A FIFTY BED GENERAL HOSPITAL FOR
BLACKSBURG, VIRGINIA

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PART I - INTRODUCTION
PART I

The purpose of this thesis is to investigate the ideal possibilities in planning an ideal medium-sized hospital, and to incorporate these possibilities into the design of a general hospital for Blacksburg and the surrounding communities.

Before any planning can be done, the requirements of the hospital must be agreed upon. By making a thorough research, one is able to determine the hospital needs of a community; the problems relating to planning, maintenance and operation of the hospital; the number of beds required; and the types of services to be offered. All these requirements will be affected by the extent of other existing facilities in the community and by those facilities in surrounding communities. When the number of beds that will be required, and the services to be offered have been decided upon, a program is developed. This program will show with reasonable completeness the requirements of each department of the hospital as to its approximate area, its major equipment, and the number and classification of personnel employed in the department.

When the program is complete, and the site for the hospital has been selected, we can proceed with the planning of the building and the preparation of drawings for it.

The following program gives a complete compilation of the
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hospital's requirements, and enough information so that they may be readily translated into the actual size, shape, and arrangement of the eventual building, and the building's relationship to the site.
PART II - PROGRAM FOR THE PROPOSED HOSPITAL
PART II

In order to outline in clear, concise form the facilities which must be included in the proposed hospital, this program has been prepared after consultation with the administrators of nearby hospitals, with doctors residing in the Blacksburg area, and after reading material supplied by the State and Federal health facilities planning services. This resume is based on two preliminary studies, which are briefly summarized in the following paragraphs.

1. The State Plan, the Virginia medical facilities survey and construction program, is designed to encourage and assist local communities in planning and constructing needed medical facilities throughout the Commonwealth. The program operates on a grant-in-aid basis and is financed by federal and State funds to supplement local resources. Financial assistance is available to local areas which take initiative in meeting the qualifications and standards for participation; operation and maintenance of all facilities built under the auspices of this program remain fully under local control upon their completion.¹ For all practical purposes, we shall assume the Blacksburg area has taken the necessary initiative steps

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to fulfill these requirements.

The medical facilities survey and construction program in Virginia was established under authority of legislation enacted during the special session of the General Assembly in 1947.\(^1\) This legislation has enabled the Commonwealth to participate in federal funds made available through the Hill-Burton Act, originally passed by Congress in 1946, and its subsequent amendments passed in 1954 as Public Law 482, to provide categorical funds for: (1) Hospitals for the chronically ill and impaired; (2) diagnostic and/or treatment centers; (3) nursing homes; and, (4) rehabilitation centers. The State Legislation designated the State Department of Health as the official agency to administer the program at the state level. In addition, the state law provides for the appointment of the Virginia Advisory Hospital Council to advise and counsel with the State Health Commissioner in the administration of the program. Within the State Department of Health, the responsibility for carrying out the program is assigned to the Bureau of Medical and Nursing Facilities Services.

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One of the major factors in the determination of need for additional facilities in many of the categories of facilities for which grants-in-aid may be made is the number of acceptable facilities or beds per 1000 civilian population. Each year the United States Bureau of Census provides a total civilian population for the state. For the current fiscal year, the estimated civilian population for Virginia is 3,418,000. This total estimate must be broken down for the general hospital service areas of the state. Roanoke is the regional center for a major portion of Southwestern Virginia, which includes fourteen counties with a total population of 391,624. Radford has been designated as the area hospital center and Christiansburg is an existing hospital community in Montgomery County, the total population of Montgomery County is 39,993, or 9.8 per cent of the total population of the Roanoke region. Other than Roanoke County, Montgomery County is the most heavily populated county within the Roanoke region.

The two hospitals now being operated in this area have a combined capacity of 114 beds. The New Altamont Hospital in Christiansburg, Virginia, opened in 1922, has a designed capacity of 25 beds, but presently has 30 beds. This indicates that the overall per cent of occupancy is above the
standards prescribed by the state. The Radford Community Hospital, Incorporated, located in Radford, Virginia, opened in 1943, has a designed capacity of 68 beds, but presently has 84 beds. The increase of 14 beds was made possible by eliminating the out-patient department within the hospital; this is another indication why more medical facilities are needed in Montgomery County.

The priority ranking of general hospital areas is based upon a statistical combination of two criteria: 1 (1) Per cent of unmet needs; and (2) occupancy of existing facilities. Generally speaking, an area with a high percentage of occupancy of existing facilities receives a high priority. An area with a low per cent of unmet needs and a low percentage of occupancy is assigned a low priority.

2. A local survey of vital statistics, population, financial resources, and physical characteristics indicate that a 50 bed general hospital is quite feasible for the Blacksburg area at the present time. If we were to consider the population and physical characteristics by themselves, we would

find that a 68 bed hospital could be built. Of the 39,993 population of Montgomery County, we find that 40 per cent of the total, or 15,997, reside within the Blacksburg magisterial district. Of this population, approximately 4,000 are town residents, and 11,997 live in the outlying communities. This does not include the estimated V.P.I. student enrollment of 5,017 for the 1957-1958 college term, or the 663 married students who will have their families with them. When we consider the wives and children of the married students, there are an additional 994 persons. This gives a total population of 22,008 for the Blacksburg area alone, not including any of the outlying districts which would undoubtedly be attracted to the medical facilities supplied by the hospital. If we consider the maximum number of four beds per one thousand population, we arrive at the figure of 88 beds, including the student enrollment. If we do not consider the student population of Blacksburg, the maximum number of beds will drop to 68, but financially it would be impractical at the present time for the community to construct, staff, and operate such a large hospital.

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This survey recommends, as the first stage in meeting the critical need for medical service, the construction of a 50-bed hospital to provide general medical, surgical, and obstetrical care, and to have an out-patient department.

Adjunct and service facilities will be provided initially that are of sufficient size to care for an expansion to 75 beds, which is probable in the near future. The character of the community is such that there is a prospect of even further expansion; and the initial planning and construction will be of such a nature as to permit a continuing program of expansion.

The site which has been selected is of such size that it suggests that a majority of facilities be housed in a one-story building to avoid the expense of elevator installation. Such service areas as the boiler room could be located in a part basement. Ample room on the site also exists for the provision of adequate parking areas for visitors, patients and staff; these can be located away from patient areas so that they provide sufficient driveway areas to handle passenger and delivery vehicle traffic and also provide future expansion.

The entrances to the hospital will be kept to a minimum.
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The hospital and out-patient department will use the main entrance and lobby jointly. Emergency entrance, service entrance and necessary fire exits will be located to reduce the possibility of entry from outside by unauthorized persons.

Bed Distribution

Assuming that approximately 30 per cent of the expected patient load will be obstetrical, 8 per cent will be devoted to pediatrics, and 62 per cent will be the medical and surgical area. On this basis, the recommended bed distribution is:

- Medical-Surgical: 30 beds
- Obstetrical: 16 beds
- Pediatrics: 4 beds

Total: 50 beds

Nursery

- 12 Bassinets - Full Term
- 3 Bassinets - Suspect
- 4 Bassinets - Premature

Total 19 Bassinets
Factors Affecting Bed Arrangement Within the Nursing Care Areas

The medical-surgical beds should be included in a nursing unit which is separate from the nursing unit housing the obstetrical beds. However, since it is possible that considerable fluctuation may occur in the bed occupancy rates of both the medical-surgical and the obstetrical nursing units, they will both be designed with sufficient flexibility to allow the use of certain bedrooms by either service when necessary.

In order to maintain maximum flexibility, no patients' rooms will contain more than two beds. A few one-bed rooms for isolation or post-operative cases will be required in both the medical-surgical and obstetrical nursing units. The economic scale of the community is not such that many one-bed rooms would be practical. Each bedroom will have a toilet, containing a lavatory and a water closet with a bed-pan washing attachment, adjacent to it. An isolation suite with private toilets and a separate utility room will be included in the medical-surgical nursing unit.
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MAP OF THE STATE OF VIRGINIA SHOWING LOCATION OF ROANOKE HOSPITAL REGION AND LOCATION OF MONTGOMERY COUNTY
MAP OF THE STATE OF VIRGINIA SHOWING THE ROANOKE HOSPITAL REGION
AND THE LOCATION OF MONTGOMERY COUNTY WITHIN THE REGION
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MAP OF ROANOKE HOSPITAL REGION, SHOWING TOWNS WHERE HOSPITALS ARE NOW LOCATED
HOSPITAL AREA SERVED BY THE ROANOKE GENERAL HOSPITAL REGION

- REGIONAL CENTER
- AREA CENTER
- HOSPITAL COMMUNITIES

SCALE IN MILES

10 0 10 20 30 40

ABINGDON HOSPITAL REGION
TAZEWELL
WYTHEVILLE
PULASKI
FLOYD
CHRISTIANSBURG
RADFORD
ROANOKE

WEST VIRGINIA
CHARLOTTESVILLE HOSPITAL REGION
BATH
HIGHLAND
ROCKBRIDGE
BETTONTWRT-BEDFORD
LYNCHBURG HOSPITAL REGION
ROANOKE

DANVILLE HOSPITAL REGION
GALAX
GRAYSON
SOUTH CAROLINA
TENNESSEE
NORTH CAROLINA
TOWN MAP OF BLACKSBURG, VIRGINIA
SHOWING SELECTED SITE FOR HOSPITAL
Before any discussion can have any real meaning which should be considered in the context of
(2) the immediate post-war reconstruction process.

The Aid

Through contributions by this government in the form of various financial grants and technical
assistance, the government of the Virgin Islands has been able to carry out several projects that
are meant to improve the health and sanitation. This government has stationed doctors and
nurses in the various hospitals and health centres.

We, the Virgin Islanders, are deeply grateful for the assistance given by the government. The
situation has improved significantly in recent years.

PART III - PROGRAM DETAILS
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Before any planning is done, there are three problems to which careful thought must be given; they are: (1) The site; (2) the exterior traffic and entrances; and (3) the interior traffic.

The Site

Through investigation it was found that the most ideal location for the hospital in Blacksburg is the Slusher property, of 32 acres, located between the Blackwood section and Route 460. We will therefore assume that, after consultation between the hospital board and the architect, this property was acquired as the site for the proposed hospital. At the present time this property is located outside the corporate limits of the town, on relatively high ground, and has access to the town’s utilities.

The site commands an excellent view of the surrounding country, and is in such a position that it receives the prevailing breezes. There are not any objectionable noises, smoke, dust, or odors in or near the property. The approach from the town and from the highway is excellent, and it is sufficiently close to the community that will be served. In case of fire, the organized fire fighting facilities could reach the site approximately five minutes after the alarm
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was given. The site is such that the patients' rooms when placed on the quiet side will also have the best orientation for sunlight and prevailing breezes.

The Exterior Traffic and Entrances

In planning of the hospital, traffic requires careful thought. Besides the various complicated lines of traffic within the hospital, traffic to and from the hospital must be given consideration. The exterior traffic will include the following:

1. Patients arriving or leaving by automobile or ambulance.

2. Patients arriving or leaving by foot.

3. The visiting public, which should have adequate parking facilities.

4. Staff members, who should have a convenient parking area reserved for their exclusive use.

5. Controlled ingress and egress of employees with proper facilities for parking.

6. Delivery of incoming supplies.

7. Removal of the dead in an unobtrusive manner.
8. Delivery of fuel and removable refuse.


In order to provide for traffic flow, and at the same time avoiding conflicting or crossing traffic streams, certain entrances must be provided. The main entrance will receive ambulant in-patients arriving on foot or by car. Staff members and employees may also use the main entrance if their parking space is convenient to this entrance. However, it would be better if a private entrance were provided for the staff members so that they may arrive or leave the hospital without interference by inquisitive visitors or other persons who might detain them in a public lobby.

