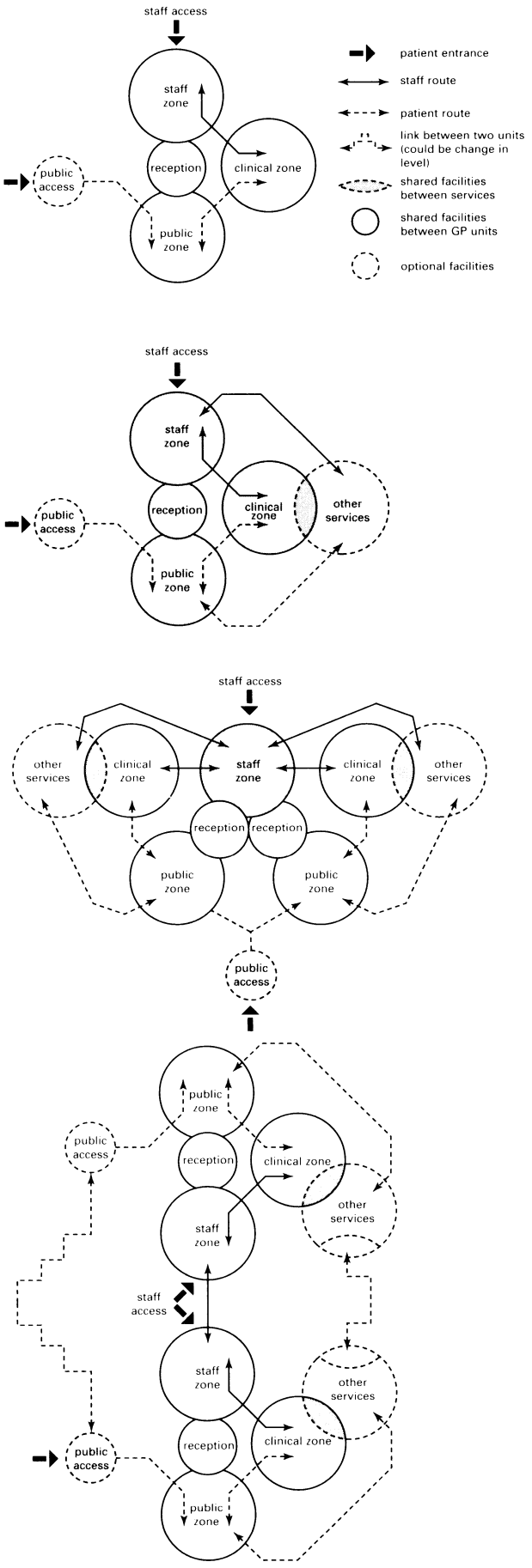
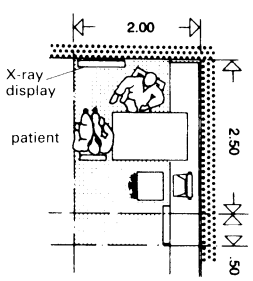
GROUP PRACTICES AND HEALTHCARE CENTRES

Primary healthcare is delivered in the community at the first contact point between members of the public and health workers. In the past, people would see their general practitioners either at their homes or in the doctor's surgery. If necessary, they would be referred to specialists to receive care. However, the sustained trend towards specialisation amongst doctors starting out on their careers has produced a shift towards medical and diagnostic centres offering extensive medical services. The advantages for the patient are shorter waiting times and a greater possibility of being able to receive a diagnosis and treatment without having to be referred to another doctor. For the doctor, the advantages are the introduction of more regulated working hours and the ability to exchange and learn from the experiences of other doctors in the practice. The simplest form of care centre is the group practice. This is a combination of two or more practising doctors with shared staff and premises.

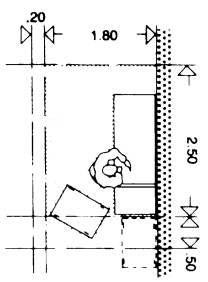
Although the main core of the primary care service is the general medical practice, with the emphasis on the general practitioner (GP), modern healthcare centres increasingly comprise nursing and other professional staff of primary and community healthcare teams whose roles are also important. There could be, for example, nursing and midwifery teams (practice nurse, health visitor, district nurse, midwife, community psychiatric nurse, school nurse, etc.) as well as visiting therapists and practitioners in specialist disciplines. The members of the team work interdependently, although each has his/her role clearly defined. There are also the administration staff who run the centre (e.g. practice manager, receptionist, records clerk and secretary). Social workers and dental practitioners might also use the facilities.



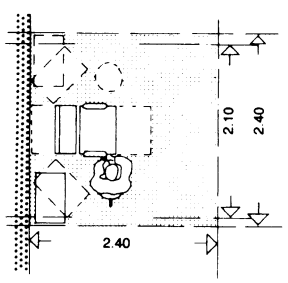
1 **General medical practice premises**



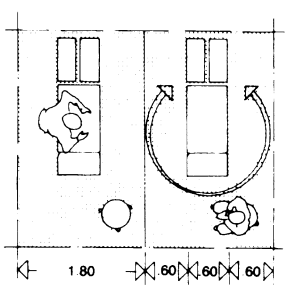
2 **Minimum area: doctor's consultation**



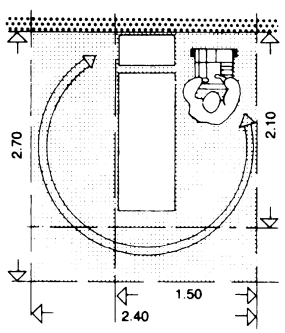
3 **Minimum area: examination of reclining patient**



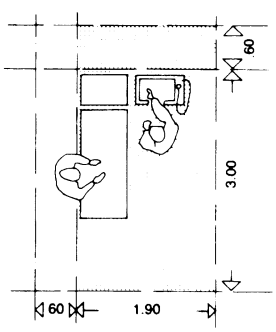
4 **Minimum area: taking blood samples**



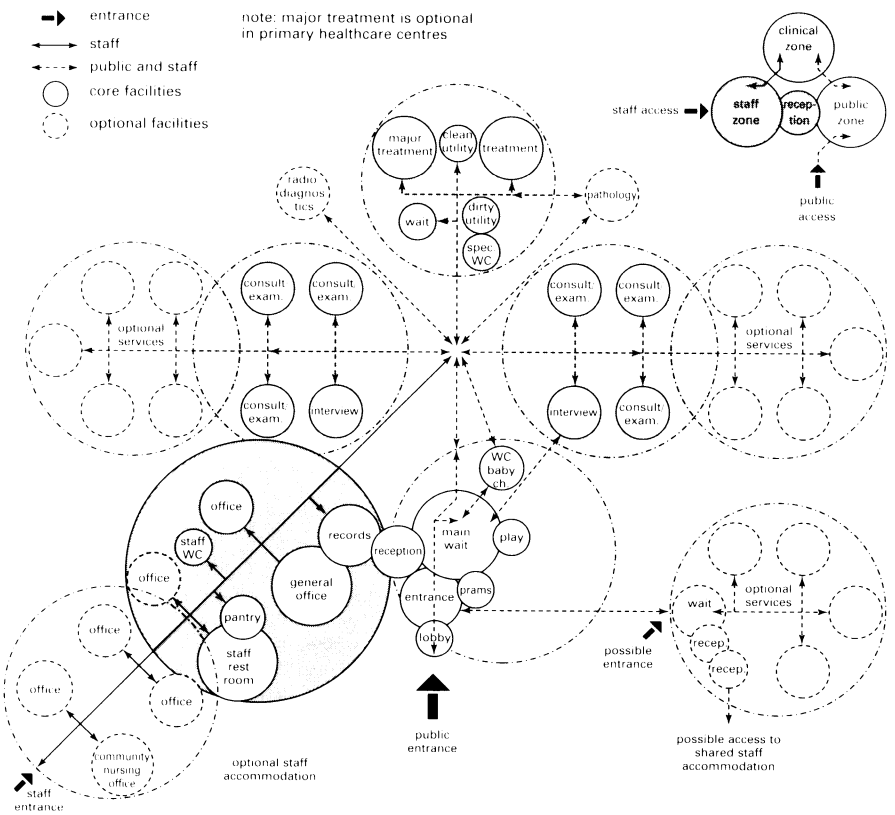
5 **Area for physiotherapy couches**



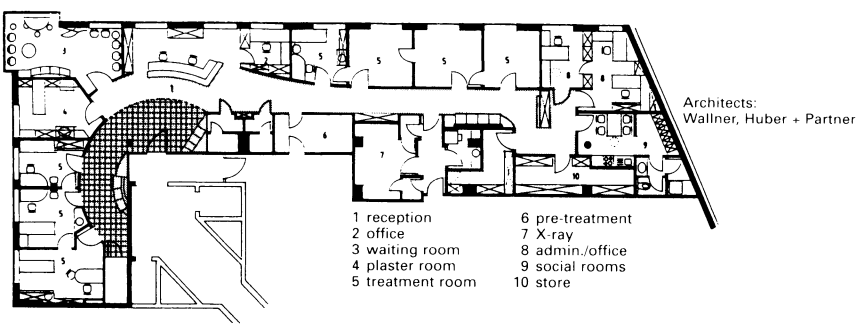
6 **Minimum area: electrocardiogram (ECG)**



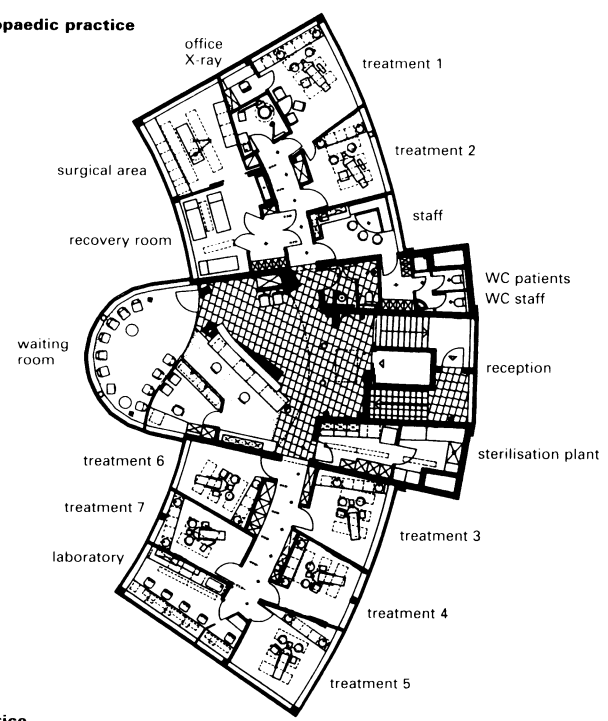
7 **Area requirements: ultrasound examination**



(8) **Functional parts and relationships**



(9) **Group orthopaedic practice**



(10) **Dental practice**

Architects: Kaiser and Wildner

GROUP PRACTICES AND HEALTHCARE CENTRES

A primary healthcare centre therefore provides a range of medical services including: consultations, treatment diagnosis, minor surgery and health education. Sometimes it may also include day care for physiotherapy and occupational therapy, and out-patients' emergency treatment. In some cases there may be in-patient short-stay beds. These centres can offer great flexibility and tend to serve an average population of between 10000 and 30000 people.

Any of these building types may include general medical practitioners, dental, ophthalmic and pharmaceutical practitioners, community nursing services, such as chiropody, physiotherapy and speech therapy, non-acute beds, resource, educational facilities, out-of-hours facilities for GPs, 'drop-in treatment' and minor surgery facilities.

There are several factors that should be considered in the design of a primary healthcare building. These include:

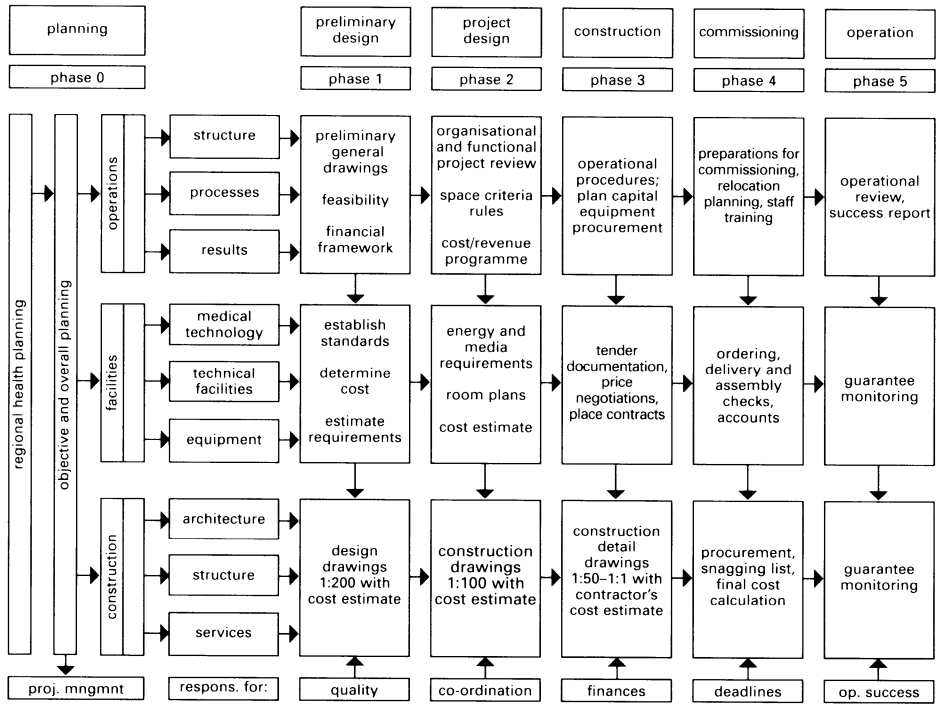
- Location of the building: should be convenient in relation to the people it serves.
- Circulation: entrance and circulation within the building must consider wheelchair users, parents with small children and people with disabilities, etc.
- Effective zoning is required: public zone, clinical zone, and staff zone.
- Privacy and confidentiality are important, especially at the reception desk and clinical rooms during consultations and treatments.
- Security and supervision in the premises will be necessary, including staff protection against personal assault and equipment safeguarded against theft and vandalism.
- For running costs, efficient staffing, energy-efficiency, long-life and low-maintenance approaches should be adopted.
- Flexibility and growth should be catered for: flexibility in the use of some spaces, and potential for future extension of the building.

The following spaces should be considered. The design, number and areas (m^2) of each of these spaces, should take account of several factors, including staff, the type and number of people to be served by the building, equipment and furniture, and with regard to functional content of the building, local circumstances, design guides: car parking spaces; main entrance; reception area; record storage; administration and office bases; waiting areas; consulting/examination rooms; treatment rooms; minor surgery spaces; dental suites; multipurpose rooms; interview rooms; WCs for patients; WCs for staff; staff amenities; out-patient consulting and diagnostic facilities; beds; educational facilities; storage for each of the services; building services requirements; grouping of spaces.

The vocational regulations in individual countries must be observed because in some circumstances they may preclude some communal practices.

HOSPITALS

General



(1) **Planning areas and planning levels for hospital construction**

The costs involved in the construction of a hospital are extraordinarily high. Consequently, efficient project management and site planning is essential. The minimisation of project and staff costs must be made a priority.

Project planning must include intensive discussions with the client, doctors, architects, technical planners and hospital administrators during the preliminary stages to eliminate the risk of bad investment decisions and unfavourable growth in operating costs. The importance of co-operation between the architects, the administrators and technical experts cannot be overemphasised.

Following on from project planning, the building design stage will establish the structure and form of the hospital as well as the provision of services and engineering systems and details for fitting out with the required medical facilities and equipment.

General comments

Medical institutions provide treatment for and care of patients with a wide range of acute and chronic conditions. The objectives of the medical care may vary in nature and extent and so need to be identified accurately. Hospitals therefore differ in the number of specialisms they support and the size of the specialist departments and treatment facilities; in their provision of specialist curative medicine, preventive medicine (prophylactics) and aftercare (rehabilitation), examination (diagnostics) and treatment (therapy); in the intensity of care, the standard of accommodation and level of welfare, psychiatric care, training and research activity.

While early hospitals were consciously planned as medico-surgical institutions, nowadays a shift can be seen towards increasing humanisation of the facilities. Modern hospitals tend to be rather like hotels in nature; a residential atmosphere is considered to be more important than the uncompromising sanitary design of their predecessors. The length of stay of patients is getting progressively shorter, and there is a growing preference for rooms with one or two beds (particularly for private patients).

Demarcation

The general hospital is divided into operational areas of care provision, examination and treatment, supply and disposal, administration and technology. In addition, there are residential areas and possibly areas for teaching and research as well as support areas for service operations. All of these areas are precisely defined within the hospital. Opinions vary concerning the arrangement of the different areas but it is important to maintain the shortest practicable horizontal and vertical links while at the same time demarcating the individual departments as far as possible.

Types

Hospitals may be subdivided into the following categories: smallest (up to 50 beds), small (up to 150 beds), standard (up to 600 beds) and large hospitals. Very few of the smallest and large category hospitals have been built in recent times, the trend now seeming to be to create an even coverage of standard hospitals. In fact, modern health reforms have produced a noticeable reduction in the numbers of the smallest hospitals. The sponsors may be public, charitable or private or a mixture of these.

Hospitals are divided by function into general, specialist and university hospitals.

University hospitals

University hospitals with maximum provision are to be considered equal to the medical academies and some large general hospitals. They have at their disposal particularly extensive diagnostic and therapeutic facilities and systematically carry out research and teaching. Lecture theatres and demonstration rooms should be included in such a way that operations are not interrupted by the observers. Larger wards should be planned so as to accommodate both visitors and observers.

The amenities and special requirements of university hospitals frequently require a specially designed set of rooms.

Specialist hospitals

The number of specialist hospitals is growing fast because of the increasing focus on individual types of treatment or medical fields: casualty, rehabilitation, allergies, orthopaedics, gynaecology, etc. Also included in this category are special clinics dealing with, for example, cancers, skin problems, lung conditions, psychiatric disorders, and the like. In turn, these feed residential rehabilitation centres, nursing homes, special schools and old people's homes.

Bed requirements

The following are typical patient numbers per 1000 inhabitants per year in a typical developed country (here, Germany in 1996)

		acute hospitals	180.1
hospitals in total	183.7	special hospitals	3.6

At present there are typically the following numbers of beds per 1000 inhabitants:

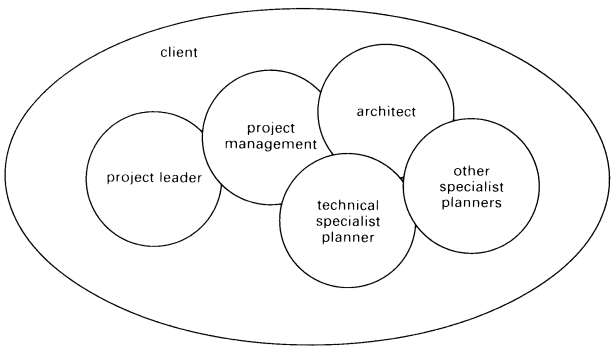
		acute hospitals	6.9
hospitals in total	7.5	special hospitals	0.6

The average patient stay (in days) in 1996 was as follows:

		acute hospitals	11.4
hospitals in total	12.1	special hospitals	47.4

The number of beds available differs from one country to another. For example, in 1994/95, the total number of beds available in NHS hospitals in the UK was 4.8 per 1000 people; for acute beds the figure was 2.3 per 1000.

Construction Planning



Planning organisation in flux
Project management plays a central role in the timed planning and execution processes for a general hospital

(1) **Planning organisation today**

Building a hospital is a highly complex project and requires systematic planning to deliver the heterogeneity and flexibility required when such a large number of people are involved. The construction process must satisfy the needs of a number of functions: accommodation, research (in university hospitals), teaching, medical activity, storage and administration. A proper planning methodology enables this to be done by utilising a variety of room dimensions and installations.

The planning team, consisting of architects, doctors, nurses, specialist engineers and administrative staff, needs to co-operate closely throughout both the planning and construction stages because the design brief could, at any time before completion, be compromised by unforeseen developments which highlight inadequacies or errors.

It takes 8–10 years for a hospital construction project to move from initial planning discussions to commissioning. This is equivalent to the time required for the development of a whole new generation of medical technology, which puts the building at risk of being out of date when ready for use if conventional construction planning and construction methods are used.

To ensure the planning of the building is realistic, it is important to co-operate with related business and industrial concerns from an early stage. For example, because the size of equipment is constantly changing in parallel with advances in computer technology, it can have major consequences for the room arrangements. The size of individual departments (e.g. radiology, radiotherapy) has also changed considerably in recent years so consultation with the intended users is therefore important.

Health service reforms will have a substantial influence on hospital planning in the future as will the trend for individual medical specialisations to move out of general hospitals and set up separate clinical centres with their own administration (e.g. radiology, geriatric day clinics, ambulant treatment centres). In addition, ever greater influence is being exerted on planning by fire prevention and sound reduction requirements, as well as building regulations and the requirements of the related professional bodies.

Period of use

Building fabric, interior works and fitting out are subject to different periods of use.

As much as possible of the construction should be of frame type in order to allow flexibility in the fitting out. Installations and interiors are, depending on the department and writing-off periods, changed about every 5–10 years, which can impose serious contraints on the spatial arrangements, particularly for large specialist equipment (e.g. linear accelerators). The installation and removal of such equipment must be taken into account during the planning stage such that the structure of the building does not have to be altered (which would, of course, have serious cost implications).

Economy

Possible changes in use, as well as the differing impact of wear, have an effect on construction planning and planning methodology. These criteria should be taken into account in economic assessments, together with short operational paths, appropriate work processes and general functional arrangements.

Construction costs

The building costs should conform to the relevant regulations and guidelines. Typical cost allocations are as follows:

- weather sealed structure approx. 22%
- fitting out and services approx. 40%
- installations and medical equipment approx. 20%
- incidental costs approx. 18%

In the planning of new buildings, about 70–100 m^2 must be allowed per sick bed, and roughly 200–280 m^3 per bed must be allowed for alterations (which includes all ancillary spaces such as environmental controls and storage spaces).

Design rules

Hospitals are often build in several phases or are added in stages to existing hospitals. Therefore, the design (circulation system, floor levels) and construction must be such as to allow a variety of extension possibilities.

Affinities

From the commencement of the first design activities, clarity must be achieved within the design team about the affinity between the individual operational spheres. The need for close co-operation between various hospital departments is facilitated by spatial proximity.

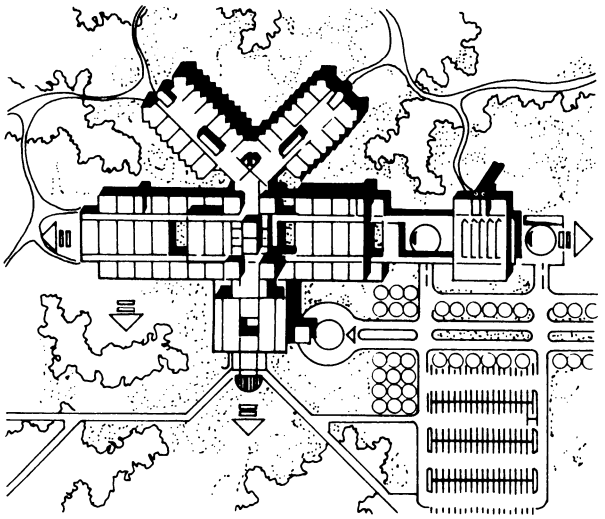
	nursing	operating	intensive care	sterilisation	maternity	emergency	laboratory	radiology	examination	X ray	out patients
nursing			□		□			□		◇	
operating			○	○	○	◇	◇				○
intensive care				◇		◇	◇			◇	
sterilisation											○
maternity						◇			□		
emergency							◇			○	○
laboratory									□		□
radiology											
examination										◇	◇
X ray											◇
out patients											

○ very good connection required ◇ good connection sensible □ connection desirable

(2) **Connections between areas**

HOSPITALS

Planning Conception



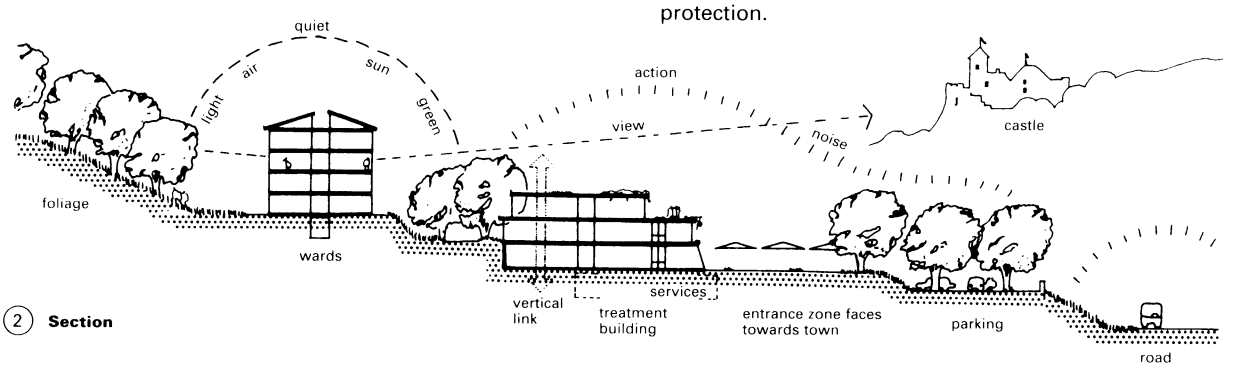
Proposal for a model clinic in co-operation with Hentrich Petschnigg & Partner and the German Hospitals Institute: the building can be expanded in three directions; pedestrian and emergency traffic are separated; supply and disposal separated from other hospital traffic

(1) **Model treatment clinic**

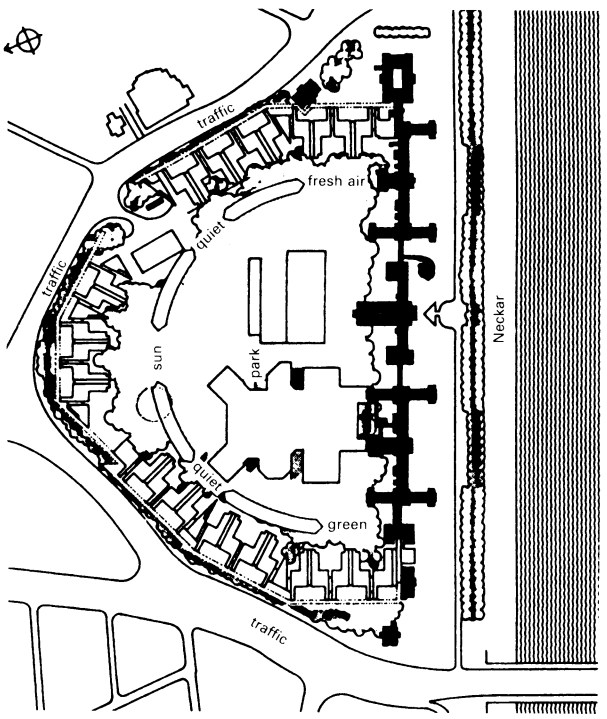
Location: The site should offer sufficient space for self-contained residential areas and hospital departments. It should be a quiet location with no possibility of future intrusive development not excluded by regulations on adjacent sites. No loss of amenity should result from fog, wind, dust, smoke, odours or insects. The land must not be contaminated and adequate open areas for later expansion must also be planned.

Orientation: The most suitable orientation for treatment and operating rooms is between north-west and north-east. For nursing ward façades, south to south-east is favourable: pleasant morning sun, minimal heat build-up, little requirement for sun shading, mild in the evenings. East and west facing rooms have comparatively deeper sun penetration, though less winter sun. The orientation of wards in hospitals with a short average stay is not so important. Some specialist disciplines might require rooms on the north side so that patients are not subjected to direct sunlight.

