KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF ARCHITECTURE AND PLANNING

FACULTY OF ARCHITECTURE AND BUILDING TECHNOLOGY

DEPARTMENT OF ARCHITECTURE

STOCK EXCHANGE DESIGN – ACCRA

BY

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Thesis design report is submitted in partial fulfillment of requirement for the degree of

PG. DIP. ARCHITECTURE (HONS)

MAY 2009

DECLARATION

I hereby declare that this submission is my own work undertaken with supervision towards the degree of P.G. Dip. Honours.

Miss Phyllis Asante ..18th. September, 2009.. .....

Index no: PG1052607 Date Signed

(Student)

I hereby declare that this submission is the students own work undertaken under supervision towards the degree of P.G. Dip. Honours.

Mr Eddie Botchway ..21/09/09.. .....

(Supervisor) Date Signed

Prof. G.W.K. Intsiful ....

(Head of department) Date Signed

DEDICATION

I dedicate this submission to the almighty God for being there to see me through it all and to my entire family for their unflinching care and devotion, particularly, Mrs. Evelyn O. Asante for continuously being a dear and supporting mother.

ACKNOWLEDGEMENT

My sincere appreciation goes to the almighty God for remembering me with favour and granting me the grace to accomplish this entire project and to write this submission.

My heartfelt thanks also go out to Mr. Eddie Botchway for going the extra mile to supervise this entire work. I am glad you have been there and could not be more pleased. To Mr S.O. Afram I appreciate the genuine concern you showed towards all the members of the class as the year master. Your commitment has indeed been laudable.

I hereby acknowledge the entire management and staff of The Ghana Stock Exchange, Accra; The SSNIT Development Office, Ridge, Accra; The Survey Department, 37; Accra and The Accra Metropolitan Assembly, Accra for their readiness to release information towards the realization of this project.

I express gratitude to Mr. Eric Osei Tutu Agyemang for his unflinching support in bringing this project to such a level as this. It was comforting to know that I had a person such as you to call on. Special thanks also go to Miss Cynthia Araba Nunoo for her readiness to co-operate with me on the project. I express my deepest love and gratitude to Mr. Samuel Asare Yeboah Junior for his dedication and advice towards the project particularly with regards to the costing. To Miss Barbara Simons, Mr. Philip Nartey, I say a big thank you for their contribution to the work mainly through constructive criticism. All your efforts have indeed been appreciated

Finally, I would like to thank all those who directly or indirectly played a role and as a result this project came to a successful completion. Keep up the great work and God richly bless you all for your time and dedication!

ABSTRACT

Stock exchanges perform important roles in national economies. Most importantly, they encourage investment by providing places for buyers and sellers to trade securities. These investments in turn enable corporations to obtain funds to expand their businesses.

The design of the stock exchange facility basically involved studies into the salient issues of the stock exchange using various research methods.

Research methods employed basically include existing literature, interviews and accessing information on the internet. Site surveys were conducted to get acquainted.

Case studies were conducted at the Ghana stock exchange which sort to also interview stakeholders and professionals in the field. The case study revealed that there were several challenges confronting the current stock trading situation given the fact of inadequate space among other factors.

Further precedence studies delved into includes the New York Stock exchange and London Stock exchange which brought to the fore the direction stock trading is headed internationally. Special technical studies were as well done to achieve the resultant architectural design.

The ensuing design seeks to address the basic needs of an exchange seeking to enhance exchange through space. Special dedication was given to the form an architectural style was chosen. Efforts have been made to make the entire design as tropical, cost effective and sustaining as possible

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CHAPTER ONE

1.0.INTRODUCTION

a. Preamble

With reference to the recent oil discovery in Ghana projections are that the macro-economy of Ghana is increasingly getting attractive to investors in the sub-region and the world over. Ghana is also well known for her relatively peaceful and conducive investment environment. The stock market culture in Ghana is also gaining grounds with people getting more cautious of their investments needs. Most of the listed companies on the GSE are Ghanaian but there are some multinationals. The current situation however leaves a lot of room for improvement. A well established stock market will therefore seek to address all these needs.

b. Problem statement

The Ghana stock exchange was incorporated in July 1989 with trading commencing in 1990. There has never been a building specifically dedicated to trading stocks in Ghana as it is the case in other countries. For some time now the exchange has been operating on the 5th floor of the cedi house in Accra. Since the cedi house is not dedicated to meeting the needs of the stock market it has become increasingly difficult to run the stock exchange. For instance the fire outbreak which occurred on the 26th of November 2008 affecting three floors of the building including the stock exchange's floor. A building solely dedicated to the needs of stock trading and its associated activities is therefore required.

c. Project justification

- The present Ghana stock exchange does not offer adequate spaces for meaningful operations since it was not purpose built.
- The participation of the Ghana stock exchange in socioeconomic development is stunted by unavailability of office spaces and other economically viable spaces.

d. Design aims and objectives

- To facilitate the participation in socio-economic development in Ghana.
- Link banking centres to facilitate transactions.
- The Ghana stock exchange must generate income for stakeholders.
- Efficiently utilize site in the C.B.D. of Accra.
- To promote efficiency and effectiveness of the GSE staff through better relationships of spaces in the design.

e. Scope

- Stock exchange
  - Meeting areas
  - Business class suites
  - Offices for leasing
    - Sec
    - Brokerage firms
    - Banks
    - Other financial institutions
  - Ancillary facilities

- Car parking spaces

The thesis design is taking into account the local market, West African market and beyond.

f. Target group

The investor population worldwide especially Ghana's, including the elite thus the business class and the ordinary Ghanaian.

g. Project financiers

- Bank of Ghana
- Ghana stock exchange
- Listed companies on the G.S.E.

h. Client

The government of Ghana with assistance from the companies listed on the Ghana stock exchange (G.S.E.).

1.1.Research Methodology

- Research on existing literature to find out the major objectives for an office complex.
- Research on the internet to help study other foreign stock exchanges and how their design can be used to help improve the final design.
- Precedence studies on the Ghana stock exchange and its associated issues.
- Interview of professionals in the marketing and other sectors of the economy as well as stake holders of the stock exchange (stockholders).
- Site survey and analysis.
- Technical studies.

CHAPTER TWO

2.0.LITERATURE REVIEW

"Wall Street is the only place people ride to in a Rolls-Royce to get advice from people who take the subway". **Warren Buffett** (1930 -) U.S. financier. New York Newsday

"It has become cheaper to look for oil on the floor of the New York Stock Exchange than in the ground". **T. Boone Pickens, Jr.** (1928 -) U.S. business executive. Time

Truly, it should be well known that the workers of the stock exchange are not themselves wealthy people however they are mostly part of the middle income group.

2.1.Definition

A stock market, or (equity market), is a private or public market for the trading of company stock and derivatives of company stock at an agreed price; these are securities listed on a stock exchange as well as those only traded privately. It is an organized market where brokers meet to buy and sell stocks and shares. Stock Exchange however is an organized market for buying and selling financial instruments known as securities, which include stocks, bonds, options, and futures. Stock exchanges perform important roles in national economies. Most importantly, they encourage investment by providing places for buyers and sellers to trade securities. This investment, in turn, enables corporations to obtain funds to expand their businesses.

2.2.Background information

2.2.1. Early history of the stock market

In the 1700s groups of brokers in Philadelphia, Pennsylvania, and New York City began to meet in parks and coffeehouses to buy and sell securities. In open auctions, traders called out names of companies and numbers of shares available. Shares went to the highest bidders. After the American Revolution (1775-1783) the number of securities traded increased dramatically. Brokers decided to organize in order to handle the growing volume.

2.2.2. The Ghana Stock Exchange

The Ghana Stock Exchange (GSE) is the principal stock exchange of Ghana. The exchange was incorporated in July 1989 with trading commencing in 1990. It currently has around 30 listed companies and 2 corporate bonds. All types of securities can be listed. Criteria for listing include capital adequacy, profitability, spread of shares, years of existence and management efficiency. The GSE is located in Accra.

2.2.3. History of operations

Since its inception, the GSE's performance has varied considerably. All listings are included in the main index, the GSE All-Share Index. In 1993, the GSE was the 6th best index performing emerging stock market, with a capital appreciation of 116%. In 1994 it was the best index performing stock market among all the emerging markets, gaining 124.3% in its index level. 1995's index growth was a disappointing 6.3%, partly because of high inflation and interest rates. Growth of the Index for 1997 was 42%, and at the end of 1998 it was 868.35. As of October 2006 the market capitalization of the Ghana Stock

Exchange was about ($11.5bil) 111,500bil cedis. As at December 31 2007, the GSE's market capitalization was 131,633.22bil cedis. In 2007 the index appreciated by 31.84%. The manufacturing and brewing sectors currently dominate the exchange. A distant third is the banking sector while other listed companies fall into the insurance, mining and petroleum sectors. Although nonresident investors can deal in securities listed on the exchange without obtaining prior exchange control permission, there are some restrictions on portfolio investors not resident in Ghana.

Some of the companies listed on the Ghana Stock Exchange are as follows: Accra Brewery Company, AngloGold Ashanti, Aluworks, Ayrton Drugs, British American Tobacco Ghana, Benso Oil Palm Plantation, CAL Banks, CFAO Ghana, Clydestone Ghana, Camelot Ghana, Cocoa Processing Company, Ecobank Ghana, Enterprise Insurance, Ecobank Transnational, Fan Milk Limited, Ghana Commercial Bank, Guinness Ghana Breweries, Golden Web, HFC Bank, Mechanical Lloyd, Pioneer Kitchenware, Produce Buying Company, PZ Cussons Ghana, Standard Chartered Bank Ghana, Starwin Products, Super Paper Products, SG-SSB, Sam Wood Limited, Trust Bank Limited, Total Petroleum Ghana, Transol Solutions Ghana, Unilever Ghana.

2.3.Principles of office design

The way in which an office is organised and roles are defined (office structure, customer management and office technology) affects the requirements for office space.

There are two principles in office planning:

a. Where spaces are accessible from corridors in which single and multiple layouts can be distinguished

b. Where the various layouts have direct access gained from a utility core.

The current Ghana stock exchange in the cedi house has a layout in which the accessibility from functional areas is gained from the utility core i.e. services lifts. Stairs etc.

2.3.1. Objectives

The planning layout and spatial organization of an office building should reflect the following:

a. **Accessibility:** Everything pertains to building elements, heights and clearances implemented should address the specific needs of the physically challenged.

b. **Aesthetics:** The building should be aesthetically pleasing and harmonise with both buildings and the environment.

c. **Cost effectiveness:** The design should be cost effective. Options must be weighed during concepts, design development, and value engineering. It should be cost effective in the selection of the appropriate building configuration including the application of building materials and other finishes.

d. **Functionality/Operations:** The layout should be functional to facilitate acceptable interrelationship of space and promote efficiencies and effectiveness of staff, visitors and their activities. Maintenance of building elements should also be easily facilitated.

e. **Productivity:** The building must promote the well being of users by providing adequate micro-climatic regime of interior space - ventilation and insulation of the building envelope.

f. **Security:** It should ensure security and safety of users through the application of exit and entry elements – stairs, lifts and adequate signage.

g. **Sustainability:** The building should also be flexible to facilitate expansion and maintain the sustainability of operation.

CHAPTER THREE

3.0.FINDINGS AND RECOMMENDATIONS

3.1. Case and technical studies

3.1.1. Case study

Additional foreign case studies were conducted on the New York and London stock exchanges in addition to the Ghana stock exchange to find out the organizational and spatial configuration of the a stock exchange since there is no purpose built Ghana stock exchange.

a. The Ghana Stock Exchange (GSE)

The GSE currently occupies the 5th and 6th floors of the Cedi House. It is 20 years old and now with 31 parties. It employs the continuous auction trading (CAT) system in trading. The GSE has several departments.

Plate 1 – Cedi house

The lower floors with external parapets form a pedestal for the upper floors. This gives the building visual stability. The horizontal and vertical combination of the outside wall skin shades the inner space from the uncomfortable effects of solar radiation. It is a tropical design and it holds its own place among the buildings in the enclave.

i. GSE - 5th floor:

The services of the cedi house are located in the core of the building with the offices surrounding them. The various spaces are accessible from corridors gained directly from utility core. The massive structural columns are located in the external walls and the various partitions provide the space for the functional operation of the stock exchange.