An emergency entrance is required for non-ambulatory patients, and it must be arranged so that traffic to and from this entrance will be unobstructed at all times. This entrance will lead directly to the emergency suite.

An entrance with proper facilities for unloading will be needed for supplies, and this should be in close proximity to storage areas, and kitchen refrigerators. It may also be used for the removal of refuse. If convenient, this entrance may also be used by the non-professional employees,
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if it is adequately controlled. The locker rooms, as well as the employee time and attendance control system, should be convenient to this entrance.

Whenever traffic will permit, an additional entrance may be provided for the removal of the dead. This entrance should be kept locked unless it is also to be used as the employees' entrance.

It might be advisable to have a separate entrance for the out-patient department, but for a hospital of this size we could have the out-patients use the main entrance in order to take advantage of a central point of information for both out-patients and in-patients.

Traffic - Interior

Within the hospital are other complex traffic lines to consider. Here some crossing of traffic lanes is inevitable. Orderly internal traffic is facilitated by correctly relating facilities and services.

The main traffic streams are:

1. Incoming patients who must proceed from the admitting and social service departments to the patient areas, emergency room, x-ray department
or other services.

2. Outgoing patients who leave the hospital, usually by way of the business office or the social service department.

3. Interdepartmental patient traffic.

4. Deceased patients who must be taken direct to the mortuary in as unobtrusive a manner as possible.

5. Visitors, who should be under surveillance to and from patient areas and during their entire stay in the hospital.

6. Staff members, who should be routed past the record library and the physicians' in-and-out board.

7. Out-patients who may be routed to the laboratory, pharmacy, x-ray, physical therapy units or other services in the hospital area proper.

8. Employees, who must be routed past their time control station and locker rooms before being in the hospital proper.
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9. Supplies, foods, and wastes, which must be as completely separated as possible from all patient and visitor traffic.

It is quite obvious that all the aforementioned items must be kept under constant consideration while laying out each particular area.

The Elements of the Hospital
So far, the discussion has centered around the hospital as a specific mass. In order to develop a definite program, we must facilitate a progressive and proper sequence of design. To do this we must list the general requirements of the hospital; these requirements are broken down into nine major elements. They are as follows:

1. Administration Department

2. Nursing Facilities
   a. Medical and surgical
   b. Obstetrical
   c. Pediatrics
   d. Isolation and psychiatric
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3. Nursery Facilities

4. Obstetrical Facilities

5. Surgical Facilities

6. Adjunct Diagnostic and Treatment Facilities

7. Emergency Department

8. Service Department

9. Out-Patient Department

Each of the elements is further broken down below so that the reader may better understand the approach to the problem.

The Administration Department

The administrative area is the central control area of the hospital, from which the overall operations are conducted. As such, it must carry the entire traffic load of hospital personnel, medical staff and the public at large. Esprit de corps can be improved by a well planned, well lighted and attractive administrative area. Into this area come visitors, patients, families of patients, often emotionally upset, hospital personnel, medical staff members, private duty
nurses, and other traffic such as salesmen, insurance adjusters, attorneys, etc.

The best way to describe the function of an administrative area would be to take each department of the area and attempt to tell its individual function. Included in the administration department are:

1. Main Lobby and Waiting Room
2. Information and Switchboard
3. Admitting Office
4. Business Office
5. Administrator's Office
6. Director of Nurses' Office
7. Secretary's Office
8. Medical Record Room
9. Staff Lounge, Library, and Conference Room
10. Public and Personnel Toilets

Usually the first area seen by patients, or the families, is
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the lobby, and first impressions are lasting impressions. Hospitals are often judged by their lobby and it is assumed that the surgical suite is only as sterile clean as the lobby is housekeeping clean, and at the same time it should present a friendly, comfortable atmosphere. The information desk and switchboard should be as accessible and as plainly marked as possible. Rest rooms are indicated and placed at convenient locations, even more so than in ordinary public buildings because of the emotional condition of many visitors. The hospital, even though it experiences today a much lower percentage of deaths than it did a decade ago, still finds many situations calling for a Chapel, a prayer room or a retiring room. The family deserves an opportunity to be by itself, or alone with its minister.

The admitting office should be in a quiet location, convenient to the main lobby. It requires the privacy of a separate room for consultation with the patient or a member of the family. One room should be for writing checks and paying bills, and one room will be used by the admitting officer of the hospital. Also, the admitting office must maintain a perpetual inventory of patients, posting vacancies immediately for emergency or other unscheduled admissions.
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The business office should be a part of, or adjacent to the bookkeeper's office, and should provide space for the clerical staff and equipment, a vault for business records and a safe for patients' valuables. There should be facilities accessible from the lobby for paying bills and receiving statements for insurance.

The administrator's office should be accessible to all other offices but located so as to allow privacy. This is usually accomplished by having the approach through the secretary's office which could also serve as a waiting room. In most hospitals, the office of the Director of Nursing is adjacent to the administrator's office. Often the secretary's office can be between the two offices so that one secretary can serve both offices.

The Medical Records Department is charged with the responsibility of assembling the medical records in a standard sequence, seeing that they have been completed and signed by the physician. It should adjoin and control the entrance to the staff lounge and should have convenient access to the inactive record storage room. Desk space should be available, either in the record room or in the staff room, for staff members to use while completing their medical records
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and for reviewing microfilmed records.

The staff lounge, library, and conference room should be arranged in conjunction with the administrator's office. The area is used for staff discussions, meetings, and as a resting place. To accommodate visiting doctors, the staff lounge may have a locker room and toilet facilities. The lounge should be large enough to allow a group to converse without annoying others, and should be equipped with comfortable chairs, smokestands, and desks where records may be studied or completed.

The hospital should also provide a lounge for the nurses. This lounge need not be a part of the administration department, but may be located in any convenient part of the building. A good location would be near the staff dining room. It should be equipped with toilet facilities, showers, and a dressing room with lockers and full-length mirrors.

The administrative department should have separate toilets conveniently located in such a position so they will not be used by the public. There is also need for a janitor's closet in this department so that the janitor need not carry mops and buckets through the main lobby.
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The Nursing Unit

Hospitals are built for the purpose of caring for the sick and injured, consequently that part of the hospital with which the patient comes in direct contact is naturally the most important part; this element is the nursing unit. All other elements of the hospital are necessary for the efficient operation of the nursing unit.

This area, in the Blacksburg hospital, will provide for a total of 50 beds, in one-bed and two-bed rooms. Twenty-seven beds are to be devoted to medicine and surgery, and nineteen beds to obstetrics, with four beds devoted to pediatrics. Probably the best arrangement is to house the medical-surgical nursing unit in a separate wing with the operating suite, and to have the obstetrical nursing unit in a separate wing with the delivery suite and nursery. The four pediatric beds could be located in either area.

Naturally, it is the desire of the patient to have a pleasant room, a room that looks more like a bedroom than a hospital ward. This can be accomplished very easily by creating a warm and cheerful atmosphere through the use of light pastel colors in the room, a large glass area which will give the patient the most amount of sunlight, air, and view, but at
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the same time suitably controlled with fabrics for light control. By using a hospital bed which is six inches lower than the customary hospital bed we are able to bring the overall vertical scale of the room closer to that of the average bedroom.

Consideration must be given to placing the nursing units as far from the inside and outside noises as possible. Careful thought must also be given to placing the nursing unit relative to the other elements, so that inside traffic will not have to pass through the nursing unit. It is preferred that the nursing units be oriented in a southerly direction so the patients will be able to take advantage of the maximum amount of sunlight and at the same time have access to the prevailing breezes.

Throughout the patient areas, efficiency of operation, economy of space and the comfort of the patient are primary considerations. Besides the use of acoustical treatment in areas where noise is expected, structural methods should be used which tend to eliminate sound transmission through floors and walls.

Friction hinges or other devices should be used to prevent the slamming of doors.
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Most room details show patients' room doors opening in toward the bed, giving increased privacy. Doors should be of the flush type and, in patient areas, should allow a full opening of three feet ten inches in order that beds may pass through. Even with this width, doors should be hung on offset hinges or the hinge edge should be protected by a metal strip.

Lighting in the patients' room should be indirect. Ceiling lights should not be used. Reading lights, nurses' call, electric and radio receptacles for each bed, and a night light so located as not to be directly visible to the recumbent patient and which can be switched on from the doorway, should be provided. All switches should be of the silent type. Oxygen outlets will be located in each room.

Besides the patient accommodation, there are auxiliary nursing facilities needed for the proper functioning of the nursing unit. These are:

1. Treatment Room
2. Nurses' Station
3. Utility Room
4. Solarium
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5. Flower Room

6. Toilet, Bedpan and Bathroom Unit

7. Closets (Linen and Supply)

Besides the one and two-bed rooms, there will be a children's unit and an isolation unit, one of which may be used as a psychiatric unit.

The one-bed rooms will be furnished with a lavatory with knee or elbow controlled valves and gooseneck spout, and will have a small toilet room with a silent water closet equipped with a device for emptying, flushing, and cleaning the patient's individual bedpan. A few one-bed rooms should be equipped with baths, as there will be a need for such suites. For safety, it is not considered advisable to place showers over tubs for the use by patients. In place of tubs, stall showers will be used in the maternity section.

It is advantageous to furnish at least one of the one-bed rooms in each nursing unit with acoustical treatment for use as a quiet room, selecting a room located away from traffic and the noise of utility facilities. It is desirable to have a view window to the quiet room from the corridor, so that the nurse can observe the patient without entering the room.
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The one-bed rooms should be of such size as to accommodate two beds in emergencies, thus furnishing flexibility in the capacity of the hospital. Because these rooms may be used for two beds in such emergencies, two clothes lockers or closets should be installed so they will be available for two patients. These lockers with the lavatory may be on the corridor wall or, if space permits, recessed between rooms.

The suggested width for any room intended for patients' use is twelve feet. The room must be at least 160 square feet in order that each bed have the minimum required square footage as set forth by the United States Public Health Service. Two-bed rooms are similar to the one-bed rooms, except that cubicle curtains should be provided.

In furnishing the rooms, there will be either one or two beds. These beds vary in size, but the usual size is from three feet, six inches by six feet, nine inches to three feet by six feet, nine inches. These sizes allow a doctor or nurse the possibility of reaching across the bed in examining the patient or making up the beds. Each bed needs some type of night table on which the patients may place some of their belongings and on which the nurse may place trays and equipment. A dressing table with mirror would be a con-
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Convenience for the ambulatory patients who, when leaving the room, may like to "pretty up", and this table would serve as a place to put cosmetics, combs, and brushes. Each room should have several chairs for the patients' use and for visitors.

The arrangement for the children's unit will be similar to that in one and two-bed rooms, except that it is desirable to have fixed partitions between the beds and curtain closure of the cubicles. Partitions should be seven feet high with shatterproof glass above the height of mattress (36 inches). Cubicles are best planned to receive adult beds, as these are often used rather than cribs. Hence, partitions should extend seven feet from the wall; projecting curtain rods will then permit a two-foot walking space between the foot of the crib and the curtain.

It is desirable that a small play area be provided adjacent to the children's rooms.