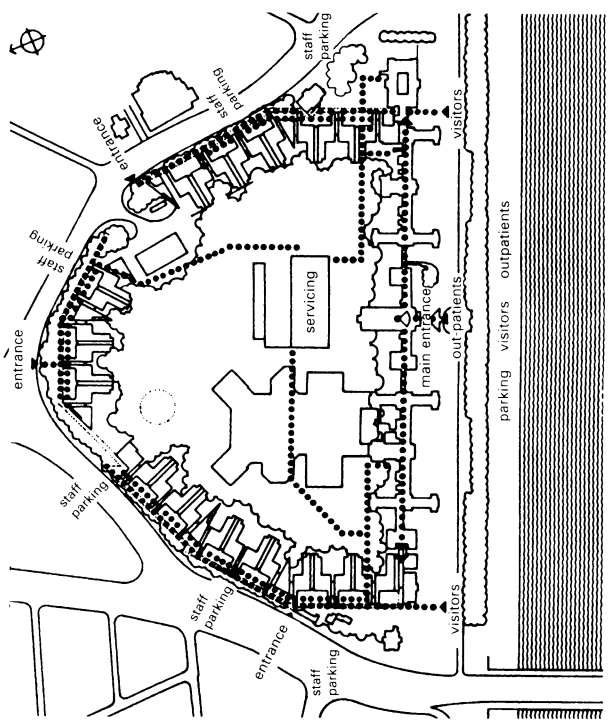
Concept: An existing hospital is to be expanded; the design includes four building phases. A large enclosed area containing a park will be created to allow windows to be opened without the need to tackle problems of noise protection.



(2) **Section**



(3) **Rear of ward buildings along the periphery, blocking off traffic noise; all wards overlook the park**

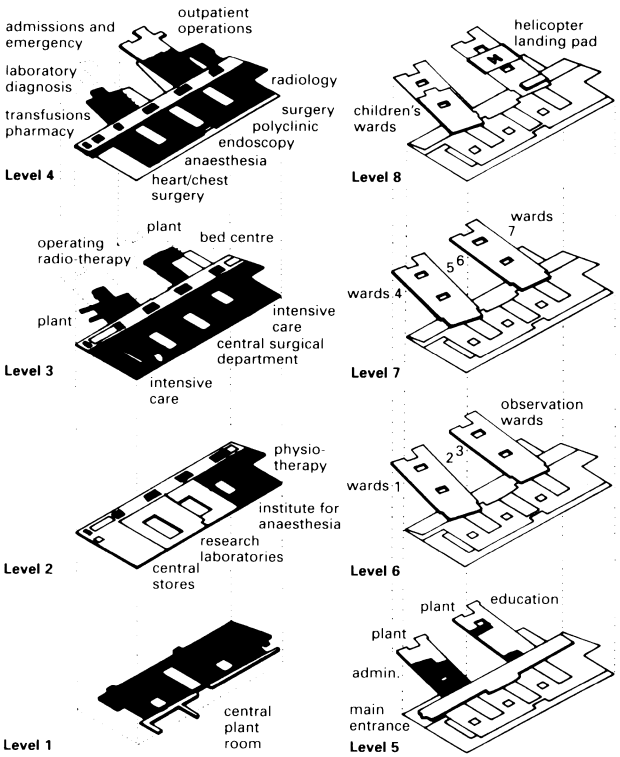


Architects: Eilingsfeld, Janisch, Utzmann, Heinz, Wissenbach

(4) **Free of car traffic; staff park at the rear of the ward buildings**

HOSPITALS

Forms of Building

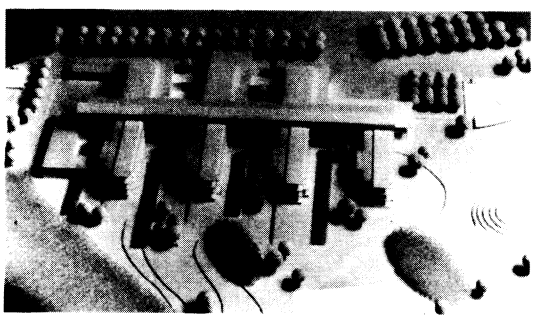


(1) **Functional areas/ vertical connections** Architects: Schuster, Pechtold and Partners

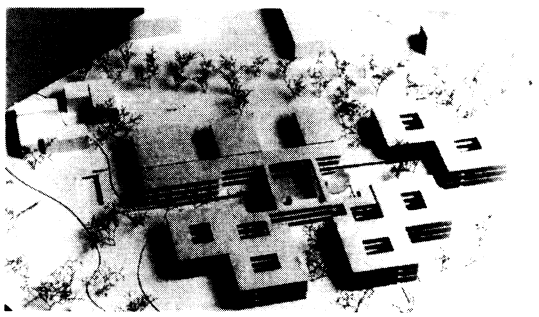
The form of a building is strongly influenced by the choice of access and circulation routes. It is therefore necessary to decide early on whether to choose a spine form with branching sections (individual departments), or whether circulation will be radially outwards from a central core. Consideration must be given to future expansion: this is most easily carried out with an extended main tract. Self-contained circulation routes should be avoided as they make any extension work far more costly and disruptive.

The vertical arrangement within a hospital should be designed so that the functional areas – care, treatment, supply and disposal, access for bedridden patients, service yard, underground garage, stores, administration, medical services – can be connected and accessed most efficiently. An effective arrangement would be as follows:

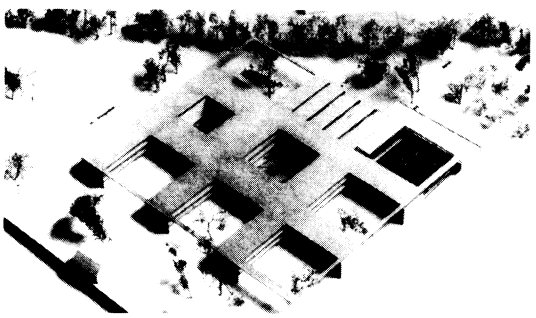
top floor:	helipad, air-conditioning plant room, nursing school, laboratories
2nd/3rd floor:	wards
1st floor:	surgical area, central sterilisation, intensive care, maternity, children's hospital
ground floor:	entrance, radiology, medical services, ambulance, entrance for bedridden patients, emergency ward, information, administration, cafeteria
basement:	stores, physiotherapy, kitchen, heating and ventilation plant room, radio-therapy, linear accelerator
sub-basement:	underground garage, electricity supply



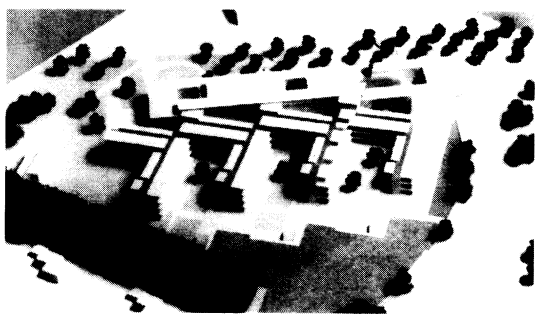
(2) **Hospital competition, Erfurt** Architects: Prof. Rossmann and Partner



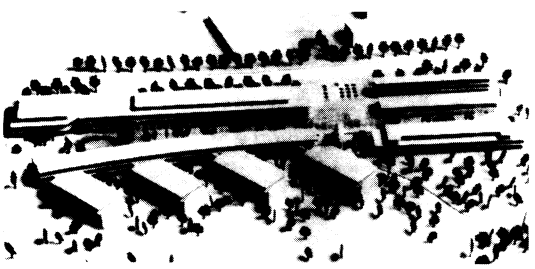
(3) Architects: Prof. H. Nickl and Chris. Nicki-Weller



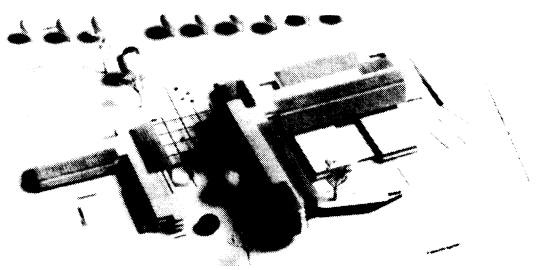
(4) Architects: Hasek and Unterholzner



(5) Architects: Thiede, Messhalter, Klösgen



(6) Architects: Heinle, Wischer and Partner



(7) Architects: Ondra and Heinzelmann

HOSPITALS

Forms of Building

Outpatients

The location of outpatient treatment rooms is of particular importance. Separation of the routes taken by outpatient emergencies and inpatients should be given consideration early in the planning process.

The number of patients concerned will depend on the overall size and technical facilities of the hospital. Where there is a consistently high number of outpatients a separate area can be created away from the other hospital operations. However, there must still be close links to the X-ray and surgical departments.

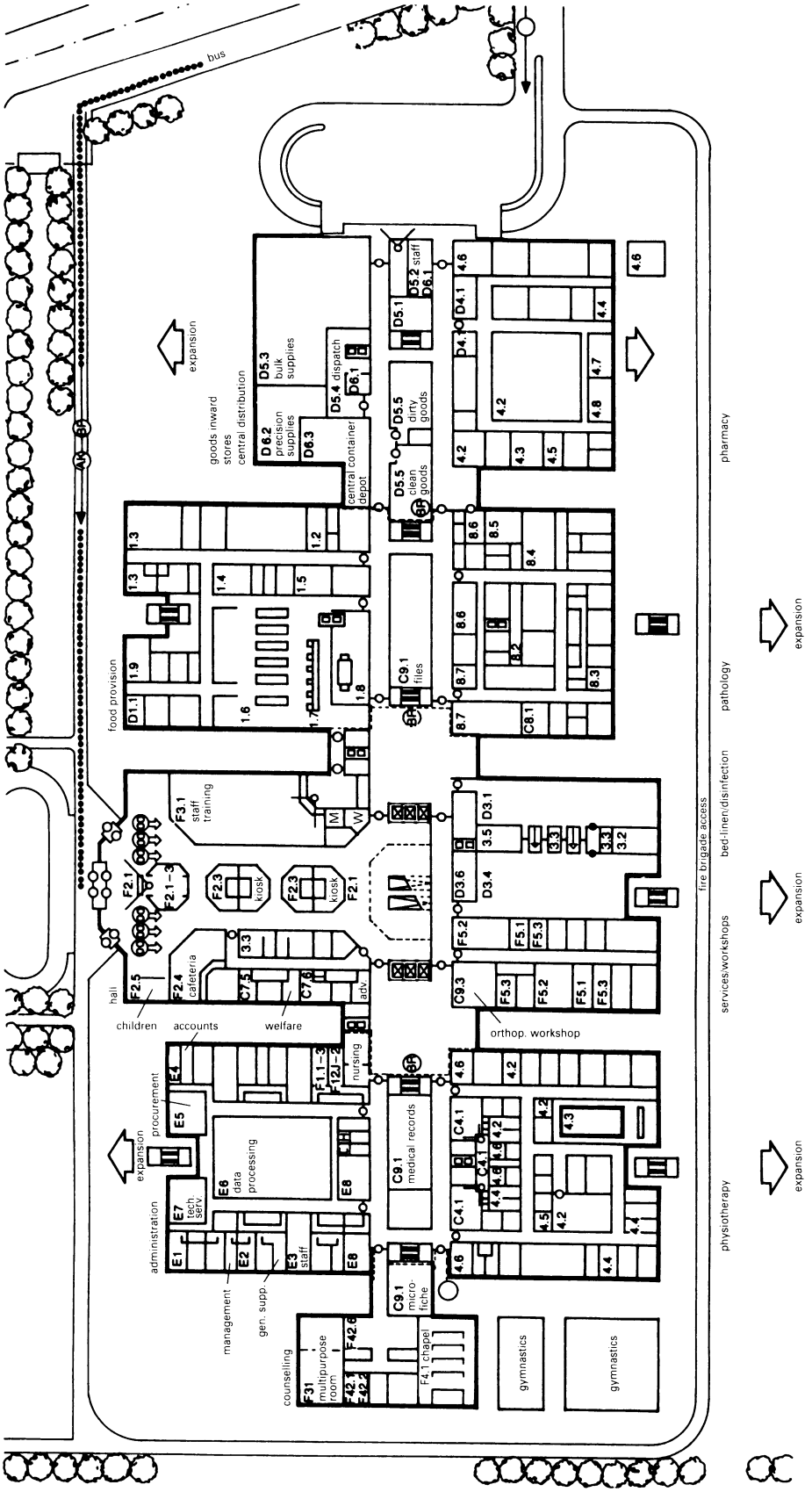
Outpatient operations are becoming increasingly important so larger waiting areas and more outpatient treatment rooms should be considered.

Design example

In a six-storey building, the vertical arrangement is designed with the nursing areas situated above the service, examination and treatment areas. On the ground floor are the accident and emergency, ambulance and X-ray departments; the surgical and intensive care departments occupy the first floor.

The constructional grid is 7.2 × 7.2 m.

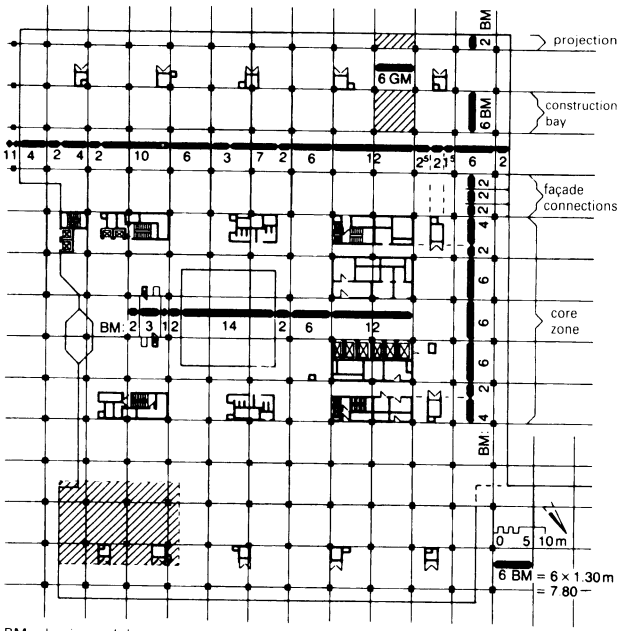
The building is conceived in such a way that it can be erected in three building phases, resulting in a connection to an existing hospital. Vertical circulation is achieved via two lift blocks, each with four lifts and one staircase. In each corner of the building are emergency stair towers. Circulation on each floor centres on a main corridor (spine) 3.6 m wide. Note the use of different storey heights for treatment areas (4.5 m) and for nursing areas (3.4 m).



(1) **City Hospital Berlin-Reinickendorf: ground floor plan** Architects: Mülberger, Schlenzig, Schneider

HOSPITALS

Dimensional Co-ordination



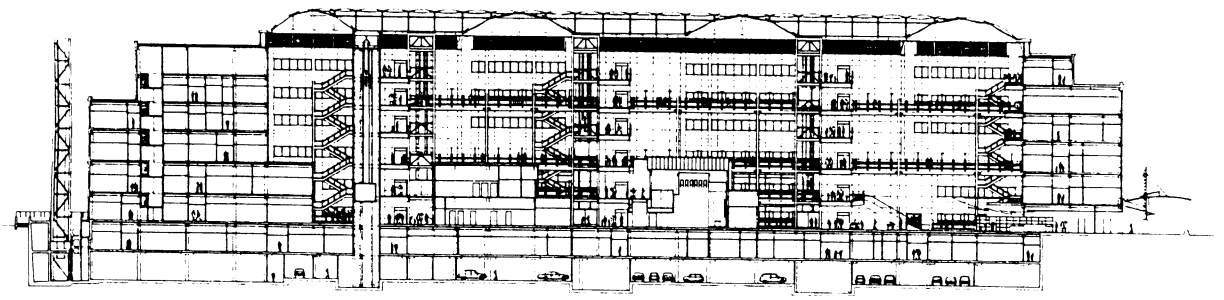
BM = basic module

(1) **Basle Cantonal Hospital: schematic ground floor plan**

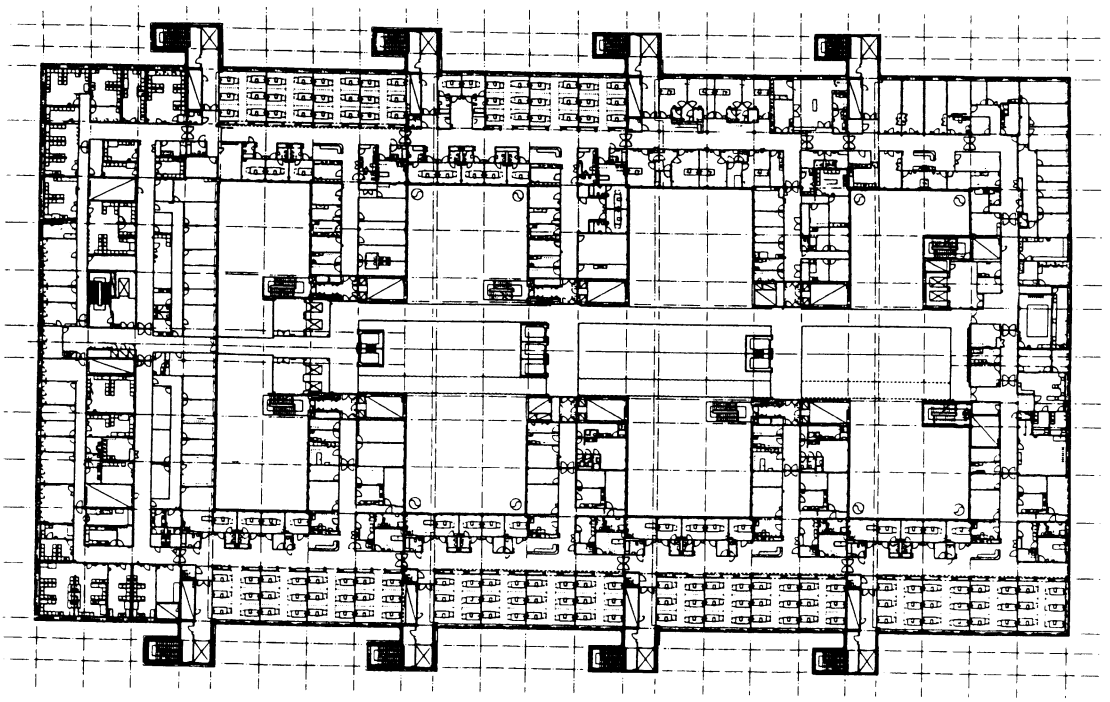
Modules: Modular dimensional co-ordination is the best starting point for meeting strategic design requirements. Reference systems, basic modules and multiple modules for construction details, layout and dimensions of building parts are all to be considered. For hospital construction the preferred module dimensions 12M = 1.20m are recommended, or 6M or 3M if the increments are too numerous. In this system all the building components are co-ordinated with each other. The supporting structure can be drawn in by producing a horizontal and vertical basic grid.

An agreement on dimensions has considerable consequences for building construction, and the building systems available on the market must conform to this dimensional co-ordination. It is therefore helpful to prescribe a normal standard dimension in planning. The benefits of dimensional co-ordination are shorter construction periods and easier replacement of interior fittings, with less disruption of service. The schematic ground floor plan of the Cantonal Hospital for the City of Basle shows the structural grid, support dimensions, façade position and layout and dimensions of core zones and shafts.

Use of grids: The Chelsea and Westminster Hospital in London is one of the largest hospitals in Europe and demonstrates how a hospital of this size can be organised and planned around a simple grid. The large internal courtyards allow natural lighting into most of the rooms on all floors. The design grid, on which all subsequent divisions are based, measures about 7.2 × 2.2m. Both the examination rooms and wards (with centres at 3.6m) are designed to comply. The necessary escape stairs are situated in the internal courtyards or on the outside of the building.



(2) **Section**



(3) **Chelsea and Westminster Hospital, London: third floor**

Architect: Sheppard Robson

Dimensional Co-ordination

Structural grid

The constructional grid must provide a precise guide as well as allowing for differentiation of areas for the main functions, support functions and vehicular traffic.

A comparison of the individual operational areas and the rooms they require should result in a structural grid which is suitable for all functions.

The various operations centres can be planned most appropriately with a column grid spacing of 7.20m or 7.80m. Smaller construction grids are problematic because large rooms (e.g. operating theatres) which must be free from internal columns are more difficult to accommodate.

Room schedule

A room schedule showing the overall classifications and requirements of the hospital must be drawn up in order to generate an appropriate structural grid and ground plan. Depending on the type of hospital, this will not detail all of the possibilities but will cover only the key functional rooms. The specifics of the room schedule must be discussed with the users so it is therefore sensible to set up a detailed room-by-room specification procedure. Specialist areas within a hospital can affect the nature and size of other individual operations centres and close co-operation between planners and users will prevent possible problems arising later.

An overview of the size of the individual operations centres can be obtained using reference area values. However, these are only recommendations and depend on the orientation and services of the actual project in question.

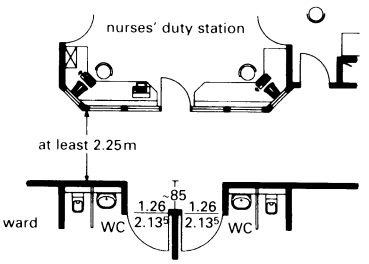
functional areas
intensive care special care normal care
functional area 1 – care
surgery recovery area rehabilitation physiotherapy X-ray diagnosis NMR diagnosis radiotherapy clinico-chemical laboratory clinico-physical laboratory clinico-neurophysical laboratory central reception and treatment delivery dialysis specialist anaesthesia department specialist eye department specialist surgical department specialist gynaecology department specialist obstetrics department specialist ENT department specialist internal medicine department specialist paediatric department specialist neurosurgery department specialist neurology department specialist psychiatry department specialist X-ray area department specialist urology department
functional area 2 – examination/treatment
functional area 3 – research
functional area 4 – pathology
functional area 5 – teaching/training
library files
functional area 6 – scientific information
emergency services blood bank
functional area 7 – special interdisciplinary facilities
central administration patient reception
functional area 8 – administration/management
staff changing room canteen shop other patient facilities
functional area 9 – housekeeping
food provision central store central sterilisation pharmacy laundry bed cleaning waste disposal transport service
functional area 10 – supply/disposal
foyer/entrance cleaning service maintenance
functional area 11 – other functions

(1) **Possible room schedule for a large hospital covering all specialist areas**

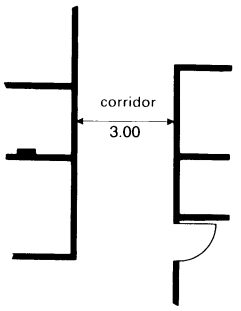
areas for the overall hospital, including functional area for:		
supply/disposal	40 – 80 m²	PA/planned bed-care area
nursing area	19 – 25 m²	PA/planned bed
intensive therapy	30 – 40 m²	PA/bed
surgical area	130 – 160 m²	PA/surgical unit
rehabilitation	19 – 22 m²	PA/treatment place
physiotherapy	68 – 75 m²	PA/treatment place
X-ray	60 – 70 m²	PA/diagnosis room
radiotherapy	300 – 350 m²	PA/equipment
recovery area	25 – 30 m²	PA/recovery bed
NMR diagnosis	100 – 150 m²	PA/diagnosis room
clinical physiology	80 – 100 m²	PA/diagnosis room
clinical neurophysiology	78 – 100 m²	PA/diagnosis room
central reception	140 – 160 m²	PA/examination/treatment room
delivery area	85 – 100 m²	PA/delivery room
dialysis	70 – 80 m²	PA/dialysis bed
specialist departments	55 – 75 m²	PA/examination/treatment room
(PA = productive area)		

(2) **Guideline areas for a standard hospital**

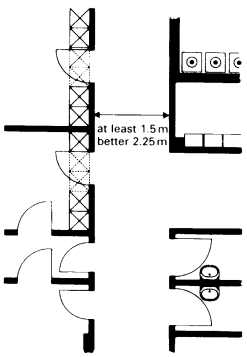
Corridors, Doors, Stairs, Lifts



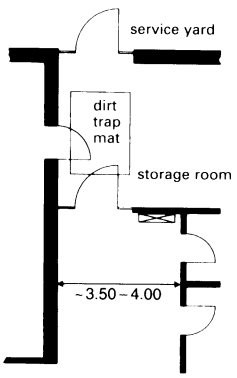
① **Ward corridor/nursing area**



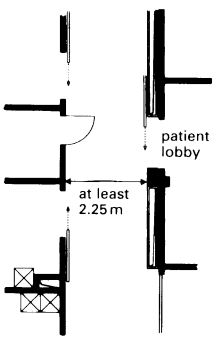
② **Main corridor (spine)**



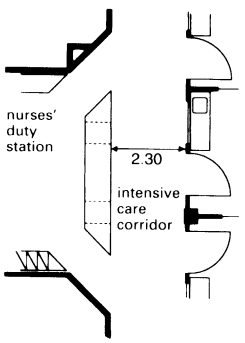
③ **Medical services corridor**



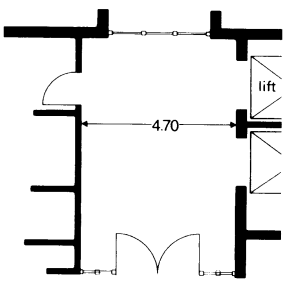
④ **Service corridor, deliveries, storage areas**



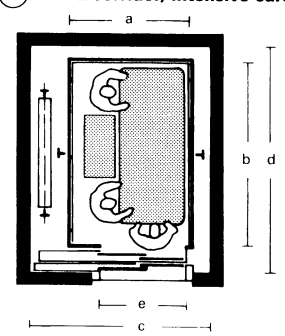
⑤ **Working corridor, surgical area**



⑥ **Ward corridor, intensive care**



⑦ **Lift lobby**



⑧ **Bed lift**

capacity (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 e	1300	1300	1300
car height	2300	2300	2300
car door height	2100	2100	2100
capacity (passengers)	21	26	33

⑨ **Dimensions of bed lifts** → ⑧

Corridors → ① – ⑥

Corridors must be designed for the maximum expected circulation flow. Generally, access corridors must be at least 1.50m wide. Corridors in which patients will be transported on trolleys should have a minimum effective width of 2.25m. The suspended ceiling in corridors may be installed up to 2.40m. Windows for lighting and ventilation should not be further than 25m apart. The effective width of the corridors must not be constricted by projections, columns or other building elements. Smoke doors must be installed in ward corridors in accordance with local regulations.

Doors

When designing doors the hygiene requirements should be considered. The surface coating must withstand the long-term action of cleaning agents and disinfectants, and they must be designed to prevent the transmission of sound, odours and draughts. Doors must meet the same standard of noise insulation as the walls surrounding them. A double-skinned door leaf construction must meet a recommended minimum sound reduction requirement of 25dB. The clear height of doors depends on their type and function:

normal doors	2.10–2.20m
vehicle entrances, oversized doors	2.50m
transport entrances	2.70–2.80m
minimum height on approach roads	3.50m

Stairs

For safety reasons stairs must be designed in such a way that if necessary they can accommodate all of the vertical circulation. The relevant national safety and building regulations will, of course, apply. Stairs must have handrails on both sides without projecting tips. Winding staircases cannot be included as part of the regulatory staircase provision. The effective width of the stairs and landings in essential staircases must be a minimum of 1.50 m and should not exceed 2.50 m. Doors must not constrict the useful width of the landings and, in accordance with hospital regulations, doors to the staircases must open in the direction of escape.

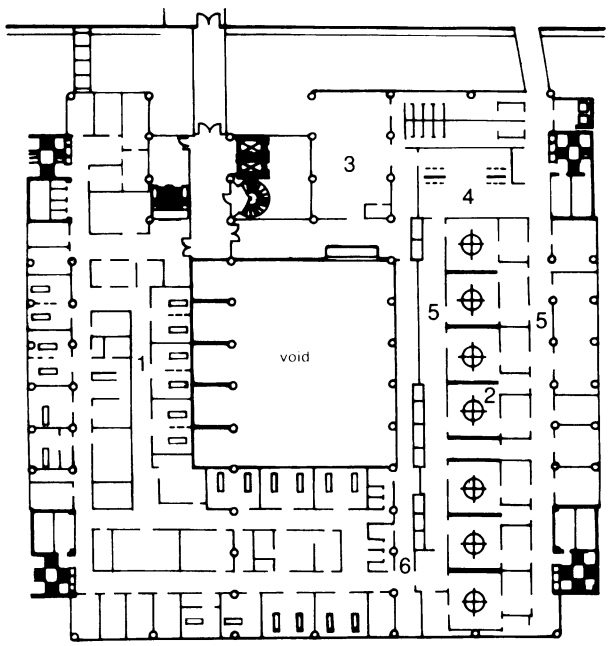
Step heights of 170mm are permissible and the minimum required tread depth is 280mm. It is better to have a rise/tread ratio of 150:300 mm.

Lifts → ⑧ ⑨

Lifts transport people, medicines, laundry, meals and hospital beds between floors, and for hygiene and aesthetic reasons separate lifts must be provided for some of these. In buildings in which care, examination or treatment areas are accommodated on upper floors, at least two lifts suitable for transporting beds must be provided. The elevator cars of these lifts must be of a size that allows adequate room for a bed and two accompanying people; the internal surfaces must be smooth, washable and easy to disinfect; the floor must be non-slip. Lift shafts must be fire-resistant.

