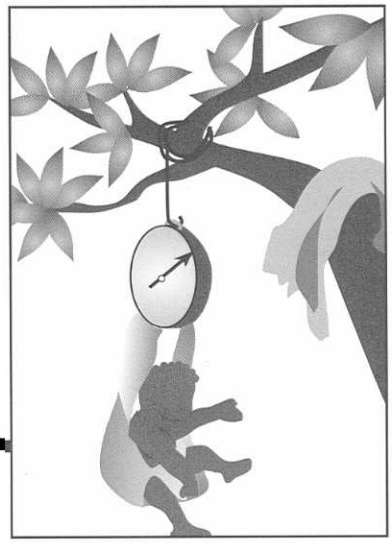


5. PROJECT DESIGN

This chapter presents some of the considerations pertinent to the design of district and rural hospitals, rural health centres and health posts

The extent and content of facilities in a health infrastructure directly influence quality and efficiency, and consequently the recurrent expenditure required in the health sector. The need for staff, their production capacity, the need for consumables and supplies, maintenance services and energy all have to be measured in relationship to the buildings in which services are provided.

A HOSPITAL IS NOT A BUILDING

Health facilities should be functional and economical to run and maintain. They should not have too much space, should be appropriately constructed —preferably of local materials— and all the technologies used should be appropriate The buildings should be able to change and expand through the years in response to changing needs and should be comfortable to inhabit and attractive to the staff who work there and to the local population Like all other buildings a health facility should be kind to the surrounding environment and should be safe to use.

A health facility should not be a monument or a coldly institutionalised structure. Through the years the catchment population using the facility will increase, patterns of utilisation will change, and new technologies will be introduced Health facilities should have the characteristics of a flexible village.

DESIGN PRINCIPLES FOR SITE LAYOUT PLANS

These have to be villages with a high level of organisation and reasonable discipline. A health facility contains complex functions, and the services required should be provided efficiently and safely. The health facility site should be organised so that different types of functions are correctly placed in relationship to each other and in relationship to internal and external traffic ways.

Basic Layout Grid

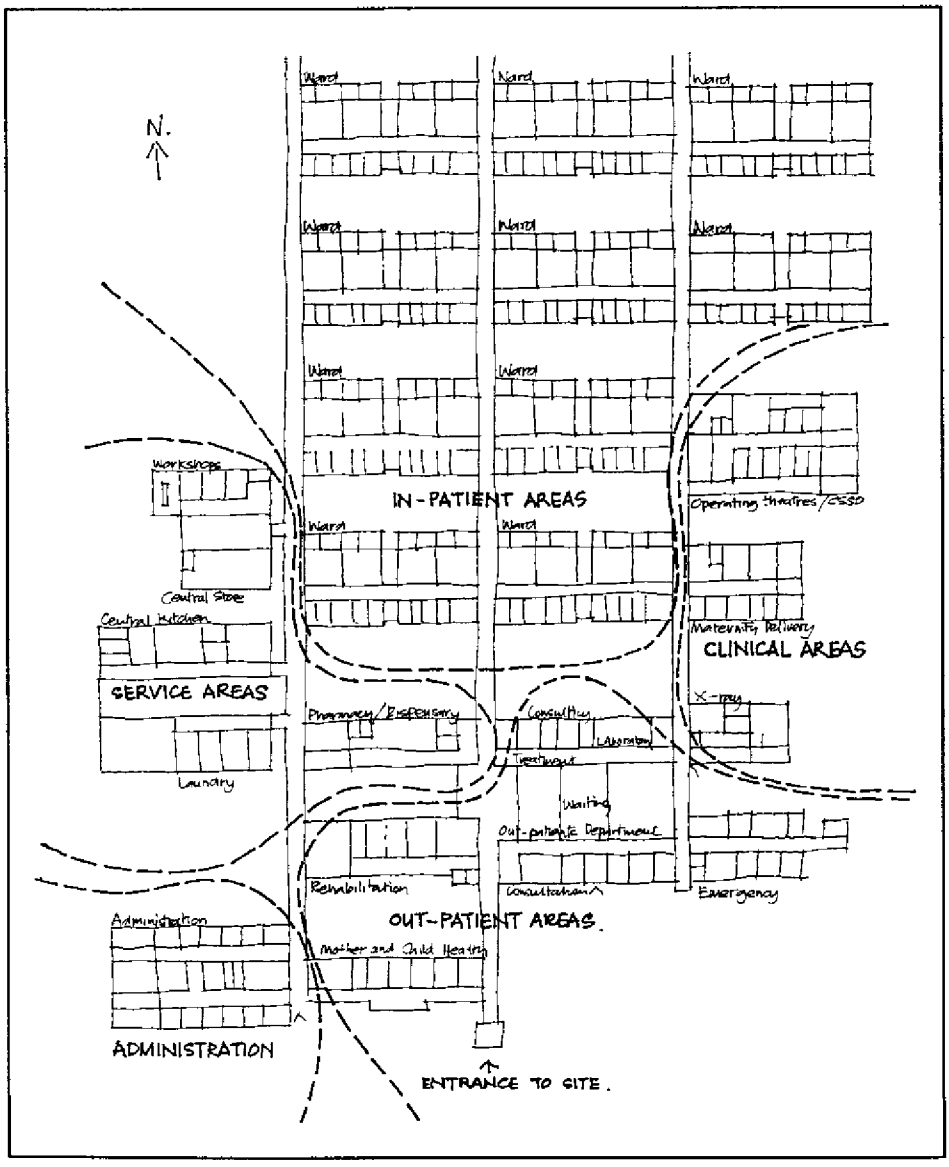
A basic grid layout should be applied to the planning of both existing and new institutions, of all types and sizes, from rural health post to rural hospital.

In using the grid layout, please bear in mind that you are:

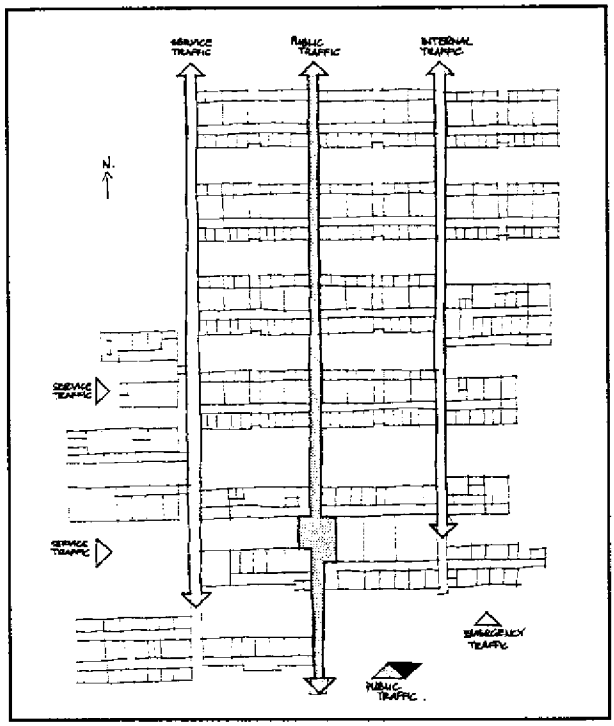
- Influencing the precise north-south orientation of all rooms.
- Separating on-site traffic ways for:
  - internal medical traffic
  - visitors and public
  - waste removal
- Allowing adequate space between traffic ways for all present and future departments.
- Influencing the correct zoning of the different functions of the hospital, including:
  - restricting the access of out-patients to the rest of the hospital
  - collecting together similar functions in in-patient areas (such as medical services areas, administration areas, and services areas)
  - providing for the correct relationship between departments
- Allowing for future growth.

The following sketches show how a standard site layout grid was developed for different sizes of district hospitals, and afterwards applied to a large number of different sites. The standard grid was also used as a basis for choosing new sites.

