4.123		Y0420
Recovery unit or Post Anaesthetic Care Unit (PACU) facilities						
Recovery bay: post anaesthetic, 1 place	12	13.5	162.0	Para 4.147		B2417
Recovery room: post anaesthetic, 1 place	4	26.0	104.0	Para 4.151		B2418
Staff & communication base, enclosed: 3 staff	1	15.0	15.0	Para 4.158		T0203
Clean utility	1	14.0	14.0	Para 4.161		T0537
Dirty utility: bedpan disposal & urine test	1	12.0	12.0	Para 4.164, 4.123		Y0302
Support facilities						
Office: medical reporting, 1 staff	1	10.5	10.5	Para 4.104	Surgical staff	M0306
Blood bank refrigerator bay	1	3.0	3.0	Para 4.143		W0650
Near patient testing/status laboratory	1	8.5	8.5	Para 4.140, 4.160		L1305
Utility: cleaning & store room, flexible endoscope	1	14.0	14.0	Para 4.108		Y0416
Service room: equipment	1	21.0	21.0	Para 4.165		L1803
Parking bay: mobile x-ray & ultrasound unit	1	5.0	5.0	Para 4.105		G0142
Parking bay: resuscitation trolley	1	1.0	1.0	Para 4.106		G0103
Parking bay: fibre optic bronchoscope light source trolley	1	1.0	1.0	Para 4.106		G0150
Store: satellite pharmacy	1	6.0	6.0	Para 4.146		W0254
Store: bulk supplies	1	80.0	80.0	Para 4.133		W0115
Store: clinical equipment	1	30.0	30.0	Para 4.137		W0110
Store: linen	1	6.0	6.0	Para 4.138	Store or linen exchange trolley options	W1592
Store: ready to use medical gas cylinders	1	4.0	4.0	Para 4.139		W1306
Hold: disposal	1	15.0	15.0	Para 4.129		Y0615
Cleaners (Housekeeping) room	1	7.0	7.0	Para 4.169		Y1501
Switchgear room	1	4.0	4.0	Para 4.171		K0101
UPS & IT hub room	1	9.0	9.0	Para 4.173		K0107
Staff support facilities						
Rest & dining room with beverage & snack preparation bay: 20 staff	2	28.0	56.0	Para 5.4, 5.11		D0453
WC & wash: ambulant	11	2.0	22.0	Para 5.8, 5.19		V1005
WC & handwash: accessible, wheelchair assisted	1	4.5	4.5	Para 5.9		V0904
Shower: ambulant (non patient)	6	2.5	15.0	Para 5.17		V0801
Staff changing room including boot change: 30 places	1	25.0	25.0	Para 5.13	Male staff	V0216
Staff changing room including boot change: 30 places	2	25.0	50.0	Para 5.13	Female staff	V0216
Utility: footwear washing	1	4.0	4.0	Para 5.23		Y0510
Interview/meeting room: 6 persons	1	14.0	14.0	Para 5.25		M0713
Office: 1 staff	3	10.5	31.5	Para 5.28		M0219
Office: 3 staff	1	18.0	18.0	Para 5.29		M1012
Office: 4 staff	1	24.0	24.0	Para 5.30	Office & IT study	M1014
Seminar room: 20 persons	1	30.0	30.0	Para 5.33		H0501
Library & study room: 5 persons	1	20.0	20.0	Para 5.37		H0339
Anaesthetic department facilities						
Main entrance foyer	1					J0152
Reception: 1 staff	1	4.0	4.0	Para 5.43		J0205
Waiting area: 3 persons	1	4.5	4.5	Para 5.43	Vistors	J1311
Office: 1 staff	1	16.0	16.0	Para 5.44	Clinical director	M0218
Office: 1 staff	1	16.0	16.0	Para 5.44	Chairman/college tutor	M0218
Office: 1 staff	1	16.0	16.0	Para 5.44	Audit lead	M0218
Office: 1 staff	1	16.0	16.0	Para 5.44	Clinical governance lead	M0218
Office: 1 staff	8	10.5	84.0	Para 5.44	Consultants	M0219
Office: 1 staff	2	10.5	21.0	Para 5.44	Managers	M0219
Office: 1 staff	2	10.5	21.0	Para 5.44	Specialist registrars	M0219
Office: 2 staff	1	13.0	13.0	Para 5.47	Trainee anaesthetists	M1002
Office: 3 staff	1	18.0	18.0	Para 5.47	Secretarial staff	M1012
Office: 1 staff	1	10.5	10.5	Para 5.49	Additional office space/audit	M0219
Interview & counselling room: 5 persons (non-patient)	1	9.0	9.0	Para 5.57		M0703
Interview/meeting room: 6 persons	1	14.0	14.0	Para 5.56		M0713
Rest room with beverage & snack preparation bay: 20 staff	1	28.0	28.0	Para 5.50		D0207
WC & wash: ambulant	4	2.0	8.0	Para 5.51		V1005
Shower: ambulant (non patient)	2	2.5	5.0	Para 5.51		V0801
WC & handwash: accessible, wheelchair assisted	1	4.5	4.5	Para 5.51		V0904
Staff changing room including boot change: 10 places	1	8.0	8.0	Para 5.51	Male staff	V0207
Staff changing room including boot change: 10 places	1	8.0	8.0	Para 5.51	Female staff	V0207
Seminar room: 30 persons	1	55.0	55.0	Para 5.55		H0504
Library & study room: 5 persons	1	20.0	20.0	Para 5.54		H0339
Store: general & stationery	1	9.0	9.0	Para 5.58		W1556
On-call overnight stay room	1	13.0	13.0	Para 5.59		D1504
Shower, WC & wash: ambulant (non patient)	1	5.0	5.0	Para 5.59	On call bedroom en-suite	V1301
Cleaners (Housekeeping) room	1	7.0	7.0	Para 5.61		Y1501
Switchgear cupboard	1	2.0	2.0			K0101A
Net Allowance			2283.5			
5% Planning Allowance			114.2			
Total			2397.7			
3% Engineering Allowance			71.9			
25% Circulation Allowance			599.4			
Total Allowance			3069.0			
Optional accommodation						