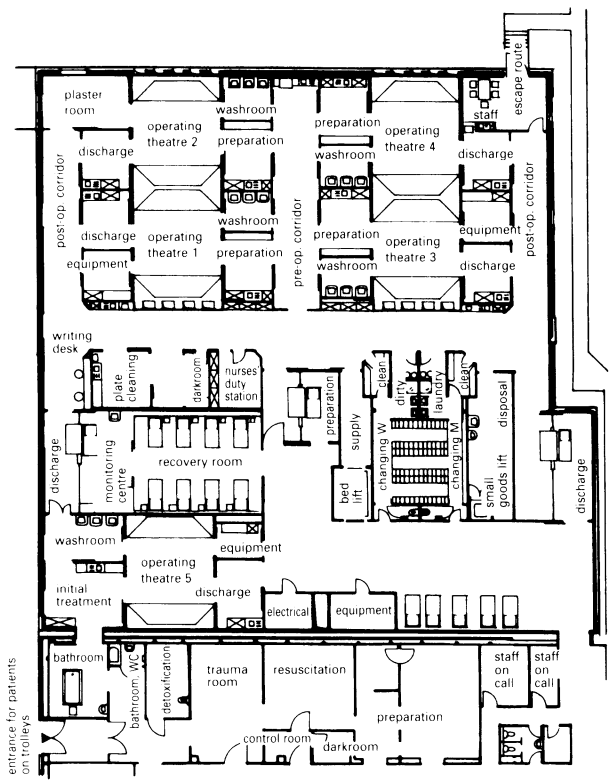
One multipurpose lift should be provided per 100 beds, with a minimum of two for smaller hospitals. In addition there should be a minimum of two smaller lifts for portable equipment, staff and visitors:

clear dimensions of lift car:	0.90 × 1.20m
clear dimensions of shaft:	1.25 × 1.50m



1 intensive care
2 surgical department
3 recovery room
4 patient lobby
5 clean working corridor
6 non-clean corridor

(1) **Surgical operations centre, Katharinen Hospital, Stuttgart: second floor** Architects: Heinle, Wischer and Partners.



(2) **Ground plan of central surgical area** Architects: Heinle, Wischer and Partners

Centralisation: advantages and disadvantages

In the past, surgical operations centres tended to be planned within the hospital as a centrally located examination and treatment unit for use by various specialist departments. The reasons for this were better utilisation of space, equipment and staff, better patient provision through centralised service functions under the management of specialists, and hygiene considerations. The possible disadvantages of particularly large centralised surgical departments are high organisational costs and an increased risk of infection because of the large numbers of people brought together. A further disadvantage is the combination of septic and aseptic operations in one centre. A plan for septic and aseptic surgical units must be discussed with surgeons and hygienists. Current designs for large hospitals have separate units for septic and aseptic operations as a rule. External surgical units can generally better meet the requirements. When deciding the location of the surgical department, service relationships with other operations centres must be checked. These include reception, the emergency service, casualty surgery, obstetrics, endoscopy and specialist clinics.

Function and layout

In the surgical department, treatment is given to the patients whose conditions have been diagnosed but cannot be cured solely with medication. It should be close to the intensive care department, the recovery room and the central sterilisation area because there is extensive interaction between these departments and so easy access must be assured. The hygiene precautions require the surgical unit to be isolated from the rest of the hospital operations. This is achieved by a demarcation system using lobbies.

Surgical departments are best located centrally in the core area of the hospital where they are easy to reach. The reception area for emergency cases (casualties) must be as close as possible to the surgical area since such patients often need to be moved into surgery immediately.

Organisation of the surgery department

Every surgical department requires the following rooms:

operating theatre	40–48 m²
entry room	15–20 m²
exit room	15–20 m²
washroom	12–15 m²
equipment room	10–15 m²

In new projects, it is permissible for two operating theatres to share the same exit room. Essential to surgical departments are a staff lobby, patient lobby, clean work corridor, anaesthetic workroom, waste lobby, supply lobby, standing area for two operating trolleys and, nearby, the recovery room.

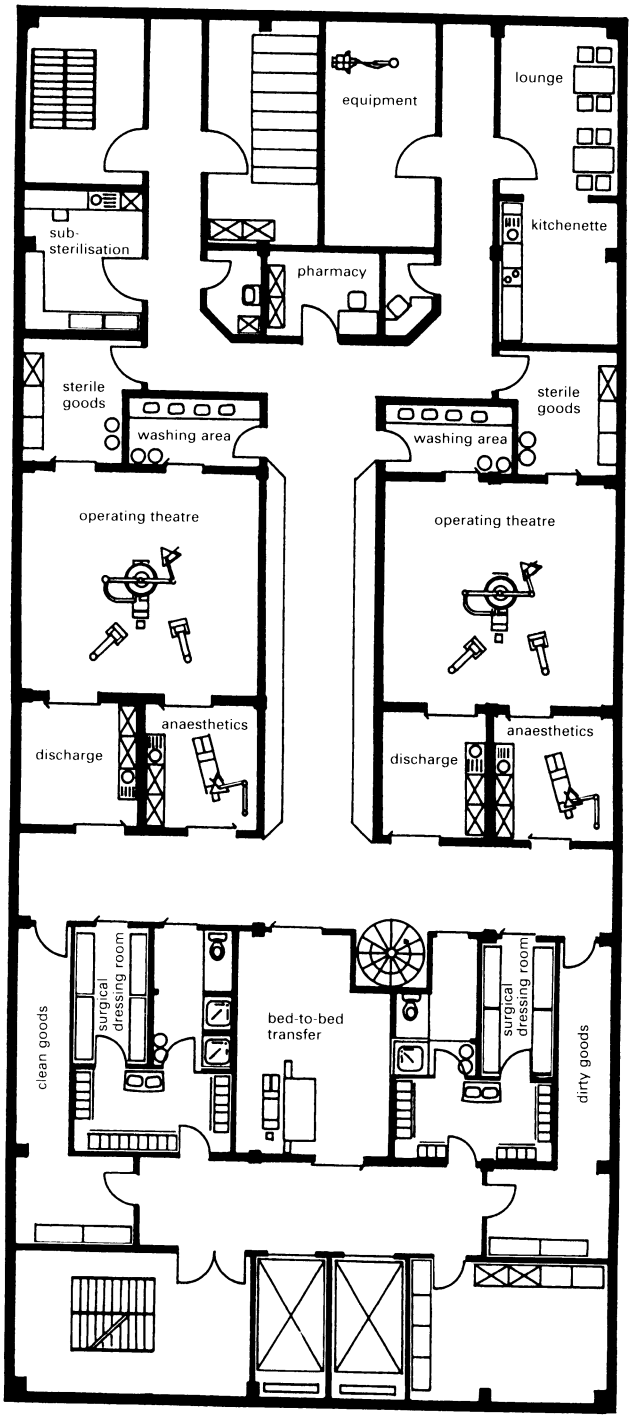
The patient demarcation lobbies are also used for bed-to-bed transfer, preparation of operating tables and ward beds, and theatre stores. An appropriate size is around 35 m² and fittings should inlude wash-basins and an electric conveyor for bed-to-bed transfer.

→ (1) Ideal floor plan of an external surgical area with a direct link to the main building. The corridor system is separated into staff corridors with links to the functional rooms and pre-operative and post-operative patient corridors. A requirement when planning a new building is that it must be expandable on at least one side.

→ (2) Floor plan of the central operating area at the Northern Hospital Centre, Dortmund, with five operating theatres and additional rooms. Pre-operative and post-operative patients are separated and the staff circulate via the area accommodating non-anaesthetised patients area.

HOSPITALS

Main Surgical Rooms



Ground floor plan of a surgical annex with underground link to the main building; recovery room one floor below

(1) **Main surgical rooms** Architects: Köhler/Müller

Routeing

Different activities should be separated in order to reduce the transmission of germs through contact. The single corridor system, in which the pre-operative and post-operative patients, pre-operative and post-operative staff, clean and non-clean goods use a single working corridor without segregation, is no longer standard. It is better to have dual corridor systems in which patients and staff or patients and non-clean materials are separated. The best combination of the individual requirements has not been clarified and they are therefore dealt with individually. One effective strategy is to separate the flow of patients from the working areas used by the surgical staff.

A number of necessary supply and workrooms adjoin the operating theatre directly. The operating theatre should be designed to be as square as possible to allow working whatever direction the operating table is turned in. A suitable size would be 6.50 × 6.50 m, with a clear height of 3.00 m and an extra height allowance of roughly 0.70 m for air conditioning and other services. Operating theatres should be fitted out as uniformly as possible, in order to offer maximum flexibility, and centre on a transportable operating table system which is mounted on a fixed base in the middle of the room. Natural lighting in the operating theatre is psychologically advantageous but often cannot be provided because of the layout. Where it is, there must be the means to shut out the light completely (e.g. eye operations are carried out in very dark rooms). Nowadays service connections and technical supply facilities are generally supplied via suspended anaesthesia equipment. Otherwise, connections for vacuum lines, nitrous oxide and emergency power must be placed at least 1.20 m above floor level.

It is important to isolate the highly sterile areas to which sterile instruments are supplied. Division of the operating theatres into septic and aseptic zones is a matter of medical controversy, but is a sensible precaution. Floors and walls must be smooth throughout and easily washed; decorative or structural projections should be avoided.

Anaesthetics room

The anaesthetics room should be approximately 3.80 × 3.80 m in size and have electric sliding doors into the operating theatre (clear width 1.40 m). These doors must have windows to give a visual link with the operating theatre. The room should be equipped with a refrigerator, draining sink (sluice), rinsing line, cupboards for cannulas, connections for anaesthesia equipment and emergency power.

Anaesthetic discharge room

This is set out identically to the anaesthetics room. The door to the working corridor should be designed as a swing door with a clear width of 1.25 m.

Washroom

Division into clean and non-clean washrooms is ideal, but from a hygiene point of view a single large room is adequate. The minimum width of the room should be 1.80 m. For each operating theatre there should be three non-splash wash-basins with foot controls. Doors into the operating theatre must have an inspection window and, if they are electrical, be opened by foot controls. Swing doors can be used if cost saving is a priority.

Sterile goods room

The size of this room is more flexible but there must be sufficient shelf and cupboard space and it must be accessed directly from the operating theatre. One room of roughly 10 m^2 is required per operating theatre.

Equipment room

Although direct access to the operating theatre is preferable, it is not always feasible; where direct access cannot be provided, the equipment room must be located as close as possible to the theatre in order to reduce waiting times. A room size of approximately 20 m^2 should be allowed.

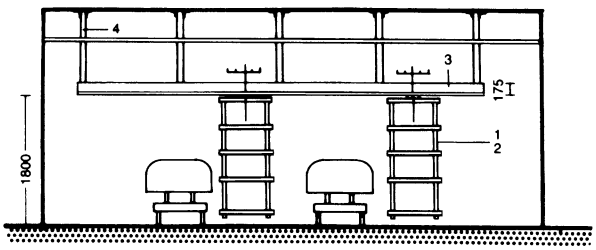
Substerilisation room

This room may or may not be connected directly to the operating theatre's sterile area. It contains an non-clean area for non-sterile material and a clean area for prepared sterile items. It should be equipped with a sink, storage surface, work surface and steam sterilisers. Linking a substerilisation room to several operating theatres causes hygiene problems and so should be avoided. Note that surgical instruments are prepared in the central sterilising unit, which lies outside the surgical area.

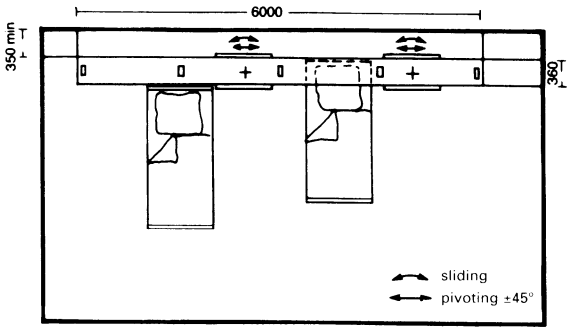
Plaster room

For hygiene reasons this is not located in the surgical zone but in the outpatient area. In emergencies the patient must be channelled through lobbies in order to get to the operating theatre.

Post-operative Facilities



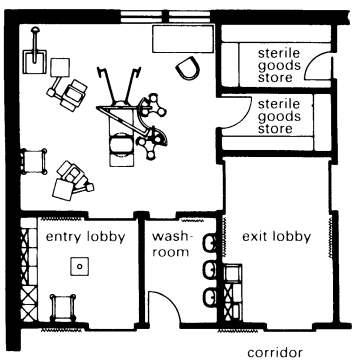
(1) **Ceiling service system (by Dräger)**



(2) **Floor plan** ▸ (1)

→ (1) Beds must not be too close together in the recovery room and allow enough space for the anaesthetist and his equipment to reach at least three sides. Awkward additional equipment, such as sublimation stands, also requires adequate space for ease of movement. The patient is supplied via mobile service bridges with connections for a vacuum line, nitrous oxide, oxygen, power and lighting. All the necessary equipment can be accommodated in a suspended equipment trolley.

The route between the recovery room, the operating theatre and the ward should contain several doors and be as short as possible so the anaesthetist can get to the patients quickly in case of emergency.



(3) **Arrangement of an operating theatre with adjacent rooms** Architects: U + A Weicken

Recovery room requirements

The recovery room must accommodate the post-operative patients from more than one operating theatre. The number of beds required is calculated as 1.5 times the number of operating theatres. Adjoining is a small sluice room with drainage sinks. A nurse's monitoring position must be provided from which all the beds can be seen. Designs should allow in daylight to help the patients to orientate themselves.

Clean room technology and air conditioning

The air conditioning system is a vital part of clean room technology. A typical example uses a low-turbulence displacement with an even speed of moving air (0.45 m/sec) to produce a laminar flow, ahead of which any germs and particles released are propelled out of the room. An additional directed jet with the flow directed towards the operating area allows air turbulence to be minimised. The combination of contaminated air and fresh air (clean room air) can also then largely be avoided. To maintain the hygiene of the operating equipment an area of approximately 3.00 × 3.00 m should be allowed.

The air conditioning system also reduces the level of airborne germs by filtering, diluting and compressing the air before introducing the appropriately prepared air in the quantity required. For example, 15–20 air changes per hour are required to ensure adequate decontamination of the air between operations.

To create a zone which is as germ/particle-free as possible within the operating theatre, there must be no uncontrolled inward air flow from neighbouring rooms. This can be achieved by hermetic sealing of the operating theatre (all joints sealed as far as possible during construction) and/or by protective pressurising (i.e. highest pressure in the operating theatre, followed by the anaesthesia rooms, and the lowest pressure in the auxiliary rooms, thus creating a pressure gradient which moves air outwards from the theatre to the areas requiring less protection). Operating theatre windows must therefore be equipped with sealable ventilation grills. Specific regulations determine the flow of air between the rooms in the surgical area.

Auxiliary functions

The rooms for auxiliary functions do not need to be in the immediate area of the operating theatre. Separation by a corridor which is not intended for patient use is advisable.

Nurses' lounge

The dimensions of this room depend on the size of the surgical department. It should be assumed that there are eight members of staff per surgical team (doctors, theatre nurses, anaesthesia nurses). In the case of surgical units with more than two operating theatres, it is appropriate to separate smokers from non-smokers. The lounge must offer sufficient seating, cupboards and a sink.

Nurses' workstations

These should be located centrally and have large glass screens to allow the working corridor to be viewed. In addition to a desk they must have cupboards and walls on which organisational schedule planners can be mounted.

Dictation room

No larger than 5 m² in size, such rooms are where the doctors prepare reports following an operation. They are not absolutely necessary.

Pharmacy

A 20 m² pharmacy can supply a combination of anaesthetics and surgical medication and other materials, particularly if a space-saving rotating shelving system is installed.

Cleaning room

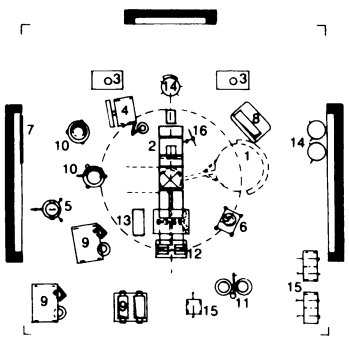
A size of 5 m² is sufficient for cleaning rooms. They should be close to the operating theatre since cleaning and disinfection are carried out after each operation.

Standing area for clean beds

Close to the patient demarcation lobby there should be sufficient space to stand beds which have been cleaned and prepared. The requirement is for one additional clean bed for each operating table.

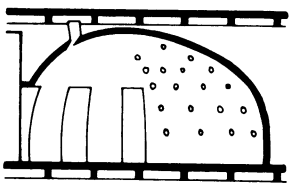
WCs

For hygiene reasons, toilets should be located only within the lobbies and not in the surgical area.

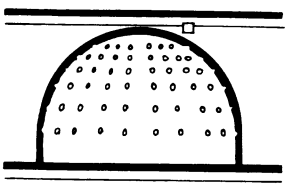


1 overhead operating lamp
2 operating table with fixed base
3 wall or ceiling pendulum
4 anaesthesia equipment
5 dish stand with heater
6 electric suction pump
7 X-ray display box
8 anaesthesia table
9 instrument table
10 waste bin, used instrument container
11 dish stand without heater
12 suturing materials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

(1) **General arrangement of a surgical operating theatre**

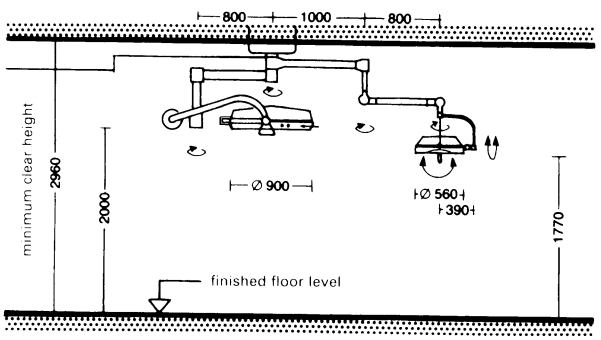


(2) **Egg-shaped operating theatre with built-in spotlights which can be switched on according to choice**

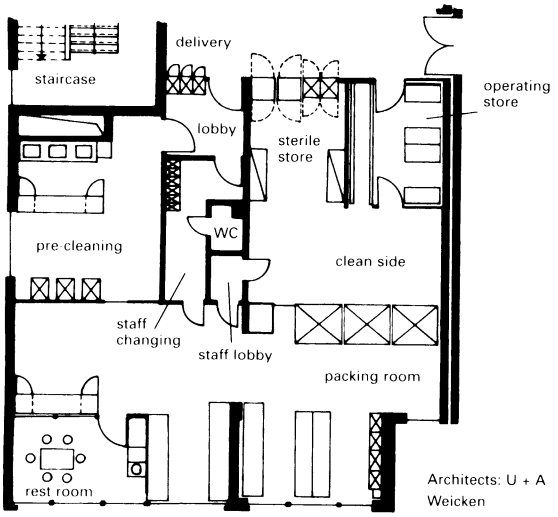


Architect: Nelson

(3)



(4) **Surgical pendant lamp with satellite**



(5) **Central sterilisation unit, St Elisabeth, Halle/S**

SURGERY SAFETY REQUIREMENTS

The operating theatre should be connected to the anaesthetics room, discharge room, a wash room and sterile materials room via electric sliding doors, fitted on the outer side of the theatre so as not to constrict the space within. The opening mechanisms must be operated by foot switches for hygiene reasons. In the rooms for auxiliary functions, swing doors with a clear width of 1.00–1.25 m are sufficient.

It must be assumed that main anaesthetics rooms contain explosive mixtures of gases (vapours, oxygen or nitrous oxide). These may also pass into surgical areas, preparation rooms and plaster rooms. To counteract this accumulation of anaesthetic gases in the air, electrical and electro-medical connections are to be placed a minimum of 1.20 m above floor level. Explosion protection measures also relate to the avoidance of electrostatic charges.

Protective measures in the main anaesthetics rooms are:

- avoid materials which produce large electrostatic charges when rubbed or separated (e.g. plastic cloth)
- use conductive materials (e.g. conductive rubber)
- equalise charges through conducting floor
- maintain constant humidity between 60 and 65%

A back-up power supply is required for surgical equipment so that, in the event of a power cut, the operation can be continued and completed. Among other things, the following must continue to be operable:

- at least one operating lamp at each operating table, with a supply which will last for at least three hours
- equipment for maintaining vital bodily functions (e.g. for respiration, anaesthesia and resuscitation)

Specific regulations apply to operating rooms in which X-ray equipment is in operation. They define the lead thicknesses required in order to weaken the radiation sufficiently for maximum exposure not to be exceeded. Even the doors must have lead lining (e.g. 1 mm)

National standards provide conversion factors for usual building materials such as steel, concrete and masonry.

Rooms for storage of anaesthetic agents must be fire-resistant and not connected to operating theatres, delivery rooms or anaesthetics rooms.

Lighting

Lighting in the operating area must be adjustable in order to provide light at different angles according to the position of the surgical incision. The most frequently used lighting system is the mobile ceiling-pendant operating light. It consists of a main ceiling light which rotates and pivots and is generally equipped with an additional light on a secondary arm. The main light is made up of a large number of smaller lights in order to avoid heavy shadows. Occasionally nowadays egg-shaped operating theatres are being planned with integrated ceiling spotlights.

Guidelines for lighting in hospitals recommend the nominal lighting strength for operating theatres as 1000 lux and 500 lux for auxiliary surgical rooms.

Central sterilisation → (5)

This is where all hospital instruments are prepared. The majority of instruments are used by the surgical department (40%), surgical intensive and internal intensive care (15% each). For this reason central sterilisation should be installed close to these specialist areas. It is recommended that the sterilisation area be situated in areas with relatively low volumes of traffic (both people and materials).

The number of sterilisers is dependent on the size of the hospital and surgical department, and can occupy an area of approximately 40–120 m^2.

HOSPITALS

Demarcation

A 'demarcation area' is formed by the intermediate zone ('lobby') between the care area and the examination/treatment area.

Demarcation may be achieved in different ways depending on the required function and specialist area: patient lobby, staff lobby, combined staff and visitor lobby, supply and disposal lobby, gown lobby, lobbies before intensive care rooms. In addition, the lobbies differ according to their hygiene function (contact control, air control) and the constructional requirement (single-lobby control, multi-lobby control, air conditioned and non-air conditioned control).

The patient who is to undergo surgery is taken into the 'patient lobby' where he/she is placed on the operating table with the aid of a mechanical bed-to-bed transfer device.

Generally, regulations require separation into clean and non-clean areas. The boundary may be marked by a threshold which cannot be crossed. Direct access routes must be kept clear for emergencies.

Medical and nursing personnel pass through the 'staff lobby' into separate male and female treatment rooms. The demarcated operations centre is reached first via an non-clean outer room in which people wash and change and then via the clean inner room where surgical clothing is provided. On leaving the centre the used surgical clothing is left in the non-clean room and the demarcation lobby is exited via the outer room.

Shared 'staff and visitor lobbies' should be located in front of operations centres, from which infections requiring preferential treatment may emanate (isolation and intensive wards). Here single-chamber systems are sufficient, these taking up less space.

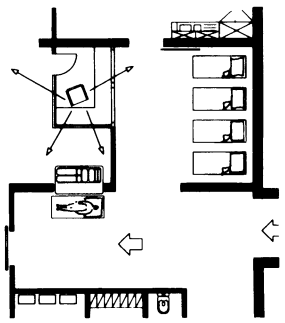
Highly sterile materials, equipment and laundry are channelled into the operations centre via 'supply and disposal lobbies'. These rooms frequently serve also as storage rooms.

The demarcation areas do not necessarily have to be rooms. They may instead be formed by segregating traffic areas. However, there must still be sufficient space in the operations centre for storage of sterile goods or waste.

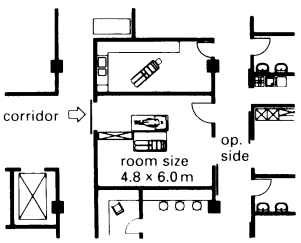
The disposal demarcation lobby should not be overlooked because waste storage within the operations centre can be a source of hygiene risks.

'Gown demarcation lobbies' are found at the transition between areas with differing hygiene requirements (e.g. between the non-clean and clean sides of bed preparation) and before rooms which are to be protected from infection or from which infection may emanate (e.g. isolation wards).

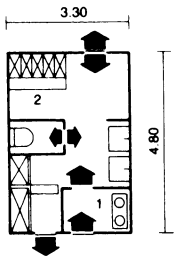
Demarcation lobbies before intensive care rooms are required before approximately 30% of the operations centres and are to be agreed with the hospital hygienists. These lobby areas must contain a workstation for continual monitoring of the most seriously ill patients and also allow ample space for nursing work and disinfection of equipment.



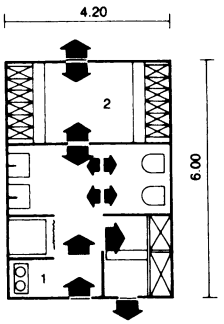
① **Bed-to-bed mechanical transfer device separates operating department from entrance area (by Maquet)**



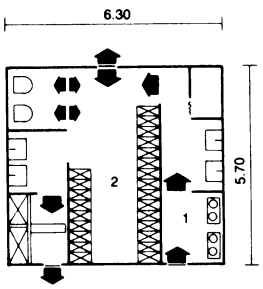
② **Example of an enclosed patient transfer unit**



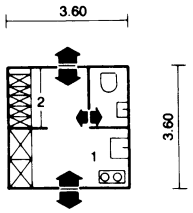
③ **Staff lobby**



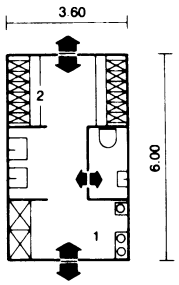
④ **Staff lobby**



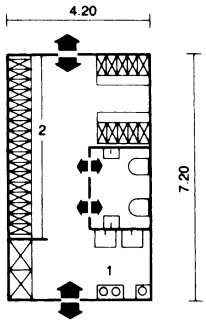
⑤ **Staff lobby**



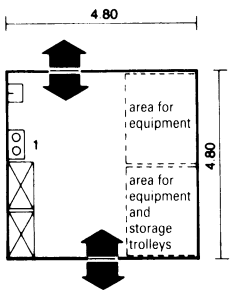
⑥ **Staff and visitor lobby**



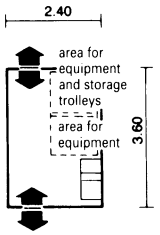
⑦ **Staff and visitor lobby**



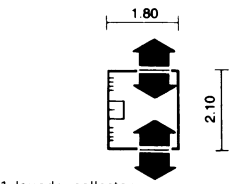
⑧ **Staff and visitor lobby**



⑨ **Supplies lobby**

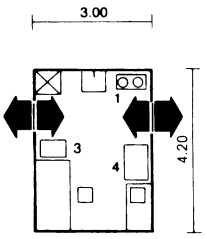


⑩ **Disposals lobby**



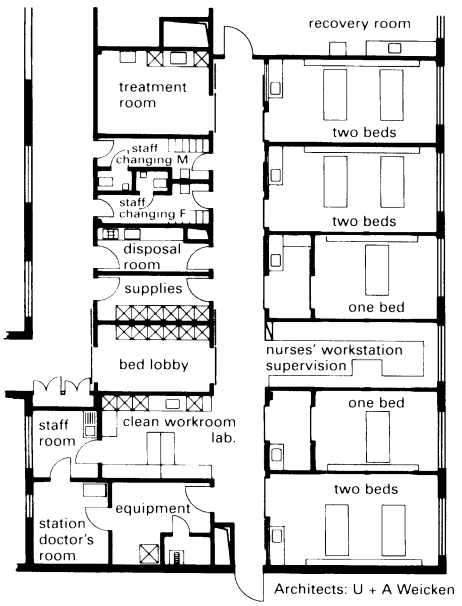
▸ ③ – ⑫

⑪ **Gown lobby**

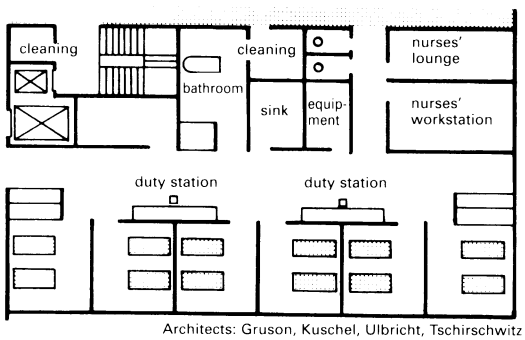


⑫ **Lobby before intensive care**

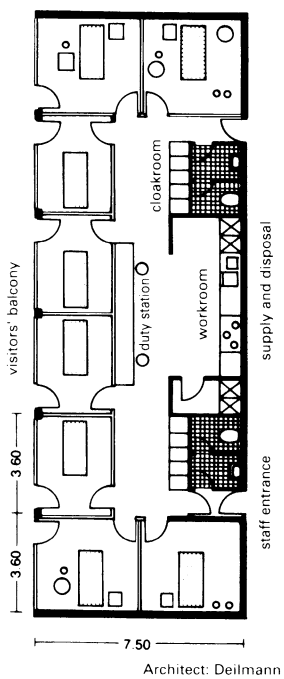
Intensive Care Area



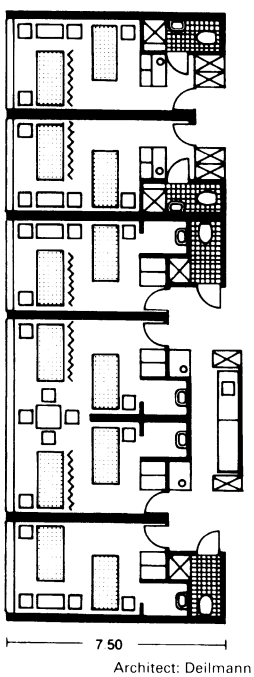
(1) **Eight-bed intensive care unit**



(2) **Intensive care group with 12 beds: St Vinzenzstift Hospital, Hanover**



(3) **Eight-bed intensive care subgroup; glazed individual rooms**



(4) **Subgroup formed by combination of four two-bed rooms with WC/shower rooms and nurses' workstation**

The task of intensive care is to prevent life-threatening disruption of the vital bodily functions: for instance, disruption of breathing, cardiovascular and metabolic disturbances, infections, severe pain and organ failures (e.g. liver, kidneys). The services of intensive care include monitoring and treatment as well as care of the patient. Special constructional and medical organisational measures are required for patients with paraplegia, burns and mental problems, which differ from usual intensive medicine.