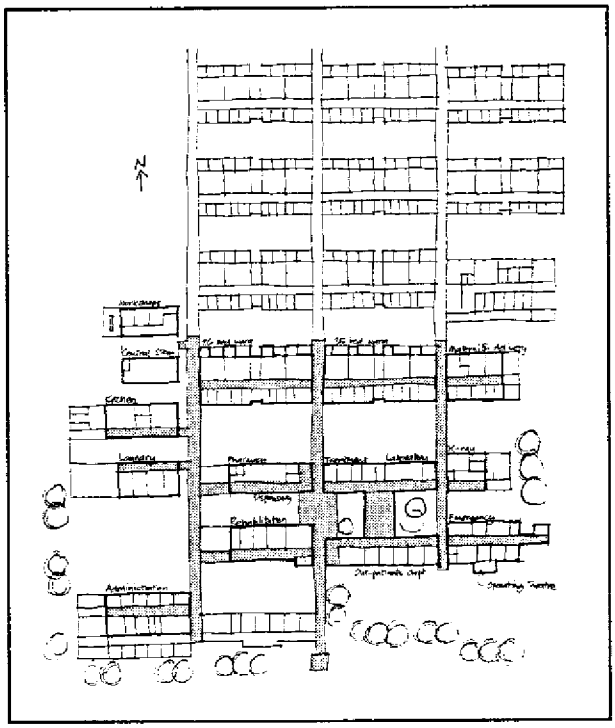
Basic site zoning pattern



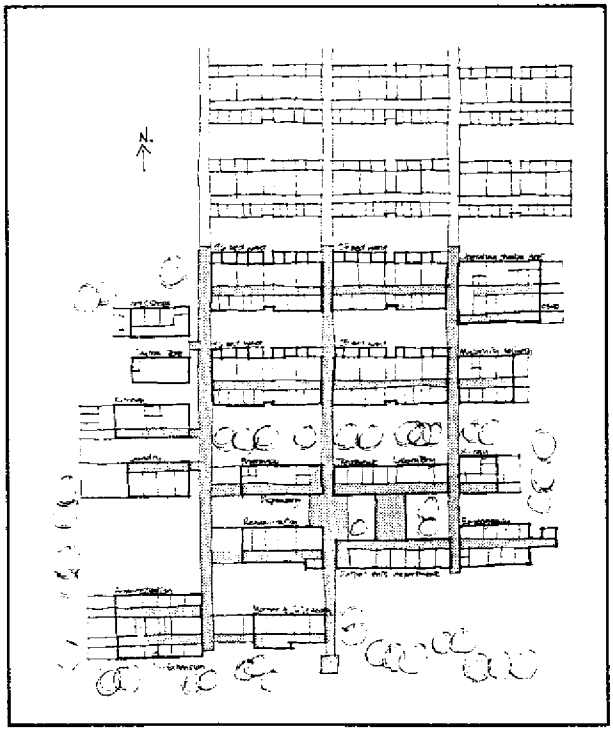
Internal and external traffic ways



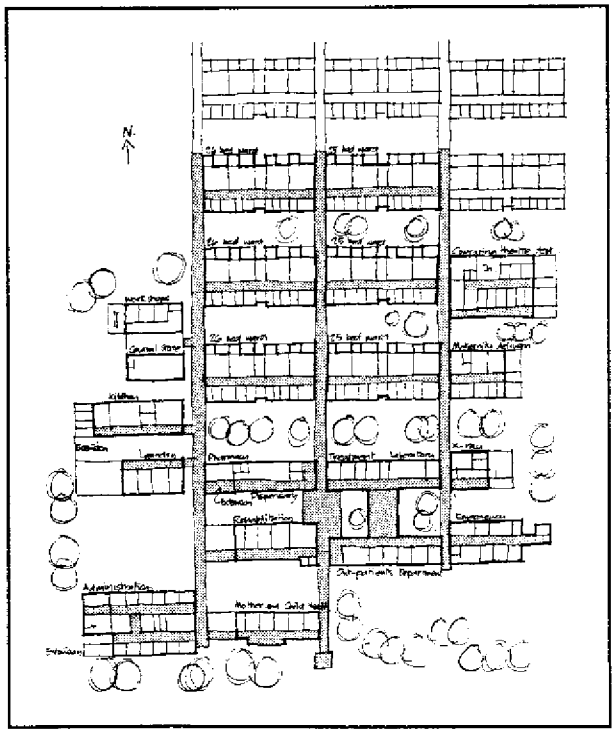
Plan of a 52-bed district hospital



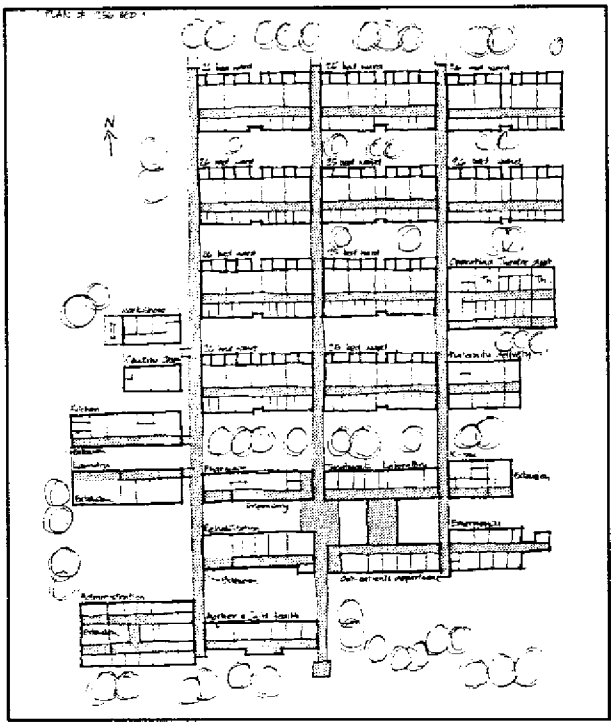
Plan of a 104-bed district hospital



Plan of a 153-bed district hospital

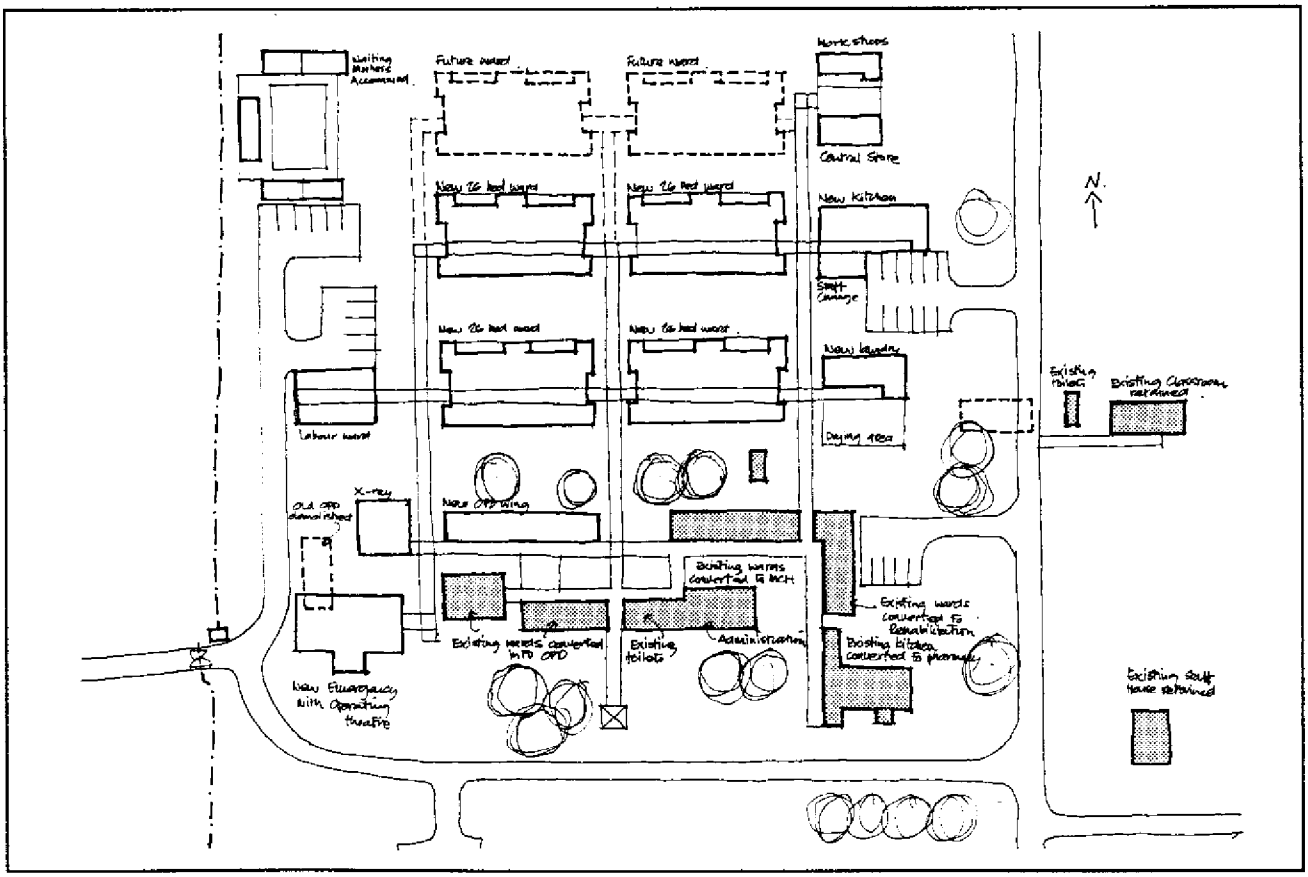


Plan of a 256-bed district hospital



Standard layout plans can also be applied to sites with existing buildings. The location of the building on the site may well influence the use it will be put to after the new development. In most cases, existing buildings are best used for out-patients departments, other clinics and administration.

