KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY,

KUMASI

COLLEGE OF ARCHITECTURE AND PLANNING

FACULTY OF ARCHITECTURE AND BUILDING TECHNOLOGY

DEPARTMENT OF ARCHITECTURE,



# DESIGN THESIS:

# UROLOGY CENTRE (KNUST-KUMASI)

A DESIGN THESIS REPORT SUBMITTED TO THE DEPARTMENT OF ARCHITECTURE OF THE KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE POSTGRADUATE DIPLOMA IN ARCHITECTURE.

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**(Post Graduate Diploma)**

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## DECLARATION

I do hereby solemnly declare that the survey, data collection, design and write up of this design thesis report was done by me under the supervision of Mr. E. Botchway

Signed……

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Signed ……

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Date……..May, 2009

# DEDICATION

To my parents Nana P. K. Achinah and Mrs. Mary Osie Achinah for their inspiration, motivation and spiritual encouragement. God richly bless them. And also to my siblings.



## ACKNOWLEDGEMENT

I express my thanks to the Almighty God for his wisdom and favours throughout my entire course.

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Finally my sincere gratitude to all friends and students who in diverse ways helped me in my thesis.

# ABSTRACT

God blessed them, and said, *"Have many children, so that your descendants will fill all the earth and bring it under their control."*[1](Genesis 1:28).

However this biblical quotation is currently impaired by the various diseases associated with the male and female reproductive organs as well as complications associated with it.

In this respect, the government has developed strategies in conjunction with the ministry of health to provide good and affordable health care delivery system for its citizenry. This shows that the role played by health care facilities in the country is of paramount importance for its growth and sustainability.

Thus the provision of Urology centre on KNUST campus to serve as both teaching and referral centre for most urology cases in and around Ashanti Region. This will help ease the stress Komfo Anokye teaching hospital currently faces and promote good health delivery in the sub region.

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## CHAPTER ONE

## 1.0 INTRODUCTION

All health is better than wealth. (Sir Scott Walter 1771-1832)

The precious gift of man that comes after life is health and man's physical existence is incomplete without sound health. Triviality and sorrow abounds in illness and man will do all he can to attain a good health status.

The greatest asset of every nation is its labour force. Efficiency, productivity and development at large are totally dependent on a healthy labour force. In fact, health can be said to be the invincible propelling force behind every growing economy. Therefore, a healthy mind in a healthy body is a surety and priority all nations must render to their citizens.

In view of this, law makers must make it a central goal to incorporate sound and effective health care policies and systems in the planning of the country. It will ensure the establishment of health related facilities like hospitals, nursing homes, clinics and the like.

A hospital is a medical institution where sick or injured people are given medical or surgical care. Therefore, a hospital where a specific kind of ailment is treated can be termed as a Specialist Hospital.

Such is the vision of the stakeholders of Urology Specialist Hospital who want to create a therapeutic environment where urology patients in the sub region of Africa can be given state-of-the-art treatment.

### 1.1 Problem Statement

Statistical figures from the country's major health centers display a geometric increase in urology cases every year. Professor Yeboah research on urology over the past few years reveals the realities associated with what urology patients go through. Besides, full treatment for urology patients has to be done overseas since the country is incapacitated in that respect.

The inadequate provision of urology centre for patients, who have disorders or are recovering, may result in complication such as infertility, cancer in men and even death. Currently, specialized facilities meant for teaching, training, research and treatment of diseases of urology are woefully inadequate compared to the number of cases recorded annually. Also the lack of facilities and conducive operational environment, tend to drive away internationally trained health workers who wish to come back and serve the nation. Hence the need for the establishment of an urology centre to argument the few established ones in the country

Therefore the establishment of urology centre at KNUST will help reduce the current pressure that Komfo Anokye Teaching Hospital (KATH) faces and also serve as a source of attraction for trained personnel who wish to come back and serve the nation. This will

go a long way to reduce the financial burden imposed on patients due to the treatment overseas.

## 1.2 Justification

Problems associated with urology disorders cannot be under estimated since they are very key to reproduction. The traditional method of handling these issues without the consultation of a professional tends to worsen matters due to the wrong application of medicine. These traditional ways of handling urology health issues have become obsolete with increasing demand and a better health service. If these practices are not curtailed through the provision of a complete unit to cater for such cases, they can cause an irreparable damage to the already deplorable state of urology victims. The establishment of an urology centre will be responsible for screening, counseling, diagnosing and treating of urology related diseases and also for learning and research purposes.

The Urology department at Korle-Bu and Komfo Anokye Teaching Hospital (KATH), which serve as major hospitals for almost all referred cases in Ghana do not only lack requisite equipments but also the needed infrastructure to house state of the art urology equipments. Also due to the increasing number of patients coupled with the high demand for proper medical attention, a newly proposed KNUST teaching hospital is to be established to reduce the current pressure Korle-Bu and Okomfo Anokye teaching (KATH) faces in the country. The new establishment, must for the above reasons has an independent urology centre to serve as a referral for urology patients from its surrounding hospitals and clinics like Emena, Ejisu, Juaben as well as other nearby towns.

## 1.3 Objectives

- To develop a facility that will be fully operational, illuminating problems of referral to overseas hospitals.
- To create an autonomous facility that will be a reference point for kidney donation.
- To design an icon in the health industry that will be capable of serving the West African sub-region.
- To design a facility conducive to the patients well-being, both physically and psychological.
- To develop a facility where data required for development of national policies for urology activities and practice can be obtained.

## 1.4 Scope

The scope of this thesis will be an architectural design of a hospital specifically crafted to wholly deal with urology disorders. The proposed scheme will include the provision of an Outpatient Department, Inpatient Department (wards) and support services.

## 1.5 Client

KNUST

## 1.6 Financiers

The financiers are the bankers of the core stakeholders.

## 1.7 Target group

The main target groups are patients from KNUST, Kumasi Metropolis and patients from the sub region (i.e. West African countries).

## 1.8 LIMITATION

Major hospitals such as Komfo Anokye Teaching Hospital ( KATH) do not keep proper records of medical cases. Bureaucracy has been a major problem in an attempt to secure data from various institutions. Accessing health facilities and obtaining information from health workers was extremely difficult. Obtaining information from the internet coupled with huge financial burden was also a herculean task.

## CHAPTER TWO

## Literature Review

### 2.0. Urology Overview:

Urology, is concerned with diseases of the urinary system and male reproductive systems. Urologists study, diagnose, and treat disorders of the ureters, bladder, urethra, and kidney, and conditions affecting the male reproductive system, especially the prostate gland.



Urologists treat common disorders of the urinary system, including urinary tract infections; enuresis, the involuntary discharge of urine; cystitis, the inflammation of the bladder; tumors of the bladder; and mineral deposits in the kidney, commonly known as kidney stones. Urologists also specialize in disorders of the male reproductive system, such as enlargement of the prostate gland, and reproductive problems such as infertility and impotence.

Urologists use a variety of surgical techniques, diagnostic tools, and treatment therapies. One of the tests urologists use most frequently to diagnose disease is urinalysis, the chemical analysis of a patient's urine. Ultrasound, a procedure that uses inaudible sound waves to generate computerized images of internal organs, enables urologists to see irregularities in the bladder and other organs. Urologists treat small kidney stones nonsurgically with lithotripsy, a procedure in which doctors direct sound waves at stones in the bladder to disintegrate them. Two other important tools are the catheter, a long, tubular device for draining an obstructed bladder, and the cystoscope, a narrow,

illuminated probe used to examine the bladder and ureters. Urologists also perform surgical procedures, such as prostatectomy—that is, the partial or complete removal of an enlarged or cancerous prostate gland—and operations to remove large kidney stones.

## 2.1 Urinary System:

The Urinary System is made up of organs that produce and excrete urine from the body. Urine is a transparent yellow fluid containing unwanted wastes, mostly excess water, salts, and nitrogen compounds. The major organs of the urinary system are the kidneys, a pair of bean-shaped organs that continuously filter substances from the blood and produce urine. Urine flows from the kidneys through two long, thin tubes called ureters. With the aid of gravity and wavelike contractions, the ureters transport the urine to the bladder, a muscular vessel. The normal adult bladder can store up to about 0.5 liter (1 pt) of urine, which it excretes through the tube like urethra.

An average adult produces about 1.5 liters (3 pt) of urine each day, and the body needs to excrete about a minimum 0.5 liter (1 pint) of urine daily to get rid of its waste products. Excessive or inadequate production of urine may indicate illness and doctors often use *urinalysis* (examination of a patient's urine) as part of diagnosing disease. For instance, the presence of glucose, or blood sugar, in the urine is a sign of diabetes mellitus; bacteria in the urine signal an infection of the urinary system; and red blood cells in the urine may indicate cancer of the urinary tract.

## 2.2 Structure and Functions of the Kidney

The kidneys lie embedded in fat tissue on either side of the backbone at about waist level. Each fist-sized kidney is reddish-brown, weighs 140 to 160 g (5 to 6 oz), and is similar in shape to the kidney beans sold at the supermarket.

On the inner border of each kidney is a depression called the hilum, where the renal artery, the renal vein, and the ureter connect with the kidney. The renal artery delivers over 1700 liters (450 gal) of blood to the kidneys each day, which these organs filter and return to the heart via the renal vein. Each kidney contains about 1 million microscopic coiled channels, called nephrons, which perform this critical blood-filtering function and produce urine in the process.

The bulblike upper portion of the kidney's nephrons filters water; urea, the nitrogen-containing breakdown product of protein; salts; glucose; amino acids, the building blocks of proteins; yellow bile compounds from the liver; and other trace substances from the blood. As this material moves through a tubular, many of these filtered materials are reabsorbed into the blood to be reused by the body to maintain normal body functions. Less than 1 percent of the water and other materials remain behind to be excreted as waste products in the urine.

These waste materials then pass from the nephrons into a funnel-shaped area called the renal pelvis. From the renal pelvis, waste trickles out of the kidney into the urethra, which is about 25 to 30 cm (10 to 12 in) long and about 0.5 cm (0.2 in) in diameter. The urethra

empties into a hollow, muscular sac called the urinary bladder. A valve like flap of tissue at the point of entry into the bladder prevents urine from flowing backward into the ureter. The urinary bladder is able to expand and contract according to how much urine it contains. As it fills with urine, the walls of the bladder stretch and become thinner, with the bladder itself lengthening to 12.5 cm (5 in) or more and holding up to about 0.5 liter (1 pt) of urine. A ringlike sphincter muscle surrounds the bladder's outlet and prevents spontaneous emptying.



As the bladder becomes full, stretch-sensitive receptors in its walls are stimulated, and the person becomes aware of the fullness. When the person is ready to urinate, or expel urine, the sphincter relaxes and urine flows from the bladder to the outside through the urethra. In females, the urethra is about 3.8 cm (1.5 in) long and is strictly a urinary passage. In males, the urethra is about 20 cm (8 in) long; it passes through the penis and also serves to convey semen during sexual intercourse.

In addition to their vital role in ridding the body of wastes through the production of urine, kidneys play important regulatory roles. They maintain water balance, ensuring that the amount of water in body tissues remains at a constant level. So, for example, if a person drinks a lot of water one day, but little water the next, the kidneys are able to adapt by regulating the water balance in the tissues. The kidneys also control calcium levels in the blood to maintain healthy bones. They aid in regulating the acid-base balance of the blood and body fluids so that all body processes can proceed smoothly.

By controlling salt levels, the kidneys help regulate blood pressure. Finally, they stimulate the body to make red blood cells, the primary component of healthy blood. Properly functioning kidneys are so vital to health that if they cease to function, death follows within days.

All vertebrates dispose of excess water and other wastes by means of kidneys. The kidneys of fish and amphibians are comparatively simple, while those of mammals are the most complex. Fish and amphibians absorb a great deal of water and, as a result, must excrete large quantities of urine. In contrast, the urinary systems of birds and reptiles are designed to conserve water; these animals produce urine that is solid or semisolid.

## 2.3 Disorders and Treatment of the Urinary System:

Urologists are physicians who specialize in treating urinary system disorders. One of the most serious disorders urologists treat is renal failure, which slows or stops the filtration of blood, causing toxic waste products to build up in the blood. Acute renal failure, which occurs suddenly, may be caused by bacterial infection, injury, shock, congestive heart failure, drug poisoning, or severe bleeding following surgery. Treatment may include drugs to address the underlying cause or to stimulate proper kidney function, blood transfusions, surgery, or, in some cases, kidney dialysis, in which the blood is mechanically filtered.

Chronic renal failure is a progressive deterioration of kidney function over a long period of time. It can be caused by diseases such as hypertension, diabetes, lupus erythematosus,

kidney failure and death. Hypospadias is a birth defect in which the male urinary opening is misplaced on the penis; it may be under the head of the penis or as far away as the scrotum. Surgery before the child reaches 24 months can correct the defect, permitting normal urination and, later, sexual intercourse.

## 2.4 Prostate Cancer:

Prostate Cancer, malignancy of the prostate gland, a walnut-sized organ located under the bladder in males. The prostate gland surrounds the urethra, which is the tube that carries urine from the bladder to the penis. Prostate cancer is the most common cancer after skin cancer, and the second most common cause of cancer deaths, after lung cancer, in men.