The organisation of intensive medicine is oriented towards specialist disciplines such as neurosurgery, heart/thorax surgery, transplant surgery and neurology, or to interdisciplinary areas of surgery and internal medicine. In normal hospitals without a particular medical specialism, it is customary to divide intensive medicine into surgery and internal medicine.

Arrangement: The intensive care department must be a separate area, and only accessible through lobbies (for hygiene reasons). Note that according to hospital regulations, each intensive care unit must be a separate fire compartment. Apart from the patient and staff lobbies, visitors should only access the unit through a visitors' lobby (waiting room). The central point of an intensive care unit must be an open nurses' workstation from which it is possible to oversee every room. The recovery room of the operating department is often located in the intensive care unit so the patients can economically be cared for by the same staff.

The number of patients per unit should be between six and ten in order to avoid overloading the medical and nursing personnel and to provide the patient with the best possible care. One nurse's duty station, a sterile workstation (medication and infusion preparation), one materials room and one equipment room per unit (six to ten beds) should be included in the plan.

Arrangement of the bed spaces: The beds may be placed in an open, closed or combined arrangement. With an open arrangement a large floor area is required. All the beds must be in clear view of a central nurses' duty station and the patients are separated by moveable half-height partitions which should be lightweight and easy to move. With a closed arrangement the patients are accommodated in separate rooms which, again, must be in sight of a central nurses' workstation. Hygienically and psychologically the closed arrangement is preferable because the patients are extremely vulnerable. A compromise which is frequently adopted is to provide two or three beds in separate rooms.

The ideal plan is star shaped, with rooms radiating out from the nurses' workstation, but this is often not feasible because of space restrictions so more traditional arrangements are used.

Auxiliary functions: For auxiliary functions the following areas and rooms should be planned in: operating theatre for minor interventions (25–30 m^2), laboratory space, kitchenette, substerilisation (20 m^2, clean material room, non-clean workroom, cleaning room, lounge for relatives, duty doctor's room, documentation room, possibly a consulting room, and sanitary facilities (co-ordinated with the hygiene department).

The operations centre must be self-sufficient in terms of medical facilities. Connection lines for oxygen, compressed air and vacuum suction must be available at all beds and, in addition to normal electrical sockets, low-voltage (for the nurse-call system) and high-voltage (e.g. for portable X-ray equipment) power must be provided.

The intensive surgical medicine ward should be close to and preferably on the same level as the surgical department and internal intensive medicine ward. It should also be close to reception and the emergency service operations centre. Intensive wards which are not associated with a specialist area should be close to the outpatients and surgical department. Short routes to the clinical laboratory and to the blood bank are preferable.

HOSPITALS

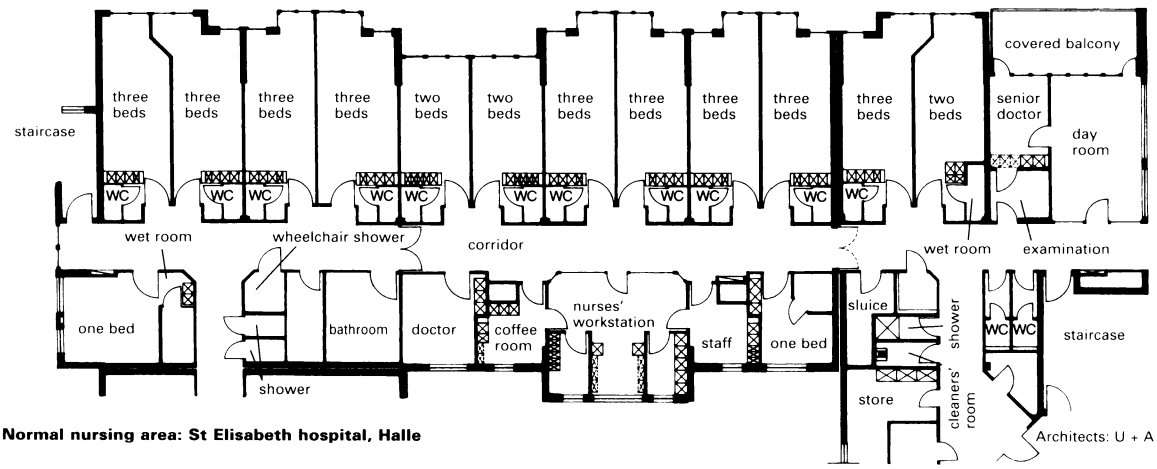
Care Areas

Areas for patient care should be enclosed and through-traffic kept to a minimum by careful planning of the circulation routes. Wards must have windows to give natural lighting whereas the service rooms (treatment areas, nurses' rooms, pharmacy etc.) can be located in the artificially lit inner area.

Care departments

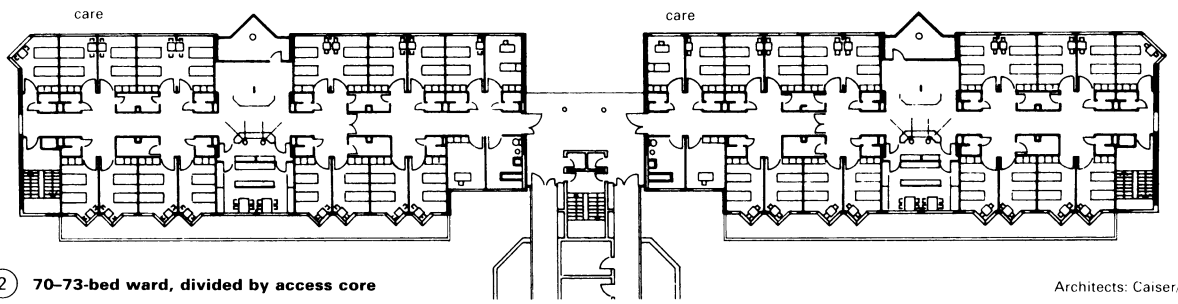
The care departments are each assigned to a specialist discipline and subdivided into care groups. To maintain an adequate level of supervision each care area should contain no more than 16–24 beds. For economical use of staff, two workstations are often placed together and connected to a large central nurses' service area (caring for about 30–34 patients). The arrangement of the rooms is dependent upon the class, type and seriousness of the illness. The following nursing areas should be distinguished: normal nursing area, intensive care area, special care area.

There are fewer beds per care group in the intensive care and special care areas (6–12 beds, depending on the size of the hospital). The rooms must be arranged such that there is sufficient freedom of movement and that beds are accessible from both sides as well as the end. An adequate number of cupboards for patients' belongings must be provided as should space for care aids (trolleys, commodes) and equipment.



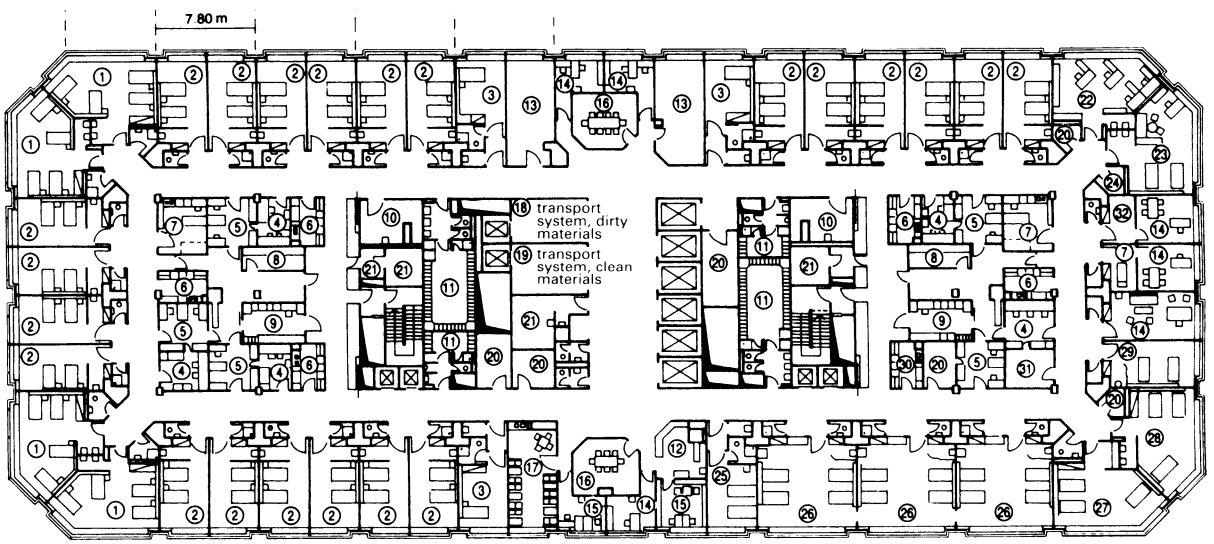
(1) **Normal nursing area: St Elisabeth hospital, Halle**

Architects: U + A Weicken



(2) **70–73-bed ward, divided by access core**

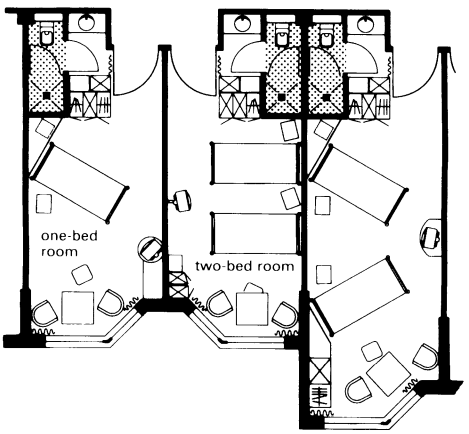
Architects: Caiser/Feigebutz



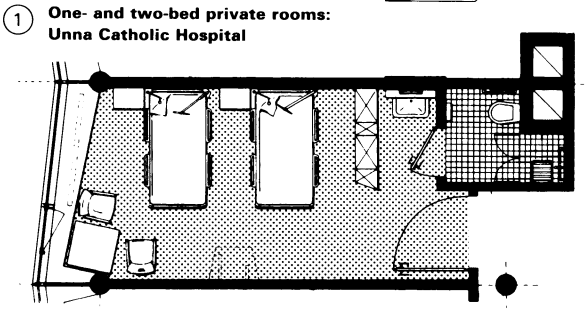
(1) four bed room
(2) two bed room
(3) isolation room
(4) doctors
(5) nurses
(6) sink
(7) examination
(8) kitchenette
(9) pharmacy
(10) bathroom
(11) staff cloakroom
(12) registration
(13) patients' day room
(14) head doctor
(15) sister
(16) consulting
(17) staff room
(20) equipment
(21) cleaning room
(22) secretarial
(23) home dialysis
(24) changing room
(25) clearance
(26) continuous dialysis
(27) peritoneal dialysis
(28) chronic hepatitis
(29) haemodialysis
(30) filter
(31) anamnesis
(32) X ray pictures

(3) **90–96-bed ward**

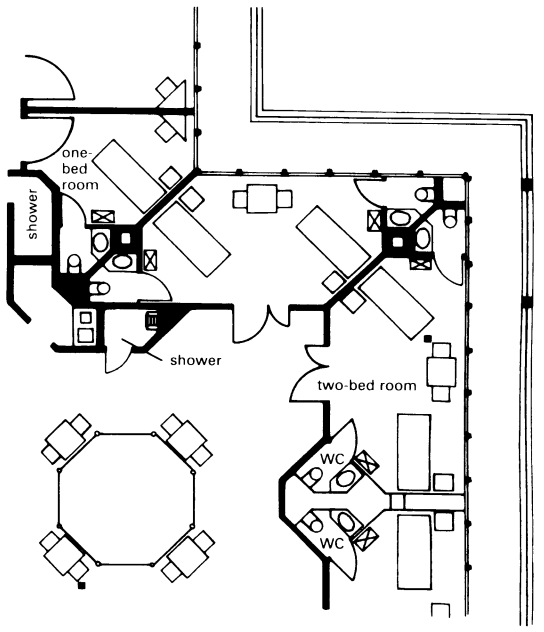
Architects: Suter & Suter



① **One- and two-bed private rooms: Unna Catholic Hospital**

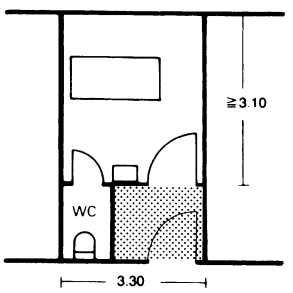


② **Two-bed room with shower** Architects: Nickl + Partner

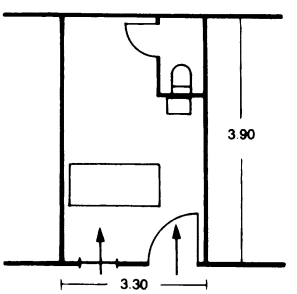


Architects: Joedicke and Partner

③ **One- and two-bed room; shower on the corridor: Clinic II, Munich**



④ **Single-bed room with lobby**



⑤ **Single-bed room, no lobby; observation possible from corridor**

HOSPITALS

Care Areas

'Normal care units' are used for general inpatient care (the main function of general hospitals), particularly for short-term and acute illnesses, primarily with a short length of stay. These units can be stacked depending on the space requirement and organisational structure. Seriously ill patients are moved from normal care groups to intensive care groups.

'Intensive care groups' are for patients under constant observation and tend to be assigned to particular examination and treatment rooms. Generally, these rooms should be larger than normal care rooms because more instruments and equipment need to be accommodated.

Patients with special needs are placed in 'special care units'. These include newborn babies, people with infectious diseases, the chronically ill, rehabilitation patients, neurotics and hypochondriacs. The length of stay of these patients is frequently longer than average.

Function and structure

The individual care areas in a hospital are attached to the specific medical faculties (e.g. surgery, medical, accident and emergency etc,) and therefore need to be planned as separate units. Essentially, they cater for pre- and post-operative patients who must stay in the hospital for observation and recovery. The patients' basic bodily functions are routinely tested on the wards but more extensive examination is carried out in separate treatment rooms. Each station must have at least one assistant doctor's room and two doctor's rooms in which minor examination and treatment can be carried out.

The hierarchical hospital structure, in both medical and nursing domains, must be reflected in the planning (e.g. separate rooms for station supervisors, assistant doctors, senior doctors).

Layout of rooms

Medical rooms and washrooms should be accessed from the main station corridor which must be easily supervised from the glazed nurses' workstation to prevent unauthorised entry. The logistics of delivering patient care is an important factor in the cost-effectiveness of the department so it is desirable to plan the necessary supply and disposal rooms for medicines, linen, refuse, food etc. centrally in groups around the nurses' workstation.

Nursing teams

Each station (18–24 patients) is served by an independent nursing team which has full responsibility for patient care. As the nurses' workstation has to be constantly occupied, it is sensible to plan a direct connection to the nurses' kitchenette and rest room.

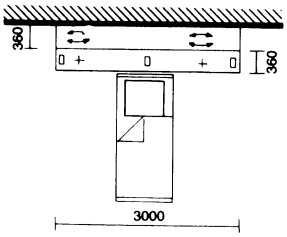
One-to-one nursing care is very much the exception nowadays and the rising costs of such provision mean that it is unlikely to be feasible in the future.

Wet cells

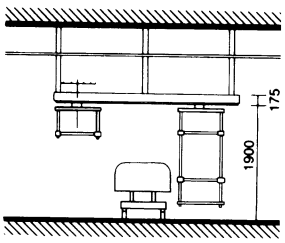
The strategy of combining one-, two- and three-bed rooms is specified by the financial department. The same constraints are also applied to the equipping of wet cells with WCs and showers or baths. If applicable, separate shower rooms are permitted.

HOSPITALS

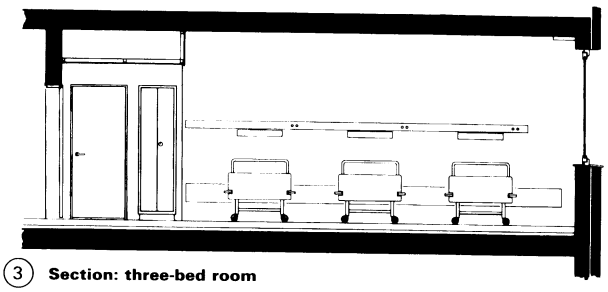
Care Areas



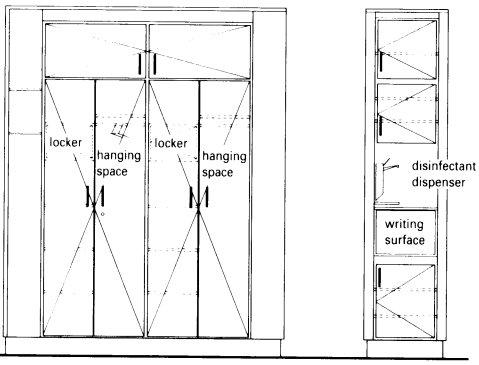
① **One-bed intensive care room with service panel**



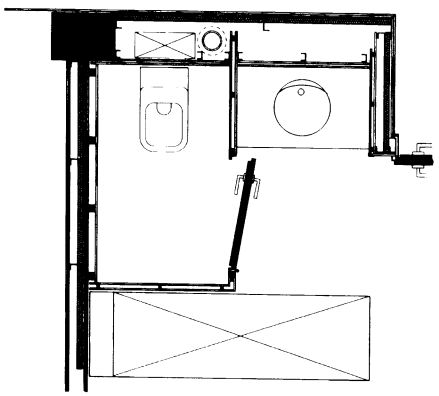
② **Section** → ①



③ **Section: three-bed room**



④ **Patient's cupboard** side view



⑤ **Wet cell** Architects: U + A Weicken

activity	patient is restricted by bed rest and/or slight disability	patient is restricted by intensive bed rest and/or severe disability
1 bodily care	2 x daily/1 pers. help with washing	2 x daily/2 pers. carry out washing
2 help with excretion	4 x daily/1 pers.	4 x daily/1 pers.
3 beds	2 x daily/2 pers.	3 x daily/2 pers.
4 storage		3 x daily/2 pers.
5 mobilisation	1 x daily/1 pers.	3 x daily/1–2 pers.
6 preventive measures	2 x daily/1 pers.	3 x daily/1–2 pers.
7 provision of meals and help with eating	3 x daily/1 pers.	4 x daily/1 pers.
8 monitoring vital signs	2 x daily/1 pers.	3 x daily/1 pers.
9 patient observation	2 x daily/1 pers.	2 x daily/1 pers.
10 information and instruction	2 x daily/1 pers.	2 x daily/1 pers.
11 caring conversation	2 x daily/1 pers.	3 x daily/1 pers.
12 talking to relatives	2 x weekly/1 pers.	2 x weekly/1 pers.
13 counselling	2 x daily/min. 2 pers.	3 x daily/min. 2 pers.
14 care documentation	2 x daily/min. 2 pers.	3 x daily/min. 2 pers.
15 obtaining specialist help		
16 other assistance	3 x daily/1 pers.	6 x daily/1 pers.

⑥ **Nursing categories**

Size of the patient rooms

The patients' beds must be accessible from three sides and this sets the limits for the overall room sizes. The smallest size for a one-bed room is 10 m²; for a two- and three-bed room, a minimum of 8 m² per bed should be allowed (in accordance with hospital building regulations).

The room must be wide enough for a second bed to be wheeled out of the room without disturbing the first bed (minimum width 3.20 m).

Next to each bed must be a night table and, where appropriate, towards the window there should be a table (900 x 900 mm) with chairs (one chair per patient). The fitted cupboards (usually against the corridor wall) must be capable of being opened without moving the beds or night tables.

In new buildings, the wet cells should be located towards the inside, off the station corridor, because future renovations will most likely make use of the external walls as the means of extending the existing areas.

Equipping the patient room

Around the walls there should be a strip made of plastic or wood (at least 400–700 mm above floor level) to protect the wall from damage caused by the movement of beds, night tables and trolleys. Similar strips should be included in the station corridors.

The patients' cupboards must be large enough to store all of the belongings they have with them. It is best to have a suitcase locker over the cupboard and a lockable valuables section within the cupboard itself. A coin-operated locking system is recommended because keys often get lost. A lockable staff cupboard for medicines should also be planned for. Hinges which allow doors to open through 135 degrees should be fitted to all cupboards.

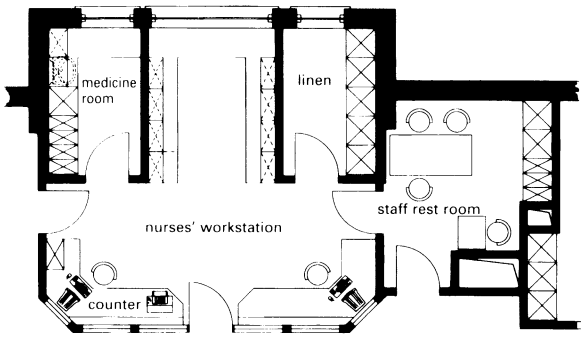
The room doors must be 1260 × 2130 mm in size and a design which gives a noise reduction of at least 32 dB should be considered (note that noise reduction seals are often necessary). The closing mechanisms must be overhead and the door furniture should be designed to suit the needs of patients and staff carrying trays.

The service supply duct runs behind the beds and supplies oxygen, a vacuum line and compressed air via special sockets. Power points, reading lights, telephone, nurse call and radio sockets are also housed in this duct.

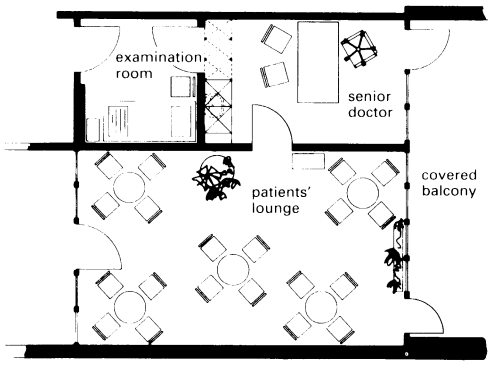
Whether each patient room is equipped with a shower often depends on the financing of the project. However, a wash-basin and WC are today standard in new buildings. Attention must be paid to the heights of the wash-basin and the WC: the wash-basin needs to be roughly 860 mm from the floor to allow wheelchairs underneath and the WC for wheelchair users should have a seat height of about 490 mm. Each station must also have additional WCs for staff, visitors and wheelchair users.

HOSPITALS

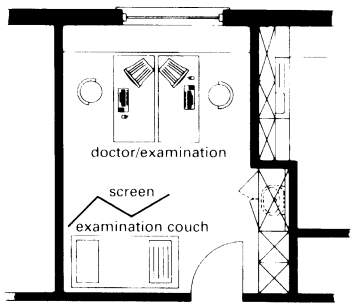
Care Areas



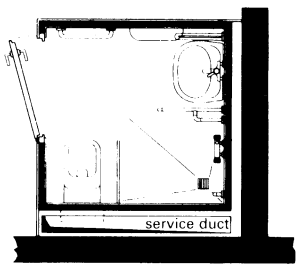
① **Nurses' work area**



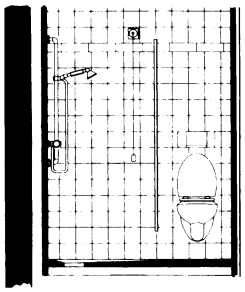
② **Senior doctor's office/patients' lounge**



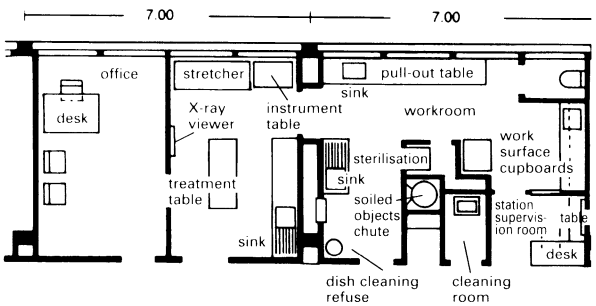
③ **Station doctor (room size 16–20 m²)**



④ **Patient bathroom**



⑤ **Elevation** → ④



⑥ **Doctor's room, treatment room, nurses' workroom and station supervision room combined in one unit** Architect: Rosenfield

Non-clean workroom

Each care area station must have a workroom, approximately 10 m² in size, for handling soiled materials. The room will contain a sink and sluice, preferably in stainless steel, and fully tiled walls are recommended.

Nurses' work area → ①

The nurses' workstation should be situated in a central position and requires a size of about 25–30 m². The corridor wall must be glazed, but fireproofing is also a consideration so it is advisable to consult the fire officer and fireproofing specialists.

Rest rooms/kitchenette

Roughly 15 m² should be allocated for staff breaktime facilities. In larger hospitals consider the inclusion of a smoking area.

Station doctor

The station doctor must be provided with a 16–20 m² room in which to examine patients. In addition to a desk, there should be ample shelving and an examination couch on which the doctor can rest when on-call. → ③

Clean workroom

The clean workroom should have an area of about 10 m² and be equipped with fixed shelving (600 mm deep) or a flexible storage system consisting of modules which can be filled up in the central stores.

Patients' bathroom

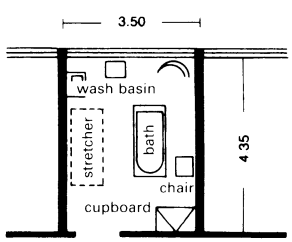
Bathrooms are often equipped with a tub which is accessible from three sides to ease the lifting of patients. Showers are an option for more mobile patients and can also be suitable for wheelchair users provided enough space is allowed (1400 × 1400 mm). → ④

Plant room

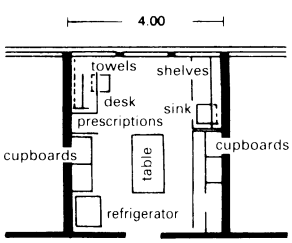
Each station must have a small (approximately 8 m²) plant room equipped with a fuseboard.

Patients' lounge

A size of approximately 22–25 m² should be allocated to serve as a general meeting place for patients. The design should emulate a domestic environment.



⑦ **Bathroom**



⑧ **Station pharmacy**

HOSPITALS

Treatment Areas

Considerable changes have been seen in the functional area of hospitals in recent years. The proportion of bed-care space has decreased over 30 years from 70% to 40%, while the area for treatment has increased by 100%. This trend can be explained by the increasing demand for medical care, diagnosis and therapy. An important aspect here is to co-ordinate medical disciplines to ensure better co-operation and consultation.

The treatment areas should face north and have central access.