Preparation room	1	20.0	20.0			T0528
Scrub-up & gowning bay: 3 places	1	7.0	7.0			N0217
Dirty utility: serving 4 theatres	1	18.0	18.0			Y0422
Store: bulk supplies	1	100.0	100.0			W0116
Store: clinical equipment	1	39.0	39.0			W0113
DH Gateway Review, Estates and Facilities Division						
Schedules of Accommodation Version 3.0 August 2007						
HBN 26 Volume 1 Facilities for surgical procedures (October 2004)						
E.g. 3: Facilities for surgical procedures, 8 general theatres, shared dirty utility & scrub comprising						
Entrance facilities Admission lounge suite facilities Operating theatres facilities: general with anaesthetic room Operating theatres facilities: ultra-clean without anaesthetic room Recovery unit facilities Staff & support facilities (Theatres/Anaesthetic Department) Anaesthetic department	Shared 8 Number with shared dirty utility & scrub - 16 places Shared Co-located					
Description	Quantity	Area(m2)	Total Area(m2)	HBN Para.	Notes	ADB Code
Entrance, reception & waiting facilities with admissions suite						
Entrance lobby: controlled access	1			Para 4. 6	Circulation allowance	J0130
Reception, administration office & communication base: 4 staff	1	24.0	24.0	Para 4.13, 4.21		J0610
Duty room: 2 porters	1	5.0	5.0	Para 4.24		M1707
Waiting room with beverage & snack preparation bay: 10 persons including 1 wheelchair user	1	20.0	20.0	Para 4.25, 4.157		D1417
WC & handwash: accessible, wheelchair assisted	1	4.5	4.5	Para 4.26	Waiting room en-suite	V0904
Consulting, examination & changing room	2	16.5	33.0	Para 4.28		C0105
Interview, counselling & quiet room: 5 persons	1	9.0	9.0	Para 4.33		M0712
WC & handwash: accessible, wheelchair assisted	1	4.5	4.5	Para 4.33	Interview room en-suite	V0904
Public telephone: single booth, accessible	1	2.0	2.0	Para 7.135		G0705
Operating theatre suites facilities						
Operating theatre: general	8	55.0	440.0	Para 4.69		N0106
Anaesthetic room: bed space	8	19.0	152.0	Para 4.34		N0316
Scrub-up & gowning room: 6 places	4	16.0	64.0	Para 4.54	Shared between two theatres	N0218
Preparation room	8	12.0	96.0	Para 4.63		T0526
Exit/parking bay: theatre, 1 bed/trolley	8	12.0	96.0	Para 4.101		G0405
Store: equipment, local to theatre	8	1.0	8.0	Para 4.103		W0108
Dirty utility: serving 2 theatres	4	14.0	56.0	Para 4.123		Y0421
Recovery unit or Post Anaesthetic Care Unit (PACU) facilities						
Recovery bay: post anaesthetic, 1 place	12	13.5	162.0	Para 4.147		B2417
Recovery room: post anaesthetic, 1 place	4	26.0	104.0	Para 4.151		B2418
Staff & communication base, enclosed: 3 staff	1	15.0	15.0	Para 4.158		T0203
Clean utility	1	14.0	14.0	Para 4.161		T0537
Dirty utility: bedpan disposal & urine test	1	12.0	12.0	Para 4.164, 4.123		Y0302
Support facilities						
Office: medical reporting, 1 staff	1	10.5	10.5	Para 4.104	Surgical staff	M0306
Blood bank refrigerator bay	1	3.0	3.0	Para 4.143		W0650
Near patient testing/status laboratory	1	8.5	8.5	Para 4.140, 4.160		L1305
Utility: cleaning & store room, flexible endoscope	1	14.0	14.0	Para 4.108		Y0416
Service room: equipment	1	21.0	21.0	Para 4.165		L1803
Parking bay: mobile x-ray, image intensifier & ultrasound unit	1	8.0	8.0	Para 4.105		G0143
Parking bay: resuscitation trolley	1	1.0	1.0	Para 4.106		G0103
Parking bay: fibre optic bronchoscope light source trolley	1	1.0	1.0	Para 4.106		G0150
Store: satellite pharmacy	1	6.0	6.0	Para 4.146		W0254
Store: bulk supplies	1	80.0	80.0	Para 4.133		W0115
Store: clinical equipment	1	30.0	30.0	Para 4.137		W0110
Store: linen	1	6.0	6.0	Para 4.138	Store or linen exchange trolley options	W1592
Store: ready to use medical gas cylinders	1	4.0	4.0	Para 4.139		W1306
Hold: disposal	1	15.0	15.0	Para 4.129		Y0615
Cleaners (Housekeeping) room	1	7.0	7.0	Para 4.169		Y1501
Switchgear room	1	4.0	4.0	Para 4.171		K0101
UPS & IT hub room	1	9.0	9.0	Para 4.173		K0107
Staff support facilities						
Rest & dining room with beverage & snack preparation bay: 20 staff	2	28.0	56.0	Para 5.4, 5.11		D0453
Utility: footwear washing	1	4.0	4.0	Para 5.23		Y0510
Office: 1 staff	3	10.5	31.5	Para 5.28		M0219
Office: 3 staff	1	18.0	18.0	Para 5.29		M1012
Office: 4 staff	1	24.0	24.0	Para 5.30	Office & IT study	M1014
Shared support facilities: Theatre & Anaesthetic department						
Staff changing room including boot change: 40 places	1	30.0	30.0	Para 5.13, 5.51	Male staff	V0218
Staff changing room including boot change: 30 places	1	25.0	25.0	Para 5.13, 5.51	Female staff	V0216
Staff changing room including boot change: 40 places	1	30.0	30.0	Para 5.13, 5.51	Female staff	V0218
WC & wash: ambulant	13	2.0	26.0	Para 5.8, 5.19		V1005
WC & handwash: accessible, wheelchair assisted	1	4.5	4.5	Para 5.9		V0904
Shower: ambulant (non patient)	6	2.5	15.0	Para 5.17		V0801
Interview/meeting room: 6 persons	2	14.0	28.0	Para 5.25		M0713
Seminar room: 30 persons	1	55.0	55.0	Para 5.33, 5. 55		H0504
Library & study room: 10 persons	1	30.0	30.0	Para 5.37, 5. 54		H0336
Anaesthetic department facilities						
Office: 1 staff	1	16.0	16.0	Para 5.44	Clinical director	M0218
Office: 1 staff	1	16.0	16.0	Para 5.44	Chairman/college tutor	M0218
Office: 1 staff	1	16.0	16.0	Para 5.44	Audit lead	M0218
Office: 1 staff	1	16.0	16.0	Para 5.44	Clinical governance lead	M0218
Office: 1 staff	8	10.5	84.0	Para 5.44	Consultants	M0219
Office: 1 staff	2	10.5	21.0	Para 5.44	Managers	M0219
Office: 1 staff	2	10.5	21.0	Para 5.44	Specialist registrars	M0219
Office: 2 staff	1	13.0	13.0	Para 5.47	Trainee anaesthetists	M1002
Office: 3 staff	1	18.0	18.0	Para 5.47	Secretarial staff	M1012
Office: 1 staff	1	10.5	10.5	Para 5.49	Additional office space/audit	M0219
Rest room with beverage & snack preparation bay: 20 staff	1	28.0	28.0	Para 5.50		D0207
Store: general & stationery	1	9.0	9.0	Para 5.58		W1556
On-call overnight stay room	1	13.0	13.0	Para 5.59		D1504
Shower, WC & wash: ambulant (non patient)	1	5.0	5.0	Para 5.59	On call bedroom en-suite	V1301
Net Allowance			2212.5			
5% Planning Allowance			110.6			
Total			2323.1			
3% Engineering Allowance			69.7			
25% Circulation Allowance			580.8			
Total Allowance			2973.6			
Optional accommodation						
Preparation room	1	20.0	20.0			T0528
Scrub-up & gowning bay: 3 places	1	7.0	7.0			N0217
Dirty utility: serving 4 theatres	1	18.0	18.0			Y0422
Store: clinical equipment	1	39.0	39.0			W0113
Store: bulk supplies	1	100.0	100.0			W0116