On the 5th floor is the Administration and Finance with the reception. It has the trading floor grounds with galleries overlooking from the floor above. There are 2 visitor lounges at the reception.

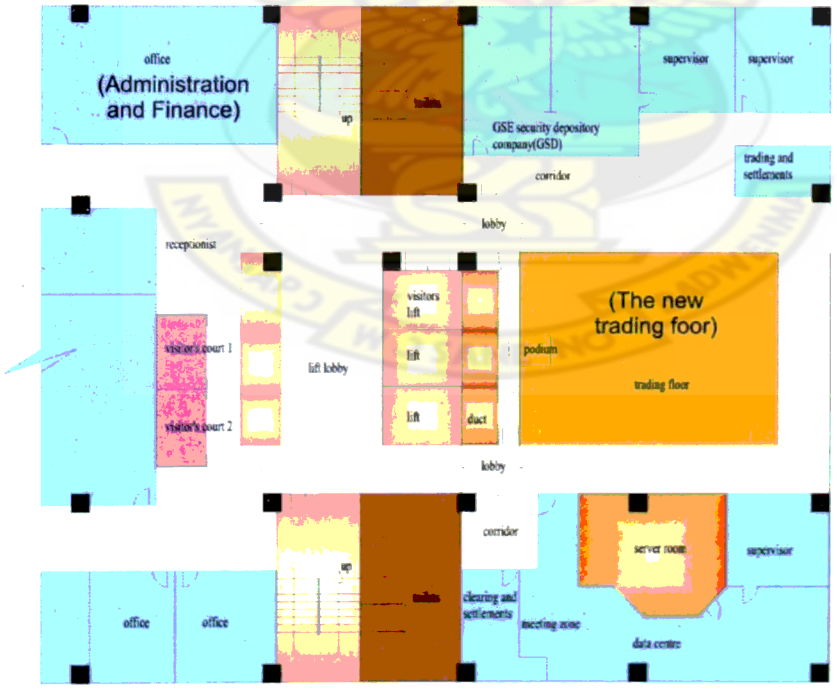


Fig 1 – GSE 5th floor

ii. **GSE - 6th floor**

The 6th floor houses the Public relations, Listings, Research and Special studies departments. The old trading room on the 6th floor is currently the location for trade due to the fire outbreak soon after the automation of the trading floor. Other departments include Accounts and Education. The GSE uses security men and C C TV cameras for their security checks. The media are allowed into the trading floor only after trading hours. Maintenance is scheduled by the Cedi House.

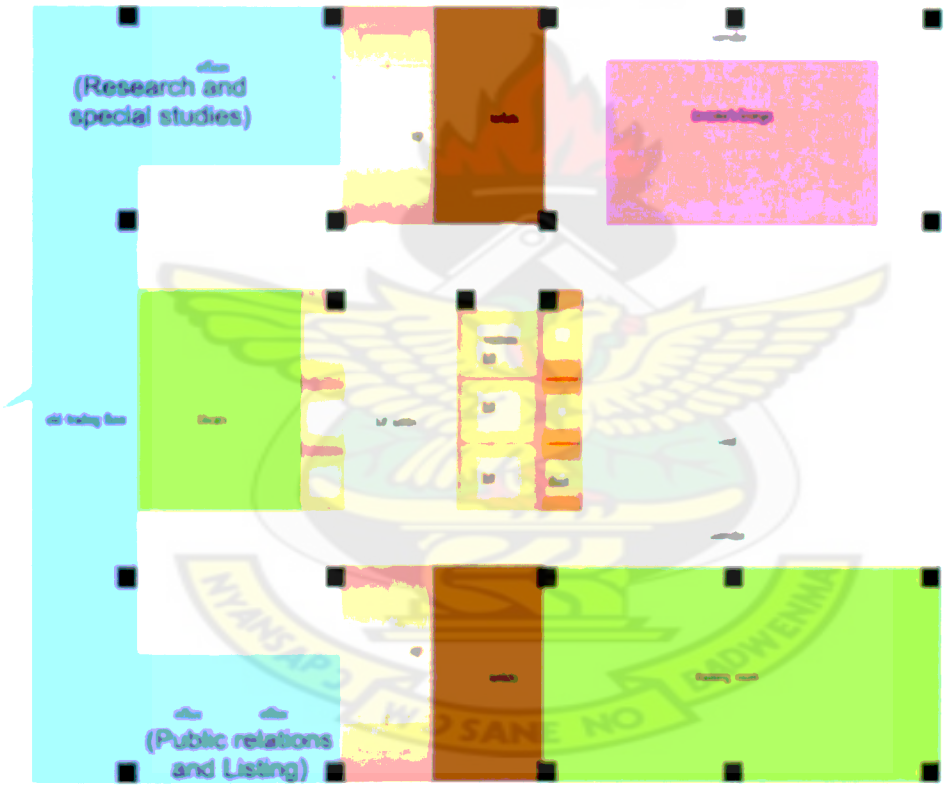


Fig 2 GSE 6th floor

- **Merits of case study**

i) Organisational structure of the office pertaining to the various departments and spaces used by the exchange was praiseworthy.

- Commendable lighting levels for tasks.
- Partitioned offices instead of solid walls eased weight on structure.
- CCTV cameras for security.

- **Demerits of case study**

- Office spaces especially the trading floor is not adequate for daily running of the stock exchange.
- Spatial arrangement in terms of function does not relate well.
- Non existence of conferencing facilities and well defined meeting areas.
- No well defined break and leisure facilities.
- Inadequate storage spaces.

a. Precedence study one

- **The New York stock exchange**

Plate 2 – New York stock exchange

It was designed by architect George B Post, Pediment by JQA Ward and Paul Bartlett and is located at 8 Broad Street, between Wall Street and Exchange Place. He used Neo-Classicism in design.

It is currently 217 years old, started with 24 parties and now with 2,764 parties. It is the world's largest market in terms of dollar volume and 2nd in terms of securities. It uses the open outcry/Call out system of Auction in trading.

Construction: The trading floor was one of the largest volumes of space in the city at the time at 109 x 140 feet (33 x 42.5 m) with a skylight set into a 72-foot (22 m) high ceiling. The main façade of the building features marble sculpture by John Quincy Adams Ward in the pediment, above six tall Corinthian capitals, called "Integrity Protecting the Works of Man".

b. Precedence study two

- **The London stock exchange**

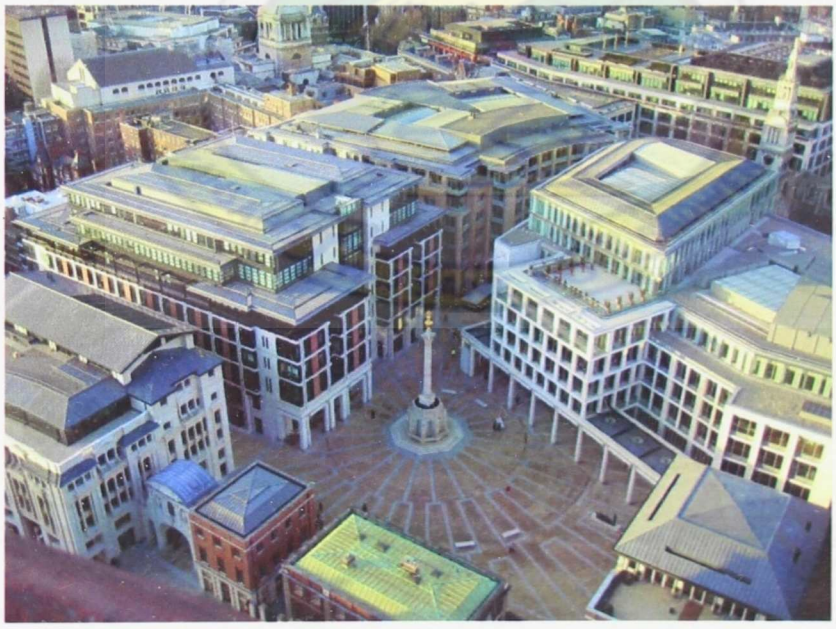


Plate 3 – London stock exchange

It was designed by Eric Parry Architects and has the International style of architecture. It is currently located at Paternoster Square, London.

It is currently 208 years old and now with over 3,000 parties. It is the most international exchange. It is an ultimate conference venue in the heart of the City. It uses the Base Residual Auction (BRA) in trading stocks.

The London Stock Exchange is hard not to notice. Next to St Paul's Cathedral, it has a beautiful setting in Paternoster Square. The purpose-built facilities boast flexible event spaces, broadcast studios and state-of-the-art technology, all wrapped up in contemporary and stunning surroundings.

The Exchange moved to 10 Paternoster Square in June 2004 and the Media & Business Complex sits on the first floor of this stylish and innovative building. With a unique combination of event space and broadcast facilities, the Media Complex offers companies a dynamic environment for conducting effective business communications.

A variety of global broadcasters, Sky News, CNN, CNBC and the BBC to name but a few, report live from the Exchange on the day's business and market news. Companies can also benefit from the Exchanges various media services. Because of their strong relationships with the global broadcasters who use their studios, it makes them ideally placed to assist companies with gaining media coverage for important events and announcements. Organisations can also hire the studios for filming corporate videos or media training.

With the studios as a backdrop, companies can hire the Media Complex event facilities to host meetings, conferences, exhibitions and receptions in a variety of flexible

spaces. The first of the large event spaces is the Theatre, offering gently tiered seats for up to 120. It guarantees comfortable viewing, with abundant leg room and double arm rests. Speakers also feel comforted by easy-to-use technology and constant support from the AV Team. Webcasting, audio and video conferencing can all be organised easily from the discreet control room.

The Forum offers maximum flexibility, either as one large combined room or divided into Forum 1 and Forum 2. With natural light, the room can be transformed into a variety of styles, from boardroom for up to 30 to a stylish seated dinner for 120.

The naturally-lit Gallery and Atrium provide valuable catering, circulation and reception space or can be transformed to accommodate an exhibition.

The Recess Rooms complete the set. They comprise two intimate meeting or private dining rooms with views over Paternoster Square. Both rooms accommodate up to 10 people and incorporate comprehensive AV equipment.

Roughly 40% of the Exchange's revenues are generated by the sale of real-time information about stock prices.

3.1.2. Technical studies

a. Types of office spaces

i. Partitioned open floor office plan

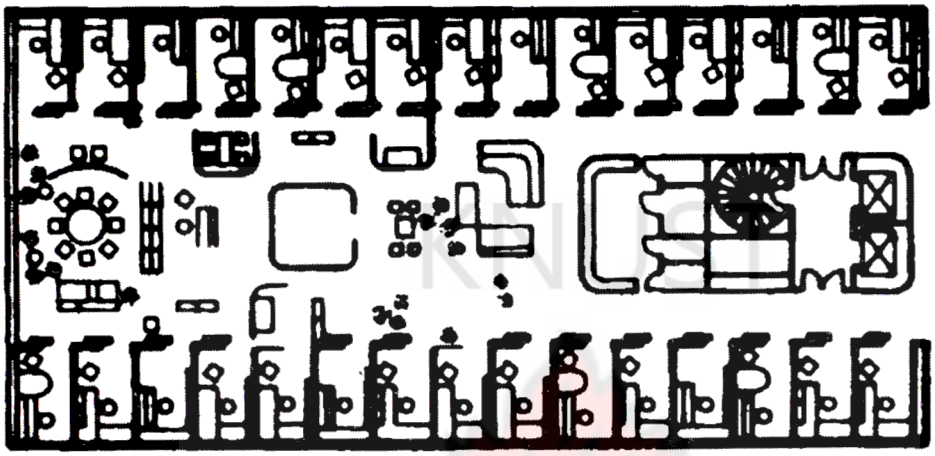


Plate 4 – Open floor offices (Source Neufert)

ii. Separate offices

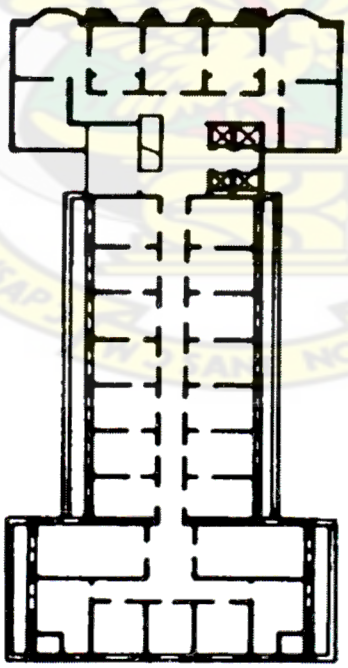


Plate 5a – Separate offices (Source Neufert)

