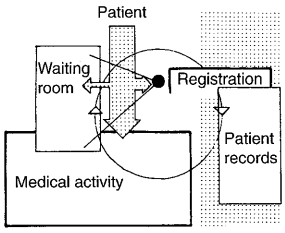
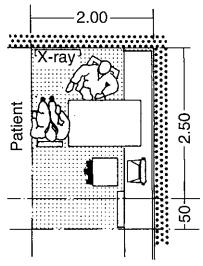
DOCTORS' PRACTICES

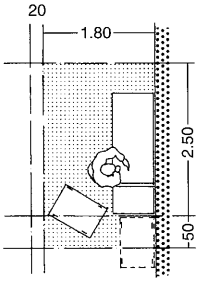
Single and Group Practices



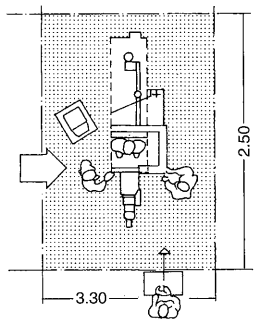
1 Reception as gatekeeper and controller for incoming patients



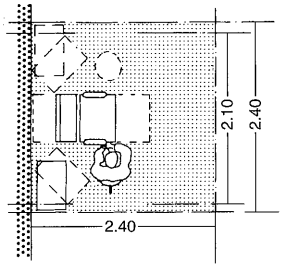
2 Minimum space required: doctor's consultation area



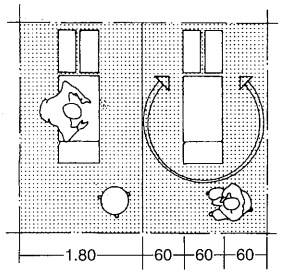
3 Minimum space required: examination of reclining patient



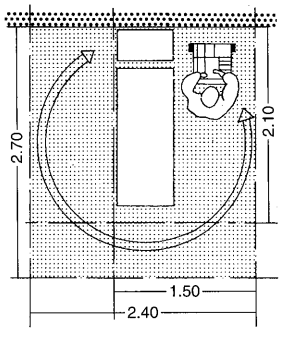
4 X-ray machine with control desk



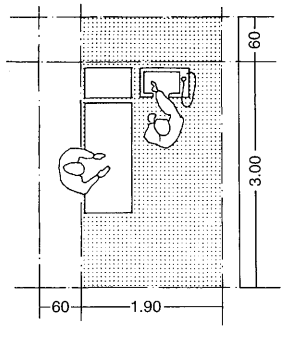
5 Minimum space required: taking a blood sample



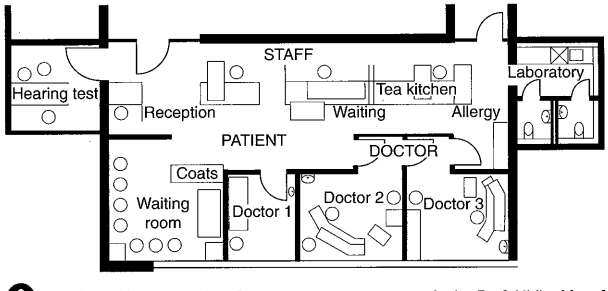
6 Physiotherapy couches



7 Minimum space required: electrocardiogram



8 Space required: ultrasound



9 Ear/nose/throat practice, Stuttgart Arch:. Prof. Ulrike Mansfeld

Single practices

A practice of a single specialist must have a minimum amount of space (approx. 150 m²) and functions separated into rooms, which are differentiated and extended according to speciality. There is a general division between the patient and the staff areas.

At the entrance, there is a waiting area with cloakroom and WC, and the doctor's area with consultation room is placed near the waiting area. The treatment room and laboratory are next door. An extension of the consultation and examination area for repeated treatments and a separate diagnostic zone are sensible. The number and size of the rooms are based on the particular specialist qualifications of the doctor (internist and general practitioner, surgeon, orthopaedist, gynaecologist etc.). Patient WCs, staff changing rooms with WCs and staff lounge complete the programme. Separate children's play areas can be a good idea in the waiting area (e.g. gynaecology).

Waiting room

The size is in accordance with the number and frequency of visits to the treatment rooms, depending on the specialisation of the doctor. If the practice is organised to require appointments, the size of the waiting room can be reduced.

Appointment planning and recording of services take place in the **reception**. The staff here must be able to oversee the waiting room and the entrance, and the connection to the medical area should be as short as possible.

Consultation room

The doctor's consultation room (12–16 m²) is a visually and acoustically enclosed room and primarily intended for the purposes of establishing case history, consultation, study of diagnostic findings, development of therapy plans and protocols. The furniture should include a desk with PC workstation, at least two chairs and an X-ray display.

Examination and treatment rooms

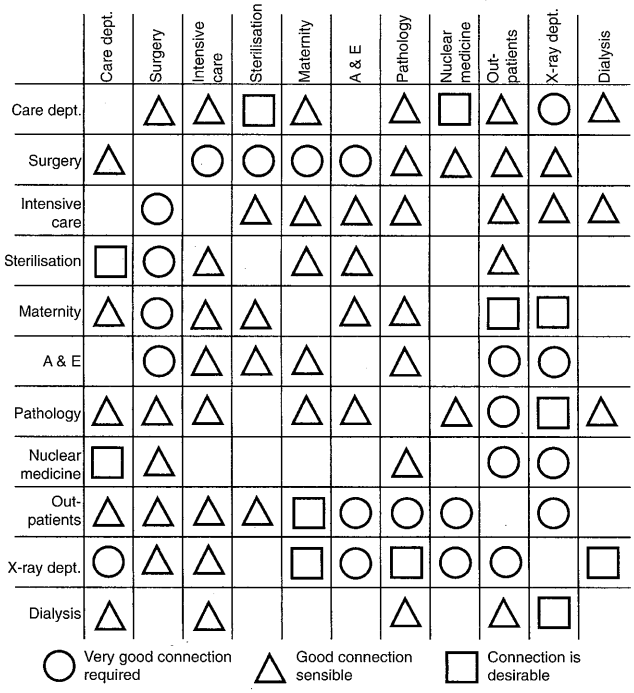
In size ≧20 m², these rooms differ according to the nature and form of treatment. The minimum furnishing would be a chair and couch for the patient, revolving stool, workbench with basin and instrument table. Adequate space for movement should be planned for the doctor and patient.

The size of other specific examination and treatment rooms (X-ray, taking blood samples, various therapies) depends on the required specialist instruments, apparatus and storage room plus integrated changing room (1.5 m²). Separate office support is not necessary. Better is a generous reception with daylight and desks (equipped with PCs) with direct access to patient files. Washbasins with additional disinfectant dispensers are to be provided in all rooms with patient contact and treatment.

Medical centres/group practices

These terms denote the combination of two or more doctors practising together with shared staff and facilities. The creation of such practices can result in a clear saving of space with improved performance and convenience, for example if facilities like X-ray, laboratory tests and various therapies, as well as administration and staff rooms, can be used communally.

In the UK group practices mainly consist of general practitioners (GPs), who if necessary refer patients to specialists (usually based in hospitals). The group practice may also include practice nurses, midwives, health visitors, physiotherapists and other health professionals.



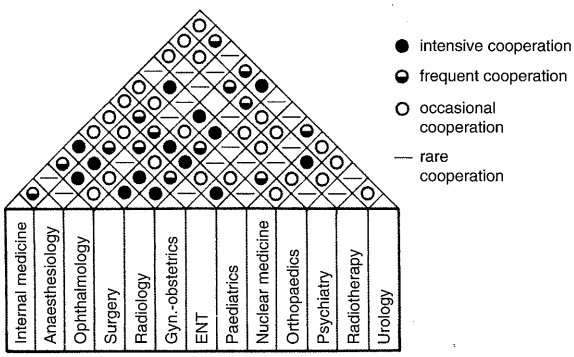
1 Operational links

The investment and operating costs of a hospital are extremely high, so operational planning and an economical room allocation plan must be produced as a priority to reduce the operating and staffing costs. This is discussed and laid down at the preliminary design stage through collaboration by the responsible authorities, client, doctors, architects, specialist designers and the hospital administration. Based on the operational planning and the room allocation plan, the architectural design team can proceed with the construction and form of the building and the installation of systems, while planning equipment for medical requirements, fittings and furnishings.

Hospitals, clinics and health centres serve to treat and care for patients with acute and chronic illnesses. The medical and care objectives determine the size of the specialist departments and treatment facilities according to the nature and extent of the conditions. Regarding domestic requirements, modern hospitals offer something of the nature of a hotel. The atmosphere of a sanatorium with particular emphasis on hygiene, which was usual in the last century, is no longer desirable. Patients' length of stay is becoming increasingly short. In a main hospital the ratio of the areas for care to the areas for examination and treatment is approaching 1:1. Reform of health provision is making great changes in the hospital landscape and among service providers, which can be public, non-profit making or private.

Area guideline		Usable area
For a general hospital with regular provision and approx. 300 beds		
Operational departments		Usable area per bed/m²
1.00 investigation and treatment 2.00 care 3.00 administration 4.00 social services 5.00 supply and waste disposal		12.0 18.0 2.0 3.0 7.0
Total	usable area	42.0 m²
operational area traffic area		8.0 m² 19.0 m²
Total	net floor area	69.0 m²
construction area (newbuild framed construction)		11.0 m²
Total	gross floor area	80.0 m²
	gross floor area/usable area	= 1.9

2 Space guidelines for a general hospital



3 Diagram of cooperation between medical specialist departments

Structure

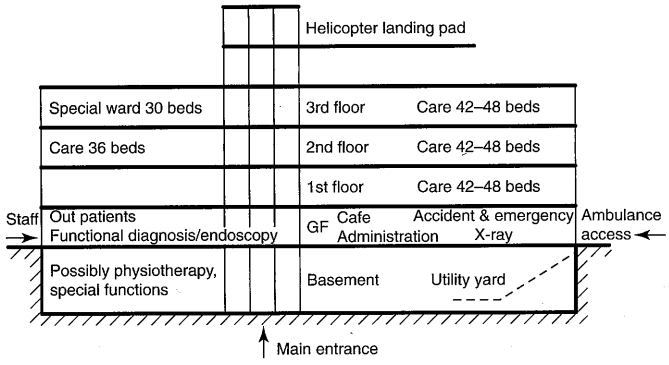
The general hospital is functionally divided into areas for examination and treatment, care, administration, social services, supply and waste disposal and services. Additionally, there are residential areas and sometimes areas for tuition and research (university teaching hospital). The above operational areas are close neighbours but operationally separate. It is necessary to maintain short horizontal and vertical connections while preserving the greatest possible flexibility and a smooth flow of traffic between all departments. Hospitals are categorised according to their function into general and specialist hospitals and university teaching hospitals. The current changes in health policy are leading to different financial structures and also to new types of building like outpatient medical centres and patient hotels. Hospitals are also divided into those for basic provision (up to about 240 beds), normal provision (up to about 520 beds) and main hospitals (up to 800 beds), depending on their particular purpose.

University teaching hospital

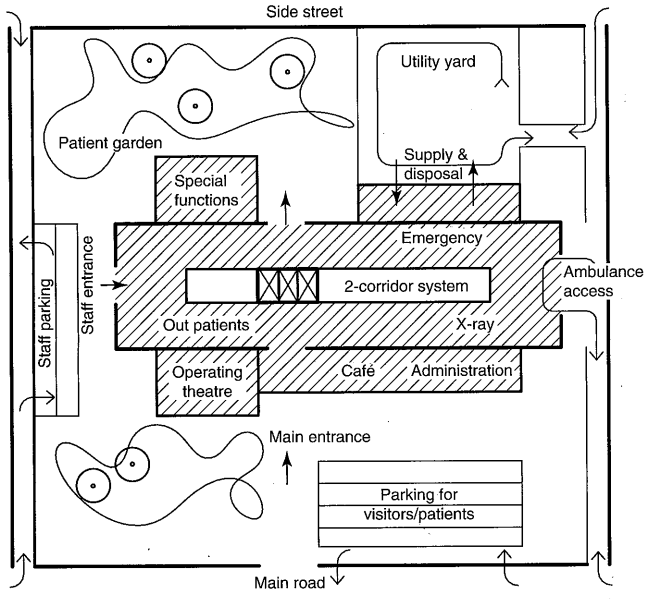
With their maximum provision, teaching hospitals are comparable to some main hospitals in their departmental structure and service provision. They possess particularly extensive diagnostic and therapeutic equipment and at the same time are engaged in education and research. Lecture theatres and demonstration rooms should be included so that the operation of the hospital is not disturbed by students. Wards need to be larger to accommodate rounds attended by a large number of people. The specialisations and particular requirements of a teaching hospital demand special organisation, function and room allocation plans.

Specialist hospital

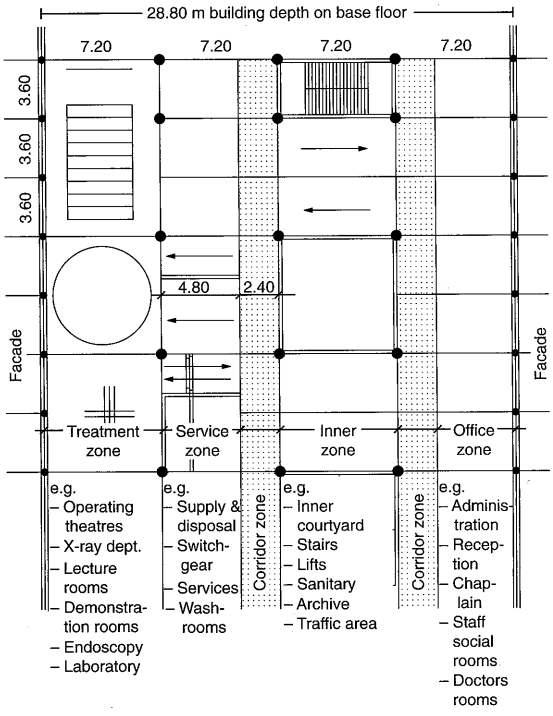
Specialist hospitals are intended for particular types of treatment or groups of complaints: accident and emergency, rehabilitation clinic, orthopaedic clinic, gynaecology etc. There are also hospitals specialising in tuberculosis, cancer, mental disorders, different types of surgery etc. There is a flexible overlap with health resorts and care, rehabilitation and homes for the elderly. The number of specialist hospitals is increasing greatly (e.g. dermatology, lung and allergy clinics) due to the growing specialisation of medicine.



1 Vertical diagram of compactly structured hospital with approx. 200 beds



2 Site: approx. 15,000 m² for hospital with approx. 200 beds and 3–4 storeys, Breitfuss type



3 Structural grid for examination and treatment area

Space allocation plan

A space allocation plan has to be produced as part of the design process, and this forms the basis of the structure and requirements of the entire hospital. Any specialist emphasis in a hospital has an effect on the nature and size of other departments. The area guideline values can give an overview of the size of the individual departments. It should be noted that these guideline values are only recommendations and depend on the specialist equipment and services of the hospital in question.

Building design

Possible alterations of use in the course of the period of operation of a hospital will have a considerable influence on the design concept, and need to be considered in addition to shortness of distances, efficient work flows and operational interactions. For the design of new hospitals intended for regular provision, approx. 42 m² usable area per bed can be assumed, and for the gross built volume approx. 200–280 m³ per bed.

Hospitals are frequently built in a number of construction phases or are extensions of existing hospitals. Therefore a comprehensive target and development plan (scale 1:500) should be produced at an early stage showing and arranging logistically the different phases. The construction and the design (routes, corridors) must be laid out so that the building can be extended in various ways. The architect should take note of the current regulations and guidelines (model hospital building regulations, operational regulations of the hospital, state building regulations etc.) at the beginning of the project.

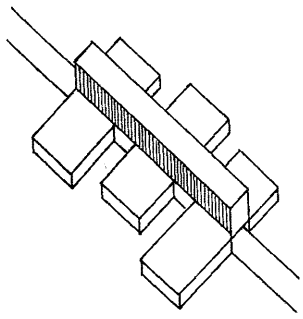
Modular coordination

The application of modular coordination of dimensions should form the basis for the design of a hospital. This involves the adoption of a reference system, basic module and multiple modules in order to determine the purpose, location and dimensions of a building element. For hospital building, the preferred dimension of 12 M = 1.20 m is recommended. If this module is too coarse, then preferred dimensions of 6 M or 3 M can be chosen. All building elements are integrated into this modular system and matched with each other. The creation of the basic grid, horizontally and vertically, defines the load-bearing structure. The effects of using a modular system are short construction times, the simpler exchange of finishing elements and thus less disturbance to existing use.

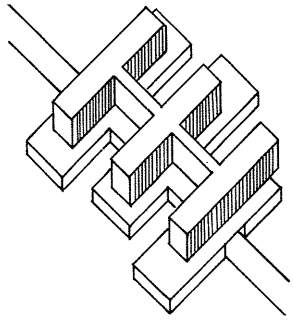
Structural grid

The structural grid must enable good route planning and the possibility of differentiating the operational departments into zones: main function, subsidiary functions and traffic. A comparison of the individual departments and their required rooms leads to a structural grid, which is suitable for all operational departments.

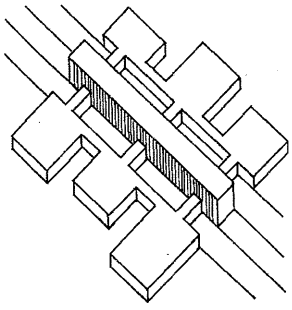
Structural grids of 7.20 m or 7.80 m have proved successful in practice. Column spacings of 7.20 m or 7.80 m enable the various departments to be included in the design with the least difficulty. Smaller structural grids (e.g. 3.60 m × 7.20 m) are also possible, because the number of larger rooms such as operating theatres (approx. 40 m²) is relatively small. Reinforced concrete slabs should be designed without downstand beams in order to simplify the routeing of the service installations.



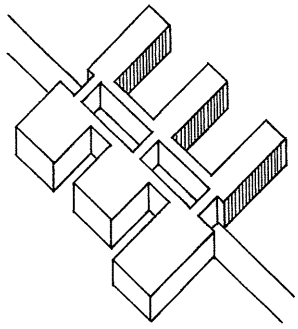
1 Open main corridor (principal traffic route)



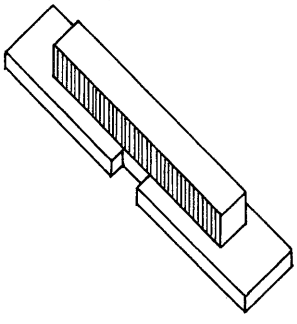
2 Care area above examination and treatment area



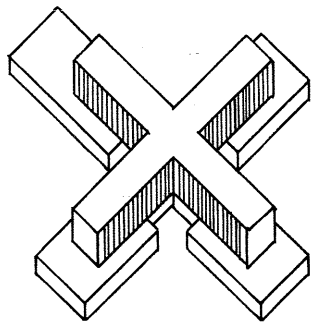
3 Open main corridor, care area next to examination and treatment area



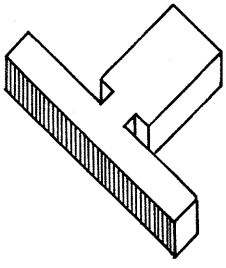
4 → 3



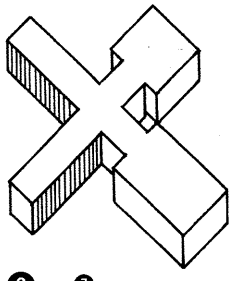
5 Enclosed main corridor, care area above examination and treatment area



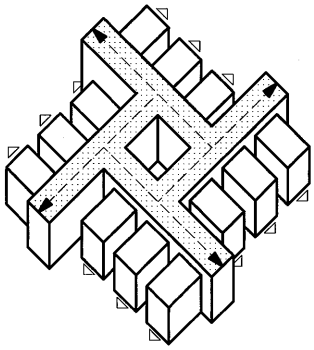
6 → 5



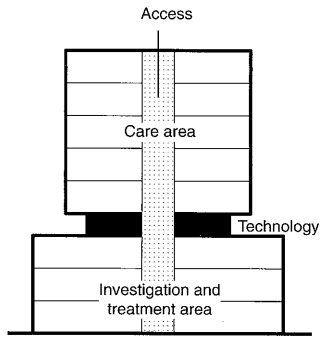
7 Enclosed main corridor, care area next to examination and treatment area



8 → 7



9 Extension possibilities



10 Vertical structure: section through a hospital with care area above examination and treatment area

Useful life

Structure, walls, fittings and finishings have different lifetimes. The structure should if possible be framed in order to keep the construction of the walls and partitions flexible. Medical equipment is replaced after approx. 5–10 years according to department and depreciation, which can have significant effect on the spatial arrangements (e.g. linear accelerators, MRI scanners). The possible installation and removal of such equipment without disrupting the load-bearing structure should be taken into account in the design.

Site

The site for a hospital needs enough space for the building, its access and any possible extensions, and should be in a quiet area. Contaminated ground should be avoided. Separated access roads for visitors and patients, staff, goods and emergency vehicles, as well as a helicopter pad, all need to be taken into account in the selection of a site. The minimum land area for an acute hospital with rectangular layout is approx. 15,000 m^2.