In this particular hospital there will be two one-bed isolation rooms designed for use by known infectious or communicable disease patients, or for patients under observation. These rooms will require separate utility room facilities. If these rooms are arranged in pairs, a single sub-utility
room may be designed to be used for both rooms. These sub-
utility rooms should be equipped with a sink with drainboard
and a utensil sterilizer, but they will require no other
fixed equipment.

Each isolation room should have a lavatory with knee action
control, a hook strip for gowns near the corridor door and
an individual toilet with bedpan flushing attachment. These
rooms are intended for use as ordinary rooms when not re-
quired for isolation. It is advisable to locate these rooms
either at the end of a corridor or off a sub-corridor.

In every general hospital at least one room should be avail-
able for psychiatric patients. In this case one of the
isolation rooms may be designed for this purpose. The win-
dows should be of the detention type with shatterproof glass
and openings restricted to five inches in one direction.
The door of this room should open out, be capable of being
locked from the outside only and have no hardware on the in-
side. A covered view window constructed of heavy shatter-
proof glass is provided in the door.

The nurses' station is the control point of the unit and
must be placed so that the nurse can control visitors from
the entrances and in the corridors. It should be situated to
save as many steps as possible for the nurses. The nurses' station should be entirely open, except for a counter separation. The station will be equipped with a nurses' call annunciator; a two-way telephone system will be used between the station and all the rooms. This will enable the nurse to speak to any of the patients without going to their room; this is a great time and energy saver for the nurse. Also included will be a medicine cabinet with separate locked section for narcotics, other cabinet space, a small instrument sterilizer, an acid-resistant sink below the medicine cabinet with a gooseneck spout for hot and cold water, a clock, a bulletin board, toilet, and an intercommunicating telephone.

For the purpose of doing surgical dressings, bathing non-ambulatory patients, for hot special baths, and other procedures, a treatment room is needed in each nursing unit. The two toilets with baths per unit may be incorporated as a part of the treatment room. The utility room in the American hospital is the work room for a nursing unit and should be centrally located.

If the central tray system of serving the patients' food is used, then a floor pantry is necessary. These pantries will have only the minimum equipment which will be used to
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wheel the food to the patients. If decentralized tray, or bulk food service is used, the pantry will have equipment necessary for making up trays. The serving of food will be taken up later in the discussion of kitchen service.

A solarium at the end of each patient’s wing is highly desirable. It should be arranged so as to be available for utilization as bed space in emergencies. In order to accomplish this purpose, a lavatory, nurses’ call and convenience outlets should be installed. When the solarium is not being used for bed space, it becomes a desirable therapeutic adjunct for the convalescent patient.

Space should be provided for a much needed workroom for the handling of flowers. This feature has been omitted too often in hospitals, and this creates a definite problem in receiving, cutting, and arranging of flowers and in refilling vases. Night or cleaning period storage of flowers and related functions are often improperly handled in the utility room. The flower room should have a 36-inch high work counter with a recessed sink, open shelves above and below for vase storage and space for waste receptacle.

One linen and one supply closet will be required for each nursing unit. One stretcher closet and one janitor’s closet
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in each unit will usually be sufficient.

The stretcher closet, which is more desirable than an alcove, should be arranged to accommodate at least one stretcher and one wheel chair. A cupboard with shelving may be installed above the level of the stretchers and wheel chairs for additional storage space.

A small linen closet will suffice in each nursing unit where a central linen room is proposed; hence, the individual linen closets need only be large enough to accommodate one day's supply of linen for the unit. Shelving should be provided in the linen and supply closets.

The janitor's closet should be a minimum of five feet deep and equipped with a janitor's receptor, hangers for mops and brooms and shelving for cleaning materials.

All closets should be provided with lights, preferably of the automatic type. Adequate ventilation must be assured in all such cases.

The obstetrical nursing unit, consisting of nineteen beds, will generally have the same facilities as the medical-surgical nursing unit. Maternity cases are probably subject to greater danger from cross infection than any other type
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patient and, therefore, this unit must be protected from other units of the hospital. This can be done by eliminating the exchange of personnel and supplies, and by physically isolating the maternity unit from the rest of the nursing units.

Nursery Unit

The nursery area is located in the maternity section, but is removed as far as possible from the delivery suite. It should be readily reached by visitors, who wish to observe the infants through the nursery view windows, without the necessity of their passing through corridors in patients’ areas.

Specific requirements for the number of bassinets necessary will vary somewhat with local practices, hospital trends, birth rates, and related factors. The approximate number of bassinets needed was ascertained by interviewing local doctors and hospital administrators. By estimating the total number of live births, we arrived at the following: 12 full-term bassinets, 3 suspect bassinets, and 4 premature bassinets, which gives us a total of 19 bassinets. Suspect bassinets must be in a separate nursery; full-term and premature may be housed either together or in separate nurseries.
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To encourage the application of sterile technique, each bassinet or incubator may be in a separate cubicle and separate connecting examination and treatment rooms should be provided so that no one but the nurse on duty will enter the nurseries. The suspect nursery must have its own anteroom. Formulas for babies will be prepared in a separate room adjacent to the nurseries and it should open directly onto a corridor, not into a work or examination area.

If the formula room is located in the dietary department, it will still be necessary for the nursery to have a room for receiving the infants' food. If it is located in the maternity unit, it will require more equipment and possibly more area. Regardless of the location, a room must be located in the maternity ward for the purpose of receiving infants' food. Space and equipment for washing bottles and warming the milk will be needed. A separate area will be needed for the washing of soiled bottles.

1. It is suggested by the Children's Bureau of the United States Department of Labor\(^1\) that the normal new born nurseries be limited to a maximum

of eight infants each. This figure is based on the number of normal infants that can be cared for adequately by one nurse.

2. The nursery should be provided with a view window from the corridor, or with a view window from a sub-corridor opening off the main corridor, and so arranged that visitors viewing the infants will not obstruct traffic. Slanted glass in this window obliterates glare.

3. Separate nurseries for premature infants are limited to a maximum of four premature infants in any one nursery. This represents the number of premature infants who can be adequately cared for by one nurse. Individual heated bassinets or incubators with temperature and humidity control should be furnished; hence, air conditioning will not be required. Otherwise, the premature nurseries will be similar to the normal nurseries.

4. An anteroom is arranged between the suspect nursery and the corridor. One anteroom may serve two suspect nurseries. It should be provided with a lavatory, a desk and a shelf, a hot plate and a
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...cabinet for necessary supplies.

Obstetrical Facilities

The delivery suite should be adjacent to the maternity nursing unit and entirely separated from the surgical and emergency suites. It should be planned in a "dead end" area, in order to prevent traffic through it to any other part of the hospital.

Delivery rooms should be provided in the approximate ratio of one delivery room for each twenty maternity beds or fewer, regardless of how small the hospital is. These will be essentially similar to operating rooms in design, including temperature and humidity control; protection against explosion hazards; having special clock, nurses' call, night light, suction apparatus, and ceiling, portable and emergency lights. Running water is not necessary but must be immediately adjacent. In addition to space for regular operating room equipment, delivery rooms should have space for a heated bassinet and oxygen resuscitation apparatus.

Labor rooms are needed in the approximate ratio of one labor room for every ten maternity beds and should be adjacent to the delivery rooms. They are of the general type of ordinary patients' rooms, except they are soundproofed and will
require portable lighting equipment and a special clock with a second timer. Since these rooms occasionally may have to serve as emergency delivery rooms, they should have an area of not less than 220 square feet. The provision of toilet facilities for use by patients in early stages of labor is desirable.

Scrub up facilities, between the delivery room and emergency delivery room, will be similar to those furnished in the operating suite. Windows that afford a view of the delivery rooms are highly desirable.

Sterilizing facilities must be furnished in the delivery suite, even though this section will be supplied from the central supply room. The area required is a sub-sterilizing room for the obstetrics suite, adjacent to the delivery rooms. Provision should be made in the sterilizing room for a water sterilizer, a small high pressure fast-time instrument sterilizer, a blanket and solution warmer, and a work counter with a sink.

The clean-up room should be similar to that room in the operating suite, except that a bedpan flushing attachment is added to the service sink.
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A treatment room within the maternity section, but not in the delivery suite, is strongly recommended. It is considered by many to be essential for postpartum examination, removal of sutures and similar procedures.

Also included in the obstetrical suite will be a storage closet, a janitor's closet, a doctors' locker room and a nurses' locker room.

Surgical Facilities

The location of the surgical suite is important. It should be completely isolated from the rest of the hospital and so located that there will be no traffic through it.

Approximately one-half of the patients admitted to a general hospital require surgery. Inasmuch as approximately 1800 patients would be admitted annually, an average of five each day, the average 50-bed hospital will need facilities for from one to three operations daily.

It is improbable that a particular operating room would be used more than an average of twice daily. Preparation of the room, performance of the operation and cleaning processes would require an average of three hours, and most surgeons prefer operating only in the morning hours. The latter
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practice would be difficult to change because surgeons prefer office hours that coincide in order to be available for consultation work and other commitments.

The major and minor operating rooms will be arranged with the scrub-up and sub-sterilization facilities between them. Orientation of operating rooms is not important because artificial light is used. Glass skylights and large windows for north light are no longer considered necessary, nor is there any need for excessive ceiling heights because of the modern air conditioning systems. However, windows are still desirable in the operating room so that electric lights will not be needed when cleaning the operating room, and also the germicidal effect of daylight in the operating room is advantageous.

The desirable minimum size for operating rooms is 18 feet by 15 feet. Sufficient space is needed for the operating table, instrument and dressing tables, an anesthetist's table, anesthesia apparatus, basin stands, stools and foot stools, a sponge rack, a drum stand and a container for soiled dressings. Open or closed shelving for sutures, solutions, trays and other material necessary for use during operative procedures may be built-in or movable, but instrument, packs and
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Supplies are not stored in this room in intervening periods. Equipment includes overhead, portable and emergency lights; clocks with sweep second hands; explosionproof emergency nurses' call; suction apparatus; and an explosionproof double view box in a built-in wall unit.

Special provision is necessary to guard against explosion hazards in all areas where anesthetic gases are used or stored and in adjacent corridors and areas designated as hazardous locations by the National Fire Protective Association. The consensus now is that a floor which is moderately electrically conductive over its entire surface offers the best and simplest means of electrically connecting together all people and equipment. Some of the floor covering that may be used in these areas are terrazzo, tile, rubber, linoleum, plastic, and armored concrete. Electrical equipment, switches and wiring should be explosionproof construction. Light bulbs should be guarded. All electrical outlets should be at least five feet above the floor. All operating room area walls should have non-glare tile to a minimum height of six feet and preferably to the ceiling.

Adjunct sterilization facilities will be located between the operating rooms. Direct access from each operating room is desirable.
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Scrub-up facilities should be located adjacent to the operating rooms. As the surgeon enters the operating room he should be scrubbed and ready to don sterilized garments. The area should have at least three sinks, each large enough so that surgeons will not splash each other while scrubbing. Space should be allowed between each sink for soap and alcohol dispensers. It is desirable to have a small window between the scrub-up room and the operating rooms, so that the surgeons or nurses may observe what is taking place in the operating room while they scrub up.

One clean-up room for the surgical area is sufficient. It should be located close to the operating room and furnished with tables and counters for preparing dressings, sinks with drainboards, and cabinets for sterile and unsterile dressings. Enough space should be allowed so that people working will not get into each other's way.

A special fireproof room is necessary for the storage of ether, anesthetic gases and anesthesia equipment. This room should be convenient to the operating rooms but should be entered from the corridor. It requires outside ventilation, either natural or artificial.