Appendix 1 – Modular operating theatres

THE BENEFITS OF MODULAR OPERATING THEATRES

One of the major advantages of the modular solution is that it is brought to the site in perfect condition and defect-free. If it is not supplied to the required standard it can be returned to the manufacturer. Being pre-formed in the factory gives an opportunity for innovation in the design, with sealed finishes that are easy to clean and aid rapid decontamination.

More specifically, manufacturers of modular operating theatres and their customers have referred to the following benefits:

- shorter construction timescales, because of repeated elements and parallel working;
- more likely to meet completion deadlines;
- less disruption to existing facilities and services, with reduced time on site;
- safer, due to nature of on-site work and fewer numbers on site. More work takes place in controlled environment;
- sites with tight physical constraints can be developed;
- quality control is easier when construction takes place in a factory environment;
- less weather-dependent, therefore fewer delays.

DIFFERENCES BETWEEN MODULAR AND CONVENTIONALLY-BUILT OPERATING THEATRES

In performance, quality and functionality, a client should find no difference between modular surgical facilities and those built conventionally. Both are subject to the same standards and regulations. Project specifications and acceptance tests should be defined to ensure that quality standards are met at handover.

However, there are differences in the processes for a modular build that planners and designers will need to take into account.

OPTIONS AVAILABLE

There are several types of modular building available, including:

- modules delivered to site with pre-installed doors, windows, internal finishes and engineering services;
- modular building shells delivered to site;
- fully equipped modules;
- modules constructed in sections, with assembly on site;
- flexible building systems with, for example, moveable walls within a more permanent shell.

Modular operating theatres can be used for longer than previously thought. Some have a life expectancy of more than 20 years and others, for more temporary solutions, a life of 5–10 years. They can be positioned as stand-alone facilities, but may also be connected to existing buildings. Thus, they are suitable for new-build, upgrade and refurbishment projects.

PROJECT MANAGEMENT AND PLANNING

As there are several systems available with differing forms of construction, the life expectancy of any modular building should be clearly defined at the earliest stage in the planning process. Project teams should also take into account the sustainability of the materials and the ability of the trust to maintain the building over its life. Of equal importance at the outset is the interface of services between the modular building and the rest of the hospital (for example, are electrical fittings compatible).

Due to its nature, a modular build project lends itself well to turnkey project management arrangements.

Overall, a modular build should be able to achieve shorter timescales because, during implementation stages, foundations can be built and the site made ready in parallel with construction of modules off-site. It will be important that lead times and delivery times are planned carefully to take advantage of this, under a just-in-time (JIT) system.

It should also be noted that the earlier stages, that is, planning the project and defining the specification, are likely to be more detailed than a traditional build, and will therefore account for a larger percentage of whole-project time. The need for more detailed specification also has the effect that design change at later stages of the process can be more difficult. Change control systems that analyse the effect of a requested change should be planned early.

Fewer people will be needed on site for a modular build, which should ease general access, accommodation and logistics requirements. However, larger cranes may be needed for a modular build. Therefore crane access issues may play a greater role than in a traditional build, with site access plans generated early in the process.

Although a modular build allows construction in a controlled environment, much of that control is handled directly by the contractor, rather than by the client. Therefore, clients should satisfy themselves during the planning stages that proposed contractors operate satisfactory safety management systems. They should also prepare carefully any acceptance testing requirements for the handover stage, and audits of contractor factory processes may be considered.

Clients may find it advantageous to explore financial options offered by module manufacturers when planning the project. Options include:

- operating leases;
- lease purchase;
- secured loans;
- unsecured loans;
- full PFI packages.

DESIGN CONSIDERATIONS IN A MODULAR BUILD

Although a modular building can match that of a traditional building in meeting required standards, modular build quality is as yet untested for the >25 year period required in business case models. It is important

to choose materials carefully when designing for long life and flexibility. For example, for a long-life solution, a steel frame may be more appropriate than a timber frame.

Previous modular designs have been built to the specifications of HBN 26 and it is anticipated that future design will continue to incorporate the recommendations in this latest version.

Designers should take into account current best practice both nationally and internationally when taking a modular approach to operating theatre design and construction. There is a wealth of experience both in the UK and abroad to inform the clinical and design teams of the benefits of using this type of system build.

Use of a modular building still allows for a flexible approach to exterior design. Variations in design can include colour of external finish, window type and size, roofing options and timber, terracotta tiles, brick or rain-screen cladding.

To allow the use of sensitive equipment in any operating theatre, it is important to specify for appropriately structural designed floors, which allow no vibrations.