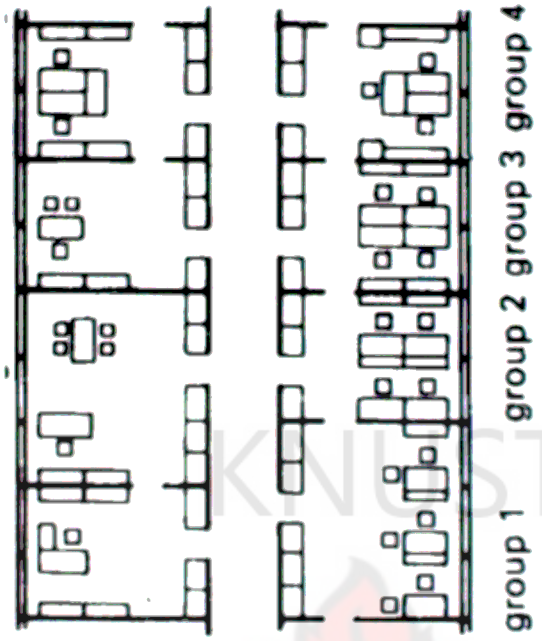


Plate 5b – Separate offices (Source Neufert)

b. Parking Requirements per 1000 sq. m. floor space

Minimum number	Desirable number	Maximum number
General		
20	20	40
Bank		
20	30	45
Offices		
10	15	25

Department **store / Supermarket**		
30	45	60
Restaurant		
25	35	60
Fast food		
60	120	150
Hotel		
- small		
1r	1.5r	-
- medium		
1.2r	1.25r	-
- large		

1.9r	1.2r	-
Residences		
- medium class		
0.75r	1.0r	-
- high class		
1.0r	1.0r	-

Table 1 – Parking requirements (source Mr Tackie – Consortium of architects and engineers, Accra)

c. Car parking

i. Turning Circles

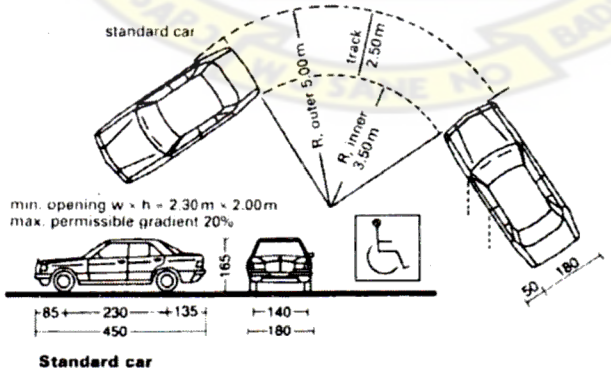
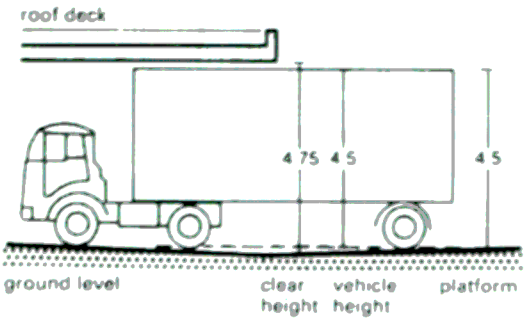


Plate 6 – Turning circles (Source Neufert)

ii. Loading bay



Dimensions for sheltered loading bays

Plate 7 – Loading bay (Source Neufert)

d. Sun shading devices

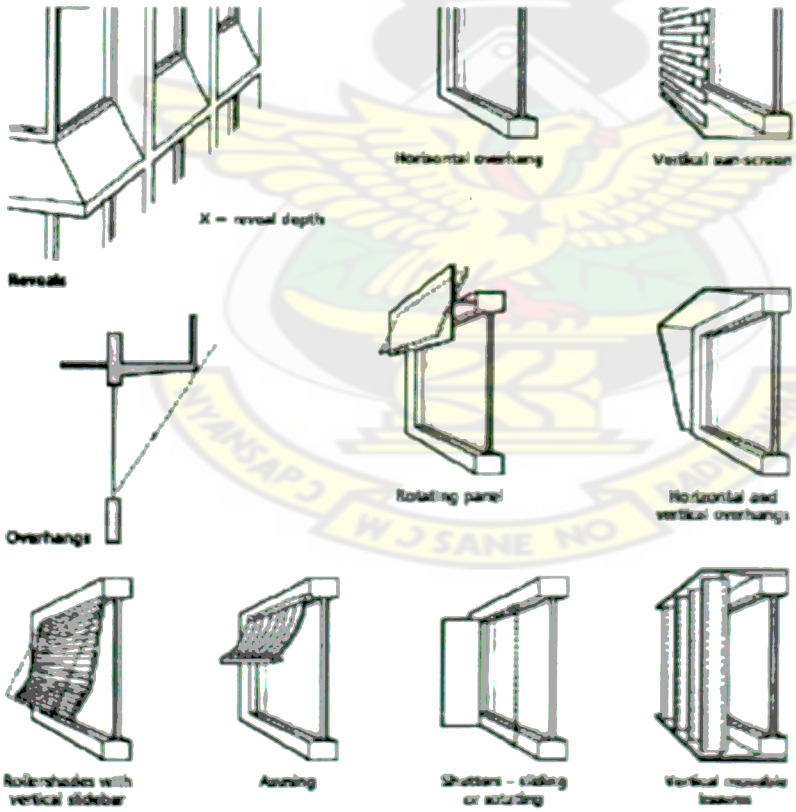


Plate 8 – External sun shading devices

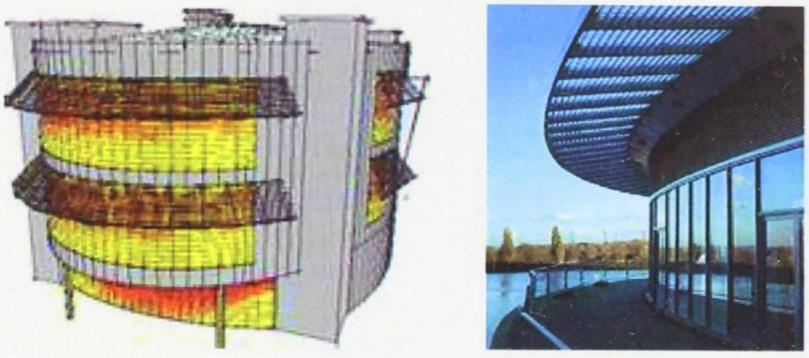


Plate 9 – Sun shading on a circular structure

Plate 10 – Sun shading on a rectangular structure

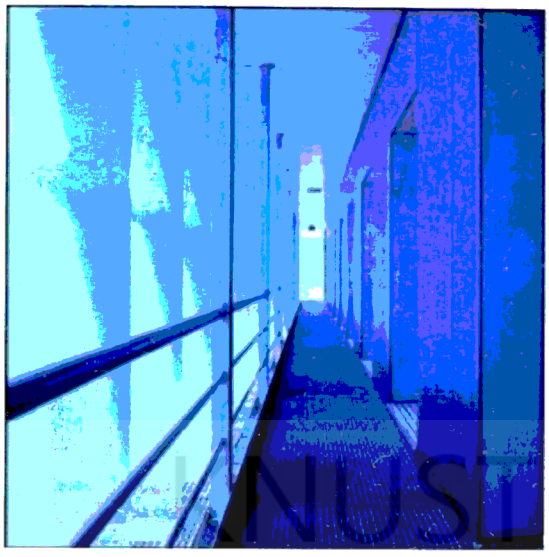


Plate 11 – Vertical sun shading devices

The appearance of the façade changes with weather, time and season. By night the louvres appear almost transparent when viewed from the outside, and appear like curtains when viewed from the inside. The active louvre façade is able to increase comfort levels and reduce energy costs.

e. Lifts

i. General purpose lift

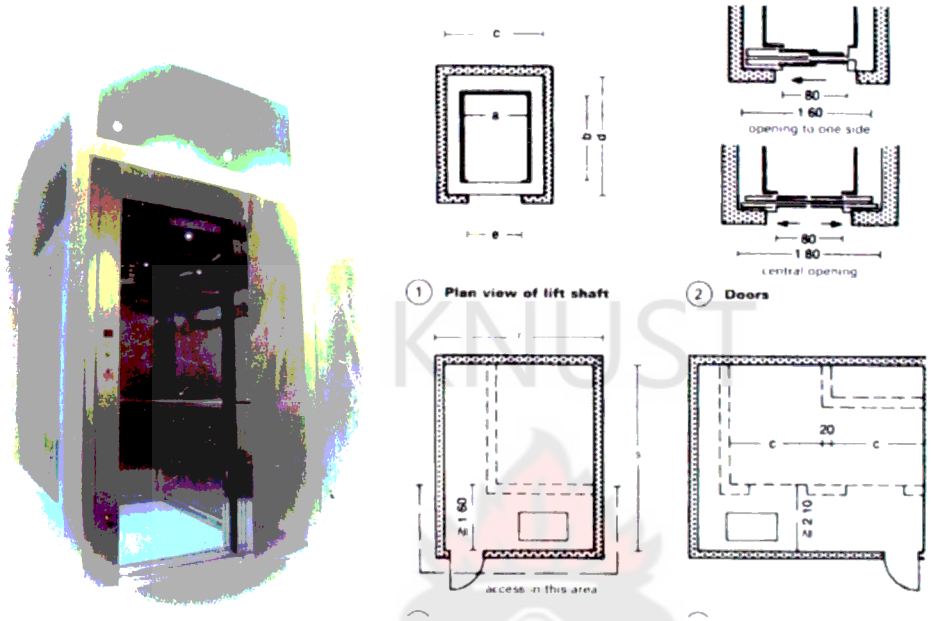


Plate 12 – General purpose lifts (Source Neufert)

ii. Panoramic lift

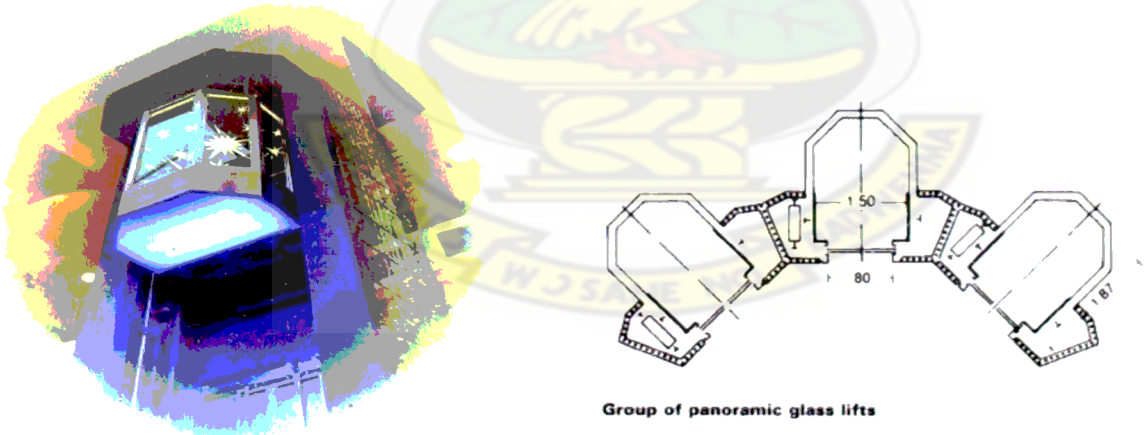


Plate 13 – Panoramic lifts (Source Neufert)