An anesthesia room should be available in the surgical suite.
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where the patient can be anesthetized, prepared for operation and kept in quiet non-irritating surroundings. In some instances the success of the operation and the welfare of the patient depends directly upon the preservation of quiet, unexciting surroundings.

A recovery room should be available, preferably adjoining the operating suite. Here specialized personnel can care for the patient until his condition is such that he can be transferred to the general duty nurse. A recovery suite provides all the equipment and drugs necessary for the handling of respiratory and circulatory difficulties. The patient in shock requires special handling and the average ward nurse is too busy to spend all her time with one patient. Also with the recovery room near the operating rooms the surgeon can reach his patient at a moment's notice in case of emergency.

A male and female lounge and locker room are needed so the personnel can leave their bacteria-laden street clothing and dirty shoes and walk into the operating suite dressed in laundered clothing and clean shoes worn only in the operating room. Control of the explosion hazard dictates a similar course. Wool and synthetic textile clothing and convention-
al shoes are removed and cotton clothes and shoes with conductive rubber soles are put on because the amount of static electricity that is generated on synthetic fibers or wool is likely to discharge and the spark may ignite combustible mixtures of gas. The interchange area assures bacteriologic cleanliness as well as protection against the explosion hazard for the patient.

The female locker room may be within the surgical suite, inasmuch as the nurses will not be in street clothes when they arrive.

In a small hospital the problem of supervision is not great. Supervision in an operating room is not one bit different from factory supervision where the effective supervisor works in the middle of things. The operating room supervisor's functional area is the operating suite. Therefore, the supervisor's desk belongs in the middle of the corridor where she is in direct command.

A storage closet is needed for extra operating room equipment and attachments. Shelving should be provided with the lowest shelf not less than four feet above the floor. This permits heavy equipment to be stored below the shelving. There will also be need for a stretcher closet for each major
operating room and a janitor's closet in the surgical suite.

The central sterilizing and supply service concentrates in one location the facilities for the care and assembling of instruments, packs, equipment and clinical supplies, with sterilization, if indicated, storage and distribution as required to all hospital departments. This permits a saving of equipment, supplies, and effort with increased general efficiency and a higher standard of work by skilled personnel.

Location at the entrance of the operating suite is recommended. This is usually a central location with respect to the other departments to be served and permits the operating room nursing staff to assist in the preparation of supplies. Access from the corridor outside the operating suite will be required for the transfer of supplies.

Space in the sterilizing room is divided into three distinct areas, which may or may not be physically separated:
(1) Work areas for receiving and cleaning unsterile material and for assembling packs; (2) sterilizing area for sterilizing supplies; (3) sterile supply area for storage and issuing of sterile supplies. It is more desirable that the sterile supply area be a separate room, if possible.
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The central unsterile supply is another important function of a centralized supply area. This area is concerned with such things as oxygen tents, inhalators and other items of the same category.

Adjunct Diagnostic and Treatment Facilities

The diagnostic facilities, with their various branches of treatment and services, has become so important in the modern hospital that the necessity of including space for this department must be automatically taken for granted by the designer in planning a well-balanced institution. These facilities must be accessible to all units of the hospital.

The diagnostic facilities will include:

1. General laboratory, which will also include an electrocardiograph, basal metabolism and specimen room, and possibly a washing and sterilizing room.

2. Physiotherapy area.

3. Radiographic suite.

4. Pharmacy.

5. Morgue and autopsy suite.
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Many diagnostic facilities are omitted in the small rural hospital. Should the occasion arise for the need of a facility which is not in the small hospital, then the case would be referred to the district or base hospital.

The hospital laboratory is one of the basically essential adjunct services of the hospital. The type of laboratory examinations to be performed, the volume of work and the departments that use the facilities should determine the location and space requirements. The function of the laboratory is to assist the physician in the recognition of disease states by microscopic and chemical examination of blood, urine, spinal fluid, and tissue. Valuable information during the course and treatment of many diseases is also furnished the physician by laboratory analysis. Last, by necropsy the laboratory obtains information on the changes which have taken place within the body.

A room adjacent to the laboratory unit for performing basal metabolism tests and electrocardiograms is desirable. This room may also be used by blood donors and the taking of some specimen types. It is convenient for the technician who does the tests and permits the patient who is coming to the hospital for the tests to go directly to the laboratory.
Physiotherapy is a part of the division of physical medicine involving various mechanical means for stimulating normal physiological processes. Its aims are to restore function in organs, limbs, muscles, and mental equilibrium. Even the smallest hospitals will have considerable physiotherapy and the present trend is toward increasing the treatment and concentrating required facilities. Treatment in this section includes not only hydrotherapy, electrotherapy, and mechanotherapy, but also different forms of inhalations, pneumatics, exercises, and massages.

The whole physiotherapy department should have rooms assigned for the different type therapies. There must be dressing booths for both hydrotherapy and electrotherapy, and also small booths or rooms for the massage tables. The mechanotherapy section could have a small space assigned for occupational therapy with a plank rail on the wall so that apparatus, such as stall bars and pull weights, may be attached. There should be rooms for inhalations and pneumatic chambers.

The radiographic suite is used by patients with all types of infirmities, as well as by out-patients; therefore, this department should be in a central location. X-ray and radiation therapy are used in hospitals for diagnostic and thera-
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peutic purposes with two principle phases involved. One is radiography and the other is fluoroscopy. Radiography is the making of a pictorial record by means of x-ray on a film. Fluoroscopy is a direct visualization through the medium of x-ray. X-ray rooms must be insulated by a material through which the rays can not penetrate; the most reliable and satisfactory protection is sheet lead.

The suite will include an office with a waiting room, a radiographic and fluoroscopy room, a viewing room, a dark room, several booths for dressing, and a toilet.

In a hospital of this size, nothing more than a dispensing pharmacy is required. It should be convenient to the outpatient department and to the various nursing stations. Space will be required for a refrigerator and a safe for narcotics. The bulk stores will be kept in the central stores area.

The morgue and autopsy rooms should be arranged so as to prevent unnecessary contact of the public and unauthorized personnel with autopsy procedures. It should be near the laboratory and adjacent to an isolated exit, if possible, to the service yard for the use of undertakers. The floor should be of water resistant material, preferably tile, and the
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walls should be tiled to a height of 5 feet 6 inches. Adjacent shower and dressing facilities for the use of the pathologist are required.

A refrigerated compartment for bodies, containing two crypts, will be needed. These crypts may be cooled with an individual refrigeration unit or from the central refrigerating system.

Emergency Department

The emergency department is generally located at the rear of the hospital. It should not be located next to the surgical or obstetrical suites. This department is open at all hours of the day and night, and accident and other emergency cases brought to the hospital by ambulance pass through it before being sent to the nursing unit or back home. Accident cases need prompt attention, as they are often brought into the hospital by excited relatives and any delay in receiving and caring for them is likely to subject the hospital to severe criticism. Also, these patients are quite likely to be so disheveled, dirty, and noisy that arrangements for their reception and immediate care should be as unobtrusive as possible. The suite should have a convenient loading platform or a ramp, and a marquee to protect patients being taken from
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cars or ambulances. Doors should be of sufficient width to permit easy access of stretchers.

The emergency room will be planned and equipped as a minor operating room, but scrub-up and utility facilities may be placed in the emergency room.

An office and waiting room for the emergency section is suggested for all but the smallest hospitals. It should be convenient to the emergency entrance and have a public telephone.

A standard toilet room is required in the area, while a bath or shower is desirable. Storage space will be required for supplies, dressings, trays, anesthesia apparatus and anesthetic gases. Storage space for splints and plaster bandages will have to be furnished if the emergency room is intended for use as a plaster room.

Sufficient space is needed for one stretcher and one or two wheel chairs. Shelves may be placed above the level of the wheel chairs and stretcher for additional storage space.

Service Departments

The service departments are maintained by personnel that rarely, if ever, come in contact with the patients, but the
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Efficiency of the service departments has a natural bearing on the patients' comfort. These services will function more smoothly and efficiently if they are located in one group and in one part of the building. To locate the service departments in a central part of the hospital is advantageous, as it tends to minimize personnel traffic; and also, the pipe lengths from the heat and power room will not be unnecessarily long. The servicing of these departments, such as delivery of food and fuel and carrying off garbage and refuse, must be kept in mind while planning the hospital.

The service department will include:

1. Dietary Facilities.
2. Laundry and Housekeeping Facilities.
3. Mechanical Facilities.
4. Employees' Facilities.
5. Storage.

The dietary service is an important part of the hospital team, and it has that team's goal as its objective - to provide better patient care through efficient operation. The primary responsibilities of the dietary department are to
serve appetizing and nourishing meals to the patients and personnel caring for the patients, and to provide this food as economically and efficiently as possible.

There are three general types of patient food service that one can consider for his hospital design. One is known as the central tray service. Each tray is completely prepared at the main kitchen, including napkin, silver, water, butter, and the dishes with the prescribed food on them. The problem is to transport the trays with the hot food as quickly and as efficiently as possible to the patient so that it will be received in a wholesome state. Trays are returned to the main kitchen and the dishes are washed in a central dishwashing room. This system is most adaptable to a small compact hospital where patients are not far from the kitchen facilities.

The second type is the decentralized service. In this system the food is put in heated bulk storage carts, then transported to serving pantries where the trays are made up. This system assures the patient of hot food, but it requires additional personnel to serve the food, and also, the dishes and trays have to be washed in the nursing unit pantry.

The third type of food service is the bedside service. Here
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the trays, minus the food, are prepared in the serving in each nursing unit and distributed to the patients. Insulated food carts bring the food to the patient. Here again the patient is assured of hot food and he can indicate the amount of food he wants. The trays and dishes must be washed in the nursing unit pantry.

The main components of the dietary department are food, refrigeration and storage, cooking, serving, special diets, dishwashing, dining, and (if included) formula preparation. These must be laid out with proper consideration for traffic lines within the kitchen and with related units being properly grouped.

A good traffic flow requires the refrigerators and day storage area be located at the rear of the kitchen so that the food progresses through various stages to the serving area at the front. From the refrigerators the food is taken to the preparation areas, where it is cleaned, peeled and cut and then to the cooking areas from which it moves to a steam table in the serving area.

The processing unit or cooking area is the most vital spot of the kitchen. It includes the range unit, bakery or dessert unit, and special diet kitchen. To these units the
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prepared raw products are delivered, processed, and the finished products sent to the serving units. Here are needed tools and equipment which are designed to give maximum efficiency. All equipment, both exterior and interior surface, should be made of stainless metals.

Adequate lighting and ventilation is of major importance. The ideal is to plan air-conditioning of the entire food department. During the summer months, the temperature for the work day ranges from $105^\circ$ to $120^\circ$. Air-conditioning is needed both from the standpoint of production efficiency and from the standpoint of employees' health and morale. Happy, comfortable employees will give more efficient work with the least loss of time and waste of materials.

Adequate space should be planned for both dirty and clean dishes. In addition to the dishwashing machine, there are pre-rinsing machines, glass washing machines, soaking sinks, several dish carts, and space for scrubbing food carts. The pot and pan area should be located near the cook's area.

Frequently the storage for cleaning equipment is overlooked. The closets should be light and well ventilated, with space for mops, pails, cloths, and brooms, shelves for cleaning supplies, and adequate floor space for barrels of soap,
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detergent, and sweeping compounds.

