

THE LONG-TERM DEVELOPMENT OF TAITA HOSPITAL

by 1264

KANG-CHENG WEI

B.S., Cheng Kung University, Taiwan, 1964

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

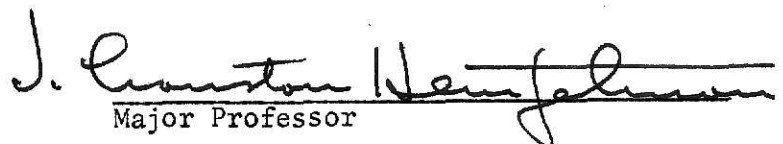
MASTER OF ARCHITECTURE

College of Architecture and Design

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1970

Approved by:


Major Professor

LD
2668
T4
1970
W43

TABLE OF CONTENTS

CHAPTER	PAGE
I. INTRODUCTION	1
II. GENERAL INFORMATION	5
Background	5
History and Development of Taita Hospital	7
Location and Site of Taita Hospital	9
III. THE PRESENT TAITA HOSPITAL	13
Existing Hospital Plan and Buildings	13
Utility and Circulation Systems	15
Distribution of Nursing Beds	17
IV. CURRENT TRENDS IN HOSPITALS	23
The Car and Mechanical Equipment in Hospital Development	23
Parking and Heliport Problems	24
Shortage of Medical Personnel	26
Rise in Emergency-Service Visits	27
Care-Needs during Evening-Hours	28
Nursing Units in Hospitals	29
Emphasis on Preventive Medicine and on Medical Research	31
Nuclear Energy in Future Hospitals	32
Location and Form of Hospitals	33
Structure of Hospitals	35
Size of General Hospitals	37

**THIS BOOK
CONTAINS
NUMEROUS PAGES
WITH DIAGRAMS
THAT ARE CROOKED
COMPARED TO THE
REST OF THE
INFORMATION ON
THE PAGE.**

**THIS IS AS
RECEIVED FROM
CUSTOMER.**

CHAPTER	PAGE
V. DESIGN CONCEPTS	40
Hospitals within Hospital	40
Organic Growth	42
Parking Capacity and Open Space Increasing as Hospital Expands	42
Flexible Space	44
VI. PROPOSED MASTER PLAN	46
VII. PROPOSED FOUR CONSTRUCTIONAL STAGES	49
Principles Applied in the Proposed Stages	49
Stage I	49
Stage II	51
Stage III	51
Stage IV	52
VIII. CONCLUSION	53
PRESENTATION	54
BIBLIOGRAPHY	63
ACKNOWLEDGEMENTS	65

CHAPTER I

INTRODUCTION

When a society becomes stable and prosperous, the people of that society will ask for better welfare conditions, which are considered by them as basic and deserved rights and privileges. These requirements, which are influenced by time and progress, are necessary for a better living standard. A society should be improved to satisfy the people. In the first half of the twentieth century, progress and construction, it may be claimed, exceeded progress and construction in other centuries: automobiles became popular; supersonic transportation was commercialized; accurate apparatus was mass-produced; computers were invented and used; and atomic energy was peacefully applied. These factors have caused changes in management methods and in adjustments to satisfy rising demands. These changes have been made to accommodate people for the new requirements of the current society which emphasizes management efficiency and future development.

Individual and public health are two of the basic welfare necessities which are seriously considered by everybody. They affect personal life, society's existence and the nation's strength. The modern hospital should be a major factor not only for curing patients but also for prevention of disease by education of the public, research and teaching.

Taiwan is surrounded by water, but is not isolated from the civilized world. The people of the island always open their minds to receive outside culture and do their best to keep pace with the newest scientific advances. As a result of fifty years of rule by the Japanese, good basic foundations for industry and medicine have been established. Since the end of World War II,

the Chinese government has tried to rebuild the war-devastated Taiwan. The population of the island had boomed from six million in 1945 to thirteen million in 1968 (most of the increased population is due to the influx of people from the mainland of China in late 1949 and early 1950), and some eighty per cent of the national budget each year had been used for maintaining a 600,000 troop army. Fortunately the living standard is still one of the highest in Asia. Once the rate of population growth is lowered and the great armed forces are removed, the living standard of Taiwan, it is believed, will catch up in a short period with that of developed countries. Some big developments and constructions are expected to materialize during that time. Taita (the National Taiwan University) Hospital is looking forward to the arrival of that day.

The National Taiwan University (known as Taita), located in Taipei, Taiwan, is the oldest and the largest university in Taiwan. There are some 10,000 students in seven colleges; they are the colleges of liberal arts, agriculture, commerce, engineering, science, law, and medicine. The first five colleges are located on the university's main campus. The other two colleges, law and medicine, have their own campuses which are five miles north of the main campus and approximately three quarters of a mile apart. Taita Hospital and Taita Medical College are divided by a 132 foot wide road.

Taita Medical College was the only medical school on Taiwan before 1950, and most of the élite in the medical field on the island are located in the college to teach or to do research work. The teaching hospital of the college has become, due to this situation, one of the best staffed and equipped hospitals on the island. Because of the hospital's extensive medical facilities, convenient transportation, and low medical fees, people in Taiwan having

unusual diseases often come to the hospital to seek specialists' care when local doctors and hospitals are unable to provide proper diagnosis and treatment. During the ten year period (1957-1966), the outpatients increased 9.5 per cent, and admitted patients 31.7 per cent and the emergency cases 77.5 per cent. Today the hospital is not only a teaching hospital but also a general city hospital.

The hospital is designed to be financially self-supporting and self-sufficient. Since the medical fees are controlled by the Chinese Central Government, the hospital cannot arbitrarily increase charges and bills in order to increase its income for future development. It has only a limited amount of money left for development each year. The funds needed for new additions and alterations are for the most part supplied by the Taiwan Provincial Government, the U.S. Agency for International Development, World Health Organization and China Medical Board of New York. The amount of money available for additions and renewals is always quite small. Therefore new buildings and additions in equipment are rarely secured. The lack of facilities directly hinder the development of advanced medicine and research, and at the same time decrease the chance to serve the patients and deny existing privileges to the people. This situation is quite unfortunate.

These planless additions, scattered along two north-south bound main streets where open space and easy access are available, keep the hospital growing, but they also become a stumbling block in the way of future development. This has been a waste of invested funds, and also affects the normal operation of the system, produces chaos in the whole organization, and may even bring about the death of the hospital.

Devising an architectural scheme to keep this septuagenarian hospital

from dying and to meet the current trends to enable it to become a medical center in the near future, is the writer's goal.

CHAPTER II

GENERAL INFORMATION

BACKGROUND

Geography

Taiwan is an island province of China and has been the seat of the Chinese Nationalist Government since 1949. The main island is about 90 miles wide by 240 miles long and lies almost 120 miles off the coast of mainland China. It lies between 21°54' N. and 25°20' N., and meridians 120°4' E. and 121°57' E. The province consists of the fourteen islands of the Taiwan (Formosa) group and sixty-four islands of the Penghu (Pescadores) group. They lie between Japan (north) and the Philippines (south). The province has a total area of 13,886 square miles (13,807 square miles excluding the Penghu Group).

Geology

The main island of Taiwan is part of a volcanic chain. On the island's precipitous eastern side, the peaks of a north-south range soar to 10,000 feet. On the western face of this range, the island slopes gradually to a 24 mile wide coastal plain. Because it is part of the Pacific earthquake belt, the island frequently suffers from earthquakes.

Climate

The climate is basically humid subtropic, but it does vary from one end of the island to the other and also according to altitude. On the plain, rainfall varies from forty to sixty inches a year, the mountains receive from one to two hundred inches of rain a year. Typhoons, which often cause floods,

usually come between May and October. Temperatures vary from an average of 55°F. in late February to 85°F. in July.

Taipei, one of the chief cities of Taiwan, was founded in 1708. The city is situated in the center of the largest agricultural basin (25°02' N. and 121°21' E.) in northern Taiwan and is 27 to 45 feet above sea level. The average temperature there is 78.8°F. in July and 65.2°F. in February. The yearly precipitation in Taipei averages 83 inches.

History

The original Taipei city had its official buildings protected by ramparts. There were five guardhouses: East-gate, West-gate, North-gate, South-gate and Small South-gate. After China's forced ceding of the Taiwan islands to the Japanese in the late nineteenth century, the walls of the city, except the three guardhouses, were dismantled. The old city area formerly protected by the walls was reserved by the Japanese Government for governmental buildings and Japanese residences. The surrounding areas were reserved for the expansion of the city. The spaces occupied by the walls were converted into wide avenues which are now parts of the main streets of Taipei. Today this central area has been developed as the center of Taipei.

The city today forms the nucleus of a major industrial area. It also is the island's communication and cultural center, containing the central offices of government-owned railroads, an international airport, and ten universities and colleges, several libraries and museums. The city is the island's medical teaching and research center; there are three medical colleges and several medical research institutes in the area.

Around Taipei there are several industrial satellite towns with a total of a million population. Besides these towns a harbor city, Keelung, the

second largest city and an international seaport in Taiwan, is located twenty miles north-east of Taipei. It had a population of 300,000 in 1968.

In June 1968, the territory of Taipei was expanded from thirty-six square miles to almost a hundred square miles and the population was, therefore, increased from 1.2 millions to 1.5 millions.

Since it is located on the Taipei basin, the soil bearing capacity of Taipei is comparatively low. The average capacity is only 2,200 pounds per square foot. The water table is rather high, averaging from six to ten feet below the ground surface.

Like the other cities of the island, the zoning regulations and the building code of the city are those which were used during the time the Japanese ruled the island. The building code has been used over forty years without any change while the building code of Japan has been revised several times. The city zoning regulations of Taipei, though revised to fit the expansion of the territory every few years, have not as yet been fully applied. Illegal buildings can be found here and there. Review work and enforcement of the zoning regulations and of the building code are urgently needed.

HISTORY AND DEVELOPMENT OF TAITA HOSPITAL

The history of the present Taita Hospital can be traced back to June 1895, the year Taiwan was ceded to Japan. The Japan Taiwan Government General established "Dai Nippon Taiwan Hospital" - earliest predecessor - in the northern section of Taipei.

The Medical School of the Taiwan Government General was established in 1896 at Taipei (where Taita Medical College is today) for the study of

"Western (modern) Medicine" in order to combat frequent and severe epidemics - malaria was one of them - on the island.

The "Dai Nippon Taiwan Hospital" was annexed by the Medical School as an affiliated hospital and was named "Taihoku (Taipei) Hospital" in 1898. The hospital was moved to the site next to the Medical School, and the foundation for the front section of the hospital was laid in that year. The construction of four linear two-story tropical type buildings as the front section of the hospital was completed in 1924.

In 1936, the hospital became attached to the College of Medicine, Taihoku (Taipei) Imperial University, and was renamed "Taihoku Imperial University Hospital." Since then the hospital has been reorganized and expanded for use in teaching and research.

Additional four-story buildings of wards and laboratories were completed in 1942. The hospital received considerable damage from aerial bombing during World War II. In October 1945, when Taiwan was restored to China, the hospital in a rather critical condition was taken over by the National Taiwan University. After the restoration, the most urgent needed reconstruction of war damaged buildings was financed by the Chinese Central Government. This rehabilitation merely brought the hospital up to its pre-war ordinary operation. Modernization efforts were carried out in the following years by various projects.

In order to achieve better nursing and teaching, the present U.S. medical system was introduced in the summer of 1948 in place of the former German-Japanese one. The nursing service was also reorganized in that year.

In 1950, the two departments of surgery and the three departments of medicine were merged into one department to avoid unnecessary competition and

duplication. All clinical laboratories and sterilized utilities maintained and supplied by each department were also centralized in that year. A new two-story building for the central supply service was constructed in March 1962 at the rear of the hospital.

An integration of five operation suites of different departments was completed in 1955. A recovery room and operation suites were completed in 1958 and in 1962 respectively.

A series of new divisions have been completed in the last fifteen years; these are a new X-ray diagnostic center, a physical medicine and rehabilitation building, an emergency service building, a neuropsychiatric building and a diagnostic laboratory building in 1953, 1958, 1962, 1964 and 1968 respectively.

All are located on the hospital site. The following institutions have contracts with the 865 bed hospital:

1. The Municipal Taipei Public Health Teaching and Demonstration Center (in a two-story building completed in 1960).
2. The Municipal Taipei Children's Mental Health Center (in a two-story building built in 1956).
3. The Provincial Taipei Tuberculosis Control Center (in a six-story building built in 1965).
4. The U.S. Navy Medical Research Unit Number two (NAMRU-2) (in a four-story building modernized and added in 1962).

LOCATION AND SITE OF TAITA HOSPITAL

Taita Medical College and Taita Hospital are located just north of the East Guardhouse. The two sites are separated by a main north-south traffic

way which was originally the site of a wall of the ancient city. Today this previously walled area has been developed into the political, academic, commercial and communications center of Taiwan.