### i. Risk Factors For Prostate Cancer

The specific mechanisms that lead to the development of prostate cancer are still unknown, but several risk factors have been identified that increase the chances of developing the disease. Prostate cancer seldom develops before the age of 40;ie incidence increases with age. Two out of three cases occur in men over the age of 65. It is most common in North America and in North Western Europe but rare in South America, the Near East, and Africa. African American men have about twice the risk of developing prostate cancer as American men of European or Asian ancestry.

Family history also plays an important role in who develops prostate cancer. Men whose fathers or brothers develop prostate cancer are more likely to develop the disease. Researchers are beginning to identify genetic markers of prostate cancer. For instance,

the gene known as *hereditary prostate cancer 1* (HPC1) appears to significantly predispose men to prostate cancer when inherited in a mutated form. Environmental factors, such as workplace exposures to cadmium, have also been associated with an increased risk of prostate cancer.

A growing body of evidence links diets rich in animal fats, such as red meat or high-fat dairy products, leads to prostate cancer. Dietary differences are believed to explain why the incidence of prostate cancer is 120 times greater in the United States than in China, where fatty foods are not part of the general diet.

Some fruits and vegetables seem to act as a shield against prostate cancer. A study reported in 1995 found that tomatoes offer protection against prostate cancer. Subsequent research has focused on lycopene, an antioxidant found in tomatoes and certain other fruits. Antioxidants neutralize free radicals molecules in the body that make cells more vulnerable to cancer-causing agents. Other studies suggest that cruciferous vegetables, such as broccoli, cauliflower, and Brussels sprouts, have some protective effect.

Some evidence suggests that long-term, moderate doses of vitamin E, a type of antioxidant, may block the progress of prostate tumours. Selenium, an element found in tiny amounts primarily in plants and yeasts, has also been associated with a lowered risk of certain cancers, although large amounts of selenium are *toxic* (poisonous). Clinical tests of the effectiveness of vitamin E and selenium in preventing prostate cancer began in 2001 at sites throughout the United States, Canada, and Puerto Rico.

### ii. Symptoms Of Prostate Cancer

Prostate cancer usually progresses slowly and produces no symptoms in its initial stages. Warning signs may eventually include difficult or painful urination; frequent urination, especially at night; and blood in the urine or semen. Pain in the lower back, pelvis, or upper thighs may signal that prostate cancer cells have spread to the ribs, pelvis, and other bones. These symptoms, however, may have other causes, such as infection or prostate enlargement. Prostate enlargement is a natural result of the aging process.



### iii. Screening and Diagnosis

Many doctors perform screening tests for prostate cancer during regular physical exams in order to identify the disease in its earliest and most curable stages. Doctors perform a digital rectal examination, in which the physician slips a gloved finger into the rectum to feel the size, shape, and firmness of the prostate. If cancer is present, a physician may feel a nodule or other prostate irregularity.

Another screening test, the prostate-specific antigen (PSA) test, measures levels of a protein called prostate-specific antigen in the blood. Prostate cancer cells overproduce this protein, causing an elevation of PSA levels in blood. Most men have PSA levels lower than 4.0 nanograms per millilitre (ng/ml) of blood, and that level is considered normal. However, a higher level does not necessarily indicate the presence of cancer. Infections and certain drugs can also elevate PSA levels.

If screening tests suggest cancer may be present, a physician will usually perform a biopsy. In this procedure a physician inserts a needle through the wall of the rectum and extracts a sample of tissue from the prostate. The tissue is then examined under a microscope for the presence of cancer cells. The biopsy can usually be performed in the doctor's office.

The American Cancer Society recommends that men aged 50 years and older consider having an annual digital rectal exam and PSA test. Men who have a high risk for the disease (African Americans or those with a family history of prostate cancer) should talk to their doctors about starting annual screening tests at a younger age. Annual screening with a PSA test is controversial because there are many false positives that is, elevated PSA levels among men who do not have prostate cancer. This leads to unnecessary additional procedures.

### iv. Staging The Cancer

After prostate cancer is diagnosed, the physician may decide more tests are necessary to determine if the cancer has spread beyond the prostate gland. This process is known as staging. Early-stage cancers either have not spread or have spread only to nearby tissues. Later-stage cancers have spread farther and usually require more aggressive treatment.

Various tests are used to determine the cancer's stage. Lymph glands from the pelvis may be surgically removed and examined for cancer cells, or a sample of fluid from the seminal vesicles (glands that secrete semen) may be examined for cancer cells. In addition, images of the inside of the body made by magnetic resonance imaging (MRI) or computed tomography (CT) scans also can reveal the presence of cancerous tumors.

Prostate cancer sometimes spreads to the bones and a radionuclide bone scan tests for such spread may be required. In this test a tiny amount of radioactive substance is injected into a vein.

The substance collects in the bones, especially in areas of unusual activity known as "hot spots" for example, where cancer cells are expanding. During the scan the patient lies on a table that passes under the scanner, which makes computer images on which any hot spots in the bones show up.



### v. Treatment Of Prostate Cancer

Men with prostate cancer face the best chance of recovery when the illness is detected early and prevented from spreading. Medical researchers are studying new methods of detection such as genetic screening, as well as a number of innovative treatments. Physicians also recommend that men take simple preventive measures such as a diet low in animal fats. Physicians Marc B. Garnick of Harvard Medical School and William R. Fair of the Cornell University Medical Centre explore medical approaches to combating prostate cancer.

The treatment of prostate cancer generally depends on the stage of the cancer and on the age of the patient. In men over the age of 70 with early-stage prostate cancer, the disease often progresses so slowly that they are likely to die of other causes before they develop prostate cancer symptoms. For this reason, some physicians believe that many patients in this age group can forgo surgery or other treatments as long as their condition is regularly monitored a treatment known as watchful waiting.

Radiation therapy is an alternative to surgery in many cases. It uses X rays or other high-energy radiation to kill cancer cells or stop them from growing. In external radiation therapy, the radiation is beamed from a machine onto the body. In internal radiation therapy, radioactive material sealed in "seeds" is inserted into the prostate. The procedure, performed under local anesthesia, spares healthy, nearby tissue and appears to be as effective as surgery for men with early-stage prostate cancer.

In some cases hormones are used to treat prostate cancer, especially if the patient is unable to undergo surgery or radiation because of other health problems. Hormone treatment may also be used for cancers that recur or for shrinking the cancer before surgery or radiation therapy. The goal of hormone therapy is to reduce body levels of male hormones, especially testosterone, that can fuel the growth of cancers. Chemotherapy the use of anticancer drugs is sometimes recommended when the disease has spread beyond the prostate. These drugs travel in the bloodstream and slow the cancer's growth and spread.

Several other treatments for prostate cancer are under investigation. Cryosurgery uses instruments to destroy cancer cells by freezing them. Immunotherapy boosts the body's immune-system defences to fight cancer. High-intensity ultrasound uses high-energy sound waves to destroy cancer cells.

### vi. Prognosis

According to the American Cancer Society, more than 90 percent of prostate cancers are discovered in early stages as a result of more widespread screening. Because prostate cancers grow relatively slowly, the five-year survival rate for prostate cancer detected in an early stage is nearly 100 percent. The ten-year survival rate is 93 percent, but the survival rate drops more sharply thereafter.

## 2.5 Urology related diseases (Prostate Cancer) Facts and Figures

The American Cancer Society estimates that more than 230,000 new cases of prostate cancer are diagnosed annually in the United States and that about 27,000 men die from the disease each year. According to the Canadian Cancer Society, each year prostate cancer is diagnosed in about 20,000 men in Canada and about 4,200 die from the disease. The death rate from prostate cancer has been dropping in both countries as a result of more widespread screening, earlier detection, and improved treatment.

Available statistics at Korle-Bu Teaching Hospital indicated that more than 1,000 new cases of urinary disorders at the Outpatient Department are recorded annually, out of which 400 are emergencies and review more than 10,000 cases annually.

The common urinary problems reported in Ghana are inability to pass urine, difficulty of urination, inability to control urination leading to wetting oneself and urethral obstruction.

Table 1

| Year | Urinary disorders |
|---|---|
| 1997 | 800 |
| 1998 | 1200 |
| 1999 | 1500 |
| 2000 | 1600 |
| 2001 | 1400 |
| 2002 | 1700 |
| 2003 | 1800 |
| 2004 | 2000 |

*Historical data of urology related diseases from the Korle-bu teaching hospital.*



## 2.6 Hospital Overview

*"A functional design can promote skill, economy, conveniences, and comforts; a non-functional design can impede activities of all types, detract from quality of care, and raise costs to intolerable levels." ... Hardy and Lammers*

Hospitals are the most complex of building types. Each hospital is comprised of a wide range of services and functional units. These include diagnostic and treatment functions, such as clinical laboratories, imaging, emergency rooms, and surgery; hospitality functions, such as food service and housekeeping; and the fundamental inpatient care or

bed-related function. This diversity is reflected in the breadth and specificity of regulations, codes, and oversight that govern hospital construction and operations. Each of the wide-ranging and constantly evolving functions of a hospital, including highly complicated mechanical, electrical, and telecommunications systems, requires specialized knowledge and expertise. No one person can reasonably have complete knowledge, about Hospital operations. That is why specialized consultants play an important role in hospital planning and design. The functional units within the hospital can have competing needs and priorities. Idealized scenarios and strongly-held individual preferences must be balanced against mandatory requirements, actual functional needs (internal traffic and relationship to other departments), and the financial status of the organization.

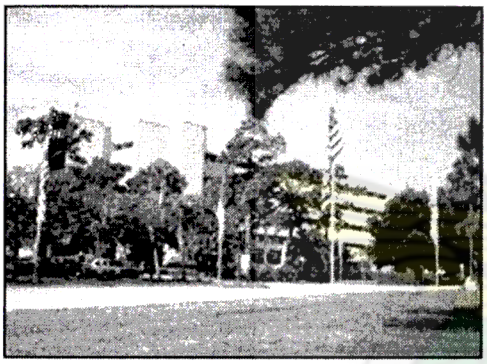

Fig.1 VAMC Bay Pines, Florida.

In addition to the wide range of services that must be accommodated, hospitals must serve and support many different users and stakeholders. Ideally, the design process incorporates direct input from the owner and from key hospital staff early on in the process. The designer also has to be an advocate for the patients, visitors, support staff, volunteers, and suppliers who do not generally have direct input into the design.

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Good hospital design integrates functional requirements with the human needs of its varied users. The basic form of a hospital is, ideally, based on its functions:

- bed-related inpatient functions
- outpatient-related functions
- diagnostic and treatment functions
- administrative functions
- service functions (food, supply)
- research and teaching functions



## 2.7 HOSPITAL ATTRIBUTES

Regardless of their location, size, or budget, all hospitals should have certain attributes.

### i Efficiency and cost effectiveness

An efficient hospital layout should:

- Promote staff efficiency by minimizing distance of unecessary travel between frequently used spaces.
- Allow easy visual supervision of patients by limited staff
- Include all needed spaces, but no redundant ones. This requires careful pre-design programming.
- Provide an efficient logistics system, which might include elevators, pneumatic tubes, box conveyors, manual or automated carts, and gravity or pneumatic

chutes, for the efficient handling of food and clean supplies and the removal of waste, recyclables, and soiled material

- Make efficient use of space by locating support spaces so that they may be shared by adjacent functional areas, and by making prudent use of multi-purpose spaces
- Consolidate outpatient functions for more efficient operation—on first floor, if possible—for direct access by outpatients
- Group or combine functional areas with similar system requirements
- Provide optimal functional adjacencies, such as locating the surgical intensive care unit adjacent to the operating suite. These adjacencies should be based on a detailed functional program which describes the hospital's intended operations from the standpoint of patients, staff, and supplies.

**ii Flexibility and Expandability**

Since medical needs and modes of treatment will continue to change, hospitals should:

- Follow modular concepts of space planning and layout
- Use generic room sizes and plans as much as possible, rather than highly specific ones
- Be served by modular, easily accessed, and easily modified mechanical and electrical systems
- Be open-ended, with well planned directions for future expansion; for instance positioning "soft spaces" such as administrative departments, adjacent to "hard spaces" such as clinical laboratories.

### iii Therapeutic Environment

Hospital patients are often fearful and confused and these feelings may impede recovery. Every effort should be made to make the hospital stay as unthreatening, comfortable, and stress-free as possible. The interior designer plays a major role in this effort to create a therapeutic environment. A hospital's interior design should be based on a comprehensive understanding of the facility's mission and its patient profile. The characteristics of the patient profile will determine the degree to which the interior design should address aging, loss of visual acuity, other physical and mental disabilities, and abusiveness. Some important aspects of creating a therapeutic interior are:

- Using familiar and culturally relevant materials wherever consistent with sanitation and other functional needs
- Using cheerful and varied colors and textures, keeping in mind that some colors are inappropriate and can interfere with provider assessments of patients' pallor and skin tones, disorient older or impaired patients, or agitate patients and staff, particularly some psychiatric patients.
- Admitting ample natural light wherever feasible and using color-corrected lighting in interior spaces which closely approximates natural daylight
- Providing views of the outdoors from every patient bed, and elsewhere wherever possible; photo murals of nature scenes are helpful where outdoor views are not available
- Designing a "way-finding" process into every project. Patients, visitors, and staff all need to know where they are, what their destination is, and how to get there and return. A patient's sense of competence is encouraged by making

spaces easy to find, identify, and use without asking for help. Building elements, color, texture, and pattern should all give cues, as well as artwork and signage.