Orientation

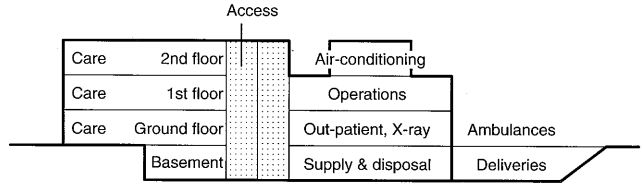
The best orientation for treatment and operational rooms is between north-west and north-east. For the fronts of patient rooms, south-east or south-west is favourable, with pleasant morning sun, little heat build-up, few sun protection measures necessary and temperate evenings. East–west rooms in contrast have deeper summer sun penetration but little winter sun.

Building forms

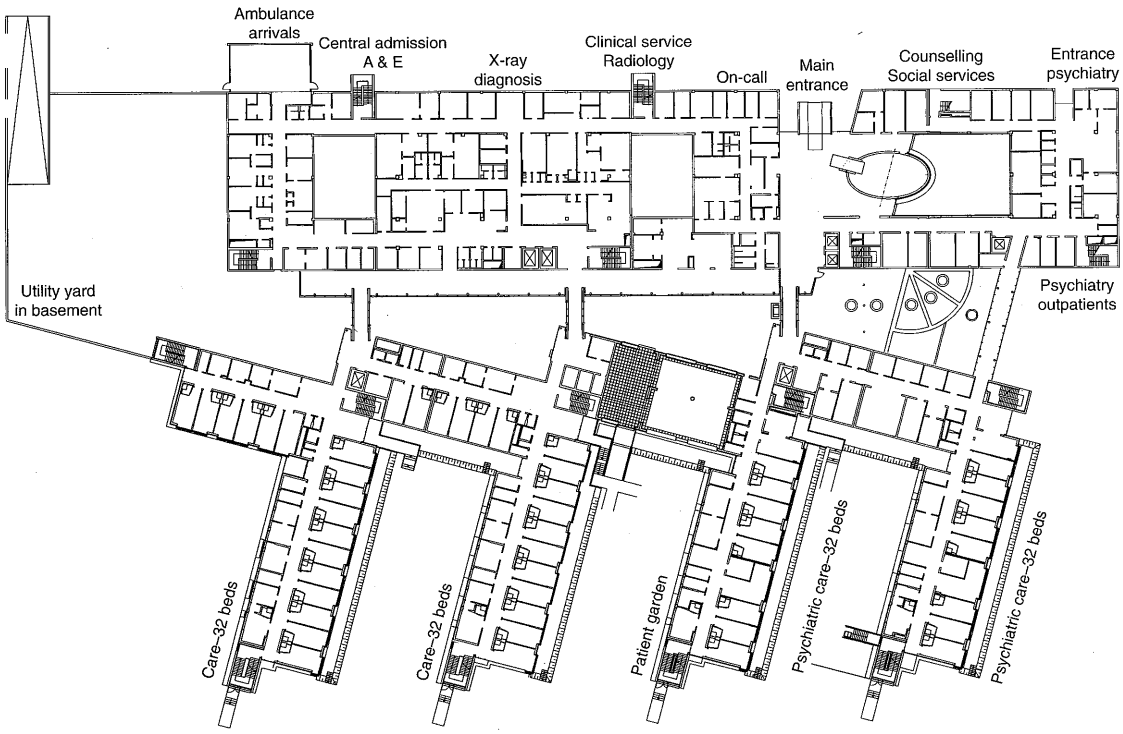
The form of the building is determined to a considerable extent by the selection of access and routeing. A decision should be reached at an early stage whether a design with a main corridor (spine) and branches (transverse corridors) is chosen or whether circulation will be radially outwards from a cruciform core. Possible extensions and construction phases should be taken into account. The vertical section of a hospital should be designed so that the functions care, examination and treatment, supply and waste disposal, delivery of patients on stretchers, service yard, storage, administration and clinical medical service can be laid out separately and reached quickly.

An example of a **vertical structure**:
- top floor: helipad, air conditioning plant
- 2nd–3rd floors: care wards
- 1st floor: operating theatre area, central sterilisation, intensive care, maternity, nursing mothers, children's ward
- ground floor: entrance and information, radiology, clinical medical service, outpatients, delivery of stretcher patients, emergency cases, administration, cafeteria
- basement: archive, physiotherapy, linear accelerator, radiation therapy, laboratory, kitchen with service yard

The different floors' height requirements should be noted: care area approx. height 3.40 m (less construction = flat slab with floor structure = 35 cm = 3.05 m clear height), examination and treatment height approx. 4.20 m, supply and waste disposal and services approx. height 4.20–5.00 m.

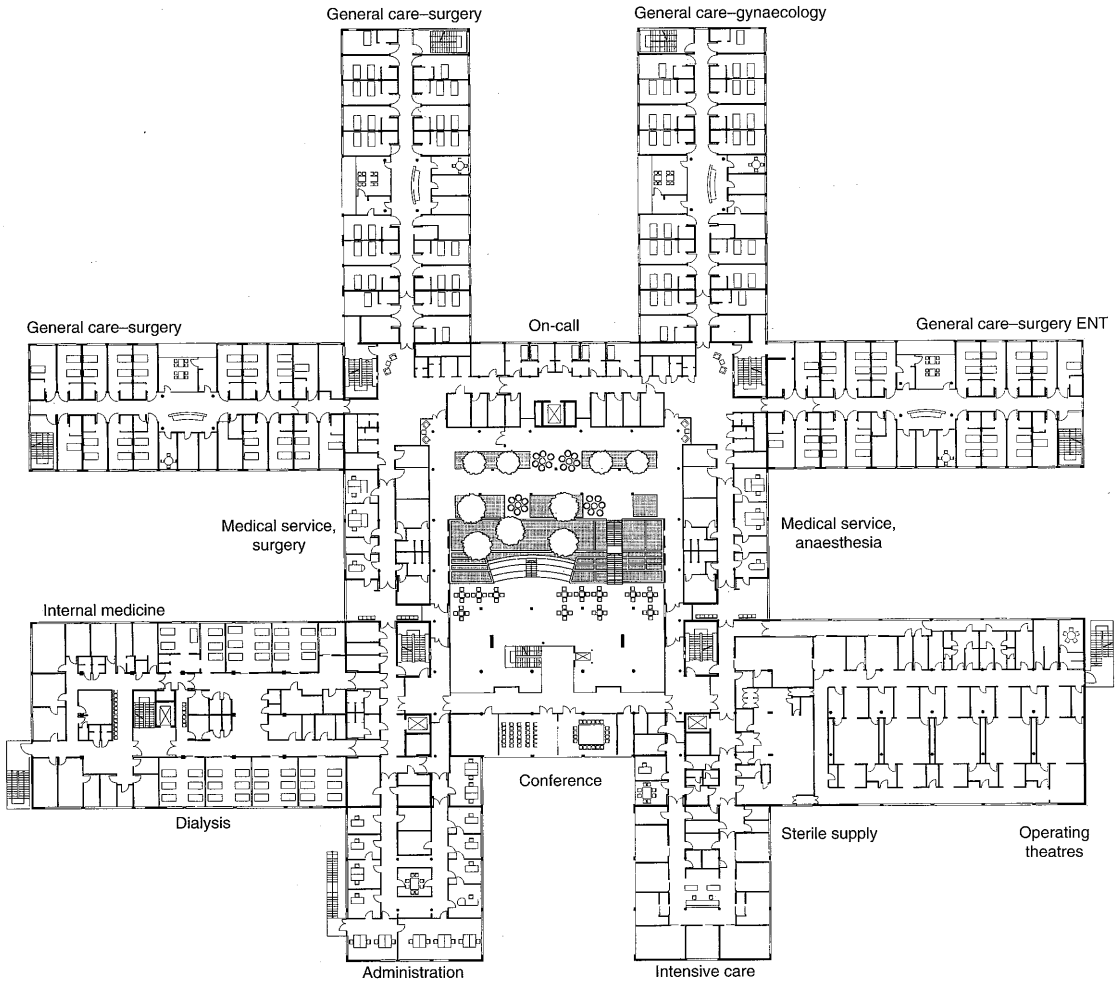


11 Horizontal structure: section through hospital with care area next to examination and treatment area



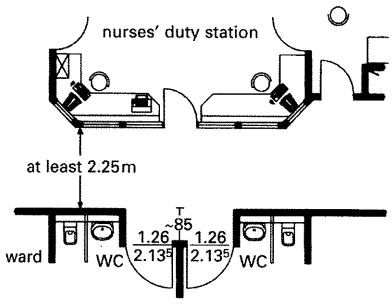
1 St Johann Nepomuk Catholic Hospital, Erfurt, ground floor

Arch.: Thiede Messthaler Klösges

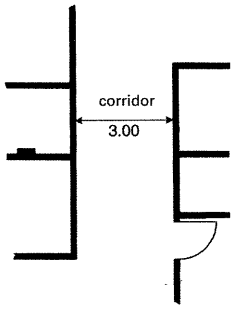


2 Helios Clinic, Gotha, first floor

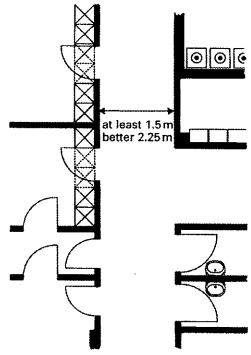
Arch.: WÖRNER+PARTNER



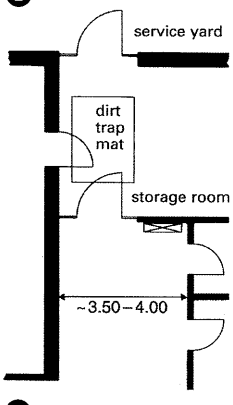
1 Ward corridor/nursing area



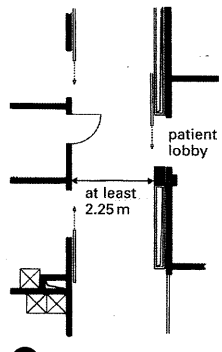
2 Main corridor



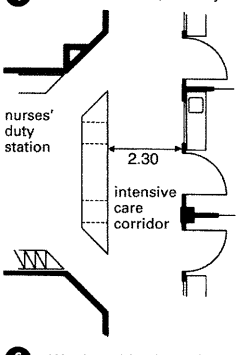
3 Corridor, medical services



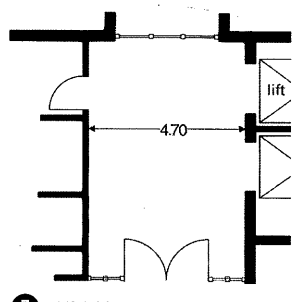
4 Service corridor, delivery and storage



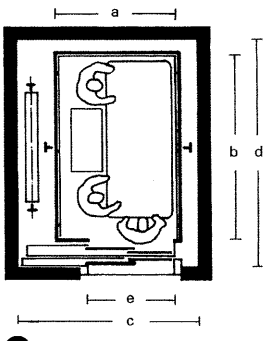
5 Working corridor, operating theatres



6 Ward corridor, intensive care



7 Lift lobby



8 Bed lift

permissible load kg	1600	2000	2500
shaft width c	2400	2400	2700
shaft depth d	3000	3000	3300
car width a	1400	1500	1800
car depth b	2400	2700	2700
car door width e	1300	1300	1300
car door height	2300	2300	2300
car door height	2100	2100	2100
permissible no. people	21	26	33

9 Dimensions of bed lifts → 8

Corridors

Corridors have to be of suitable dimensions for the expected traffic. Generally accessible corridors should be at least 1.50 m wide and those in which patients are transported on beds must have a usable width of at least 2.25 m. The suspended ceiling in corridors can be lowered down to a height of 2.40 min. in order to provide room for service runs. This does, however, lead to the use of special fire protection ceilings in order to secure escape routes. Fire protection requirements must be observed. Internal corridors should be avoided because these have to be mechanically smoke extracted. The usable width of corridors should not be narrowed by installations, columns or other building elements. Windows for lighting and ventilation should not be wider than 25 m apart.

Doors

The placing and selection of suitable doors in hospitals deserves particular attention. The construction and quality of room doors must meet the requirements of sound reduction and fire protection, and the surface cladding must resist long-term cleaning and disinfection.

The clear opening height of doors is according to type and function:

- standard door (unfinished): 885 × 2135 mm
- doors through which beds pass: 1260 –1375 × 2135 mm
- corridor doors, double: 2400 × 2400 mm

In firewalls, T90 doors (held open) should be installed in order not to obstruct traffic.

Stairs

For safety reasons, stairs must be built so that they can accept the entire vertical traffic in case of need. They must also be constructed to prevent sound and odour transfer and prevent draughts. Stairs must have handrails without free ends on both sides. Spiral stairs are not permissible as emergency stairs. The usable width of emergency stairs and their landings must be at least 1.50 m and not more than 2.50 m.

Door leaves must not restrict the usable width of the stair landings. Risers of 17 cm are permissible and treads of 30 cm are recommended. Doors to the stairwells must open in the direction of the escape route.

Lifts

Lifts transport patients, staff and also all supplies and waste. A separation of use should be established for hygienic and aesthetic reasons. The cars of bed lifts require sufficient space for a bed and two accompanying people. The internal surfaces of the lift car must be flat, capable of being washed and disinfected, and the floor must be non-slip. Lift shafts must be fire-resistant.

A multi-purpose lift for beds, ambulant patients and visitors should be provided for every 100 beds. Additionally, there should be suitably located smaller lifts to transport equipment and staff:

- car, clear dimensions: 0.90 × 1.20 m
- shaft dimensions: 1.25 × 1.50 m

HOSPITALS

Operational Areas

Key No.	Area/dept	Key No.	Area/dept
1.00	**Examination and Treatment**	3.03	Information and Documentation
1.01	Admission and Emergency Provision	3.04	Library
1.02	Medical Service		
1.03	Functional Diagnostics	4.00	**Social Services**
1.04	Endoscopy	4.01	Service Facilities
1.05	Clinical Pathology	4.02	Pastoral Care and Social Services
1.06	Pathology	4.03	Staff Changing
1.07	Radiological Diagnosis	4.04	Staff Catering
1.08	Nuclear Medicine Diagnosis	5.00	**Supply and Waste Disposal**
		5.01	Pharmaceutical Supply
1.09	Surgery	5.02	Sterile Goods Supply
1.10	Maternity	5.03	Equipment Supply
1.11	Radiotherapy	5.04	Bed Preparation
1.12	Nuclear Medicine Therapy	5.05	Catering
1.13	Physiotherapy	5.06	Laundry
1.14	Occupational Therapy	5.07	Storage and Goods Handling
1.15	On-call Duty		
		5.08	Maintenance and Repair
		5.09	Waste Disposal
2.00	**Care**	5.10	House and Transport Services
2.01	General Care		
2.02	Nursing Mothers and Antenatal Therapy	6.00	**Education and Research**
2.03	Intensive Care	6.01	Research
2.04	Dialysis	6.02	Education
2.05	Paediatric Care	6.03	Training
2.06	Infectious Diseases		
2.07	Psychiatric Care		
2.08	Nuclear Medicine Care	7.00	**Other**
2.09	Admission Care	7.01	Ambulance Service
2.10	Geriatric Care	7.02	Limited Care Dialysis
2.11	Day Clinic	7.03	Child Care
		7.04	Outward Services
		7.05	Inward Services
3.00	**Administration**	7.06	Residential
3.01	Management and Administration		
3.02	Records		

1 Categorisation of a hospital into functional areas and departments

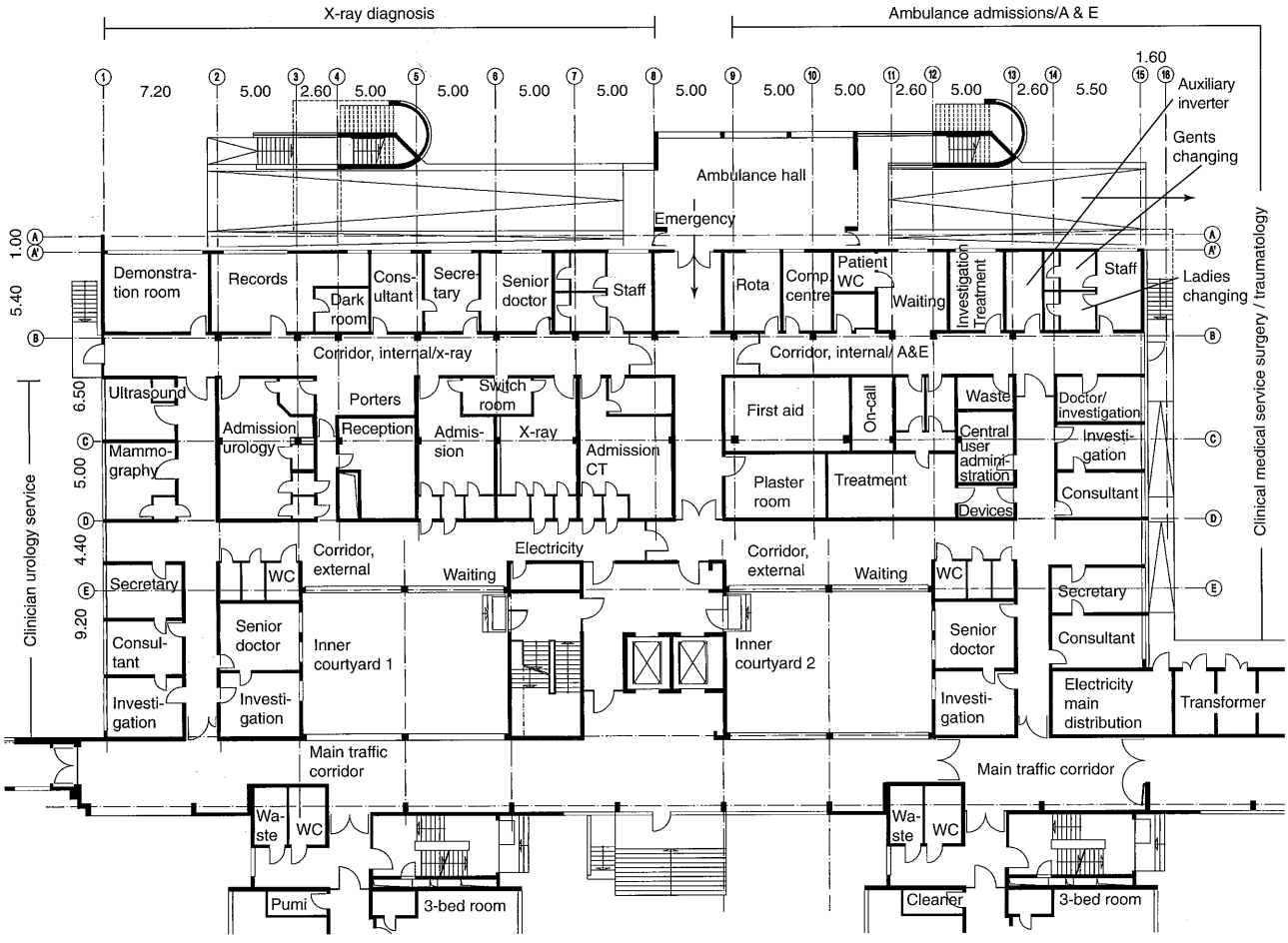
Hospitals are laid out according to operational areas and operational departments:

- examination and treatment
- care
- administration
- social services
- education and research
- other

The examination and treatment area is, besides care, the most important within the overall organisation of a hospital and is characterised by particular features resulting from its specialisation and equipment.

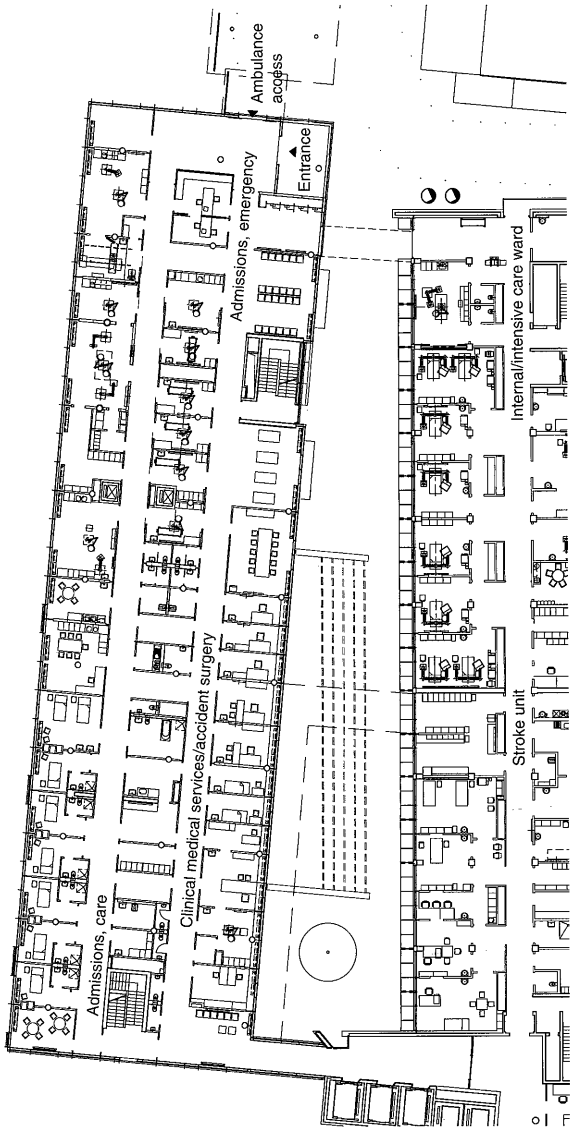
Patient–doctor contact varies according to discipline, as does the frequency of patient examinations. The precise determination of the location of the various examination and treatment areas in the building and their relation to each other can be made in general terms. The individual departments in the examination and treatment area are preferably situated in the basement, or on the ground floor and first floor, with outpatient attendance concentrated in the ground floor. The combination of all medical disciplines into a cohesive area is important in order to improve cooperation and consultation.