The sanitary and efficient kitchen needs a garbage and trash unit, located near the service entrance, with a refrigerated space for use until garbage can be incinerated, ground, or picked up. A can washing unit is needed in this area.

For the employees' comfort, attractive locker rooms with showers, lavatories, and dressing space should be planned for. A toilet room, in or adjoining the kitchen, is necessary if locker rooms are any distance from the kitchen, and within the kitchen there must be several hand sinks.

Another need is office space for the dietitian. Efficient supervision and training calls for office space in the kitchen itself. In addition, however, the dietitian desires an office removed from the kitchen area where she can think, plan, and concentrate, hold conferences and give professional services. The special diets kitchen may be included in the dietitian's office area for a hospital of this size. Minor cooking equipment is all that will be required, since bulk cooking will be done in the main kitchen and only minor modifications will be performed in the diet kitchen.

The dining space may be provided on a basis of two or more
sittings for the personnel served. Either cafeteria or
table service may be provided for. Service to personnel in
hospitals of more than 50-bed capacity is usually cafeteria
style. It has been found practical and workable to use only
one serving line for all. The feeding of professional grades
with non-professional grades tends to promote a better re-
lationship among the hospital personnel. The hospital dining
area should be restful and an intimate place where persons
eating can enjoy their meals and not feel that they are
eating in a public restaurant.

While most patients readily accept the professional services
of their doctors and nurses with the minimum amount of
criticism, they can and do judge the hospital by the personal
care and attention given to them while they are confined to
a hospital bed. Criticism of the linen service by both
patients and personnel is one of the most frequent complaints
heard in hospitals. The major share of this criticism can
be avoided by properly planned linen and laundry services.

For hospitals with more than 50 beds, the consensus appears
to be that it is usually more economical and more satisfac-
tory for the hospital to operate its own laundry; for hos-
pitals of less than 50 beds, opinion is divided.
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Even if the hospital sends its linen to commercial laundries, space must be provided for collecting, sorting, and sending out soiled linen. Space must also be provided for the delivery, sorting, mending, storage, and distribution of clean supplies.

The housekeeper's office should be located adjacent to the central linen room, where all the linen supplies are kept for the hospital. Space for a desk with a house telephone and files for the housekeeping records should be provided. Generally speaking, three kinds of space are needed for equipment and supplies. Floor space is needed for machines, wall space for hanging cleaning equipment, and shelf or cabinet space for housekeeping supplies.

It is necessary that competent engineers be employed in designing the boiler plant. Consideration must be given to the heating function, furnishing of steam for sterilizing, laundry, cooking and heating domestic hot water. The location of the boiler room must be in accordance with local fire ordinances. Some states do not permit installation of high pressure boilers within a hospital. When they are permitted, the room may be located in the basement, preferably at the end of a wing, with all precautions taken to assure safety of patients and personnel.
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The space needed for the storage of fuel depends on the type of fuel being used. If coal is chosen, space should be provided for its receipt in carload lots, and it should be fed by gravity to the boiler room. Tanks for storage of oil are best located underground to permit convenient filling from fuel trucks.

The hospital engineer's office may be located on a balcony level at one end of the boiler room but it must be protected from heat, dust, and dirt. Necessary gauges and other regulatory devices are located at this point.

The maintenance shop should be convenient to the boiler room, inasmuch as the same persons are usually on duty in both areas. In small hospitals, a single shop equipped for general repair work will probably be all that is required. Storage space for minor mechanical supplies must be provided in or adjacent to the shop. A locker room is desirable, and in even the smallest hospital, a toilet and lavatory are required.

Landscaping and garden work are important factors in the administration of most hospitals. Some provision should be included in every hospital for a small work space with storage for tools and equipment. Such an area should be
readily accessible from the outside.

Employees' facilities include locker rooms with toilet facilities, showers, and lockers. There should be separate locker rooms for nurses and the female help in the hospital, but one male locker room is sufficient. These facilities are best located near the kitchen area where most of the employees work, except for the nurses whose lounge, in connection with the locker rooms, can be located near the dining room. Employee lockers and restrooms should be convenient to the employee entrance. It is considered desirable practice to permit neither professional nor non-professional employees to go through the building in street clothes; therefore, locker rooms are so located as to obviate, as far as possible, the necessity for traversing corridors between the entrance used and the locker rooms. Some hospitals desire separate facilities for volunteer workers.

Included as part of the service department will be many rooms for storage purposes, such as dead medical records, pharmacy stores, furniture room, anesthetics, and all other supplies and replacements to be issued for use throughout the institution. All storage rooms should be dampproof and have some type of ventilation, either artificial or natural.
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Mechanical Equipment

The first cost of the mechanical and electrical equipment of a hospital is approximately one-third of the total cost of the building. Moreover, the cost of operating and maintaining this equipment is far greater than it is for all other parts of the building. Consideration should therefore be given to the design and selection of materials for the mechanical and electrical plant so that the first cost will be economical, excessive repairs can be eliminated and the cost of labor, fuel and power can be reduced to the minimum. At the same time the plant must be adequate to protect the health and safety of patients and employes and to maintain sanitary conditions in the hospital.

The heating of a hospital cannot be compared to that of an apartment building, hotel, residence or office building. It must operate continuously 24 hours per day; it must maintain different temperatures in various departments; its operation cannot be interrupted; it must not only supply the heat but also hot water at 150 and 180 degrees, steam for the laundry at 100 pounds, 40 pounds steam for sterilization and low pressure steam for the kitchen, and it must burn refuse without smoke. The ventilating systems, laundry, plumbing systems, plumbing fixtures, sterilization, elevators,
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and lighting of a hospital present engineering problems which are entirely different from those of any other building.

There are three principle methods of heating a hospital: Hot-water, steam, and hot-air. The two most widely used are hot-water or steam; hot-air is not advisable because recirculation of the air is a bad practice in hospitals for some of the recirculated air may carry infected air into un-contaminated areas. A hot-water heating system, including radiant heating is preferred by the writer rather than steam. The hot-water system requires no more radiation than the steam system, the hot-water mains and branches are smaller, and the first cost need not be greater. The heat is more desirable as it is more uniform; radiators are always warm and the radiators are rarely as hot as for steam – only during extremely cold weather. The hot-water system heating system is quieter as there can be no water hammer, no valve chatter nor cracking from the continual expansion and contraction of risers, mains and branches. The maintenance of the hot-water system is less as there is no corrosion, no traps to repair or replace, and no complicated controls. The cost of operation is less and overheating can be avoided more effectively.

Oil or gas-fired boilers should be used unless the cost of
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these fuels exceeds the combined cost of coal and labor, since they eliminate the noise and dirt caused by coal and ash handling. If coal is used, automatic stokers are more economical than hand-fired boilers, stokers also give better control of heating systems with a more uniform heat output.

The electrical service should be brought into the building underground when possible, to avoid interruption and unsightly poles. Where available, two services from independent generating plants should be used, one for normal use and the other as a breakdown or emergency service. As a minimum, the emergency service should have capacity to supply the operating and delivery rooms, corridor lights, stairs, and exit lights. Where a second service is not available, a battery or automatic generator must be installed for emergency use.

Lighting in all areas of the hospital should be designed for comfortable seeing. Fixtures should be durable, of a standard type, neat, of attractive design, easily cleaned and relamped. Wiring and switching should be arranged for convenient control. Matt finishes for equipment, instruments, furniture and light colored draping materials for tables are desirable for minimizing glare where high intensities of
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lighting are required. The intelligent choice of interior finishes enhances the lighting effect and influences human emotions so as to produce either stimulating, neutral, restful or depressing reactions.

In areas such as offices, waiting rooms, maintenance shop, boiler room, kitchen, dining room, storage spaces, and exits, the lighting may be treated approximately as in ordinary commercial buildings. In treatment, nursing and other specialized areas of the hospital the lighting should be designed for the particular specialty.

Patients' rooms should have installed lighting for three distinct services: general illumination for the room, a reading light for each patient, and a night light. A fourth service, provision for a doctor's examination light, may be incorporated into the patient's reading light or it may be only a receptacle for a portable lamp with an extension cord.

In operating and in delivery rooms, the high intensity of lighting needed may produce extremely annoying glare from metal instruments, equipment, white gowns, and draping materials. Reflected glare from instruments and materials in the surgical field is one factor which affects the maximum practicable lighting intensity in operating rooms. The use
of low gloss finishes for instruments, colored gowns and draping materials, permits higher intensities of lighting without increasing the discomfort from reflected glare. Because of the difficulty of visually distinguishing different tissue, a rather high intensity of lighting is required on the surgical field for maximum seeing efficiency.

The electrical service throughout the hospital will include call systems, doctors' paging system, intercommunication, fire alarms, clocks, and special installations. The design of light fixture in a hospital is not limited to any prescribed fixture, therefore, the designer is free to choose or design any fixtures he may desire, but it must be remembered that the fixtures should be of a functional rather than an ornamental design, and they should be easily cleaned and easily replaced if broken.

The plumbing fixtures in a hospital are subjected to more and harder use than in any other type of building, therefore, the fixtures and fittings must be of the best quality, sturdy, and substantial so that the cost of maintenance and repair can be kept at a minimum. The cost of plumbing in a hospital represents about twenty per cent of the total cost of the building, therefore, the plumbing system should be laid out
as simply and economically as possible. Every care must be taken to avoid the possibility of a cross-connection between supply and drainage to avoid contamination of the pure water supply.

The plumbing service of the service department includes drainage of sewage, water supply, storm water drainage, stand-pipe for fire protection, boilers, and installation and maintenance of all piping, fittings, and fixtures.

The modern hospital, in keeping pace with the advance in medical knowledge and techniques, has become one of the most complex and expensive building types. Annual operating costs are at an all-time high. As a result, hospital management, conscious of such costs, is reluctant to assume the additional financial burden imposed by a complete air conditioning system.

The problem will be resolved for many communities on the basis of climatic conditions and the duration of extremes for the particular locality. For this particular area the average number of hours that the outdoor temperature may exceed 80 degrees is from 800 to 1200 hours per year.

The possibility of limiting the system to those areas of the hospital where required by clinical treatment or accepted
practice should be fully explored. These areas are: Operating, delivery and emergency rooms, nurseries, x-ray, recovery rooms, special treatment rooms and isolation rooms. However, the therapeutic value of maintaining the physical comfort and mental tranquility of the patient in general nursing areas through air conditioning should not be overlooked. Also to be considered is the efficiency and morale of hospital personnel. Patient care is the prime consideration of any hospital and the quality of care is to a great extent dependent upon satisfied personnel.

Although it is difficult to evaluate financially, air conditioning should offer the following returns: (1) Reduction in nursing workload resulting from more comfortable patients; (2) leveling off of occupancy rates resulting from more summer elective cases; (3) reduction in personnel turnover as competition with other enterprises increases; (4) maintenance of the overall efficiency of the entire staff; (5) reduction in housekeeping and redecorating costs; and (6) more satisfied patients.

It is the writer's opinion that air conditioning should be included in this hospital, possibly limiting it to only those areas mentioned above.
PART III

The Hospital Structure

Due to the nature of the occupancy of a hospital building, its structure should be made as safe as possible. Structural safety can be assured by the application of the design standards and regulations ordinarily used by the structural engineering profession. Fire safety can be achieved by making provisions for structural resistance to fire and the spread of fire. This is best obtained by the use of incombustible materials and approved methods of construction for all structural members throughout the hospital. In addition, the use of combustible materials for the building finish and trim should be restricted to the fewest possible locations.