Site layout plan for the development of an existing hospital

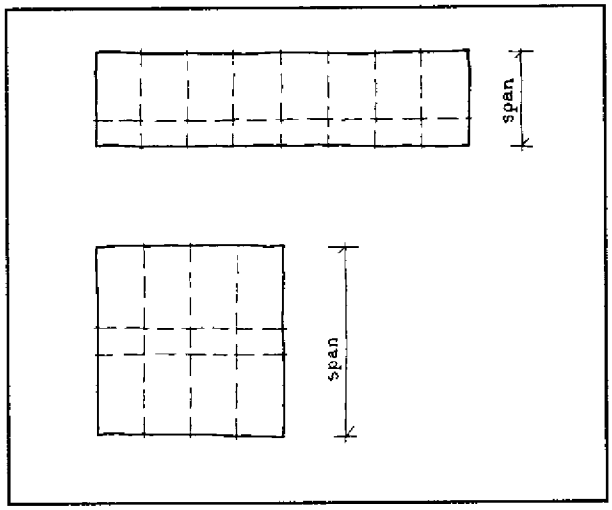


DESIGN PRINCIPLES FOR DEPARTMENTS

When designing health facility buildings for warm climates, long narrow forms are usually preferred to square ones. This is for reasons of:

- **Economy:** the roof structure is often the most expensive part of the construction and narrow spans are cheaper in materials than wide ones; and
- **Protection of the internal environments:** to protect the internal environment, the narrow form provides for cross-ventilation to all parts of the building and for natural daylight to all rooms. When correctly oriented with the main facades facing due north and south, the extended roof overhang offers maximum shading to the facades.

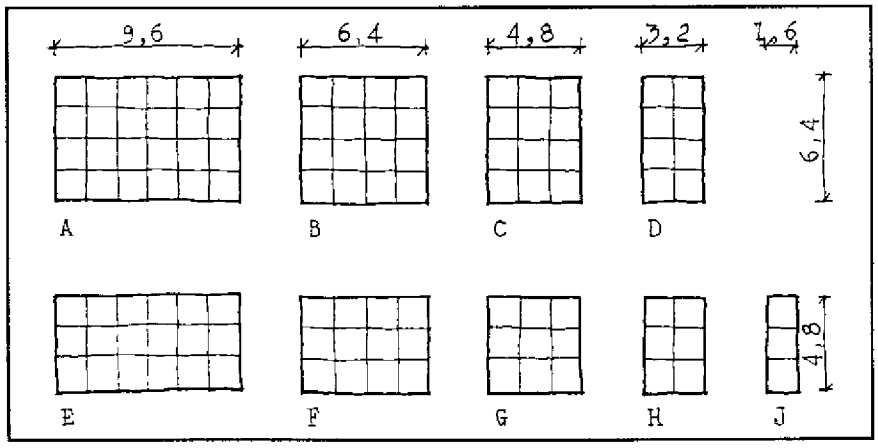
Long narrow buildings have been preferred to square ones



THE USE OF STANDARD ROOM SIZES

The sizes of rooms provided in a building must relate to the spacing and dimensions of the structure, in particular to the external walls and columns. To achieve reasonable flexibility in use, sizes should be related to the maximum number of different functions, and room widths should be related mathematically so that when partitions are removed the resulting spaces relate to a predetermined system.

At the earliest stages of the design process, the team should determine which room sizes can be most reasonably provided. The system of standard room sizes uses a basic planning module of 1.6 metres.



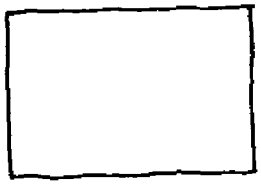
Different rooms sizes which can be formed using a 1.6 metre planning module

Instead of measuring the space required around each separate facility or function, the project design team should establish which of the standard room sizes would provide the space required for the function. In this way a list can be made of all the different activities which can be made to fit into the different rooms.

Spaces and functions

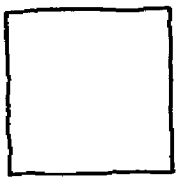
Area approximately 60m² A
Uses Classroom
Waiting area
Store
9-10-bed ward
Laundry
Kitchen

A. Approx. 60m²



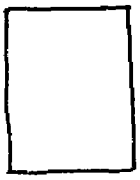
Area approximately 40m² B
Uses Operating theatre
Sterilisation (TSSU)
Laboratory
Large X-ray room

B. Approx. 40m²



Area approximately 30m² C
Uses Minor theatre
Small sterilisation (TSSU)
Standard X-ray room
Library

C. Approx. 30m²



Area approximately 30m² F
Uses X-ray
Laboratory
Central drug-store
Mother and child room
5-bed ward
Observation ward

F Approx. 30m²

Area approximately 15m² H
Uses Examination room
Injection room
Dressing room
Out-patient dispensary
Pharmacy
Toilets/staff change
Emergency room
Observation room
Mother and child room
Nurses duty room

H. Approx. 15 m²

The result here is considerable flexibility in both design and use. For example 1 room type (G) will satisfy a large number of different functions all of which in principle can be substituted during use. Two rooms type (G), side-by-side can be combined to form 1 room type (E)

STANDARD PLANS

Most Ministries of Health have standard plans for different departments and different types of institution which they know from experience to be satisfactory in use. It is important that standard plans be of high quality and known to satisfy client's normal requirements.

Standard departmental plans generally should be known:

- To provide correct standards of space with due regard to economy (by using a module which gives adequate room dimensions) and by careful planning
- To make maximum use of standard room sizes and standard constructional dimensions (by using a limited number of different interrelating room sizes and by having only two different building widths)
- To allow at all times for maximum flexibility and extendibility of all units departments and buildings (by the use of standard rooms which can easily be adapted for alternative uses and by fitting the departments and buildings into a logical circulation and zoning system)
- To be based on the use of appropriate technology for materials and forms of construction (by using as far as possible locally-available materials)
- To provide structures which are easy to maintain and extend
- To promote the most economical use of staff
- To provide good comfort conditions without the use of expensive technology. This can be ensured by among other things: correct orientation of buildings, cross-ventilation to all rooms, high -3.5m- floor to ceiling heights, insulation of ceilings, good overhang at eaves.

Now the design requirements for the different departments of a rural or district hospital are set out.