COST BENEFITS

Although modular operating theatres may be more expensive when comparing cost per square metre with traditional forms of building, other factors in overall construction or during the life-cycle may demonstrate a modular choice to be a suitable solution (for example speed of construction on site, potential for rapid decontamination etc).

Life-cycle costs will vary with choice of materials and type of operating theatre required. The initial brief preparations should consider the type of modular system and types of material available; for example, painted plasterboard walls will have a higher maintenance cost than prefabricated powder-coated metal systems. This in turn will inform the life costing exercise that needs to be carried out as part of the business case.

Appendix 2 – Patient and staff views

PATIENT VIEWS

The patient experience is a crucial consideration when designing and building a new operating department. Although there have been a number of studies that focus on patient views about their operations, the majority report on clinical issues such as pain control or the quality of communication. Little information has been identified that relates to the patient experience and the built environment.

At the Friarage Hospital, Northallerton, theatre staff sent a questionnaire to patients following discharge from hospital as part of their clinical governance protocol. They were asked about their journey to the operating theatre, their reception, experience in the anaesthetic room, in the operating theatre (if conscious) and finally in the recovery unit. Many of the questions focused on verbal communication between the staff and the patients; however, some were related to the built environment. Of the 70 patients who responded, the majority viewed as very important being able to maintain their privacy, dignity and confidentiality, being warm and comfortable, and experiencing minimum noise levels in all areas of the department. More than 25% remained awake and alert during their operation and nearly 70% remembered their stay in the recovery unit.

STAFF VIEWS

A survey carried out as part of the NHS Modernisation Agency's Theatre Programme (June 2002) asked operating staff in nine NHS trusts to identify the factors that influence their morale and performance.

Poor working conditions were cited frequently as a cause for dissatisfaction. Large units were viewed as impersonal, which added to staff dissatisfaction. A number of suggestions were made to improve the built environment. These included:

- staff rest facilities should have comfortable fittings and furnishings, most particularly seating;
- water boilers and a dedicated cold water drinking supply, preferably a water fountain, should be installed in the rest rooms;
- better catering facilities on a 24-hour basis;
- better changing rooms with more supplies of linen and theatre clothing. The lack of storage and clothing was also the biggest complaint from theatre staff in a recent survey conducted by Stock (2003);
- more office space;
- better IT resources;
- dedicated "smoking" area;
- more natural daylight;
- better training facilities;
- better security.

All respondents emphasised the importance of involving clinical staff in PFI development and redesign of an operating department through widespread and ongoing consultation.

Appendix 3 – Capacity planning

INTRODUCTION

The previous HBN 26 (1991) contained eight steps to calculate the number of theatres required for each specialty. In this new guidance the steps have been reduced to seven, with step 8 calculating the number of theatres required for planned preventive maintenance and emergency sessions.

Steps 1 to 6 generate an estimate of the predicted number of theatre cases per year for a specialty. The method should be modified to produce separate estimates of:

- in-patient elective theatre cases;
- dedicated day theatre cases;
- in-patient emergency theatre cases.

A clear statement of such variables as surgical bed provision, length of stay, and bed occupancy are required as input to the method. Because these variables are recorded, and because the method consists of a sequence of calculations based on these variables, the reasoning which led to the final figure is made explicit and is therefore available for subsequent review not only by the original team, but also by those who, perhaps years later, actually manage the department when it is in service.

For each surgical specialty the following variables should be known:

- surgical bed provision;
- average length of stay and bed occupancy;
- throughput per annum;
- average cases per operating session (for selected session lengths);
- number of working weeks per theatre per annum;
- policies for emergency usage of theatres and for planned preventive maintenance.

Note. Definitions of the terms should be agreed by the project team.

THE METHOD

In **STEPS 1 to 7** the number of theatres required for a single specialty is obtained. These steps should be repeated for each specialty.

The surgical specialty chosen for the following worked example is in-patient elective orthopaedic surgery.

STEP 1 State the number of **beds** that will be available for in-patient elective orthopaedic surgery.

Answer: 60 beds

STEP 2 State average bed occupancy for in-patient elective orthopaedic surgery.

Answer: 80%

STEP 3 State average length of stay.

Answer: 8 days

STEP 4 Estimate future average elective orthopaedic bed throughput per annum.

$$\begin{array}{rcl} \text{Average orthopaedic} & & \text{Average bed occupancy} \\ \text{bed throughput per} & & \text{for orthopaedic} \\ \text{annum} & = & \text{surgery} \times 365 \\ & & \hline & & \text{Average length of stay} \\ & & \text{for orthopaedic patients} \\ & & \\ & & = \frac{0.8 \times 365}{8} \end{array}$$

Answer: 36.5

Note. This calculation is an estimate of the number of patients using each orthopaedic bed in a year; this estimate, in turn, depends upon an estimate of bed occupancy and length of stay. The bed occupancy figure selected may be the current figure. However, planners may wish to introduce a desired or proposed figure; in this case care should be taken to ensure that the figure is realistic, confirmed by audit, and can be achieved in practice, since the level assumed may in part determine the overall theatre caseload and, consequently, the number of theatres provided. The figure obtained should be compared with pertinent regional statistics.

STEP 5 Calculate total bed throughput per annum for orthopaedics.

Total surgical beds available for orthopaedics x Average orthopaedic bed
= throughput per annum

$$= 60 \times 36.5$$

Answer: 2190

STEP 6 Calculate total orthopaedic theatre caseload per annum.

Total bed throughput for in-patient x % of in-patient elective orthopaedic patients undergoing surgery
= Total orthopaedic theatre caseload per annum

$$= 2190 \times 0.8$$

Answer: 1752

Percentage of surgical bed throughput undergoing surgery should include an estimate of day cases and emergencies.