iii. **Goods lift**

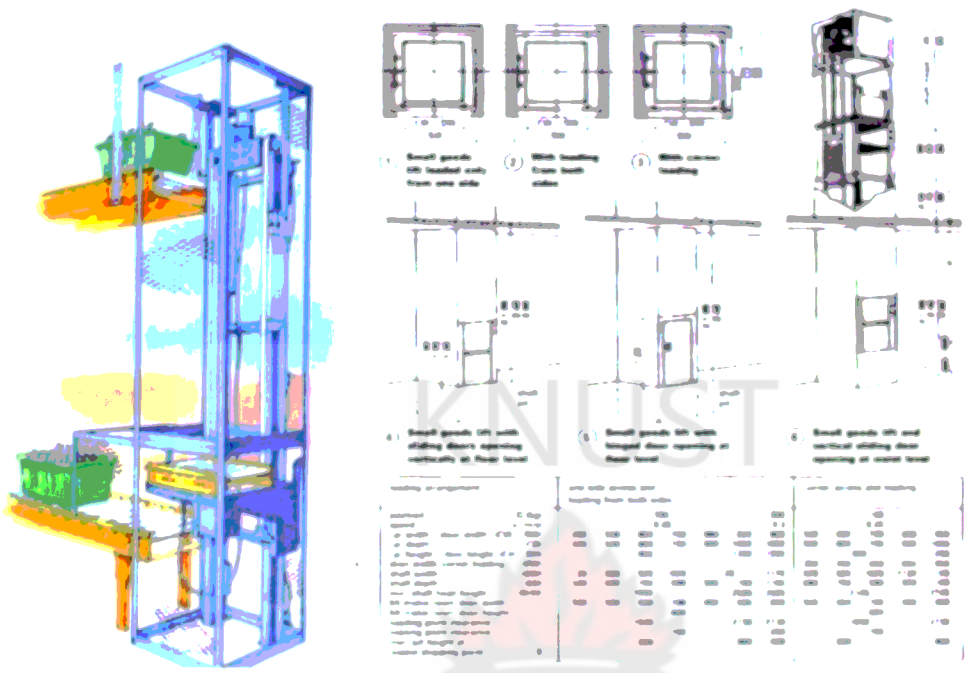


Plate 14 – Damp waiter (Source Neufert)

3.1.3. Special studies

- **Spaces to consider**

i. The Office Building

Interestingly, the life-cycle cost distribution for a typical service organization is about 3 to 4 percent for the facility, 4 percent for operations, 1 percent for furniture, and 90 to 91 percent for salaries. This can be managed through integrated design with increased worker satisfaction and productivity, improved health, greater flexibility, and enhanced energy and environmental performance.

ii. Surface

Outside surface parking refers to large paved areas used for extensive vehicle parking—beyond the incidental parking provided for individuals, official government parking, and short-term drop off—located adjacent to a building.

iii. Parking – Basement

The Basement Parking space type refers to parking located below grade within an occupied building. The Level of Service of the Inside/Basement Parking indicates the use by some unfamiliar users, moderate daily turnover, and medium percentage of small cars and light trucks; and requiring one-way aisles of 3300mm straight-ways and 4000 turns.

iv. Clinic / Health Unit

The Clinic/Health Unit space types are facilities where outpatient ambulatory health services are provided. Sub-space types, such as office spaces, private toilets, and filing and storage areas are included. This space type does not include provisions for invasive surgery, in-patient services, medical diagnostic categories I, II, and III equipment or medical laboratory spaces. Clinics where general anesthesia, invasive procedures, or overnight care are provided require Institutional Occupancy construction types.

v. Auditorium

The Auditorium space types are areas for meetings, presentations, and performances. Auditorium space type facilities may include assembly halls, exhibit halls, auditoriums, and theaters. Auditorium space may include such features as sound reinforcement systems, audiovisual systems and projection screens, food service facilities, proscenium stages with

heights greater than 15000mm or fly gallery, orchestra pits, revolving or hydraulic stag platforms.

vi. Joint Use Retail

The Joint Use Retail space types are stores used for the sale of products and services. Joint Use Retail space types may include news and book stands, flower shops, convenience stores, travel agencies, credit unions, shoe shine stands, barber and beauty shops, print shops, courier mail shops, retail of clothing or other hard goods, and similar applications.

vii. Physical Fitness (Exercise Room)

The Physical Fitness (Exercise Room) space type is a space specifically designated for exercise, fitness training, and physical wellness activities. Also included are toilets, office, and general storage normally found in a Physical Fitness (Exercise Room) space to meet codes and regulations. Fitness space types do not include: high bay court games (basketball, racquetball), saunas, hot tubs, steam rooms, swimming pools, food preparation, and service or sporting goods retail. The Physical Fitness (Exercise Room) space types provide a comprehensive, varied program of physical activities to meet the individual training regimens of its occupants.

3.2.THE SITE

3.2.1. Site location

Plate 15 – Ghana map

Accra is the capital, and most populous city of Ghana, a nation on the coast of the western region of Africa. The city also doubles as the capital of the Greater Accra Region, and of the Accra Metropolis District with which it is coterminous.

It is the administrative, communications, and economic center of the country. Over 70% of Ghana's manufacturing capacity is located within this region district. Accra has been Ghana's capital since 1877, and contains public buildings reflecting its transition from a 19th century suburb of Victoriasborg to the modern metropolis it is today.

Stock exchanges are normally located in the CBD therefore Ridge and Accra central were considered.

Ridge is close to Accra Central which houses most of the offices in the CBD. It is relatively less chocked and in proximity to the current location of the existing Stock

Market, The Cedi House. The legislation in the area says a minimum of 6 floors while the current range is 1-13 floors.

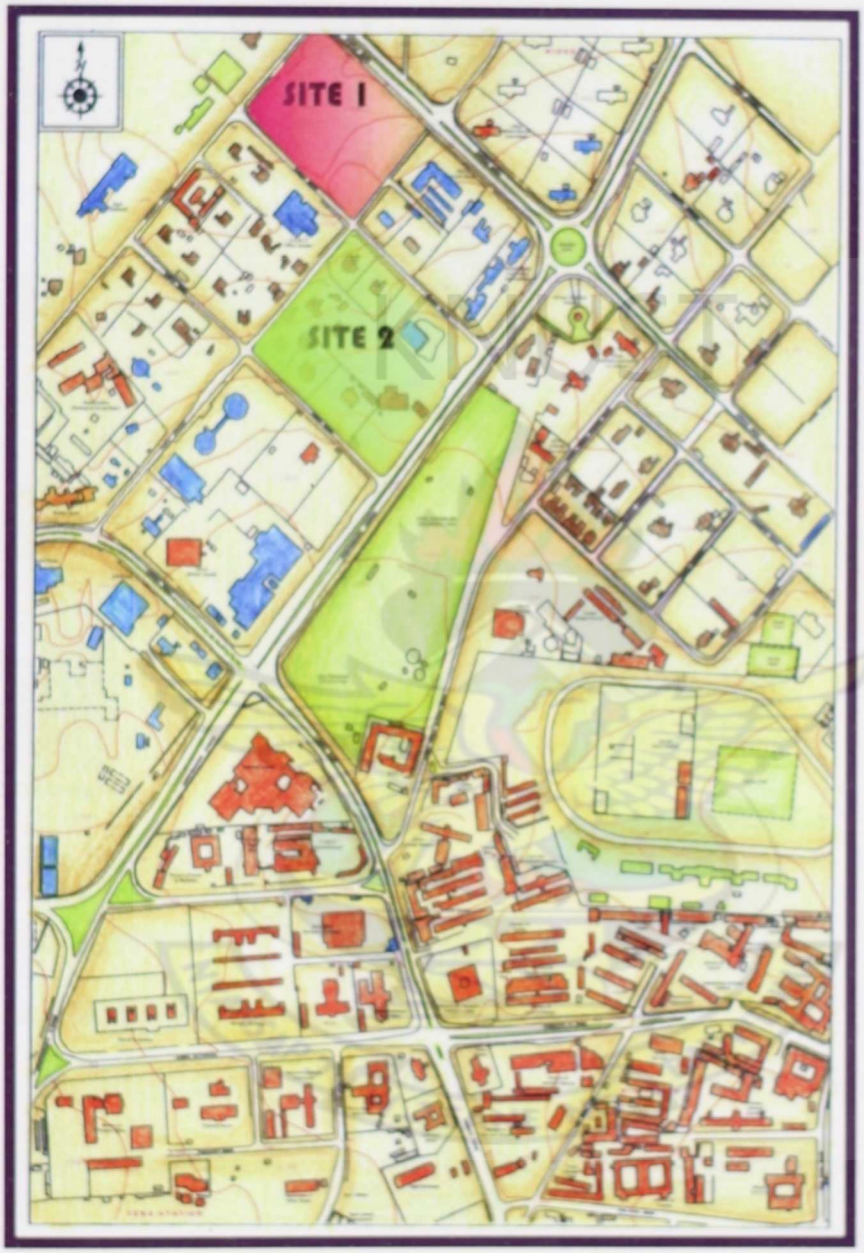


Fig 3 – Site map

Fig 4 – Site location and peripheral development

3.2.2. Site selection

a. Site1 – SIC

Location: The site is bounded by the Castle Road to the North, the Sudan Road to the South, the Valco Trust Towers to the East and the Seventh Avenue to the West.

Strengths

- Existing less busy roads.
- Sufficient land and building space are available.
- Municipal environment is fine in general.

Weaknesses

- Site prone to seismic forces
- Absence of street lighting.
- Lack of proper waste disposal systems.
- Site is obscured and lacks architectural views.

b. Site 2 – SSNIT

Location: The site is bounded by the Sudan Road to the North, the Libya Road to the South, the Independence Avenue to the East and the Sixth Avenue to the West

Strengths

- There are existing transportation networks around site.
- Site is insulated from busy public roads.
- Site is located close to other well developed commercial facilities.
- Sufficient land and building space available.

Weaknesses

- Pedestrian - vehicular conflicts do arise on site due to poor planning.
- Absence of soft landscaping and public lighting systems in the area.

a. Lack of proper waste disposal systems in the area.

3.2.3. Site inventory

The site has been chosen because of the following reasons which were investigated and documented at SSNIT.

a. **Accessibility & Traffic:** The site is bordered on the North by the Sudan Road, the South by the Libya Road, the East by the Independence Avenue and the West by

the Sixth Avenue. There is a layby and an existing pavement around the site. Footpaths are but short and few.

b. **Geology:** Site has a loamy clay soil type. Site has a gentle slope with the dominant slope being 1/100. There are no rocks or stones on site none the less when one dig to a level of about 6-10m there are rocks.

c. **Vegetation cover:** Plant growth is well supported by site and it is evident in the luxuriant nature of trees, shrubs, creeping plants and grass.

d. **Drainage:** Since the site slopes there is good drainage. There are existing drains on site which have been covered by concrete slabs. There are also inspection chambers in the street and on the pavements.

e. **Sensory features:** There are good views to and from site due to site location. The site is prone to vehicular and pedestrian noise.

f. **Site security:** Measures have been put in place to ensure that the enclave is well secured. There are also the existing fence walls to buildings possibly portraying the architectural view of buildings in the enclave. There is the need to provide street lighting on the minor streets to complete the security in the area.

g. **Utilities:** There are existing telephone and electricity poles on site. There are street lights along the main street but the minor streets are basically lit by frontage lighting from existing buildings with few scattered street lights. The area takes its water from the mains running parallel to the liberation avenue.

h. **Signage:** There are existing signages on and close to site. There are the advertisement boards as well as road user signs. There are also road markings for laybies, zebra crossings etc.

i. **Surrounding structures:** There are existing shops and kiosks in the area. There are also some squatters currently using the site. There are also other buildings like Banks, Offices and an ongoing multi storey car park construction. Opposite the site is the Efua Sutherland Children's park.