**iv Cleanliness and Sanitation**

Hospitals must be easy to clean and maintain. This is facilitated by:

- Appropriate, durable finishes for each functional space
- Careful detailing of such features as doorframes, casework, and finish transitions to avoid dirt-catching and hard-to-clean crevices and joints
- Adequate and appropriately located housekeeping spaces
- Special materials, finishes, and details for spaces which are to be kept sterile, such as integral cove base. The new antimicrobial surfaces might be considered for appropriate locations.

**v Controlled Circulation**

A hospital is a complex system of interrelated functions requiring constant movement of people and goods. Much of this circulation should be controlled.

- Outpatients visiting diagnostic and treatment areas should not travel through inpatient functional areas nor encounter severely ill inpatients
- Typical outpatient routes should be simple and clearly defined
- Visitors should have a simple and direct route to each patient nursing unit without penetrating other functional areas
- Separate patients and visitors from industrial/logistical areas or floors.

- Outflow of trash, recyclables, and soiled materials should be separated from movement of food and clean supplies, and both should be separated from routes of patients and visitors
- Transfer of cadavers to and from the morgue should be out of the sight of patients and visitors
- Dedicated service elevators for deliveries, food and building maintenance services.



**vi Aesthetics**

Aesthetics is closely related to creating a therapeutic environment (homelike, attractive.) It is important in enhancing the hospital's public image and is thus an important marketing tool. A better environment also contributes to better staff morale and patient care. Aesthetic considerations include:

- Increased use of natural light, natural materials, and textures.
- Use of artwork.
- Attention to proportions, color, scale, and detail.
- Bright, open, generously-scaled public spaces.
- Homelike and intimate scale in patient rooms, day rooms, consultation rooms, and offices.
- Compatibility of exterior design with its physical surroundings.

### vii Security and Safety

In addition to the general safety concerns of all buildings, hospitals have several particular security concerns:

- Protection of hospital property and assets, including drugs.
- Protection of patients, including incapacitated patients, and staff.
- Safe control of violent or unstable patients.
- Vulnerability to damage from terrorism because of proximity to high-vulnerability targets, or because they may be highly visible public buildings with an important role in the public health system.

### viii Sustainability

Hospitals are large public buildings that have a significant impact on the environment and economy of the surrounding community. They are heavy users of energy and water and produce large amounts of waste. Because hospitals place such demands on community resources they are natural candidates for sustainable design.

## CHAPTERTHREE

## 3.0 RESEARCH METHODOLOGY

The thesis design will be executed by taking full advantage of the following procedures:

1. **Interviews** - formal and informal meetings will be arranged to know what both clients and the prospective users of the facility will like to have and see. People in the industry will also be interviewed.
2. **Photography** – graphic representation is a way to explain visually what exists and what will pertain before the project starts and after the project is complete. It will also be a way of representing what entails in relevant local and foreign facilities.
3. **Electronic and print media** – the internet, various news papers, architectural magazines, relevant books and brochures will be a source of getting information.
4. **Historical research** – documents on the existing and other related buildings in terms of architectural drawings will be used. Background information of mainly the clients and financiers will also be needed.
5. **Personal observations**. – a visit to the site and other relevant facilities both local and foreign is of importance to know the scale of the project and what goes into it in terms of construction, materials and services.

## 3.1 CASE STUDIES

Analyses of similar situations are used as basis to draw conclusions for the proposed Urology Centre.

In undertaking the case studies, the following were given prime significance:

- Location and configuration of the facility
- Functional flow pattern within the facility
- Utilisation of specialised systems
- Merit and demerit of the facility

The above were considered to help establish the following facts:

- A form and space conceptualisation in relation to the different functional areas.
- The appropriate brief and schedule of accommodation for the Urology centre.

### i Grand River Regional Cancer Hospital

**Location:** Campus of Kitchener, Ontario, Canada

**Designers:** Vermeulen /Hind Architects

**Service Provision:** It provides exclusively outpatient oncology treatment and relies on its host hospital for any additional patient services.

The hospital

The master plan identified the aging Scott Building as the preferred site for the new centre. Well known to the community as the original Berlin Hospital, its brick, stone and stained glass were salvaged during its demolition for incorporation in feature walls of the new building.

The planning of the new centre responds to the need for patient flow between existing campus buildings, the desire for natural light, and the compact and sloping nature of the site. The building's main entry level coincides with the hospital's main entry, providing a seamless transition between public spaces and patient amenities. The main level houses the Supportive Care and Radiation Therapy programme and includes six doorless, high-energy treatment rooms and two simulator rooms. A broad public stair and vertically interconnected waiting spaces link to the Outpatient Clinics and Chemotherapy Suite on the floor above. Support areas are located on the bottom floor of the centre, and medical staff offices, administration, and conference rooms are located on the top floor.

The outpatient waiting areas have direct access to a courtyard patient garden, which features a water garden and reflecting pool, and a trellis-shaded outdoor sitting area. A portion of the courtyard garden is a 'green roof' over the floor below and is open to the campus on its north side. Landscape materials repeat the building palette of stone, brick, and wood.

Fig.2 *Exterior view of Grand River Regional Cancer Hospital*

The building's spatial volumes and materials choices were developed to create a calm, comfortable environment and a sense of regional identity. Inspiration came from the forms and craftsmanship of the region's Mennonite farmsteads and rolling landscape. To reinforce the importance of the patient as an individual and overcome the highly technical nature of the treatment equipment, hand made elements are integrated into the design. Locally crafted quilts identify each radiation treatment room, hand kilned glass and gouged-ash panels are used at reception areas, and hand-carved stone panels welcome patients at the building's entrances.



Merits

- The design provides a good functional relationship among the various units within the hospital.
- The building is well engineered within its surroundings
- The building really creates a therapeutic environment for its patients as there are gardens and water features

Demerit The compactness of the facility makes it too helmed in.

**ii Heartland Urology Centre**

**Location:** Great Bend, Kansas, USA

**Designers:** Lantz Baggio Architects

**Service Provision:** It provides a comprehensive program of radiotherapy treatment and chemotherapy in a relaxed, comfortable setting

The Centre

The challenge in designing urology centre is to alleviate patient anxiety, loneliness, and the overwhelming nature of prostate cancer treatment by improving the traditional

institutional experience of the environment. Treatment areas are organised around common interior and exterior spaces composed to reinforce evidenced-based design principles: natural light, views of nature, socialization, and family interaction. The lobby space creates a visual passage through the building and maintains a visual connection with nature. Both interior and exterior spaces provide a choice between privacy and social interaction.

Fig.3 *Exterior view of Heartland Urology Centre*

Fig.4 *Interior view of Heartland Urology Centre*

Specific planning and design concepts were employed to emphasize supportive, life-affirming care, as well as promote socialization and family interaction. The Radiation Therapy Suite – comprised of a Linear Accelerator, a CT Simulator, and Radiation Imaging – is softened by natural light passing through examination rooms and patient accommodations. The Chemotherapy Suite – shared by two Oncology practices – is centred on the Infusion Area and the Healing Garden. Material selections reflect the colours and textures of native sandstone and prairie grasses. The clarity of function and circulation enhances the patients', families', and staff's sense of well-being and comfort and strengthens the connection to nature.



Merits

- The design brings users of the space to nature thereby creating a healing environment.
- The design concepts employed facilitates socialisation and family interaction which is vital for the patient's healing process.

Demerits

- The external outlook of the design has less to say about it being a health related facility

**iii Sunyani Regional Hospital**

**Location**: Brong Ahafo Region, Ghana

**Designers:** International Hospital Group.

**Service Provision:** It provides total health care for the Ghanaian populace especially the inhabitants of Brong Ahafo Region.

The Hospital

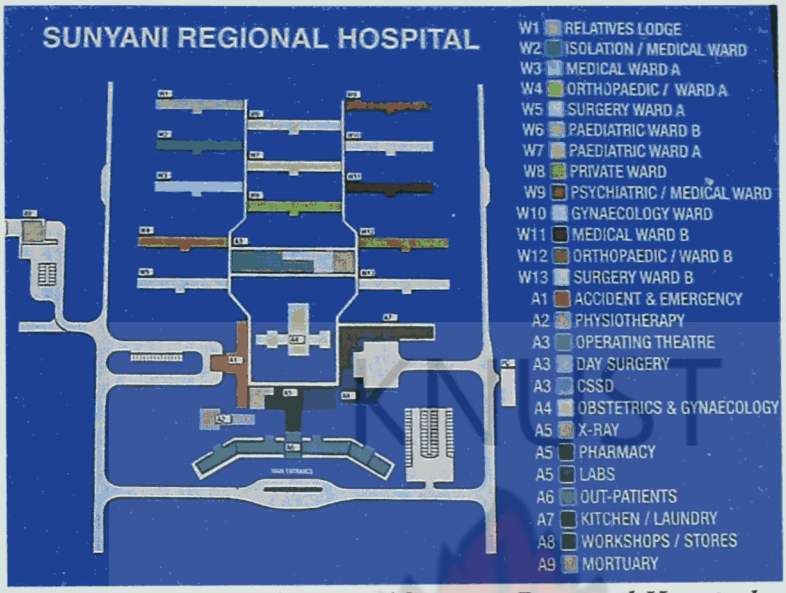



Fig.5 *The general layout of Sunyani Regional Hospital*

The hospital has a lot of success in its layout as a tropical health facility.

The welcoming entrance structure consisting of the OPD and administration is the first point of call adjoined by the public parking at the right flank.

Fig.6 *An exterior view of the welcoming entrance facility*

The clinical zone follows with the incorporation of accident and emergency unit. The surgical zone is the heart of the entire layout.

Carefully designed wards of various hierarchies are located at the rare of the layout.

Support and services facilities are positioned at the extreme flanks which are accessed by isolated service routes.

Merits

- The layout utilises hospital street concept which is effective from the clinical zone to the nursing zone.
- The entire layout is very tropical which enhances total energy efficiency.

Demerits

- Possibility of issues relating to rain water drainage due to unusual roof connections.
- Land value has not been critical in the total planning.

**Iv Komfo Anokye Teaching Hospital (KATH)**

**Location:** Kumasi, Ashanti Region, Ghana.

**Area of Study:** Operating Suite and Oncology Unit

Komfo Anokye Teaching Hospital is located in the Kumasi District of Ashanti Region. It is located on an elevated ground overlooking the Central Business District (CBD) of Bantama Township. KATH is bounded on the North by Bantama, South by 4BN Infantry,

East and West by the main Bantama Kejetia dual carriage way and Udurra, and Central and west by the Central Police Barracks. The hospital was named after the legendary Fetish Priest of Ashanti; Okomfo Anokye who planted a mystery sword which remains stuck to the ground till today and serves as a site for tourist.

KATH has gone through a series of transformations with additions of various departments. It was originally developed by the British colonial masters to serve as an African and European Hospital. Due to the addition and extension of various units to the existing facility it was later granted a teaching hospital status in 1975 and when the School of Medical Sciences of Kwame Nkrumah University of Science and Technology was established it was linked to it. From the late 1970's to date, KATH has gone through a series of expansion through changes in equipment and facility upgrading. The physiotherapy department is one of the major units added to it on 25th August 2003.

Fig 7: Komfo Anokye Teaching Hospital (KATH)

**OPERATING SUITES – KOMFO ANOKYE TEACHING HOSPITAL, KUMASI**

The department is located in the surgical block. It has the following areas:

Operating theatres, Endoscopy room, Recovery wards, Intensive care unit

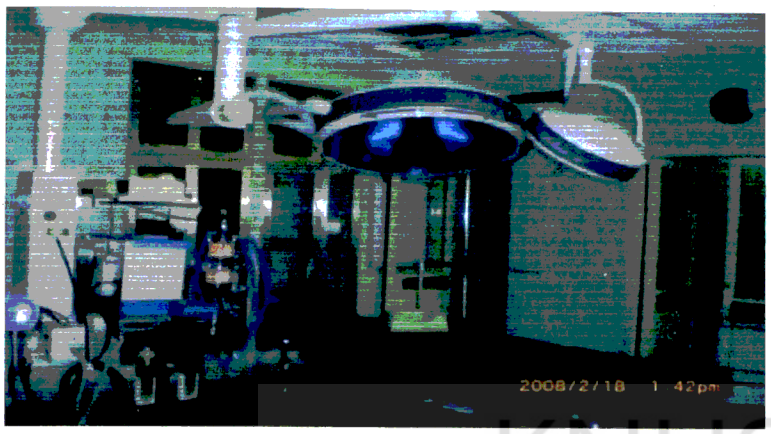



Fig8: Operating Theatre



**Common auxiliary facilities**

Sluice,Instrumentation,Anesthetic,Store,Spaces,Nurses station, Recovery ward, Intensive care unit,Staff changing rooms

**Operating theatre, Komfo Anokye Teaching Hospital**

Each theatre is accessible from the major air-lock lobby; the theatres have doors that lead to a clean corridor with 2 theatres sharing a scrub, sluice, instrumentation and stores.

i. **Materials**

- Walls have light green wall ceramic tiles.
- Theatre windows overlooking outside are translucent.
- Floor has terrazzo finish with waste water outlets for cleaning purposes.
- Ceiling has plywood painted( white)
- lighting is artificial throughout

-All spaces are air- conditioned

- Theatre doors into corridor have upper part being transparent

ii. **Merits**

- Very good circulation, ventilation, lighting and economical use of space due to shared areas.