NB: On hospital plans, Pumi and Fango are types of therapy. OT = occupational therapy.

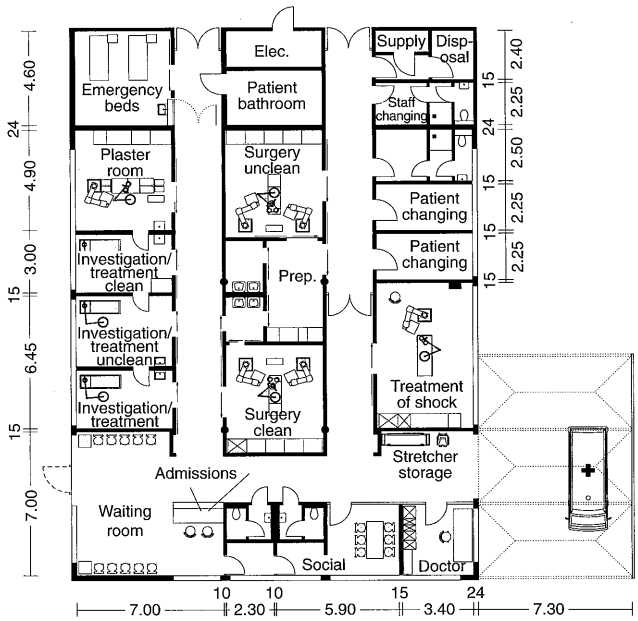


2 Partial plan of Luckenwalde Hospital, 300 beds

Arch.: Thiede Messthaler Klösges



1 Outpatients, ground floor, Berlin-Spandau Hospital; today: Vivantes Clinic Berlin-Spandau Arch.: Heinle, Wischer und Partner Freie Architekten



2 Emergency admission, Helios Clinic, Gotha Arch.: Wörner + Partner

Outpatient facilities

Facilities for outpatient treatment are visited daily or consulted many times, according to an appointment schedule, by patients capable of walking.

Of particular importance is the allocation of outpatient rooms. A separation of the routeing of outpatients and inpatients should be included in the design work at an early stage. The number of outpatients attending depends on the size of, and the specialist departments in, a particular hospital. If there are a large number of outpatients, then a larger dedicated area can be provided, separate from the rest of the activity. There must, however, always be a rapid connection to the X-ray department. The increasing significance of outpatient (day) surgery should also be considered (larger waiting rooms, more outpatient rooms).

Outpatient surgery

The share of operations performed on outpatients will increase further. Outpatient (or day) surgery departments can be added to existing hospitals, integrated into the surgical department or set up as independent clinics. In the hospital, the department should be near the main entrance and the emergency care department.

The patients in an outpatient surgical centre (mainly undergoing elective operations as part of an outpatient, day clinic or short-stay treatment arrangement) are in a different physical and mental state from patients delivered as emergency cases. A clear guidance and signposting system and friendly, confidence-boosting ambience are particularly recommended.

One surgical department which concentrates on elective outpatient treatment, has a 'modern' room arrangement with smaller operating theatres (approx. 30 m^2), a multi-functional preparation room, smaller washrooms for two operating theatres, one recovery room with five places, and a quiet zone. There are no purely preparation and post-op rooms, storerooms or classic access control lobbies for patients.

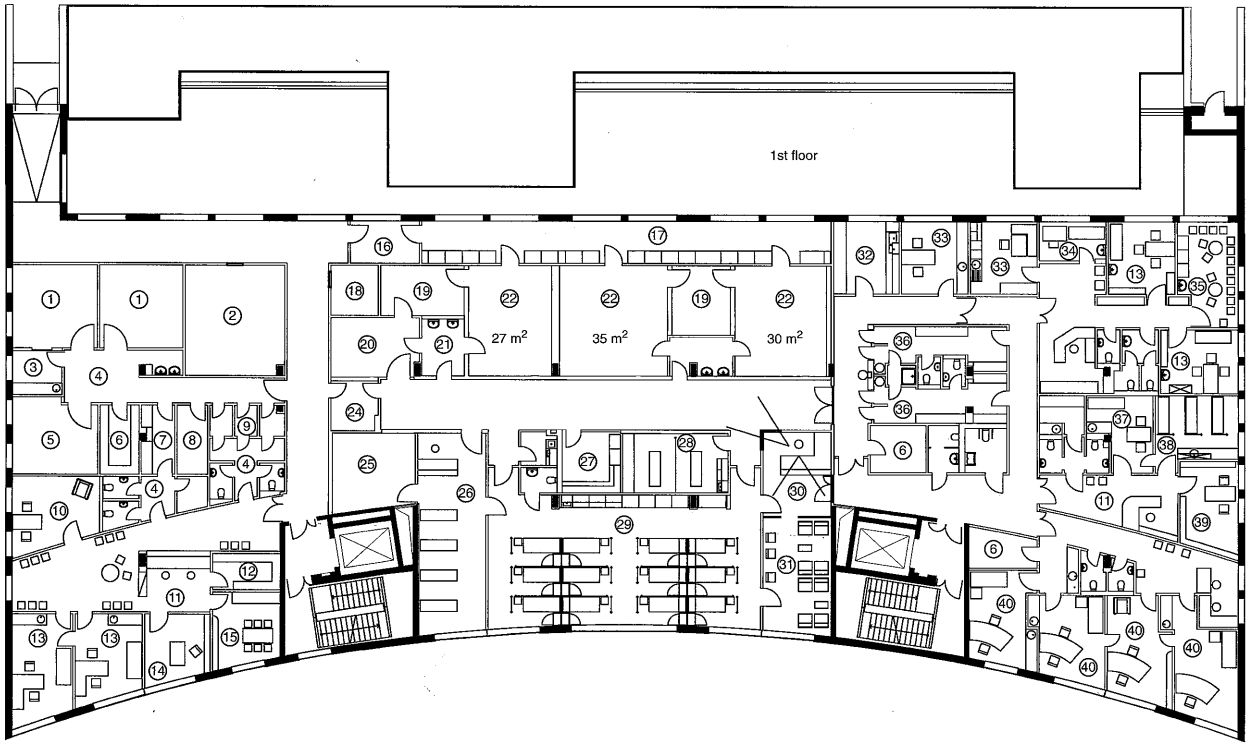
Outpatient medical centre

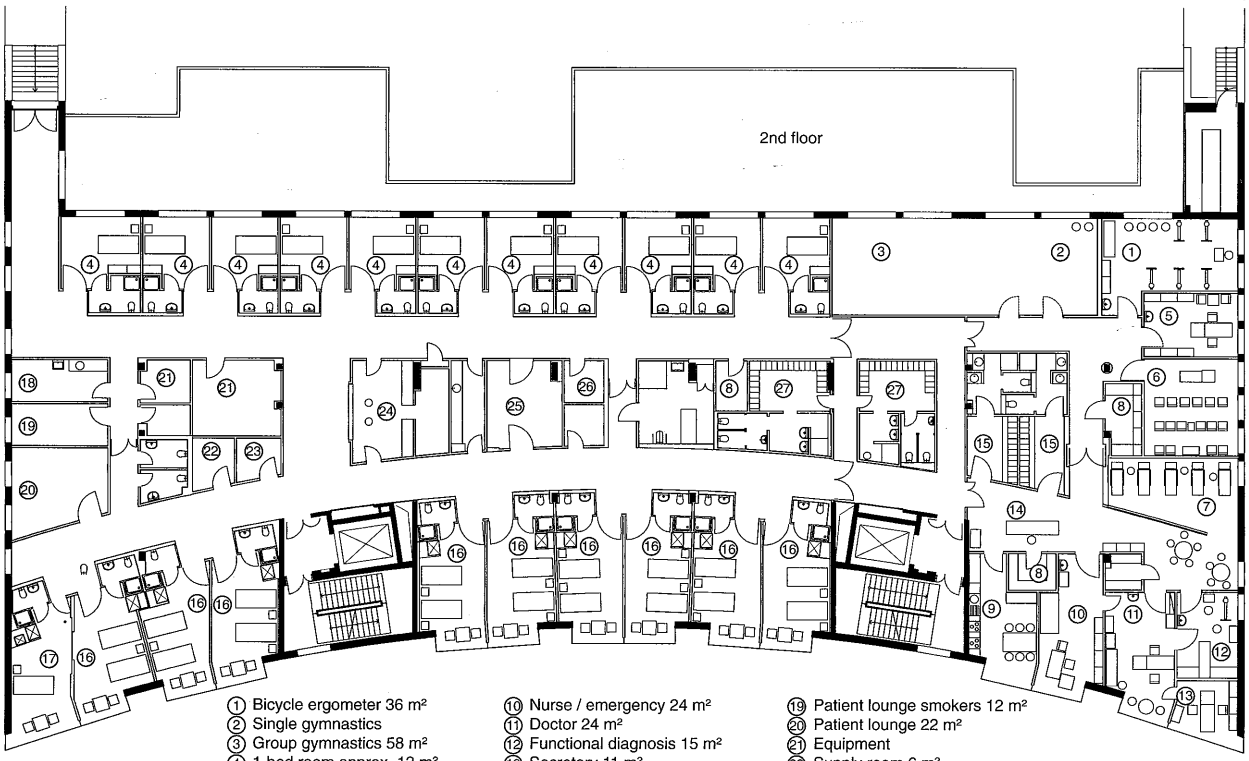
This is a separate establishment associated with a hospital for the treatment of patients on an outpatient or short-stay basis; the room and organisational structure differ considerably from inpatient hospital treatment. The spectrum of complaints treated and the medical services offered have to be considered. The technical medical equipment can be reduced and the room furnishing can be designed rather more generously regarding hygiene (e.g. carpets, parquet).

Inpatient care and therapy of patients with infectious diseases, chronic illnesses, serious complications after an operation etc. are not provided here, so the stringency of the hospital building regulations can be partially relaxed or even waived for a particular project with carefully reasoned exemption applications.

The decision about the quantity and quality of ventilation equipment, anaesthetic technology, ceiling supply units, radiation protection equipment etc. should be critically examined, because there are considerable potential savings. For most operations, air-handling systems to reduce bacteria counts and particles are not necessary, so the advance determination of the planned spectrum of operations is also of economic significance.

① Operating room
② Services – ventilation 32 m²
③ Instrument preparation 6 m²
④ Internal corridor
⑤ Preparation, post-op room 19 m²
⑥ Store 8 m²
⑦ Staff vestibule 6 m²
⑧ Waste disposal 6 m²
⑨ Changing room
⑩ Doctor's room 15 m²
⑪ Reception/waiting 55 m²
⑫ Records, server 15 m²
⑬ Consulting room approx. 13 m²
⑭ Writing room 13 m²
⑮ Staff social room 14 m²
⑯ Waste disposal vestibule 8 m²
⑰ Sterile goods store 50 m²
⑱ Services – electricity 7 m²
⑲ Devices operations approx. 12 m²
⑳ Operating room, washing 15 m²
㉑ Operating room 7 m²
㉒ Operating theatre
㉓ Washing 7 m²
㉔ Waste disposal vestibule 7 m²
㉕ Patient vestibule 19 m²
㉖ Recovery room (4 places) 40 m²
㉗ Sedation 10 m²
㉘ Regional anaesthesia 19 m²
㉙ Post-op room (12 places) 110 m²
㉚ Nurse's station, monitoring 17 m²
㉛ Waiting, outpatient operations 23 m²
㉜ Disinfection room 14 m²
㉝ Staff social room 14 m²
㉞ Isolation room 8 m²
㉟ Waiting room 17 m²
㊱ Operations vestibule 14 m²
㊲ Treatment 12 m²
㊳ Pain, outpatients 16 m²
㊴ Office 15 m²
㊵ Consulting room

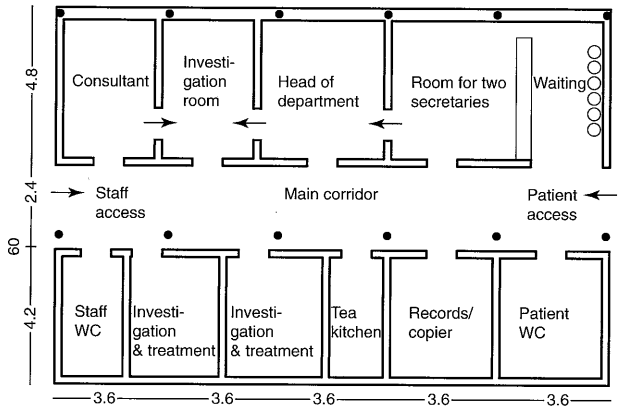




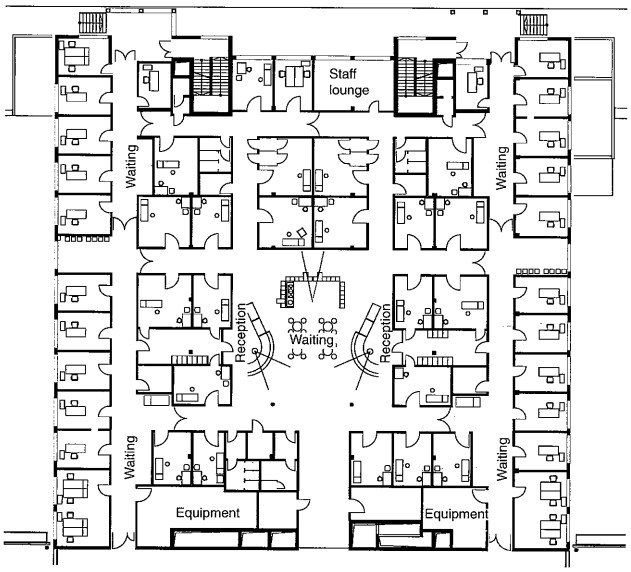
① Bicycle ergometer 36 m²
② Single gymnastics
③ Group gymnastics 58 m²
④ 1-bed room approx. 13 m²
⑤ Consulting 18 m²
⑥ Seminar room 27 m²
⑦ Rest room 25 m²
⑧ Store
⑨ Diet kitchen / staff social 21 m²
⑩ Nurse / emergency 24 m²
⑪ Doctor 24 m²
⑫ Functional diagnosis 15 m²
⑬ Secretary 11 m²
⑭ Reception / access / cafe 51 m²
⑮ Changing room approx. 9 m²
⑯ 2-bed room approx. 23 m²
⑰ Suite 23 m²
⑱ Staff social 12 m²
⑲ Patient lounge smokers 12 m²
⑳ Patient lounge 22 m²
㉑ Equipment
㉒ Supply room 6 m²
㉓ Disposal room 5 V
㉔ Reception / monitoring 18 m²
㉕ Investigation & treatment 18 m²
㉖ Laundry 5 m²
㉗ Staff changing approx. 11 m²

1 Medical centre at the Oskar-Ziethen Hospital, Berlin-Lichtenberg

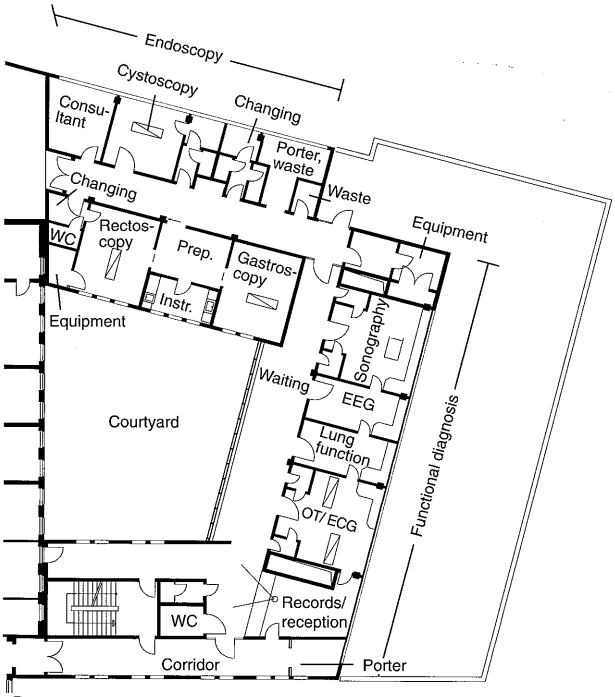
Arch.: Deubzer König Architekten



1 Clinical medical unit



2 Interdisciplinary clinical medical service Arch.: Thiede Messthaler Klösges



3 Endoscopic and functional diagnosis department, with beds, at Beizig Hospital
Arch.: Thiede Messthaler Klösges

Reception and emergency provision
The accident and emergency unit must be quickly reached by accident patients (on stretchers) via the ambulance hall (clear access road height = min. 3.50 m) and by ambulant patients from the main entrance.

A good location for this department is the opposite side to the main entrance. The department consists of a row of small examination and treatment rooms (16–21 m^2), equipped with a couch, small operating light, cupboard units with sink and possibly patient cubicles. There must also be a plaster room with plastering bench and a first-aid room for treating shock. Additionally, surgery rooms (similar to operating theatres) should be available. The X-ray department should be nearby. Storage places for at least two stretchers and for wheelchairs should be provided in the ambulance hall.

The clinical service doctors, surgeons and anaesthetists should be grouped in the vicinity.

Clinical medical service
This term describes all the management rooms of the individual specialist departments/clinics. The classic medical service facilities include a medical superintendent's room with office support, a senior doctor's room and an examination room with waiting area and toilets. These clinical medical service rooms form the core of the outpatient zone on the ground floor of the hospital.

General medicine (internal medicine)
Further rooms should be provided for the following specialisms:
Ophthalmology: Treatment room (25 m^2) with slit lamp, capable of being darkened; squint treatment room; laser room.

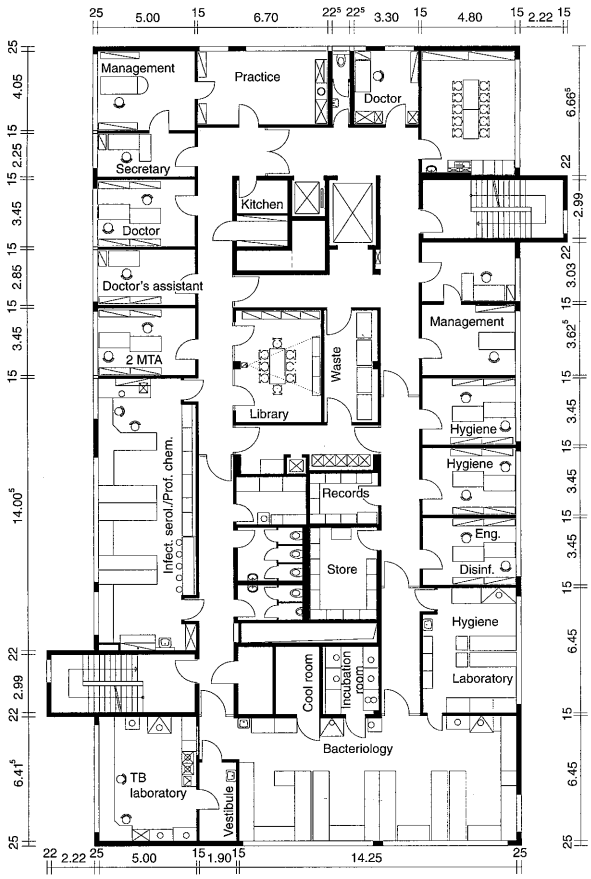
Ear, nose and throat: Treatment room (25–30 m^2), capable of being darkened, with treatment table or treatment chair for examinations.

Urology: Urological treatment is connected with X-ray diagnosis. The treatment room (25–30 m^2) has a table for endoscopic examinations and is equipped with suspended irrigator and floor drainage. Next door is an instrument room with sink.

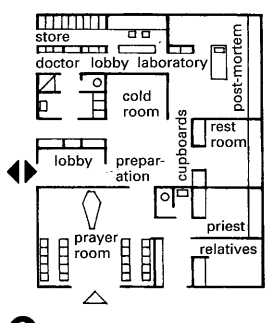
Functional diagnosis
Functional diagnosis is becoming ever more important in hospitals, partly due to progress in heart/thorax examinations and also the increase in complaints relating to heart-lung and circulation functions.

All examination rooms must be accessible through patient cabins, possibly also preparation rooms (for left heart catheter measurement).

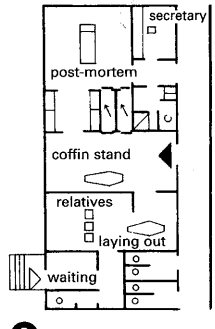
Endoscopy
An endoscope is a mirror instrument used to illuminate and observe cavities inside the body. It is inserted through natural body openings with the patient under partial anaesthesia. The categories are gastroscopy, bronchoscopy, rectoscopy, laparoscopy and cystoscopy. The device is prepared directly in the examination and treatment room. WCs should be provided for the patients before entering. This department should have a bedded waiting area and rest room (beds = no. of endoscopy rooms × 2) .