STEP 7

Elective in-patients, with illustration for 1752 orthopaedic in-patient theatre cases

- i) estimate operating hours of the estimated cases (based on time of start of anaesthetic to time patient leaves operating room)

multiply theatre cases by average operating hours per case

$$\text{for example } 1752 \times 1.2 = 2102 \text{ op hrs per year}$$

- ii) convert the operating hours into theatre timetable hours required by dividing by the efficiency of utilising planned hours of timetabled sessions. Note that a forthcoming Audit Commission review paper identifies three efficiency factors:

- lists held (planned hours) as fraction of lists planned (planned hours), U_c
- actual run time of lists as fraction of their planned hours, U_r
- patient operating hours as fraction of run time hours, U_p

These may be combined into an overall efficiency factor that shows how much planned theatre time is actually used for operations on individual patients, U_o , where

$$U_o = U_c \times U_r \times U_p$$

and suggested target values are:

$$0.77 = 0.925 \times 0.9 \times 0.92$$

that is, 77% of theatre timetable template hours can be expected to be used on individual patients.

Therefore, timetabled planned hours required = annual operating hours/efficiency

$$\text{for example } 2102/0.77 = 2731 \text{ hours per year}$$

- iii) convert these to timetabled hours per week. Note that U_c is based on utilisation of planned lists hours where the plan does not already adjust for the absence of surgeons/anaesthetists etc, so division by 52 weeks is appropriate

$$\text{for example } 2731/52 = 52.8 \text{ timetabled hours per week}$$

- iv) decide on pattern of work each week. Will elective lists be held only on weekdays or on Saturdays as well? Will the theatre unit have two-session days or three-session days?

Define the pattern over the week as:

$P_{1 \text{ to } 5}$ = proportion of hours to be done on weekdays
for example, $P_{1 \text{ to } 5} = 0.9$

P_6 = proportion of hours to be done on Saturdays
for example $P_6 = 0.1$

P_7 = proportion of hours to be done on Sundays
for example $P_7 = 0$

Define the daily patterns as:

P_{two} = proportion of weekday daily hours that will be done on two-session days

P_{three} = proportion of weekday daily hours that will be done on three-session days

$$\text{for example } P_{\text{two}} = 0.8; P_{\text{three}} = 0.2$$

In our example, we need to see how much work for this specialty will occur on a weekday (the peak part of the week) on average:

$$\text{weekday hours} = P_{1 \text{ to } 5} \times \text{timetabled hrs/wk}, \\ 0.9 \times 52.8 = 47.5$$

$$\text{hours per weekday} = 47.5/5 = 9.5$$

$$\text{sessions per weekday} = 9.5/3.5 = 2.71 \\ [\text{Session} = 3.5 \text{ hours}]$$

Then we need to see how much of the daily sessions translates into theatres. For P_{two} of the time, theatres can handle two sessions a day; for P_{three} they can handle three sessions a day.

In our example, 2.71 sessions a day translates into
 $(P_{\text{two}} \times 2.71/2) + (P_{\text{three}} \times 2.71/3)$ theatres

$$= (0.8 \times 2.71/2) + (0.2 \times 2.71/3)$$

$$= 1.26 \text{ theatres for in-patient elective orthopaedic surgery}$$

- v) Repeat calculations for all other specialties for in-patient cases, and add theatres.
- vi) Round fractions of theatres up to a whole number.

Elective daycases

Make similar calculations as for in-patients. Take into account that the pattern-of-work factors may be different from those for in-patients.

Also bear in mind that less than 100% of day cases will be done in dedicated day case theatres: x% will be put on in-patient theatre lists and will affect in-patient theatre capacity requirements. Actually, this fact would need to be recognised at the outset (that is, step 7 elective in-patients) so that these x% of day cases are included with the elective in-patient calculations.

Step 8 Add requirements for emergency cases

- i) Estimate numbers of emergency theatre cases by specialty from FCEs
- ii) Estimate numbers of operating hours by specialty by multiplying by average hours per case.
- iii) Estimate the proportion of these hours that will fall in the period 08:00–18:00 on any day of the week. National average is 70%, but the estimate should be based on local analysis, and it will be influenced by whether scheduled emergency theatre sessions are to be provided or not (which in turn depends on the volume of emergency theatre cases).

For example, total operating hours
 = 60 hours per week

average hours falling within 08:00–18:00 on any day
 = $60/7 \text{ days} \times 0.7 = 6 \text{ hours}$.

- iv) If these hours were undertaken on scheduled daytime emergency lists the expected utilisation of planned hours for the lists would be about 50%.

For example, 6 hours operating requires 12 scheduled hours. Given that the basis for these figures is a 10-hour period each day, it is clear that one theatre is required for emergency cases.

It should be noted however that the NCEPOD report recommends that tertiary hospitals with a high trauma requirement should dedicate two theatres for emergency cases.

Variations on Steps 7 and 8

The last stage of the calculations for elective in-patients and elective day cases involves rounding numbers of theatres to a whole number, usually by rounding up.

If some theatres are required to be dedicated to particular specialties, the number of theatres required for each relevant specialty should be rounded up first, before adding their requirements to those of other specialties.

In a similar way, trauma theatres are usually required to be separate from general emergency theatres. In that case the calculations for emergency cases would be partitioned into orthopaedic emergencies (trauma) and the rest. The utilisation of planned theatre hours for these two categories is different, with trauma averaging around 60% and other emergency 50%. Numbers of theatres would be rounded up for the two groups separately.

Appendix 4 – Advantages and disadvantages of anaesthetic rooms

The lead anaesthetist from the NHS Modernisation Agency (2003) describes the advantages and disadvantages of including anaesthetic rooms in a new build:

Advantages

Anaesthetic rooms provide a quiet place for staff to greet and introduce themselves to the patients, to provide an opportunity for some semblance of dignity to the patients on which there is increasing emphasis. Final safety checks confirming, for example, the patient's identity also take place in privacy here.

Patients can be nervous of being anaesthetised in theatre and prefer less technical environments. Behaviour changes by theatre staff are necessary. They are used to patients being in anaesthetic rooms, and make a lot of noise in theatres. This is very off-putting to patients being anaesthetised.

If instruments are laid up in the operating theatre, the patient has to listen to this happening whilst being anaesthetised or wait until it is completed, thus delaying the whole list.

A considerable number of patients require local or regional anaesthetic blocks to be inserted while still awake. These procedures may be lengthy. A second anaesthetist can undertake this procedure in the anaesthetic room whilst the operating theatre is still occupied by the previous patient.

Patient choice, cultural considerations and parental presence for children all support the continuing use of anaesthetic rooms.

Anaesthetic staff, particularly trainees, inducing patients in an anaesthetic room rather than in a main operating theatre are less likely to be put under unnecessary pressure as is reported from North America.