- U. V. light has been mounted on the wall to kill bacteria, etc

iii. **Demerits**

There is not enough storage facility in the theatre.



**The Oncology Unit**

This unit of the teaching hospital deals with the treatment of malignant tumours. It utilises modern therapy such as radiotherapy and chemotherapy.

Its site on the hospital premises is carefully done. It is located at the right flank from the hospitals main entrance and is opposite the general out-patient department.

Its immediate premises have substantial parking facilities for both staff and the general public. Behind the main facility is an excavated stretch of grand modulation meant for future expansion purposes.

The character of the unit depicts the post- modernism style of architecture which deviates a little from the existing character in terms of external renderings.

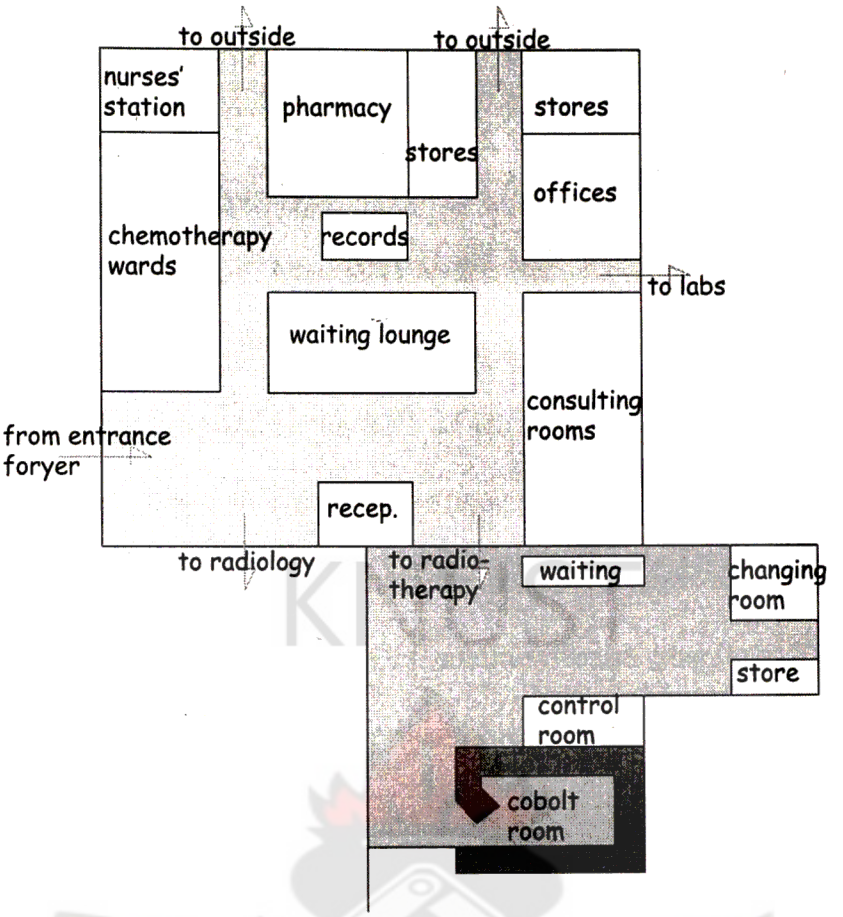



Fig.9 *A Schematic plan of the Oncology Unit, KATH*

Merits

- The unit is sound in terms of the strategic location in the complex and well ventilation, day lighting and circulation corridors.
- The external envelope is aesthetically pleasing and may have a therapeutic effect on healing.

Demerits

- The unit lacks the ability to incorporate the healing process into a therapeutic environment. For example, the exposure to nature and the fostering of social interaction.
- The records room is poorly located in terms of functional relation with the waiting room, it was intended to serve.

## X-RAY DEPARTMENT; 37 MILITARY HOSPITAL, ACCRA

### i. History

This hospital was established on 4th May 1941 by the British colonial masters in Accra. It was in response to a need for a health facility for the Africans veterans who fought during Second World War. The hospital is the 37th of such type of hospitals built all over commonwealth countries, hence its name "37 military hospital". This is the hospital base for the Ghana Armed Forces. It is north-south orientated. Takoradi European hospital is the 34th of the European and African type of commonwealth hospitals. The structures consist of barracks type of wooden structures and block buildings, either semi-detached or detached.



### The X-ray Department of 37 Military Hospital

This department has received a major face lift in terms of structural adjustments and equipment. It has almost every modern sophisticated radiotherapy equipment installed and in use.

The functional areas are as follows:

Reception with waiting area, Film production room, Radiographic rooms with air lobbies, Changing rooms, Operating cubicle, Offices, Storage Space, Staff changing rooms

This department has been planned into two major spaces. There is the staff area and another space for patients with their counterparts. The patients section has a reception and

a waiting area. Poly based materials have been used for both the walls and floors. These materials are noted to be strong and washable.

Special lead doors have been used to regulate patients entry for X-rays to be taken. The doors are open by staff inside to allow for patients entry. Patients cannot open from the outside. Red and green coloured bulbs have been placed at the entrance doors of the X-ray rooms.This regulates the time of entry into the X-ray room. The whole place is fully air-conditioned with no external windows.

Walls are as usual lightly coloured. Inside the X-ray rooms is a space for the operator with a glass seal to cut off radiation. This glass is usually lead protected. Patients have to wait in waiting rooms till staff opens them for safety reasons. Radiographic rooms ideally should have and air lobby to prevent exposure to radiation.

Floor skirting would have to be 100mm minimum from the floor finish. The rooms should be dust free with internal rough finished walls and non washable. A wash hand basin has been provided for staff. Space for monogram is in a different room. There should be a storage space for storage of disposed films, offices, staff changing rooms, etc.

### 3.2 Conclusions of Case Studies

- Effective layout of hospital design can be achieved through a centralised hospital street corridor.
- The health facility should be seen as part of the total environment, that is, the practice of organic architecture

- Therapeutic environment for health related facilities can not be compromised on.
- In health designs, functionality over-rides form, that is, form should follow function.
- Although hospitals should exhibit homely conditions to put the patient's mind at ease, there should still be the aura of health characteristics both internally and externally. In fact, there should be a blend.
- Climatic design concepts must be utilised with respect to the appropriate climatic zone to achieve energy efficiency.
- Services and supply plays a major role in hospital architecture.
- From the case studies, attention has been paid to detail which makes the hospital environment unique as compared to other public facilities

### 3.3Technical Studies

This focused basically on spatial planning parameters, service considerations as well as design considerations of the sort of activities that will go on in Urology Hospital.

- **Surgical Suite and Nursing Station**

The surgical suite should provide an environment of maximum comfort for both surgical team and patients while reducing the risk of infection to exposed tissues during surgical procedures. The surgical suite comprises the operating theatre together with its immediate ancillary accommodation whiles an operating theatre is a room in which surgical operation and some diagnosis are carried out.


Fig.10 *Arrangement of an operating theatre with adjacent rooms*

- **Laboratories**

According to Tony Branton, all laboratories must be designed to cope with growth and change irrespective of the scientific discipline involved or the scale of work. There are three major types of laboratories:

- Research labs
- Teaching labs
- Routine labs

Fig.11 *Labs designed with overhead connects and disconnects allow for flexibility and fast hook up of equipment*

- **Planning Module:**

Working unit (group of work places) forms basic planning bay or module. Normal work place can be considered as being approximately 1600 x 800mm. Module width may vary from 2600mm to 5250mm; average approximately 3000 to 3600, which allows 2 parallel rows of benches with centre gangway giving room to pass between 2 work module w=2work.

Typical building dimension include:

| | |
|---|---|
| Module w | 3000 – 3600 |
| Module L | 5000 – 8000 |
| Corridor | 2000 – 2500 |
| Store | 3600 – 4200 |

- **Fire fighting and protection**

Usually large hospitals require extensive use of fire alarms and fighting appliances but for most specialist hospitals ordinary hand held extinguishers are enough.

In order to reduce fire from spreading, the building can be divided into compartment not exceeding 1860 sq.m with a cubic area not exceeding 7080 sq m.

Lift and escape stair wells should be enclosed within fire proof construction and their openings protected by automatic fire doors.



**Handicapped Accessibility**

The public areas within the place should be designed for all classes of persons including the handicapped persons in society. Spaces shall be designed to be able to accommodate wheel chairs and allow sufficient space for moving around in safety. Access paths should be 1.20 -2.00m wide and be as short as possible. Ramps should ideally be straight; with a maximum slope of 5.7% and should be no longer than 6m. Corridors should be at least 2.3m wide to enable two wheelchairs to pass, with a clear opening of doors of 0.95m and height of light switches and electrical sockets located at about 1.0 – 1.05m above the floor. (Neufert 3, pg 298)