3.2.4. Site survey and analysis

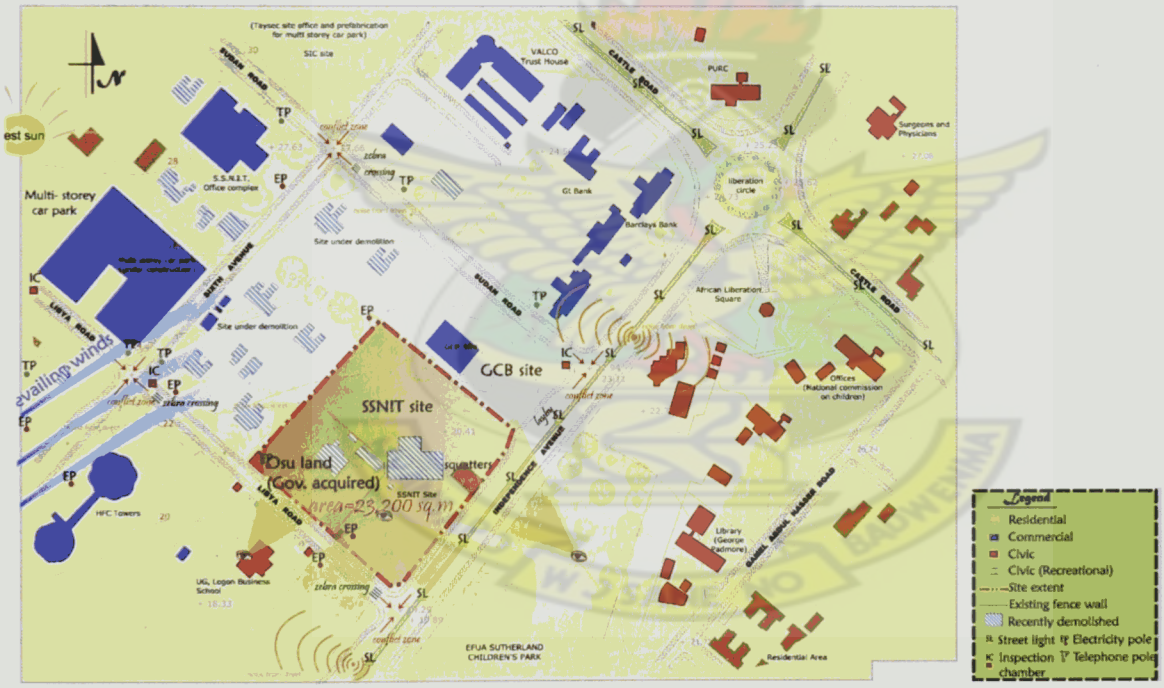


Fig 5 – Site analysis

3.3. THE DESIGN

a. Client

The government of Ghana with assistance from the companies listed on the Ghana stock exchange (G.S.E.).

b. Project financiers

- Bank of Ghana
- Ghana stock exchange
- Listed companies on the G.S.E.

c. Target group

The investor population worldwide especially Ghana's, including the elite thus the business class and the ordinary Ghanaian.

d. Design aims and objectives

- To facilitate the participation in socio-economic development in Ghana.
- Link banking centres to facilitate transactions.
- The Ghana stock exchange must generate income for stakeholders.
- Efficiently utilize site in the C.B.D. of Accra.
- To promote efficiency and effectiveness of the GSE staff through better relationships of spaces in the design.

3.3.1. Design philosophy and concepts

a. Philosophy

Fig 6 – Philosophy

This philosophy was adopted because of the essentiality of space to the trading of stocks. Several levels of agreements occur in the exchange among given parties. It could take place between 2 individuals, an individual and a group or two groups

b. Concepts

i. Architectural style - International style

It identifies three different principles: the expression of volume rather than mass, balance rather than preconceived symmetry and the expulsion of applied ornament. The common characteristics of the international style includes: a radical simplification of form, a rejection of ornament, the use of glass, steel and concrete as preferred materials. Due to the need for a tropical design the use of glass was toned down to ensure energy efficiency. Tropical architectural features have been inculcated as well to ensure favorable micro-climatic conditions in and around the building.

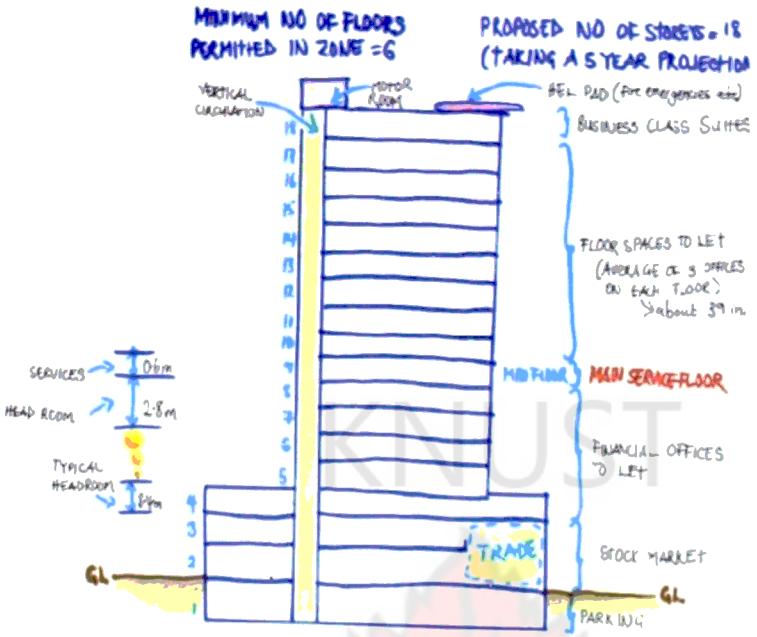
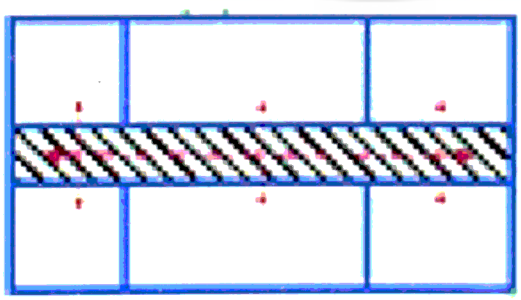


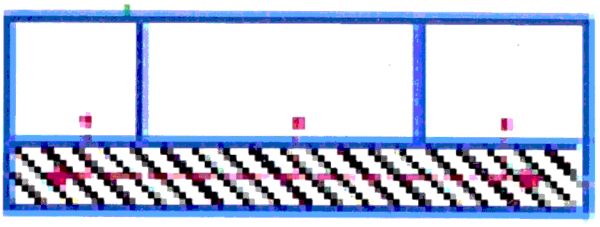
Fig 7 – Floor allocation

ii. Circulation systems

The verandah and corridor circulation types were considered. They were relatively cost effective when compared with the strict core system of circulation which leads to huge running cost due to high energy consumption levels. It is also difficult to ventilate the core system of circulation in which case designers have to resort to artificial ventilation and air condition systems.



- Corridor system of circulation



- Verandah system of circulation

Fig 8 – Circulation type

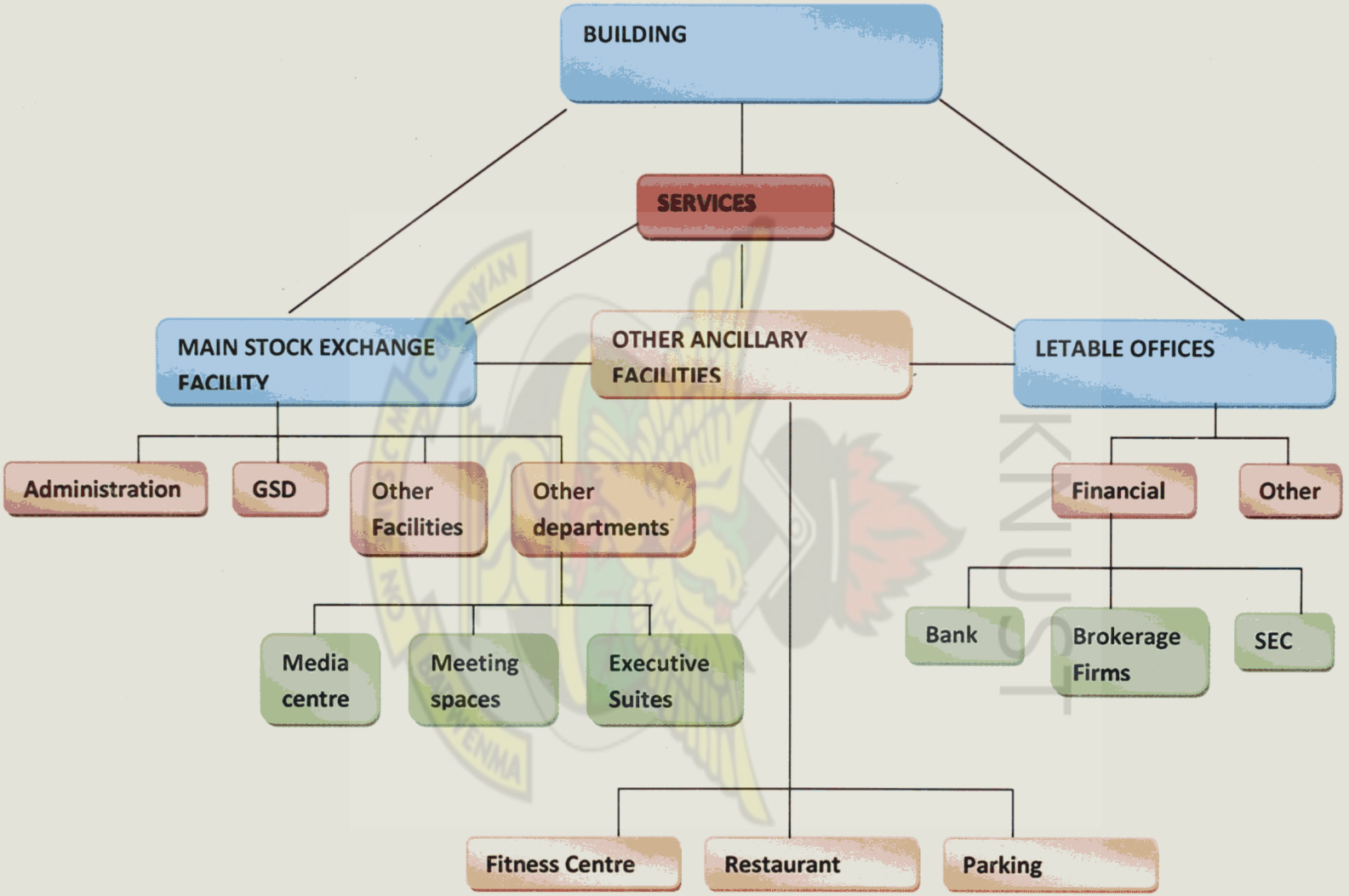


Fig 9 – Functional relationship diagram

3.3.2. Brief

a. Stock exchange (G.S.E)

- Trading floor
- Spaces for G.S.E. departments
- GSD

b. Meeting areas

- Auditorium
- Conferencing facilities

c. Business class suites

d. Offices for leasing

- Banks
- Brokerage firms
- SEC
- Other offices

e. Anillary facilities

- Fitness centre
- Media centre
- Restaurant
- Convenience shop

f. Car parking spaces

- Surface parking
- Basement parking

3.3.3. Accommodation schedule

Space			No	Area (sq. M)	Total area (sq. M)
Main stock market departments	Administration	Reception	1	20	81
		Managing director's office	1	23	
		General manager's office	1	18	
		Company secretary's office	1	12	
		Wc	4	2	
	Accounts	Office space	1	16	16
	Finance	Office space	1	16	16
	Education, research and special studies	Library	1	80	234
		Stock storage	1	6	
		Museum	1	9	
		Training room	1	130	
		Exams section	1	9	
	Trading	Trading floor	1	300	336
		Office space	1	36	
	IT	Server room	1	20	44
		Office space		24	
	Listings	Office space	1	24	24

	Public relations	Reception and waiting area	1	25	
		Complaints and enquiries section	1	16	50
		Head p.r.o.'s office	1	9	
	Clearing and settlement	Supervisor	2	9	
		Data centre	1	16	58
		Office space	1	24	
GSE security depository Company (GSD)	Office space	Meeting area	1	40	78
		Trading and settlement	1	20	
		Supervisor	2	9	
Meeting areas	Auditorium	Main auditorium	1	270	
		Stage and back stage	1	24	302
		Av room	1	4	
		Control room	1	4	
	Conference room		1	45	45
	Board rooms		1	30	30
	Investor's lounge		1	18	18
	Syndicate room		1	18	36
Ancillary facilities	Media centre	Media personnel lounge	1	30	