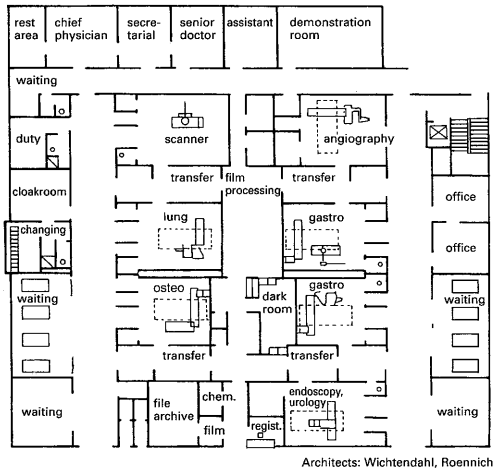
1 Laboratory area at the Dr. Horst Schmidt Clinics, Wiesbaden
Arch.: Wörner + Partner



2 Soltau District Hospital, 354 beds
Arch.: Poetzig, Biermann



3 Pathology department at the St. Clemens Hospital, Geldern, 480 beds
Arch.: Poetzig, Biermann



Architects: Wichtendahl, Roennich

4 Munich-Perlach Hospital, 687 beds

Laboratory medicine

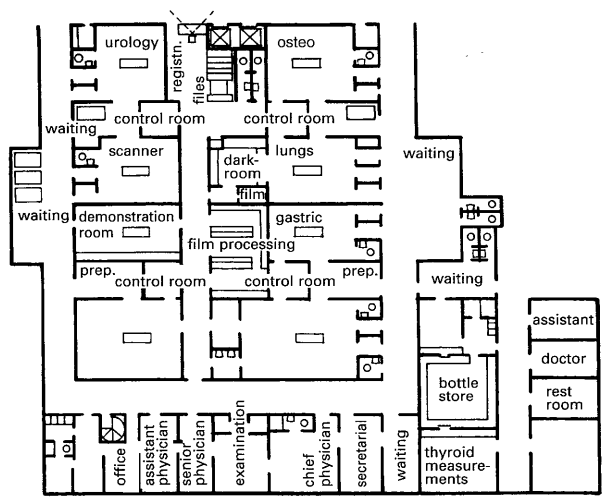
The laboratory is mostly concerned with the preparation and processing of blood, urine and stool samples. The laboratory should be a large room with standing and sitting workstations. Specialist laboratories are added on as separate rooms. Subsidiary rooms include rest room for staff, rinsing room, sluice room, disinfection room, cold room. Quick connection to other departments is provided by a pneumatic delivery system. Laboratory areas can also be completely off-site and serve several hospitals.

Pathology

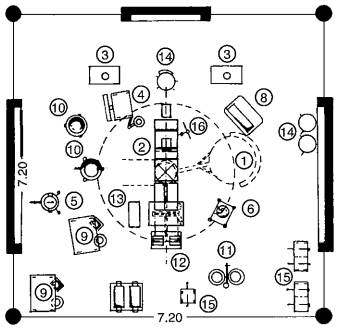
The pathology department of a hospital includes rooms for storage of bodies, dissection, refrigeration of bodies, laying out, placing into coffins, coffin storage and changing rooms for the pathologists. Separate access for relatives and the shortest possible road access for undertakers are important. This department should not be in the vicinity of the service yard.

Radiology

Radiology requires rooms in which ionising radiation is applied for diagnostic and therapeutic purposes. It should be near the outpatients department and the ambulance approach road. The heavy weight of the equipment (up to approx. 14 t) means that this department is better located on the ground or first basement. A connecting room for staff, which also serves as store, dictation room and possibly as switchroom, is advantageous. The size of the departments' rooms is determined by the large medical equipment and related technology. Sonography, mammography and jaw radioscopy need room sizes of approx. 15–18 m^2, radioscopy and exposure rooms approx. 20–30 m^2. The access for patients should be through two changing cubicles for each radioscopy room and a wide (1.25 m) door for beds is also necessary. WCs for gastroscopy, colonoscopy and contrast medium patients should be attached to the radioscopy rooms. Angiography rooms require a preparation room with cupboard units (sink, pharmaceutical refrigerator). The exposure room for computer tomography must have dimensions of approx. 35 m^2. Between the switchroom and the exposure room is a door and a clear window. An additional room for switching cabinets and a room for film development are also sensible. The walls and ceilings are protected with lead inserts (e.g. in plasterboard walls). The lead equivalent values in walls and ceilings depend on the X-ray equipment and its manufacturer, with whom early collaboration is essential.

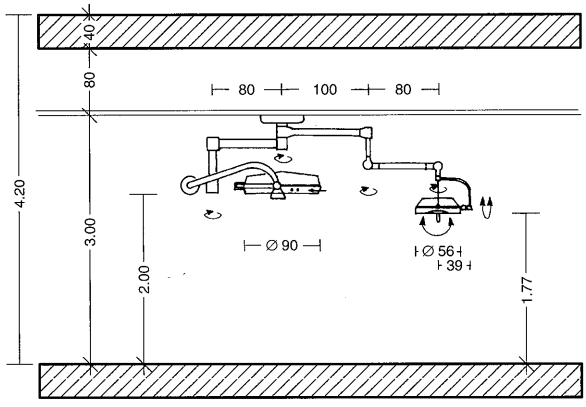


5 Fulda City Hospital, 732 beds: centre of examination and treatment area, near the functional diagnosis and nuclear medicine diagnosis departments
Arch.: Köhler, Kässens

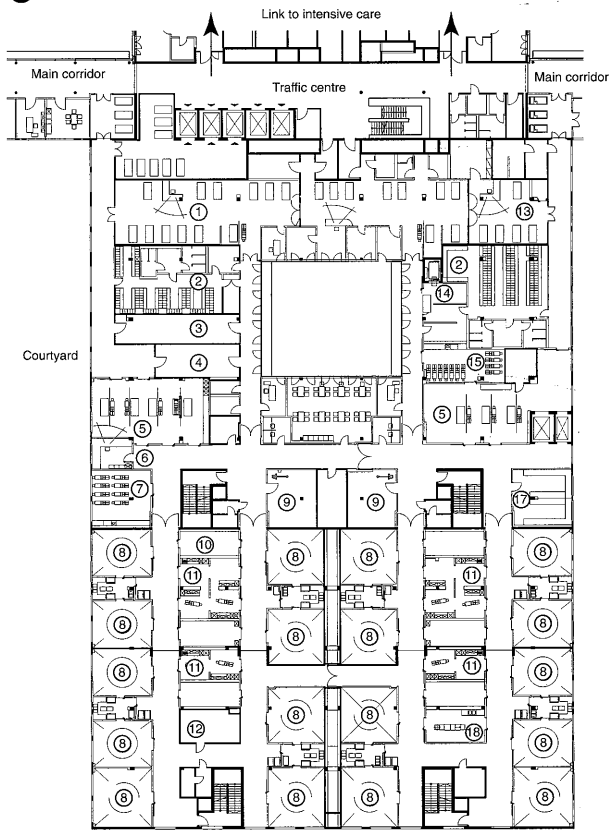


① overhead operating lamp
② operating table with fixed base
③ wall or ceiling pendulum
④ anaesthesia equipment
⑤ dish stand with heater
⑥ electric suction pump
⑦ X-ray display box
⑧ anaesthesia table
⑨ instrument table
⑩ waste bin, used instrument container
⑪ dish stand without heater
⑫ suturing materials table
⑬ operating steps
⑭ swivel stool for surgeon
⑮ drum stand
⑯ infusion stand

1 Equipment plan for operating theatre



2 Suspended lamp for operating theatre with satellite



① Recovery room
② Staff changing room
③ Supply vestibule
④ Waste disposal vestibule
⑤ Patient rebedding
⑥ Operations control centre
⑦ Trolley cleaning/store
⑧ Operating theatre
⑨ Equipment
⑩ Wash places
⑪ Entrance and exit zone
⑫ Electricity
⑬ Children's recovery room
⑭ Disposal of sterile goods
⑮ Trolley cleaning
⑯ Staff lounge
⑰ Rapid section laboratory
⑱ Plaster room

3 Surgery zone at the Helios Clinic Berlin-Buch, 1000 beds
Arch.: Thiede Messthaler Klösges Keitel

Operating department

The location of the operating department in the overall organisation of the hospital is of great significance. The design should include a short distance to the intensive care unit, recovery room and central sterile store, because rapid access between these departments must always be ensured. Surgical departments are best placed centrally and with easy accessibility in the core of the hospital.

Organisation of the operating department

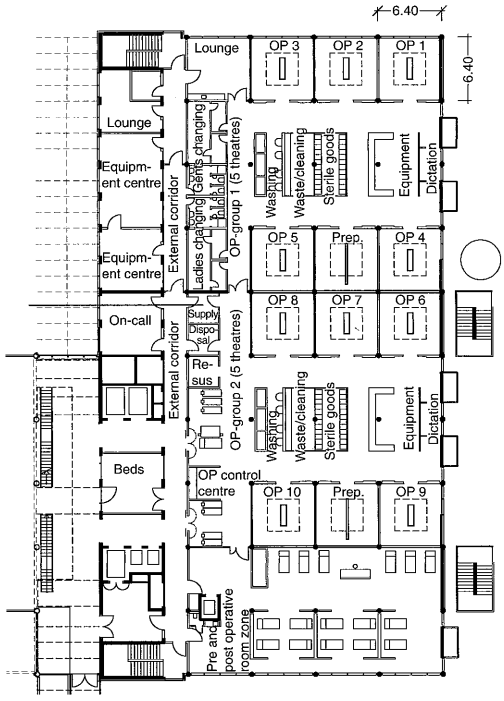
The following rooms or room zones belong in every operating department:

– operating theatre, preparation, transfer, scrub room, sterile goods store, with a total area of approx. 80 m².

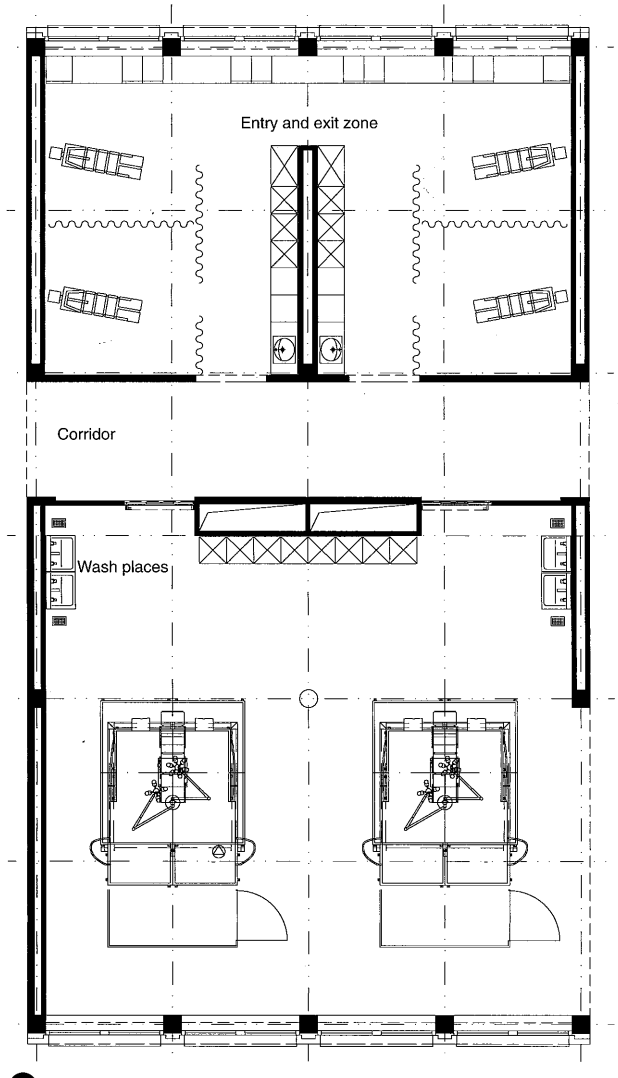
The operating theatre should be as square as possible to enable proper working with the operating table (size approx. 6.50 × 6.50 m) turned in any direction. The clear ceiling height must be 3.00 m with a space above the ceiling of approx. 70–80 cm for air conditioning and other services. Operating theatres should be designed to be as uniform as possible to enable interdisciplinary work. The doors to the operating theatre operate automatically.
The basic equipment includes an adjustable and transportable operating table system mounted on a fixed plinth in the centre of the operating theatre.

Routeing

In order to reduce infection through contact, the various work processes should be separated.
The one-corridor system, in which pre- and post-operative patients, clean and dirty goods can all be present in one corridor leading to the theatres, is still often used today for reasons of cost and space.
Two-corridor systems are better, with the patients and staff or patients and dirty goods separated. The separation of the flow of patients from the work area of the operating theatre is important.
In exceptional cases a **preparation room** is sensible. The size is approx. 3.80 × 3.80 m. Electrical sliding doors on the side toward the operating theatre, with 1.40 m clear opening width and clear windows, which should provide a connection to the operating theatre. The fixtures should include refrigerator, sink, rinsing unit, cupboard for cannulas, sockets for anaesthetic equipment and emergency power supply.
Likewise, a **transfer room** is advisable only in exceptional cases. It is equipped like the preparation room. There is a sliding door to the working corridor with a clear width of 1.25 m. There should be a sink.
A **scrub room** with at least six places should be provided in the immediate vicinity of the operating theatre. The minimum width of the room should be 1.80 m.
One **sterile goods room** is required per operating theatre, of approx. 10–15 m². This must be directly accessible from the operating theatre. There are also floor layouts with a large central sterile goods store. The **equipment room** should not be too far from the operating theatre; size 20 m².
The **operating theatres control centre** should be centrally located and have a large area of glass from which to oversee the working corridor. In addition to a desk, there should be cupboards and a pin-board for organisational planning.
Dictation rooms can be provided as small room units of approx. 6 m², as the surgeons need this room only for reports after operations.
There must be a **cleaning room** of 5 m² in every operating department, because cleaning and disinfection is performed after each operation. Near the control lobby for patients, sufficient space should be provided for clean, prepared beds, one clean bed per operation.
Toilet facilities should not be located near the patients' control lobbies, and are to be avoided in the operating area for hygienic reasons.



1 Operating department (10 theatres), first floor, Brandenburg an der Havel City Clinic, Newbuild West Arch.: Heinle, Wischer und Partner Freie Architekten



2 Large operating theatre with associated entry and exit zones

A number of essential supply and workrooms are associated with the operating theatre. The operating department includes staff and patient control lobbies, instrument preparation, waste disposal control lobbies, supply control lobbies, storage space for operating trolleys and also, in the direct vicinity, the recovery room. Integrated into the patient control lobby are the functions bed transfer, preparation of the operating table and storage for operating tables.

A replacement power supply is necessary for operating departments to ensure the continuance and completion of operations in case of a mains failure.

Post-operative patient monitoring

The **recovery room** has to accept post-op patients from several theatres. The number of beds required is thus 1.5 times the number of theatres. There should be a nurse's observation point with a view of all beds and a dirty room next door. The recovery room should be designed as a large, suitably arranged space.

The **equipment preparation room for anaesthetic devices** has a dirty side for unsterile (infected) material and a clean side for devices prepared for use. The fittings include sink, storage and worktop space, and steam sterilisers. Operating instruments are prepared exclusively in the central sterile store, which is situated outside the operating zone.

A **plaster room** with plastering bench also belongs in the operating suite, particularly where many surgical-orthopaedic operations are carried out.

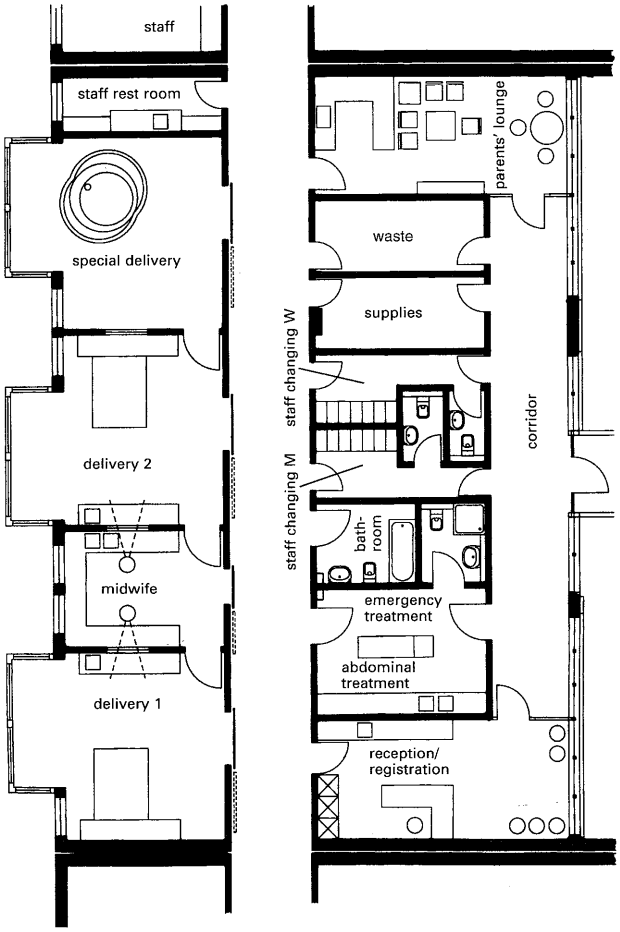
The dimensions of the **staff lounge** correspond to the size of the operating department. Each theatre team (surgeons, anaesthetists, operating department practitioners (ODPs), theatre nurses, anaesthesia nurses) should be assumed to have eight members. The lounge should have sufficient seating, cupboards and a sink.

Natural **lighting** of the operating theatre is psychologically advantageous, but is often impractical due to the layout of the rooms. The artificial **lighting** of the operating environment must be designed so that the light can fall from various directions according to the layout of incisions. The most frequently used lighting system is the mobile operating light suspended from the ceiling. This consists of a swivelling ceiling light, usually equipped with an additional light in the form of a satellite. The main light contains a number of small lights in order to avoid sharp shadows.

The division of the operating theatre into septic and aseptic zones is medically controversial, but is still sensible as a precaution. Floor and walls must be flat and easily washable throughout.

Air conditioning

Operating departments are nearly always air-conditioned. The ventilation serves to reduce micro-organisms by filtering, diluting and replacing the air. The supply of appropriately conditioned air in the required quantities is provided by the air-conditioning system. 15–20 air changes are required per hour to achieve a reasonable decontamination of the air between operations. In order to create an extensively sterile zone in the operating theatre, there should be no uncontrolled air intake from surrounding rooms. This can be achieved through an airtight envelope around the operating theatre (tightest possible joint sealing during construction) and/or by protective pressurising (i.e. pressure dropping from the room to be protected to other, less vulnerable areas). A standard lays down the air flow direction in the operating area. The operating theatre has the highest pressure in order to prevent air entering. The lowest pressure should be in the subsidiary and functional rooms. Windows in operating theatres should be lockable.



1 Maternity/birth assistance St Elisabeth Hospital, Halle

Maternity unit

In addition to the task of overseeing normal births, the maternity unit also treats women with complications. A room similar to an operating theatre, for caesarean births, is therefore absolutely necessary in addition to the normal delivery rooms. In situations where a theatre-like delivery room is not possible inside the maternity unit, the unit should be next to the general operating theatre. The maternity area should be attached to the post-natal and baby care zones.

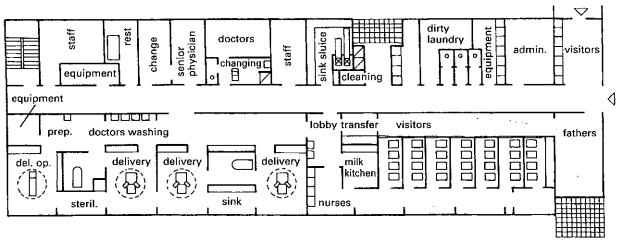
The delivery suite should include a room for midwives and for observation (large glass window) and a labour room. The delivery room should be equipped with a changing table with integrated baby bath and a radiant heater. A demand has arisen recently for further equipment for various types of birth (water birth etc.), and a bath for relaxation near the delivery room is also very popular. A specific team of staff work in the maternity unit and require the appropriate lounge, clean and dirty workrooms, reception, and toilets for staff and patients.

Radiotherapy

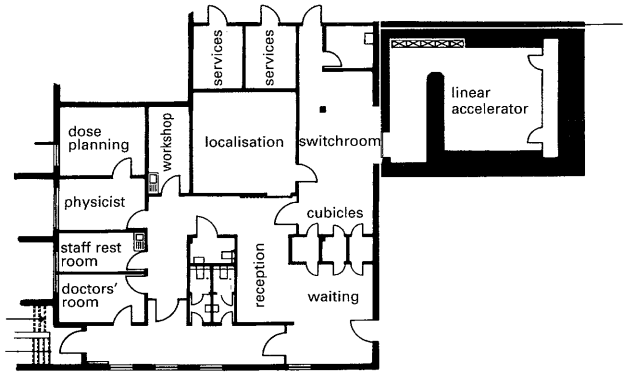
Conditions diagnosed as tumours are treated in the radiotherapy department. Each treatment room requires a changing cubicle for ambulant patients and a waiting area for bedbound patients, and each department requires doctor's rooms, a switchroom, possibly a localisation room, services rooms and a film development room. A workshop and at least one physics laboratory are also necessary.

The safety conditions are particularly stringent for radiation therapy: a series of laws, regulations and standards is in place. Radiation protection can be achieved by using lead inserts or thick concrete (e.g. barite concrete) walls.