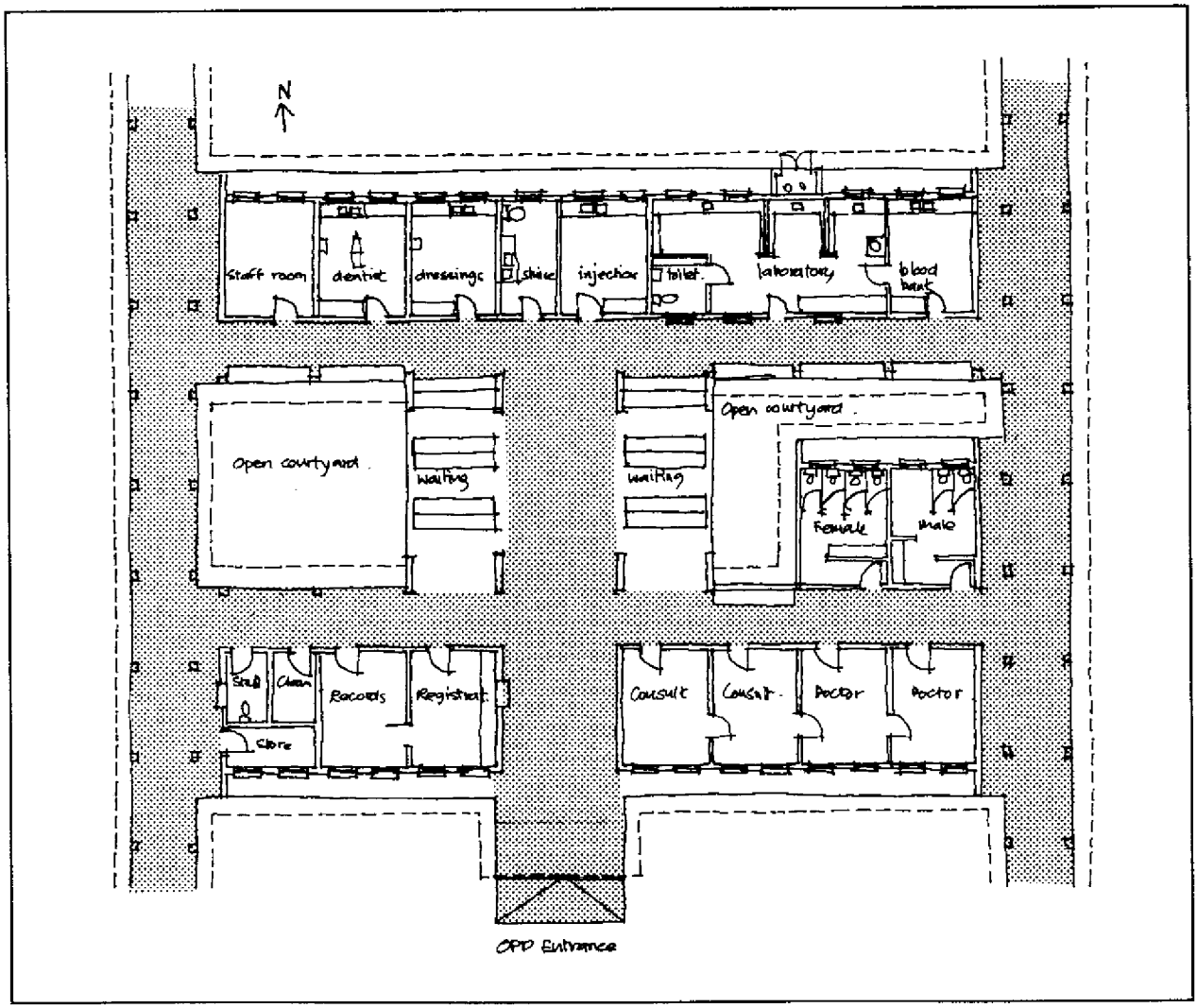
Out-patients department

Utilisation of the different parts of the out-patient department vary significantly. The out-patient department of a rural hospital should usually be an H-shaped building which can also be used as a rural health centre. The accommodation should be zoned in relationship to utilisation. Registration, records and consultation rooms should be placed in the front wing and rooms for injections, dressings, laboratory, and dentist in the rear wing.

In the initial stages perhaps one wing only can be provided. If this is made up of similar-sized rooms and with the regular distribution of waiting spaces, there is potential for flexibility, both in use, and in the distribution and separation of different activities. The department can easily be extended later in 4 different directions to provide space for extra or increased activities.

Out-patient services should be placed at the entrance to a rural or district hospital, close to the medical services departments.

Out-patients department



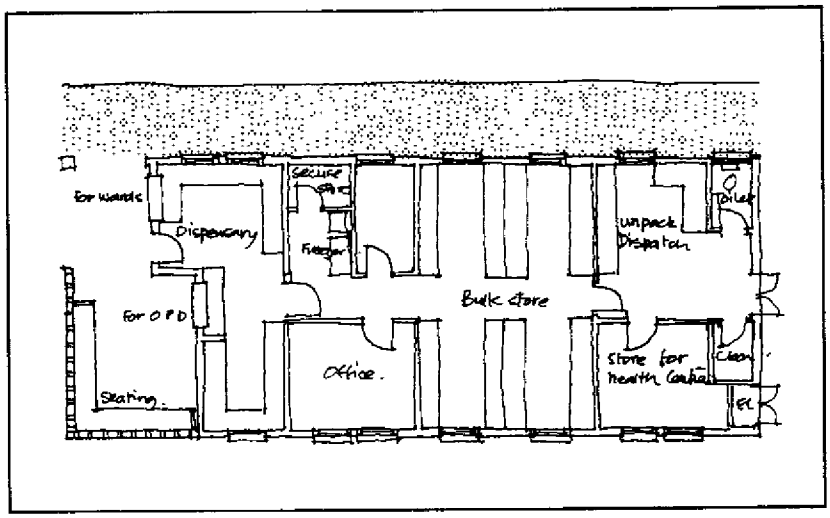
Pharmacy / dispensary

To economise on staff and facilitate correct supervision, the pharmacy store and dispensary should occupy a single narrow building. Separate secure spaces should be provided within the building for unpacking and for storing pharmaceuticals for delivering to other institutions in the district. A waiting space should be provided separate from the waiting areas to the OPD.

Since over 80% of all out-patients usually require pharmaceuticals, the department should be placed close to both the out-patient department and the entrance. Close proximity to the in-patient departments is not so essential as pharmaceuticals are usually delivered to the wards only once a day. Lockable hatches should be provided so that supplies for the wards can be collected without disturbing other activities in the department.

Convenient access for vehicles should be provided at the rear of the building.

Pharmacy / dispensary

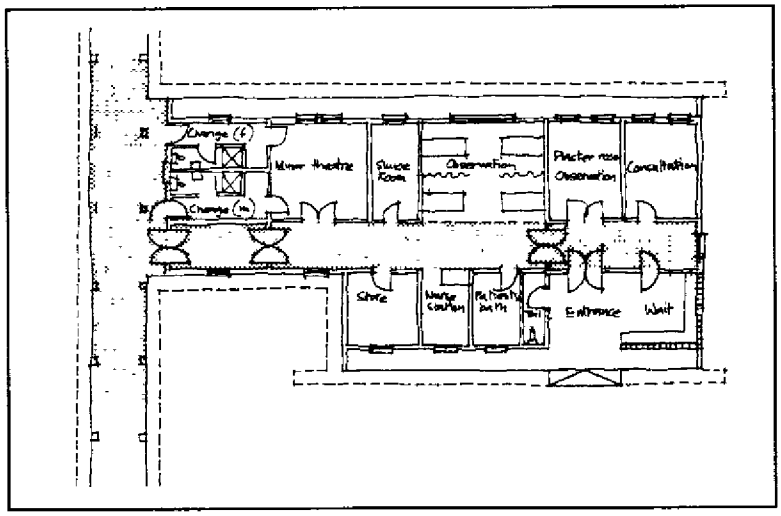


Emergency / minor theatre

This department should operate on a 24-hour basis and should contain the essential basic functions of a referral hospital: consultation, operation, resuscitation and intensive observation

The illustration shows a compact layout for these functions. In normal periods this area can be staffed by one nurse or technician, supplemented as necessary on the arrival of patients.

Emergency / minor theatre

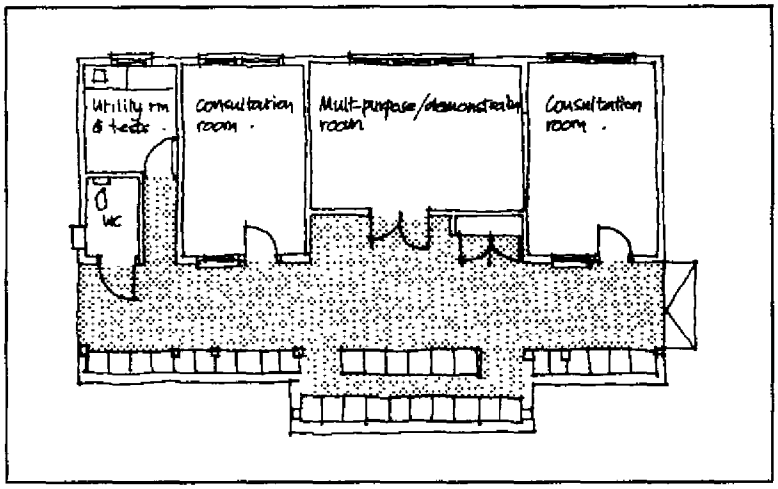


In smaller hospitals where there are no surgeons, the minor theatre should be sufficient for all surgical requirements.

Mother and Child clinic

There is much discussion about the proximity of the Mother and Child clinic to the out-patient department. Some claim that many children are only brought to the hospital when they are sick and so the MCH clinic should be attached to the OPD. There is also debate about whether the MCH unit should be in a district hospital at all In order to reduce missed opportunities for vaccinations, for family planning, and for antenatal care, all the infrastructure for these functions should be grouped together close to, or integrated in, the OPD In any case, the design of the MCH unit will be the same A large multi-purpose room for consultations for individual children can also be used to give health education to all the waiting mothers.