Anaesthetic rooms provide dedicated storage areas for intubation and regional analgesia equipment, drugs, disposables and fluids, together with a fridge for pharmaceuticals items etc that need to be kept in this way. It is unlikely that similar space for all these could be provided in even an enlarged operating theatre without compromising its own flexibility.

In the UK a number of training schemes for Anaesthesia and Critical Care Practitioners (ACCPs) are being tested.

Once trained, these practitioners will be able to maintain a stable patient in the operating theatre, while the anaesthetist anaesthetises the next patient and inserts monitoring lines. Further information can be obtained from the Royal College of Anaesthetists website (<http://www.rcoa.ac.uk>).

They provide separate clinical hand-wash basins for anaesthetic staff.

Anaesthetic rooms have both supply and extract ventilation, leading to rapid dilution of any anaesthetic gases released particularly around the induction period.

Disadvantages

Due to the training regulations for anaesthetists and the shortage of trained anaesthetists, there are few occasions when the next patient can be anaesthetised in the anaesthetic room while the previous patient is woken up in theatre. There are long periods when the anaesthetic room is empty while a patient is in the operating theatre.

More complex monitoring has been introduced, and there are sicker patients. Over the last 20 years, there has been a steady increase in more complex surgery and also an older and frailer patient population. Along with this, and supporting it, is the increased use of anaesthetic monitoring. If a patient is connected to at least four kinds of monitoring in the anaesthetic room, it can be seen as dangerous to disconnect them from this to transfer them to the operating theatre. There is a period when they are not being monitored. This is an argument for anaesthetising the patient in the theatre to avoid transfer and disconnection from monitoring. Similarly, this applies to transfer at the end to recovery, but both are due to be overcome by continuous wireless infrared monitoring systems.

Monitoring equipment and ventilators are expensive. To ensure standards of safe anaesthesia, monitoring is mandatory at all times. Lengthy insertion of monitoring lines requires a ventilator to maintain the patient's breathing during this process. The use of anaesthetic rooms means that expensive equipment has to be duplicated, with significant additional costs, although the actual cost per patient is small and the presence of an additional machine in case of, for example, total electronic failure is an advantage.

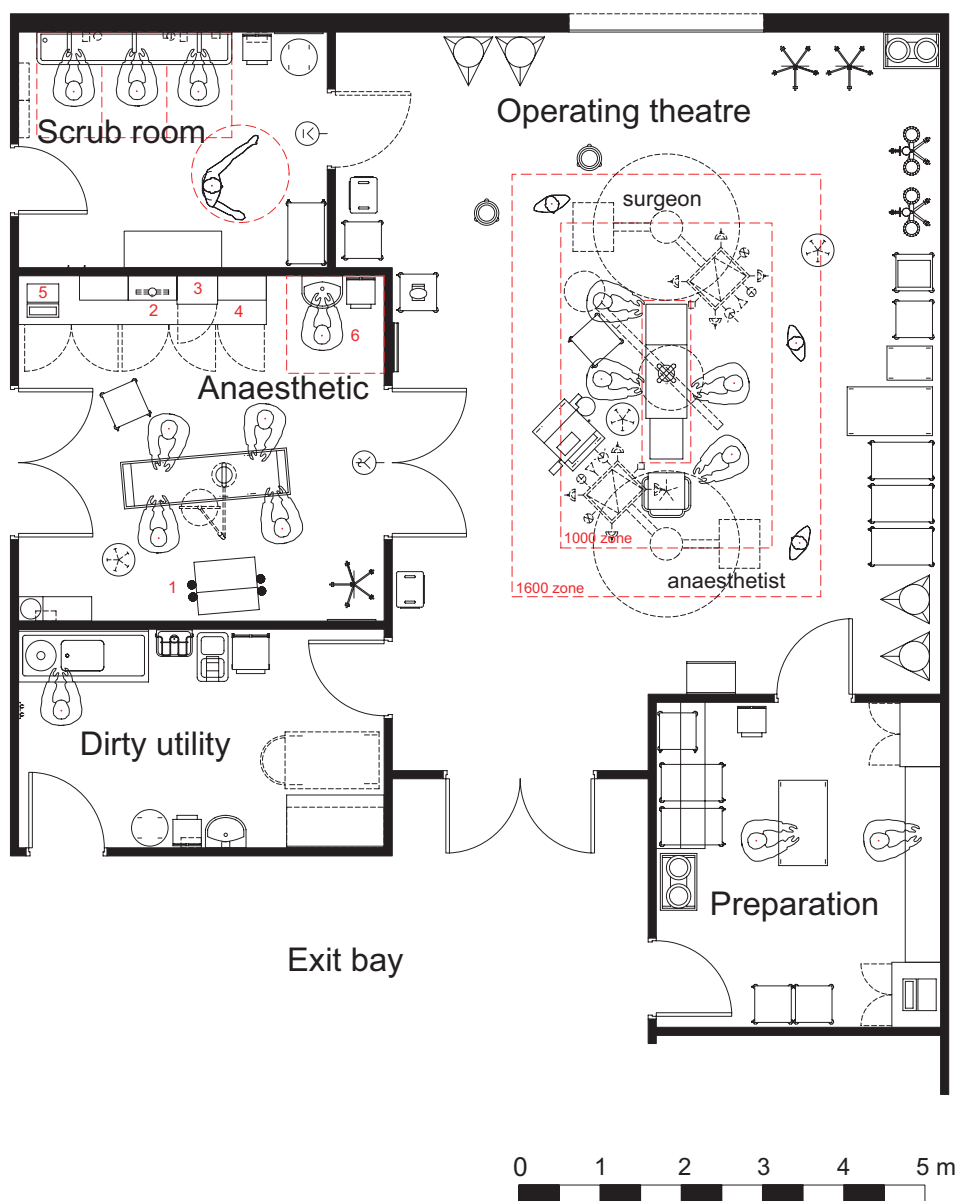
Appendix 5 – Room layouts

- 1) Operating theatre suite 1
- 2) Operating theatre suite 2
- 3) Operating theatre suite 3
- 4) Shared scrub rooms 4

Operating theatre suite

Typical operating theatre suite

Sheet 1



Key for anaesthetic room:

1. Wall-mounted medical gas services: air, nitrous oxide, oxygen, vacuum and gas scavenging
2. Lockable controlled drugs cupboard
3. Lockable drugs refrigerator
4. Work surface and storage units

For key to other rooms see:

Preparation room and dirty utility – Sheet 2

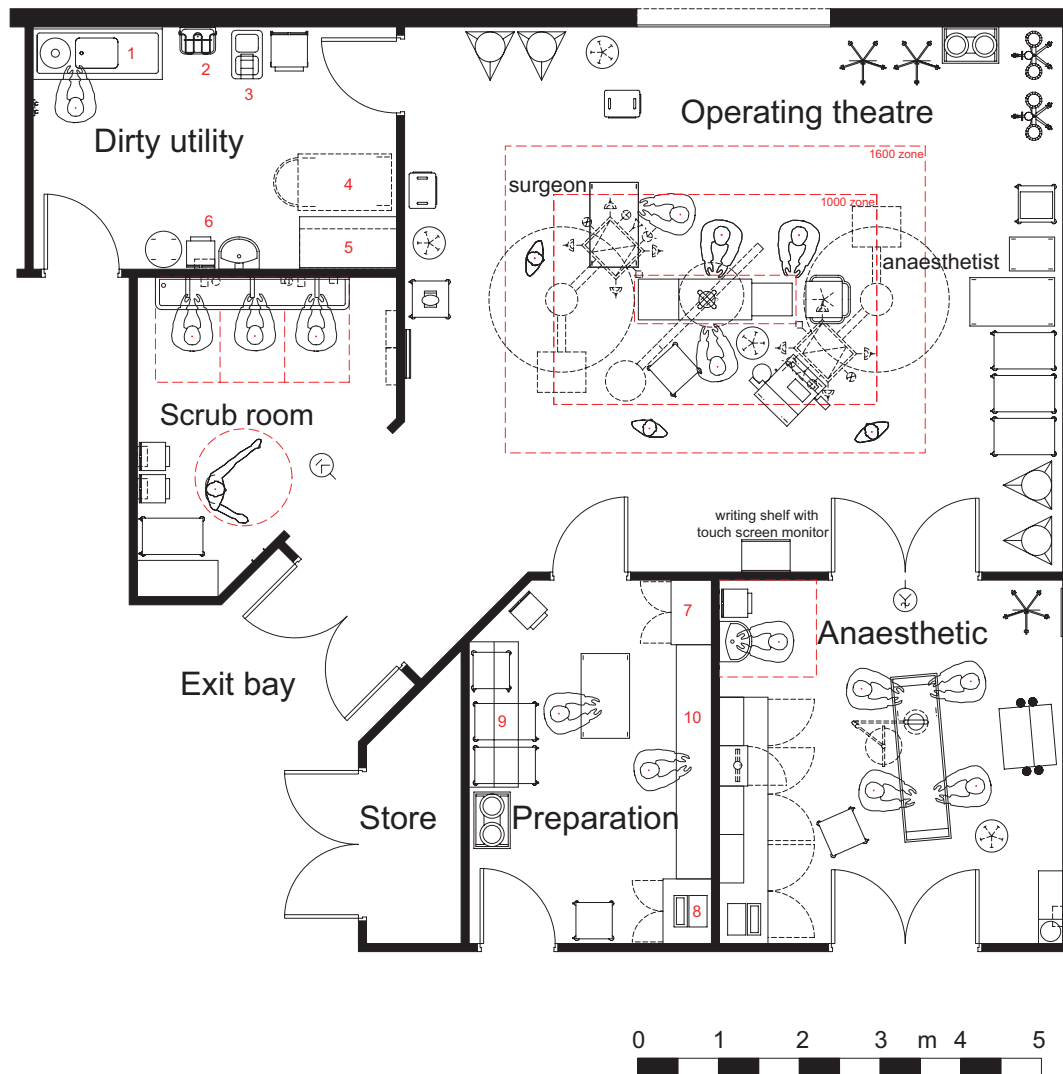
Operating theatre – Sheet 3

Scrub room – Sheet 4

Operating theatre suite

Typical operating theatre suite with integral scrub room

Sheet 2



Key for preparation room and dirty utility

1. Sink and slop hopper with cistern
2. Bucket sink
3. Double mop bucket
4. Instrument tray collection trolley
5. Worktop and shelving/cupboard
6. Clinical hand-wash basin with non-touch taps, soap and paper towel dispenser, clinical waste holder
7. Lotion cabinet
8. Computer workstation

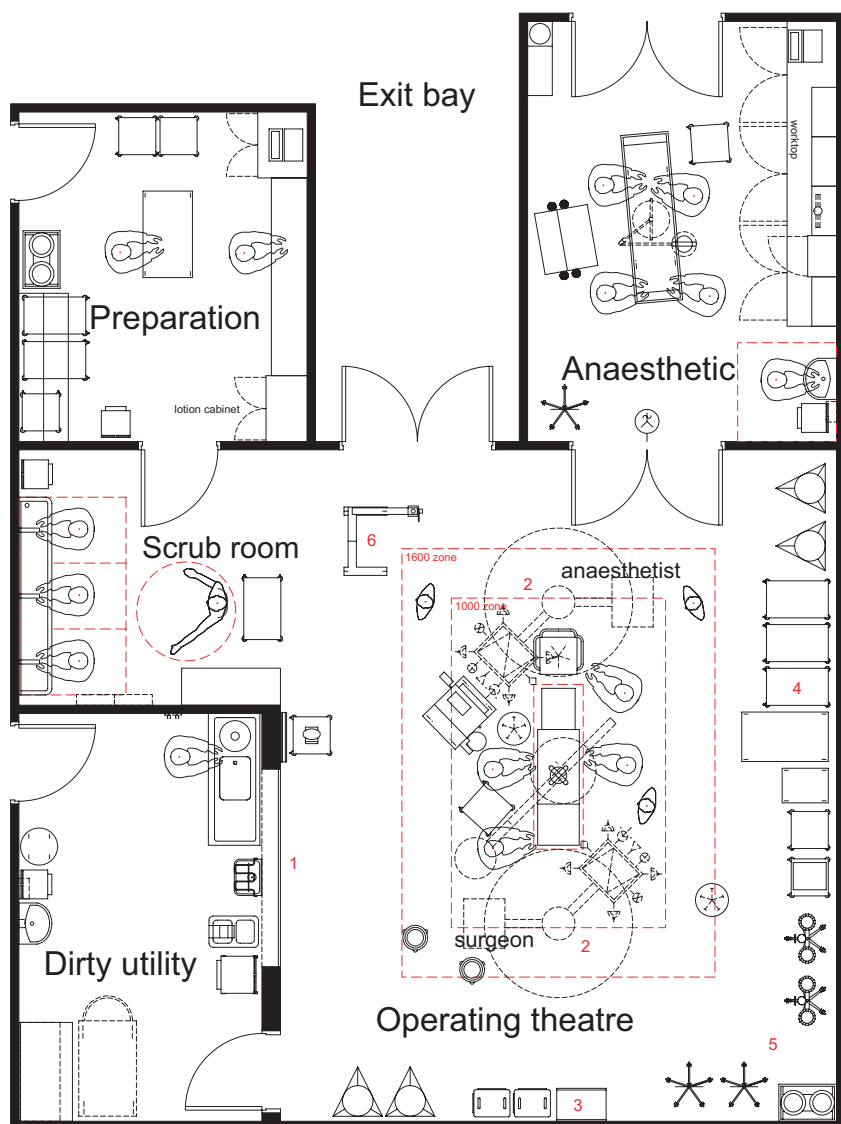
For key to other rooms see:

- Anaesthetic room – Sheet 1
- Operating theatre – Sheet 3
- Scrub room – Sheet 4

Operating theatre suite

Typical operating theatre suite with integral scrub room

Sheet 3



Key to operating theatre:

1. Theatre control panel
2. Surgical and anaesthetic medical supply units
3. Writing shelf with touch-screen monitor
4. Various dressing trolleys (7–10) including trolleys for equipment, for example swab weighing scales and diathermy machine
5. Drip stands, bowl stands, suction unit
6. Operating microscope



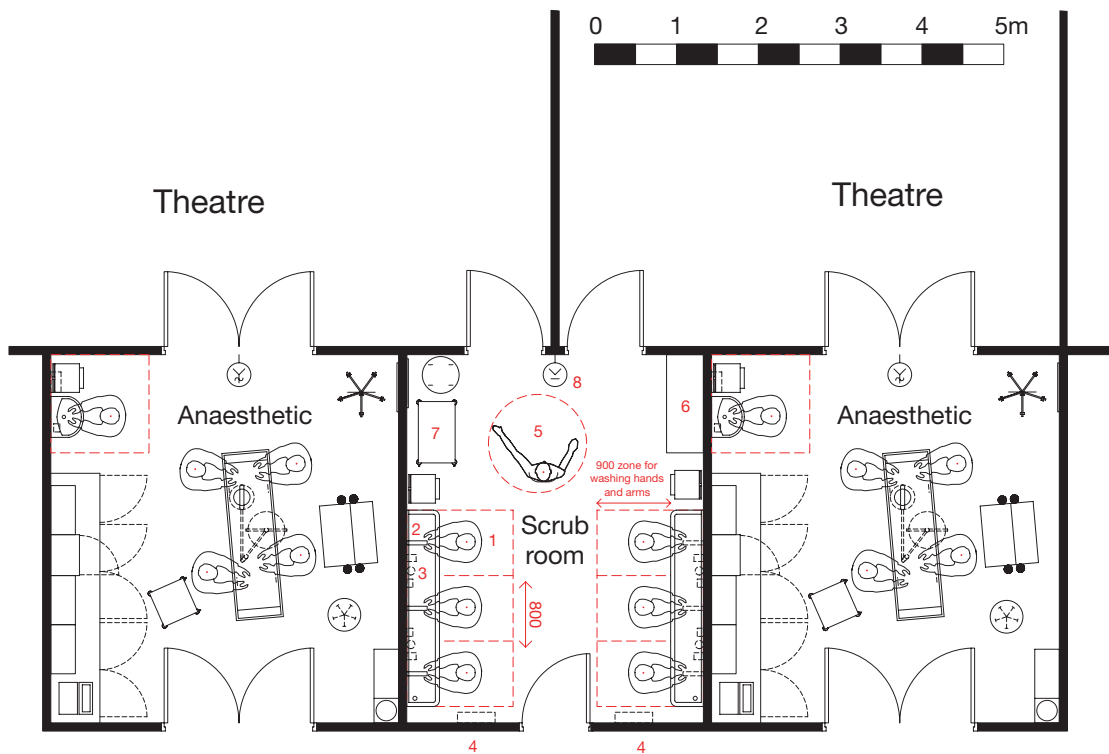
For key to other rooms see:

- Anaesthetic room – Sheet 1
- Preparation room and dirty utility – Sheet 2
- Scrub room – Sheet 4

Shared scrub room

Two theatre suites sharing combined scrub room

Sheet 4



Key for scrub room

1. A zone of 800 mm wide by 900 mm deep is required for washing hands and forearms in front of each scrub tap
2. Non-touch scrub taps are recommended
3. Shared non-touch scrub solution dispensers located in a 200 mm zone between each tap
 - For the height of the scrub trough and water outlets, see HTM 64 – ‘Sanitary assemblies’
 - Liquid soap and nail brush dispensers should be 1100–1200 mm above finished floor level
4. Disposable glove, apron and mask dispenser
5. 1200 mm clear space is required for arms in extended position during gowning procedure, with an additional 300 mm minimum side clearance to prevent contamination

6. Shelf space is required for storage of gown packs. These should be sited conveniently but not above gowning trolley

7. Sufficient space should be provided around gowning trolley to permit safe opening of the gown pack

8. Radio-controlled clock with sweep seconds hand.

All anaesthetic rooms should be identical and under no circumstances can they be handed/mirrored

For key to other rooms see:

Anaesthetic room – Sheet 1

Preparation room and dirty utility – Sheet 2

Operating theatre – Sheet 3

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NHS Estates
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NHS Estates Decontamination guidance
<http://www.decontamination.nhsestates.gov.uk>

NHS Modernisation Agency Clinical Governance Support Team
<http://www.cgsupport.org>

Medicines and Healthcare Products Regulatory Agency
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Royal College of Anaesthetists
<http://www.rcoa.ac.uk>

Royal College of Surgeons of England
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