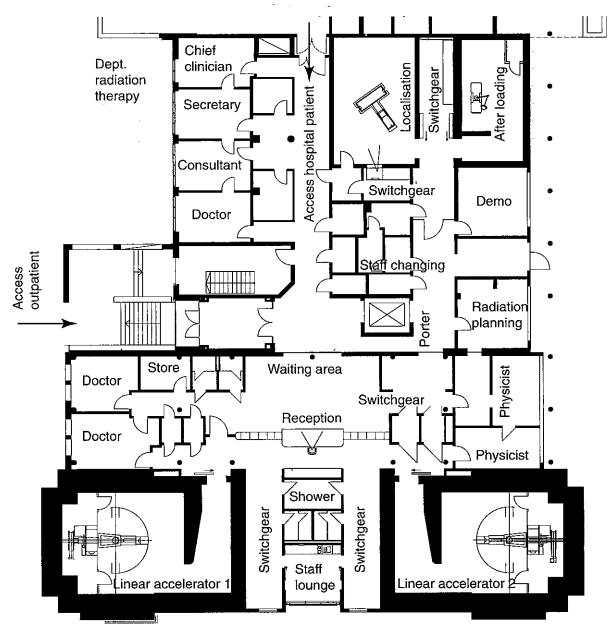
The massive weight of radiation equipment and its required constructional radiation protection mean that radiation therapy will be located in the basement or ground floor. The clear ceiling height of radiation rooms must be 3.00 m and the concrete walls can, depending on the exact equipment, be up to 3.00 m thick for the treatment and examination area in the primary radiation area and up to 1.50 m thick for the secondary area.



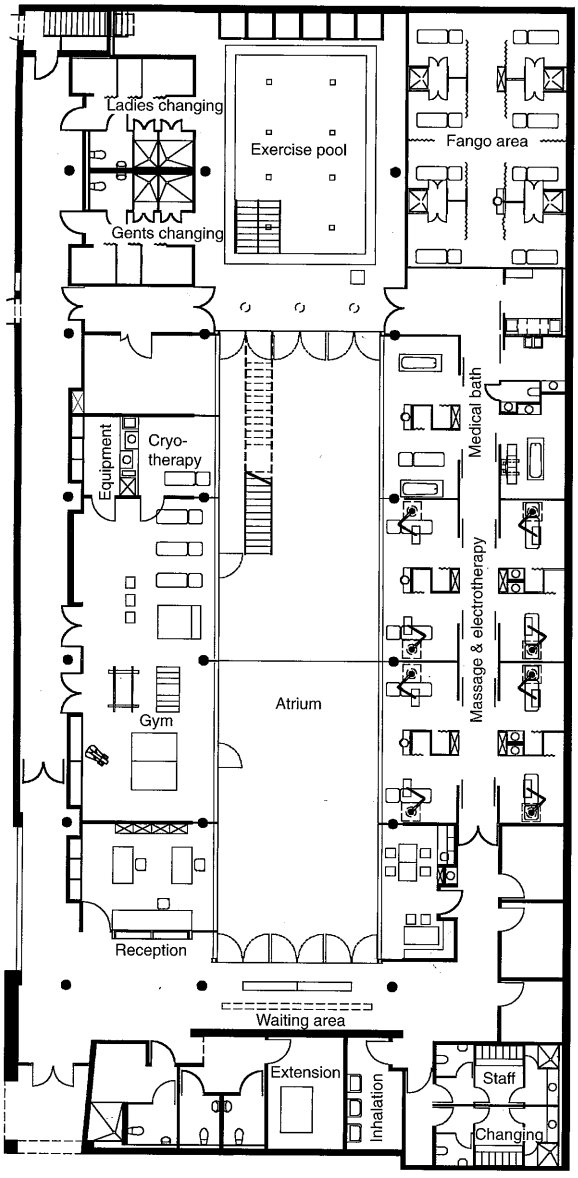
2 Waldbröl District Hospital, 448 beds; bath and sink provided next to every two maternity places Arch.: Karl Monerjan



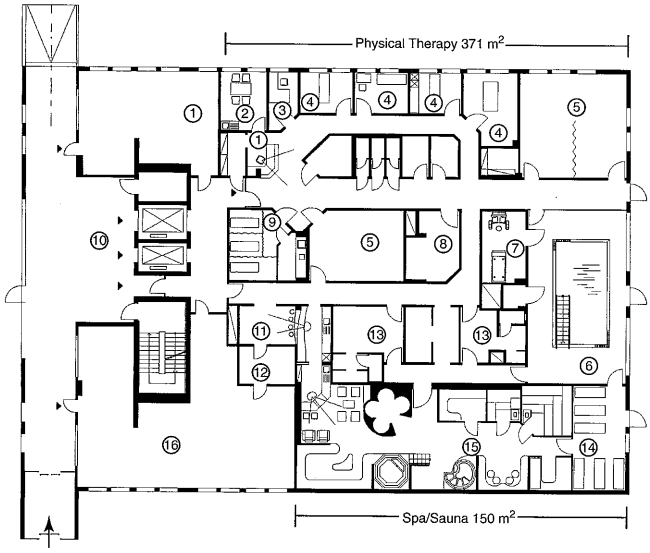
3 Linear accelerator department Arch.: U + A Weicken



4 Radiation therapy department, Werner-Forssmann Hospital, Eberswalde, 475 beds Arch.: Thiede Messthaler Klösges



1 Physiotherapy, first floor, Berlin-Spandau Hospital; today: Vivantes Clinic, Berlin-Spandau
Arch.: Heinle, Wischer und Partner Freie Architektenen



2 Physiotherapy, ground floor, Thüringen Clinics, Saalfeld-Rudolstadt
Arch.: Thiede Messthaler Klösges Kasper

Physiotherapy

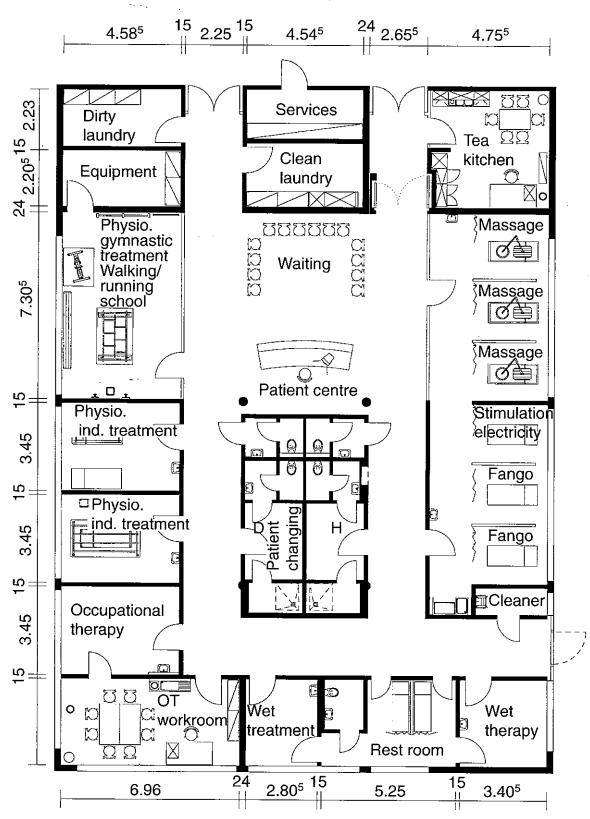
This department can be placed on the ground floor, but should have adequate natural ventilation through rooflights or light shafts. It must be accessed through a reception area.

Physiotherapy is divided into a dry and a wet area, the latter consisting of exercise bath (approx. 4 × 6 m), 'four-cell' bath, 'butterfly' bath, inhalation rooms, massage baths, hand-foot baths and the associated subsidiary rooms. The separation between wet and dry areas should be implemented completely.

The necessary subsidiary rooms are changing rooms for women and men, wheelchair-friendly toilet, staff and patient toilets, lounge, laundry store, waiting zone, cleaning room and services rooms for the exercise bath.

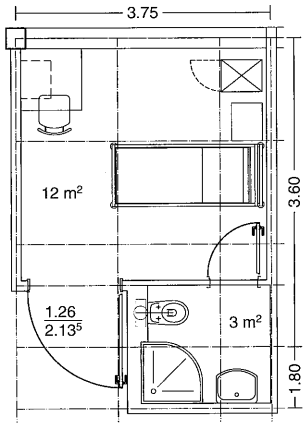
In the dry area, there are gymnastics rooms (approx. 40–50 m²) for group treatment and single therapy rooms (approx. 20 m²) for Bobath concept and exercise therapy. The clear ceiling height must be min. 3.00 m.

Decentralised therapy rooms can also be convenient near the wards (e.g. accident surgery, orthopaedics).

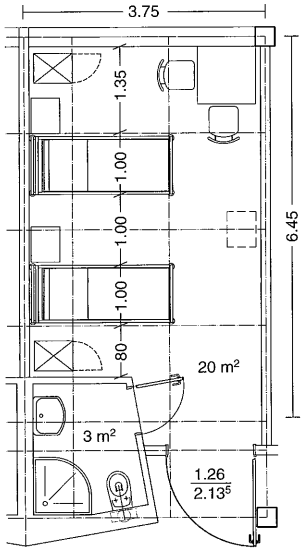


3 Physiotherapy, Helios Clinic, Gotha
Arch.: Worner + Partner

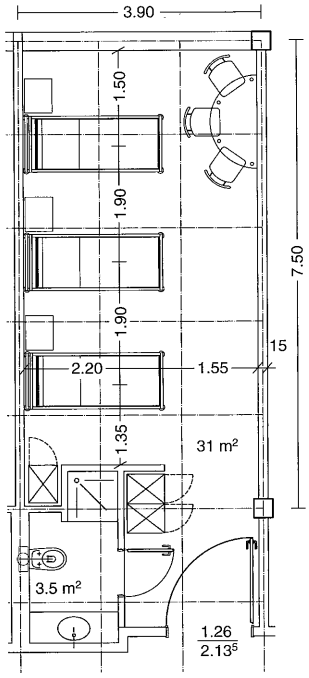
← ① Special use (66 m²)
② Personal residence
③ Office
④ Treatment
⑤ Gymnastics
⑥ Exercise pool
⑦ 4-cell bath
⑧ Occupational therapy
⑨ Massage
⑩ Elevator hall
⑪ Waiting
⑫ Cosmetics
⑬ Locker room
⑭ Rest room
⑮ Spa / Sauna
⑯ Pharmacy (132 m²)



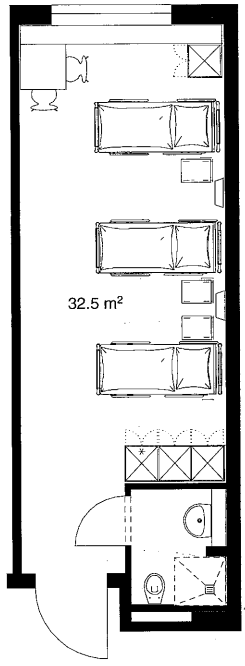
1 One-bed patient room



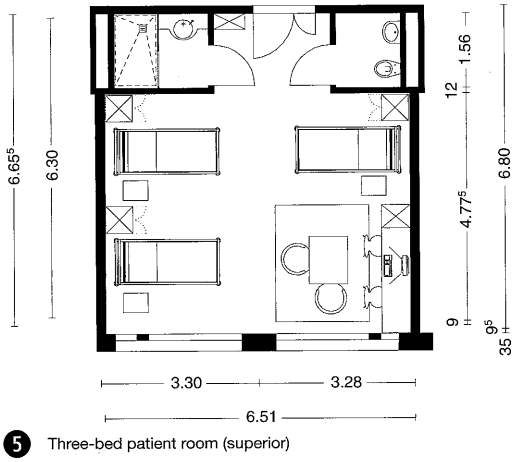
2 Two-bed patient room



3 Three-bed patient room with shower (column grid 7.80 m)



4 Three-bed patient room (standard)



5 Three-bed patient room (superior)

The care department is laid out as an enclosed unit and through traffic should be avoided. The wards must be naturally lit but functional rooms, like those for treatment, or the duty station with clean workrooms and pharmaceutical stores, can be located in the internal artificially lit area.

The normal size of a care ward is 30–36 beds. If the arrangement of the central functional rooms is appropriate (nurses' station, clean workroom etc.), then a number of wards can be structurally combined.

With other organisational forms of medical care, economic ward sizes of up to 48 beds can be reached. The rooms must be laid out so that there is sufficient room for movement. A sufficient number of patient cupboards, and space for care equipment (walking frame, commode) and care devices must be available.

General care

Standard care units provide general inpatient care, particularly for short-term and acute illnesses, with predominantly short stays. Units with the same space requirement should be structured above each other, in bed blocks.

The individual wards of a hospital are increasingly being run on an interdisciplinary basis and mixing the sexes, so the wards should be planned as units capable of being combined. Each ward must have at least one doctor's room where minor examinations can take place.

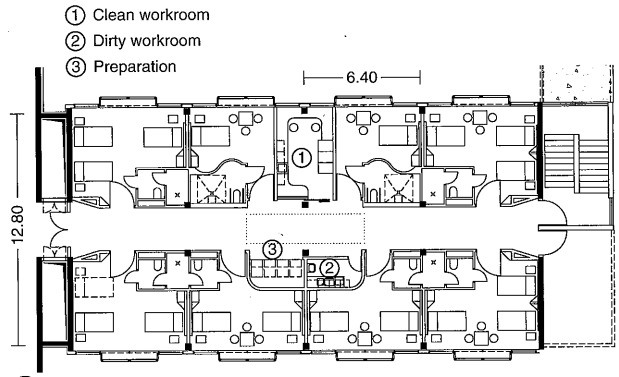
Room relationships

The ward entrance lobby must be clearly visible from the glazed nurses' station, and pharmaceutical stores and wash rooms should be easily accessible. The logistics of patient supply requires centrally located supply and waste disposal rooms for medication, laundry, waste and catering.

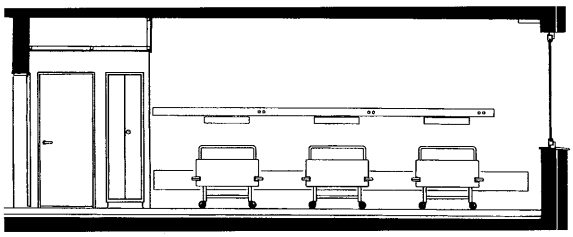
Wet cells

Each patient room should have its own wet cell with WC, washbasin and sometimes also shower, although these can also be separated as shower rooms. The wet cells should be accessible for disabled people.

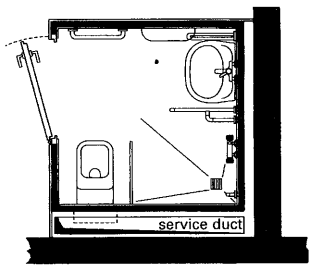
The heights of vanity unit and WC are important (vanity unit min. 86 cm so that wheelchairs can fit underneath). The WC for wheelchair users should be at a height of approx. 49 cm, i.e. top level of the toilet seat. Each ward should also have staff, visitor and wheelchair WCs.



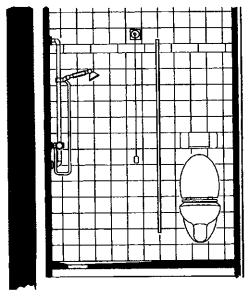
6 Section of floor plan, second floor, general care ward, Brandenburg an der Havel City Clinic, Newbuild East
Arch.: Heinle, Wischer und Partner Freie Architekten



1 Three-bed room, section



2 Patient bathroom



3 Elevation → 2

Size of patient room

Patient beds should be accessible on three sides, and next to the bed there should be at least one side table. On the window side, a table (90/90 cm) with chairs (one per patient) should be provided. It must be possible to open the built-in cupboard without having to move bed or side table.

The minimum size for a single bedroom is 16 m^2, for two and three bedrooms 8 m^2 per bed (Hospital Regulations). The room widths should be chosen so that the beds at the back can be wheeled out of the room without having to move the first bed out of the room (minimum width 3.45 m with an axial width of 3.60 m).

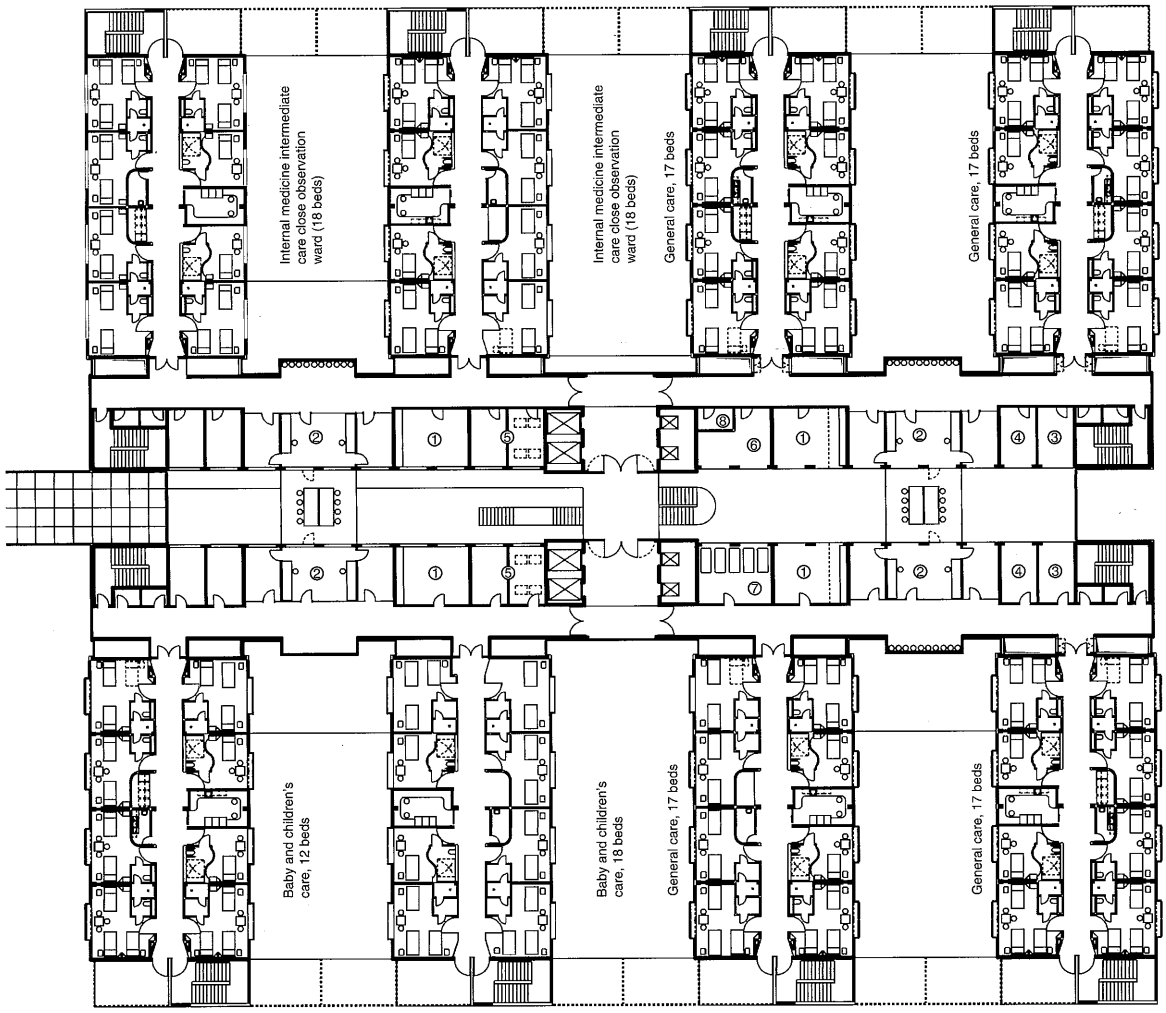
Fitting out patient rooms

In order to protect the walls of the room from damage by beds, side tables or trolleys, a protection rail made of suitable material must be fixed to all walls (height min. 40–70 cm above floor level). This also applies to the corridors in the ward.

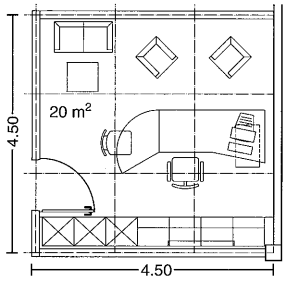
Patient cupboards must be sufficiently large. A suitcase compartment above the cupboard and a lockable compartment for valuables inside the cupboard are useful.

The **room doors** must be large, 1.26 × 2.13 m, on account of frequent bed transport, and sound protection to the corridor should be 32 dB. Behind the beds, there is a supply rail for air/gas and lighting. Special sockets can supply oxygen, vacuum and compressed air. Also integrated are sockets, reading lamp, telephone, nurse call button and radio.