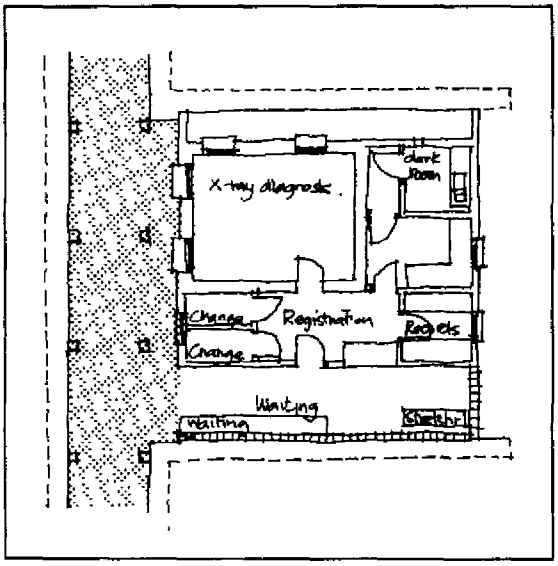
Mother and Child clinic



Diagnostic X-ray department

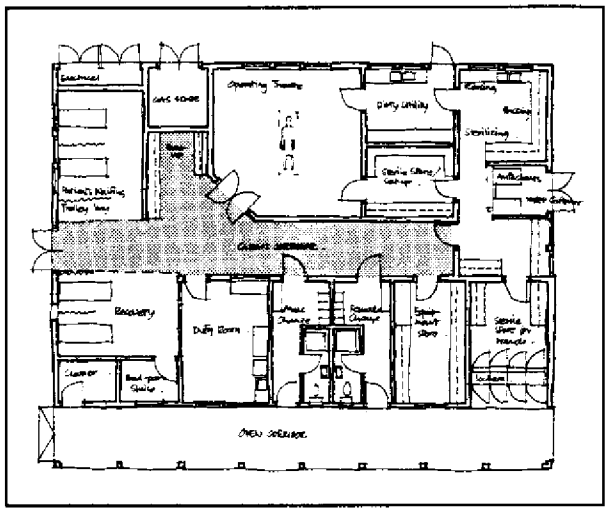
This simple one diagnostic room X-ray unit is intended to be operated by one technician. In most places the Basic Radiology System (BRS) will be used, and developing may be done manually. It is often difficult to keep automatic X-ray developing machines in operation Ultra-sound is becoming a standard provision in X-ray units.

Diagnostic X-ray department



Operating theatre department

Operating theatre department



This operating theatre should only be provided in larger institutions, and where surgeons or surgery technicians are available. Having two theatres allows one to be reserved for septic cases. A one-theatre department could be provided by omitting the end-theatre.

This department has been extensively rationalised. Only two changing rooms are provided, one for male and one for female staff. There is only one staff rest room.

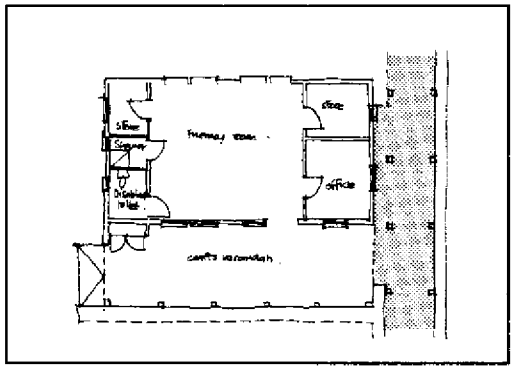
Limited room reserved for waiting has been provided. Having rows of patients waiting to be operated on is not practical. In normal staffing conditions there would be no-one available to observe them. Any patients waiting can be parked in the corridor where some supervision is possible.

In-department facilities for recovery have been kept to a minimum. In higher-level hospitals responsibility for the recovery of the patients is with the anaesthetist; in rural or district hospitals it will probably be with the ward nurse.

The Central Sterile Supply Department (CSSD) is placed next to the operating theatre and benefits from using vertical drum (sputnik type) autoclaves. Long experience shows these as the most consistently reliable. Work in the CSSD will be carried out by the theatre staff after operations and on days when no operations are scheduled. A separate store with outside access is provided for keeping sterile goods for other departments.

Rehabilitation department

Rehabilitation department



In most hospitals this is becoming a most important department. Even with two separate dividable spaces for physiotherapy and occupational therapy (as shown), a large proportion of activities will take place out of doors, on the crafts veranda, or other adjacent areas.

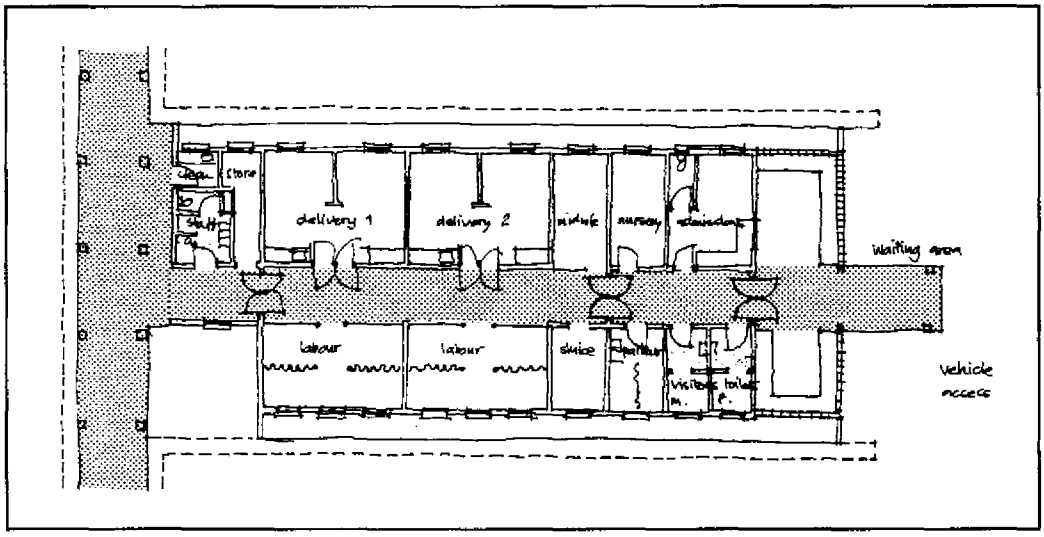
Partly because there are at present very few qualified rehabilitation staff in most southern African countries, these departments will not always be given high priority.

Labour ward / delivery

The delivery unit is designed to simplify the work of the staff. The semi-open first-stage labour beds are easily supervised, and are immediately across from the enclosed delivery beds. These facilities have been duplicated to allow separate facilities for septic cases.

The nursery in this example is located inside the delivery unit where there will be qualified supervision.