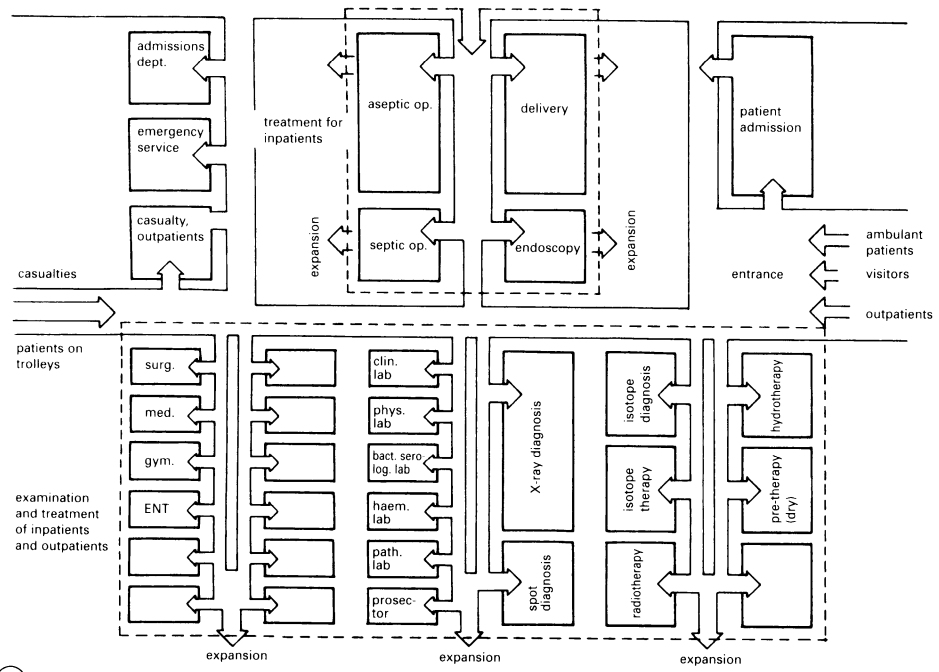
Obstetrics

In addition to looking after normal deliveries, the obstetrics department also has to handle complications during pregnancy and childbirth so it is therefore essential to have a treatment room next to the conventional delivery rooms. It is also sensible to position this near to the surgery and intensive care departments. The delivery area is separated from the maternity and baby care units, as these are connected more to the nursing areas.

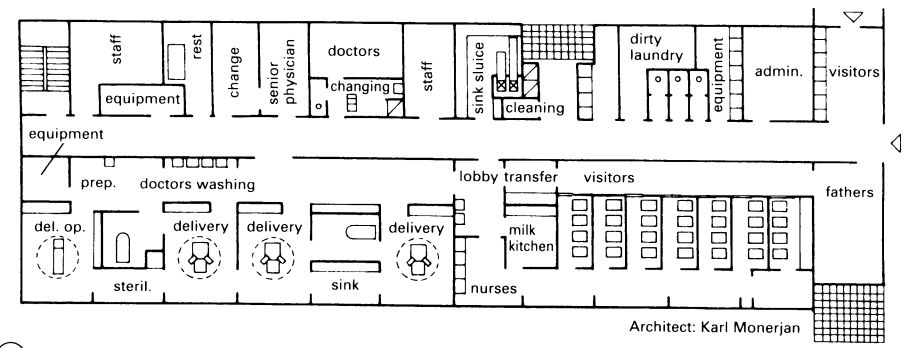
Room planning

Among the central delivery rooms is an observation room with large glass windows as well as waiting and admission areas with 'contraction rooms'. In addition there should be a clean workroom (12 m²), a non-clean workroom (12 m²), a treatment room (12 m²), a midwives' workstation (20 m²), a staff rest room (15 m²), and staff and patient WCs.

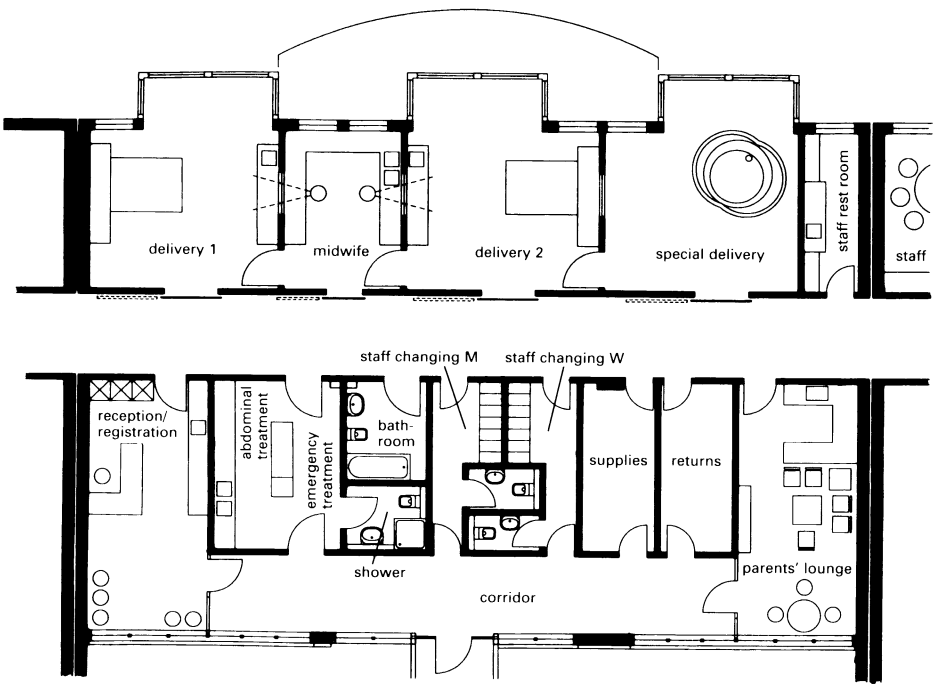
The equipment in the delivery rooms will depend on the birthing method chosen but it should ideally also include a bath for patients.



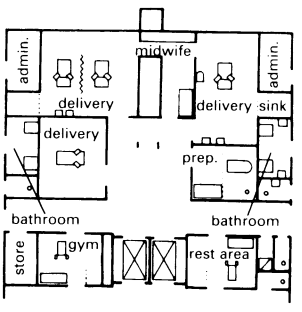
(1) **Access and assignment diagram of departments in the examination and treatment area**



(2) **Waldbröl District Hospital: 448 beds; bath and sink directly accessible for every two places**

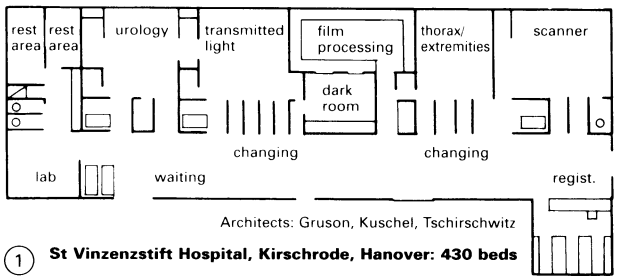


(3) **Delivery area/prenatal: St Elisabeth Hospital, Halle**



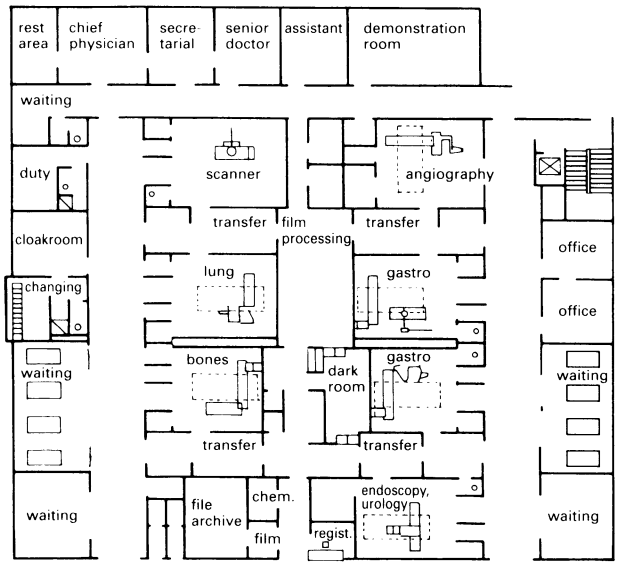
Architects: Bohne, Colling, Schneider

(4) **Private hospital, Karlsruhe Durlach: 180 beds**



Architects: Gruson, Kuschel, Tschirschwitz

① **St Vinzenzstift Hospital, Kirschrode, Hanover: 430 beds**



Architects: Wichtendahl, Roennich

② **Munich-Perlach Hospital: 687 beds**

	max operating voltage (kV)	min thickness lead (mm)	concrete (mm)
transmitted light	75	1.0	120
X-ray photography	100	1.5	120
skin therapy	100	1.5	120
medium radiation	150	2.5	–
deep radiation	175	3.0	–
deep radiation	200	4.0	220
deep radiation	225	5.0	–
deep radiation	300	9.0	–
deep radiation	400	15.0	260

③ **Minimum protection levels (according to Rendich and Braestrup)**

HOSPITALS

Treatment Areas

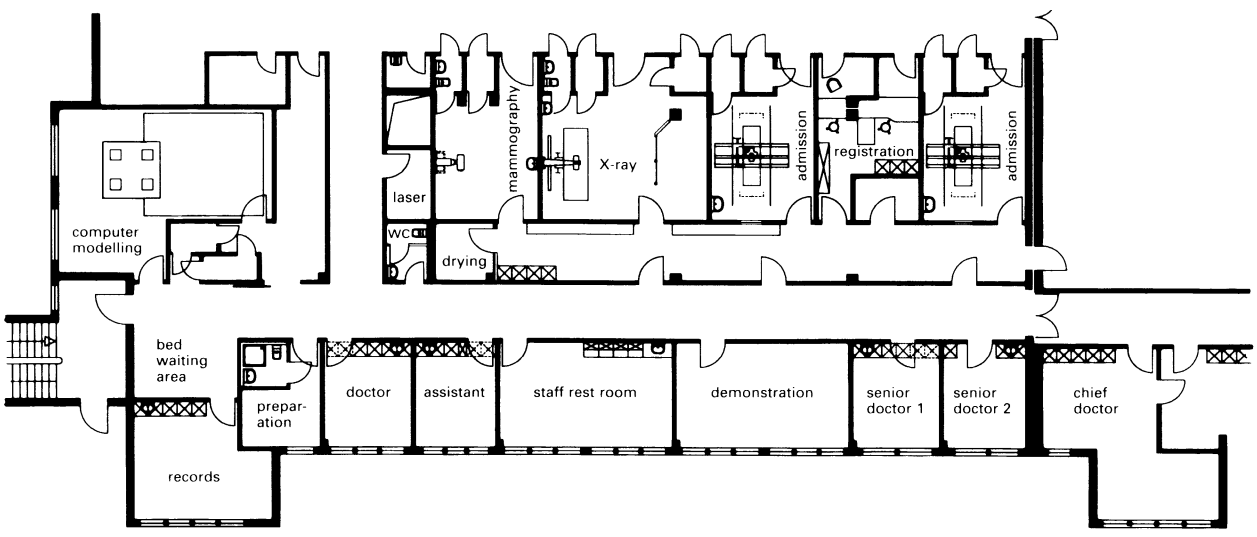
Internal medicine treatment area

This area brings together all the examination techniques and treatments associated with internal medicine which, depending on the size of the hospital, can encompass: cardiology, angiology, pulmonology, endocrinology and metabolism, and gastroenterology. The basic facilities comprise examination rooms (25 m²), a secretarial/ administration office (20 m²) between the senior physician's room (15–20 m²) and the chief physician's room (20–25 m²), an archive room and patient waiting areas. Staff stand-by rooms (15 m²) should also be provided.

Radiology

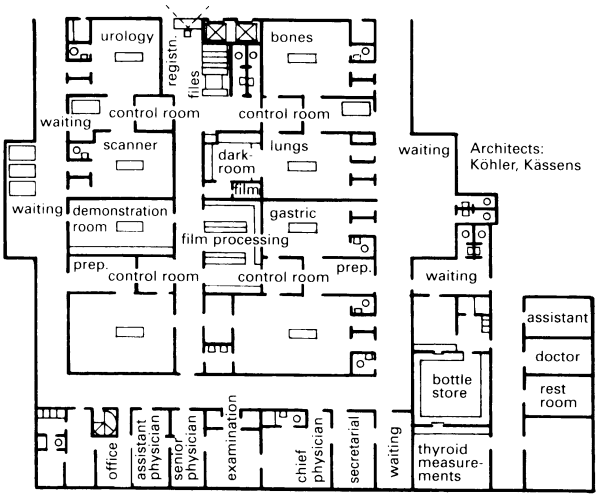
Radiology includes the specialist areas which use ionising radiation for diagnostic and therapeutic purposes. This includes X-ray diagnosis, radiotherapy and nuclear medicine. The radiology department should always be close to the ambulance entrance and, because of the great weight of the equipment (up to 14 t), it is sensible to plan these areas on the ground or first basement floor.

The rooms of the individual diagnostic areas must be so arranged as to minimise the distance between them. A connecting corridor which can be used simultaneously as a store, dictating room and, possibly, a switchroom as well as for staff circulation, is desirable. The size of the rooms depends on their use and what they contain: for example, sonography, mammography and jaw X-ray require about 12–18 m² whereas standard X-ray and admission rooms need to be 20–30 m². The access route for patients should be through two changing cubicles, and a wide door (≥1250 mm) for beds is necessary. WCs should be installed in X-ray rooms used for stomach/intestinal inspection. Angiography rooms require an auxiliary room with a sink and built-in storage (e.g. medicine refrigerator); medical gases must be also be available. The admission room for computertomography (CT) must be about 35 m² in area. The patients pass through lobbies or changing rooms in order to reach the admission room. The switchroom is connected by a door and a window. An additional room for switch cupboards and film developing is desirable. The walls, ceilings and floors must be shielded with lead sheeting, the thickness of which depends on the type of equipment to be used. Co-operation with the manufacturers of X-ray equipment is absolutely essential.



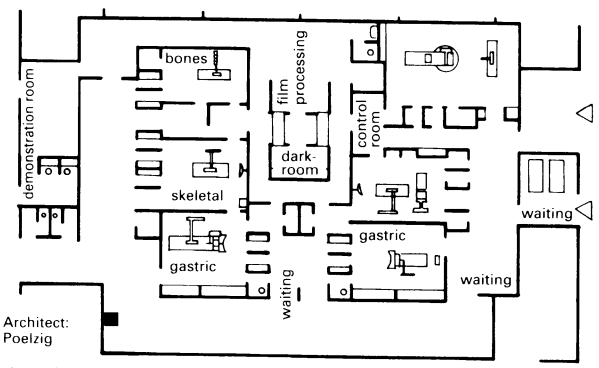
Architects: U + A Weicken

④ **X-ray department, St Elisabeth, Halle/S**



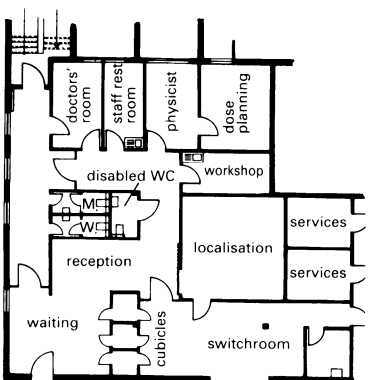
situated at the hub of the treatment area, in the immediate vicinity of functional diagnosis and diagnostic nuclear medicine

① **Fulda Municipal Hospital: 732 beds**



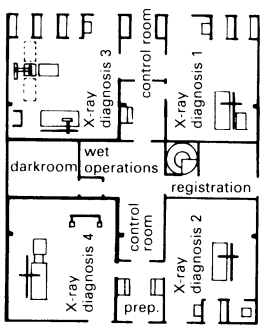
situated on one level with the central laboratory; diagnosis rooms using cystoscopy have adjoining waiting areas; double-sided access

② **Stade Hospital: 616 beds**



Architects: U + A Weicken

③ **Department for linear accelerator**



Architects: Köhler, Kässens

X-ray diagnosis with layout known as an X-ray cross

④ **University Hospital, Bonn**

Radiotherapy

In radiotherapy, conditions diagnosed in the radiography department (e.g. tumours) are treated. The radiotherapy department comprises a reception and waiting area, doctors' rooms (approximately 18 m²), a switchroom (15 m²), possibly a localisation room (20–25 m²), a service room (20 m²), a film developing room (10 m²), stores and a cleaners' room. Each treatment room requires a changing cubicle for patients. If the department includes a linear accelerator a workshop (15 m²) and at least one physics laboratory (15–18 m²) will also be necessary. The clear height of the radiation rooms must be 4.30 m.

For hygiene reasons the patient waiting area, examination, localisation, preparation and radiation rooms must be well vented and well ventilated (at least five changes of air per hour).

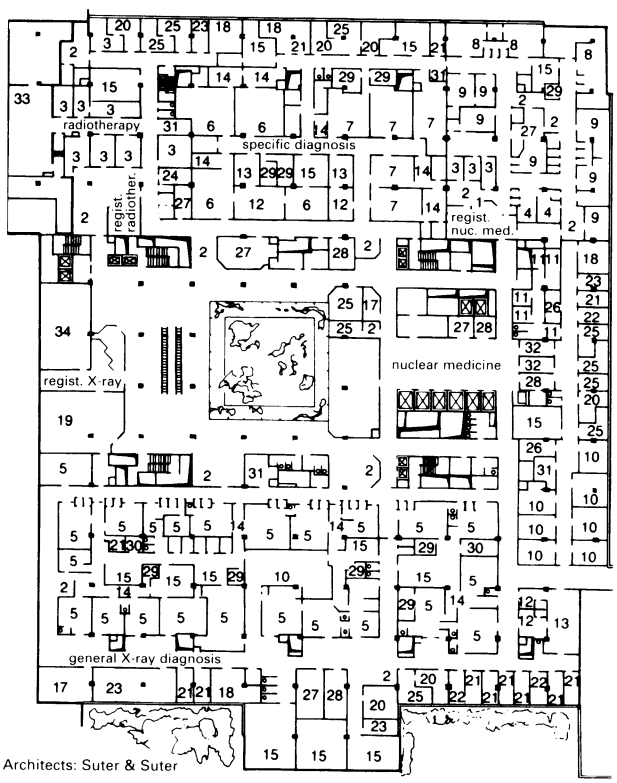
The safety requirements are particularly strict for radiotherapy departments and must satisfy all applicable national and international regulations. Structural shielding from radiation can be achieved by using lead inserts or with thick concrete walls (e.g. barite concrete). The thickness of walls constructed in concrete only should be 3.00 m for treatment and examination rooms in the primary radiation area and 1.50 m for rooms in the secondary radiation area, according to the type of equipment.

The huge weight of the equipment and the required structural radiation protection measures make it necessary for radiotherapy departments to be located in the basement or on the ground floor.

key → ⑤

principal rooms:

2	waiting	25	office
3	examination	26	equipment
4	treatment	27	clean material
5 – 7	X-ray diagnosis	28	dirty material
8 – 11	nuclear medicine	29 – 34	supplementary functions
21 – 23	doctors' rooms		



Architects: Suter & Suter

linking of the service area; radiotherapy, nuclear medicine and X-ray diagnosis are linked on one level; common access

⑤ **Basel Cantonal Hospital**

Laboratories; Functional Diagnosis

Laboratory department

The laboratory department is concerned mostly with the preparation and processing of blood, urine and faecal samples. It is often separated from the treatment and nursing areas, the connection to the other departments being through a special pneumatic tube dispatch system.

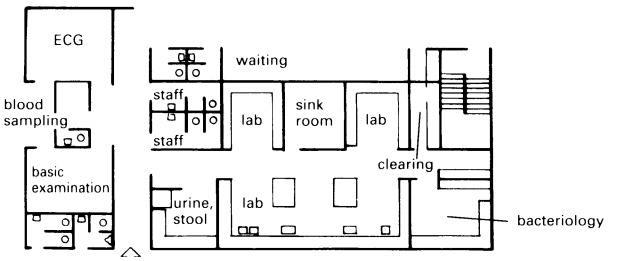
The laboratory itself should be in a large room with built-in work surfaces (standing work places) to offer a high level of flexibility. Specialist laboratories are added on as separate rooms. Subsidiary rooms include rinsing rooms, sluice rooms, disinfection rooms, cool rooms, rest rooms and WCs for staff. The size of the department depends on the demands of the hospital.

Sometimes the laboratory departments are completely separate and serve a group of several hospitals.

Functional diagnosis

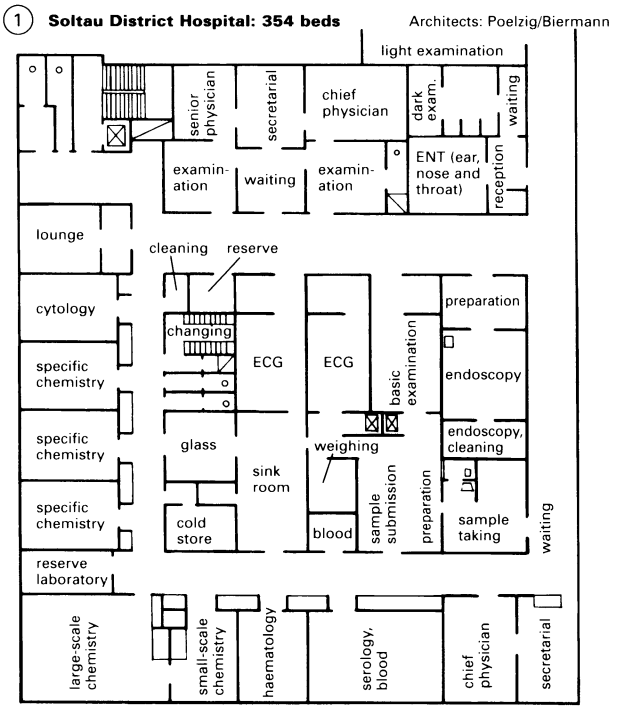
Functional diagnosis is playing an increasingly important role in hospitals due to advances in heart and thorax research and the rising number of patients with heart, lung and circulation problems. Flexibility in the design is absolutely essential to accommodate the wide range of techniques and equipment used in such departments. A direct connection with the laboratory department is beneficial, but not essential. A data link to the radiology, radiotherapy and surgical departments is necessary to allow combined monitoring (e.g. analysis of X-ray results together with ongoing assessment of the vital functions).

All examination rooms must be accessible through a patients' cubicle and, possibly, also a preparation room. Waiting rooms must be sympathetically designed because the patients are often extremely nervous.



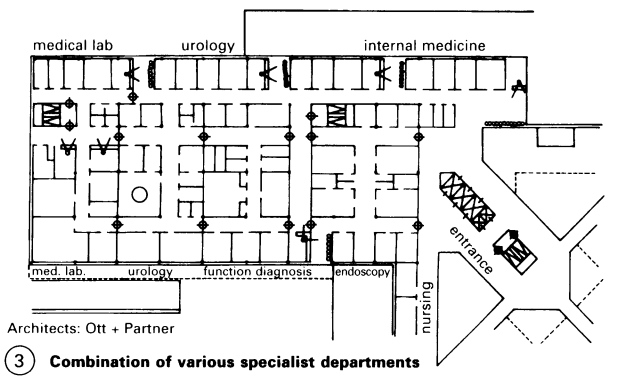
separation of rooms with and without patient traffic; routine laboratory segregated from clinical chemistry

① **Soltau District Hospital: 354 beds** Architects: Poelzig/Biermann



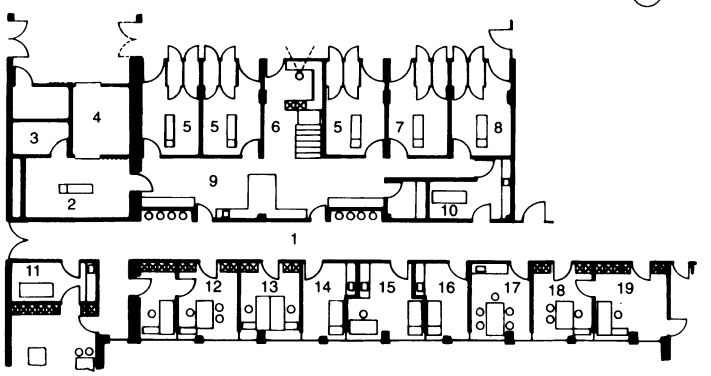
Architects: Wichtendahl & Roemmich

② **Laboratory area for large hospital, Munich-Perlach Municipal**



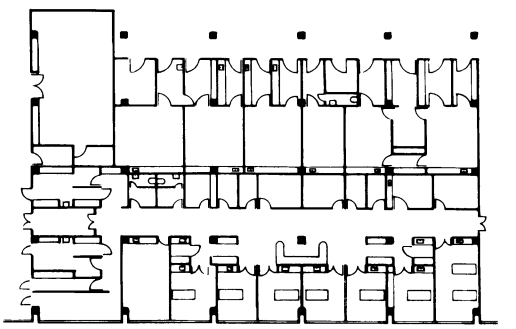
Architects: Ott + Partner

③ **Combination of various specialist departments**



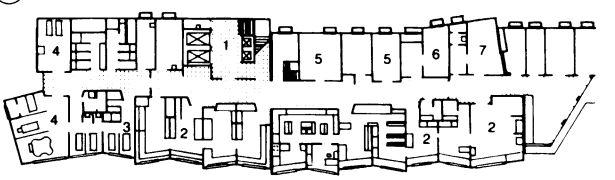
④ **Functional diagnostics, St Elisabeth, Halle/S**

1 functional diagnosis
2 heart monitoring
3 equipment
4 preparation
5 sonograph
6 current records
7 doppler
8 echocardiography
9 clean workroom
10 lung function testing
11 general examination room
12 senior doctor
13 assistant
14 electrocardiography
15 long-duration ECG
16 ECG
17 staff
18 senior doctor
19 secretary



Architects: Kleihues, König

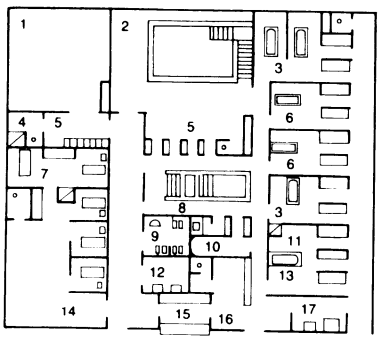
⑤ **Endoscopy and casualty diagnosis, Berlin-Neukölln Hospital**



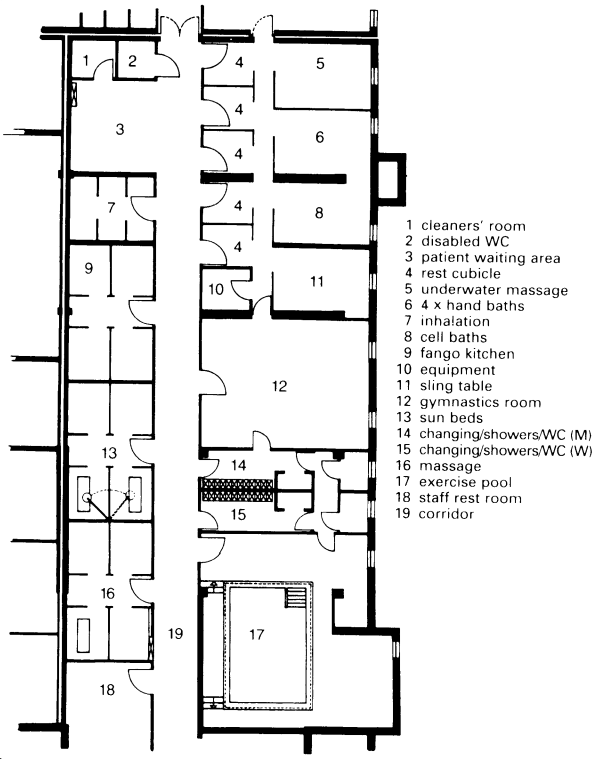
1 entrance hall
2 laboratory
3 massage
4 medical baths
5 supplies
6 autopsy
7 linen

Architect: Bockemühl

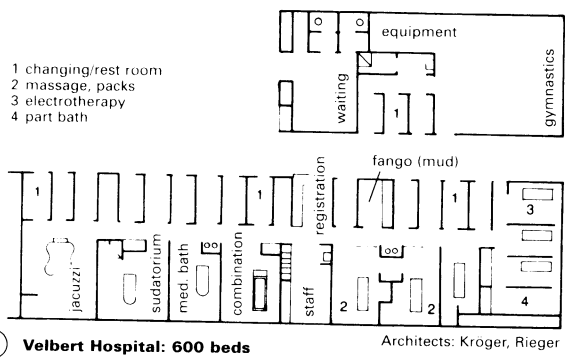
⑥ **Laboratory/therapy departments, Herdecke Hospital, Ruhr**



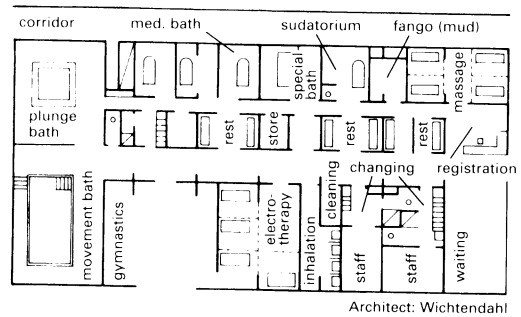
(1) **St Marienwörth Hospital, Bad Kreuznach: 330 beds**



(2) **Physical therapy department with gymnasium**



(3) **Velbert Hospital: 600 beds** Architects: Kröger, Rieger



(4) **Munich-Perlach Municipal Hospital: 687 beds**

Supplementary Disciplines

Physiotherapy

The physiotherapy department contains a 'wet area' consisting of an exercise pool (approximately 4 × 6m), a 'four cell bath', a 'butterfly bath', inhalation rooms, a massage bath, hand and foot baths as well as the necessary subsidiary rooms. It is, obviously, important to use slip-resistant tiles in this area.