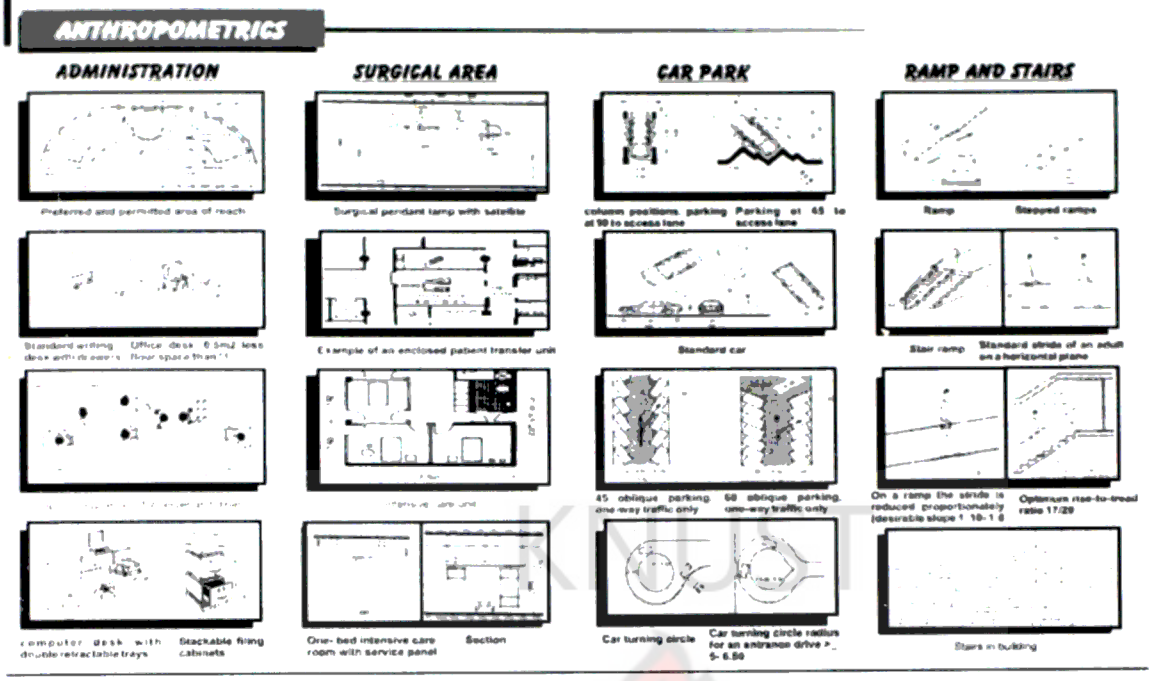



**Fig. 12Technical Studies**

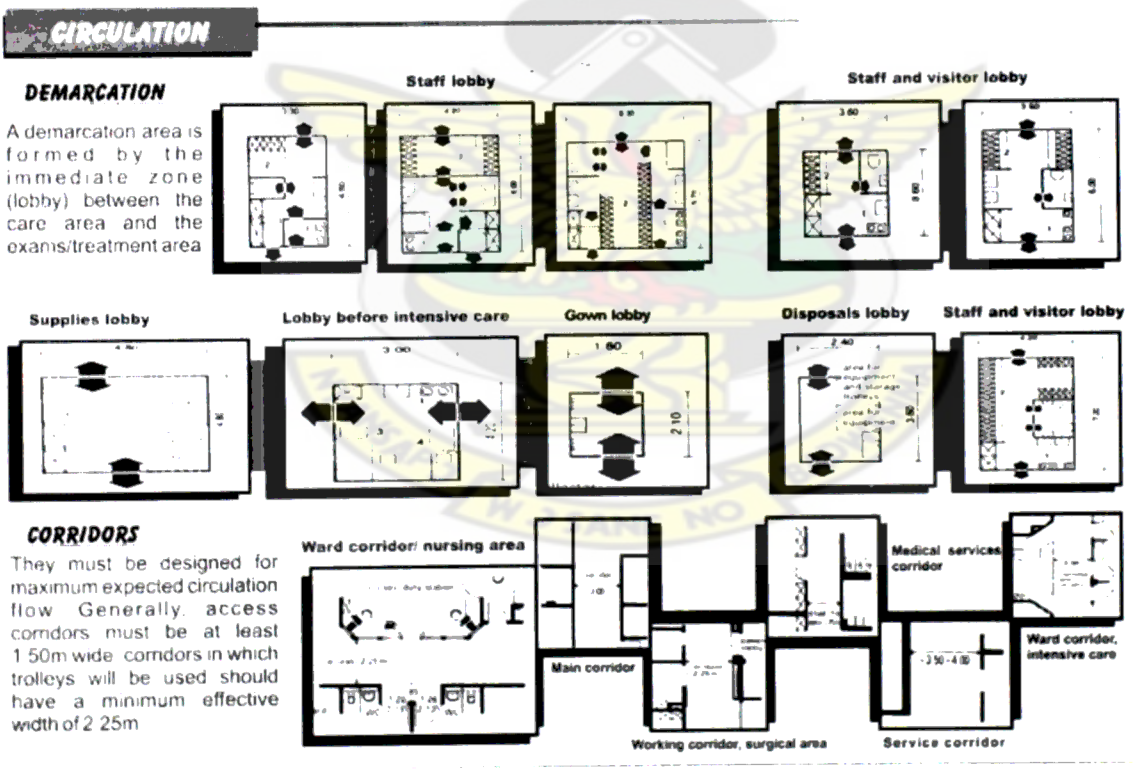



**Fig13 Circulation**

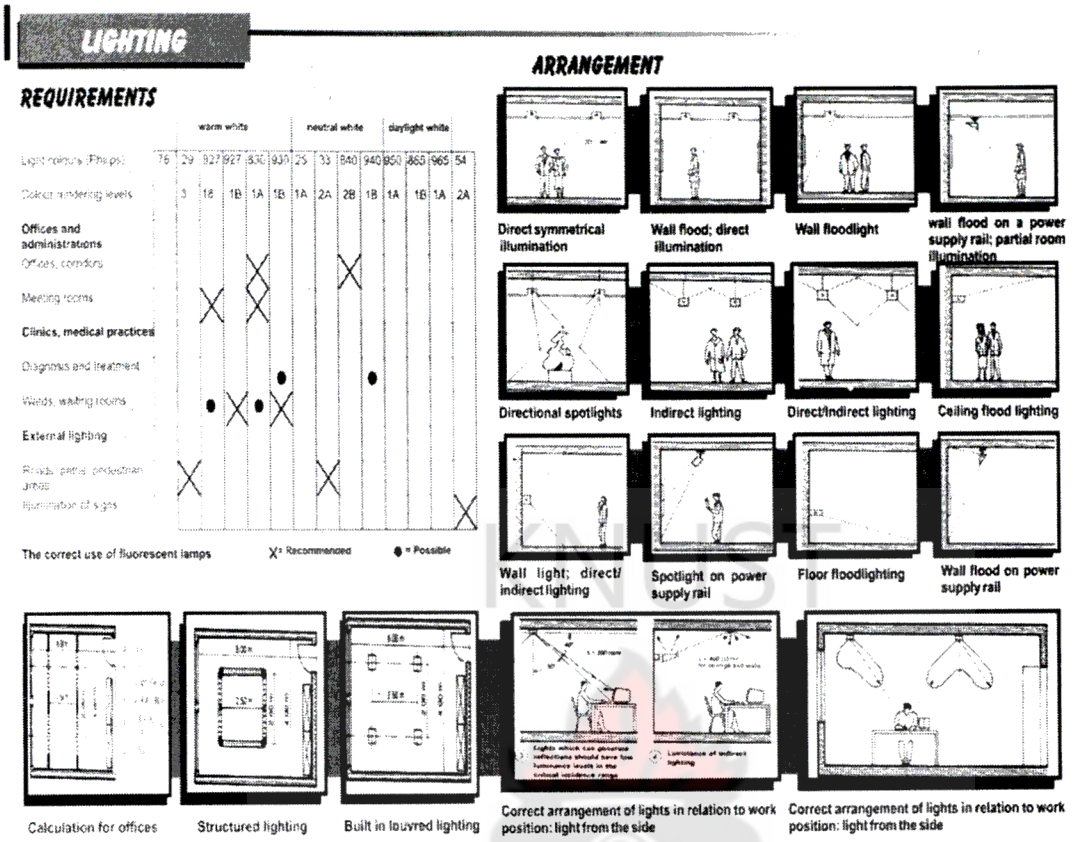



**Fig. 14 Lighting**

## CHAPTERFOUR

## 4.0 SITE STUDIES

### 4.1 Location

The urology centre shall be located on the peripheral of KNUST campus near Boadi, located off the Accra Kumasi road a suburb of Kumasi in the Ashanti Region.

### 4.1aClimate and Vegetation

The site lies within the Ashanti Region experiencing all the macro climatic conditions prevailing in the region.

The site is generally grown with shady trees with shrubs found in large splotches.

The region experiences double maximum rainfall in May/June and October with an average monthly mean volume of 1450 and 1476 millimeters. Sunshine on ordinary non-rainy day is intense, lasting about 5-7 hours.

Mean monthly temperature is between 26.7oc and 30oc with an annual range of 6oc and 8oc.

Humidity is very high in the region averaging 75% to 80% throughout the year.

There are South-West monsoon winds experienced between the month of March and November and North-East Trade winds experienced from November to February.

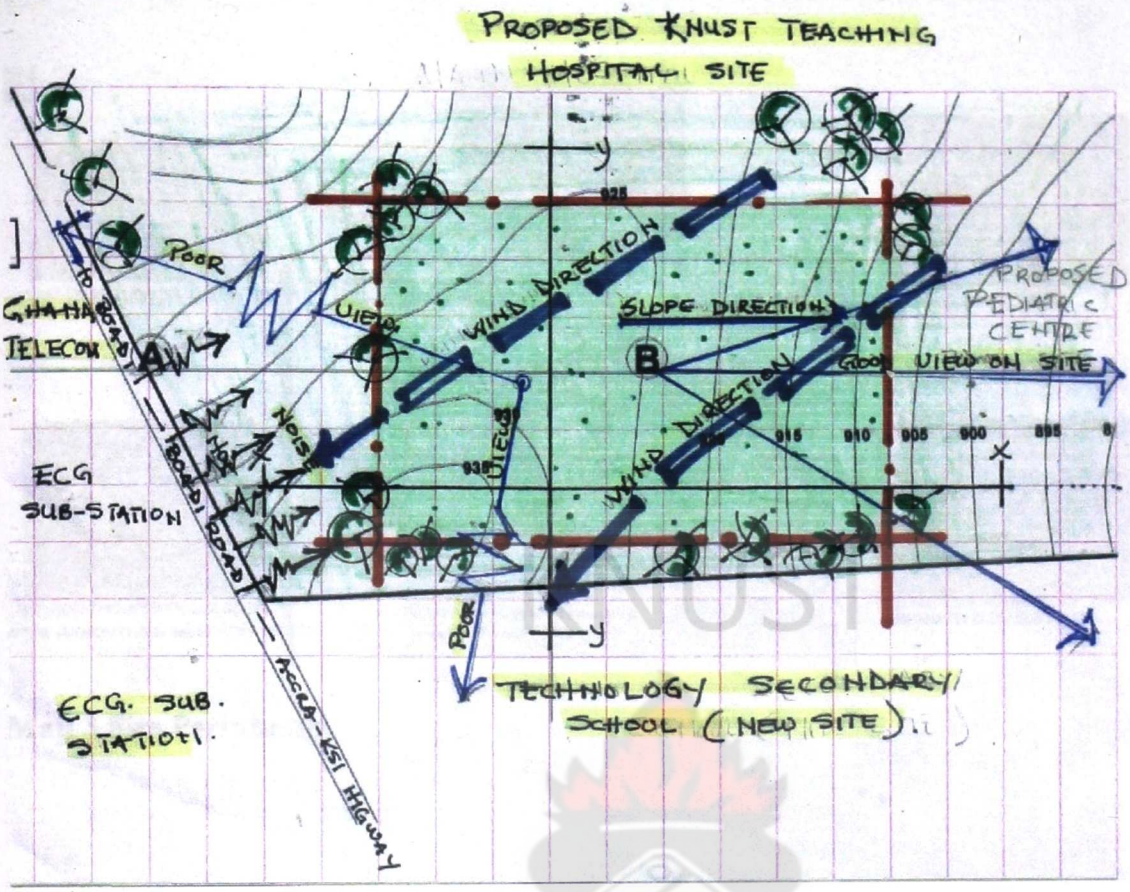
### 4.1b SITE JUSTIFICATION

- Location on KNUST campus present people the opportunity to break away from the hustle and bustle of traffic associated in going to Komfo Anokye Teaching Hospital.
- Aside the forest nature of KNUST, the environment is serene and calm for such a facility.
- Also proximity to medical school will help enhance studies as well as research related issues.

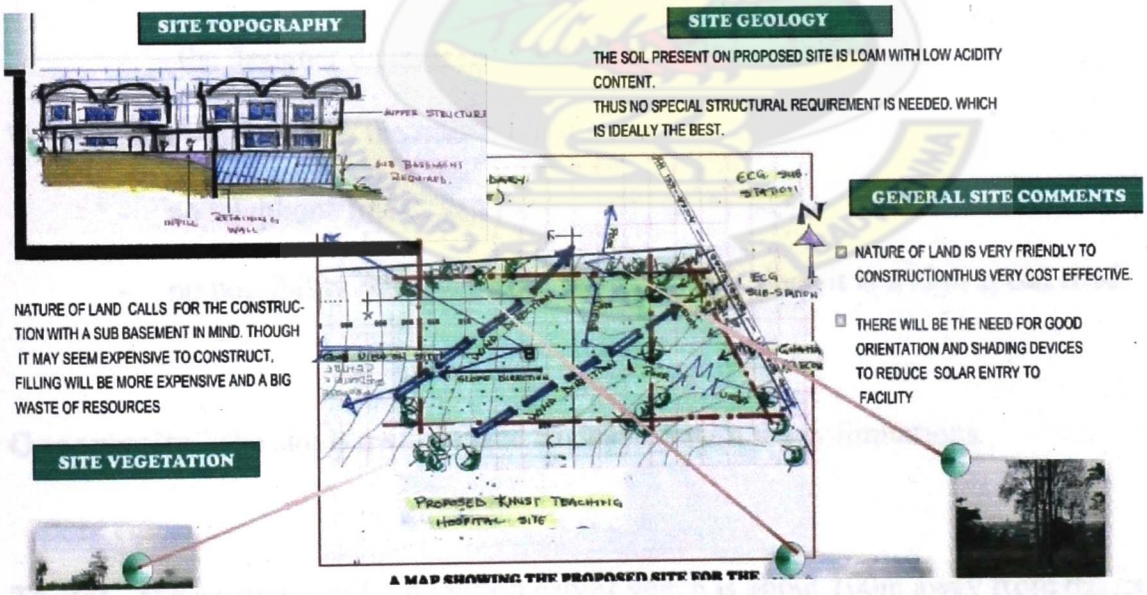


### 4.1c SITE INVENTORY/ANALYSIS

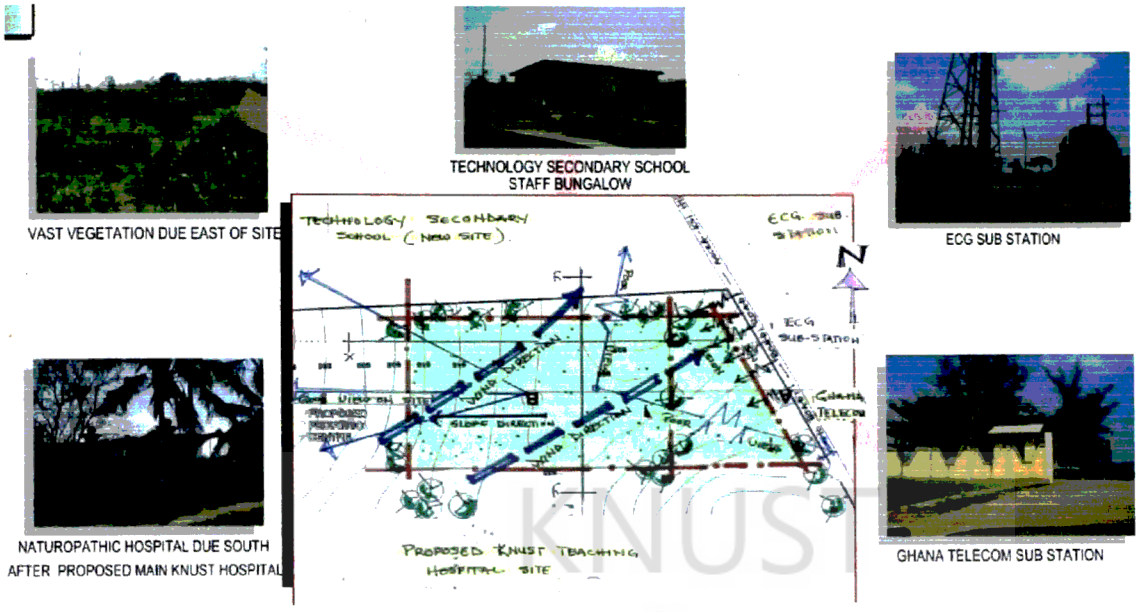
The structures, vegetation, strong wind direction and other features existing on site and their relative positions have been captured on the site inventory map below. This was achieved by physical experience of the site by the author.




**Map 1.0 Site Inventory**




**Map. 2 Site Analysis**




**Map 3 Site Peripheries**

## 4.1dSite Analysis

**Strengths** – the site has unobstructed views from all sides.

- the designer dictates the vocabulary of the vicinity.