		Journal section	1	48	158
		Printing house	1	80	
	Physical fitness area	Work out area	1	32	
		Showers and changing room	2	12	68
		Wcs	4	2	
		Bar	1	4	
	Maintenance	Maintenance supervisor	1	9	
		Cleaner's common room	1	16	
		Cleaner's storage	2	6	475
		Shower and changing room	2	12	
		Service floor	1	350	
		Laundry	1	64	
	Child care centre	Caretaker's office	1	9	
		Rest room	1	18	
		Shower and changing room	1	12	71
		Playing area	1	32	
	Visitor support centre	Lounge	1	18	
		Convenience shop	1	25	49
		Building directory lobby	1	6	
	Cafeteria	Kitchen	1	70	
		Scullery	1	12	
		Pantry	1	12	142
		Damp waiter	1	4	
		Eating area	1	32	
		Wc	6	2	
	Security post	Cctv room	1	15	
		External security post	3	2	21

	Power back up house	Main space	1	49	55
		Maintenance room	1	6	
Business class suites	Reception		1	15	
	Manager's office with wc		1	12	
	Lounge/bar		1	22	
	Breakfast room		1	32	
	Common room with it service				573
	Room		Single 10	10	
			Double10	10	
	Bathroom		20	4	
	Study		30	4	
Offices to let	Brokerage firm	Public relations area	1	20	
		Brokers area	1	25	75
		Board room	1	35	
	Bank	Banking hall	1	48	
		Offices	4	9	
		Pre counting area	1	15	
		Vault	1	12	
		Server room	1	10	161
		Bullion van inn	1	32	
		Wc	4	2	

	Other offices to let	39	160	6,240
Car parking spaces	Basement parking space	120	6	1,170
	Surface parking space	150	6	
	Service yard parking	7	30	

Table 2 – Accommodation schedule

3.3.4. Conceptual site planning

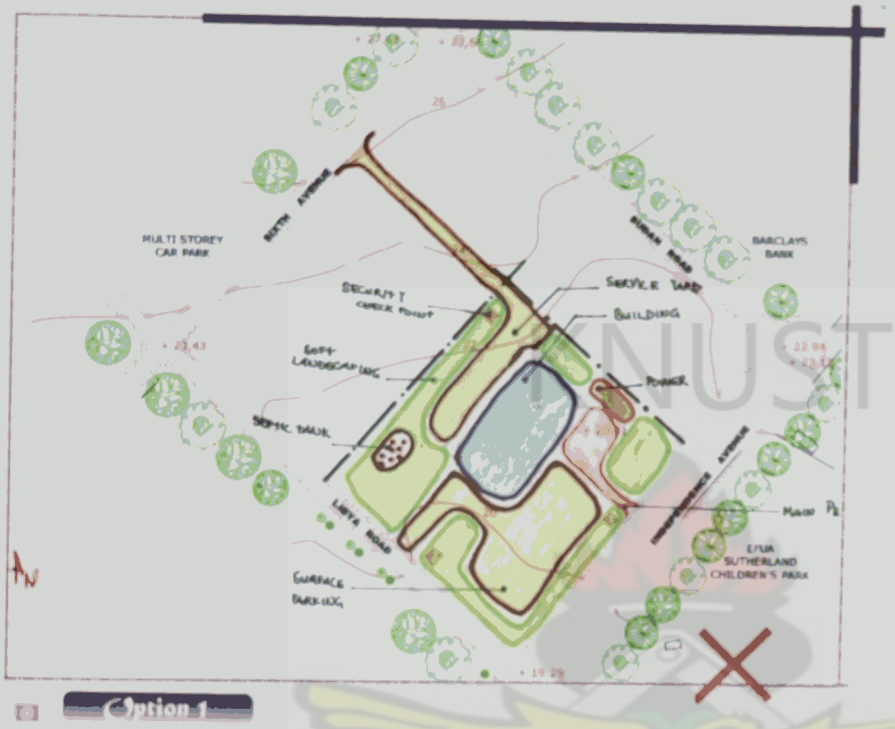


Fig 10 – Site planning option 1

Fig 11 – Site planning option 2

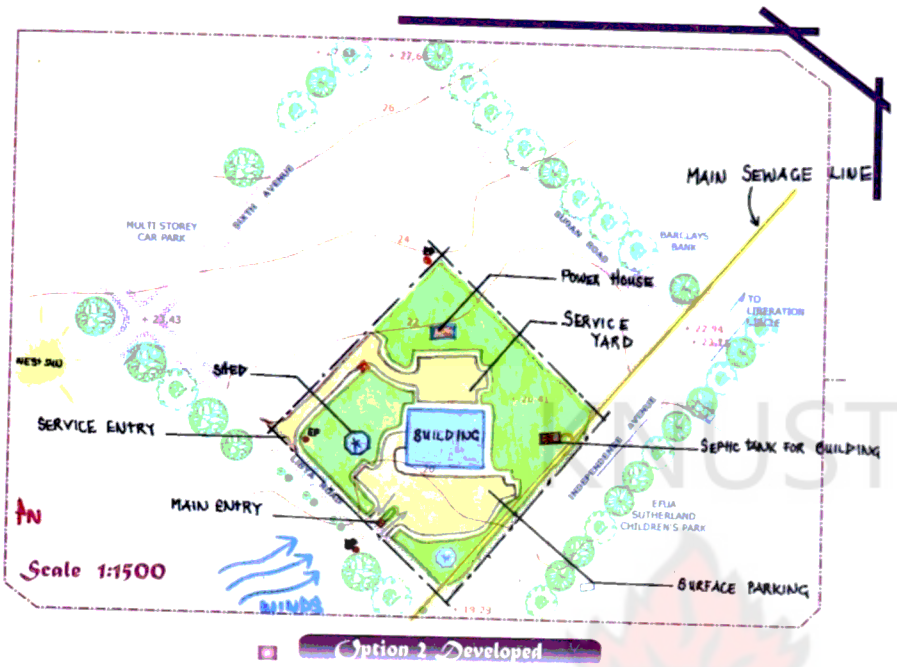


Fig 12 – Development of site 2 (stage 1)

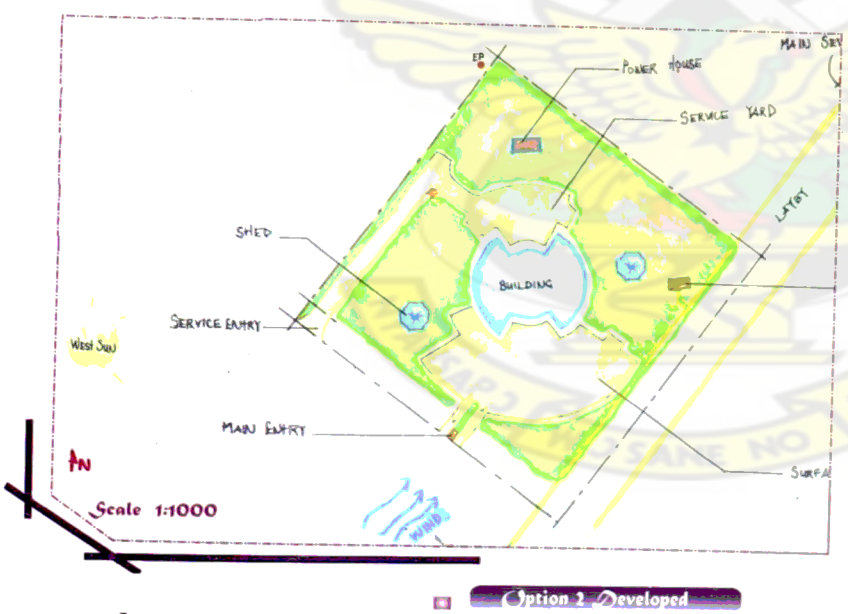
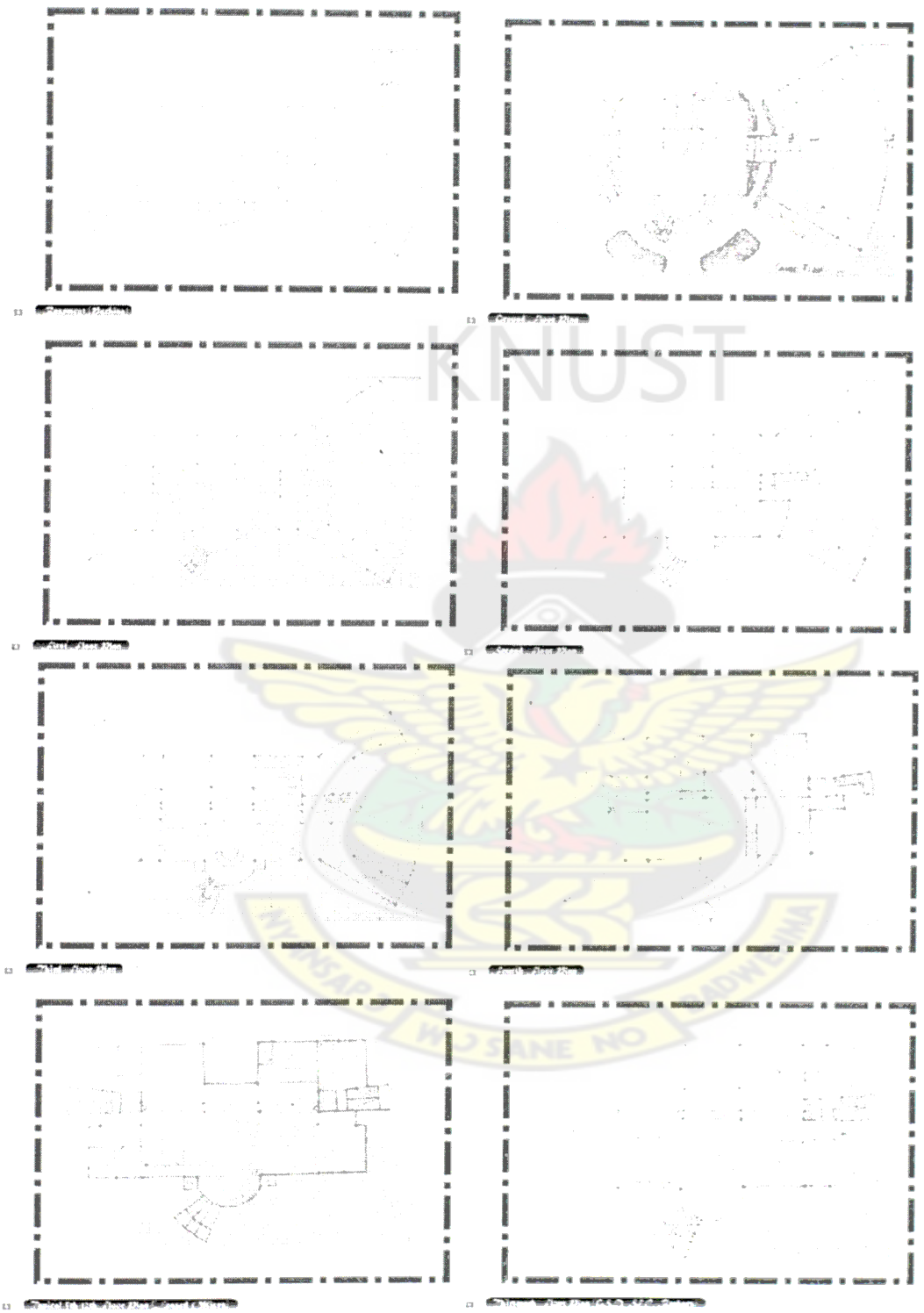


Fig 13 – Development of site 2 (stage 2)