The location of the Taita Medical Center, including the hospital and medical college, is now bordered on the east by the Executive Yuan, Legislative Yuan, National Bureau of Standards, a vocational school and a girls' high school; a primary school, a municipal swimming pool, and the National Guest House are at the southern perimeter; a city park with a museum, a music stage and library, and a few office buildings are at the west side; and office buildings and the Taipei Municipal Council House are at the north. Located within a half mile wide belt around the Medical Center are lots used for governmental offices, many banks, several schools, and three universities.

The hospital and the medical college land areas are almost the same size. The site of the hospital is a rectangular block, 1285 feet between the north and south lines of the right-of-way, and 595 feet between the east and west lines.

Because the hospital is located at the bottom of the Taipei basin, the land is rather even and flat.

LOCATION OF TAITA HOSPITAL

	Taita Hospital		Major Traffic Way
1	Taita Medical College		Minor Traffic Way
2	Taita (Taiwan University)		Railroad
3	Taita Law College	14	National Guest House
4	National Bureau of Standards	15	Presidential Office
5	Legislative Yuan	16	The Supreme Court House
6	Control Yuan	17	Botanical Garden
7	Executive Yuan	18	Provincial Post Hospital
8	Taipei City Council	19	Provincial Teachers' University
9	Taipei Municipal Government	20	Municipal Hospital
10	Taipei Railroad & Bux Complex	21	Taiwan Sanitarium
11	Provincial Taipei Hospital	22	Air Force Hospital
12	Provincial Railroad Hospital	23	MacKay Memorial Hospital
13	Taipei New Park		



Fig. 1. Site of Taita Hospital

CHAPTER III

THE PRESENT TAITA HOSPITAL

EXISTING HOSPITAL PLAN AND BUILDINGS

The hospital had been developed according to a master plan before the end of World War II. The construction of the hospital began at the southern section of the site and then expanded northward in north-south facing rows of buildings. The first two rows accommodate the administration and out-patient department. These have two stories above and one story under the main floor. Then come two, two-story inpatient wards, and two, four-story inpatient wards which also contain research laboratories and doctors' offices. Beyond the doctors' offices there are a four-story dormitory and a four-story laboratory building. The former faces east and west, the latter is an L-shaped structure mainly facing north and south. The good points of the master plan were that all new additions to the north of the hospital would not affect the normal operation of the whole hospital, and the hospital could be expanded northward according to its financial resources and the need of bed-space. All the buildings except the four-story ones, have wide arcades around a central block of rooms. This design is used to avoid direct sunshine and tropical storm weather, and to promote natural ventilation and natural lighting. For preventing dampness the main floor of each building was raised to different elevations. The main floors of the administration and out-patient department are 9 ft. 7 in. above the ground and those of the two- and four-story patient wards are 6 ft. and 4 ft. 6 in., respectively.

These parallel rows of buildings are connected by a central corridor. Because of the different levels of the main floors, the fifteen feet wide

central corridor slopes down northward. This sloping corridor is used not only to connect different levels, but also limits the available visual distance and therefore shortens the length of the corridor psychologically.

For the open pavilion arrangement of the hospital, brick walls have been used as fences to assure the security of the hospital. This plan also provided only one main entrance for all medical personnel, employees, visitors and students. There are side gates used for service vehicles only. The central corridor has therefore become a main traffic line for both persons and supplies, and the corridor in each wing has become a branch line.

Before World War II, the most popular vehicle in Taiwan was Jinrikisha. Cars were scarce. Therefore, no special parking area for jinrikishas was provided and parking problems are now troubling the hospital. The only available parking areas are in front of the main entrance and the northwestern corner of the site.

The structure of these buildings built before 1945 is brick bearing walls and columns, and reinforced concrete floor slabs. Some temporary buildings like a dormitory and morgue are of wood or brick structure.

After World War II, a developing and renewing movement from war damages took place. Because of insufficient funds, and little financial aid all new structures were of one or two stories, with few rooms. On the other hand, for lack of a redevelopment plan, these additions have become unorganized, scattered buildings around the site.

In the recent years, because of the change of the financial aid policies of both the local governments and foreign countries, the hospital is getting more and more aid and constructing higher and higher, bigger and bigger buildings. Yet the hospital is still being developed in a planless procedure.

Most of the green areas between the nursing units, especially the sections along streets, are now occupied by low and high, small and large buildings. If a master plan of the hospital cannot be decided upon soon, the more additions it has, the more troubles it will have.

UTILITY AND CIRCULATION SYSTEMS

If one considers the arrangement and types of buildings composing the hospital, some of the utility systems must be understood.

The storm sewer system is made up of a set of open gutters, which surround each of the buildings, leading to the covered storm sewers along the right-of-ways of the site. Then the storm sewers are connected to the underground storm mains leading to the nearby Tamshui River.

The sanitary and storm drainage systems at Taipei are combined into one system. No special main pipes are used for sanitary wastes. Yet the pipes inside the site are separated. Wastes should first travel through septic tanks before going out to the main pipes. These sanitary sewer pipes and septic tanks are buried under the ground around each building.

Water used in the hospital is mainly supplied by the city's water mains which are available along the two north-south main streets. The water lines in the site, connected to the city's mains, form a loop or network system. These water lines are buried, and they circle each building, with branches bringing water into every part of the hospital. Two water pumping and pressure stations with water towers were added to the site by the city for use in case of water shortage.

An electric power and transformer station was built in the center of the buildings. The station has two inputs to its transformers from outside

high-voltage lines. One of the inputs is exposed high tension wires and the other is buried in the ground. From the station, low voltage lines go out to the distribution station of each wing. By those individual distribution stations, electricity reaches every point in the hospital. The system used in the electric lines is a branching pattern.

There are some new additions, which receive electrical power directly from the city's high-voltage lines without going through the hospital power station.

The original design of the hospital aimed at natural ventilation and cooling, for the hospital had no cooling system. A poor heating system was operative only in offices and treatment rooms, not in the wards. After renovation, heating was extended to the wards. The main and branch pipes for heating were installed on the ceiling of the central and wing corridors, respectively. Cooling facilities are still inadequate. Only some rooms, such as operation and delivery rooms, have their individual air conditioning services.

The central storage and supply rooms are located at the north (the rear part) of the hospital, and the main entrance is located on the south (the front part). Because of this situation, all supplies and personnel utilize this covered two-story (ground floor and first floor) central corridor as the only horizontal passage. The central traffic corridor and wing corridors are now providing an important horizontal circulation system. As to the vertical circulation system, there is one elevator located near the central corridor in each linear row of buildings for transporting supply carts and wheel-chair patients from floor to floor. New multistory constructions have more than two elevators; the number depends upon the number of stories. Since the buildings

constructed before World War II are not more than four stories high, the main vertical circulation facility available for medical personnel and visitors is the staircase.

Other utilities, such as communication systems, are mostly installed uncovered on the ceilings of the central and wing corridors.

DISTRIBUTION OF NURSING BEDS

The distribution of the 865* nursing beds is as follows:

<u>Department</u>	<u>No. of beds</u>	<u>% (1)</u>	<u>% (2)</u>
Medicine	232	26.8	28.6
Surgery	225	26.0	27.8
Obstetrics- Gynecology	103	11.9	12.7
Pediatrics	81	9.4	10.0
E. E. T.	61	7.0	7.5
Psychiatry	55	6.4	-
Urology	34	3.9	4.2
Emergency	30	3.5	3.7
Eye	29	3.4	3.6
Dermatology	8	0.9	1.0
Dentistry	<u>7</u>	<u>0.8</u>	<u>0.9</u>
Total Number of Beds	865 (1)	100.0	-
	810 (2)	-	100.0

(1) Including nursing beds in the psychiatric building.

(2) Excluding nursing beds in the psychiatric building.

* Another one hundred beds in the Provincial Tuberculosis Control Center.

BUILDING		STORIES	YEAR CONSTRUCTED	MAIN FLOOR HEIGHT ABOVE GROUND
A	Administration	3	Early 1900's	9 ft. 10 in.
B	Outpatient Dept.	3	Early 1900's	9 10
C	Nursing Units	2	1924	6 7
D	Nursing Units	2	1924	6 7
E	N.U., Teaching, Labs	4	1942	5 0
F	N.U., Teaching, Labs	4	1942	5 0
G	Power Plant	2	Early 1940's	1 7
H	Dormitory	4	1942	1 7
I	U.S. NAMRU-2	4	1942 & 1962	1 7
J	Radiology Dept.	1	1954	1 7
K	Diagnostic Bldg.	8	1968	9 5
L	Pub. Health Demon.	2	1960	1 7
M	Rehabilitation	2	1963	1 0
N	Child. Mental Health	2	1956	1 7
O	Psychiatry	6	1964	4 7
P	Lecture	3	1960	4 7
Q	Emergency, Surgery	4	1962	9 10
R	Delivery, Nursery	1	1955	6 7
S	Ct. Sterile Supply	2	1962	1 7
T	Dietary Dept.	1	Mid 1950's	1 7
U	T.B. Center	5	1965	9 5
V	Dormitory	2	1960	1 7
W	Morgue	1	Early 1960's	1 0
X	Power Station	1	Early 1960's	6 7