**Weaknesses** – noise from the near-by motorway

- no telephone lines
- no possibility of taping from the motorway since it is a high speed road

**Opportunity** – the site is a virgin land to develop with fewer limitations.

**Threat** – the existence of high tension cables which is about 100m away from the site

## 4.2PLANNING AND DESIGN

### 4.3 Accommodation Schedule

Based on the studies conducted and the conclusions drawn, the brief was further expanded with the approximate floor areas.

**Out Patients Department**

| Space | Area (square meter) |
|---|---|
| Entrance foyer | 54m2 |
| Trolley Bay | 6.3m2 |
| Reception/Records | 36m2 |
| Snacks | 110m2 |
| Sanitary | 54m2 |
| Consulting Room | 36m2X 6 |
| Clinical Psychology | 36m2X 2 |
| **Sub-Total** | **741.28m2** |

**Treatment Zone**

| | |
|---|---|
| Pharmacy/drug store | 72m2 |
| Changing rooms | 9m2X2 |
| Store | 5m2 |
| Treatment room | 24m2 |
| Lecture room | 90m2 |
| Doctor's room | 10.5m2 |

Rest room/ Lounge----------30.3m2X3

Waiting----------72m2X2

Laboratory----------42m2

Doctor's room----------27.5m2X2

***Surgery***

Surgical suite----------63m2

Waiting lounge----------9m2

Intensive care----------64m2

Nurses' station----------12m2

Discharge / sluice / scrub-up-room----------63m2

Emergency exams room---------- 90m2

**Sub-total----------886.02m2**

**Research Zone**

Laboratories----------72m2

Offices----------12m2

**Sub-total----------233.28m2**

**Nursing Zone**

Children's wards (4 in a room) ----------63.8m2X4

Female wards (4 in a room) ----------63.8m2X5

Male wards (4 in a room) ----------63.8m2X9

VIP ward----------49m2X7

Nurses' station----------12m2X2

Reception/waiting lounge----------9m2

**Sub-total----------2839.2m2**



**Support Zone**

***Administration***

ICT centre----------72m2

Library/archives----------90m2

Lecture room----------110m2

Store----------16m2X2

Sanitary----------54m2

MD's office----------42m2

Reception/waiting----------12m2

Conference room----------9 x 8

Offices----------16m2X3

***Catering and laundry***

Laundry----------100m2

Store rooms----------30m2

Changing rooms----------12m2X2

Matrons' office----------16m2

Bar/servery----------6m2

Cooking area----------63m2

**Sub-total----------811.8m2**



**Service Zone**

Plant (medical gas, generator, air-con) ----------110m2

Temporal morgue----------15m2

Staff parking----------648m2

Public parking----------2400m2

Emergency parking----------594m2

Service yard----------360m2

**Sub-total----------2530.6m2**

**Grand Total----------7809m2**

## 4.4PHILOSOPHY OF THE DESIGN AND CONCEPT

**"Comfort and relaxation"**

Comfort and relaxation philosophy committed to improving medical care from the patient's perspective. According to this philosophy, the role of a healthcare system is to provide an optimum healing environment for the body, mind and spirit.

**Design concept**

The concept that will be used in achieving this philosophy will be

- Creation of views from the building envelop to the natural environment.
- Easy way finding in and around the facility
- Spacious workspace to facilitate activities
- The strategic use of colour and texture.
- Comfortable patient room to help support patient dignity
- The use of good security measures

## 4.5Conceptual Site planning

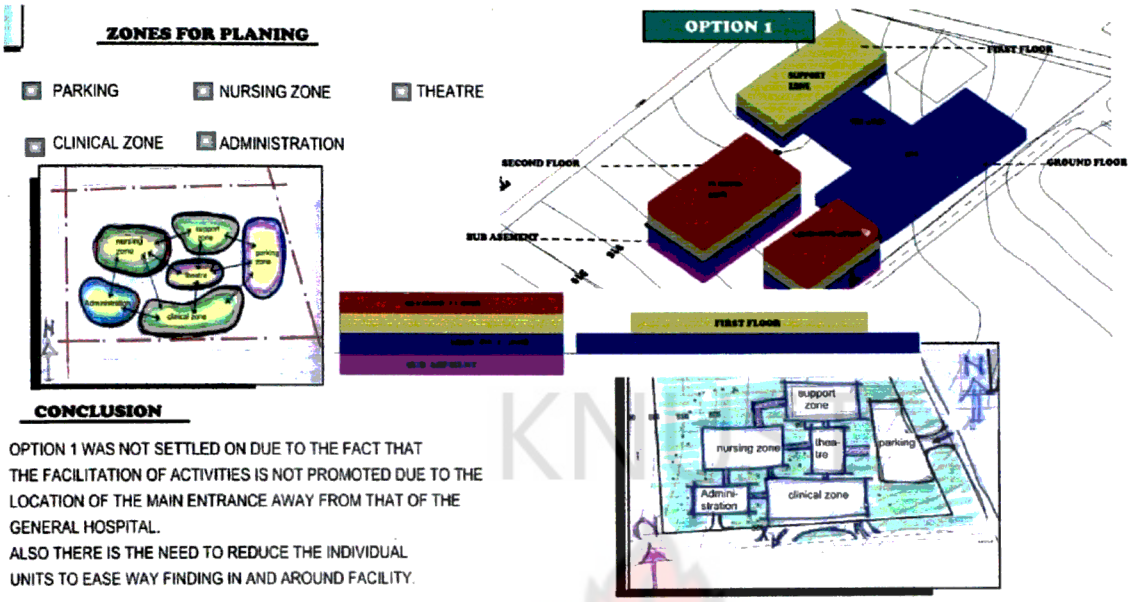



**Fig. 15 conceptual (option 1)**

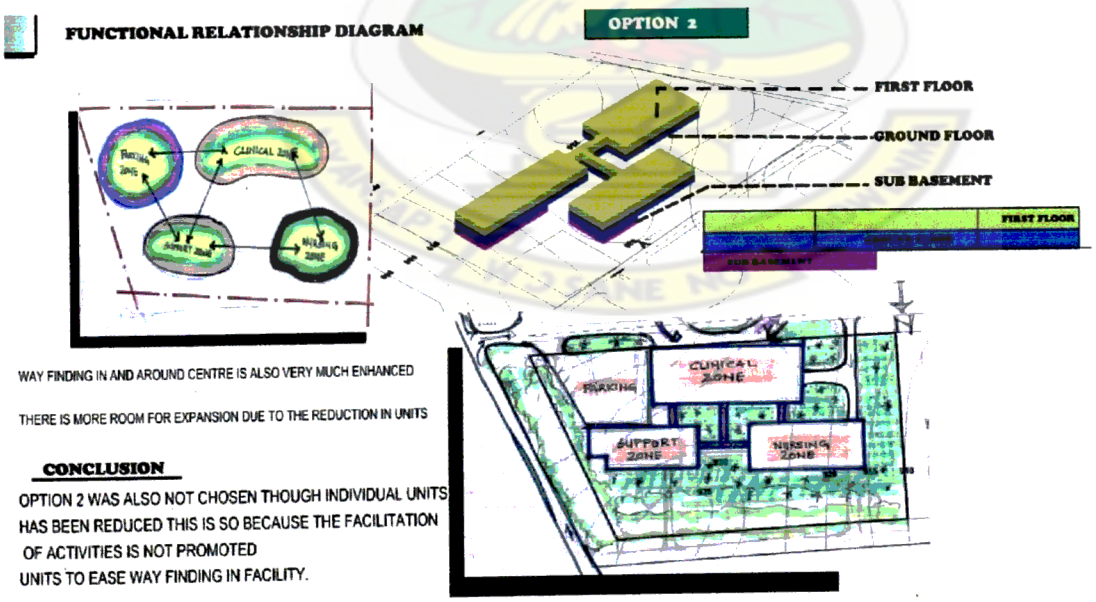



**Fig. 16 conceptual (option 2)**

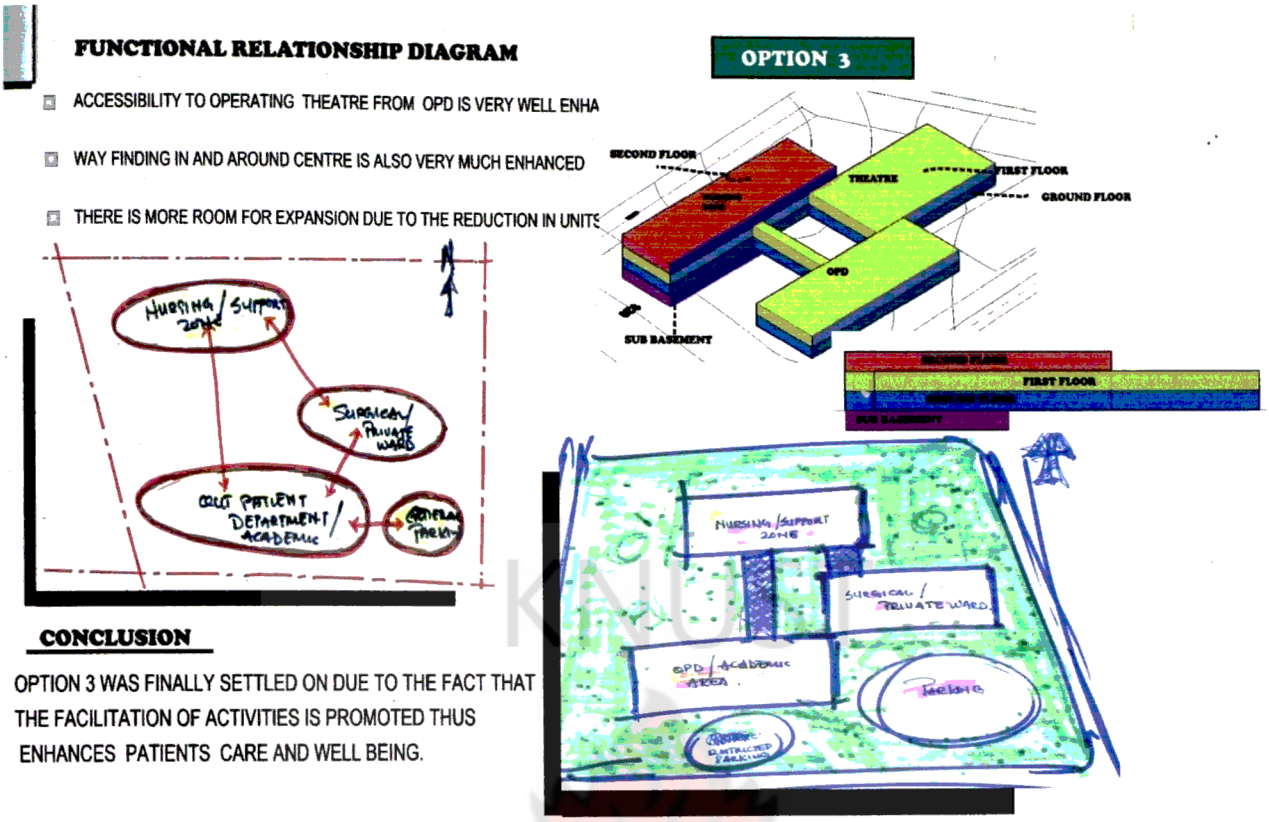



**Fig. 17 conceptual (option 3)**

Option 3 was finally settled on due to the fact that the facilitation of activities is promoted thus enhances patients care and well being.

### 4.6 The Design

The Urology centre went through an evolutionary process by considering the various studies undertaken without neglecting the design philosophy and concepts.

#### i Block Plan

It has two main accesses to the site. The first one leads to the public parking and the second leads to the staff parking, the emergency bay and the various service yards.

Beyond the security check point leads to the public parking which ushers the user to the OPD with its welcoming entrance foyer.

The entire block plan has an arrangement whereby series of building blocks which are of the same orientation as the site are linked to a centralised street corridor giving it an interlocking effect for effective functional flow pattern.

**Parking:** public parking – 90, senior staff parking – 24

**ii Plans**

The plan utilises a 1.2m grid modulation system with column spacing of 3 m x 5.

From the entrance foyer, the patient is introduced to the OPD where the necessary consultation and diagnosis are carried out. Other facilities like snack, pharmacy, billing and sanitary are available here.

The treatment block follows the OPD with the various therapeutic departments. A minor corridor system links it with the wards. Healing gardens are carefully created at the courtyards adjacent to the wards. Opposite these blocks are the strategic locations of lifts well with stairs beside them. The administration is located directly on the first floor of the OPD block.

The surgical block with research labs comes in between the VIP wards and the general wards. The catering/laundry unit is located at the basement of the nursing block.

At the rare of the specialist hospital are the service facilities and the morgue.

**iii Structure/Form**

The surgical block is characterised by one level structure whiles the OPD and the general wards are two level structures with three levels at the VIP block. The general wards have fire escape stairs attached at the extreme flanks.

External columns of the two and three level structures are off-set from the main walls making provision for shading devices to be incorporated in them.

The main entrance structure which is of a quadrant shape has one and half volume. This is to grace and give it a welcoming effect.

The dutch roof type with the manipulation of two angle system has been employed for all the various building blocks.