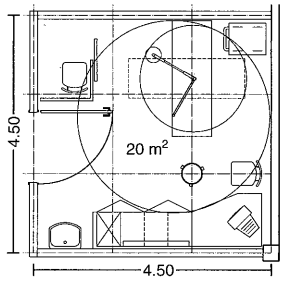
① Patient lounge
② Care/doctors' station
③ Equipment
④ Staff lounge
⑤ Supply & disposal
⑥ Bathroom
⑦ Bed preparation
⑧ Cleaners' room



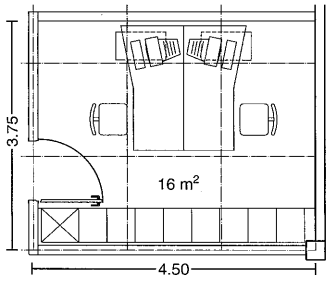
4 Care unit (337 beds), second floor, Brandenburg an der Havel City Clinic, Newbuild East — Arch.: Heinle, Wischer und Partner Freie Architekten



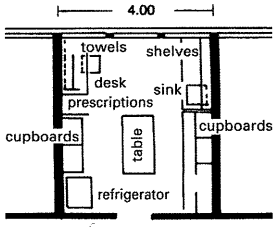
1 Senior doctor's office



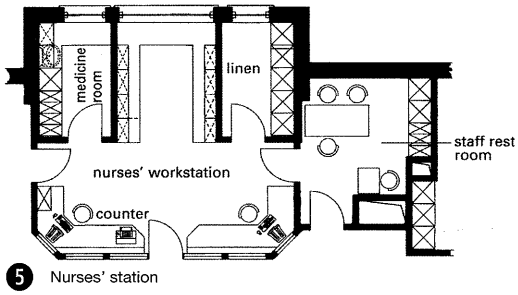
2 Examination and treatment room



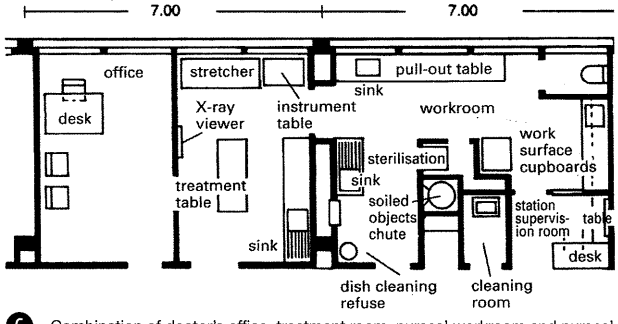
3 Ward doctor's office



4 Clean/medication workroom



5 Nurses' station



6 Combination of doctor's office, treatment room, nurses' workroom and nurses' station into one unit
Arch.: Rosenfield

Workroom, clean/medication

The clean workroom should be about 20 m². The fitting out consists of fixed shelving or a flexible storage system of modular units, which are filled up in the central stores, and pharmaceutical cabinets. Special cupboards for medicines should be available and also a safe for narcotics.

Workroom, dirty

This room is for the staff in the vicinity of the patient rooms. One dirty workroom should be provided for every eight beds. There should be cleaning and disinfection sinks (emptying bed pans), wash-hand basins, worktop with lighting, cupboards or shelves for dirty washing bags, room size approx. 8–10 m².

Nurses' station

The nurses' station, size approx. 25–30 m², should be in the centre of the ward. It should have a large glazed opening to the corridor for visual and communication contact (observe fire regulations).

Staff lounge/kitchenette

The staff lounge, size approx. 16 m², with its own kitchen work area, staff refrigerator and possibly lockers for valuables. The **kitchenette** is for preparation and warming up of small amounts of food for patients. The equipment depends on the organisation of the main kitchen, e.g. catering distribution system with insulated trolley.

Ward doctor's office

The ward doctor must be able to examine patients here. In addition to the desk, there should be room for shelves and an examination couch. Room size approx. 16–20 m².

Patients' lounge

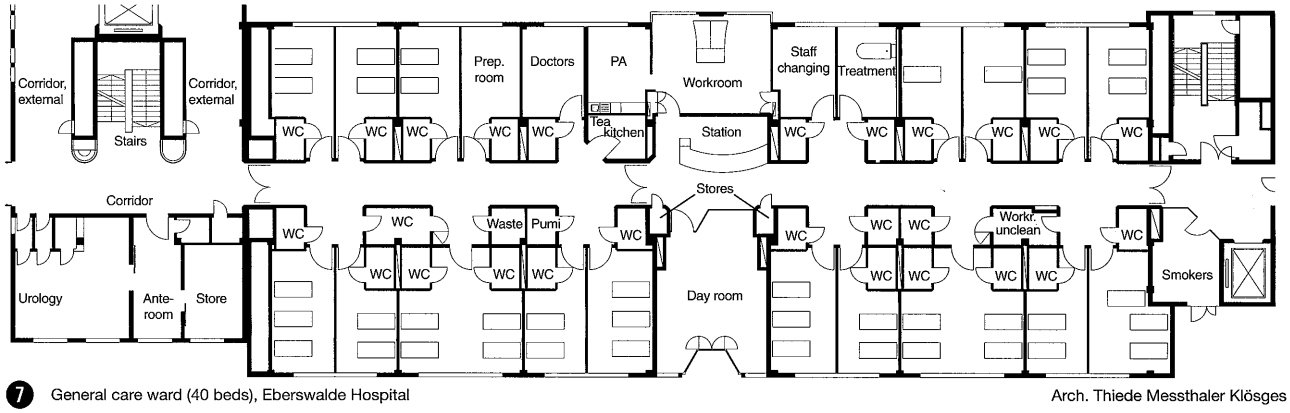
As general meeting point for patients, size approx. 22–25 m². The furnishing should be homely. A television set no longer has to be provided here, as this is normally mounted on the wall in each patient room. The question of separate lounges for smokers and non-smokers should be clarified at an early stage with the hospital management.

Patient bathroom

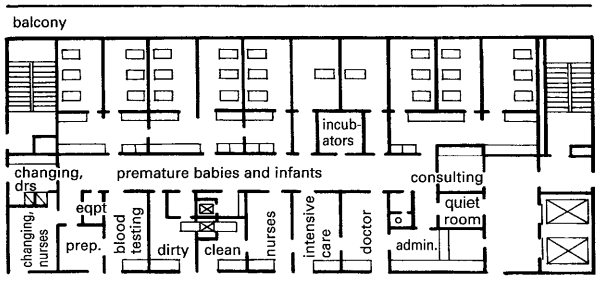
The equipment includes a bath with lifting device, which is accessible on three sides. An additional shower in a version designed for disabled people is also useful and an accessible WC should be integrated.

Services room

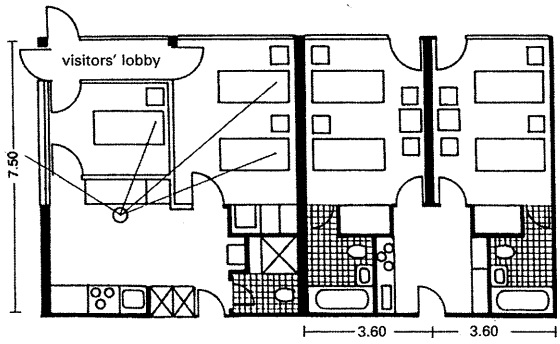
Each ward must have its own electricity distribution board for high-voltage electricity, emergency power supply and communications/IT. Room size 8 m².



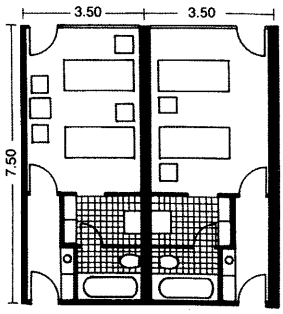
7 General care ward (40 beds), Eberswalde Hospital
Arch. Thiede Messthaler Klösges



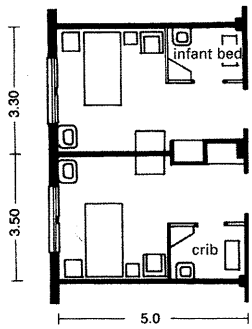
1 Premature baby and infant ward with 27 beds, Fulda Arch.: Köhler, Kässem



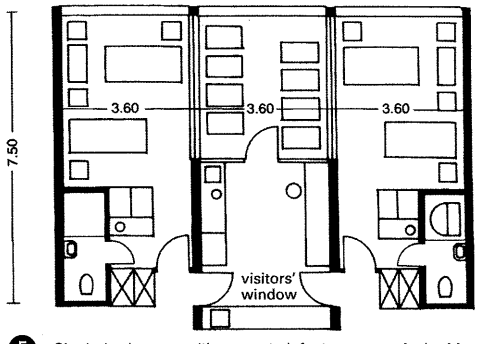
2 Care of infectious children, room variant Arch.: Deilmann



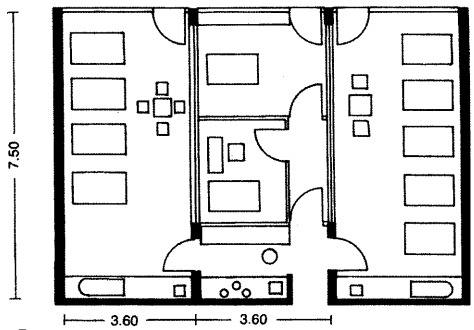
3 Care of infectious children, room variant Arch.: Deilmann



4 Single-bed room with separate infant room Arch.: Mayhew



5 Single-bed rooms with separate infant room Arch.: Mayhew



6 Room unit for infants' and children's care Arch.: Mayhew

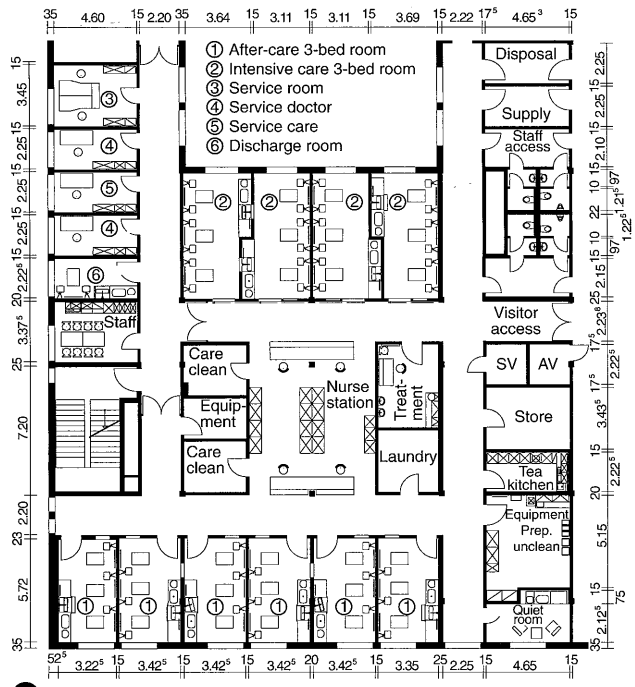
Nursing mother and neonatal care

The care of nursing mothers and babies includes all activities necessary after a hospital delivery for the bodily, medical, psychological and social support of nursing mothers and newborns with normal progress.

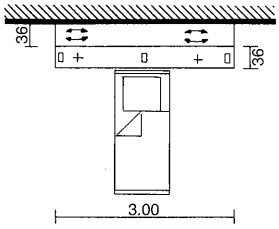
The organisation of care for nursing mothers is similar to that for general care. Where the care of newborns is centralised, their care unit is located at the edge of or within the nursing mothers' unit. In order to reduce infection, the area is divided into small rooms or compartments. The babies are carried or wheeled on trolleys into the nursing mothers' room for breastfeeding. This creates a more frequent and intensive contact between mother and child than the former arrangement with a central breastfeeding room. The accommodation of new mothers and newborns in one room ('rooming-in') avoids the transport of babies and makes less work for the staff.

Care units are mostly smaller than for normal care; limiting the size of the care group to 10–14 beds is sensible. For hygienic reasons, the requirements for the care of nursing mothers and newborns are higher than for normal care. Therefore, in addition to the normal control lobby system, a lobby plus cloakroom must be provided for visitors. The bed space can be designed as with normal care but the spacing of the beds needs to be larger to allow for the baby's cot. The sanitary facilities must include hip-bath/shower combinations and showers.

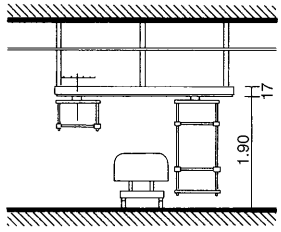
Neonatal care units comprise: cot spaces for newborns, nappy removal, baby bathing, nappy fitting, cradle space, work area for neonatal nurse, possibly parking for transport trolley, work area for the departmental sister, nurses' lounge, kitchenette, doctor's office, examination and treatment room, clean workroom, patient bath, day room for patients and visitors, store, equipment and cleaning rooms, staff and visitors' WCs, linen cupboards.



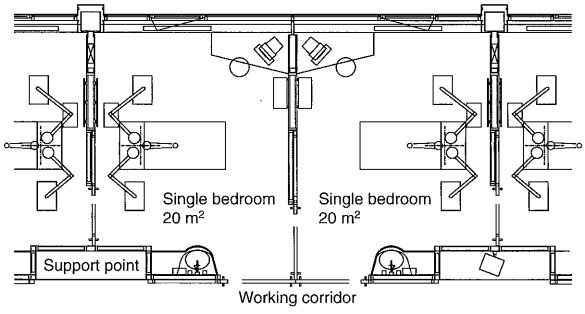
7 Neonatology, Leipzig University Clinic Arch.: Wörner + Partner



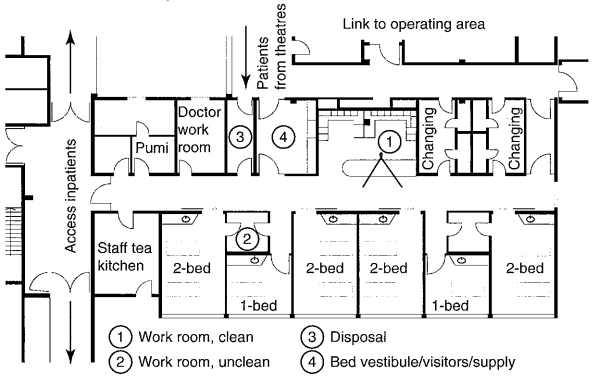
1 Intensive care room: single bed with supply panel



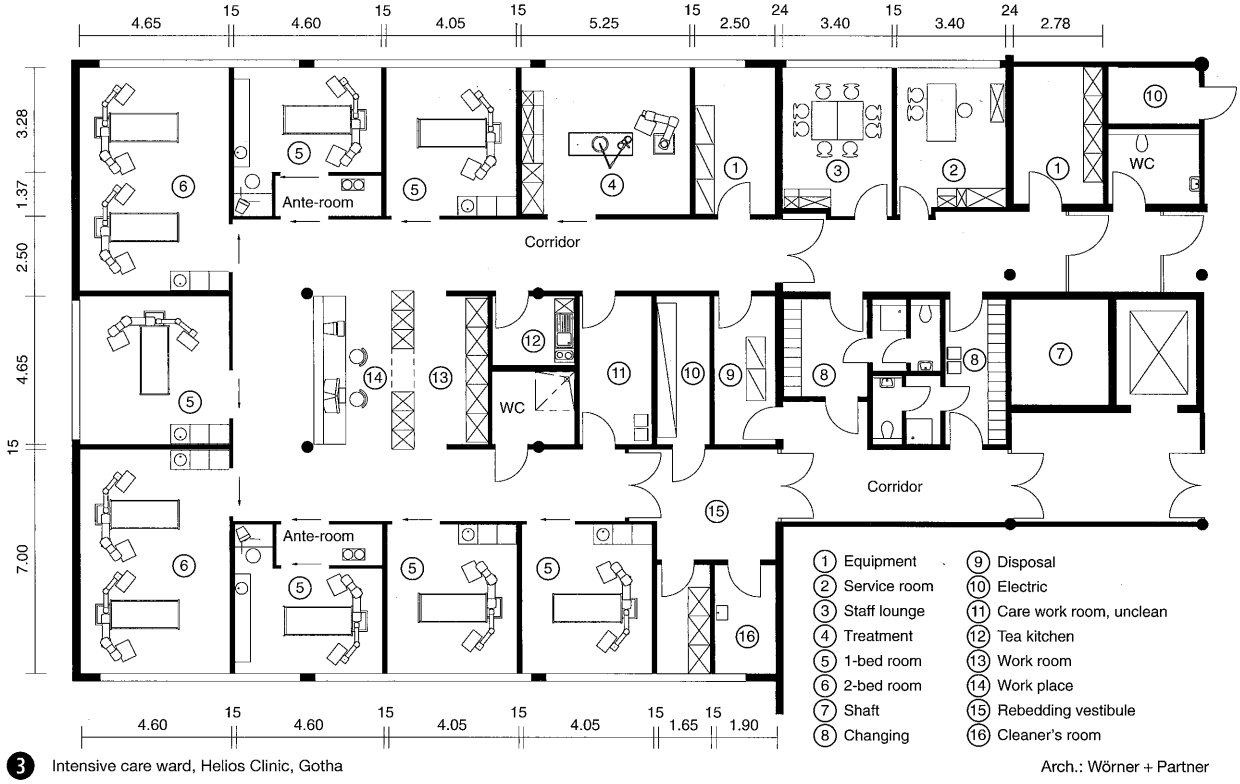
2 Section → 1



3 Intensive care rooms at the Heinrich Heine University, Düsseldorf
Arch.: Henie, Wishcher und Partner Freie Architekten



4 Intensive care ward, Luckenwalde Hospital, 10 beds
Arch.: Thiede Messthaler Klösges



3 Intensive care ward, Helios Clinic, Gotha
Arch.: Wörner + Partner

Intensive care medicine

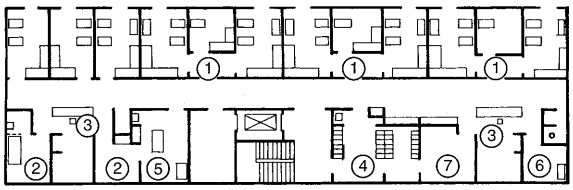
Patients with significant disturbance of vital bodily functions are treated in intensive care. A direct, short route to the surgical department and to the medical service (anaesthesia) is necessary. The patients are permanently monitored by doctors and care staff. The organisation of intensive care is similar to that of related disciplines like neurosurgery, heart/thorax surgery, transplant surgery and neurology or interdisciplinary fields like surgery or internal medicine.

For general hospitals without a particular medical specialisation, the integration of intensive care with surgery and internal medicine is usual. Intensive care must be spatially separated from the general care area and accessible only through a system of control lobbies (for hygiene reasons).

The central point of every intensive care ward is an open nurses' station with a view of every room. The number of patients (6–36) in an intensive care unit depends on the total size of the hospital. Each unit requires a duty station, a clean workroom (preparation of medication and infusions) and a materials and equipment room.

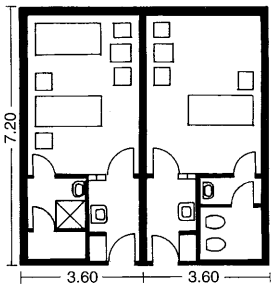
The beds can be arranged in an open, closed or combined layout. The open layout requires a spacious area. The patients are separated visually by half-height partitions with glazed window elements. In the closed arrangement, the patients are separated into different rooms.

Further facilities should be provided: anaesthesia preparation room, clean material room, dirty workroom, cleaning room, waiting room for relatives, doctors' on-call lounge, documentation room, and possibly consulting room. There should be connections for oxygen, compressed air and vacuum at every bed space.

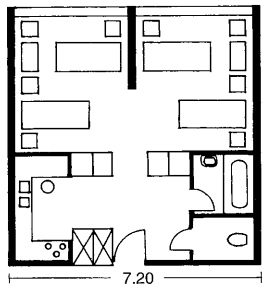


1 Bedroom
2 Doctor
3 Nurses' station
4 Personal wardrobe
5 Treatment
6 Quiet room
7 Nurses' lounge

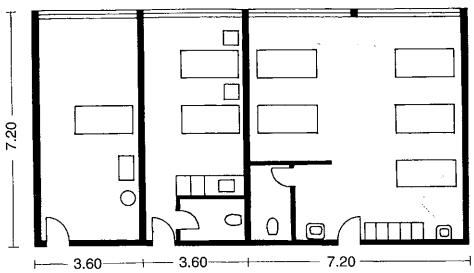
1 Children's ward with 28 beds, Velbert City Hospital Arch.: Krüger, Krüger, Rieger



2 Single- and two-bed rooms with strong radiation protection, in the controlled area of a radiology ward Arch.: Deilmann



3 Four-bed room with all equipment for basic care (for long-term psychiatric patients) Arch.: Deilmann



4 Room unit for patients with mild mental illness and for those needing care Arch.: Deilmann

Paediatric care

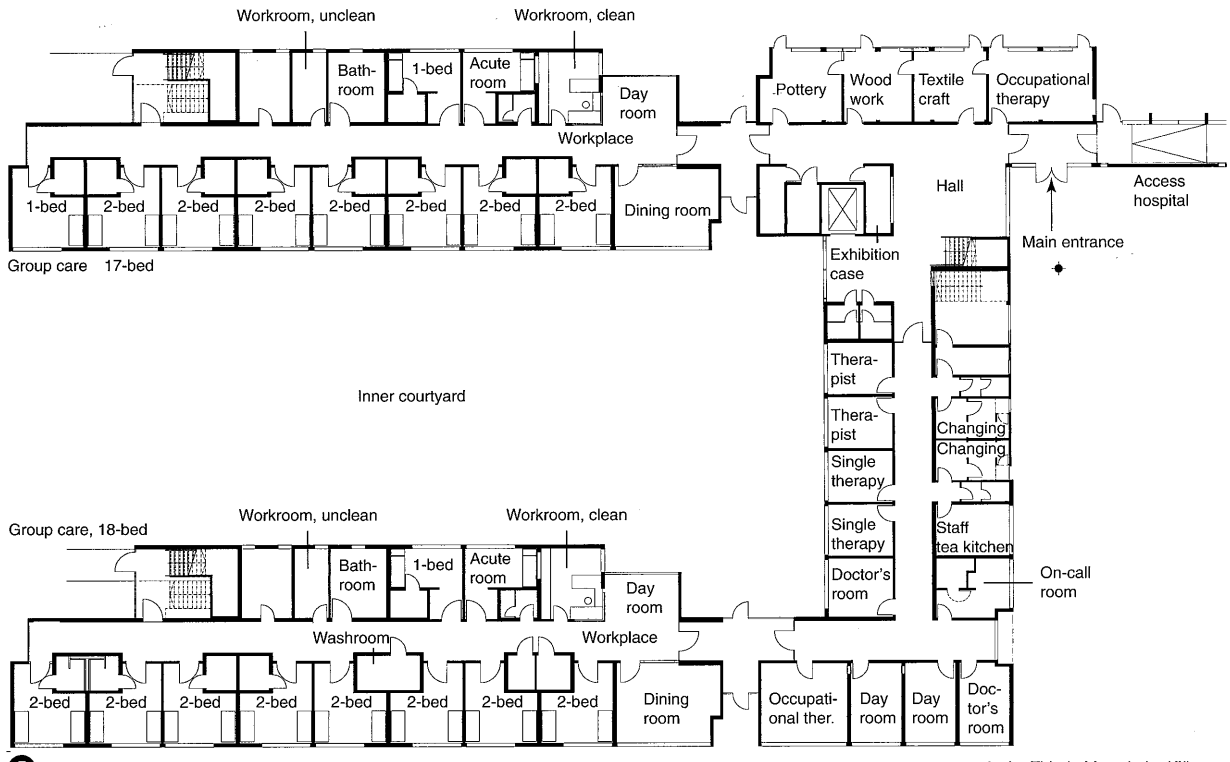
The proportions of patients in dedicated children's hospitals are babies (35%), premature babies (13%), small children and schoolchildren up to 14 years old (22%) and all ages after infectious illnesses (22%). The accommodation of this last group should aim to avoid contact between patients and other patients/staff. Isolation wards should be provided for measles, chickenpox, diphtheria, scarlet fever and TB. Rooms should also be provided for teaching, activity and play. The design of children's wards should be similar to that of a kindergarten, rather than a sterile clinical area.