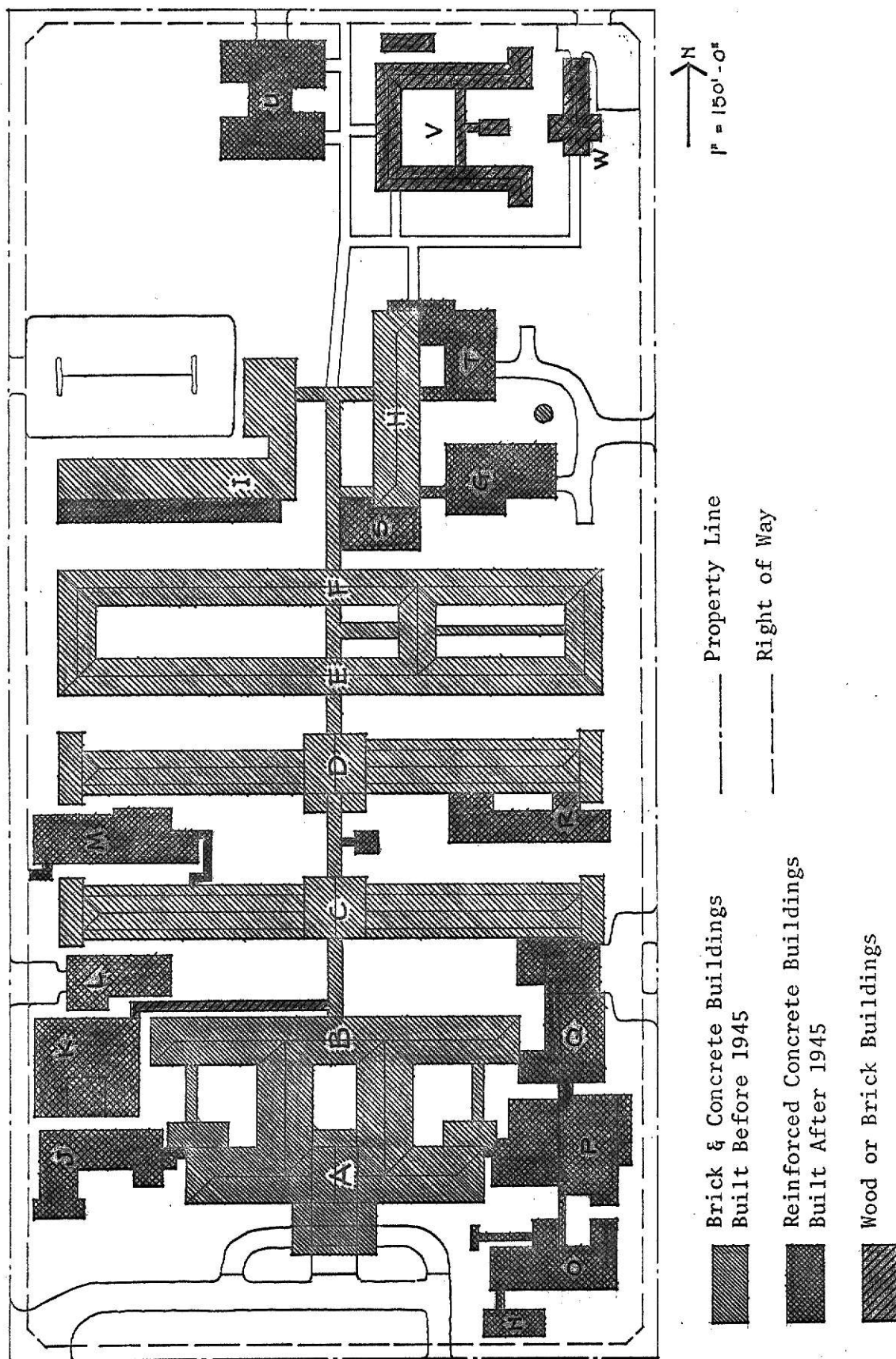


Fig. 2. Existing Buildings

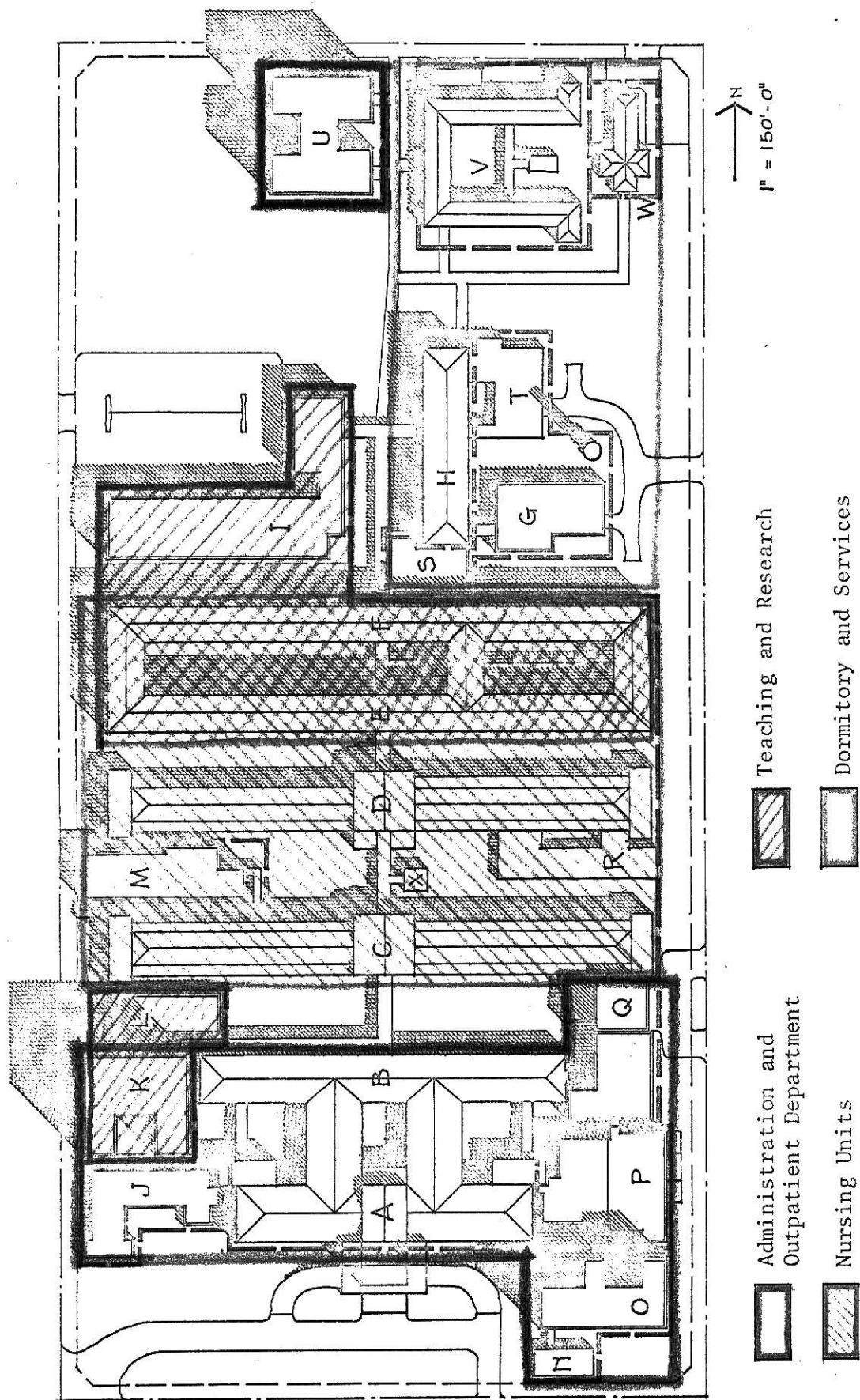


Fig. 3. Present Zoning

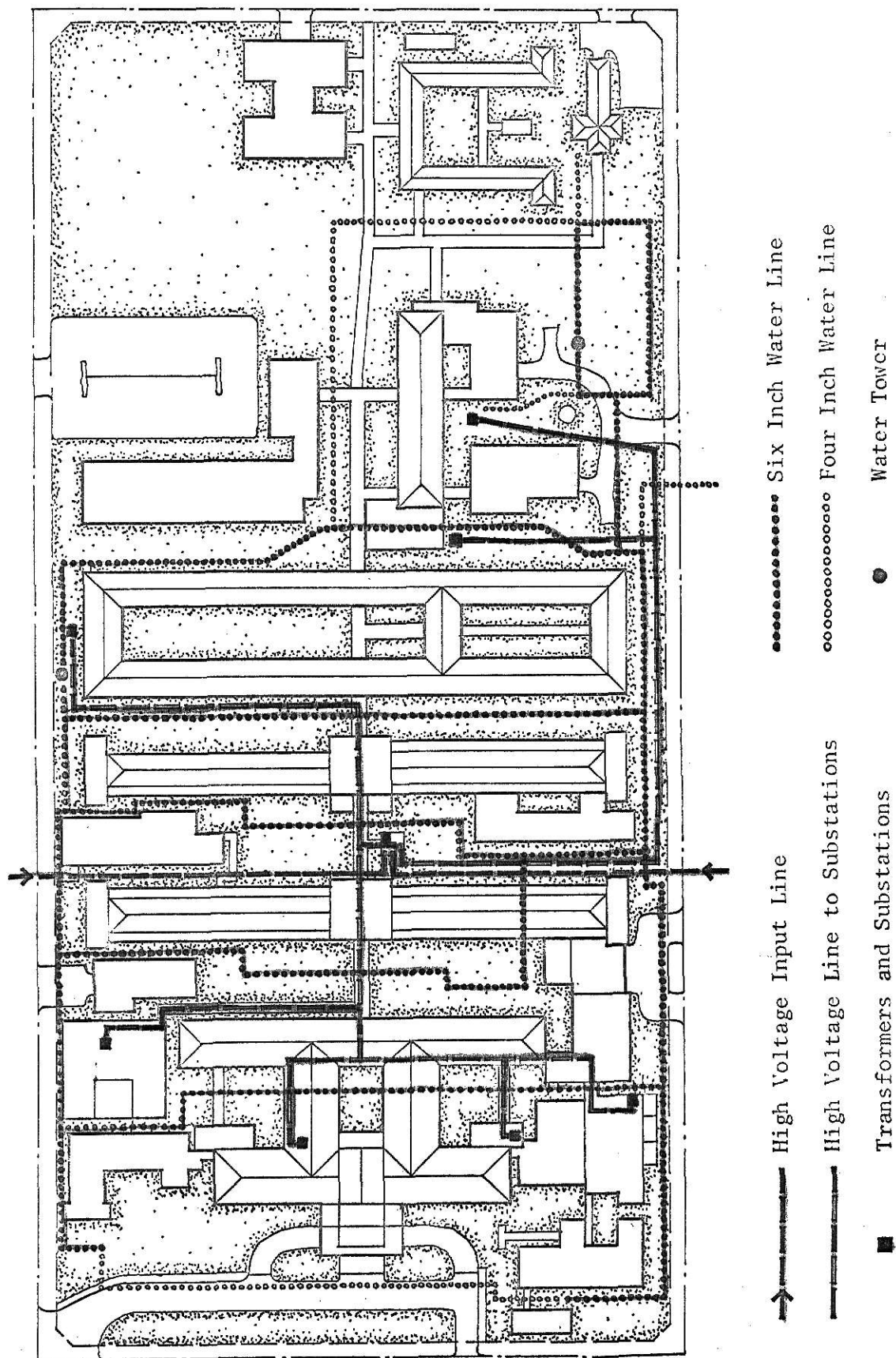


Fig. 4. Utility Systems

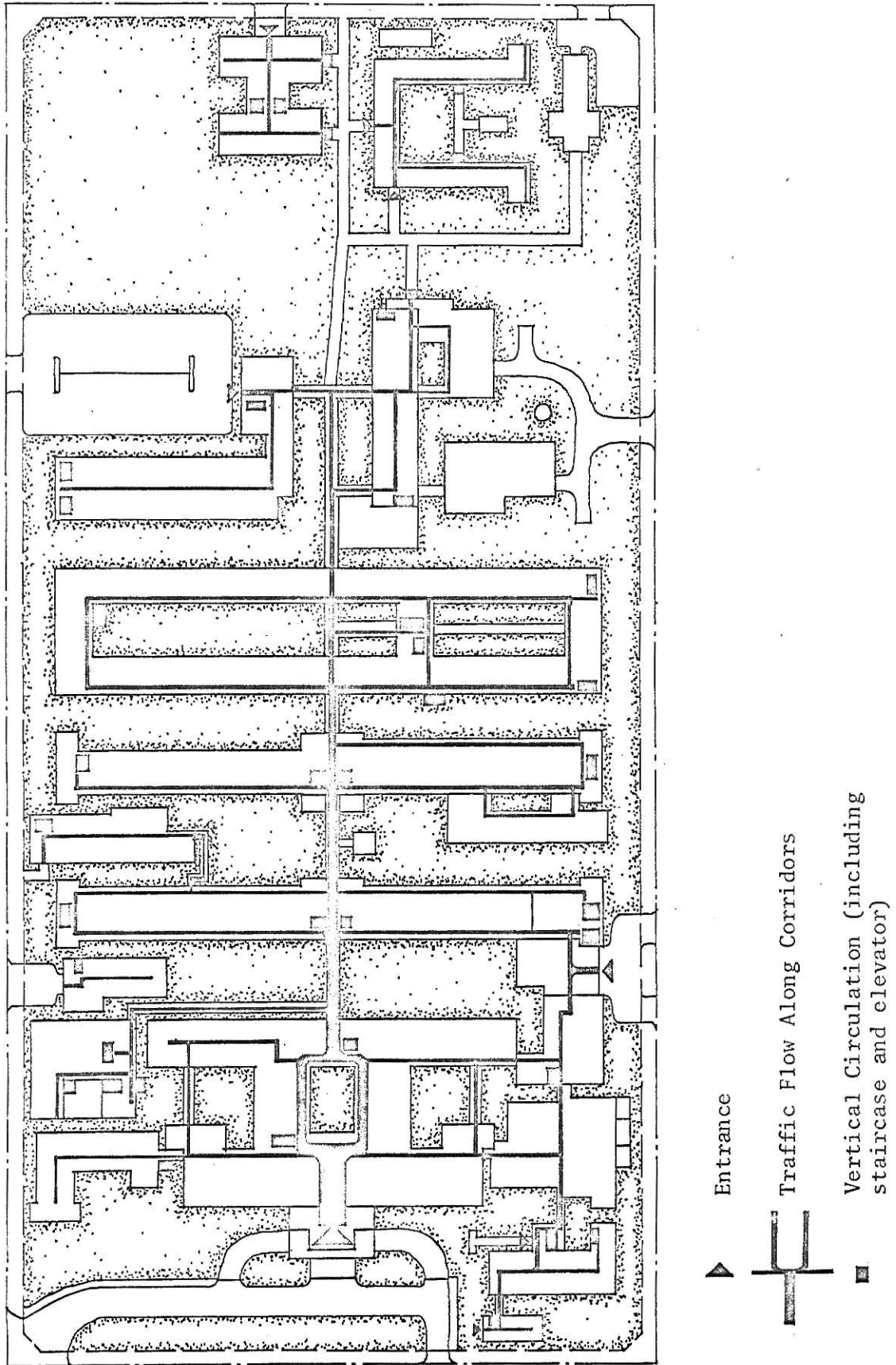


Fig. 5. Present Main Floor Circulation

CHAPTER IV

CURRENT TRENDS IN HOSPITALS

THE CAR AND MECHANICAL EQUIPMENT

IN HOSPITAL DEVELOPMENT

Progress in transportation and communication has changed the relations between the hospital and community, medical personnel, and patients. Progress in transportation has widened the radius of a hospital's service circle and has increased the mobility of medical personnel and patients, therefore escalating the service ability of medical personnel and increasing the number of patients. On the other hand, the convenience of transportation has also produced the concentration of patients and the shortage of parking facilities for both medical personnel and visitors.

The convenience of communication has saved much time on transportation and has sped the transferring of messages and the exchanging of ideas. It has made personal and business contacts possible without face to face communication. This progress therefore has increased working efficiency and saved much manpower.

The change of viewpoint concerning air conditioning, from a luxury facility to a basic hygienic necessity, has influenced hospital design also. By increasing the use of air conditioning, hospitals are becoming more enclosed than before. An enclosed space is not only necessary for easier control of temperature and moisture, but also for better control over noise, dust, insects, germs and other problems.

To accommodate the rapid increase of patients and the shortage of space for new equipment, hospitals must expand their size. Especially for those

located in urban areas, the need of expansion and development is urgent.