**Views:** A landscaped garden with a water body can be viewed from the various zones. The facilities have been aligned to add a touch of nature and a form of relaxation and a serene environment for patients. By virtue of topography there are clear views into the Knust hostel facilities which is sited west of the facility

**Capacity**. This centre will cater for a maximum of 240 patients on daily basis. 80% of Staff housing will be provided by Knust, assuming the remaining 20% reside in the Boadi Township and around.

**Circulation** To make circulation in the facility easy, bed-lifts, staircases, walkways and ramps have been provided. There are also service lifts at the Nursing section.

**Services** - Electric power, water, telephone and Internet lines are basic amenities that cannot be avoided in the design. Secondary provision has been made in the area of electricity and water. Provision has been made in the form of a standby generator and overhead storage tank for electricity and water respectively.

Ventilation has also been looked at with the provision of courtyards and open spaces. Natural lighting has also been taken care of with the open spaces to bring light into the corridors and circulation areas. The structure was considered so that maximum use of every space could be achieved. For example, ceilings are used for services and walls and floors can be serviced depending on the type of construction done.

**iv Elevations**

The elevations have a playing tune of two and three volumes with one and half at the front and one volume at the rare.

The entire elevation design also uses similar modular system as the plans.

The columns and beams standing out of the external walls have designed with much detail like bone linkages. The external topmost beams are designed as segmented arches which reduces the rigid nature of the entire design. The careful use of horizontal shading devices adds to the aesthetic quality of the scheme.