The department should be accessed through a main reception area and the division between wet and dry areas must be obvious. Additional rooms to be planned include changing rooms for men and women, wheelchair users' WC, staff and patient WCs, rest rooms, linen stores, waiting areas, cleaners' room and service rooms for the exercise pool.

A gymnasium is often included in the physiotherapy department. This will require a clear height of at least 3.00m, the provision of a sprung floor and the installation of impact resistant lighting. Because of the high internal temperatures (28–30°) construction physics problems should be anticipated.

Ideally, the physiotherapy rooms should be arranged on the basement floor where natural lighting can be admitted through roof lights and light shafts.

Urological treatment

This discipline is related to X-ray diagnosis. The treatment room should be 25–30m² in size and it must be close to the surgical department. The room should contain an examination and treatment table for endoscopic investigations and be equipped with a wash-basin, suspended irrigator, floor drainage, 4–6volt power points (cystoscopy), two changing cubicles and a WC. There should also be an instrument room adjoining (roughly 15m²), with sterilisers, sinks and a wash-basin, and a patient waiting area.

Eye treatment

Eye treatment can be carried out in a room approximately 25m² in size which can be darkened as required. The necessary equipment includes a treatment chair, examination and diagnostic instruments, an examination couch, a wash-basin and a writing desk. A patients' waiting room should be situated to the front of the treatment room.

Ear, nose and throat (ENT) treatment

ENT treatment is carried out for inpatients in their own care area. The treatment room (25–30m²), which can be darkened, should contain a treatment table for examinations, a treatment chair, a steriliser, a sink and wash-basin, storage spaces for portable equipment, 4–6volt power points and compressed air/suction lines. Adjoining the treatment room should be a rest room and a patients' waiting room.

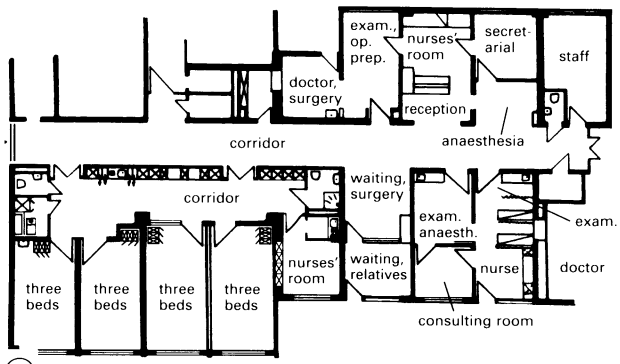
Dental treatment

This specialist area of treatment should be provided primarily in special ENT and rheumatism clinics. The treatment room needs to be 25–30m² in size and contain a treatment chair with dental unit, a desk, a wash-basin, X-ray and anaesthetic equipment, a sink alcove with steriliser and, if possible, a darkroom.

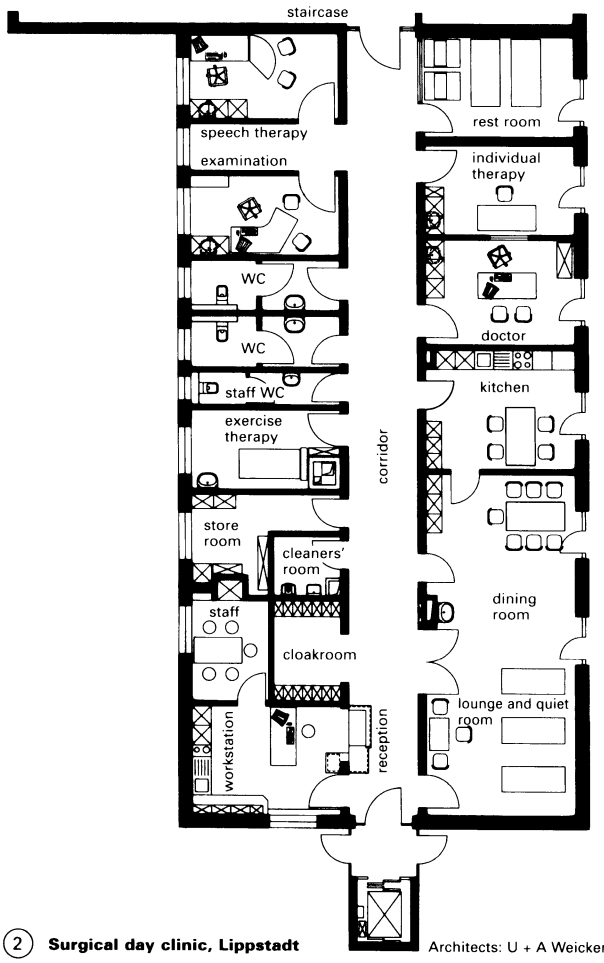
DAY CLINICS; OUTPATIENT SURGERY

The contracting out of services following health reforms has freed space in many hospitals. Much of this has been converted into day clinics for patients who are only cared for during the day and do not require hospital beds, or who have undergone outpatient surgery. As these patients are divorced from the rest of the hospital activities, it is necessary to provide a separate entrance for them. The reception and waiting areas must be designed to a standard equivalent to a doctor's surgery and should be differentiated from the character of the hospital. Room schedules are specified by the client; fire precautions and escape routes must comply to the hospital regulations and so should be discussed with the appropriate officials.

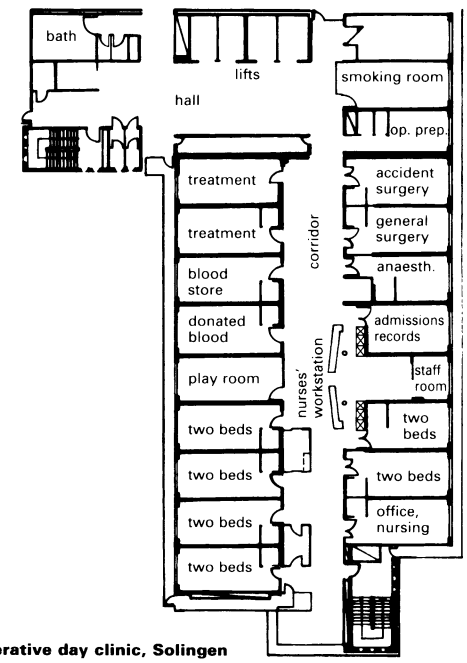
Outpatient surgeries for minor operations are becoming increasingly common. They can either be connected to existing hospitals or be completely independent clinics: both options seem to be developing in parallel. In a hospital, the outpatient surgery should be close to the emergency room and the surgical department.



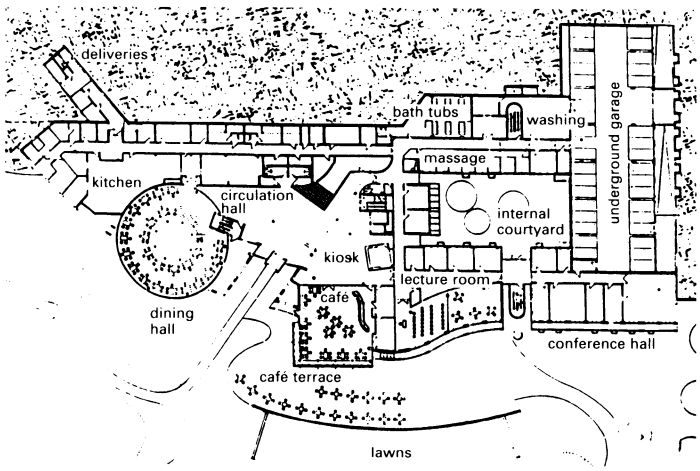
(1) **Surgical day clinic, Harburg**



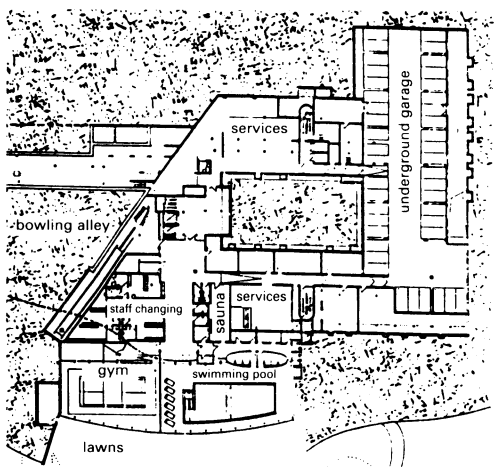
(2) **Surgical day clinic, Lippstadt** Architects: U + A Weicken



(3) **Operative day clinic, Solingen**

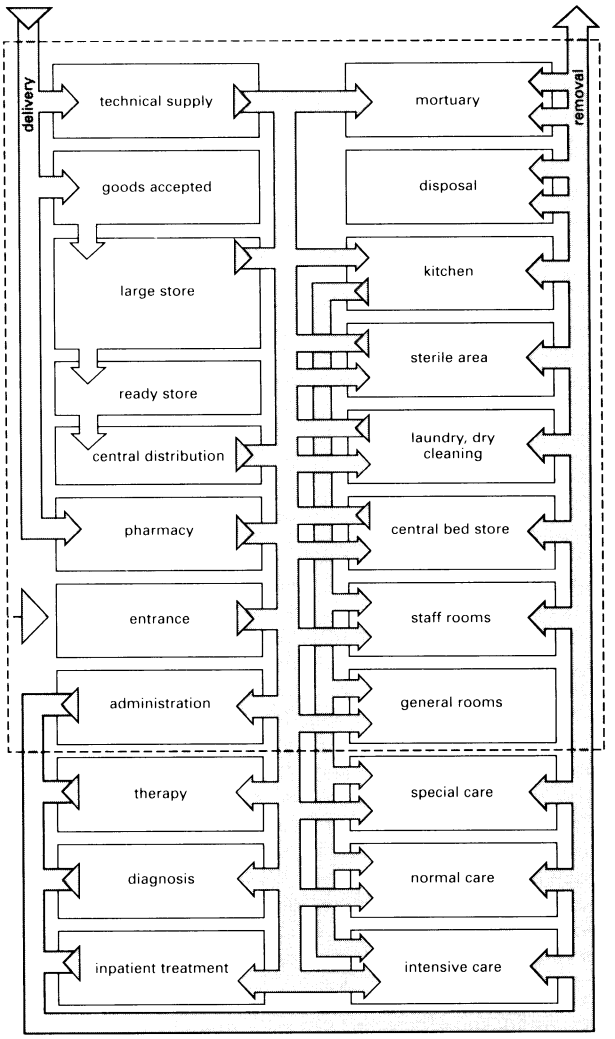


(4) **Rehabilitation clinic, Constance** Architect: Grüttner



(5) **Basement** → (4)

Supplies Areas



(1) **Supply and disposal area: route relationships**

The clinical, nursing and technical supply centre is located either in a separate supplies building or at a neutral supplies and disposal level under the main building. It is best to have a goods yard which is separated from the main and ambulance entrances. A north-facing orientation for this entrance is ideal. External and internal circulation routes must be co-ordinated so that overlaps with the routes used by the care and treatment areas are avoided.

During the design stage, it must be remembered that this area of the hospital can create a great deal of noise (goods vehicles and machinery) and smells (refuse containers, kitchen waste etc.) and so should not be situated close to the nursing wing. The planning of the supplies area is arranged according to the medical departments of the hospitals. A detailed specification can only be devised after the detailed design of the nursing and treatment wings has been established. The increasing use of automation demands co-operation between the architects, specialist engineers and manufacturers in the design stages. A tendency towards greater centralisation is noticeable, the incentive being to keep investment at a minimum and to produce economies in staffing. As a result of this, in the case of small clinics, an in-house main kitchen and laundry can be dispensed with: meals are delivered from a central kitchen and the laundry is managed by an external service organisation.

For goods and materials which are required only by one department it is economic to provide a decentralised preparation/disposal unit (e.g. for surgical instruments and substerilisation, or for developing X-ray film in the X-ray diagnostic department).

Means of transport

In addition to the organisation of stores and the preparation of delivered and reused goods, there is the question of transportation. Multipurpose trolleys are frequently used for distributing the required items to each point of consumption and these can be used at the same time for storing equipment. In medium-size and large hospitals a vertical conveyor, with selective automated discharge, for distribution to the various storeys and return of used goods to the non-clean preparation zone is necessary in order to relieve personnel. A dispatch system using pneumatic tubes, for example, should be provided for sending small items such as drugs and notes.

The scale of the transport system depends on the size of the institution: the supply and disposal requirement per bed per day is 30–35 kg. For large or heavy items (e.g. beds, respiration equipment, heart and lung machines) conventional bed elevators are available. A fully automatic conveyor system can be used for transporting medium-size items (e.g. food, laundry, refuse, consumer goods) in large hospitals.

Central supply

The advantages of collecting together all of the supplies functions on one supply/disposal level are uniform overall management, common stock control and the utilisation of the same transport systems. Centralisation also means there is a single point to which goods are delivered; from here, distribution and storage of goods can be controlled efficiently.

For hygiene reasons it is important to separate clean and non-clean goods. This is a primary consideration when designing transport systems.

Staff rooms

In the supplies area, changing and washrooms, WCs, cleaning rooms, storage rooms (for cleaning equipment) and rest rooms must be provided in the immediate vicinity of the goods inward/collection point.

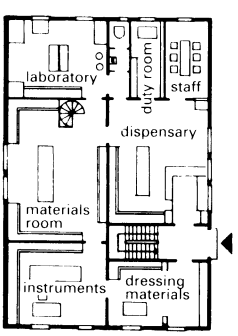
Sterilisation

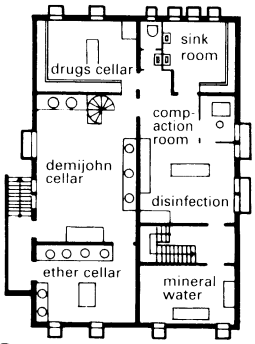
Since it is primarily items for the surgical department which are prepared in the central sterilisation unit, the two should be situated close together. However, to meet immediate needs, the surgical department will have its own substerilisation facilities. The central store for drugs and instruments must be closely linked to the central sterilisation unit.

Dispensary

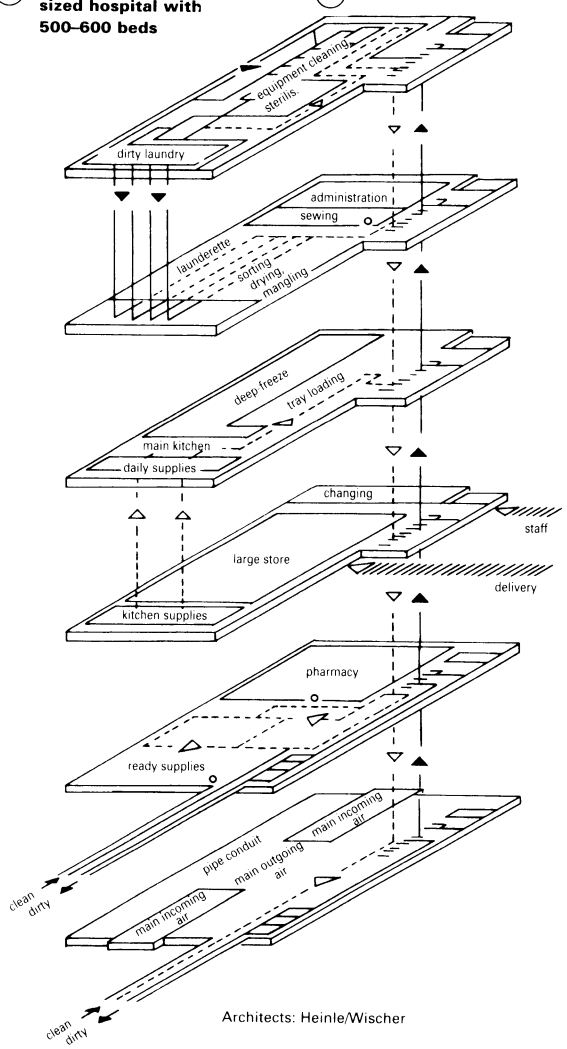
In institutions without a full pharmacy, medication requiring approval is distributed from the dispensary. This consists of a work and dispensing room (25 m^2) which is accessed directly from the main circulation corridor. It is fitted out with a desk, washing facility, sink, weighing station and lockable cupboards. Adjoining are a dry store and proprietary medicines store (15 m^2), a cold store (10 m^2) for hazardous substances, a dressing materials room and a damp store in accordance with fire regulations. When planning new buildings, it is recommended that a full pharmacy be included in the design.

Supplies Areas

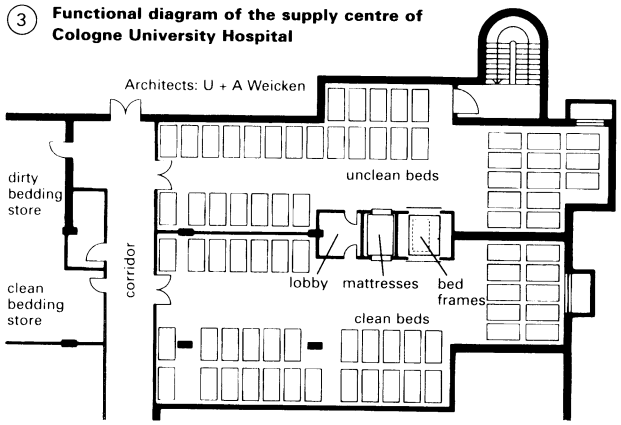




① ② **Pharmacy for a medium-sized hospital with 500–600 beds**



③ **Functional diagram of the supply centre of Cologne University Hospital**



④ **Central bed unit, St Elisabeth Hospital, Halle/S**

Pharmacy

In medium-size and large hospitals the pharmacy stocks prescriptions and carries out examinations under the management of an accredited pharmacist. In the design the following rooms are necessary: dispensary, materials room, drug store, laboratory and, possibly, an issue desk. If necessary, also include herb and dressing materials rooms, demijohn and acid cellar, and a room in which night duty personnel can sleep. The dispensary and laboratory should contain a prescription table, a work table, a packing table and a sink. The storage of inflammable liquids and acids, as well as various anaesthetics, means appropriate safety measures are stipulated for the walls, ceilings and doors.

The pharmacy must be close to lifts and the pneumatic tube dispatch system.

Central bed unit

From the point of view of hygiene and economy, every hospital should contain a bed unit, in which the appropriate staff strip down, clean, disinfect and make up the beds. A complete bed change is required for new admissions, patients after 14 days as an inpatient, after operations and deliveries, as well as after serious soiling. The size of the bed unit depends on the number of nursing beds in the hospital: for about 500 inpatients a bed unit for 70 beds should be provided. The functional demarcation requires a clean and non-clean side, separated by the bed cleaning room, mattress disinfecting room and staff lobby. For carrying out repairs, a special workshop, approximately 35 m^2, should be situated in the close vicinity, as should the laundry and store for clean bedding, mattresses etc. If machines are to be used to clean the bed frames and mattresses, the specific requirements of the equipment must be taken into account at an early stage (e.g. demands for floor recesses, clear heights).

Laundry provision

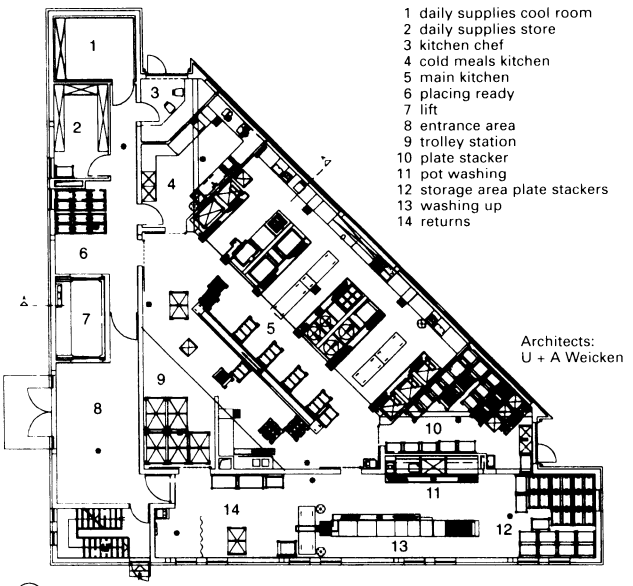
Figures for the amount of dirty dry washing generated per bed per day vary between 0.8 and 3.0 kg. The following sequence of work is preferred in the laundry: receipt, sorting, weighing, washing, spinning, beating out, mangling or drying (tumble dryer), pressing (if possible high pressure steam connection), ironing, sewing, storage, issue. The laundry hall consists of a sorting and weighing area (15 m^2), laundry collection room under laundry chutes from the wards, wet working area (50 m^2), dry working area (60 m^2), detergent store (10 m^2), sewing room (10 m^2) and laundry store (15 m^2).

Meal provision

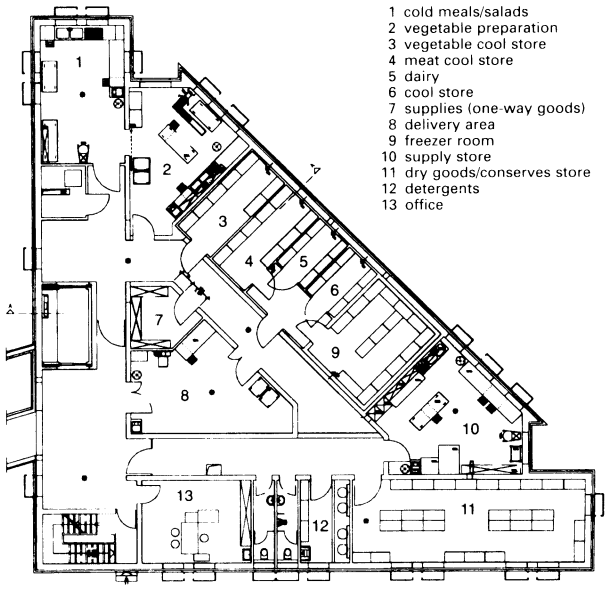
Providing the patients with proper nutrition places high demands on food preparation since the required amounts of protein, fat, carbohydrates, vitamins, minerals, fibre and flavourings often vary. The dominant food provision systems are those which rationalise the individual phases of conventional food preparation (preparatory work, making up, transporting, distribution). Preparation of normal food and special diets takes place separately. After preparation and cooking the meals are put together on the portioning line. The portioned trays are transported with the supply trolleys to the various stations for distribution. The same trolleys are used to transport the used crockery back to the central washing up and trolley cleaning unit.

Staff catering consists of about 40% of the total catering demand. The staff dining room should be close to the central kitchen. A division into separate rooms for domestic staff, nurses, clerical staff and doctors could be considered in a large hospital but, again, for economic reasons, these rooms must be near to the main kitchen. For small and medium-size hospitals this type of division is not recommended.

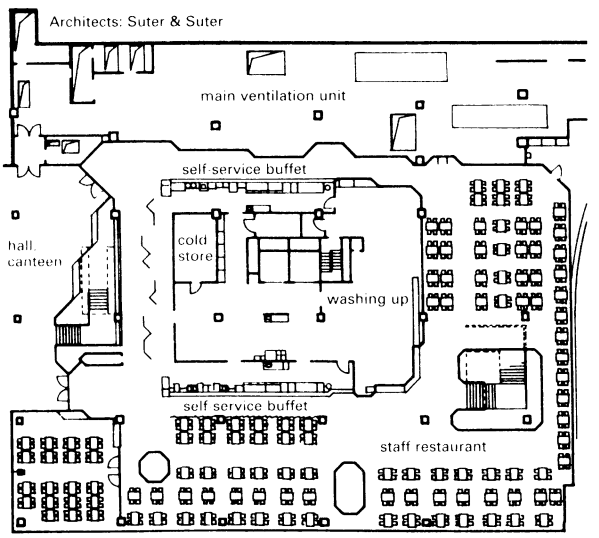
Supplies Areas



(1) **Kitchen building, ground floor**



(2) **Basement** ‣ (1)



(3) **Staff restaurant for 150 employees, Basel Cantonal Hospital**

Central kitchen: Historically, kitchens were on the top floor to reduce the smell and noise. Today they are positioned on the same level as supplies to give an efficient working process: delivery, storage, preparation, making up and dispatch. When deep-frozen food is used, the set-up of the kitchen changes. Here the architect and users must co-operate closely to optimise the meal preparation process and find an advantageous, space-saving solution. The clear height of the kitchen hall should be 4.00 m. The size of the kitchen depends on the requirements and number of patients in the hospital. In the main kitchen an area of 1.00 m^2 is needed per person. A special-diet kitchen (60 m^2 minimum) should also be planned, with a desk for the head chef, a 30 m^2 vegetable cleaning area and a 5 m^2 provision for waste disposal. In addition, the plan must include a daily supplies room (8 m^2), a cold store with compartments for meat, fish and dairy products (8 m^2 each) and a pre-cooling store (10 m^2) with a chest freezer and cooling unit. The goods delivery area should be connected to administration and have sufficient storage space (15–20 m^2). The main store should hold fruit and vegetables (20 m^2), dry goods (20 m^2) and tinned goods/preserves, and must be adjoining.

Central washing-up unit: The central washing-up unit, adjacent to the central kitchen, stores and cleans the staff and patients' dishes. The high level of automation makes it essential for the designer, at an early stage, to clarify and conform to the specific requirements of the individual pieces of equipment.

Technical supplies: The technical service is responsible for technical supplies and plays an increasingly important role as more automation is introduced. Tasks include building maintenance, domestic technology, medical technology, conveyor technology and administration.

It should be noted that sanitary installations are the subject of rapid technical development. It is advantageous to have ring circuits for the horizontal supplies on each storey and rising supplies in separate ducts for vertical connections. The horizontal supply pipes should be installed in the voids above suspended ceilings to make subsequent alterations easy. Water is treated centrally; only areas with higher quality requirements (pharmacy) have local water preparation (desalination, softening). Water consumption is calculated at 400–450 l of water per hospital bed per day, depending on the type and situation of the hospital. Note that waste water is subject to local regulations.

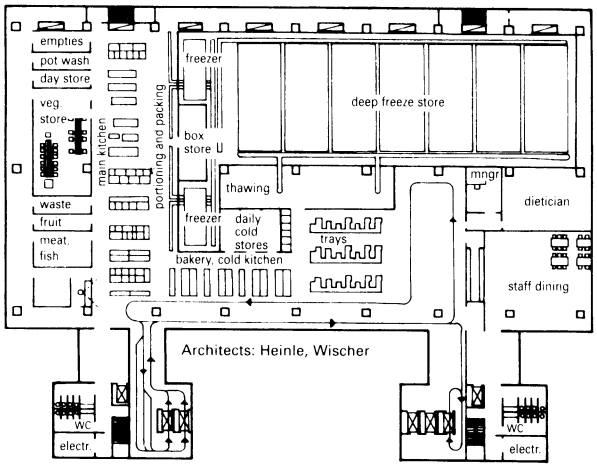
Ventilation and gases: The ventilation equipment is best situated near to the open air. During planning, the horizontal and vertical ventilation ducts should be tested against technical fire protection criteria.

It is necessary to provide medical gases for the surgical, intensive care and radiology departments, and special supply rooms are required. The pumps for oxygen, carbon dioxide, vacuum and compressed air should be duplicated so as to provide a backup in case of failure. An additional technical requirement is an emergency electrical supply system.