The development of transportation also increases parking problems. Large areas are needed to accommodate the increase in private vehicles. The expansion and parking problems are forcing hospitals to grow upwards, and the improvement of vertical transportation and building techniques are also encouraging the use of high-rise building.

In the last decade, computers, monitors, closed circuit television, filing systems, and other such equipment and procedures have been widely accepted by hospitals.¹ Mechanical devices, both in management and in medicine, are becoming more and more important.

The use of machines has increased the demand for technicians and decreased that of physicians proportionately. Most clerks because of low efficiency, low accuracy, and high wages, can and will be replaced by machines. The spaces originally used as office rooms will gradually be taken over by machines.

Because of the rapid improvement in technology, the possibility of installing new equipment and remodeling existing equipment in buildings is becoming an important consideration. Some structural systems in recent years are mainly designed to meet this technical demand.

PARKING AND HELIPORT PROBLEMS

Mass transportation methods have been greatly developed; yet they are still not as convenient as private vehicles. Mass transportation vehicles are

¹Jean W. Prognier, "The New Hardware," Progressive Architecture, Feb. 1969, pp. 118-121; Robert M. Cunningham Jr. (ed), "Computer Systems Spread to Patient Care," Modern Hospital, Nov. 1969, pp. 84-107.

still not feasibly operated within limited areas, or applicable when a passenger has to go to a special destination. The most popular and convenient method is by private vehicle. Yet the main problem is where a car can be parked at its destination. The problem of parking space is becoming more and more serious. This trouble also affects hospitals. Those located in populous and limited areas are already facing this serious problem and are restricting the number of cars. Those in suburban areas, for lack of available public transportation and therefore increasing private vehicles, are struggling with the parking problem too. The increasing need of parking areas is forcing most hospitals to build multi-level parking garages whose construction costs are several times more expensive than those of ground parking.

Newly designed hospitals should have at least one parking stall per patient's bed. The ground parking areas can be altered to multi-story parking garages in the future to accommodate the increasing number of vehicles.

The most important solution to the parking problem is to operate more convenient public transportation provided by the city or private ownership for the public and by the hospital for its medical personnel and employees.

For alleviating traffic congestion, speeding up of medical service, and increasing a hospital's service circle, other means of transportation should be found. After the commercialization of helicopters, they are being gradually used to serve as ambulances.² For the future, every hospital should have at least one helicopter port, whether it is on the ground or on the roof. The port should be so located that patients can be easily moved into the emergency service area.

²John T. Foster, "Helicopters Make Sense in Medical Care," Modern Hospital, Feb. 1969, pp. 78-82.

SHORTAGE OF MEDICAL PERSONNEL

The problem of medical personnel shortage is becoming serious. The basic method used to relieve this problem is to educate and train more skilled personnel in medicine, nursing and technology.³ There is a need not only to change the policy of health education, but also to encourage people to study medicine by means of decreasing enrollment fees. Though this is the most effective system, it will take a long time to reach this objective. Before the problem can be solved, designing hospitals which can more efficiently use the available medical personnel and equipment is important. Increased mechanization and systemization is also easing the need of medical personnel.

In general, the vertical transportation equipment available today is more convenient and more efficient than that of horizontal transportation. Yet this does not mean that a vertical transportation system is more effective than a horizontal one. Therefore, neither a high-rise nor a broad building indicates a well functioning structure.

In hospital design, the functional relationships between departments, medical personnel, and visitors should be carefully studied. The go-and-return time of medical personnel between inpatient and outpatient departments, or laboratories and nursing units, or doctors' offices and patients' rooms should be shortened. So should that of patients wheeled around from patients' rooms to examination and treatment rooms and to laboratories. The less time medical personnel consume in transportation, the more time there is available to use for patients.

³Peter J. Farago, Elizabeth W. Seigel, and John E. Robinson, "Hospital College Program Taps New Manpower Source," Hospitals JAHA, Sep. 1, 1969, pp. 73-76.

RISE IN EMERGENCY-SERVICE VISITS

During the past thirty years the usage of emergency rooms in general hospitals throughout this country has been on a striking and constant increase. This is not the result of a parallel increase in the rate of accidents or critical illnesses, but rather a redefinition of hospital usage made by the public. The emergency room now is "the place where twenty-four hours a day care can be obtained no matter what the urgency."⁴ The public has made this redefinition because (a) transportation is not a problem; (b) the hospital is always open; (c) it is easier to find a doctor at a hospital than any other place; (d) all the necessary equipment for diagnosis and treatment is available at the hospital; and (e) many health insurance policies cover visits to the emergency rooms.

Other factors also stimulate the use of emergency departments. It has been well summarized⁵ as:

- @ Mobility of the population (the patient does not have a personal physician or cannot contact his personal physician in case of illness).
- @ Large concentration of low-income groups in metropolitan areas.
- @ The bypassing of physicians' offices and direct use of the hospital emergency service either because the patient has difficulty finding a physician at night or on weekends and holidays or because the patient does not wish to inconvenience his physician.

⁴John H. Knowles (ed.), The Teaching Hospital (Cambridge: Harvard University Press, 1966), p. 81.

⁵Michael H. Silver, Richard F. Manegold, and John E. Gartland, "The Emergency Department Problem," JAMA (The Journal of the American Medical Association), Oct. 24, 1966, 198:146.

- @ Availability of round-the-clock care without any appointment.
- @ The realization by many physicians that hospital facilities for diagnosing and treating certain conditions often are better than those in their own offices.
- @ Increased use of emergency departments by physicians as an "after-hours office."
- @ The tendency of industry, schools, police and fire departments to refer sick or injured persons to hospital emergency departments.

Above all, it seems difficult to find out a reasonable way to slow down the tendency. The way to meet the trend is to enhance the service of the emergency department, and make available evening care in hospital.

CARE-NEEDS DURING EVENING-HOURS

For the urban hospital in particular, the influx of patients needing emergency service has reached the dimension of a potential crisis. At some institutions, the growth since World War II has been several hundred per cent, with two-thirds of the patients medically classified nonemergency.⁶

Concentrating in the inner city are low-income families. The people in these low-income families are usually of the working class, and need a babysitter and an automobile. If seeing a doctor is not extremely necessary or a disease is not too serious, workers will not come to hospitals until after their work-hours to avoid losing their day's wages; wives and children will not be hospitalized until children can be taken care of, or transportation means are available. Most patients in a low income group can go to hospitals

⁶Herbert Paris and Desmond Callan, "City Families Need Hospitals That Offer Full Outpatient Care at Night," Modern Hospital, Jan. 1968, p. 88.

freely only after worktime or in the evening. At that time, only emergency departments are still available. This has been one of the main reasons of the rapid growth of emergency visits. To decrease these visits, the need for clinics for those in low-income families is obvious.

According to the present situation in society, hospitals cannot expect the heavy evening load at the emergency door to diminish. It is more likely to increase, as poverty and social disorganization increase in the inner city. It is therefore necessary to create special areas within or near the emergency station for care of acute, nonemergency, nonaccidental cases. Some hospitals located in the inner city have already offered special services in the evening, or are extending the office-hours of their out-patient departments to ten o'clock at night.

NURSING UNITS IN HOSPITALS

Mass emergence of semi-private and private rooms in hospitals has been accelerated by the rise in the living standard and the availability of the health insurance systems.

The following new concepts also increase the tendency to use private rooms.⁷

1. The capital used in semi-private and private rooms can easily be recovered by higher admission fees.
2. The occupancy rates of semi-private and private rooms are higher than

⁷ Herbert McLaughlin, "All Private Room Units: They May be an Unexpected Bargain," Modern Hospital, Mar. 1968, pp. 100-103; Michael L. Bobrow, "Design Innovations for Single-bed Rooms," Hospitals JAHIA, May 16, 1968, pp. 55-59; Gary Silvers and Warren G. Harding II, "Semi-private Rooms Are Not Bad, These Patients Told Surveyors," Modern Hospital, July 1969, p. 63.

that of wards because the segregation of patients by ages, sexes, races, and diseases are fewer or unnecessary.

3. The patients' privacy is greater and hence the conversation between patients and medical personnel and guests becomes easier.

4. The number of a doctor's or nurse's call can be reduced from semi-private or private room because there will be fewer or no subsequent calls from the other patients in the same room if a doctor and/or nurse appears.

5. Friction between patients' personalities in a semi-private or private room can be decreased or prevented.

6. A private room can be used as a treatment and examination room without wheeling the patient to another room to obtain nursing and medical needs.

Today a semi-private room with a folded partition seems to be basic for the nursing unit. More and more private rooms are now becoming available in high living standard areas. Some newly designed hospitals have only private rooms.

If only private rooms are available in a hospital, the patients will therefore be forced to be lonely and to pay higher fees.⁸ Once a disaster happens, the hospital cannot easily accommodate the excess patients because of the limited room area. In a semi-private room other patients can be easily admitted by simply adding an extra bed in each room.

The pattern of nursing units is changing. A typical traditional nursing procedure is to arrange patients' rooms along a corridor, and to have one or two concentrated nurses' stations on each floor. A new trend is to

⁸Fred J. Cook, The Plot Against the Patient (Englewood Cliffs, N.J.: Prentice-Hill, Inc., 1967).

decentralize a large nurses' station into several small units. These small units can be located along a nurses' corridor; such areas are called nursing support areas which are mainly designed for use by medical and para-medical personnel. Other special corridors, in most cases, are used for visitors only. This arrangement requires fewer nurses because this area is smaller. The number of nurses at each nurses' station will depend upon the patients' needs for nursing. Using this arrangement, nurses can save some time now consumed in traveling and gossip, and can have more time to communicate with patients and to do their nursing work.

Another type of nursing unit is emerging especially designed for patients in a critical condition. This new nursing unit is usually called an intensive care unit. In each unit, a special designed nurses' station is equipped with many different monitors for each patient. In this station, the nurses can understand each patient's condition from reading monitors and looking into each patient's room.

EMPHASIS ON PREVENTIVE MEDICINE AND ON MEDICAL RESEARCH

Man has successfully struggled with diseases. Some one-time fatal or incurable diseases become general easy-care ones, and some once unknown causes of death have been discovered. Yet some common illnesses are still incurable and uncontrollable medically, or cannot be rooted out, or can be eradicated only by using special devices to overcome the malady. Some examples are color blindness, influenza, diabetes, cancer, diseases of the eyes and heart, caries, and hard of hearing. More study and research in these fields should be done in the near future to discover basic cures for these diseases.

Some newly developed ideas, such as hibernation and transplants, to

lengthen man's life and renew his organs have many problems ahead medically and technically. Medical research in hospitals is therefore being emphasized.

Therapy is no longer the best way to maintain health. Therefore, the role of a hospital today is changing from curing to preventing diseases.⁹ Infectious, mental diseases and degenerative diseases are detectable through routine physical and mental examination. As more complete routine examinations are performed, more diseases can be prevented or cured in their early stages. The burden of motivating the examination will be loaded on the shoulder of the public health division.

Public health and medical research are becoming two of a hospital's main functions.

NUCLEAR ENERGY IN FUTURE HOSPITALS

The development of nuclear energy has benefited medical treatments. Nuclear power will not only heat and light the hospital of the future, but will also provide a host of new diagnostic and therapeutic instruments and tools. A scholarly discussion of nuclear energy in hospitals has suggested a whole new world of uses for nuclear power and its by-products in hospitals of the future.¹⁰

The future hospital will be very large, perhaps 10,000 beds or more; it will be a major center of medical research and treatment; it will be designed to provide rescue and survival operations during disasters, whether created by man or nature. At the heart of this future hospital will be a nuclear

⁹Jan C. Rowan (ed.), "Health Care," Progressive Architecture, Feb. 1969, p. 94.

¹⁰David H. Lennox, "How Nuclear Energy Will Shape Hospitals," Modern Hospital, Dec. 1966, pp. 91-99.

reactor. There are also many suggested uses of radiation for heat and power, in sterilization, and in many diagnostic and therapeutic procedures. Because heavy shielding is required for both the hospital reactor and its associated radiological laboratories, the report also suggested that the reactor must be located below ground. Although building such a mega-hospital may be but rarely possible in the near future, the extensional use of nuclear energy in the existing large hospitals is possible. All newly designed large hospitals should prepare for the possible installation of a nuclear reactor in the future.

LOCATION AND FORM OF HOSPITALS

There is now a trend to build long-term and convalescent hospitals in suburban areas where larger sites, fresh air, green grass, sunshine and quiet are available. Although these sites are far away from populated areas and are usually not as convenient for most patients and visitors, the patients in these types of hospitals are more stable and visitors are rarer than for those in short-term hospitals. Thus suburban sites have comparatively more advantages than those in populous and limited areas for long-term and convalescent hospitals. Patients in those hospitals usually need less nursing but more relaxation. For securing these requirements these hospitals must give a strong feeling of "home-ness" and therefore they are developed horizontally.