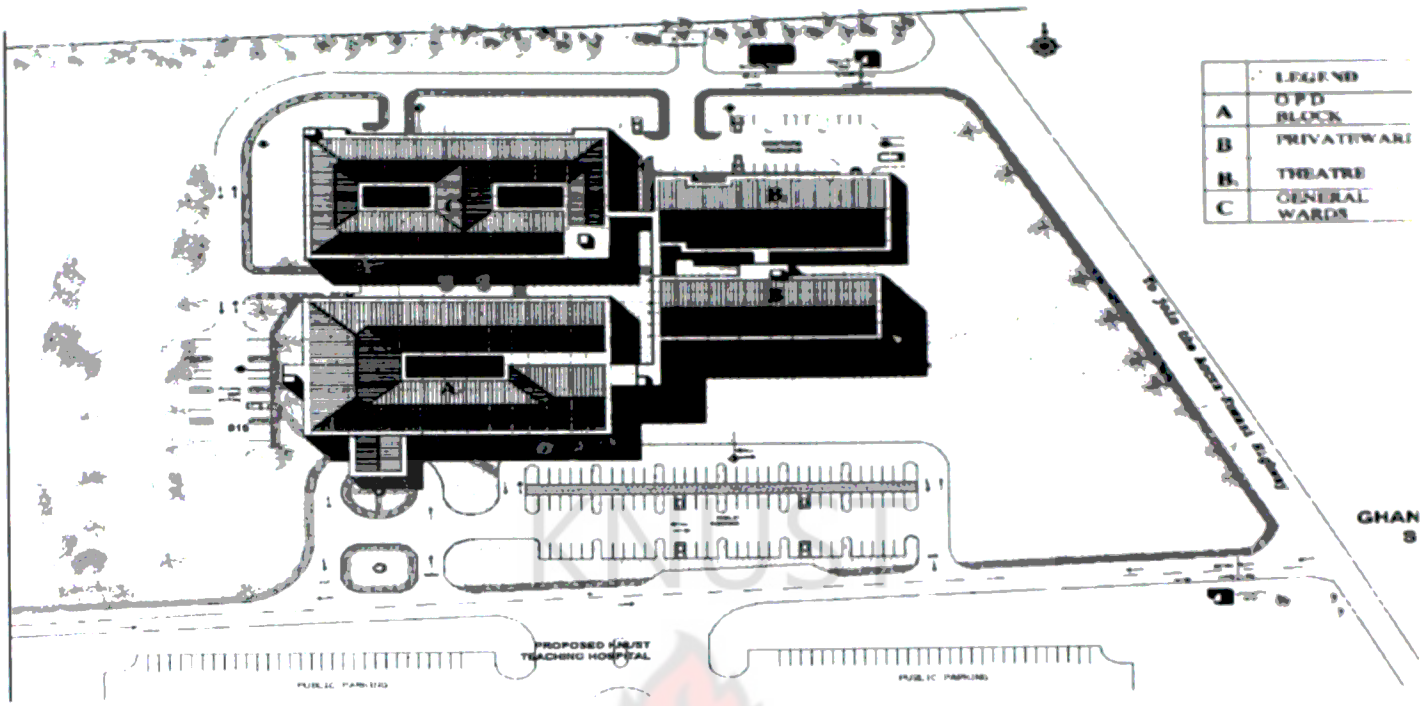



**Fig. 18 BLOCK PLAN**

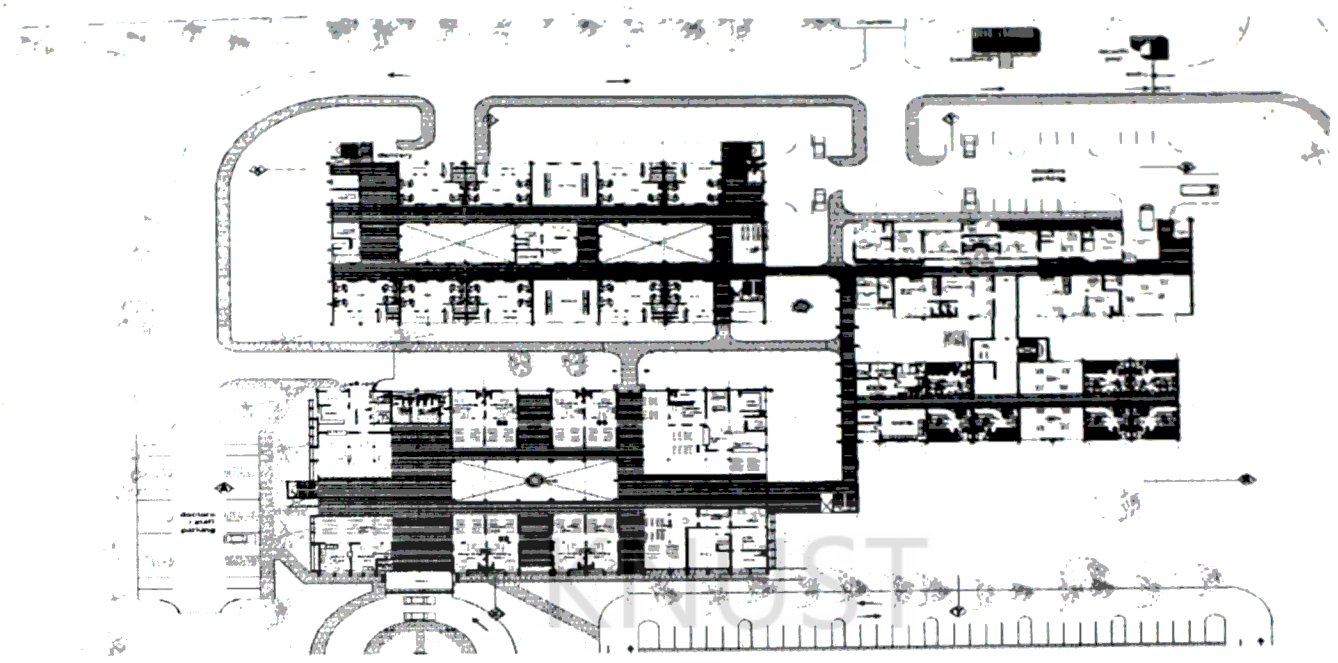


**Fig. 19 GROUND FLOOR PLAN**

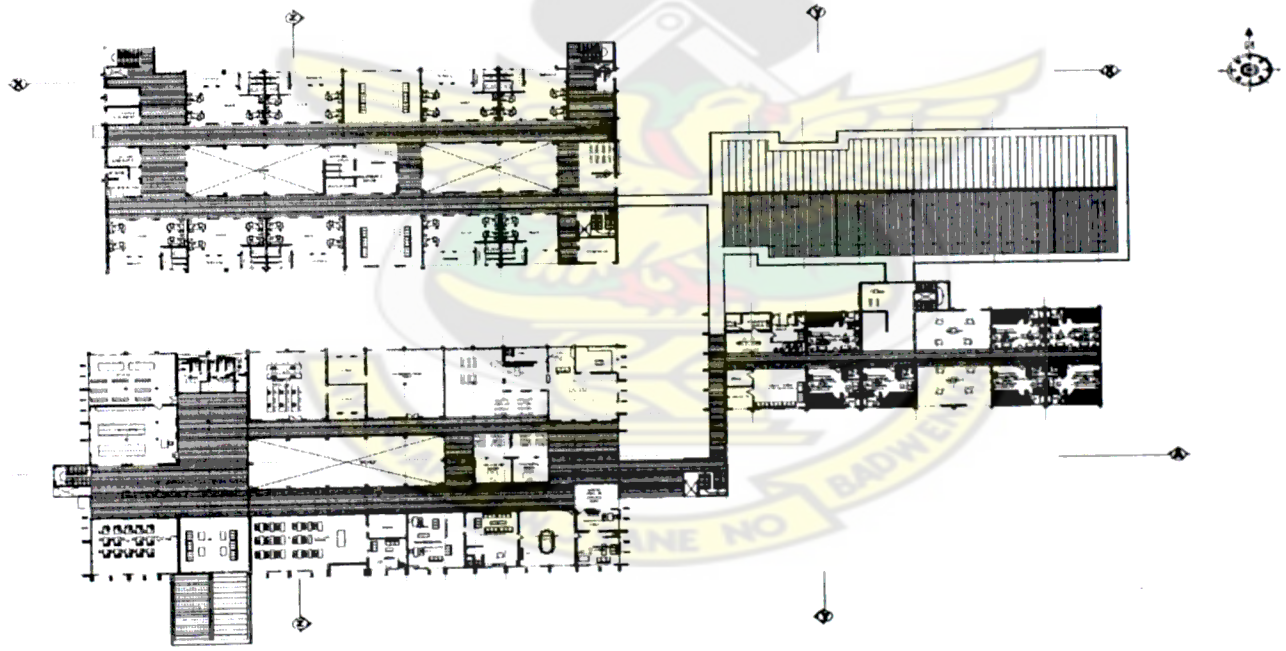


**Fig. 20 FIRST FLOOR PLAN**

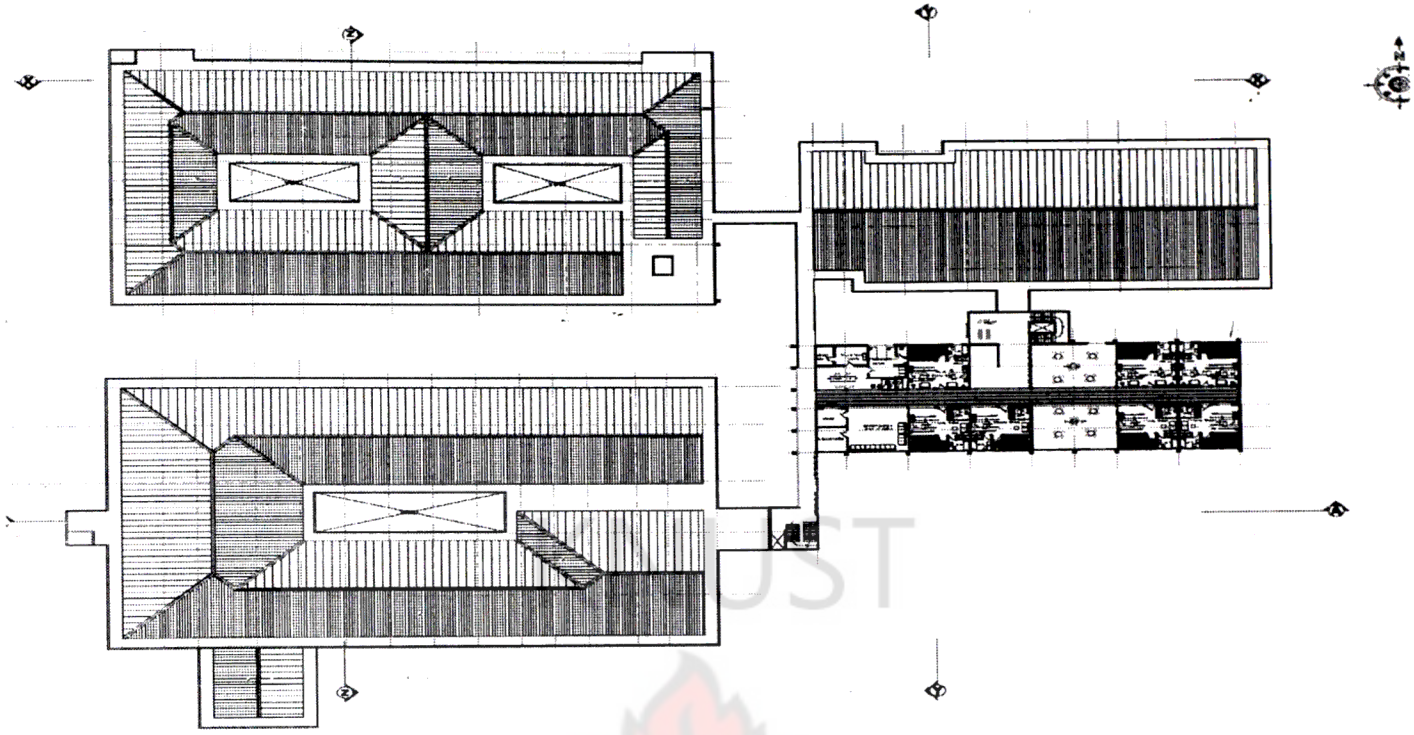


**Fig. 21 SECOND FLOOR PLAN**

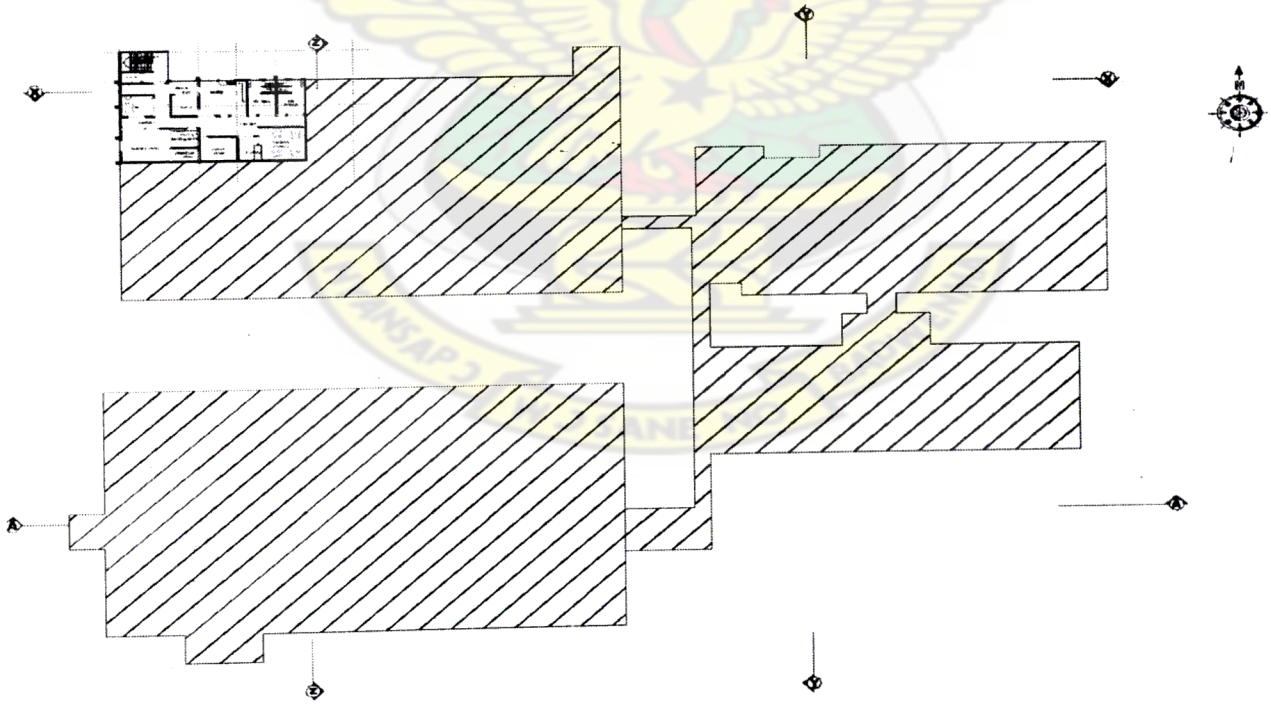
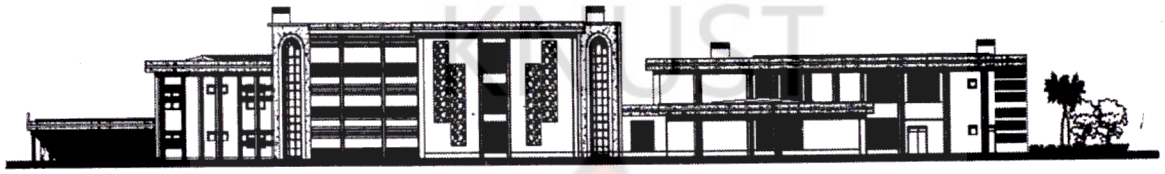


**Fig. 22 SUB-BASEMENT PLAN**

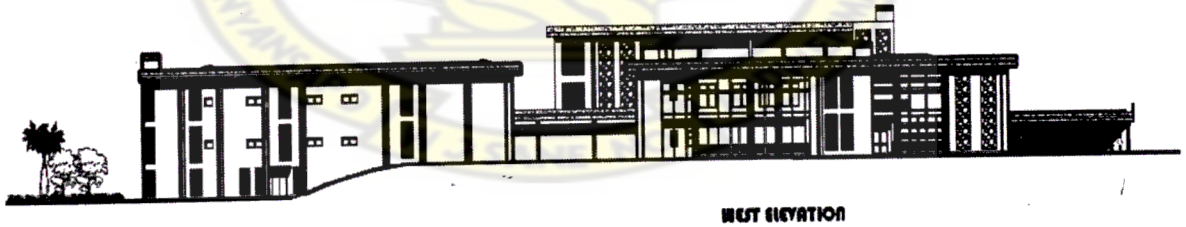
Fig. 23 ELEVATIONS

SOUTH ELEVATION



EAST ELEVATION

NORTH ELEVATION



WEST ELEVATION

## 4.7 MATERIALS AND CONSTRUCTION

### 4.8a STRUCTURAL FORM

From all the clues gathered under the case studies, special studies and technical studies, a conscious effort was made to develop a modular grid system for the entire facility. A 7 by 7 metres grid was adopted as the basic grid for two zones. Thus the nursing zone and the surgical/ private ward zone. The total composition of the entire facility is to be moulded on a column and beam frame basis. Expansion joints have been introduced at appropriate joints (25m intervals) to help the entire structure in the event of uneven settlement.



### 4.8b CONSTRUCTION TECHNOLOGY

The method of composite construction has been used, where a mixture of concrete, block and brick work, steel and glass are used. The sizes and total number of columns reduces so that the building does not become heavy. This is also to reduce the cost implication. Due to the ventilated and lateral distributions of load, the base is the biggest, so as to make it structurally sound to carry the other imposing load

### 4.8cLANDSCAPING

Both hard and soft landscaping will be employed in the facility. However, soft landscaping will dominate in the facility to serve as a therapy for healing. A careful

selection of trees and shrubs will be employed to prevent allergy experienced by patients to some plants.

A fountain has been placed near the porte-cochere to welcome patients, staffs and visitors alike to the facility. This fountain has been carved in the shape of calabash psychologically inviting all and sundry to drink from it signifying welcome as it pertains in Ashanti traditional homes. The main entrance of the facility will have low grass interplayed with medium sized trees. The hard landscape areas will include the car parks and the walkways

## 4.9 ENVIRONMENTAL IMPACT OF DESIGN

Physically, the facility has been designed to fit in its environment, both structurally and aesthetically. The building height has also being designed so as not to create a superimposing image in its environment but to make it appear as a landscape feature. Thus, the shape of the building, roof-scape, colour scheme and materials have all been chosen to conform to what exist in Boadi and KNUST and are also readily available. The radiation from the radio-therapy is efficiently handled so as not to negatively affect the environment. In the aspect of pollution, the sewage and soil waste have being directly connected to the main sewage line which leads into a biogas digester. This has been done so that the discharge and the treatment of the waste does not become a nuisance in the immediate environment.

### 4.10 FINISHES

The finishes for the facility will be carefully selected with emphasis on durability, high quality finish, aesthetic appeal, functionality, ease of maintenance and value for money.

## 4.11 SERVICES

### 4.11a ELECTRICITY

KNUST has a sub-station that supplies adequate power to the entire campus Hydroelectric power will be tapped by using underground armoured cables from a 3 face LV lines, which can be located along the major road leading to Boadi township. The electrical power after being tapped from the mains is drawn into a switch room where the distribution is done. The electric power is serviced to the various floors through service ducts that have been provided at vantage points.

### 4.11b LIGHTING

The two major source of lighting has been employed in this design. A greater part of consideration has been given to natural lighting so as to make the design cost effective. Due to the exterior finish used, a lot of day light is optimized in used. Day lighting in the interiors will be supplemented with artificial lighting. The offices, consulting rooms, and wards would use natural lighting most of the time due to the working hour's duration

### 4.11c VENTILATION

Consideration has been made for both natural and artificial ventilation. The buildings will most of the time use artificial ventilation due to the activities that go on. The consulting rooms, wards, pharmacy and laboratory will use natural ventilation via open able glass windows. The operating theatre, x-ray and Audiovisual and observation rooms will rely on artificial ventilation for aseptic, radiation leakages and acoustic reasons. Artificial and natural ventilation has been combined in the sub-basement.



### 4.11d COMPRESSED AIR

Clinical and laboratory work requires a regular and reliable supply of clean compressed air. Air compressors located in the medical Gas supply room delivers clean air through pipes running through ducts.

### 4.11e MEDICAL GAS SUPPLY

Operation will be carried out in this facility and therefore the need to provide medical gases through 12mm ducts from the control supply station. Oxygen, Nitrous oxide and triclinic will be stored in gas cylinders and mixed at the central point.

### 4.11f INFORMATION SYSTEM

The facility will be computer networked to facilitate documentation and transfer of information. This will be monitored at the ICT.

### 4.11g SECURITY CONTROL

This is aimed at reducing theft, terrorist attacks and other unpleasant scenes. Security alarms and cameras will be introduced at all escape doors at nursing as well as other vantage areas of the facility. In addition to this, security post at the entry points will be used to monitor the facility. In totality there is a main control room where there is the provision of CCTV so that security checks can be easier. This is also to make communication among the security personnel effective, faster, easier, and co-errant.



### 4.11h FIRE FIGHTING PROVISION

Two fire factors were considered in order to minimize fire risks. First and foremost was to ensure proper planning measures to minimize incidents of fire outbreak. In case of a fire outbreak, there is the provision of easy water sprinkles, which is activated on the detection of smoke, House reels and fire extinguishers. The incorporation of fire exit into open spaces and the exterior of the building for people to escape to safety is a second measure to combat fire outbreaks. Fire resistant materials have been used in area of fire escape an example is the lifts. Water Hydrants have been externally provided at every 420sqm.

### 4.11i SECURITY LIGHTING

External and internal artificial lighting would be provided so as to serve as to improve the security of the place at night. These would be introduced in the facility, parking areas and the pedestrian circulation routes. Garden lamps will also be introduced to aid visibility at night

### 4.11j WATER SUPPLY

A water reservoir of 675m3 water storage capacity will be placed uphill of the main teaching hospital allowing water to flow by gravity through two 100mm diameter PVC pipe line buried approximately 1.0 meter in the ground, and on the right side, which passes in front of my facility. Water would be tapped from this main line to service the various parts of the building.



The Direct and indirect system of water supply is used in serving the building. The direct system is used to supply the kitchen and other areas where water would be trapped to drink. The indirect is used to service the sanitary areas and also used for other activities than the direct usage.

### 4.11k SURFACE DRAINAGE

Drainage has been provided to take one of sewage soil waste, wastewater and rainwater. The soil waste and wastewater have been discharged off by draining it into the control sewage pipeline system leading into a biogas digester, which lies down the western side of the site. The rainwater is collected and then used when there is a water shortage to maintain or keep the sanitary areas of the building functioning.

### 4.11l TELEPHONE

There are existing telephone poles on the site from which telephone lines will be tapped to service the various sections of the building through the service ducts and also have a

central unit form where connection and disconnections can be made. Inter-communication facilities will not be left out. The telephones will especially be supplied to the administration and the wards. Card phones will also be provided at certain vantage points. The inter-communication system will be connected from the nursing station to the beds of patients.

### 4.11m REFUSE DISPOSAL

KNUST already has a network responsible for these services. Refuse will be collected through chutes from upper floors and gathered at a central collection point. It is from here collection will be done by management.

# CHAPTER FIVE

## 5.0 COST ESTIMATE

This costing is an estimate to give the client an idea of the financial investment the project will need. The price per square meter for the construction of this project is currently quoted between 350-400 dollars. To arrive at the estimated total cost, the total area of the design should be multiplied by the cost per square meter (For this project 350 dollars will be used).



The cost per square meter of construction is $350, that is GH¢560

Hence,

Outpatient department----------741.28 m² x ¢560

= GH¢**415,117**

Treatment zone----------886.02 m² x GH¢560

= GH¢**496,171**

Research zone----------233.28 m² x GH¢560

=GH ¢**130,637**

Nursing zone----------2839.2 m² x GH¢560

= GH¢**1,589,952**

Support zone----------811.8 m² x GH¢560

= GH¢**454,608**

Service zone----------2530.6 m² x GH¢560

= GH¢**1,417,136**

**Grand Total**----------7809 m² x GH¢560

= GH¢**4373040**

## 5.2 CONCLUSIONS

The urology centre would be dedicated to the research and treatment of kidney disorders prostate cancers, especially the types prevalent in sub-Sahara Africa.

The facility is designed to meet the needs of all users of the space in a harmonious atmosphere by the use of state of the art technology and the creation of a therapeutic environment.

It is, therefore, hoped that the client and all concerned would come together to make this proposed scheme a reality within the shortest possible time.

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