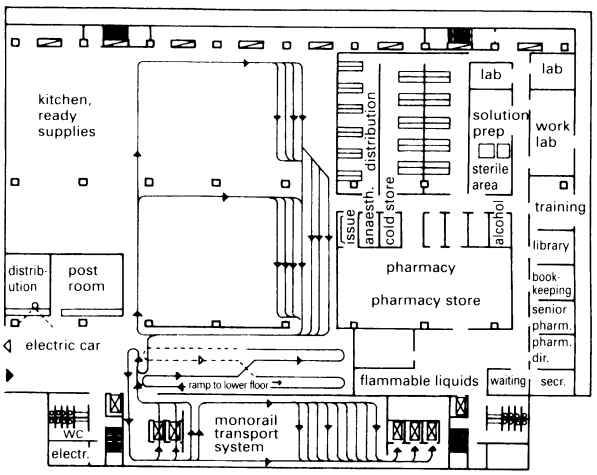
Central heating unit: Earlier systems, using a boiler room, required large basement areas (≥100 m^2), generally on two storeys. Current heating systems are less area-intensive and district heating is particularly advantageous. Note that the surgical and intensive care departments must have a continuous heat supply so emergency systems must therefore be planned. The heating system and medical services supply/emergency power unit may be accommodated in one large room. The layout requirements for services (water, electricity, gas etc.) and flues are laid down in regulations and these must be observed. Emergency escape doors must open outwards.

If possible, the 'heat store' (and entry to it) should be situated underground, outside the building. Note that there are building and heating room regulations which apply.

Supplies Areas

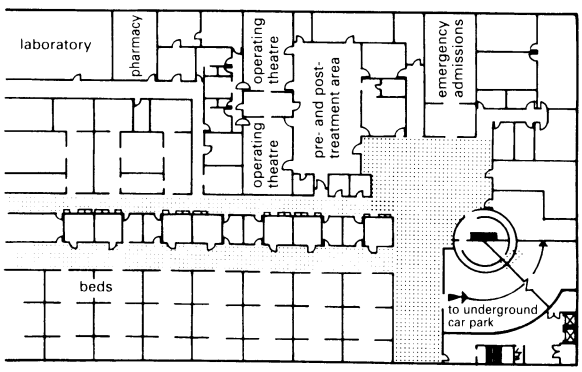


(1) **Kitchen area: Cologne University Hospital**



Architects: Heinle, Wischer

(2) **Supply centre: Cologne University Hospital**



Architects: Suter & Suter

(3) **Civil bunker with two operating theatres and recovery areas: Basel Cantonal Hospital**

In recent years increasing use has been made of modern organisational models. The central organisation of individual supply and disposal areas alleviates the problem of increasing staff shortages. Internal central supply routes are separated from the other traffic flows in the hospital and external disruption is avoided, allowing optimum use of the transport system's capacity. Computer simulation programs can show the architect efficient operational sequences (which can still be modified throughout the planning phase) and setting utilisation targets allows the space required in the supplies area to be minimised.

Electrical systems

The power supply is taken from the national grid: 220–240V standard voltage and 380V high voltage. The low voltage system is controlled from the distributor room which requires at least two free-standing transformer cell units. Sufficiently wide doors (at least 1.30m clear width) and good ventilation must be provided and all relevant VDE and professional association regulations must be complied with. The size and number of emergency power units depends on the size of the hospital and local plants for individual functional units (surgical/outpatients department, care areas, radiology) are preferable to a central emergency power system. Anti-vibration foundations should be used underneath these units to reduce noise. Additional batteries must be provided for lighting and emergency power in the surgical department.

Central gas supply

Oxygen and nitrogen lines are supplied from steel cylinders, alternating between operating and reserve batteries with an automatic changeover facility. To reduce the distance that these cylinders need to be transported, direct access to the goods yard is preferred. The cylinders may be stored with the medical services pumps (for vacuum and compressed air lines) at a central supply point (possibly computer-controlled). Gas cylinders are beginning to be replaced by 'cold gasifiers'. These must stand in the open air at least 5m from buildings.

Workshops

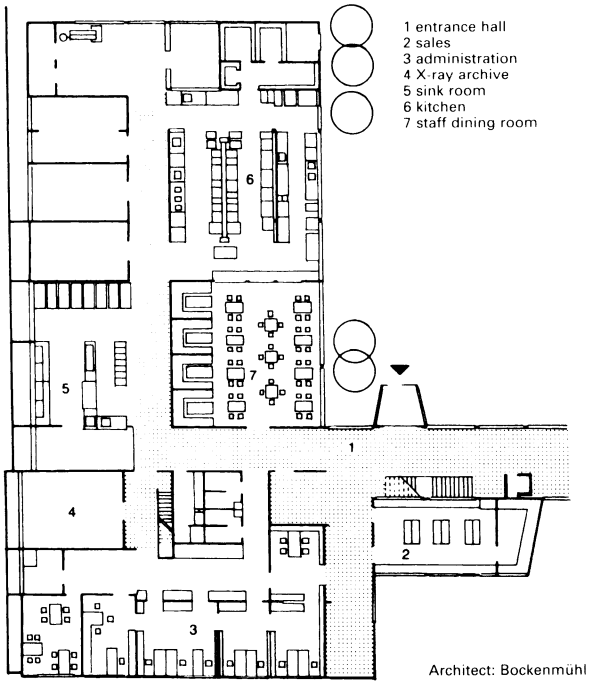
Connected to the goods yard are metalwork and electrical workshops ($40\,m^2$), with a materials store, spare parts store ($20\,m^2$), general store ($60\,m^2$) and standing area for transport equipment ($15\,m^2$). A water reservoir (emergency water tank) should be planned for, possibly at the elevator crossings over the top storey ($40\,m^3$). Water treatment plant for the general hospital and the sterilisation area must be separated.

Communications centre

The following information and communications media could be needed in the hospital: telephones and faxes, intercom systems, nurse call system, clocks, pagers, a PA system for music and announcements, television, telex, radio. For a better overview, a central point should be set up for co-ordinating these media (in the entrance hall or in a room off reception). Pagers are to be provided in parallel with the telephone network where it is not feasible to reach a telephone for time or operational reasons (e.g. surgical area, radiology). The nurse intercom system allows a voice link between individual nurses' workrooms and the patients' rooms. Several hundred clocks with a second hand can be controlled from a quartz battery clock via the telephone network. Patients' rooms are to be equipped with telephone, telephone paging and television. In teaching and research hospitals it is important to have closed-circuit television (monitoring). All buildings must be monitored by an automatic fire alarm system, supplemented with manual alarm switches. In the event of fire, the ventilation system, transport systems and elevators are controlled via the fire alarm system. Consultation with specialist engineers is essential.

Bunkers

The requirements of structures providing protection from radioactive fall-out and air attack vary from country to country so the local guidelines must be followed. In Switzerland, for example, an auxiliary operating theatre, wards, sterile goods store and emergency technical systems must be provided.



① **Entrance hall and administrative area of Herdecke Community Hospital in the Ruhr: 192 beds**

Archive and store rooms

A short route between archives and work areas is advantageous but generally difficult to provide. One possibility is to locate them in the basement and have a link by stairs. Distinctions should be made between store and archive rooms for files, documentation and film from administration, the X-ray department etc. and supplies (pharmacy, disinfection, kitchen etc.) and equipment (kitchen, administration, workshops etc.). The necessary depth of shelves and cupboards depends on the goods stored. For files, books and film, 250–400 mm is adequate; for equipment, china spare parts etc., 400–600 mm is needed. Mobile shelving systems are useful for reducing the floor area occupied. The high loads imposed by shelves (up to 1000 kg/m²) must be taken into account from an early stage.

Communal rooms

Dining rooms and cafeteria are best situated on the ground floor, or on the top floor to give a good view, must have a direct connection to the servery. The connection to the central kitchen is by goods lift, which is not accessible to visitors. Consider whether it is sensible to separate visitors, staff and patients. Nowadays, the dining areas are often run by external caterers and the self-service system (servery 6–8 m) has become generally accepted. Salad counters should stand independently.

Prayer rooms

These should, preferably, occupy a central location, at the intersection of internal and external circulation routes, but outside the care, treatment and supply areas. This allows access for employees, visitors and inpatients. The size of devotional rooms and the facilities they offer will vary according to faith, place and person, but they are often not oriented towards a particular faith. At least 40 m² should be allocated.

In large hospitals, it might possibly be desirable to include a chapel, in which case the relevant church authorities should be consulted. (See the section entitled Places of Worship for details of the requirements.)

When planning rooms to cater for spiritual needs in hospitals, it is essential to consider space requirements for wheelchair users and those who are bedridden.

Administration rooms

Rooms for administration should be connected by corridor to the entrance hall and be close to the main circulation routes. A suitable route to the supplies area must also be planned.

Staffing per 100 occupied beds and 1000 patients (Germany, 1980–1995)

	for each 100 beds					for each 1000 patients				
number per staff group	1980 West Germany	1985 West Germany	1990 West Germany	1991 Unified Germany	1995 Unified Germany	1980 West Germany	1985 West Germany	1990 West Germany	1991 Unified Germany	1995 Unified Germany
1 medical	11.7	13.6	15.7	17.1	20.4	5.4	6.0	5.9	6.8	6.8
2 nursing	44.8	48.8	55.2	58.5	70.4	20.6	21.4	20.9	23.4	23.4
3 medical technical	14.1	15.8	17.5	21.9	25.0	6.5	7.0	6.6	8.8	8.3
4 operational	9.4	11.0	12.9	14.1	16.3	4.3	4.8	4.9	5.7	5.4
groups 1–4	80.1	89.2	101.2	111.5	132.2	36.8	39.2	38.4	44.7	43.9
5 clinical domestic	10.2	8.2	7.0	7.6	6.8	4.7	3.6	2.7	3.0	2.2
6 managerial and supplies	18.1	17.0	17.1	17.2	17.2	8.3	7.5	6.5	6.9	5.7
7 technical	1.3	2.3	3.3	4.4	4.5	0.6	1.0	1.3	1.5	1.8
8 administration	7.5	8.0	8.8	10.9	12.1	3.5	3.5	3.3	4.4	4.0
9 specialist	1.4	1.5	1.7	2.0	1.6	0.7	0.6	0.7	0.8	0.5
10 other staff	3.4	3.4	3.9	3.5	3.9	1.6	1.5	1.5	1.4	1.3
11 total staff	122.1	129.6	143.0	157.0	178.3	56.2	57.0	54.3	62.9	59.2
without 'other' (10)	118.6	126.2	139.1	153.5	174.4	54.6	55.4	52.8	61.5	57.9

source: German Hospital Association (DKG), issued 1997

The following requirements are based on a one hundred-bed occupancy level. In the administrative area, 7–12 m² per member of staff should be planned. Rooms for dealings with patients and relatives need to be connected to reception (entrance hall), admissions and accounts (25 m²). Links to the casualty entrance are also important, and there should be at least two reception areas (each 5 m²) for demarcation before the main reception, the cash-desk (12 m²) and accounts (12 m²).

Additional rooms needed include: an office for the administrative director (20 m²), a secretarial room (10 m²), an administrators' office (15 m², possibly in the supply area), a nurses' office (20 m²), a personnel office (25 m²) and central archives (40 m², possibly in the basement with a link to the administration department via stairs).

According to requirements, the plan should also provide: duty rooms for matron and welfare workers, a doctors' staff room and consulting rooms, a messenger room, a medical records archive, specialist and patients' libraries, and a hairdresser's room (with two seats).

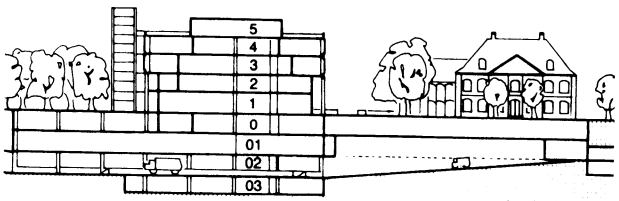
The increasing rationalisation of accounts and the use of electronic systems and computers should be taken into consideration during planning (e.g. cableways in floors – possibly, raised floors – central desk with tube post link etc.).

Main entrance

General traffic goes only to the main entrance; for hygiene reasons (e.g. risk of infection), special entrances are to be shown separately. The entrance hall, on the basis of the open-door principle, should be designed as a waiting room for visitors. Today's layouts are more like that of a modern hotel foyer, having moved away from the typical hospital character. The size of the hall depends on bed capacity and the expected number of visitors. Circulation routes for visitors, patients and staff are separated from the hall onwards. The reception and telephone switchboard (12 m²) are formed using counters, allowing staff to supervise more effectively. However, it must be possible to prevent public access from reception to inner areas and main staff circulation routes. The entrance hall should also contain pay phones and a kiosk selling tobacco, sweets, flowers and writing materials.

Casualty entrance

A covered access road or closed hall overlooked by the administration department, but not visible from the main entrance, is preferred for incoming casualty patients. Short routes to outpatients, the surgical/X-ray departments and the wards should be planned and these must be free of general traffic. An examination room for first aid (15 m²), a washroom (15 m²), an ante-room (10 m²), standing room for at least two stretchers, and a laundry store should be included in an area where they are accessible directly beyond the entrance.



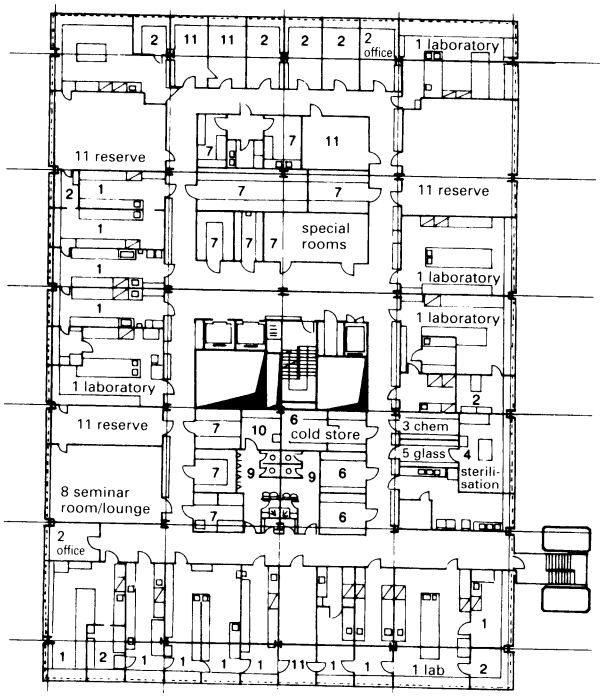
Architects: Suter & Suter

03 services
02 stores, laundry, pool
01 kitchen, workshops, experiment station

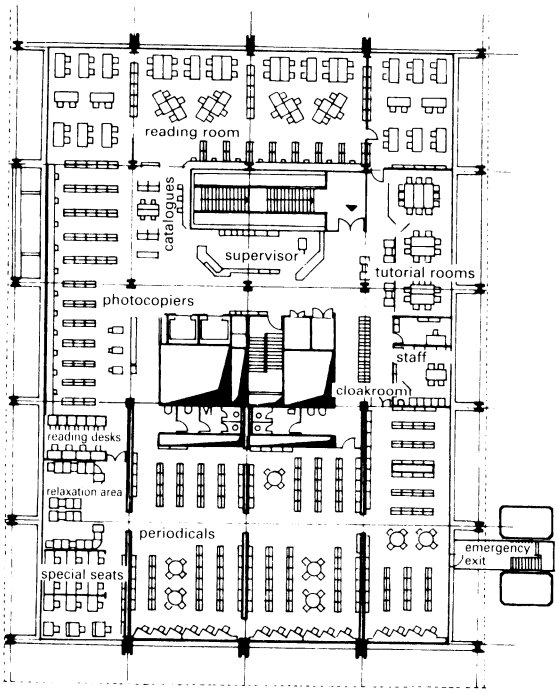
0 canteens, halls
1 cafeteria, lecture theatres
2 library

3 laboratories
4 training laboratory
5 plant

(1) **Teaching and research centre, Basel**



(2) **Level 3: research laboratory**



(3) **Level 2: library**

HOSPITALS

Teaching and Research

Residential area

The residential areas are, without exception, separated from the main hospital but reached via the access road for the entire site. The area is divided into residential homes, apartments and training schools. There must be sufficient parking spaces for vehicles belonging to the employees.

In addition to nurses, residential homes for female employees should also accommodate female doctors, assistant physicians, auxiliary staff and students, if necessary. Bedsitting rooms should be designed uniformly as single rooms with a cupboard and wash-basin (16 m²) or, preferably, with a separate WC/shower area. The usual dimensions of the rooms are approximately 4.60–4.75 m × 3.00–3.50 m. The storey height of standard residential buildings is adequate.

Opinions on the arrangement of kitchen units vary. Previously, the norm was 10–12 bedsitting rooms in a residential group sharing a kitchen (6 m²), lounge (20 m²), possibly a balcony, and a cleaning room (10 m²). Today bedsitting rooms with an integrated cooking area and en-suite facilities are usual (see the section covering student halls of residence). Common rooms for all employees are one lounge (1.0 m² per bedsitting room; 20 m² minimum), connecting with a multipurpose room (20 m²), a cloakroom, WCs, a laundry room (10 m²), a drying room (15 m²) and a storage room (30 m²). Similar residential homes for male employees should be in the design unless the size of the hospital necessitates a common residential home.

Apartments

Doctors should be housed in two-room apartments (40 m²) in separate male and female residential blocks. Three- and four-room apartments (70–90 m²) away from these blocks should also be planned for doctors, hospital administrators and house masters. Communal rooms may be arranged for doctors if necessary: library and reading room (25 m²), club room (35 m²). The proportion of apartments for doctors is currently growing smaller.

Training schools

To provide practical experience, a specific area in close contact with the hospital is required for training medical students, teaching and research. Increasing student numbers are making greater demands on training schools. The following must be provided: stores, workshops, experimental stations (pharmacy), audiovisual facilities for video transmissions from the surgical department, possibly a separate cafeteria, lecture theatres (150–500 seats), a library, research and teaching laboratories, practice rooms and office space. The number and size of all rooms depend on the scale and location of the institution.

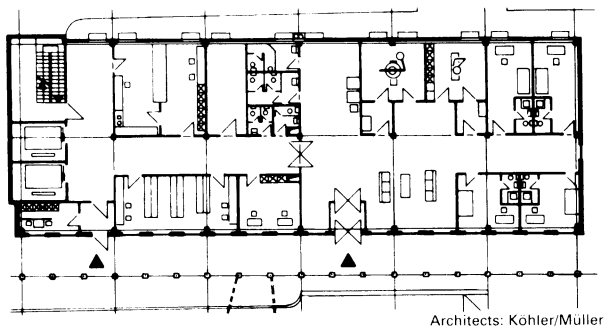
Experimental stations

This is where all laboratory animals are kept and is an area of particular importance in university hospitals. The experimental station is connected to other laboratory areas by passenger and goods lift. Large additional areas must be planned for the breeding and keeping of animals.

Library

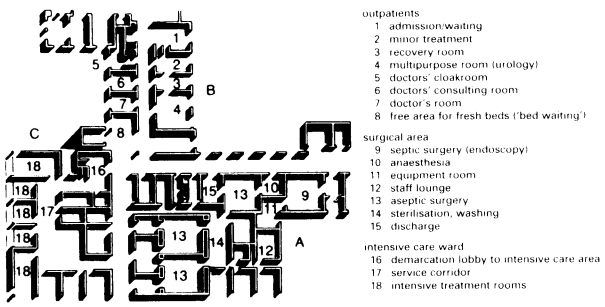
Medical libraries should be designed as open-shelf libraries, with no closed stores and no requirement for issuing books. A large part of the literature will be made up of periodicals. It is important to have an adequate number of reading tables with reading lamps, workstations with microfiche readers, slide viewers and typewriters. It is advantageous if the library is connected to the small or medium-size transportation systems of the hospital.

A&E AND OUTPATIENTS DEPARTMENT

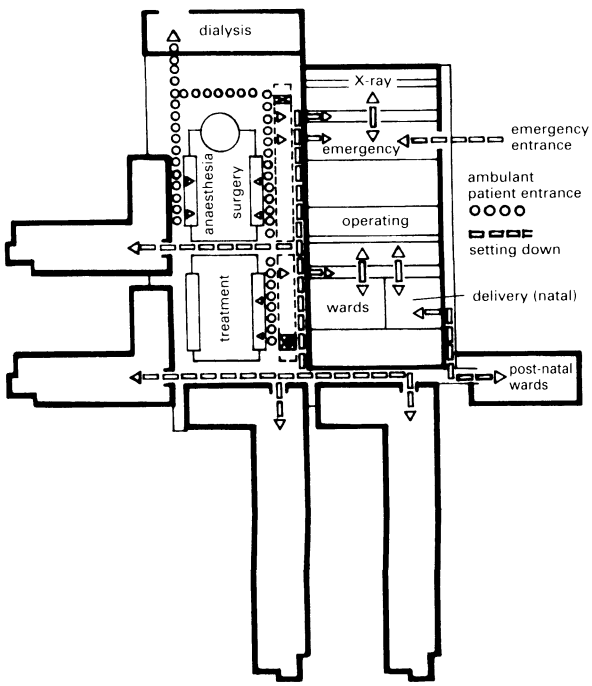


Architects: Köhler/Müller

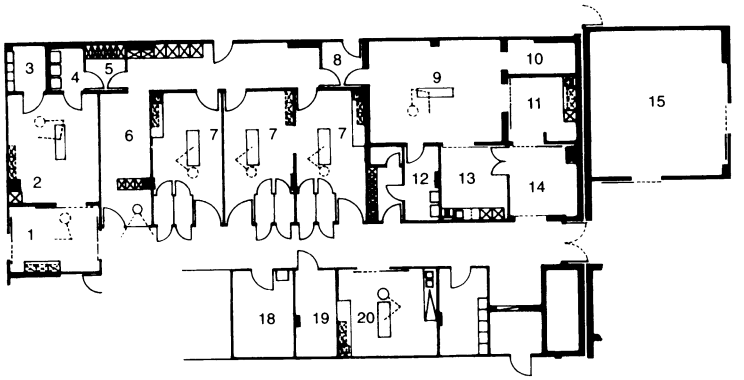
(1) **Accident and emergency department: duty doctors' rooms; central sterilisation**



(2) **Part-plan of the functional areas: A surgical, B outpatients, C intensive care**



(3) **Internal connections, Prignitz Hospital** Architects: B + C Lambart



Architects: U + A Weicken

(4) **Accident and emergency, St Elisabeth Hospital, Halle**

Accident and emergency (A&E)

The accident and emergency department is for ambulant and bedridden patients and is accessed via the emergency entrance (note that the minimum vehicle headroom is 3.50m). Clear signposting to the drive-in entrance is of life-saving importance for ambulance drivers. It is convenient to site this entrance on the opposite side of the building to the main entrance to avoid contact with the visitors and other patients.

The accident and emergency department consists of emergency treatment rooms (20–25m^2) equipped with operating tables, small operating lights, cupboard units with sinks, and patient cubicles. In addition, a plaster room with plastering bench and equipment and a shock treatment and recovery room must be available.

Proximity to the surgical department is essential, even if a special intervention room for emergencies is included in the plan, and surgery and anaesthesia services should also be grouped nearby.

Casualty hospitals

These are generally found only in cities and often also serve rehabilitation purposes. Such auxiliary hospitals, with a well-trained surgical department, are often accommodated in old general hospitals which have been moved to new buildings.

Public health offices

In Germany these generally perform the functions of an outpatients clinic; they provide the outlet for preventive measures and follow-up treatment of ambulant patients who have been discharged.

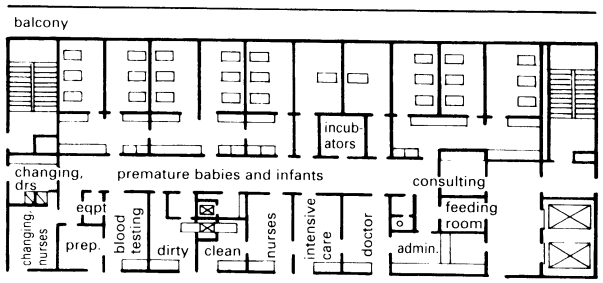
Typical facilities in an outpatient clinic are as follows:

- examination and treatment rooms are needed for initial diagnosis, preliminary treatment, follow-up treatment and consultations, etc., all with separate waiting rooms
- office rooms should be provided for doctors co-ordinating, for example, strategies for combating epidemics and these should have ante-rooms (e.g. for records, inoculations etc.) as well as a separate waiting room
- venereal disease treatment requires examination rooms (with WCs), ante-rooms for patient records and medication etc., and waiting rooms
- infant welfare services should have a waiting room, a nursing room and ample space for prams (at the entrance), materials and records

In addition, plans must include medical-technical rooms, X-ray departments, rooms for administrators and personnel, and rooms for storage and archiving.

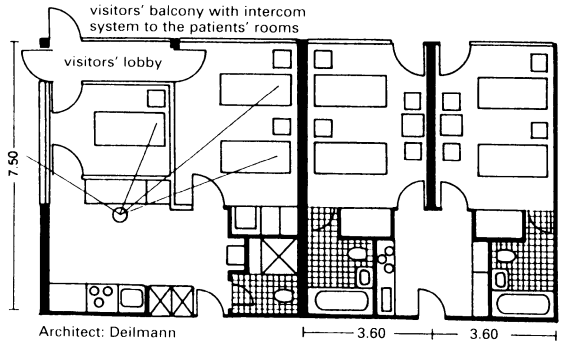
The size of all of these rooms varies and needs to be agreed between the planner and the users.

Maternity and Neonatal Care



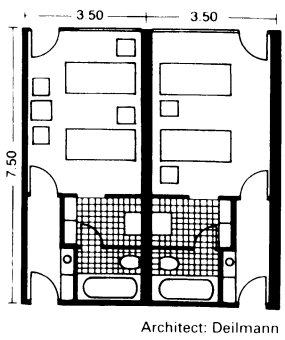
Architects: Köhler, Kässern

① **Premature baby and infant ward with 27 beds, Fulda**



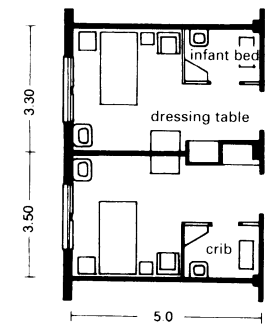
Architect: Deilmann

② **Care of infectious children: room variations** → ③–④



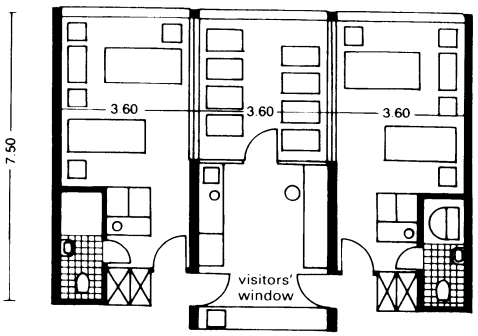
Architect: Deilmann

③ **room variations**

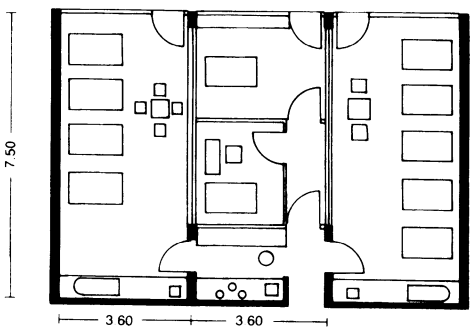


Architect: Deilmann

④ **room variations**



⑤ **One-bed room with separate infant room** Architect: Mayhew



⑥ **Neonatal and maternity care** Architect: Deilmann

The maternity and neonatal department provides continual physical, medical, psychological and social care for mothers and new babies following a hospital delivery. After uncomplicated births, the care of new mothers can be considered part of normal care. However, new mothers with highly infectious diseases, such as typhoid, TB and hepatitis, need to be housed in an isolation care ward. Where vital functions are disrupted, provision should be made for easy transfer to the intensive care ward. Neonates with infections or respiratory difficulties (e.g. premature babies) have to be transferred to special departments or the nearest children's hospital.