Labour ward / delivery



Standard ward

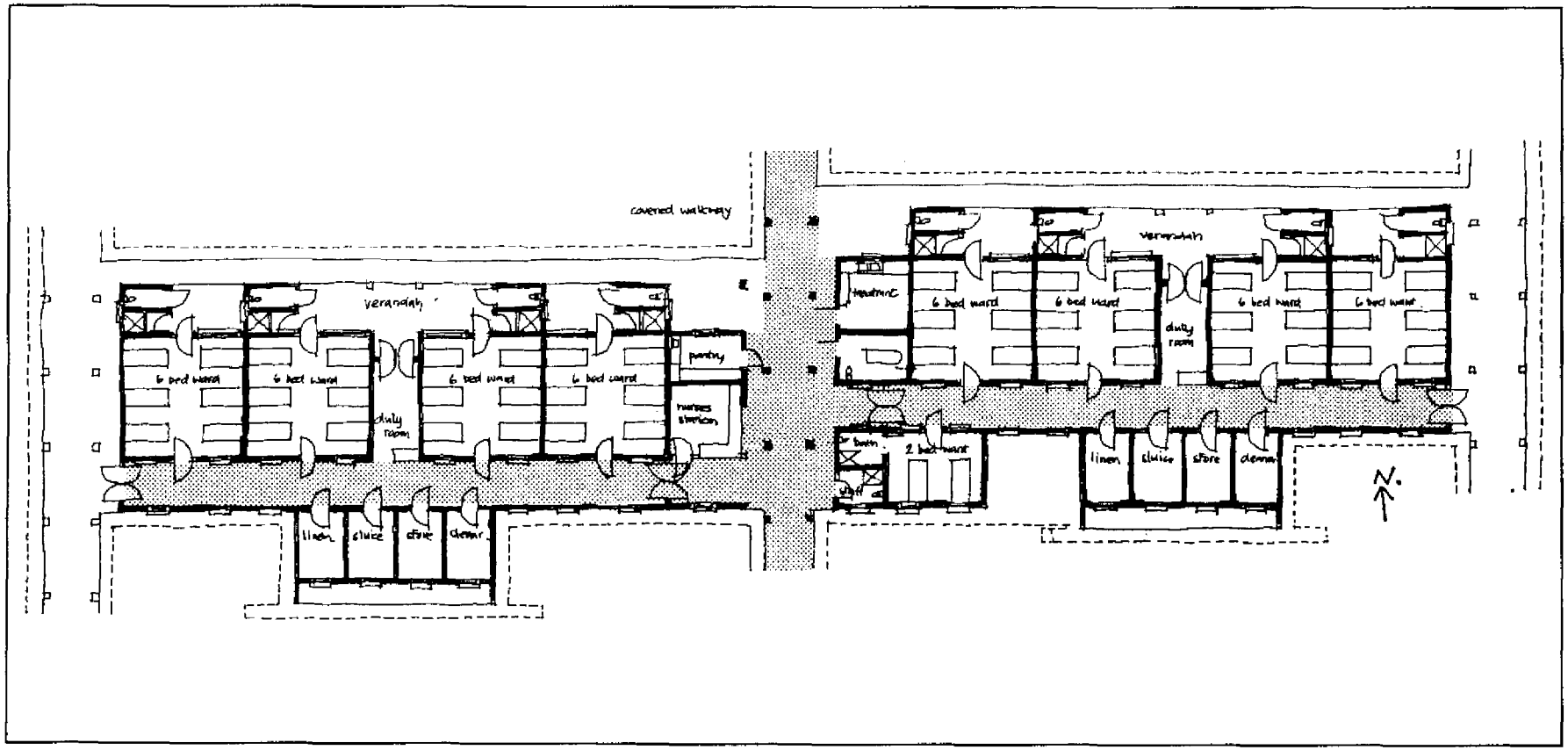
The layout of this ward unit, which can be standard for all categories of in-patients, differs in several ways from historically-accepted solutions.

The ward unit is built up of a number of fully enclosed self-contained 6-bed ward rooms each with its own toilet and washing facilities. Patients can be effectively segregated according to diagnosis, and according to sex and age group.

This is highly appropriate because hygiene and the control of infection are major factors affecting efficiency and quality of care in the institution. It also allows much greater degree of flexibility in use and for the allocation of rooms to different patient groups, allowing for seasonal variations, using a smaller number of beds.

The ward unit is also designed to make maximum utilisation of a small staff, in particular during the afternoon and night shifts. In this way it is possible to pool central facilities such as treatment room, pantry, and assisted bath and toilet, between two 25-bed ward units.

Standard ward



Kitchen and laundry

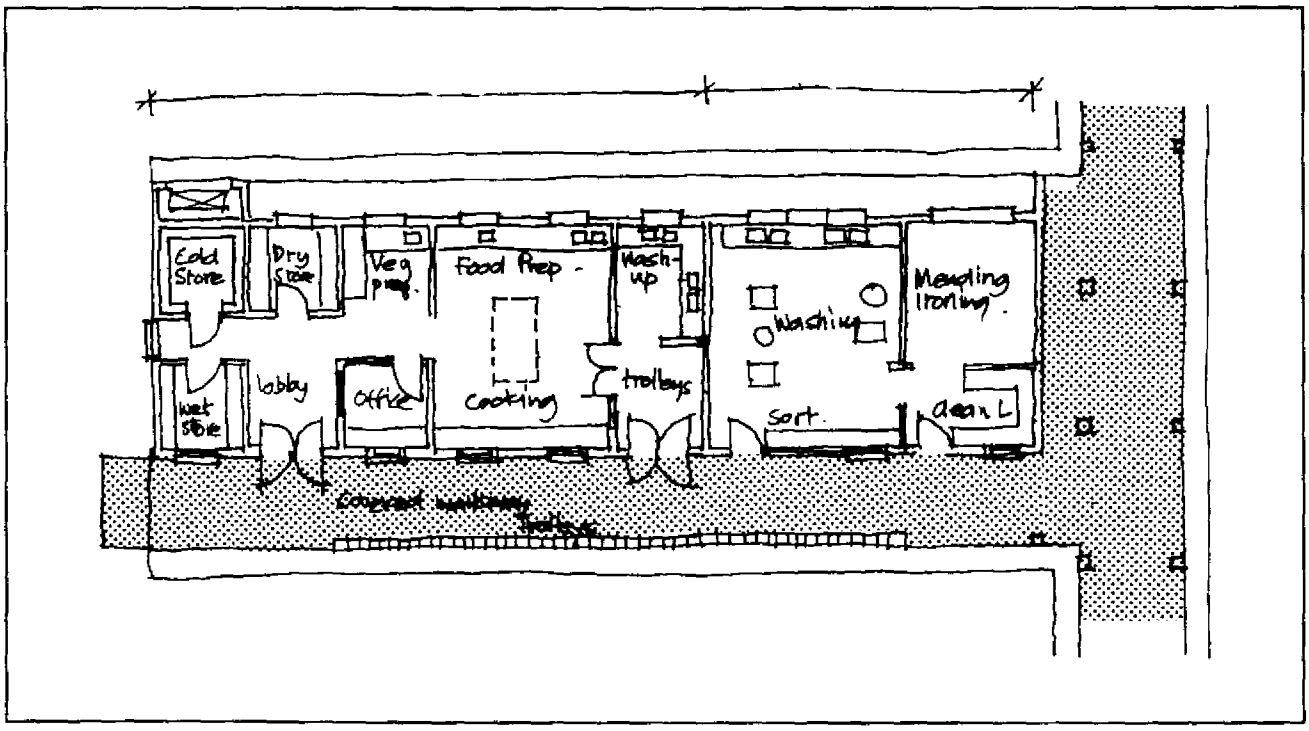
The layout shown for a kitchen is based on the assumption that electrical equipment will be used. Where no mains power is available, an alternative traditional kitchen with a good ventilation system can be used. A small canteen for staff is provided.

The kitchen should be planned after due consideration of the number of staff who will be working there as well as the number and type of meals which will be prepared. Around the southern African region there is a substantial number of kitchens with designs borrowed from European models. These kitchens are usually much too big and complicated in design. Example: a 200 m2 kitchen for a district hospital with baking alcoves, vegetable preparation alcoves, special alcoves for fish and meat preparation, a multiplicity of stores. (The local staffing norm is 1 cook and 2 general hands.)

The canteen should be so dimensioned that one can also use it for staff meetings.

A layout for a small laundry using electrical equipment is shown. Where there is no mains power available, a traditional design should be used. A covered drying area is required.

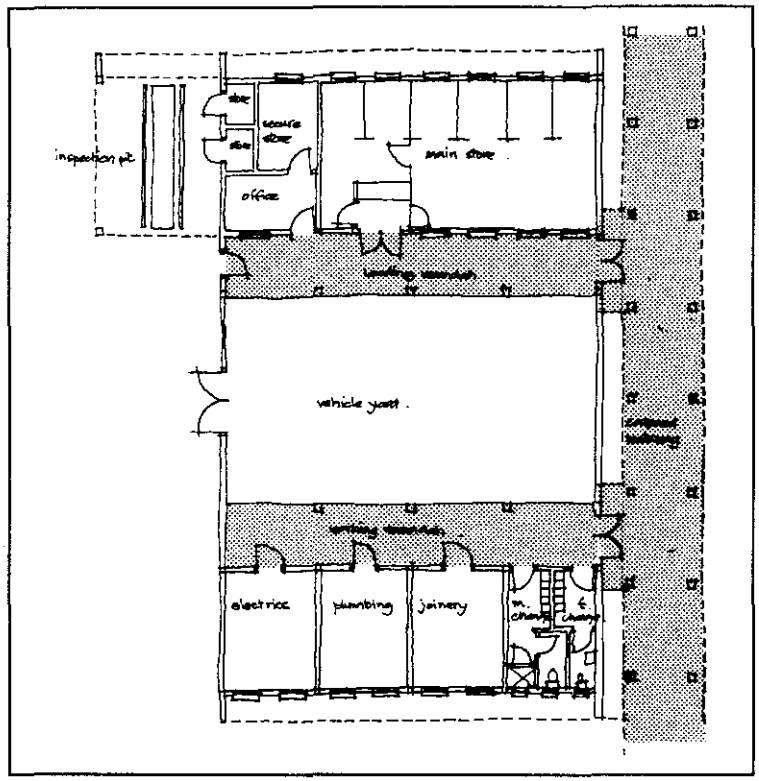
Kitchen and laundry



Central stores and workshops

This is a block with a large central stores room and with three small workshops or stores for maintenance staff. Providing this cluster should improve the general maintenance services at the institution. Facilities are also provided for vehicle maintenance.