As to short-term hospitals, it seems that nobody can lessen the medical visits to these hospitals. Most of the medical visits are short and average not more than ten days. Therefore these hospitals are mainly located in populous areas where they are easily accessible to everyone. The medical personnel are busier and more nervous than are those in long-term hospitals.

Efficiency is important for both medical personnel and patients.

Since most of the hospitals have been established for a long time in one-time suburban areas that have become urban areas, there are limited spaces left for further development. These old hospitals, in fact, need to install new equipment and increase space for medical research to keep abreast of the scientific and technologic advances. To reach this goal, most of the old hospitals in urban areas have been forced to develop high-rise medical and research buildings.

After World War II, a hospital form frequently described as "the match box on the muffin" has developed.¹¹ The in-patients' areas are concentrated and located in the bed tower, the match box; and the diagnostic and therapeutic services are spread out and housed in a broad, expandable base, the muffin. This arrangement has given out-patients a direct access to facilities without using elevators or going through the hospital proper. It also made the expansion of the out-patient department easier. The X-ray, laboratory, and emergency departments are located either with at least one free end or near the so-called "soft" areas, such as lockers and storages, which can be easily replaced to make way for the expansion of the out-patient services.

The hospital form has assumed a relatively stable building type. As time goes on, some situations are changing. The joint use of the diagnostic and therapeutic services by both in-patients and out-patients has worked well as long as the out-patient load has been comparatively small. The increase of ambulant patients in the recent years, however, makes it mandatory that reassessments should be made of the location, accommodation, and effectiveness

¹¹Roy Huderburg, Planning the Community Hospital (New York: McGraw-Hill, 1967), p. 82.

of those facilities. Similar reassessment should also be made of all facilities that provide care to ambulant patients. This match-box-on-the-muffin hospital form, designed for the convenience of machines and their attending technicians, has also been challenged recently by the shortage of medical personnel. The centralization of laboratories and operating rooms in a horizontal base topped by nursing towers seemed the obviously economical way to allocate space. But the wasted time spent by nurses and doctors traveling between surgery and bedside, and the discomfort for patients following the same route, was not considered. Conferences between doctors and anesthesiologists or radiologists were inconvenient, and it was difficult to convey the logic of diagnosis and treatment to students.

A new style in hospital planning is to serve all staff and patient needs from a central administrative - medical core.¹² Patients wait in their beds for surgeons or X-rays, instead of being wheeled to another floor to wait. Doctors spend more time with patients and less time in getting there. And students reap the benefit of multidisciplinary teaching teams.

STRUCTURE OF HOSPITALS

To survive, a hospital must keep pace not only with new knowledge and techniques but also with new equipment and facilities. If the hospital cannot replace old equipment and facilities, then it will deteriorate and fade out. The fewer obstructions of structural columns, mechanical shafts, and waste lines there are on a floor, the more flexible and freer the plan can be.

The structure of a hospital building, therefore, tends to increase the

¹²Alis D. Runge, "The Health Megacenter," Progressive Architecture, Feb. 1969, pp. 110-117.

span of beams and decrease the number of columns. Meanwhile, the space between two floors can be increased to make more space available for ducts, tubes and pipes.

In recent years, a more ambitious structural system has been developed. This system, "large span system,"¹³ will eliminate completely all columns in the floor plan.

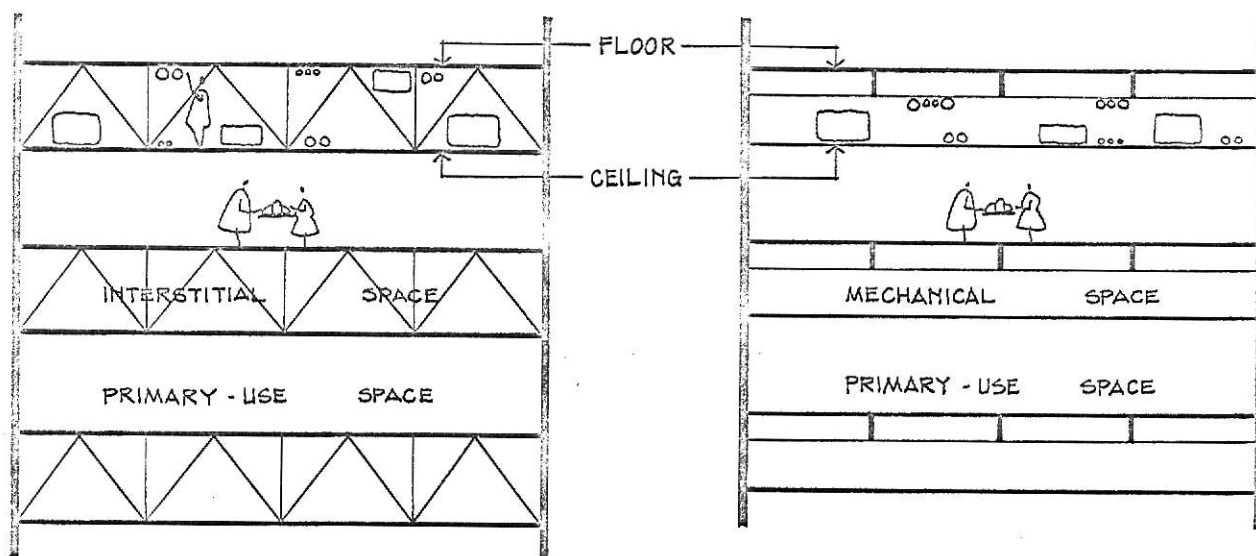
There are two ways to obtain a space without columns. One is to place all columns around the outside walls of a building, and the other is to support floors at two opposite ends. Floors can be supported by either beams or trusses.

The spans of truss systems are usually much larger than those of beams. The higher the truss is, the larger the area the truss can span. To a certain degree, the truss space sandwiched by upper floor and lower ceiling can be very effectively used as an engineering sub-floor, or "interstitial space" distinguished from "functional space."¹⁴

The interstitial space can accommodate horizontally all mechanical, electrical, and plumbing services, and will allow engineers to work inside the space without disturbing normal medical functions. This wide spanned system also eliminates many vertical elements, such as structural columns, mechanical shafts, and waste chutes. The elimination of these elements makes the rearrangement of the floor plan easier.

¹³C. Ray Smith, "Can We Keep Hospitals from Dying?" Progressive Architecture, Feb. 1969, p. 123.

¹⁴Ibid., p. 125.



SIZE OF GENERAL HOSPITALS

The size of a hospital is usually decided in terms of the number of patients' beds, according to economic and managerial limitations. In 1822, Nathaniel P. Russell, the treasurer of the Massachusetts General Hospital, noted: "It is evident that in proportion as the boarders increase, the expense of each will be diminished."¹⁵ Unfortunately this is true only to a certain extent. The average expense of each bed does not always decrease as the number of beds increases. Then, what is the most economic size of a hospital which can still offer the best services to patients. To this question, the Hospital Survey for New York was unable to give an answer except to say:

¹⁵ John H. Knowles, The Teaching Hospital (Cambridge: Harvard University Press, 1966), p. 56.

"The relatively high costs in the voluntary general hospitals of 500 beds and over as a group seem excessive when compared with those of hospitals of 200 to 499 beds. Similarly, the costs of the voluntary hospitals of less than 100 beds, were high for the service they were equipped to render."¹⁶

In over-sized hospitals, costs may be disproportionately high in relation to services rendered. Usually a large hospital elongates the distance of inter-passages and, at the same time, increases the needs of manpower, machines, plumbing, and other facilities. Long distance conveyance also causes a lot of heating, cooling, and pressure loss on the way to their destination. These items increase the maintenance fees. An out-of-size unit also produces difficulty in management, upset of morale, and time-loss on transportation and wheeling; all of which decrease the working efficiency. Or it will mean more manpower is needed. From the above, it is evident a large hospital needs more manpower, more equipment, and more maintenance and, therefore, has a higher operating cost to the in-patient. If a good arrangement can be made not only for the convenience of machines but also for the medical personnel and visitors, then the operating cost of a large hospital would be lower than that of the other hospital groups.

When a hospital grows larger and larger, the organization of the hospital becomes more complicated. The increased complication will produce difficulty in management. In general, everyone's managing ability is limited to a certain extent. There is no special article available concerning hospital size on the point of management. The author dared not say what size hospital is the best for management. But, according to the recent trend, the

¹⁶Ibid.

power of an administrator is decentralizing into several assistants, each of whom is in charge of a part of a hospital. Thus a hospital can be composed of several smaller hospitals. Therefore the size of a hospital can be extended to include up to several thousand beds without much trouble. The appearance of computers and other automatic devices has been of great assistance to hospital management.

Then what are the advantages and disadvantages of a large hospital and of a small hospital? A small hospital can offer more personalized care, more informal environment, and have an easier time determining the financial outlay necessitated by construction. On the other hand, highly specialized laboratory equipment and physician-specialists are less available in small hospitals. Such hospitals seem more suitable for those patients who need just nursing and rest and conventional treatment.

In the last two decades, most of the ambitious and aggressive medical personnel, including doctors, nurses, and medical technicians, tend to concentrate in large hospitals where more new equipment, specialists, and knowledge are available. In this situation the concentration of the medical personnel has stimulated and accelerated the growth of large hospitals into still larger hospitals.

Influenced by the rapid growth of the large hospital, some small hospitals near-by may be affected and then fade and die. To save them from dying, a small one should be renewed or receive some new devices, or be converted into a mental hospital, or a long-term hospital.

CHAPTER V

DESIGN CONCEPTS

HOSPITALS WITHIN HOSPITAL

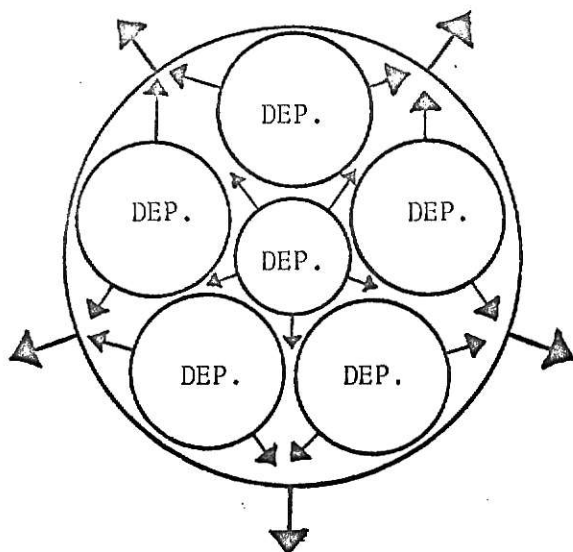
When the population of a hospital service area keeps growing, the hospital should also keep growing to meet the needs of the people. The hospital will then inevitably become a bigger and more complicated organization.

Meanwhile, because of the trend of specialization and the increasing difficulty in management, more specialized and semi-autonomous divisions or departments will come into existence in a large scale hospital.

As a result, each of these specialized and semi-autonomous divisions will be shaped into a specialized hospital, such as a mental health hospital, children's hospital, eye hospital, and cancer hospital. Each specialized hospital can have its own outpatient department and/or nursing units. Yet these hospitals will be tied together to a core of shared adjunct diagnostic facilities, in which operation rooms, X-rays, special laboratories, and treatment rooms are available.

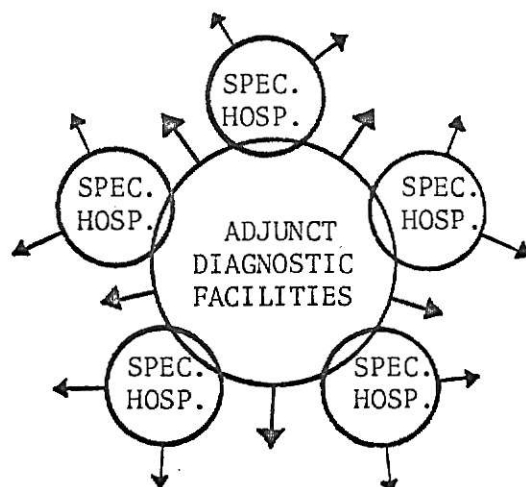
The share of adjunct diagnostic facilities will save the time spent by nurses and doctors traveling between surgery and bedside, to comfort the patients following the same route. It also will favor the conferences between doctors and anesthesiologists or radiologists. Furthermore students will reap the benefits of multidisciplinary teaching teams.

The core of adjunct diagnostic facilities will become a main nerve of the hospital.

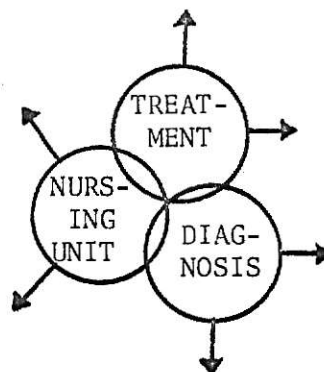


The expansion of each department in a conventional hospital arrangement is difficult.

A new concept is that specialized and semi-autonomous hospitals can expand independently according to their needs.