3.3.5. Spatial planning



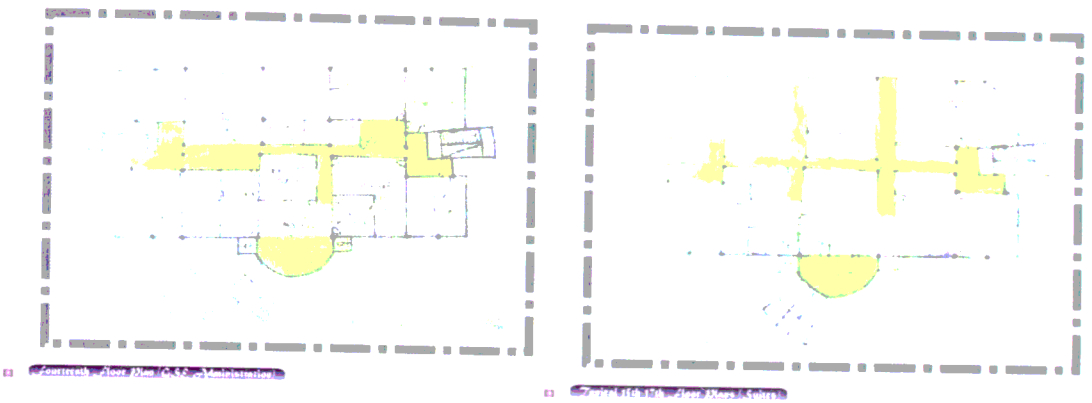


Fig 14 – Spatial planning

3.3.6. Sketch design

i. Plans

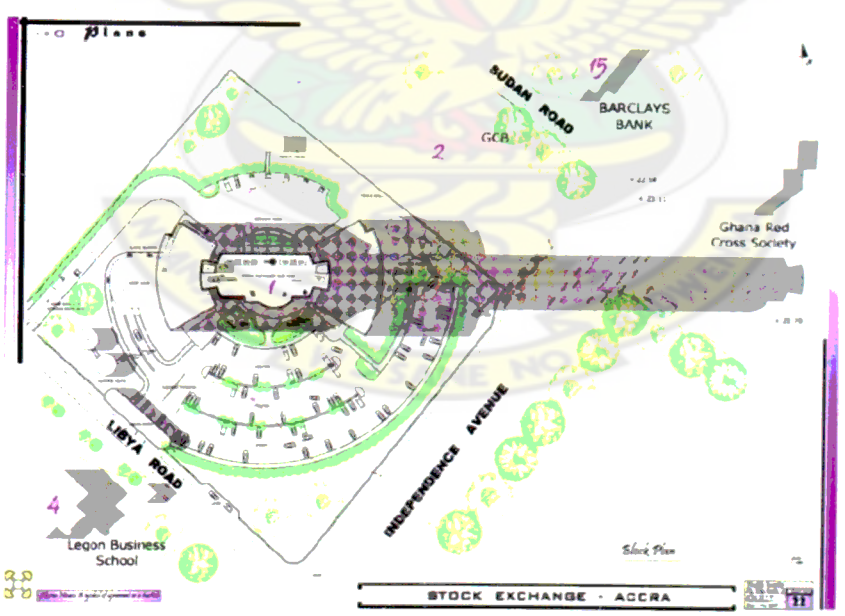


Fig 15 – Block plan

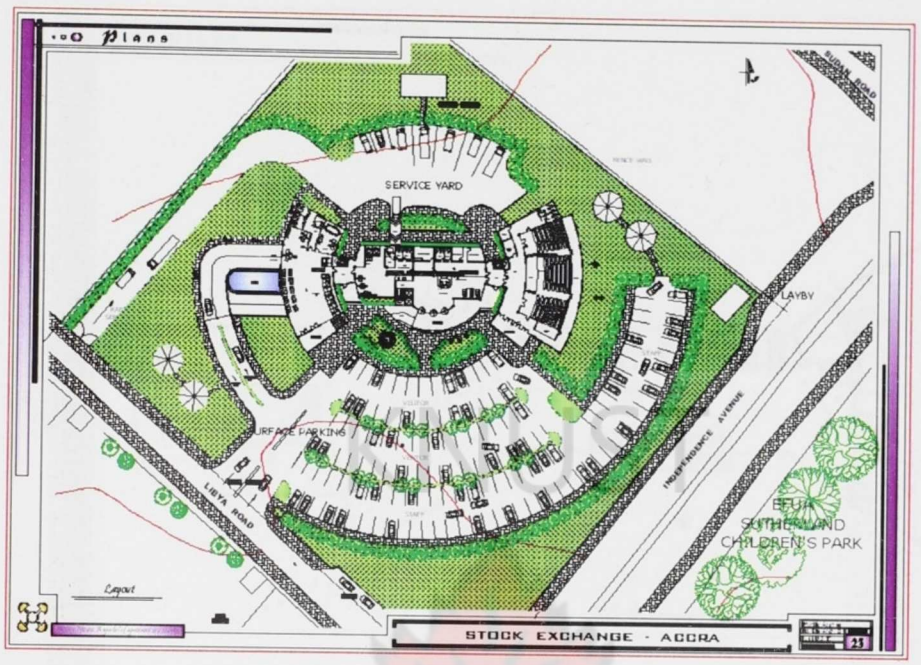


Fig 16 – Layout and landscaping

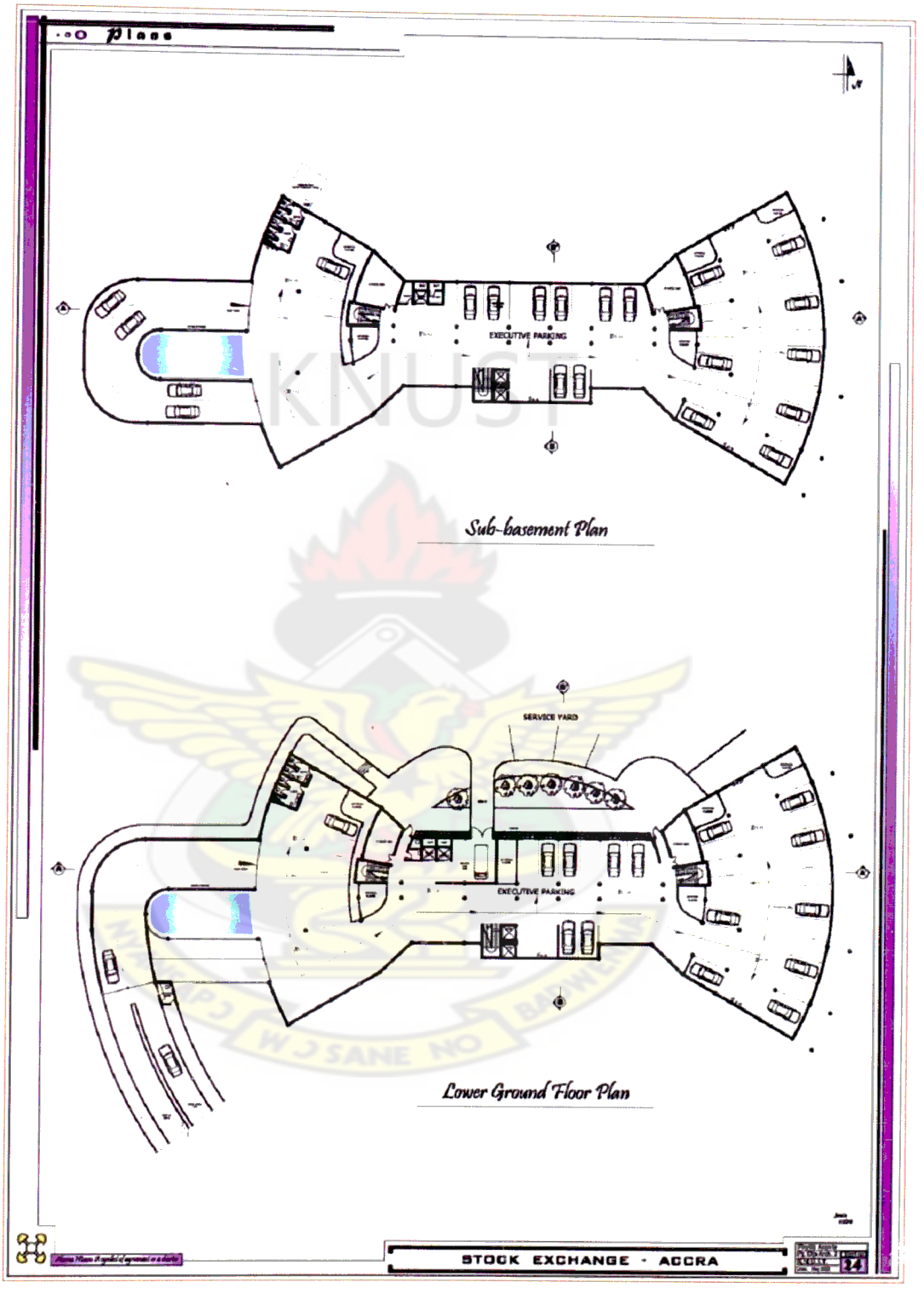


Fig 17 – Sub-basement plan and Lower ground floor plan