The selection of an economical hospital framing system will be based on the functional arrangement of the various departments, the location of equipment, and the desired architectural treatment. Other considerations will be local conditions such as the types of materials and labor available, contractors' experience and preferences, climate, building codes, soil conditions, disposition of the site and the time factor.

Many types of structural framing systems can be adapted to hospital buildings. The important thing is to provide a
structure which will accommodate the necessary mechanical and architectural features in a satisfactory and economical manner. Inasmuch as the mechanical and electrical services may constitute as much as one-third of the total construction cost of a hospital building (a value considerably higher than that expended in the average commercial building types), it is desirably to provide adequate space to install and service the equipment and connections required. The structural engineer should be completely familiar with the physical requirements of all hospital equipment and appreciate the significance of those architectural and mechanical considerations which distinguish a hospital building from other structures.

A skeleton structural frame of concrete or steel is universally used for all larger hospital structures and is recommended as equally suitable for the smaller buildings. It offers many advantages in construction which make it highly desirable for hospital buildings. For one thing, the installation of the mechanical and electrical service lines is greatly simplified.

The use of non-load bearing walls and partitions will allow much freedom in the arrangement and layout of the interior. Future alterations and changes can be made with much less
difficulty in such non-load bearing elements. For site conditions which require relatively lighter foundation loads, a structural steel frame is generally used. Several of the most desirable functional structural arrangements for a hospital building are: Long span construction, cantilever frame, flat slabs or flush girder, which presents essentially the same characteristics as the flat slab construction.

The floor system shall be selected with due regard for the coordination of other facilities -- heating, air conditioning, plumbing, floor finishes, etc. Many types of openings and surface depressions may be required in the slab. Provisions should be made for the pits for boilers, sump pumps and sewage pumps. Depressions for the base construction of walk-in type refrigerators to make the refrigerator floor flush with the finished floor of the room. Openings must be included for vertical pipe chases, and the heating and ventilating ducts.

Consideration should be given to the transmission of sound through the floor construction. Tapping noises, such as those caused by walking or by moving furniture, can be especially objectionable to patients and should be muffled as much as possible.
The ceiling surface throughout most of the hospital will consist of a hard plaster protected with an oil or enamel paint. The ceilings in the areas that are considered to be the greatest sources of noise should have some type of surface that will tend to control, absorb, or reduce the effect of the noise. These include such rooms as nurses' stations, utility rooms, corridors, lobbies, and waiting areas.

**Out-Patient Department**

Where the out-patient services are not available elsewhere in the community, they should be provided by the hospital if it is to meet fully its community responsibilities. Too often hospitals which have omitted this function in the original planning, later find it more or less forced upon them with consequent, unsatisfactory makeshift arrangements.

The original design should allow for the future addition of this important function if it is not incorporated in the initial construction phases. Otherwise the department will be forced into areas remote from necessary adjunct services and will be located in poorly lighted or ventilated space designed for other purposes. This is usually done at the expense of storage or other space necessary to efficient operation of the hospital. Traffic lines become confused and complicated.
PART III

The out-patient department is usually assigned space on the ground or the main floor with ready access to the main administration areas, especially the record room, and convenient to all adjunct services. A separate entrance from the street without steps is desirable and should be as isolated as possible from the areas occupied by in-patients. The area required will depend on the patient load and variety of the service to be rendered. Of the existing hospitals with regular out-patient services, it is reported that there is an average of one out-patient for every 3.5 occupied beds each day, but this average will be much lower for the Blacksburg area because at the present time there are no such facilities available in Montgomery County; therefore, there will be one out-patient for every 1.75 to 2 occupied beds each day.

The usual arrangement will require: a waiting room; facilities for admitting, appointments and cashier which control the entrance to clinical sections; clinical section with examining rooms, dressing rooms, treatment rooms, dental and other specialty rooms as required. There should be convenient access without undue traffic from the out-patient department through the hospital to the pharmacy, radiology, laboratory, and physical therapy and rehabilitation areas.
PART III

The waiting room, with its direct street entrance, must be light, well ventilated, ample in size and attractively finished to promote the psychological aspects so necessary to the treatment and care of any patient. Furnishings, while durable, should be comfortable and pleasing to the eye. Display boards and racks for health education material and other magazines should be provided. Automatically projected slides and films have been used with outstanding success.

A small playroom for children accompanying their parents or awaiting treatment has been found to be well worthwhile. A sheltered preambulator area may also be provided.

Examining and treatment rooms may be individual units opening from the corridor only, or in series with a circulation area for physicians and nurses. A surgical treatment room, finished rather like the minor operating room of the hospital, is usually necessary. In addition to general examining and treatment rooms, special areas, such as a darkroom, are necessary for eye, ear and throat work.

Dentists generally agree that a two-chair unit is minimum for any dental suite. A minimum of 200 square feet is required for two operatories and a small laboratory, to which it is usually advisable to add space for a recovery room and
PART III

a small waiting area.

An operatory should have a minimum area of 7 feet 6 inches by 10 feet. Each operatory includes the standard chair, dental unit, instrument cabinet, sterilizer unit, knee or foot action lavatory with gooseneck spout with a glass shelf and paper towel dispenser above, stool and waste receptacle. General illumination, in addition to the dental spotlight, is necessary. One unit should be supplied with a dental x-ray machine. The wall finish should be light, but without glare, and attractive. A smooth and washable finish is preferred. Floors may be of linoleum or rubber tile.
PART IV - FACILITIES NEEDED
Indicated on the following pages are the different elements of the 50-bed hospital and suggested areas for each element. Quite a few of these elements will be designed for a 75-bed hospital, for the anticipation of future expansion. The areas given are suggested by the United States Public Health Service and it is not intended that these should be followed implicitly, but rather they are merely approximations by which the designer may begin the design procedure.
### PART IV

<table>
<thead>
<tr>
<th>Administration Department</th>
<th>Number of Units Needed</th>
<th>Recommended Square Footage For Each Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Lobby and Waiting Room</td>
<td>1</td>
<td>495</td>
</tr>
<tr>
<td>Retiring Room</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Public Toilets</td>
<td>2</td>
<td>65</td>
</tr>
<tr>
<td>Public Telephone</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Admitting and Social Service Office</td>
<td>1</td>
<td>175</td>
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<tr>
<td>Information and Telephone</td>
<td>1</td>
<td>65</td>
</tr>
<tr>
<td>Administrator's Office</td>
<td>1</td>
<td>210</td>
</tr>
<tr>
<td>Director of Nursing Office</td>
<td>1</td>
<td>130</td>
</tr>
<tr>
<td>Secretary's Office</td>
<td>1</td>
<td>115</td>
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<tr>
<td>Business Office</td>
<td>1</td>
<td>365</td>
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<tr>
<td>Personnel Toilets</td>
<td>2</td>
<td>55</td>
</tr>
<tr>
<td>Medical Records Room</td>
<td>1</td>
<td>210</td>
</tr>
<tr>
<td>Staff Lounge, Library, and Conference Room</td>
<td>1</td>
<td>340</td>
</tr>
<tr>
<td>Janitor's Closet</td>
<td>1</td>
<td>20</td>
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Approximate Total Square Footage: 2,505

### Adjunct Diagnostic and Treatment Facilities

<table>
<thead>
<tr>
<th>Pathology Department</th>
<th>Number of Units Needed</th>
<th>Recommended Square Footage For Each Unit</th>
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<tbody>
<tr>
<td>General Laboratory</td>
<td>1</td>
<td>350</td>
</tr>
<tr>
<td>Basal Metabolism, Electrocardiograph and Specimen Room</td>
<td>1</td>
<td>190</td>
</tr>
<tr>
<td>Morgue and Autopsy Rooms</td>
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<td>385</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>925</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Radiographic Suites</th>
<th>Number of Units Needed</th>
<th>Recommended Square Footage For Each Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiography and Fluoroscopy Room</td>
<td>1</td>
<td>215</td>
</tr>
<tr>
<td>Toilet</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Control Enclosure</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Dark Room</td>
<td>1</td>
<td>65</td>
</tr>
<tr>
<td>Office and Viewing Room</td>
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<td>145</td>
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<tr>
<td>Waiting Room</td>
<td>1</td>
<td>60</td>
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<tr>
<td>Dressing Room</td>
<td>2</td>
<td>15</td>
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<tr>
<td>Storage Closet for X-ray Mobile Unit</td>
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<td>10</td>
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<tr>
<td><strong>Total</strong></td>
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### PART IV

**Adjunct Diagnostic and Treatment Facilities (Cont'd)**

<table>
<thead>
<tr>
<th>Service</th>
<th>Units Needed</th>
<th>Recommended Square Footage For Each Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Therapy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waiting Room</td>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td>Office</td>
<td>1</td>
<td>60</td>
</tr>
<tr>
<td>Exercise Room</td>
<td>1</td>
<td>135</td>
</tr>
<tr>
<td>Corridor</td>
<td>1</td>
<td>130</td>
</tr>
<tr>
<td>Examination Room</td>
<td>1</td>
<td>75</td>
</tr>
<tr>
<td>Therapy Booths</td>
<td>2</td>
<td>135</td>
</tr>
<tr>
<td>Hydrotherapy</td>
<td>1</td>
<td>35</td>
</tr>
<tr>
<td>Linen and Storage Closet</td>
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<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>640</strong></td>
</tr>
<tr>
<td><strong>Pharmacy Department</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compounding and Dispensing</td>
<td>1</td>
<td>230</td>
</tr>
<tr>
<td>Laboratory</td>
<td></td>
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<tr>
<td><strong>Approximate Grand Total Square Footage</strong></td>
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<td><strong>2,350</strong></td>
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</table>

**Nursing Service Facilities**

<table>
<thead>
<tr>
<th>Service</th>
<th>Units Needed</th>
<th>Recommended Square Footage For Each Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical One-Bed Room</td>
<td>12</td>
<td>180</td>
</tr>
<tr>
<td>Typical Two-Bed Room</td>
<td>17</td>
<td>180</td>
</tr>
<tr>
<td>(Area Includes Closet Space</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and Toilet)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolation Suite, Two Rooms</td>
<td>2</td>
<td>520</td>
</tr>
<tr>
<td>and Facilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solarium</td>
<td>2</td>
<td>480</td>
</tr>
<tr>
<td>Treatment Room</td>
<td>2</td>
<td>190</td>
</tr>
<tr>
<td>Visitors' Waiting Area</td>
<td>1</td>
<td>130</td>
</tr>
<tr>
<td>Nurses' Station with Stretcher Space</td>
<td>2</td>
<td>180</td>
</tr>
<tr>
<td>Service Units Within Nursing Area</td>
<td>2</td>
<td>160</td>
</tr>
<tr>
<td>Utility Room</td>
<td>2</td>
<td>160</td>
</tr>
<tr>
<td>Floor Pantry for Centralized</td>
<td>2</td>
<td>125</td>
</tr>
<tr>
<td>Bulk Food Service</td>
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<td></td>
</tr>
<tr>
<td>Flower Room</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Floor Toilets</td>
<td>4</td>
<td>80</td>
</tr>
<tr>
<td>Baths</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>Closets (Linen, Storage, Janitor)</td>
<td>2</td>
<td>240</td>
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</tbody>
</table>

| **Approximate Total Square Footage** |   | **10,480**                              |
## PART IV