Central stores and workshops



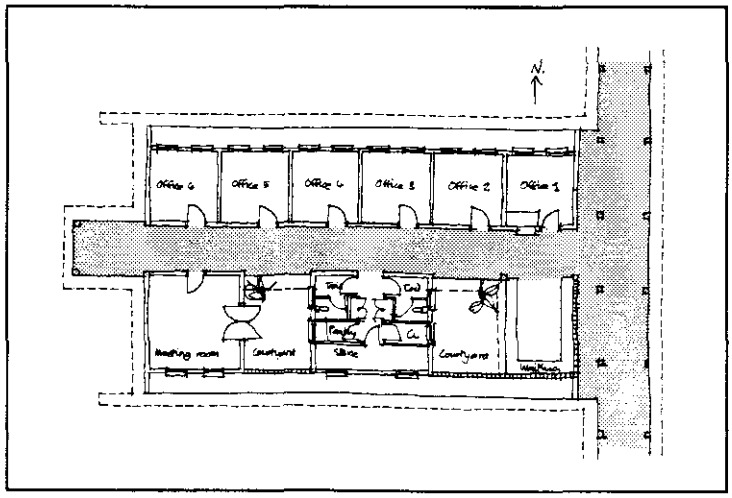
Administration

The administration department is made up of a suite of 6 standard rooms each with space for 1, 2, 3 or 4 staff depending on their level and the activities which they carry out.

The meeting room can also be used for teaching smaller groups.

Administration

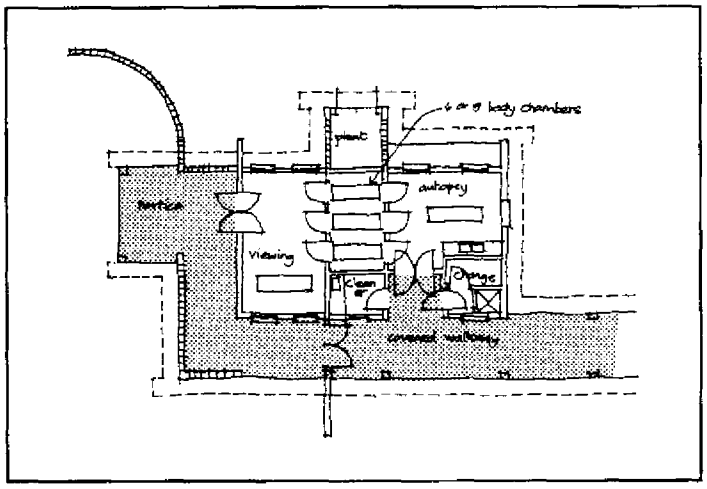
The public will often require access to the Cashiers room to make payments. This should be provided through a hatch in an outside wall with a covered canopy over it so that the public do not need to enter the administration building.



Mortuary

A complete mortuary consists of an autopsy room and a laying-out room completely separated by a specially constructed bank of double-ended body chambers. The unit can accommodate 3, 6 or 9 shelves as required. Positioning a mortuary on a hospital site is extremely difficult. It should not be visible to the wards or be in close proximity to the kitchen and public areas. It should have its own access, yet be under the close supervision of the hospital.

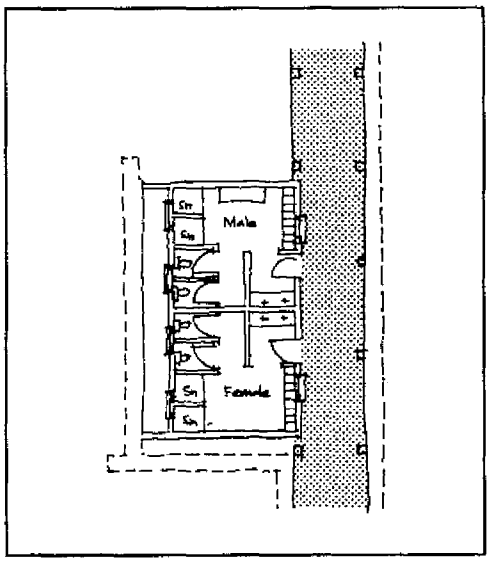
Mortuary



Central staff change

A small block is provided with toilets, lockers and change facilities for male and female staff.

Central staff change



HEALTH CENTRE DESIGN

There are many ways of designing health centres and most are reasonable. The functions involved do not place large demands on zoning, interrelationship of departments, or traffic patterns. The basic principles regarding the form of buildings and orientation still apply. In most cases four or five of the 15 m^2 type (G) rooms and a covered waiting area (which also can be used for demonstrations and teaching) would provide what is needed. The result would be a flexible building which could adapt to many different applications.

Many health centres are still much under-used: this low use has only slight relationship to architectural and planning decisions. Usually improving the supervision of the centres by medical practitioners and at the same time improving communications and transport will increase utilisation of health centres and reduce by-passing.

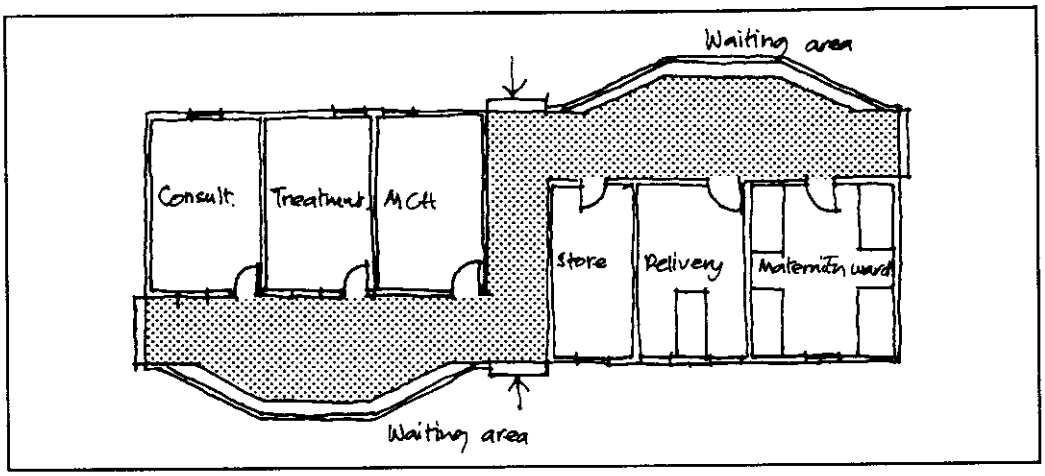
Wards attached to health centres are also often very little used. Many centre staff do everything possible to quickly send potential in-patients on up the referral system. Staffing is often insufficient to provide quality in-patient care. Staff know that if the patients stay in their facility staff will have to stay up all night to monitor them

and that the staff may have to prepare in their own kitchens any food that the patients eat. If there are in-patient facilities in a health centre, it would be reasonable to provide modest traditional cooking and laundry facilities.

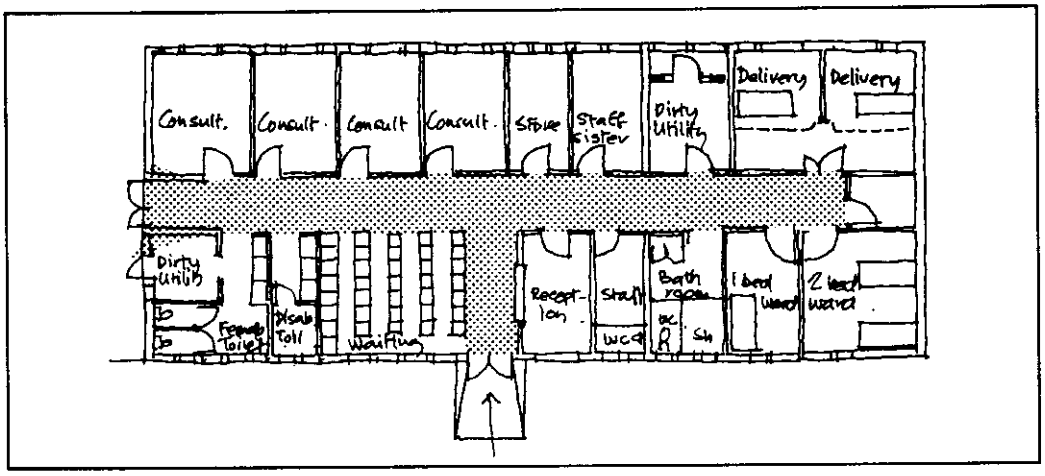
Use of natural features on the site should be encouraged. Most patients in rural areas much prefer to wait under a tree than in a roofed concrete waiting area. However, a covered area which also can be used for teaching should be provided.