Care of the mentally ill

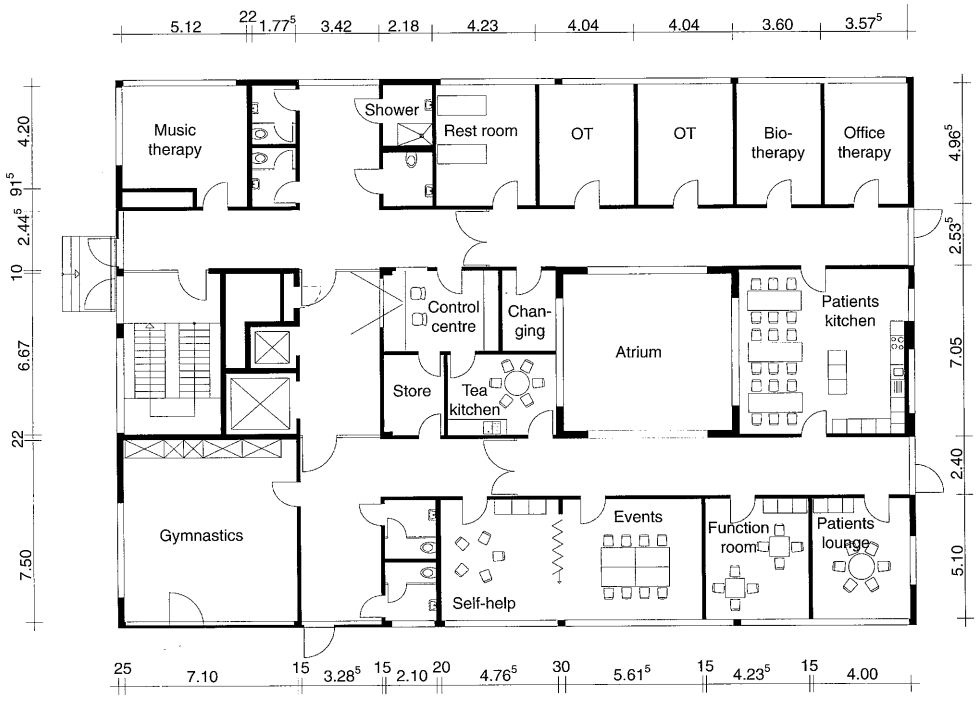
This can be open or closed (as well as in the special forensic form under a hospital treatment order). The special nature of mental illness results in a higher space requirement for day rooms, dining rooms and rooms for occupational and group therapy. Small care units (up to 18 patients) should be created with short circulation routes and homely design in order to give the patients a feeling of security. The trend is towards the integration of psychiatric departments into general hospitals.

Care of radiotherapy patients

In the design of nuclear medicine care groups, which address the diagnosis and therapy of patients undergoing radiation treatment, compliance with the Radiation Protection Regulations is the first principle. The size of a care group should correspond to a normal care group. The operational centre is divided into a controlled area and a supervised area. In this way, patients who have received the greatest radiation doses are separated from those treated with less. Patients should therefore be accommodated in single-bed rooms.



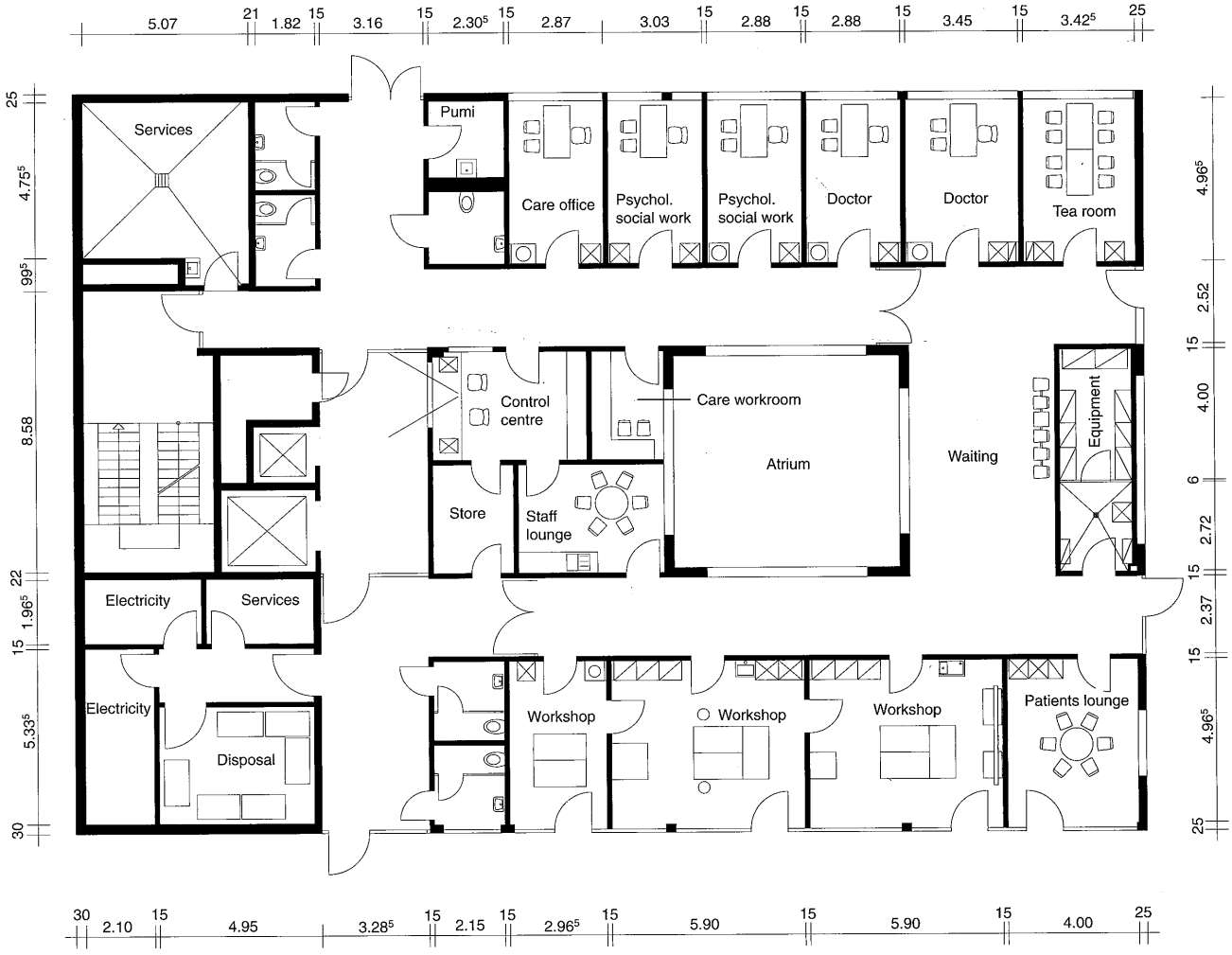
5 Psychiatric care, Finsterwalde Hospital, 70 beds Arch.: Thiede Messthaler Klösges



1 First floor → 2

Day clinic

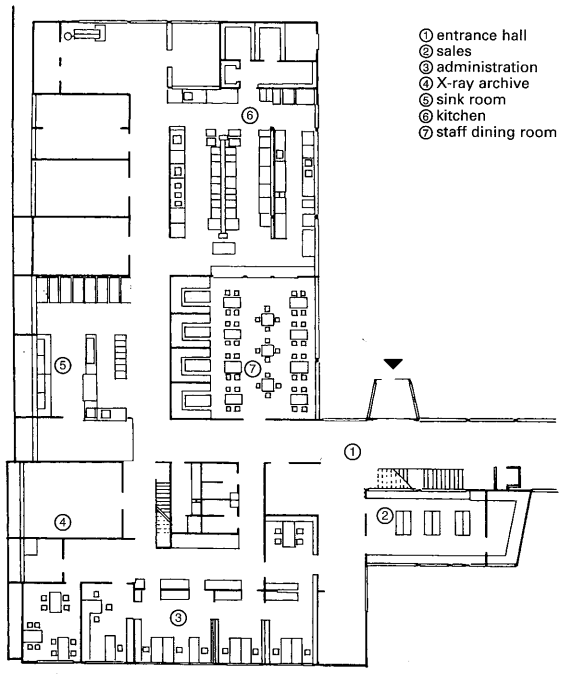
In the course of the reform of health provision, many hospitals are partially outsourcing certain clinical areas, which can be operated by private doctors' collectives. These specialist clinics are for patients who are cared for only during the daytime without a bed in the hospital. Outpatient operations can also be carried out. Because these patients are separate from the usual operation of the hospital, a separate entrance is required. The reception and waiting areas are designed in a similar way to a doctor's practice and should avoid a 'hospital' atmosphere.



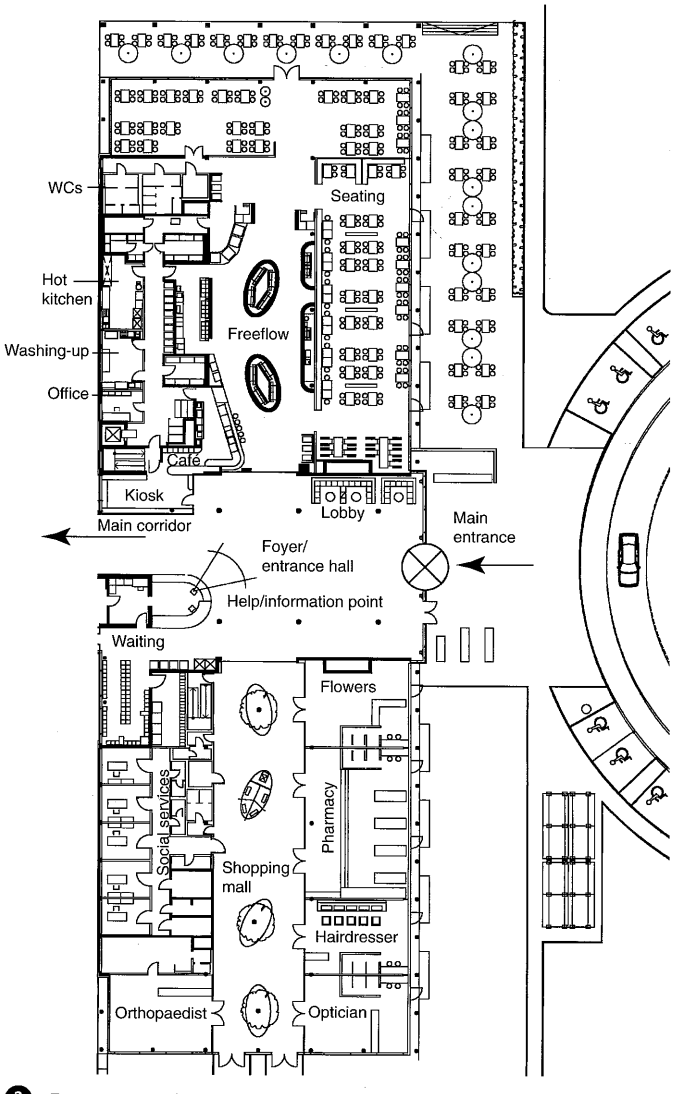
2 Ground floor plan, psychiatric day clinic, Dr. Horst Schmidt Clinics, Wiesbaden

Arch.: Wörner + Partner

Health



1 Community Hospital, Herdecke/Ruhr, 192 beds; entrance hall with administration area
Arch.: Bockenmühl



2 Entrance and café, Helios Clinic, Berlin-Buch
Arch.: Thiede Messthaler Klösges

Management and administration

Administration offices are divided into those dealing directly with patients, and other offices. Offices for patient admission and dealings with friends and relatives should be provided near the main entrance. The offices for internal hospital business are: administrative director's office with secretarial support, accounts department and personnel department. Conference and meeting rooms are also required. In larger hospitals, social workers and psychologists also work in the administration.

Increasing rationalisation in accounting and the application of IT need to be considered in the design, perhaps involving raised floors and the central accounts office with pneumatic postal delivery connections.

Records

A short distance between records and working areas is advantageous but mostly difficult to achieve. A location in the basement with access by stairs is possible.

There is a difference between stores and records rooms for files, literature, films, administration, X-ray department etc. Mobile shelving is useful to reduce the space requirement for the same storage capacity. The high loading assumptions for shelves (up to 1000 kg/m^2) have to be considered. The storage term for patient files is 30 years.

Library

Medical libraries should be provided with open shelving, without closed stores and book issue. A large part of the literature is journals. Sufficient availability of reading tables with lamps is important. Hospital libraries are divided into patient libraries and medical libraries for doctors. The significance and use of these is reducing through today's omnipresent IT and Internet resources.

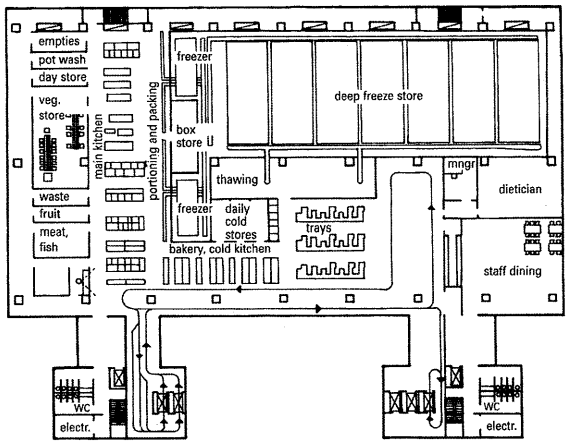
Main entrance and services

A simple and easily recognisable main entrance with vehicle access and disability parking places must be created for general patient and visitor traffic and delivery by taxi. Special entrances should be avoided if possible. The entrance hall should be designed as a waiting room for visitors on the open door principle, with the layout today more like a modern hotel lobby. From here, visitors, outpatients, inpatients capable of walking and business traffic go their separate ways.

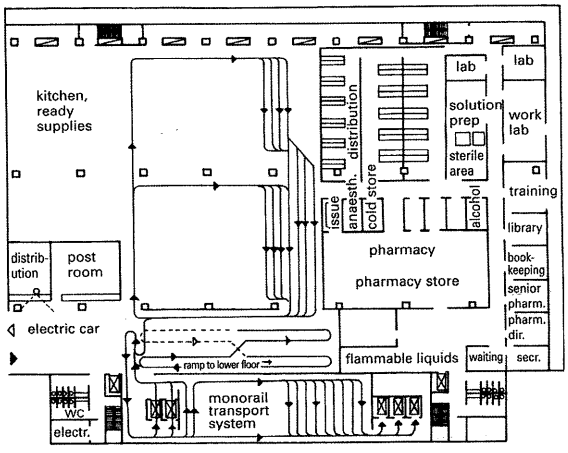
The size of the entrance hall is in accordance with the hospital's bed capacity. The reception can put telephone calls through and also act as the post room. Also in the entrance hall are coin telephones, and kiosks for sweets, flowers, stationery etc. A cafeteria for visitors and patients is situated directly next to the entrance and is open all day offering a free choice of warm and cold food and drink. Also important are storage facilities and the provision of rooms for staff in accordance with Workplace Regulations.

Pastoral care and social services

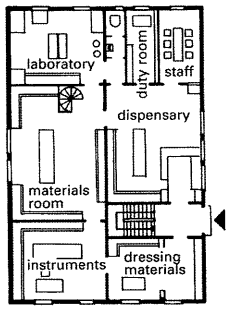
There should be a non-denominational chapel or prayer room. This has adjoining rooms for the chaplain and vestry, and side rooms. These facilities also need offices for the chaplain and the social workers.



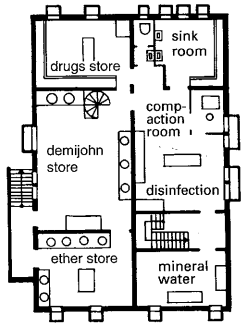
1 Supply centre, Cologne University Clinic: kitchen, prepared stores
Arch.: Heinle, Wischer und Partner Freie Architekten



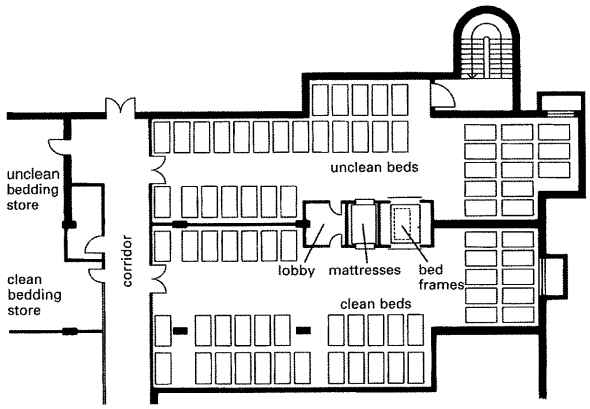
2 Supply centre, Cologne University Clinic: kitchen and pharmacy, prepared stores
Arch.: Heinle, Wischer und Partner Freie Architekten



3 Pharmacy for medium-sized hospital with 500–600 beds, ground floor



4 Basement → 3



5 Central bed unit, St. Elisabeth Hospital, Halle/Saale
Arch.: U. + A. Weicken

Supply area

Commercial and technical supply enters the hospital either via a separate service building or at a neutral supply and waste disposal level (basement) under the main building. There should be an access for deliveries into the service yard, separated from the main entrance and the arrival of patients on stretchers. The location of delivery and waste disposal areas to the north is ideal. External and internal traffic routes should be designed so that interaction with the traffic in the care and treatment areas is avoided as much as possible.

It should be taken into account in the design that this area of the hospital can potentially cause noise and odour nuisance (waste containers, kitchen waste, etc.). There is a noticeable tendency towards increasing centralisation of supply and waste disposal facilities and also the outsourcing of certain functional areas (e.g. laundry, kitchen).

Sterile goods supply

The central sterile store should be near the surgical department, the largest consumer (smaller stores of sterile goods in the theatres themselves are no longer needed). The layout is structured according to the direction of flow of materials into acceptance, pre-cleaning, washing machine, sterilisers, packing zone and sterile goods store. All the instruments for use in the hospital are prepared here. The departments with particularly heavy use are surgery with 40% and operative intensive care and internal intensive care with 15% each.

The number of sterilisers required depends on the size of the hospital and the surgical department. Size of central sterile store approx. 40–120 m^2.

Pharmaceutical supply

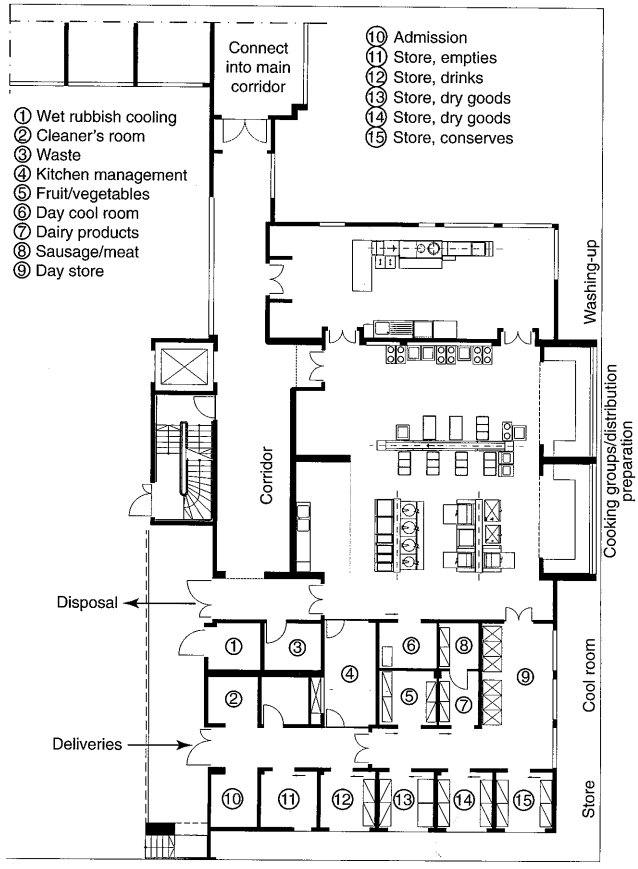
Pharmacy: In medium-sized and large hospitals, the pharmacy stores formulations and carries out the production of drugs under the management of a qualified pharmacist. For design purposes, the rooms required are dispensary, materials room, drug store, laboratory and possibly also issue desk. Rooms may also be required for herbs, dressings, substance storage, on-call room. The equipment of pharmacy and laboratory includes formulation table, work or packing table and a sink. The fitting out is similar to that of the dispensary. The location of the pharmacy should involve a short route to the lifts, pneumatic post etc. Since fire-hazardous substances and acids are stored here as well as various narcotics, the walls, ceilings and doors need to meet security standards.