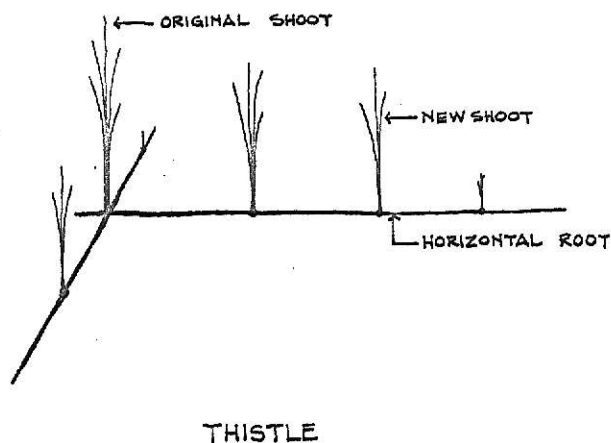
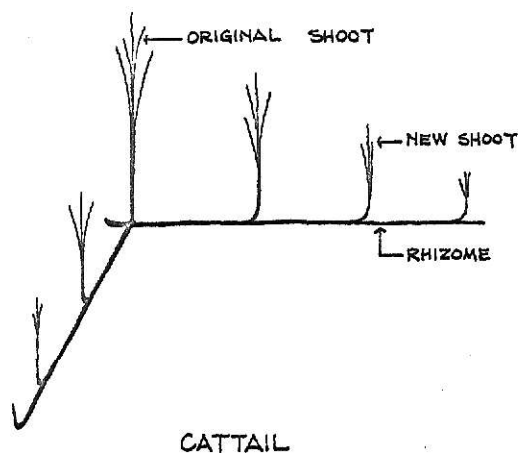
Therefore, within a specialized hospital, each functional division can expand individually.



- NOTE: 1. The size of circle does not indicate the importance or dimension of the indicated division.
2. Arrows show the direction of expansion of each division.

ORGANIC GROWTH

An institution, like a cattail or a thistle, can grow thicker and taller, but can also grow rhizomes or horizontal roots from which shoots arise. The rhizomes or horizontal roots of a hospital are its service and supply corridors. The new shoots are the attached specialized institutions such as a mental hospital, public health hospital, medical research center, rental doctors' offices, and so on. These institutions can be expanded individually without restrictions on the main body.



PARKING CAPACITY AND OPEN SPACE INCREASING

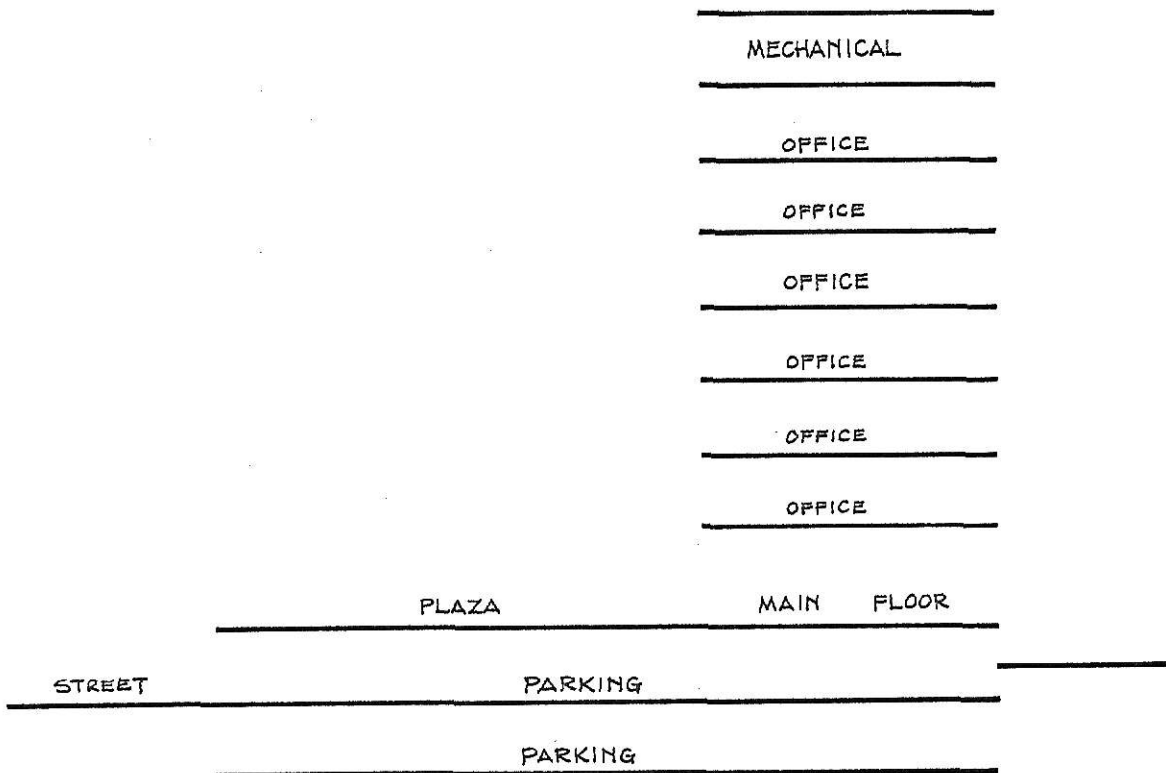
AS HOSPITAL EXPANDS

When a hospital expands, more facilities are needed. In the past we find more land is covered and parking for more automobiles is needed. Then open

space decreases and parking becomes a problem. An ideal situation is one in which both open space and parking area increase as the hospital expands.

In order to obtain more open space, new high-rise buildings must replace existing low ones which usually occupy large land areas. Each new building should have a parking area for the necessary cars relating to its function. It is rarely possible to have land available for ground floor parking around each building. A practical method is to raise the building and have multiple level of parking under it. If a parking structure extends into an open space, the top of the structure should be used in some way.

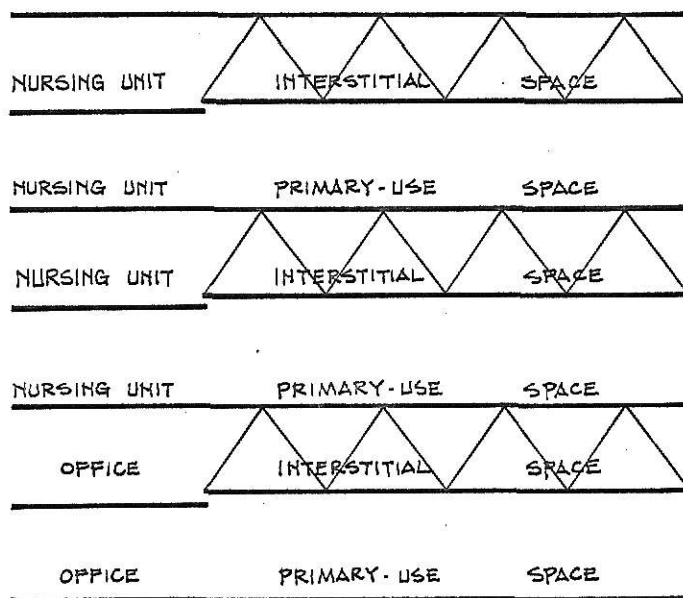
With an ideal situation, more high-rise buildings are built to replace existing low buildings, parking and open space will then become available.



FLEXIBLE SPACE

To meet the unpredictable future of change in all areas of health service (scientific, technical, operational and social), flexibility should be the objective for health facilities.

Obtaining flexible space in hospitals, minimizing the obstruction of structural columns, mechanical shafts, and waste lines is a problem. It can be solved by using the "interstitial space" concept, that is, to utilize deep trusses for large spans housing all mechanical, electrical, and plumbing services in the horizontal space between side-by-side trusses. The space under the interstitial space will be primary-use space. In subsequent adaptations to new functions, therefore, it would be unnecessary to vacate the floors above and below when changes in the mechanical systems were required, or even to vacate the rooms to the side.



Mechanical, electrical and plumbing services of nursing units and offices are less subject to change and less space is needed than for clinics, surgical suites and laboratories. The total floor-to-floor height of a primary-use space (the ceiling height nine to eleven feet) with an interstitial space (the clearance six to seven feet) added is roughly the same as that of two nursing or office levels (with the ceiling height eight feet for each level).

CHAPTER VI

PROPOSED MASTER PLAN

A nursing-diagnosis-treatment complex is designed to be the nucleus of the hospital. Located at the center of the site, it is closely connected with other health-care facilities. It contains the outpatient department at the lower levels and the nursing units surround a core of adjunct diagnostic facilities on the upper floors. Also located at the center but north of the central complex is a teaching-research group, converted from the present four-story nursing-teaching-research building and another four-story one used as a U.S. navy medical research unit. The arrangement of the central complex and the teaching-research group is designed for the convenience of communication between medical and paramedical personnel and also practical medical personnel and researchers.

At the south part of the site are a mental health center and a rehabilitation-radiotherapy center which have been developed from the existing neuro-psychiatric building and diagnosis-research building, respectively.

A public health control and research center located at the northwestern corner of the site will be developed from the existing tuberculosis control center.

A dormitory, a power plant, and a central supply storage area will be either relocated or expanded at the northeastern section where they are.

Three main plazas covering parking levels are planned for the hospital campus. The principal one will be on the south facing the central complex and between the other two centers. The second one will be at the northwestern corner and will be connected with the public health center and the teaching-

research group. And the third, located at the northeastern corner, will be next to the dormitory.

The parking area under the south plaza has four levels. The two underground levels will be mainly arranged for medical-paramedical personnel and the other above-the-ground ones, for visitors and patients.

Each main building will have a sub-basement service area and a mechanical space above the basement. Main service tunnels will be located on the sub-basement level radiating from the area of the central supply storage and the power plant. These tunnels will go along the north-south central line and the two paralleled right-of-ways for each sub-basement or basement service area. Each tunnel will accommodate a personnel corridor and an ACTS tunnel¹ in which supply pipes and lines, an automatic cart system, and pneumatic tubes will be housed. The personnel corridor will connect mainly with the service area, but the automatic cart will go into the upper part of the sub-basement or basement service area. These supply pipes and lines will turn into the ground floor mechanical space of each building and then go vertically or horizontally into the other interstitial spaces. Also, two passages will be tunneled to connect the southeastern part of the hospital with the campus of Taita Medical College.

The main entrance of each individual building will be from its nearby street. There are second entrances accessible from parking levels. A service road has been designed to go through the northeastern section of the hospital.

The nursing-diagnosis-treatment complex, as mentioned above, has a central supply service level (sub-basement) and an emergency department level (basement), and is planned to have two levels for the outpatient department. Above

¹"Drive-in Hospital is Planned for Cologne," Modern Hospital, Dec. 1966, p. 72. (Automatic Cart Transportation System)

the outpatient department, there are five more levels for operation suites and ten nursing floors that accommodate fourteen hundred beds. The top of the complex will be reserved as a heliport on which six or more helicopters could be landed at the same time. The complex will be the highest structure of the hospital.

The rehabilitation-radiotherapy center and the mental health center will be expanded from the existing diagnosis-research building and neuro-psychiatric building, respectively.

A new research building for the public health center, using an interstitial space system, will be built on the northwest plaza.

An L-shape dormitory has been designed to have ten residential floors, each wing of which will accommodate more than four hundred persons.

The maximum capacity of the projected hospital is around two thousand nursing beds, with fourteen hundred beds in the central complex, the others will be located in the other three health centers.

The master plan was so worked out that the hospital will still have plenty of space in which to expand. The central complex can expand northward to the site of the teaching-research group; the public health center can have another building on the west side of the present tuberculosis control center; the southern end of the site can be used for one doctors' rental office building. All of these further expansions will not interfere with any other part of the existing hospital, either operationally or mechanically.

CHAPTER VII

PROPOSED FOUR CONSTRUCTIONAL STAGES

PRINCIPLES APPLIED IN THE PROPOSED STAGES

1. During each constructional stage, either construction or deconstruction should not retard or hinder the regular hospital operation. Before a building is dismantled, the patients and/or facilities in it should be well settled.
2. The order of construction should be decided according to the existing needs. Urgently needed facilities should be provided first.
3. Parking areas should be increased after each stage.
4. Temporary settlement or construction should be minimized to the least.
5. Each stage should provide easy access from the streets into the constructional field or area.

STAGE IPreparation

1. Evacuate the institute of Pathology and the school of medical technology from the third floors of buildings E and F, respectively, to the campus of Taita Medical College.
2. Move the patients and facilities temporarily from the east wing of building D (nursing unit of obstetrics) and building R (delivery rooms and nursery) to buildings E and F.
3. Dismantle the east wing of building D and building R.

Construction

1. Construct the northeastern quarter of the central complex. This quarter of the complex will have a capacity of three hundred and fifty beds, forty operation rooms and twelve delivery rooms.

2. Expand the power plant, building G, eastward. The power plant is supposed to supply hot water, cool water, steam, electric power and such things to the whole projected hospital complex.