### Nursery Facilities

<table>
<thead>
<tr>
<th>Facility</th>
<th>Number of Units Needed</th>
<th>Recommended Square Footage For Each Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursery</td>
<td>16 Bassinets</td>
<td>30</td>
</tr>
<tr>
<td>Premature Nursery</td>
<td>4 Bassinets</td>
<td>30</td>
</tr>
<tr>
<td>Work Space and Examination and Treatment Area</td>
<td>1</td>
<td>120</td>
</tr>
<tr>
<td>Suspect Nursery</td>
<td>3 Bassinets</td>
<td>30</td>
</tr>
<tr>
<td>Anteroom for Suspect Nursery</td>
<td>1</td>
<td>60</td>
</tr>
<tr>
<td>Formula Room</td>
<td></td>
<td>125</td>
</tr>
<tr>
<td>Bottle Washing</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Preparation and Filling</td>
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</table>

**Approximate Total Square Footage**

1,085

### Surgical Facilities

<table>
<thead>
<tr>
<th>Facility</th>
<th>Number of Units Needed</th>
<th>Recommended Square Footage For Each Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Operating Room</td>
<td>1</td>
<td>320</td>
</tr>
<tr>
<td>Minor Operating Room</td>
<td>1</td>
<td>320</td>
</tr>
<tr>
<td>Scrub-Up Alcove</td>
<td>1</td>
<td>60</td>
</tr>
<tr>
<td>Sub-Sterilizing Room</td>
<td>1</td>
<td>120</td>
</tr>
<tr>
<td>Central Sterilizing and Supply</td>
<td>1</td>
<td>475</td>
</tr>
<tr>
<td>Unsterile Supply Room</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Clean-Up Room</td>
<td>1</td>
<td>120</td>
</tr>
<tr>
<td>Stretcher Space</td>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td>Surgical Supervisor</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Janitor's Closet</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Doctors' Locker Room</td>
<td>1</td>
<td>210</td>
</tr>
<tr>
<td>Nurses' Locker Room</td>
<td>1</td>
<td>150</td>
</tr>
<tr>
<td>Anesthesia Storage</td>
<td>1</td>
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</table>

**Approximate Total Square Footage**

2,075

### Obstetrical Facilities

<table>
<thead>
<tr>
<th>Facility</th>
<th>Number of Units Needed</th>
<th>Recommended Square Footage For Each Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery Room</td>
<td>1</td>
<td>290</td>
</tr>
<tr>
<td>Labor Room (One Emergency Delivery Room)</td>
<td>2</td>
<td>210</td>
</tr>
<tr>
<td>Scrub-Up Alcove</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Sub-Sterilizing</td>
<td>1</td>
<td>95</td>
</tr>
<tr>
<td>Clean-Up Room</td>
<td>1</td>
<td>125</td>
</tr>
<tr>
<td>Doctors' Lounge and Locker Room</td>
<td>1</td>
<td>200</td>
</tr>
<tr>
<td>Nurses' Locker Room</td>
<td>1</td>
<td>95</td>
</tr>
<tr>
<td>Nurses' Station</td>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td>Non-Sterile Storage</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Sterile Storage</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>Stretcher Storage</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Janitor's Closet</td>
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</table>

**Approximate Total Square Footage**

1,395
### PART IV

<table>
<thead>
<tr>
<th>Emergency Department</th>
<th>Number of Units Needed</th>
<th>Recommended Square Footage For Each Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vestibule</td>
<td>1</td>
<td>216</td>
</tr>
<tr>
<td>Stretcher and Wheelchair Storage Area</td>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td>Toilet</td>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td>Operating Room</td>
<td>1</td>
<td>280</td>
</tr>
<tr>
<td>Storage and Supply Closet</td>
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Approximate Total Square Footage: 616

### Service Facilities

<table>
<thead>
<tr>
<th>Dietary Department</th>
<th>Number of Units</th>
<th>Recommended Square Footage For Each Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Kitchen and Bakery</td>
<td>1</td>
<td>1,100</td>
</tr>
<tr>
<td>Diet Kitchen and</td>
<td></td>
<td></td>
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<tr>
<td>Dietitian's Office</td>
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<td>150</td>
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<tr>
<td>Dishwashing and Truck Washing Refrigeration</td>
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<td>180</td>
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<tr>
<td>Meat</td>
<td>1</td>
<td>30</td>
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<tr>
<td>Dairy Products</td>
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<td>30</td>
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<tr>
<td>Fruits and Vegetables</td>
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<td>30</td>
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<tr>
<td>Garbage and Can Washing</td>
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<td>60</td>
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<tr>
<td>Day Storage</td>
<td>1</td>
<td>105</td>
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<tr>
<td>Dining Area</td>
<td>1</td>
<td>500</td>
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<tr>
<td>Janitor's Closet</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2,205</td>
</tr>
</tbody>
</table>

### Housekeeping Department

| Central Linen and Sewing Room            | 1               | 300                                    |
| Housekeeper's Office                     |                 | 90                                     |
| Laundry Department                       |                 | 1,100                                  |
| Total                                   |                 | 1,490                                  |

### Mechanical Facilities

| Boiler and Pump Room and Engineer's Office | 1,100 |
| Maintenance Shop                          | 165   |
| Total                                     | 1,265 |

### Employes' Facilities

| Nurses' Locker Room                      | 1     | 430 |
| Male Help's Locker Room                 | 1     | 230 |
| Female Help's Locker Room               | 1     | 230 |
| Total                                   |       | 890 |
### PART IV

<table>
<thead>
<tr>
<th>Service Facilities (Cont'd)</th>
<th>Number of Units Needed</th>
<th>Recommended Square Footage For Each Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Facilities</td>
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<tr>
<td>Dead Record</td>
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<td>Central Stores</td>
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<tr>
<td>Total</td>
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</table>

Grand Total Square Footage 8,055

### Out-Patient Department

<table>
<thead>
<tr>
<th>Room</th>
<th>Number of Units Needed</th>
<th>Recommended Square Footage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lobby and Waiting Room</td>
<td>1</td>
<td>160</td>
</tr>
<tr>
<td>Telephone Booth</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Appointment Room</td>
<td>1</td>
<td>115</td>
</tr>
<tr>
<td>Social Service Office</td>
<td>1</td>
<td>110</td>
</tr>
<tr>
<td>Examination and Treatment Room</td>
<td>2</td>
<td>125</td>
</tr>
<tr>
<td>Surgery</td>
<td>1</td>
<td>255</td>
</tr>
<tr>
<td>Eye, Ear, Nose and Throat Room</td>
<td>1</td>
<td>130</td>
</tr>
<tr>
<td>Women's Toilet</td>
<td>1</td>
<td>80</td>
</tr>
<tr>
<td>Men's Toilet</td>
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<tr>
<td>Janitor's Closet</td>
<td>1</td>
<td>20</td>
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<tr>
<td>Utility Room</td>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td>Dental Suite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operatory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral Surgery</td>
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<td>45</td>
</tr>
<tr>
<td>Prosthodontia</td>
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<td>45</td>
</tr>
<tr>
<td>Laboratory</td>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td>Recovery Room</td>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td>Closet</td>
<td>1</td>
<td>25</td>
</tr>
</tbody>
</table>

Approximate Total Square Footage 1,425
PART V - CONCLUSIONS
PART V

The Site:
There are many factors that must be considered before the final choice is made of the site where the hospital is to be located. The size of the site will depend not alone upon the number of beds planned, but should also allow for future increases. This is particularly true for the Blacksburg area, where one is unable to determine the increase of population in the next twenty-five years. The site chosen is located on the southeastern part of the town of Blacksburg. It is located on the main road, Route 460, leading to the town but is large enough so the hospital may be placed far enough from the road to eliminate all the extraneous annoyances either visual or auditory, but at the same time is easily accessible from the main road to be convenient for the ambulant patient, the visitor, or the staff member. The availability of all public services are easily accessible so that none of them will require to be led in from any distance. The site is large enough to allow for the contemplated twenty-five bed expansion and to insure the protection from future encroaching buildings.

The Building and the Relationship of Its Composite Areas:
The type of building selected is a one-story scheme. This type of scheme has been proven to have many advantages for a
hospital up to 100 beds. It permits simple and economical construction and may easily be expanded by the addition of another nursing unit, and the arrangement of complete nursing units. The various wings will allow better separation and control of types of patients. This type of scheme also eliminates all vertical transportation which alleviates the burden of moving patients from one floor to another, and it also reduces the mechanical equipment cost to a minimum.

By using single loaded corridors throughout the nursing elements, the horizontal circulation is kept to a minimum and at the same time it gives the best possible orientation for the patients' rooms. By orienting each room to the south-southeast, it is possible to take advantage of the sunlight most of the day, as well as the prevailing breezes.

The Administration Department:
This department is located at the main entrance easily accessible to all individuals who enter. All the hospital business is transacted within this area. The four areas that must be accessible to the public are the information, cashier, admissions office, and the retiring room. All the areas facing the lobby and waiting room will be separated by free standing partitions to better define the areas and
make the lobby and waiting areas more attractive to the public upon entering. All the other elements needed in the administrative area will open into the corridor away from the public's view. The doctors' lounge, library, and conference room are adjacent to the medical records room. All the administrative personnel, plus the staff have easy access to the medical records room.

The Out-Patient Department:
This department is also located near the main entrance with a separate waiting area not visible from the main lobby and waiting area. The out-patient department is designed to facilitate future expansion which will be needed within the next ten years. At the present time this area contains an enclosed garden area which will contain potted vegetation of different varieties enclosed with glass. The clerestory located on the East-West axis is divided into three separate elements. One is located over the out-patient waiting area and enclosed garden; the second is over the administrative area facing the lobby and waiting area; and the third is located over the dining area, dietary area, and central storage area.
PART V

The Adjunct Diagnostic and Treatment Facilities:
These facilities are located so they are easily accessible to both the out-patient department and the nursing units. The areas are rather large for a fifty-bed hospital but when the contemplated expansion takes place there will be sufficient square footage in this area for the additional utilities which will be needed. Included in the diagnostic facilities for the hospital are the physical therapy suite, x-ray and radiation therapy, basal metabolism and electrocardiography room, general laboratory, pharmacy, and the morgue and autopsy room.

Nursing Facilities:
There are two nursing wings oriented so all the patients' rooms are facing south-southeast, with a designed capacity of fifty beds. By putting two beds in all the single rooms, we have a maximum capacity of 65 beds in the event of an emergency. All the patients' rooms will be the same size for maximum flexibility. Each pair of rooms have a toilet and separate lavatories with the usual furnishings: chairs, dressers, tables and beds.

All the elements that are used by the nurses are located around the nurses' station for their convenience. The
PART V

utility room which is used by the nurses at all times is located behind the nurses' station; on one side of the nurses' station is the stretcher space, flower room, bath, linen closet, storage space and janitor's closet; on the other side is the floor pantry.

The maternity nursing area is located in a separate unit. This will alleviate the danger of cross-infection between maternity patients and other types of patients. Adjacent to the maternity nursing area is a waiting area for the expectant fathers.

The nursery area will contain 12 bassinets and four premature bassinets. There is a separate suspect nursery containing three bassinets. All these areas may be viewed through large windows.

Surgery and Delivery Department:
The surgery and delivery departments are located in the core area between the two major corridors, separated by the central sterilizing department and the service facilities needed by each department. The central location insures easy access to all the nursing units, and the emergency department. There is a clerestory over the central sterilizing and service facilities. No natural lighting is needed in the operating
or delivery rooms. This will insure absolute quiet so there will be no distracting noises during an operation.

The Service Departments:
The service department consists of such functions as the dietary facilities, laundry and housekeeping services, central storage area, mechanical facilities, maintenance service, and locker areas for the employees and nurses.