Dispensary: In hospitals without a full pharmacy, medicines requiring approval are issued from the dispensary. This consists of work and dispensing rooms with direct access to the circulation corridor. The equipment consists of desk, washbasin, sink, scales and lockable cupboards. Adjacent rooms are the dry and proprietary medicines stores, cold store for hazardous substances, a dressings room and a damp store according to fire regulations.

Bed preparation

The processing of used beds and mattresses is normally done today with spray and wipe disinfection in the ward, or possibly even in the room.

Pushing numbers of beds through the building and the heavy mechanical wear and wetting of the beds, usual in central bed processing, is no longer necessary. It can, however, be sensible to provide for separate disinfection of mattresses in the basement, possibly combined with a bed repair room.



1 Kitchen with service yard, Luckenwalde Hospital
Arch.: Thiede Messthaler Klösges

Catering

Providing patients with appropriate nutrition places high demands on the preparation because there are often particular requirements regarding protein, fats, carbohydrates, vitamins, minerals, dietary fibre or flavourings. The predominant catering systems rationalise the individual phases of conventional food preparation (preparing, processing, transporting, serving). The processing of food is separated into normal and diet recipes. After preparation and cooking, the food is assembled on the portioning conveyor. The ready-portioned trays are taken to the wards on serving trolleys for distribution. The same trolleys transport the washing up back to the central washing up and trolley cleaning room. Staff catering amounts to about 40% of total catering. The cafeteria for staff should be very close to the central kitchen.

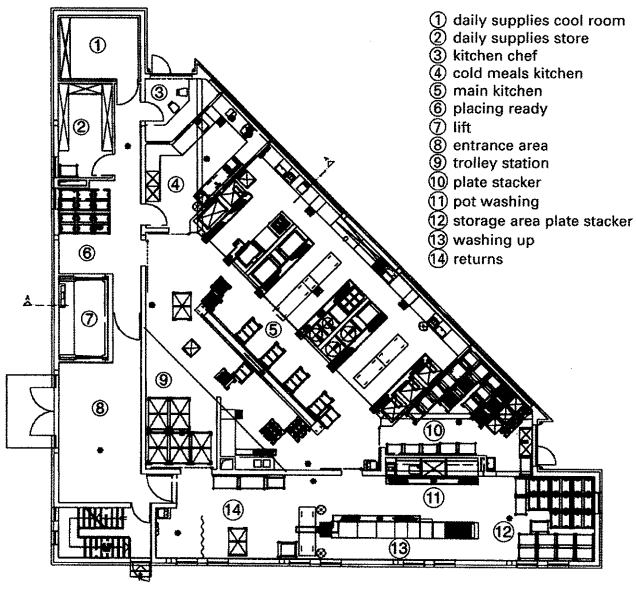
The location of the kitchen on the supply level guarantees an efficient flow of delivery, storage, preparation, processing and serving. When frozen food is used, the function and fitting out of the kitchen alters. The clear ceiling height in the kitchen is 4.00 m, and the size depends on the requirements and the number of patients in the hospital.

The design should also provide a special diet kitchen (min. 60 m^2) with a desk for the head chef, vegetable cleaning area (30 m^2) with room for waste (5 m^2), a daily supply room (8 m^2), a cold room with compartments for meat, fish and dairy products (each 8 m^2), and a pre-cool room (10 m^2) with chest freezer and cooler.

The **goods reception** should have sufficient storage space (15–20 m^2). The main store, with fruit and vegetable store (20 m^2), dry goods store (20 m^2) and store for conserves is next door. Provide sufficient changing rooms and social rooms for the kitchen staff.

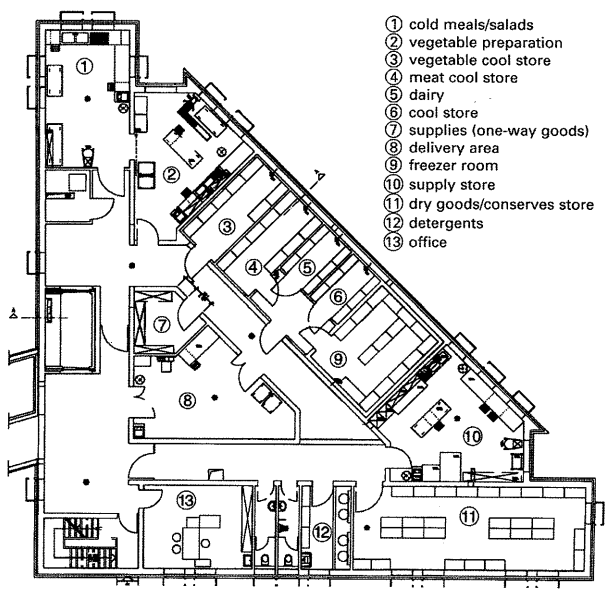
The **central washing-up** unit of the central kitchen is organised around one or more large dish washing machines (approx. 30 m^2). There should be sufficient worktop space for dirty and clean racks.

New cooking methods make it possible to supply food for a number of hospitals from one central location.

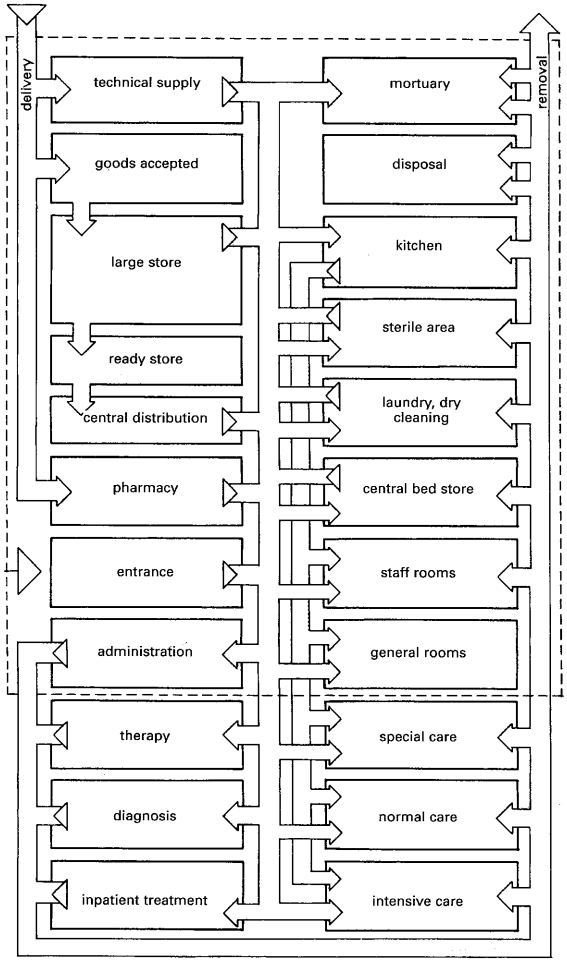


2 Kitchen building, ground floor

Arch.: Thiede Messthaler Klösges



3 Basement → 2



1 Supply and disposal area – traffic relationships

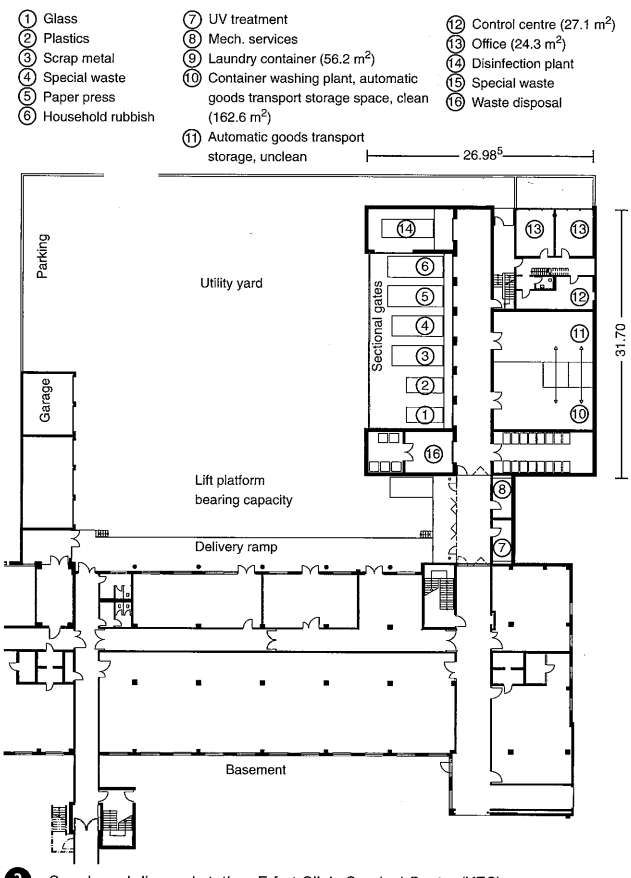
Laundry provision
The collection and delivery of laundry is normally undertaken by an external organisation. In the hospital, only collecting rooms for dirty and clean washing (each 30 m^2) need to be provided, near the service yard.

Storage
This is divided into coarse pallet storage, rack storage and special storage. All storerooms should be centrally placed near the service yard and very robustly built. A logistics room is required, from where the collection and delivery services for the hospital are controlled. The distribution and storage of goods is rationally controlled from here. Important: for hygienic reasons, dirty and clean items should be separated. Automatic laundry transport systems are cost effective only for large hospitals (from 400 beds).

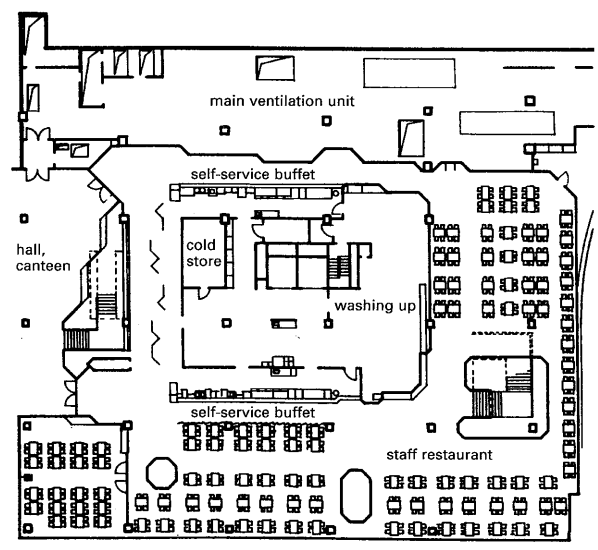
Workshops
Connected with the service yard, these could be metalwork, joinery and electrical workshops, and a medical technology office with materials stores, replacement parts store, general stores and parking for vehicles.

Housekeeping and transport service
Multi-purpose mobile units and trolleys are often used for the distribution of requested items to each location of use and at the same time for storage. A pneumatic delivery system should be provided for the sending of small goods (medicines, paperwork). The scope of the transport facilities depends on the size of the institution; the supply and disposal quantity is about 30–35 kg per bed and day. For large, bulky goods (beds, ventilators, heart-lung machines), normal bed lifts are available. Separate groups of lifts can be arranged for the transport of medium-sized goods (food, laundry, rubbish, consumables).

Service yard
The design should consider the parking and turning areas for delivery trucks, also the multitude of types of waste (kitchen and special rubbish, glass, waste paper, developing fluid etc.) and their storage areas. The service yard can also provide service rooms for emergency power generator, sprinklers, oxygen and compressed air, and other supply requirements. With its location in the basement, the service yard will require a ramp (gradient less than 15%!) for access. Minimum size of a service yard: 30 × 30 m.



2 Supply and disposal station, Erfurt Clinic Surgical Centre (KEC)
Rossmann + Partner Architekten



3 Staff restaurant for 150 staff, Cantonal Hospital, Basel Arch.: Suter&Suter

Heating, ventilation, sanitary, medical gas supply
Plant and service rooms, shafts and installation areas

Early consideration of the buildings/rooms required for the installation of building services is a precondition for optimised layout and for hygienic and energy-saving operation of the facilities. The size and location of plant areas should generally be able to fulfil the following requirements:
a) optimal transport of air (short routes)
b) energy-saving specification of building elements
c) compliance with hygienic requirements and provision for cleaning
d) provision of maintenance and repair areas at central plant area

Building requirements
Space required for air-conditioning plant
The area and space requirement for air-conditioning equipment is determined by:
a) volume flow
b) number of thermodynamic conditioning stages
c) installed elements
d) connection situation for the duct network

The minimum height of a central plant room should be 3 m clear for optimal operation; 4–4.5 m following the number of functional units. The calculation of the area needed should be discussed according to the specific technical requirements, and a specialist building services engineer should be appointed. General note: the size of the air-conditioning equipment can be estimated via the volume flow with a speed of 2 m/s. The total length is the sum of the length of the individual elements required, taking the thermodynamic functions into account, and additional space for connection at each end and maintenance.

Cooling plant room
The cooling plant room has to provide space for chillers, expansion vessels, cold water and cooled water distributor and collector, main pumps and the associated control equipment. The space required depends on the nature and type of chiller and the capacity. Room heights should be more than 3 m, which may depend on the output.

Recooling plant
The area and space requirement for recooling plant is determined from the required cooling capacity, the type of cooling, the form of the air intake and outlet, the mounting and the noise insulation. The selection of the room height and the floor area must take into account the lateral proportion, operation, maintenance and repair. The installation should also take special aspects of noise emission and fumes emission into account. The recooling capacity depends on the type and capacity of cooling.

General equipment of plant rooms
Preferably, plant rooms should be located near the supply area. The location of the central plant area should ensure suitable conditions for supply and disposal and result in short distances for air/gas supply.

Plant rooms must comply with the fire protection and safety requirements of the relevant state building regulations, the conditions imposed on the particular building and the Workplace Regulations if appropriate. The operation of the technical equipment in the plant rooms should not impair the environment nor cause nuisance in the building through noise or vibration.

Technical details, temperature requirements
The temperature in plant rooms must not sink below 5 °C for technical reasons (danger of frost!) and should also not exceed 40 °C (because of electrical equipment), which should be ensured by suitable technical measures. Damp and increased humidity should be avoided. Plant rooms should be equipped with a water supply with hose connection and backflow preventer, and also at least one floor gully. The EU safety data sheets for the equipment and consumables should be at hand in case of breakdowns. The installation of electrical equipment should comply with German Association of Electrotechnicians (VDE) standards. Plant rooms should have at least one power socket (230 V, 16 A) and a three-phase connection (400 V) suitable for the particular situation. The nominal lighting intensity in plant rooms should be 100 lx; and at switching panels, and regulation and measurement equipment 200 lx.

Requirements for service shafts and horizontal ducts
Shafts are employed for vertical service runs and horizontal services use service ducts or are fixed below the floor slab, with cables in cable trays. In accordance with the applicable state building regulations, installation shafts and cable runs in buildings, with the exception of buildings of limited height and any installation shafts or cable runs which bridge fire compartments, must be detailed so that fire and smoke cannot enter staircases, other storeys or other fire compartments. Installation shafts and ducts must comply with fire resistance class L30, L60 or L90 for the relevant pipe or cable. Comb-shaped connection to functional areas is ideal. The sum of air ducts, pipe runs and cable trays should remain constant in relation to the height of the storey. Shafts and ducts should be detailed so that they cannot act as structural stiffening. Only main shafts and ducts are permissible in this case. Accessible shafts should be reachable from a corridor.

Suspended ceilings
The space between structural and suspended ceiling should not be used directly for air supply and cannot be used directly for air extraction, depending on the extracted air collection arrangements. The spacing between the bottom of the slab and the top of the suspended ceiling depends on the degree of installation (air ducts, water pipework, electric cable runs, lighting elements, air handling units, air intakes and outlets, sprinkler pipework) and should normally be min. 400 mm. A smaller ceiling space is possible in exceptional cases.

Gas supply plant room
The special oxygen pipework is supplied from operational and reserve units with automatic switchover equipment. In order to ensure short transport distances, direct access to the service yard is sensible, e.g. for delivery and collection of the cylinders. The storage of the cylinders can be combined with the air/gas pumps (vacuum, nitrogen, compressed air) in order to enable centralised control (possibly computer-controlled). The gas cylinders are being replaced nowadays with bulk tanks, which must be situated in the open air and at least 5.0 m from buildings.

Electrical installation / high voltage plant
Electricity supply is generally from a public medium-voltage mains network (10–20 kV) provided by the electricity supply organisation. The mains connection transformation to low voltage (400 V) and distribution inside the building take place in the hospital sub-station. The appropriate switchgear and transformers should each be placed in their own room, and the Regulations for Building Electrical Service Rooms and the VDE standards should be complied with. In larger hospitals, a number of specialised electrical rooms should be provided in addition to the sub-station. The installation is sized depending on the dimensions of the building and the energy requirements of the individual pieces of equipment. The hospital sub-station should be situated centrally and provided with good, ideally level, road access as well as adequate ventilation and extraction. A location in the basement is not suitable if there is any risk of flooding.

A hospital should also have an emergency power system, which continues to supply certain defined equipment in case of a mains failure. This arrangement is provided by emergency power generation sets with diesel motors and alternating current generators. This equipment should be placed in its own room with ensured air supply and extraction, and exhaust gas escaping above the roof. An additional emergency power supply must be provided for lighting in operating theatres and certain vital medical devices. Decentralised battery sets are provided for this for use in the room containing the medical device.

Starting from the sub-station, the general and emergency power supplies are distributed separately, in a star shape, through the hospital. Depending on the building structure and the distance, this may be via distribution boards on each floor or one central distribution board. The arrangement and number of distribution boards on the floors have to be in accordance with fire compartments, whose assignment to functional areas should also be taken into account. The distribution boards are separated into general and emergency power supply and placed in their own rooms.

Telecommunications / IT
The correct functioning of telephone and data networks in a hospital is essential for the care of patients and the basis for economic success. A central telecommunications room and also at least one server (IT) room should be provided to accommodate the system components, each with a size of 35–70 m^2. Uninterruptible power supplies and an extra cooling system should be provided.

In order to optimise availability, a further IT room should be planned for backup systems in another building or at least another part of the same building. Starting from the central telecommunications or server room, the star-shaped distribution cabling (copper or fibre-optic cables) runs to the distribution hubs on each floor. The telecommunications and IT devices are connected from here.

The modern 'structured cabling topology' provides unified sockets for telephone, IT and medical technology, enabling rapid reaction to the very fast progress of development in communications technology.

Speech communication in administrative areas is provided by analogue and digital telephones, which are connected directly to a central telephone system. Cordless mobile DECT phones in connection with powerful communications servers are rapidly replacing traditional pagers, and provide a second route for communication.

Each patient room is provided with a patient operating panel with call light, signal connections for wall-mounted TV and/or bedside devices and sockets for telephone and Internet access. TV signals come either from a cable operator or from a satellite reception system and are fed centrally into the signal network. When a patient presses the call button, the light signal system communicates with the locations where the care staff have logged in. The prioritisation of calls:

- patient call
- WC call
- emergency call
- resuscitation call etc.

is also supported, as is forwarding of any calls to the mobile DECT phones of the care staff, including detailed information. The fire early warning and alarm scheme includes a fire alarm system with automatic and manual alarms as a loop system, which saves cabling, and an electro-acoustic system with its own cable network to maintain function. The delivery routes and roads to the parking places are secured by barriers. These can be manually controlled by the gatekeepers or automatically controlled according to identification or invoicing.

Cameras are provided, either fixed or adjustable, to monitor the entrance areas, access roads and specific areas; the images are sent through a central cross-loop to the monitors for observation.

The operating units for the telecommunications components:

- switchboard for the telephone system
- camera control
- server for the hospital information system
- control server for the patient media system
- lift surveillance etc.

are installed in the lodge or entrance area in smaller hospitals.

In larger hospitals, these will be installed in a central control room. This is where all relevant fault reports arrive and are processed centrally. The requirement for prompt recording of and access to all relevant clinical and patient data is ensured by the use of complex software. The functionality of the user applications is based on active network components in the central server rooms and IT rooms on each floor, together with the system of servers.

Stationary PC workstations in functional and care departments and mobile data recording stations in the wards are integrated into the network and support the care staff. The internal network is secured from access by unauthorised third parties by firewall solutions, which have to be updated constantly.

Speech and data integration (VoIP – Voice over IP) and database consolidation (SAN) of all IT and medical IT systems are an important part of hospital IT.

The radiology department, in particular, with a number of systems producing and processing images, places very high demands on the quality and capacity of the network.

The appointment of specialist engineers is absolutely necessary.