3. Build a wing of the proposed dormitory.

4. Next to the tuberculosis center, building U, build a laboratory building with two parking levels beneath it.

5. Construct the northeastern network of the tunnel system. The tunnel will house an ACTS tunnel above and a personnel tunnel under.

Relocation

1. Move the nursing units of the departments of surgery and obstetrics-gynecology to the completed part of the complex. Locate the emergency department in the basement.

2. Move the electric power station from building X to the power plant.

3. Move nurses and doctors from the existing dormitories, buildings H and V, to the new one.

4. Convert the evacuated building H to a central supply storage.

5. Utilize the new tunnels as main service-supply routes instead of the existing central corridor.

6. Move the laboratories from building I to the new public health center and transfer the radiology department from building J to K.

7. Consolidate the tuberculosis center (in building U) and the public health demonstration center (in building M) into the public health center.

STAGE IIPreparation

1. Dismantle building Q and the east wing of building C.
2. Dismantle buildings S, J and V.

Construction

1. Construct on the southeastern quarter of the central complex as many stories as seem required.
2. Expand buildings K and O for the rehabilitation-radiotherapy center and the mental health center.
3. Construct the southeastern part and western part of the tunnel system.

Relocation

1. House the pediatric department and expand the surgery and obstetrics-gynecology departments in the new section of the central complex.
2. House the morgue from building W to the sub-basement of the complex.
3. Move the children's mental health center from building N into the new mental health center.

STAGE IIIPreparation

1. Dismantle the buildings N, L, M, W and the west wings of buildings C and D.

Construction

1. Build the western half of the complex.

2. Expand the mental health center.
3. Construct the other wing of the dormitory.

Relocation

1. Move the other inpatient departments and the outpatient department into the complex, from buildings E, F, and A, B, respectively.

STAGE IV

Preparation

1. Remove buildings A and B.
2. Remove the east and west ends of buildings E and F.

Construction

1. Build the parking levels south of the central complex.

After the completion of the designed four stages, the lower levels of the central complex will house the central supply services, the departments for emergencies, for outpatients, and for administration. The upper ones will accommodate the nursing units, the operation rooms, the delivery rooms, the X-rays, and the labs.

Thereafter, the complex will be divided into east and west hospitals with separate entrances. The east hospital constructed during the first two stages, will include the departments of surgery, and growth-and-development (pediatrics and obstetrics). The west one, completed after stage three, will house the divisions of medicine, musculo-skeletal, neuro-sensory, and cardio-pulmonary.

CHAPTER VIII

CONCLUSION

The redevelopment of an obsolescent hospital is just like the performance of a transplanting operation on a patient.

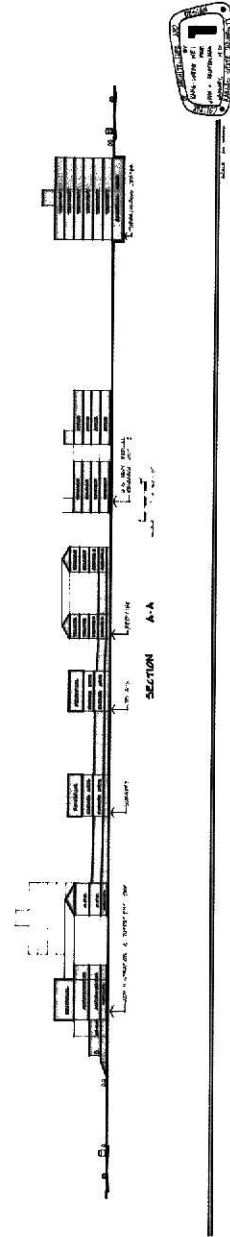
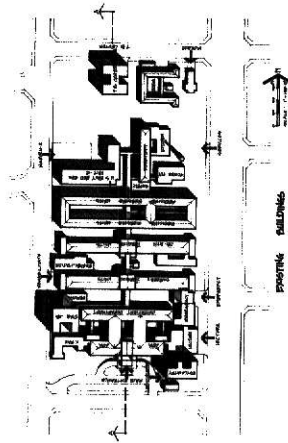
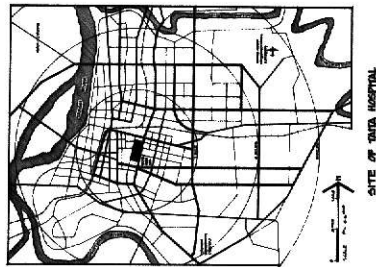
The transplanting operation is a replacing of a dying or useless organ by a healthy organ. If this new organ cannot be kept healthy in the patient's body, the patient is still on the way to death. Therefore, the problem of how to keep the new organ healthy and longlasting should be studied. If the patient can have an artificial organ which can function perfectly just as a natural one would and can be renewed or overhauled after a certain time, then the patient can live the rest of his life with the use of this artificial organ.

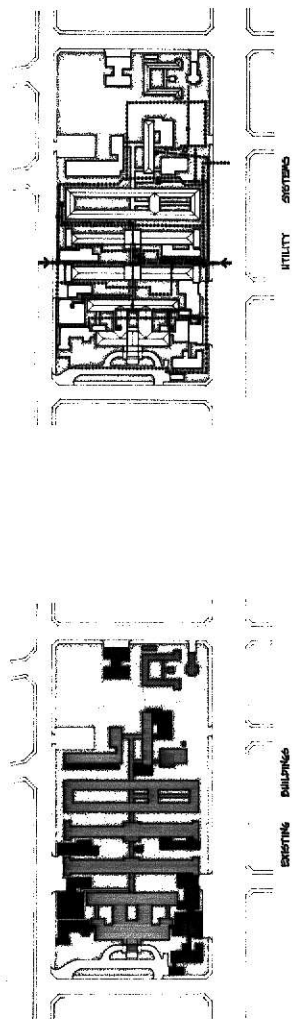
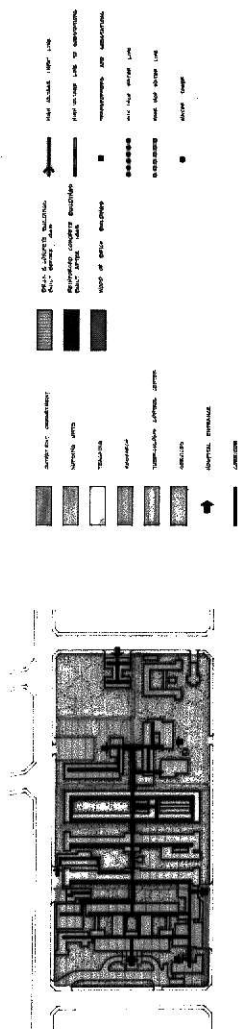
In fact, even if a perfect artificial organ can be found, that does not mean the patient can survive. The process of the operation is an important factor. Any disconnection of his supply system may force all of his other functions to come to a stop. Before disconnecting his artery there should be some sort of substitute to conduct the blood. Therefore careful studies concerning the process of the operation are needed.

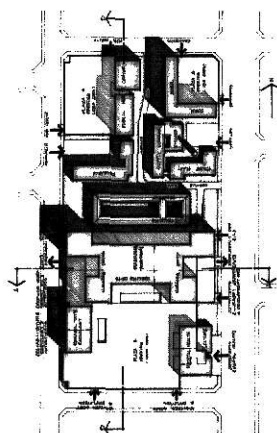
The Taita Hospital in this project was designed to have a flexible master plan to keep it healthy and longlasting. The stages of design were also so arranged that the hospital at any time could be operated with the minimum of inconvenience in its every day functioning.

PRESENTATION

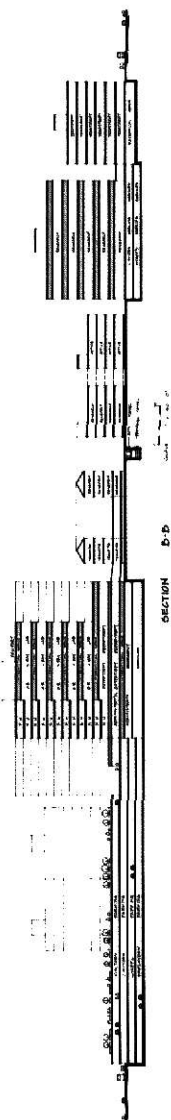
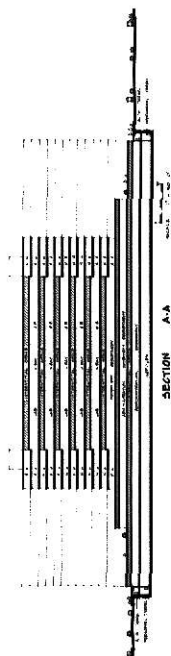
TAITA HOSPITAL



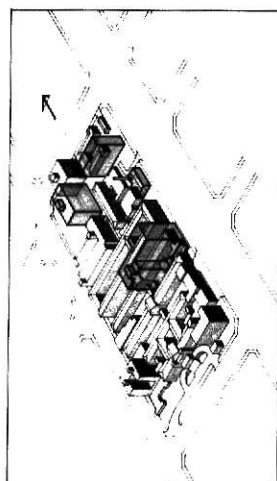




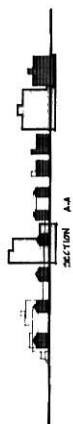
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----



PHASE I



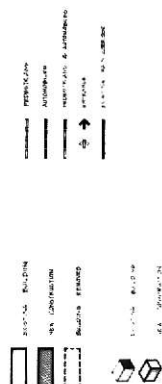
Pathways	Condition	Location
----------	-----------	----------



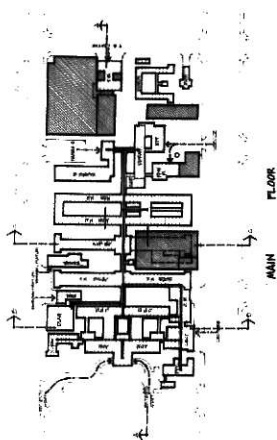
SECTION A-A



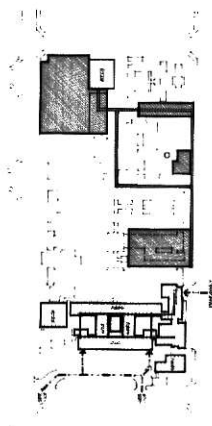
Section B-B



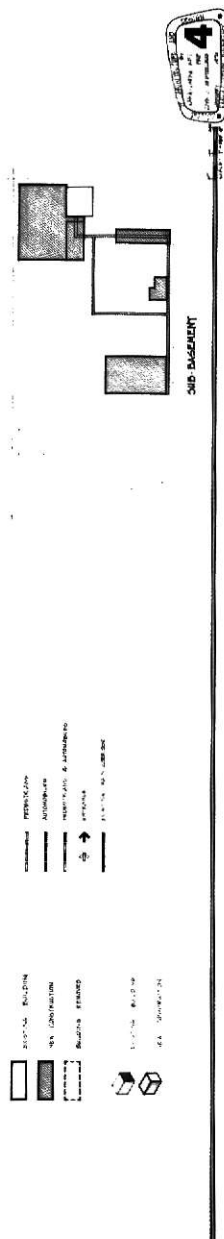
66



MAIN FLOOR



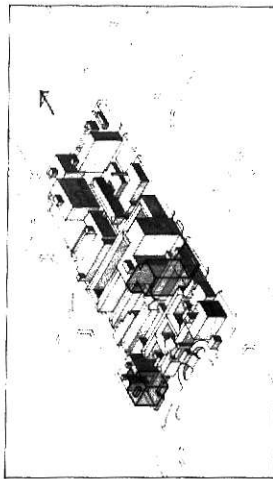
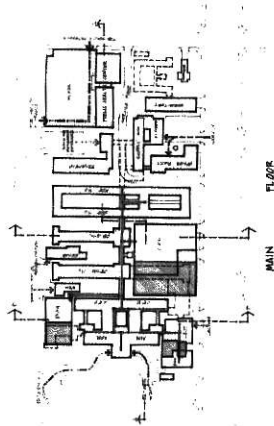
GROUND FLOOR & BASEMENT