The designer feels that the best type of food service for this hospital is a slightly revised bedside service system. The trays would be partially prepared in the main kitchen with the foods that need not be heated, such as the salads, desserts, and dairy products, along with the silverware and napkin. The trays are then taken to the nursing units along with the insulated food carts. This way the patient is assured of hot food and he can indicate his choice and the amount of food he wants; this will eliminate much of the food wasted by the patients, thus cutting down on the daily food bills for the hospital.

The laundry and housekeeping facilities are located in the central part of the service area. The laundry is arranged so the soiled linen is taken by carts to the soiled linen area where it is put into the sorting bins. The laundry is
PART V

arranged so that during the process of washing, starching, ironing and pressing, the linens are directed back to the sewing, linen storage, and housekeeping area.

The Structure and Materials:
The type of construction used will be a structural steel welded frame. This structural system will reduce the dead load to a minimum. The steel used in the building will only be the fixed shapes that come from the rolling mill. The use of the skeleton frame will eliminate bearing walls, and partitions allowing much more freedom in the arrangement of the interior areas. The curtain walls which enclose the building will be placed between columns exposing the exterior of the steel columns and spandral beams. The curtain walls will have brick, glass and panel infilling with steel mullions placed four feet on center.

Interior partitions that run from floor to ceiling will be made of steel studs with metal lath and plaster or glazed tile finish. Ceilings are a composition of gypsum-vermiculite plaster which furnishes fireproofing for the steel members as well as an insulating factor. Flooring is vinyl tile laid on a four-inch concrete floor slab which rests on a four-inch cinder concrete slab.
PART V

Panel heating, consisting of copper coils embedded in the ceiling will be used throughout all the areas except in the service portion of the building. Although the initial cost is more for installation, the designer feels it will soon pay for itself because it is cheaper to operate and maintain. The continuous flow of hot water through the coils will maintain a uniform temperature throughout the areas.

Due to the climatic conditions of this area, the designer feels that a cooling cycle will be needed for selected areas only, such as operating and delivery rooms, special treatment rooms, nurseries, obstetrical nursing area, dietary department, and the laundry. These requirements will be best served by factory assembled units located outside the area, utilizing conventional duct systems for air transmission.

Artificial lighting will either be suspended from the ceiling or mounted on the walls. There will be no fluorescent fixtures suspended from the ceiling. Lighting in the patients' rooms will be a multi-purpose lighting fixture over the bed.
PART VI - PRESENTATION OF THE DESIGN
PART VII - PRESENTATION OF THE LANDSCAPE DESIGN
Definitions

Top soil is defined as an organic surface soil suitable for cultivation, a fertile, friable loam containing a liberal amount of organic matter of the best quality that can be obtained in the locality.

Humus shall be a domestic product and shall be reed peat, sedge peat, moss peat, reed muck or sedge muck.

General

Plant materials shall conform to the requirements of the plant list and to the sizes shown on the plant plan drawing. The plants shall be sound and healthy, vigorous, free from plant disease and shall have healthy normal root systems. All plants will be purchased at a reliable nursery approved by the architect.

All plants shall be true to the botanical names and standards of size, culture and quality for grade number one stock or better, as adopted by the American Association of Nurserymen.

Should any work or materials be required which is not denoted either on the drawings or in the specifications, either directly or indirectly, but which is nevertheless necessary for the proper carrying out of the intent thereof, the con-
PART VII.

Contractor shall understand the same to be implied as required, and shall perform all such work and furnish any such material as fully as if same were particularly delineated or described.

All work must be performed in the best manner, and all materials of which the work is composed shall be at all times employed to execute the work with due dispatch, the whole to be done to the satisfaction of the architect, and any materials furnished or work done not satisfactorily to the architect shall be immediately removed and satisfactorily replaced.

The contractor shall provide the architect with a complete typed maintenance guide for his approval.

Excavation

All topsoil shall be stripped from the sub-soil and stock piled at convenient locations. Precautions shall be taken by the contractor to preserve all stock piles. Additional top-soil shall be furnished from outside sources.

The contractor shall be liable for any damage to property caused by topsoiling operations, and all areas and construction disturbed shall be restored to their original condition to the satisfaction of the architect.
PART VII

The material shall consist of natural topsoil, free from subsoil, obtained from an area which has never been stripped. It shall be removed to a depth of one foot, or less if subsoil is encountered. Topsoil shall be of uniform quality, free from hard clods, stiff clay, hard pan, sods, partially disintegrated stone, lime, cement, ashes, slag, concrete, tar residues, tarred paper, boards, chips, sticks or any other undesirable material.

Before any topsoil is placed the contractor shall complete all excavating within the planting areas to be covered with topsoil, necessary to bring the surface of the proposed subgrade to the following elevation below, and parallel to, proposed finished grade:

(a) 6" -- For lawn areas.
(b) 6" -- For ground-cover areas.
(c) 18" -- For shrub areas.

The subgrade shall be graded to a smooth uniform surface. Hollows, depressions and gullies shall be filled with acceptable materials free from stones over two inches in diameter, cinders, rubbish and other unsuitable material. All surplus material, including stones over two inches in diameter, and
debris, shall be removed and disposed of as directed by the architect. The subgrade shall be compacted with an approved roller, as directed by the architect.

Where required by the architect, the surface of the subgrade, immediately prior to being covered with topsoil, shall be loosened to a depth of two inches, by discing, harrowing, raking or other approved means, to permit bonding of the topsoil with the subgrade.

**Planting Preparations**

All areas to be seeded for lawn shall be thoroughly loosened with a disc or a similar implement to a depth of four inches. Fertilizer will be applied over the complete area for the full depth of the seed bed.

The fertilizer will be thoroughly mixed with topsoil at the rate of three pounds per one hundred square feet. Ground limestone shall be applied at the rate of seventy-five pounds per one thousand square feet. The surface shall then be rolled with a Cultipacker.

Seed mixed in the proportion of 3/4 bluegrass and 1/4 red top shall be evenly sown at five pounds per one hundred square feet, or one hundred fifty pounds per acre. Grass seed shall
PART VII.

be sown by hand or by approved machine in such a manner that a uniform stand will result. After seeding, the surface shall be evenly raked with a fine-toothed rake and rolled with an approved roller, as directed by the architect. The seed area will be covered with a light mulch of clean straw at one-fourth bale per one hundred square feet.

Plants and trees will be planted immediately after arrival; the earth will be kept moist at all times. The burlap will be kept on the roots until after the plant is in the ground.

Holes or trenches for plants shall be dug sufficiently large to take all the roots without doubling them back and deep enough so that there will be three inches of rich soil in the bottom in order that the plant will stand at a depth approximately as they were at the nursery. Tree pits shall have humus placed in the bottom of the hole to a depth of six inches. Tree trunks shall be protected with a wrapping of burlap, and the trees will be guyed down satisfactorily.

The planting soil shall be free from lumps, clods or stones. Peat humus shall be mixed with the planting soil at a rate of not less than one hundred pounds of humus or manure to each cubic yard of topsoil. Use fertilizer sparingly, taking care not to permit contact with the roots. The surface of filled
PART VII:

holes should, after settling, be at least even with the surrounding ground.

Ground cover beds shall be excavated to a depth of six inches, the subgrade shall be loosened to a depth of two inches by discing, harrowing, raking or other approved means, to permit bonding of the topsoil with the subgrade. Humus shall be mixed with the topsoil at a rate of one hundred pounds of humus to each cubic yard of topsoil. Fertilizer will be spread over the topsoil at the rate of twenty pounds per one thousand square feet and will be mixed thoroughly with the topsoil to a depth of three to four inches. The bed will be raked to a smooth, even surface conforming to the established grades allowing for settlement.

The root systems of all plants will be watered at such intervals in order to keep the surrounding soil in the best condition for the promotion of plant life.

Penetration Macadam Wearing Course

This work shall consist of constructing a three-inch compacted depth pavement of crushed slag penetrated and sealed with bituminous material, on a prepared base in accordance with the specifications.
PART VII

The aggregate shall consist of crushed stone or crushed slag. It shall be of reasonably uniform quality throughout and shall be clean and free from an excess of dust and flat or elongated pieces. Rock or slag shall have a percentage of wear by the Los Angeles abrasion machine test of not more than forty. Slag shall weigh not less than seventy pounds per cubic foot.

Road tar shall be used as the bituminous material. It shall be road tar number eleven and applied to the surface at a temperature of $275^\circ$ to $350^\circ$ Fahrenheit. The temperature of application for the seal coat shall be $225^\circ$ to $250^\circ$ Fahrenheit.

The bituminous material shall be applied only when the aggregate is dry and atmospheric temperature is above $45^\circ$ Fahrenheit. The equipment shall include adjustable aggregate-spreading equipment, pressure distributor, heating equipment for bituminous material, blade grader, push and drag brooms, and power rollers.

Rollers shall be self-powered, 3-wheel type weighing not less than tons and shall be equipped with sprinkling devices and adjustable wheel scrapers. One roller shall be kept in operation for one hour on each one hundred square yards of com-
PART VII

Completed pavement, at a speed of not more than three miles per hour.

The bituminous material shall be applied uniformly with a pressure distributor. Hand methods may be used in locations inaccessible to the distributor.

Sufficient course aggregate shall be uniformly spread to be three inches thick when compacted. Any thin, flat, or oversized aggregate that appears on the surface shall be removed. All patches or areas of fine or undersized aggregate shall be removed and replaced with suitable aggregate.

Rolling shall start at the edge and work toward the center. Each trip of the roller shall overlap the previous trip by at least one-half the width of a rear wheel. Rolling shall be continued until aggregate is well keyed, does not creep ahead of the roller, and the surface is firm, even, and true to line, grade and crown. The surface shall be true to the established grade. The surface shall not vary more than 3/8 inch in ten feet from true profile and cross section.

The first application of bituminous material shall be from 1.5 to 1.7 gallons per square yard. Immediately after the application of bituminous material, sufficient clean, dry
key aggregate shall be uniformly spread to fill all voids, approximately twenty-five to forty pounds per square yard. The key aggregate shall be broomed into the voids and rolled. Scattering key aggregate and brooming shall continue during rolling until the voids are completely filled. Material shall be rolled until the surface is firm and thoroughly compacted. No excess cover shall remain on the surface.

The second application of bituminous material shall be from 0.6 to 0.7 gallons per square yard. Uniformly clean, dry, fine aggregate shall immediately be spread in sufficient quantity, approximately fifteen to thirty pounds per square yard, to cover the surface completely. Sufficient additional fine aggregate shall be spread, broomed, and rolled to absorb any excess bituminous material that shows through during rolling. After this the areas will be opened to traffic.

At the end of thirty to sixty days preferably, and never less than five days, the surface shall be swept clean of all loose or foreign material and 0.3 to 0.4 gallons per square yard of bituminous material shall be applied. Uniformly clean, dry, fine aggregate, approximately fifteen to thirty pounds per square yard, shall be spread immediately. The aggregate shall be rolled until firmly embedded. Additional
PART VII

fine aggregate shall be spread, broomed, and rolled to absorb any excess bituminous material that shows through during rolling. Approximately ten days after completion of the seal coat all loose aggregate shall be removed.

The surface shall be true to established grade. The finished surface shall not vary more than 3/8 inch in ten feet from the true profile and cross section.


Schafer, Margaret K., Central Supply Equals Economy and Efficiency, Hospital Topics, Washington, D. C., April, 1952.


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