The division of maternity care is the same as for normal care: basic care, treatment care, patient care, administration and supply. Organisation of the processes with the options of ward care, group care or individual care are also the same as for normal care. With centralised neonatal provision, the care unit for neonates is located at the side of or within the maternity care unit. To reduce infection, the area is divided into small rooms or compartments. Neonates are carried into the mother's room on trolleys or by hand for breast feeding. This achieves more frequent and more intensive contact between mother and child than in previous designs with central feeding rooms. Accommodating mothers and neonates in one room ('rooming in') means the infants do not need to be moved, which thus relieves the staff, but requires uneconomic local neonatal provision. Despite this, it has become standard practice in some hospitals.

Facilities and size of care units

They are generally smaller than the units in normal care areas. Smaller wards are preferable because they are easier to control in terms of hygiene (less movement of staff and visitors) so it is advisable to limit the size per care unit to 10–14 bed spaces. The functions may be divided into: care of healthy mothers, care of healthy neonates, care of special neonates (e.g. premature babies) and incidental functions. For hygiene reasons, higher demands are to be made on maternal and neonatal care than on normal care. Therefore, a visitors' lobby and cloakroom area must be provided in addition to the usual system of demarcation. The bed space can be planned as in normal care but the bed spacing must be increased to allow space for a baby's crib next to the beds. Sit-bath/shower combinations and showers must be provided in the sanitary zones where mothers should not take full baths in tubs.

The neonatal care units comprise: bed spaces for neonates, undressing/dressing areas, baby bathing, weighing point, children's nurses' duty station and, possibly, a trolley standing area. A special neonatal care unit with isolated beds and care points should be provided for babies with pathogenic conditions. The following elements or rooms are also to be included in an incidental function area: duty station for the ward sister, nurses' lounge, kitchenette, doctors' offices, examination and treatment room, clean workroom, patient bathroom, day-rooms for patients and visitors, storage space for equipment and cleaning materials, staff and visitors' WCs, linen cupboards and a room for consultation with relatives.

Environment

To minimise the transfer of airborne germs, the ventilation system must process eight changes of air per hour. The room temperatures must be between 24°C and 26°C.

Position

The transport route for new mothers and neonates after delivery should be as short as possible and not cross any other busy corridors. Obstetrics and maternity care should preferably be on one level to avoid the need to use lifts.

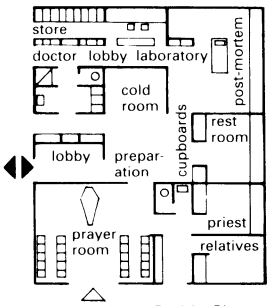
Mortuary, Pathology, Service Yard

Mortuary, pathology

The mortuary of a hospital contains storage rooms and post-mortem rooms. Specifically, there must be a coffin store, refrigerated storage for corpses, an area for laying out and undertakers, and changing facilities for pathologists. As an independent hospital department it should be so planned as to have access by a short route to a group of lifts (to the nursing stations). The entrance must be clearly marked for the relatives and there should be a short drive-in entry point for the undertakers. Depending on the size of the hospital, this area can be extended with the addition of a laboratory and an archive.

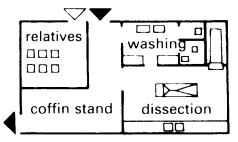
Service yard

Hospital logistics should be centred in one place. A service yard, conveniently situated in a low-level supplies and disposal area, makes this possible. The supply and disposal of all hospital goods and materials is conducted via a separate road connection, segregated from the main and emergency entrances. During planning, consideration must be given not just to the parking and manoeuvring area for goods vehicles, but also to the wide variety of waste to be managed (kitchen, septic, metal, glass, paper, chemicals etc.) and the necessary storage requirements. In addition, service yard auxiliary rooms house emergency electricity generators, the sprinkler control room, the oxygen distribution system, and other services. As a result of the many different functions and the different types of supply vehicles which will have to be accommodated, it is not possible to specify the space needed for this area; at an early stage, the designer and users need to agree on the requirements. Given that the basement is the most suitable location for the service yard, it will only be accessible via a ramp; the slope must be less than 15°. Where the yard is built over, regulations regarding ventilation must be followed.



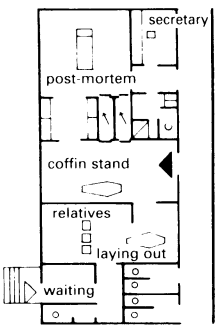
Architects: Poelzig, Biermann

① **Soltau Hospital: 354 beds**



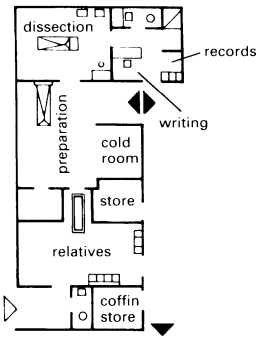
Architects: Köhler, Helfrich

② **Mortuary, St Joseph's Hospital, Wipperfürth (372 beds)**



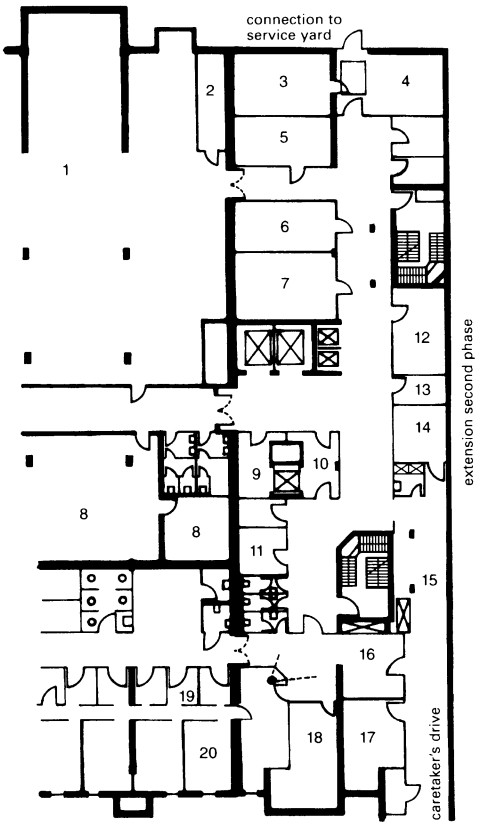
Architect: Poelzig

③ **Mortuary, St Clemens Hospital, Geldern (480 beds)**



Architects: Krüger, Krüger, Rieger

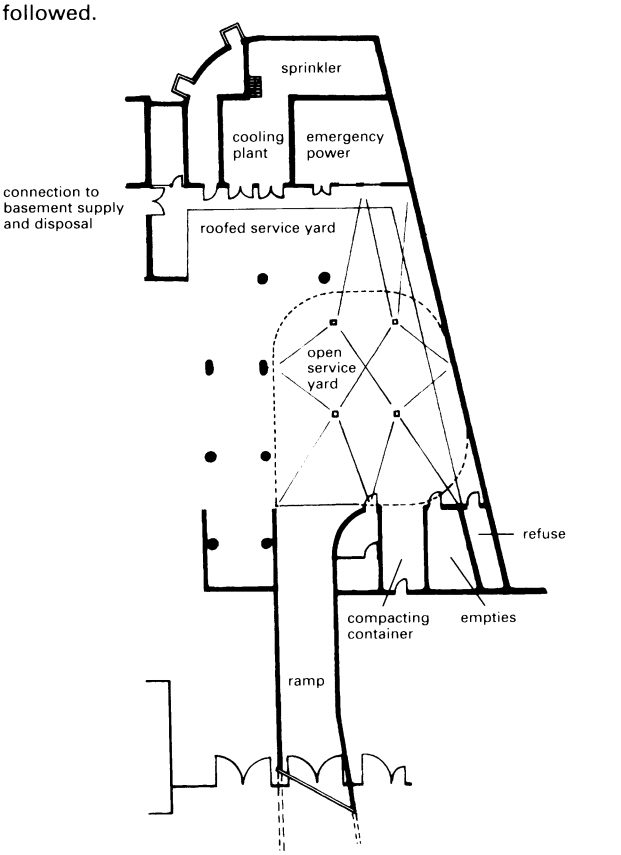
④ **Mortuary, Municipal Hospital, Verbert (444 beds)**



1 heating/services
2 electrical switchgear
3 water/gas feeds
4 store room
5 oxygen
6 electrical controls
7 data handling
8 store
9 supplies
10 disposals
11 laundry
12 store room
13 relatives
14 laying out
15 coffin standing
16 dissection
17 equipment
18 records
19 rest room
20 hydro-massage

Architects: U + A Weicken

⑤ **Basement floor with supply and disposal provision, mortuary, physical therapy**



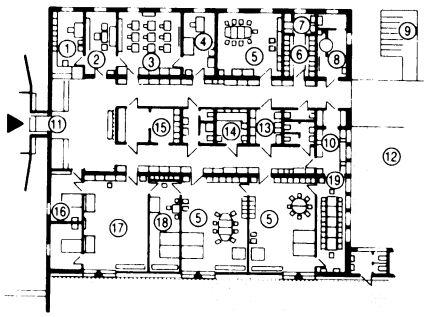
Architects: U + A Weicken

⑥ **Service yard/ramp**

SPECIAL HOSPITALS

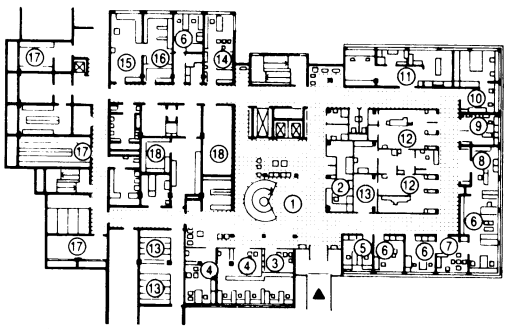
Hospitals specialising in specific medical fields are becoming increasingly important. They require a far more space-intensive general arrangement and this leaves the planner facing extra demands. It is vital to have ongoing co-operation between the architect, medical engineers and the doctors/nurses who will be working in the hospital.

Special hospitals cover medical disciplines such as specific surgical procedures, a range of therapies, psychiatry and paediatrics. There has been a proportionate increase in the number of clinics for treating allergies, skin complaints and lung diseases.



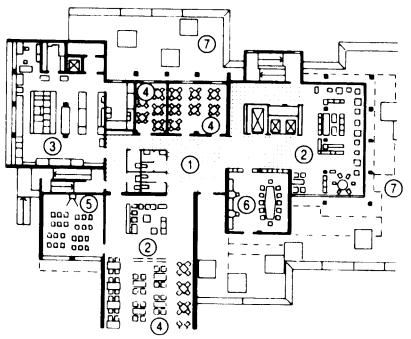
① office
② consulting
③ lectures
④ tuition
⑤ kindergarten
⑥ staff cloakroom
⑦ staff bathroom
⑧ heating
⑨ bicycles
⑩ kitchen
⑪ entrance
⑫ goods yard
⑬ washing room
⑭ baby changing
⑮ equipment
⑯ treatment
⑰ gymnasium
⑱ occup. therapy
⑲ staff lounge

① **Göggingen Spastics Centre**



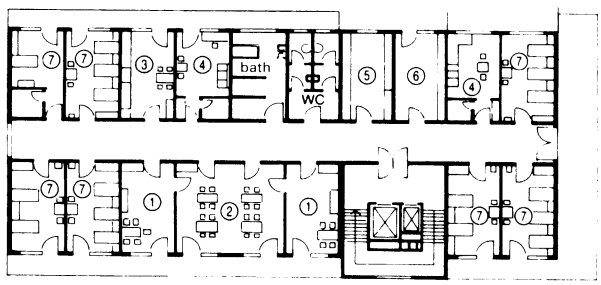
① hall
② porter
③ registration
④ administration
⑤ office
⑥ doctor
⑦ waiting room
⑧ examination
⑨ ECG
⑩ laboratory
⑪ endoscopy
⑫ X-ray exam.
⑬ files
⑭ nurse
⑮ laundry
⑯ sewing/ironing
⑰ kitchen suppl.
⑱ stores

② **Wildbad Rheumatism Hospital (100 beds): ground floor**



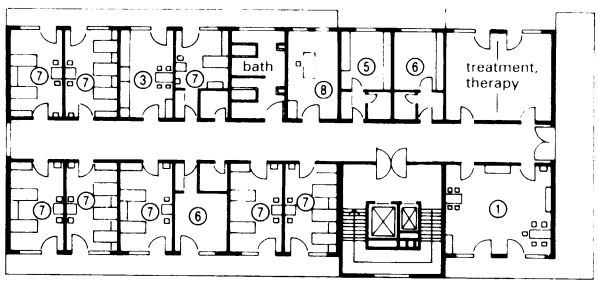
① hall
② day room
③ kitchen
④ dining
⑤ TV room
⑥ consulting, library
⑦ terrace

③ **Wildbad Rheumatism Hospital: first floor**

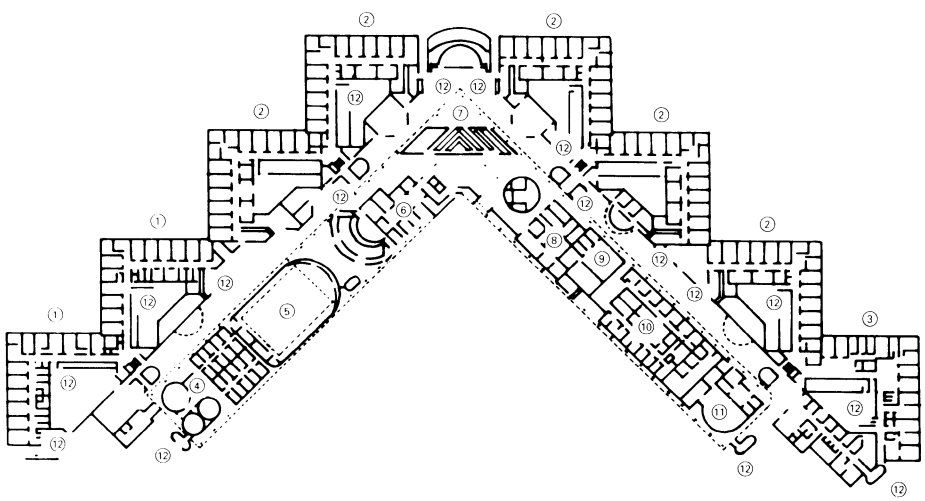


④ **Munich Rehabilitation Centre (72 beds): floor 1/2**

① living
② dining
③ kitchenette
④ lecturer, duty staff
⑤ cleaning
⑥ store
⑦ sleeping
⑧ duty doctor



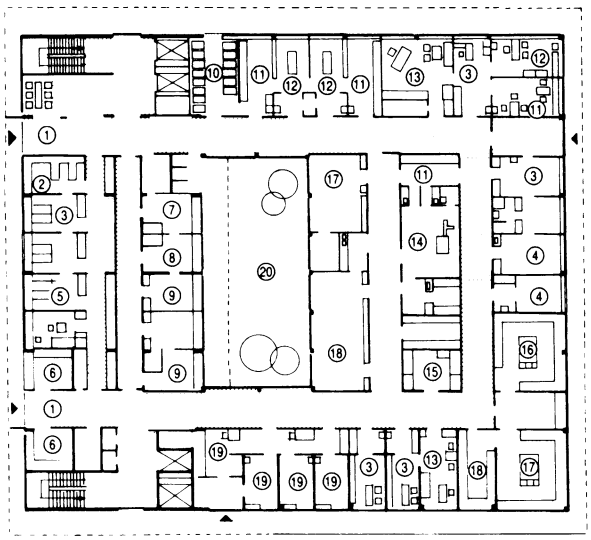
⑤ **Munich Rehabilitation Centre: fourth floor**

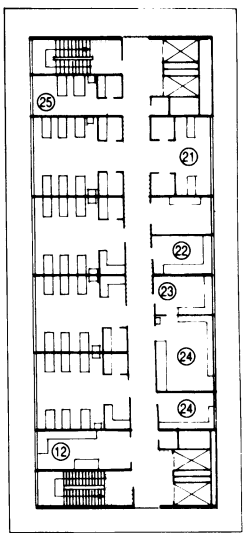


① geriatric unit
② adult unit
③ pediatric units
④ psychiatric outpatient clinics
⑤ consulting area
⑥ volunteer workers
⑦ dining area
⑧ admissions
⑨ medical records
⑩ emergency clinics
⑪ business area
⑫ free-standing colour-coded stairs in mall each serve four residential units; supplemented by elevators for disabled

Architects: Todd Wheeler & Perkins & Will Partnership

⑥ **Capital District Psychiatric Center, Albany, New York accommodates 400 inpatients in 16 residential units, each of which serves 25 day patients**



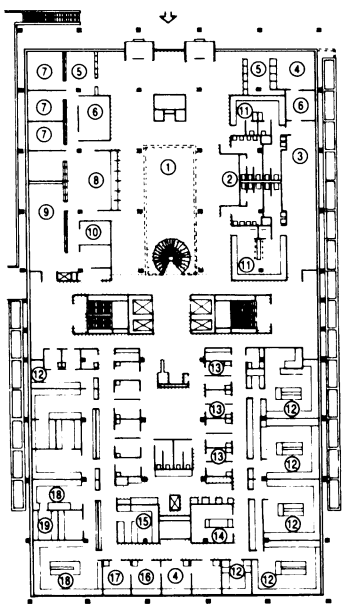


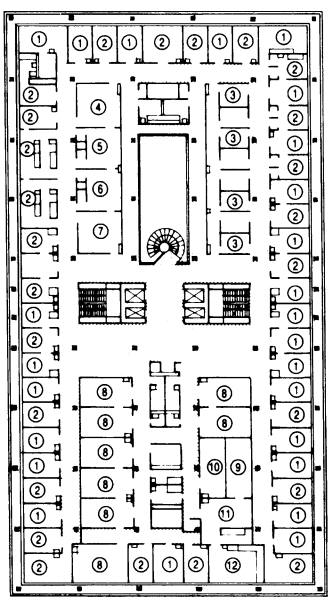
Architects: Amon, Häckl, Kochta

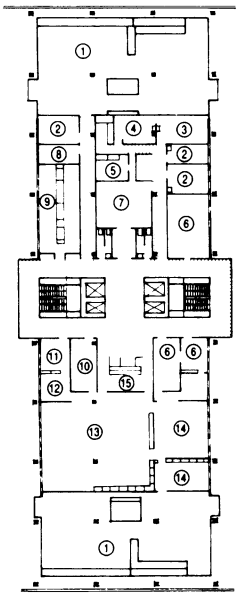
① entrance hall
② porter
③ secretarial area
④ administration
⑤ matron
⑥ admission
⑦ ENT
⑧ eyes
⑨ EEG
⑩ pram
⑪ waiting room
⑫ examination
⑬ doctor
⑭ X-ray
⑮ ECG
⑯ clinical lab
⑰ serology lab
⑱ bacteriology lab
⑲ infection records
⑳ courtyard
㉑ isolation room
㉒ kitchen
㉓ nurse
㉔ care work
㉕ parents

① 200-bed Fürth Municipal Children's Hospital: ground floor

② upper floor







Architects: Braun/Schlockermann/Braun-Krebs

ground floor
① hall
② cloakroom
③ lounge
④ doctor's room
⑤ anteroom
⑥ consultation
⑦ administration
⑧ admissions
⑨ main office
⑩ switchboard
⑪ changing
⑫ laboratory
⑬ blood sampling
⑭ sink room
⑮ auto-analysis
⑯ secretarial
⑰ chemist
⑱ biochemistry
⑲ physics/chemistry

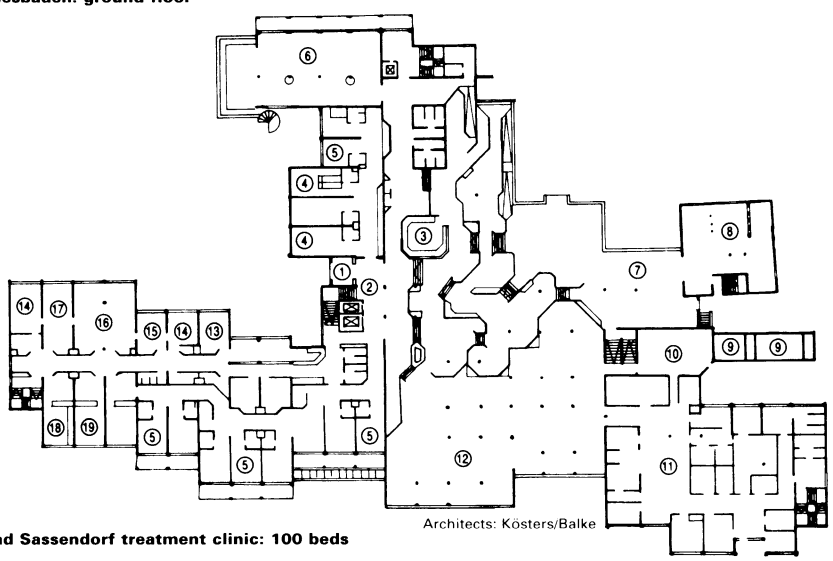
first floor
① ventilation centre
② doctor's room
③ nystagmography
④ myography
⑤ dark room
⑥ files
⑦ studio
⑧ gas sterilisation
⑨ central sterilisation
⑩ waiting
⑪ manager
⑫ secretarial
⑬ plant room
⑭ programmer
⑮ operator

second floor
① doctor's room
② examination
③ measuring centre
④ gas analyses
⑤ ergo-spirometry
⑥ ergometry
⑦ dye testing
⑧ pathology measuring
⑨ strong room
⑩ dose admin.
⑪ radioactivity lab
⑫ sample measuring

③ German Clinic for Diagnostics, Wiesbaden: ground floor

④ first floor

⑤ second floor

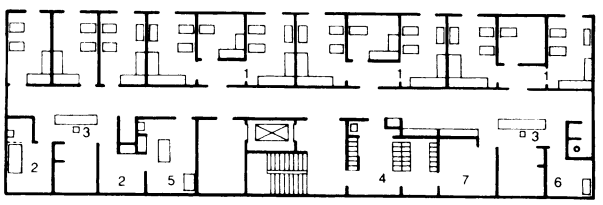


Architects: Kösters/Balke

① porter
② entrance hall
③ reception
④ double room
⑤ single room
⑥ conference
⑦ hall
⑧ lounge
⑨ electric plant
⑩ staff dining
⑪ kitchen
⑫ dining room
⑬ laboratory
⑭ senior physician
⑮ examination
⑯ chief physician
⑰ secretarial area
⑱ staff nurse
⑲ ECG

⑥ Bad Sassendorf treatment clinic: 100 beds

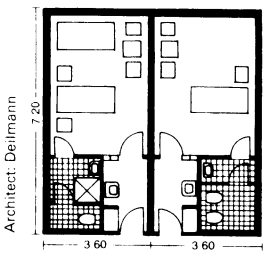
SPECIAL CARE AREA SAFETY



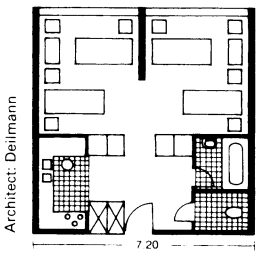
1 bedroom
2 doctor
3 nurse's duty station
4 staff cloakroom
5 treatment
6 breast-feeding room
7 nurses' lounge

Architects: Krüger, Krüger, Rieger

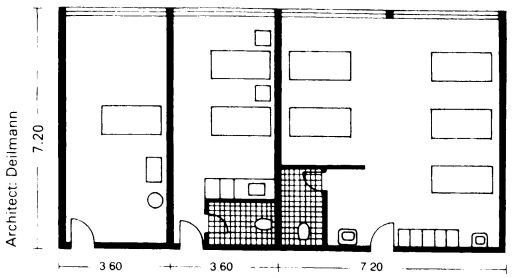
① **Children's ward with 28 beds, Velbert Municipal Hospital**



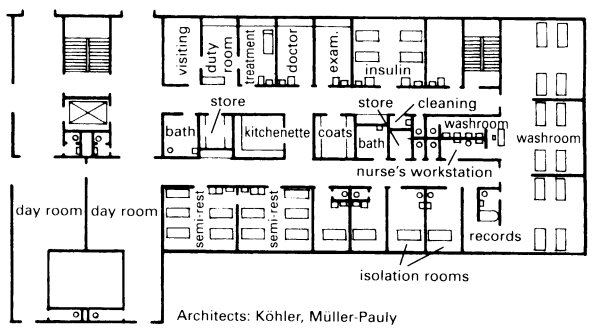
② **Single/two-bed room in control area; high radiation protection**



③ **Four-bed room; all facilities for basic care (long-term patients)**

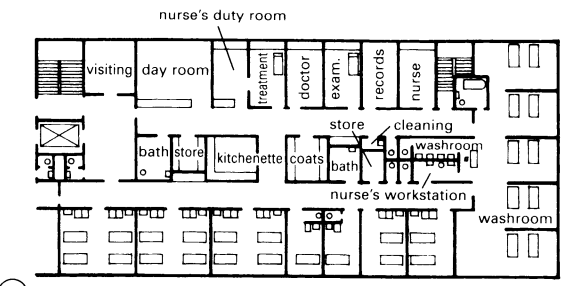


④ **Room unit for people with slight mental illness and for those requiring care**

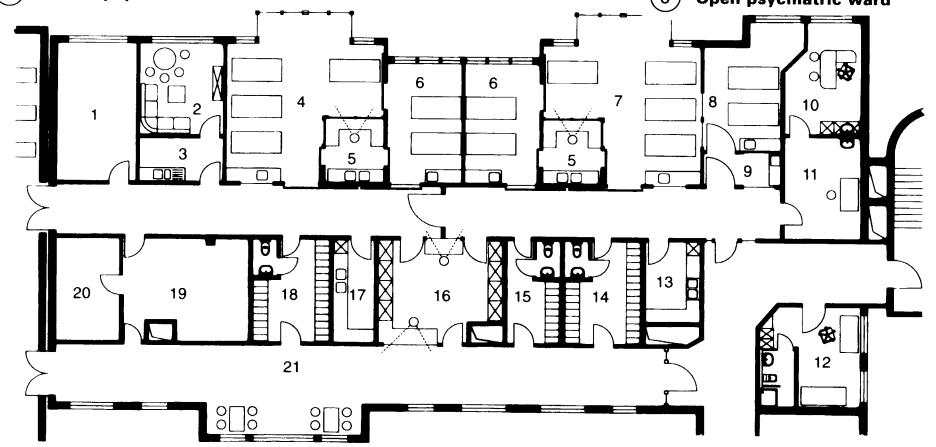


Architects: Köhler, Müller-Pauly

⑤ **Closed psychiatric ward**



⑥ **Open psychiatric ward**



1 service room/equipment
2 staff rest room
3 kitchenette
4 four spaces (white)
5 supervision point
6 two spaces
7 four spaces (yellow)
8 two spaces (emergency)
9 lobby
10 doctor
11 examination
12 doctor/preparation
13 materials store unclean (yellow)
14 patient changing (yellow)
15 staff changing
16 nurses' workstation/records
17 materials store unclean (white)
18 patient changing (white)
19 central concentrate supply/dilution
20 store
21 waiting

⑦ **Dialysis station for 12 places**

Architects: U + A Weicken

Infants and children

The patients generally found in special children's hospitals may be categorised as follows: infants (35%) and premature babies (13%), small children and schoolchildren up to the age of 14 (22%), and groups of all ages with infectious diseases (22%). In such areas, contact between the patients and other patients/staff should be avoided as far as possible.

Windows, heaters and electrical apparatus must be secured in such a way that children cannot be put at risk. Rooms for teaching, entertainment and play should be similarly fitted out.

Isolation wards must be provided for measles, chickenpox, diphtheria, scarlet fever and TB. The walls must withstand washing and disinfecting below a height of 1.50m and the design should as far as possible resemble a kindergarten rather than a clinical area.

Care of patients receiving radiotherapy

When planning a care area using nuclear medicine for patients needing radiotherapy, the provisions of radiation protection regulations must be observed. The size of such care groups should be similar to that of a normal care group. The operations centre is divided into a control area and a supervision area. In this way, patients whose bodies have received the greatest radiation doses are separated from those who have received less. Patients should therefore be accommodated primarily in one-bed rooms.

Care of the mentally ill

The variable nature of mental illness results in a requirement for open and closed wards (for those in need of slight care and those who are seriously ill and possibly violent). The two types need to be accommodated when planning and setting up care units. Large areas are required for day-rooms, dining rooms and rooms for occupational and group therapy, because patients are not confined to bed. Small care units (up to 25 patients) should have short circulation routes and provide good observation points for nursing staff. A homely design should always be used to give patients a feeling of well-being. There is a trend towards integrating wards for the mentally ill into general hospitals to prevent these patients becoming institutionalised.