INTENT



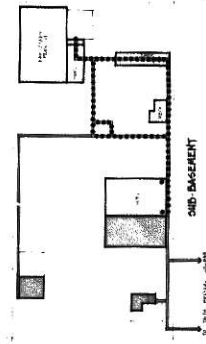
PHASE II



BUILDING AFTER STAGE 1

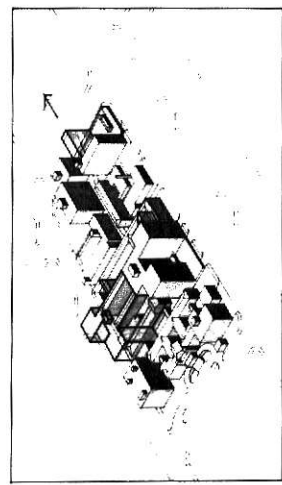


GROUND FLOOR & BASEMENT



5

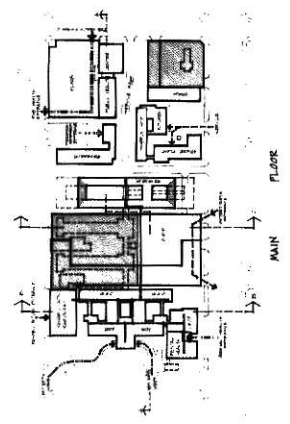
PHASE III



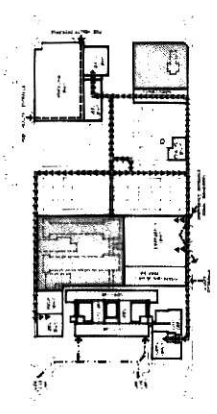
SECTION A-A



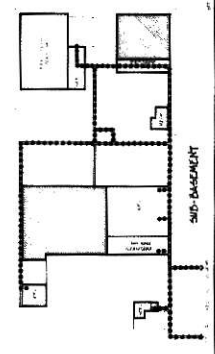
- | | |
|--|--------------------|
| | CONCRETE STRUCTURE |
| | BRICKWORK |
| | MASONRY |
| | STEEL STRUCTURE |
| | GLASS CURTAIN WALL |
| | ROOF STRUCTURE |
| | FLOOR STRUCTURE |
| | WALL STRUCTURE |
| | DOOR |
| | WINDOW |
| | STAIRCASE |
| | ELEVATOR SHAFT |
| | UTILITY ROOM |
| | STORAGE ROOM |
| | PARKING SPACE |
| | LANDSCAPING |
| | SITE BOUNDARY |



MAIN FLOOR



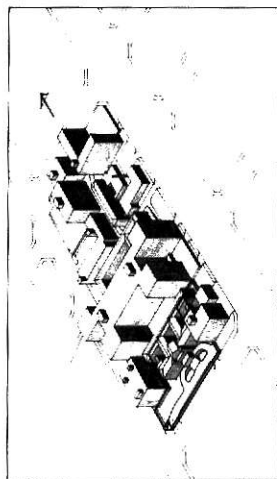
SECOND FLOOR & BASEMENT



SUB-BASEMENT



PHASE IV



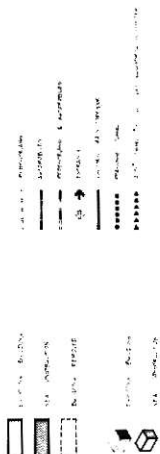
SECTION A-A' SPACE III



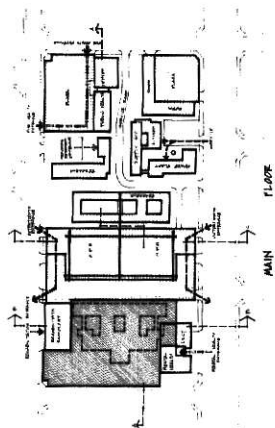
SECTION A-A'



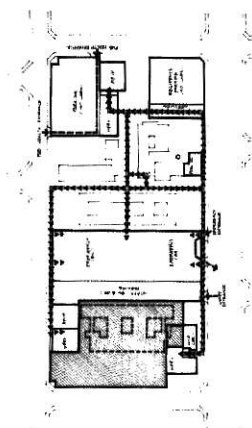
SECTION B-B'



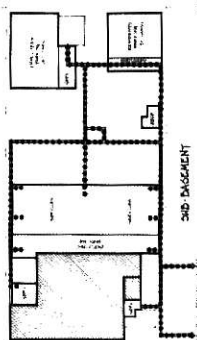
SECTION C-C'



MAIN FLOOR



SECOND FLOOR 2nd FLOOR

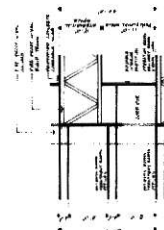
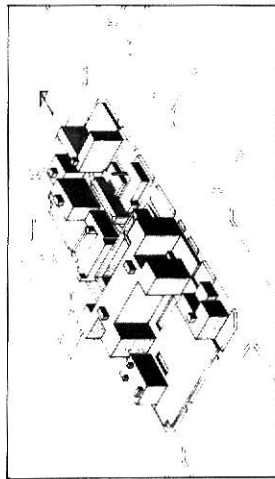


3RD FLOOR

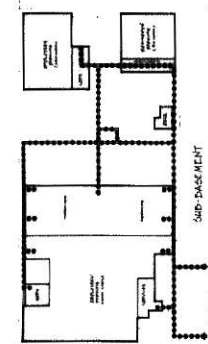
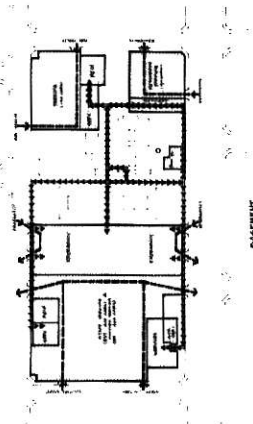
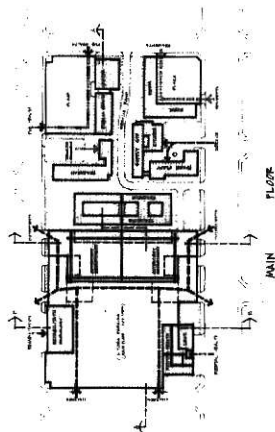


4TH FLOOR

COMPLETED MASTER PLAN AND CIRCULATION DIAGRAMS



1	CONCRETE
2	STEEL
3	GLASS
4	WOOD
5	PAINT
6	PLASTER
7	CEILING
8	FLOORING
9	MECHANICAL
10	ELECTRICAL
11	TELEPHONE
12	TELEVISION
13	RADIO
14	RECORDING
15	PHOTOGRAPHY
16	MOVIE
17	THEATRE
18	CONCERT
19	EXHIBITION
20	LECTURE
21	CLUB
22	BAR
23	RESTAURANT
24	CAFETERIA
25	KITCHEN
26	BREAKFAST ROOM
27	DINING ROOM
28	LIVING ROOM
29	SLEEPING PORCH
30	BED ROOM
31	BATH
32	CLOSET
33	WALK-IN CLOSET
34	LAUNDRY
35	STORAGE
36	ENTRY
37	HALL
38	STAIR
39	ELEVATOR
40	REAR PORCH
41	PORCH
42	SCREENED PORCH
43	DECK
44	WALKWAY
45	DRIVEWAY
46	PARKING
47	LANDSCAPE
48	PLANTING
49	WATER
50	SEWER
51	GAS
52	ELECTRIC
53	TELEPHONE
54	TELEVISION
55	RADIO
56	RECORDING
57	PHOTOGRAPHY
58	MOVIE
59	THEATRE
60	CONCERT
61	EXHIBITION
62	LECTURE
63	CLUB
64	BAR
65	RESTAURANT
66	CAFETERIA
67	KITCHEN
68	BREAKFAST ROOM
69	DINING ROOM
70	LIVING ROOM
71	SLEEPING PORCH
72	BED ROOM
73	BATH
74	CLOSET
75	WALK-IN CLOSET
76	LAUNDRY
77	STORAGE
78	ENTRY
79	HALL
80	STAIR
81	ELEVATOR
82	REAR PORCH
83	PORCH
84	SCREENED PORCH
85	DECK
86	WALKWAY
87	DRIVEWAY
88	PARKING
89	LANDSCAPE
90	PLANTING
91	WATER
92	SEWER
93	GAS
94	ELECTRIC
95	TELEPHONE
96	TELEVISION
97	RADIO
98	RECORDING
99	PHOTOGRAPHY
100	MOVIE



BIBLIOGRAPHY

BIBLIOGRAPHY

- Bobrow, Michael L; "Design Innovations for Single-bed Rooms," Hospitals JAHA, May 16, 1968.
- Cook, Fred J.; The Plot Against the Patient, Prentice-Hill, Inc., Englewood Cliffs, New Jersey, 1967.
- Cunningham, Robert M., Jr.; "Computer Systems Spread to Patient Care," Modern Hospital, Nov. 1969.
- Farago, Peter J., Elizabeth W. Seigel, and John E. Robinson; "Hospital College Program Taps New Manpower Source," Hospitals JAHA, Sep. 1, 1969.
- Foster, John T.; "Helicopters Make Sense in Medical Care," Modern Hospital, Feb. 1969.
- Huderburg, Roy; Planning the Community Hospital, McGraw-Hill Book Co., New York, 1967.
- Knowles, John H.; The Teaching Hospital, Harvard University Press, Cambridge, Massachusetts, 1966.
- Lennox, David H.; "How Nuclear Energy Will Shape Hospitals," Modern Hospital, Dec. 1966.
- McLaughlin, Herbert; "All Private Room Units: They May Be An Unexpected Bargain," Modern Hospital, Mar. 1968.
- Paris, Herbert, and Desmond Callan; "City Families Need Hospitals That Offer Full Outpatient Care at Night," Modern Hospital, Jan. 1968.
- Progner, Jean W.; "The New Hardware," Progressive Architecture, Feb. 1969.
- Rowan, Jan C., (ed.); "Health Care," Progressive Architecture, Feb. 1969.
- Runge, Alis D.; "The Health Megacenter," Progressive Architecture, Feb. 1969.
- Silver, Michael H., Richard F. Manegold, and John E. Gartland; "The Emergency Department Problem," JAMA, Oct. 24, 1966.
- Silvers, Gary and Warren G. Harding II; "Semi-private Rooms Are Not Bad, These Patients Told Surveyors," Modern Hospital, July 1969.
- Smith, C. Ray; "Can We Keep Hospitals from Dying?" Progressive Architecture, Feb. 1969.
- ed., "Drive-in Hospital is Planned for Cologne," Modern Hospital, Dec. 1966.

ACKNOWLEDGEMENTS

The author wishes to thank the many hospital administrators interviewed, who gave so freely of their time, and the many experts in the field who made helpful criticisms and suggestions.

Special notes of thanks are directed toward his major professor, John C. Heintzelman, College of Architecture and Design. This thesis, together with the design, was prepared under his able guidance and supervision.

Much of the information pertaining to the present Taita Hospital was collected through the assistance of the author's father, Professor Houyao Wei, Dean of Taita College of Medicine, who has served as pediatrician in Taita Hospital since 1947 and acted as the administrator for five and a half years.

THE LONG-TERM DEVELOPMENT OF TAITA HOSPITAL

by

KANG-CHENG WEI

B.S., Cheng Kung University, Taiwan, 1964

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF ARCHITECTURE

College of Architecture and Design

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1970

INTRODUCTION

Taita (Taiwan University) Hospital was developed according to a master plan but has exceeded its originally designed size. The hospital site is now saturated with its buildings. A new master plan is urgently needed for its further development.

The hospital has eight hundred and sixty-five nursing beds. There are another one hundred beds in the Provincial Taiwan Tuberculosis Control Center, which is located on the site and has contracts to cooperate with the hospital.

PROBLEMS

The future Taita hospital should be designed to accommodate some two thousand nursing beds, approximately double the existing number of beds. It should also be designed to meet the minimum medical requirements in developed countries and the current trends in medical fields, such as rapid changes in medical facilities, and emphasis on preventive medicine and on medical research. Some extra spaces should also be available for its unpredictable needs in constructional additions.

DESIGN CONCEPTS

To have several semi-autonomous and specialized hospitals within a large and complicated hospital is inevitable. These specialized hospitals should be tied together to adjunct diagnostic facilities and capable of individual expansion.

Also inevitable trends are the erection of high rise buildings and parking levels to increase the open space and parking capacity as a hospital expands, and the use of the large span structural system to provide flexible

inner spaces for the needs of rapid changes in medical facilities.

MASTER PLAN

A central complex of nursing rooms, surgery suites, labs, and so on has been designed as a main core of the hospital. A teaching-research group, a public health center, a mental health center, and a rehabilitation-radiotherapy center are to be located around the complex. Parking levels are designed under new buildings and plazas.

An underground system of service tunnels will radiate from the area of the central supply storage and power plant. All tunnels are located and designed not to interfere or to be interrupted during each constructional stage.

FOUR CONSTRUCTIONAL STAGES

Stage I

The main construction of the first stage will be the northeastern quarter of the central complex (mainly to house the inpatient departments of the surgery and obstetrics-gynecology on the upper floors and the emergency department in the basement), and the northeastern part of the tunnel system. Also constructed will be a laboratory building for the new public health center, a wing of the L-shape dormitory and the expansion of the power plant.

Stage II

The second stage will be the construction of the southeastern quarter of the central complex (mainly to expand the two mentioned inpatient departments and to house the pediatric department), the expansion for the new mental health center and the new rehabilitation-radiotherapy center.

Stage III

At this stage the central complex, the mental health center, the dormitory and the whole tunnel system will be completed. This western half of the complex will house medicine and the remaining departments.

Stage IV

The main parking structure at the southern site will be constructed during this stage.