Figure 54: Examples of health centre layouts from several Southern African countries

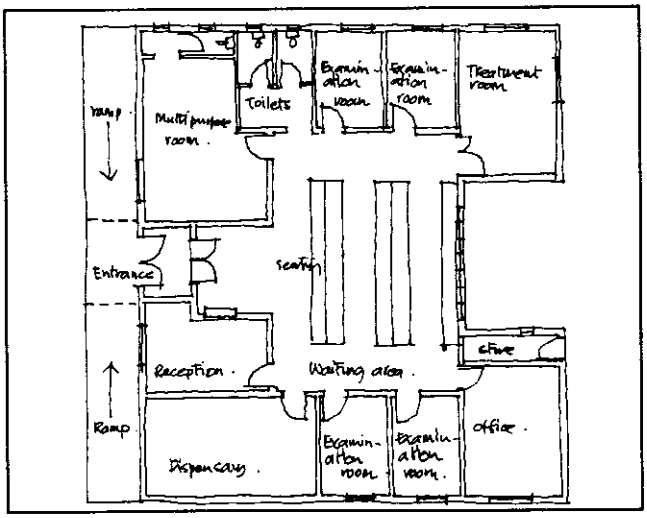
Country A



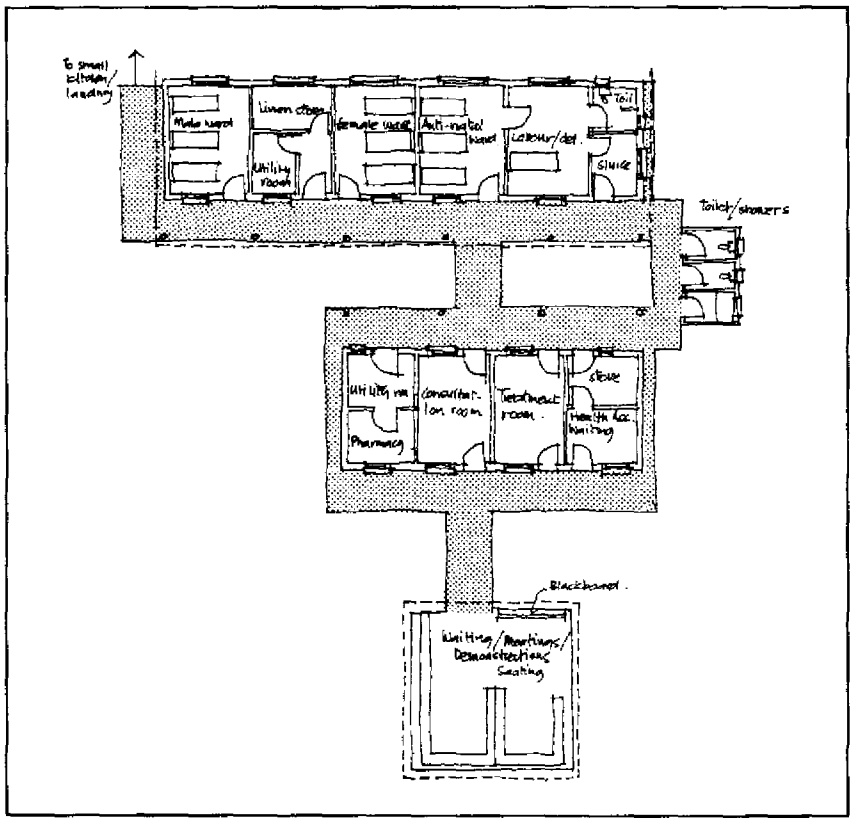
Country B



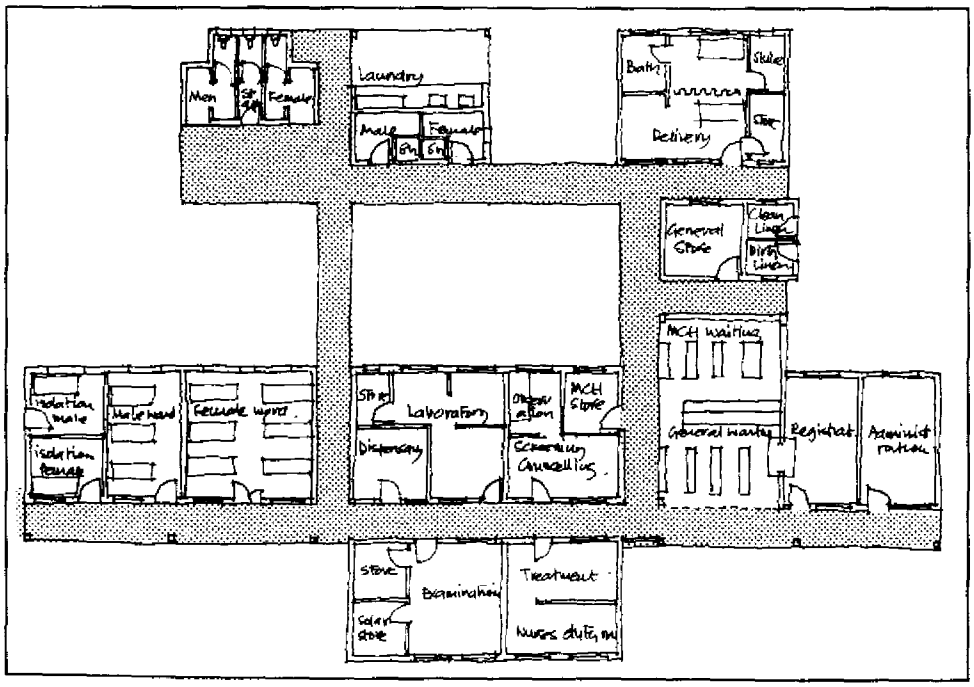
Country C



Country D



Country E



USE OF EXISTING BUILDINGS

Health buildings in the southern Africa region are usually of varying quality, particularly from a functional point of view, but usually their fabric is surprisingly solid, even after many years without maintenance. Even in colonial times, most buildings for health services in the region (though few in number) were sited and orientated correctly and very solidly constructed.

Depending on the age of the building, in 90% of cases conventional repair work will bring the buildings back to reasonable condition.

Functionally however, these buildings are usually very unsatisfactory. When comparing their functional standards with those proposed for the standard type plans in this chapter, we observe that the greatest differences between what exists and what is required usually occur in.

- **the wards,** which are usually the multi-bed type with little possibility of isolating patients, or achieving flexibility of allocation. Wards usually do not have the facilities needed for achieving good hygienic conditions.
- **the theatres,** where usually it is difficult to maintain correct hygienic conditions. The theatres are often closely connected to other traffic-ways and functions in the hospital.
- **X-ray rooms** which often are unsatisfactory regarding protection of radiologists and passers-by from radiation, and where the equipment and electrical installations are often dilapidated, sometimes even dangerous.
- **laboratories** which (if existing at all as defined locations) are often inadequate in space, location, equipment and installations.

In existing buildings, many different functions are usually collected together in single blocks, and as a result separate extension of individual facilities can be very difficult. Where there is more than one block, ground connections between the different buildings may be neither paved nor covered. Over and above the problems and inconvenience for patients and staff there is often an increased danger of soil erosion because of this.

In most existing rural health facilities, buildings are adequate for use as offices, consulting rooms, class-rooms, stores, dispensaries, but inadequate for use as wards, operating theatres, and medical services facilities The last applies to most of the rooms required for in-patients.

Proposed procedure

When upgrading existing rural health institutions, the following sequence of activities will be usually be relevant.

No	Activity	Effect on recurrent costs
1	Establish circulation pattern of covered walkways between existing blocks allowing for future connections to new buildings	Negative, should improve quality and efficiency and prolong the life of trolleys and containers
2	Provide acceptable accommodation for staff	Neutral, should improve quality and efficiency
3	Construct new wards	Neutral if bed numbers stay the same, may well imply savings in staff with efficient design
4	Construct new operating theatres, X-ray, laboratory, maternity delivery, etc.	Neutral, may imply slight increases if equipment which originally did not work is now made to work
5	Convert existing facilities to out-patients, administration, stores, etc.	Neutral, but with proviso as No 4