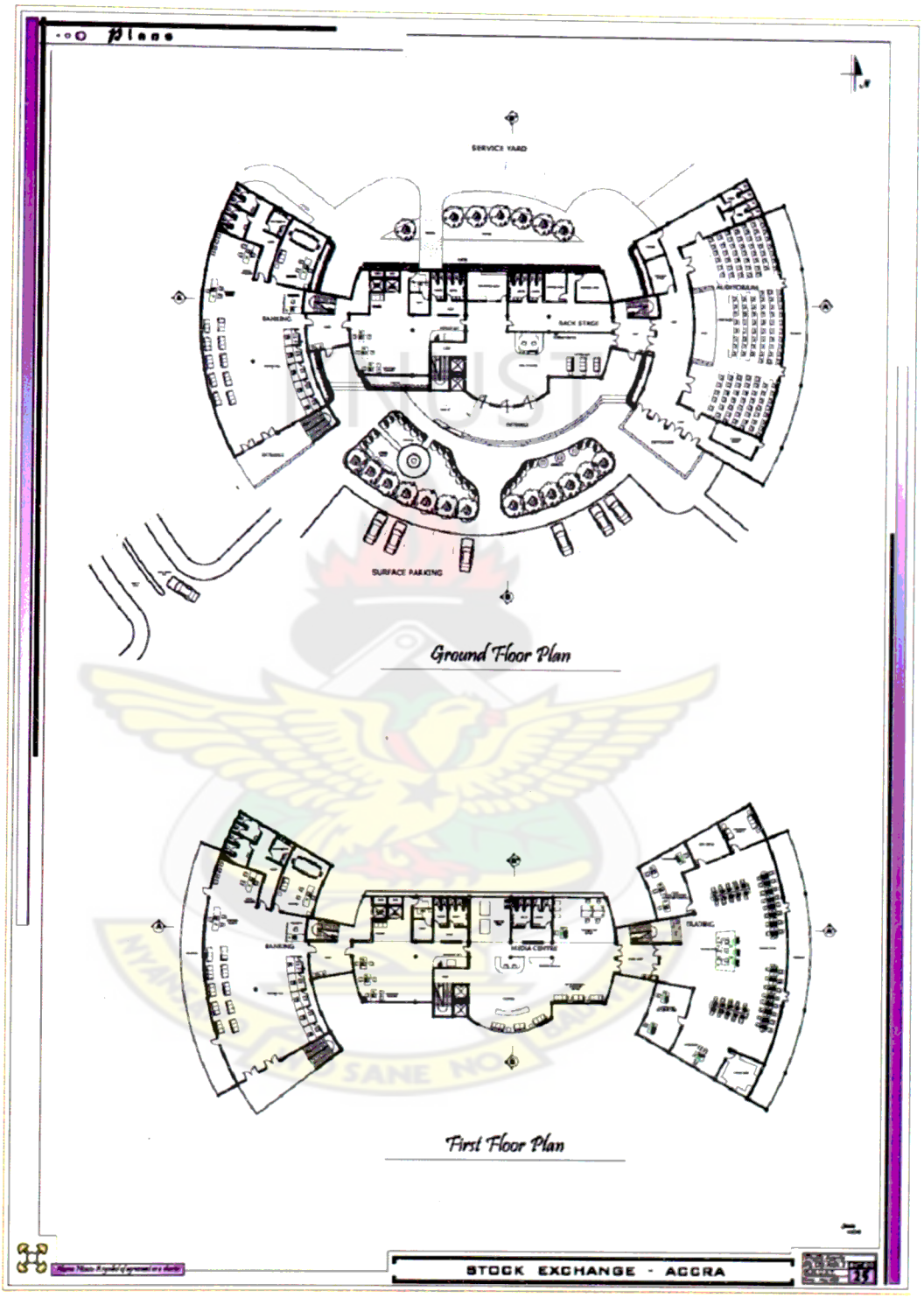


Fig 18 – Ground floor plan and First floor plan

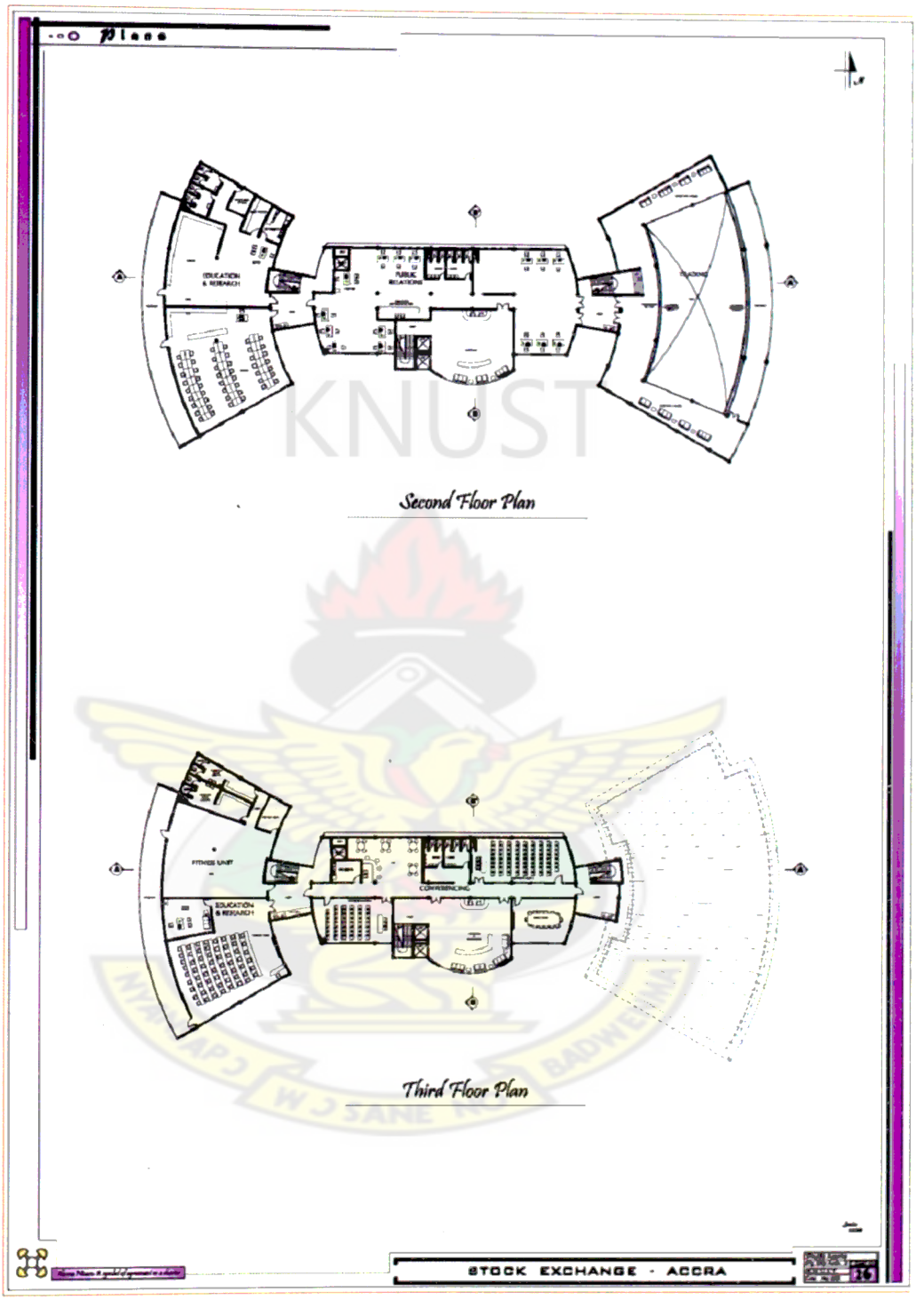


Fig 19 – Second floor plan and Third floor plan

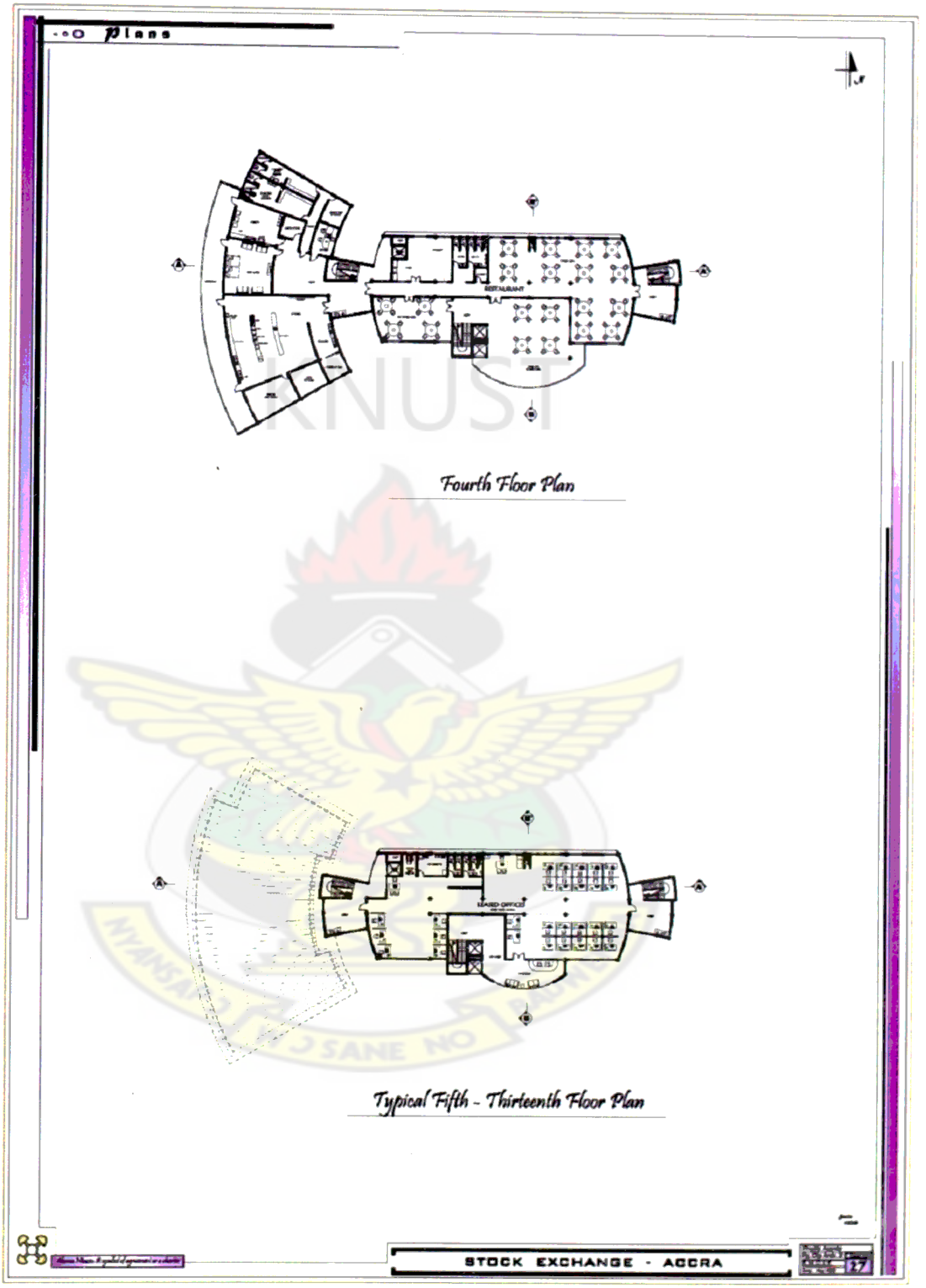


Fig 20 – Forth floor plan and Fifth - thirteenth floor plan

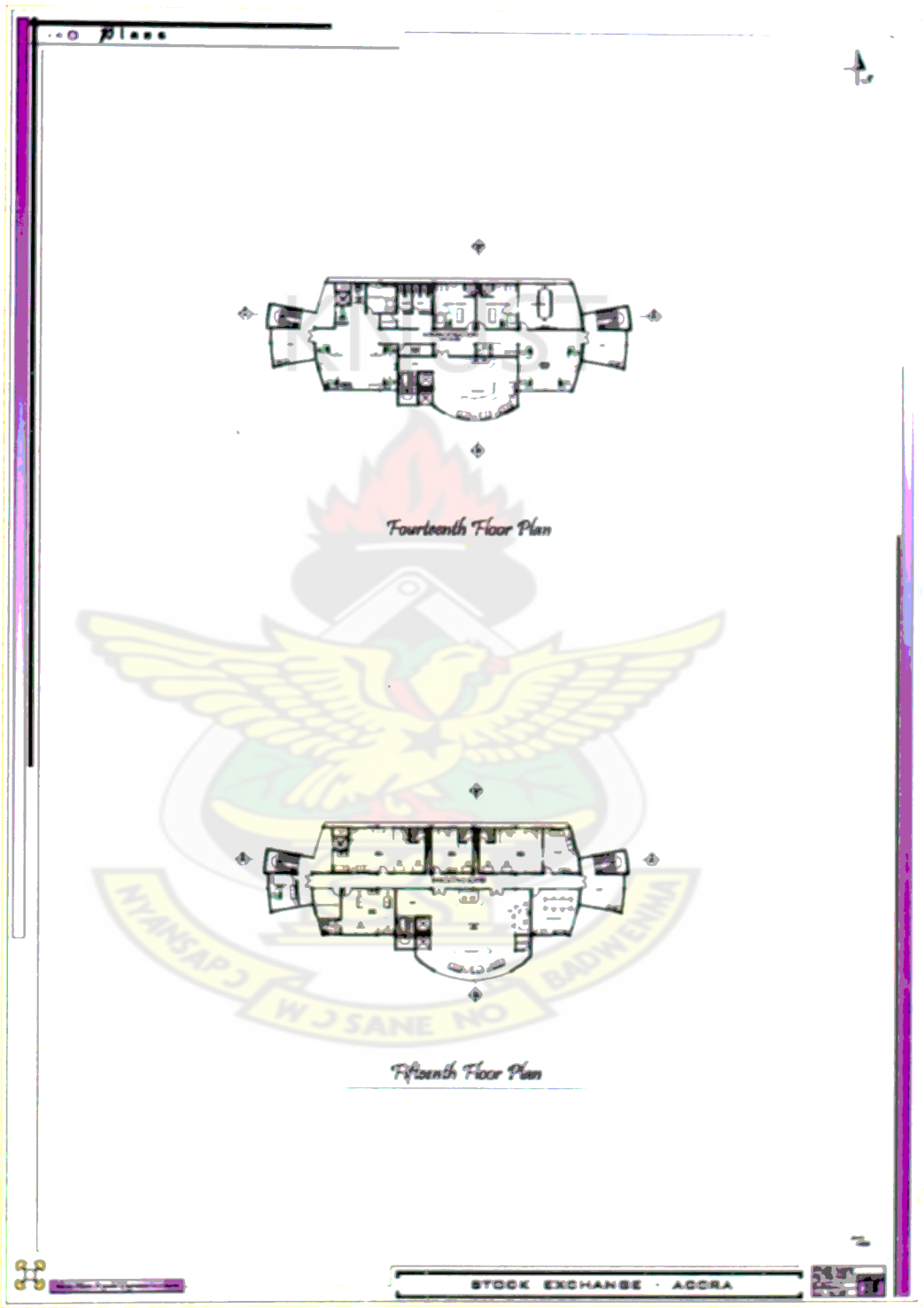


Fig 21 – Fourteenth floor plan and Fifteenth floor plan

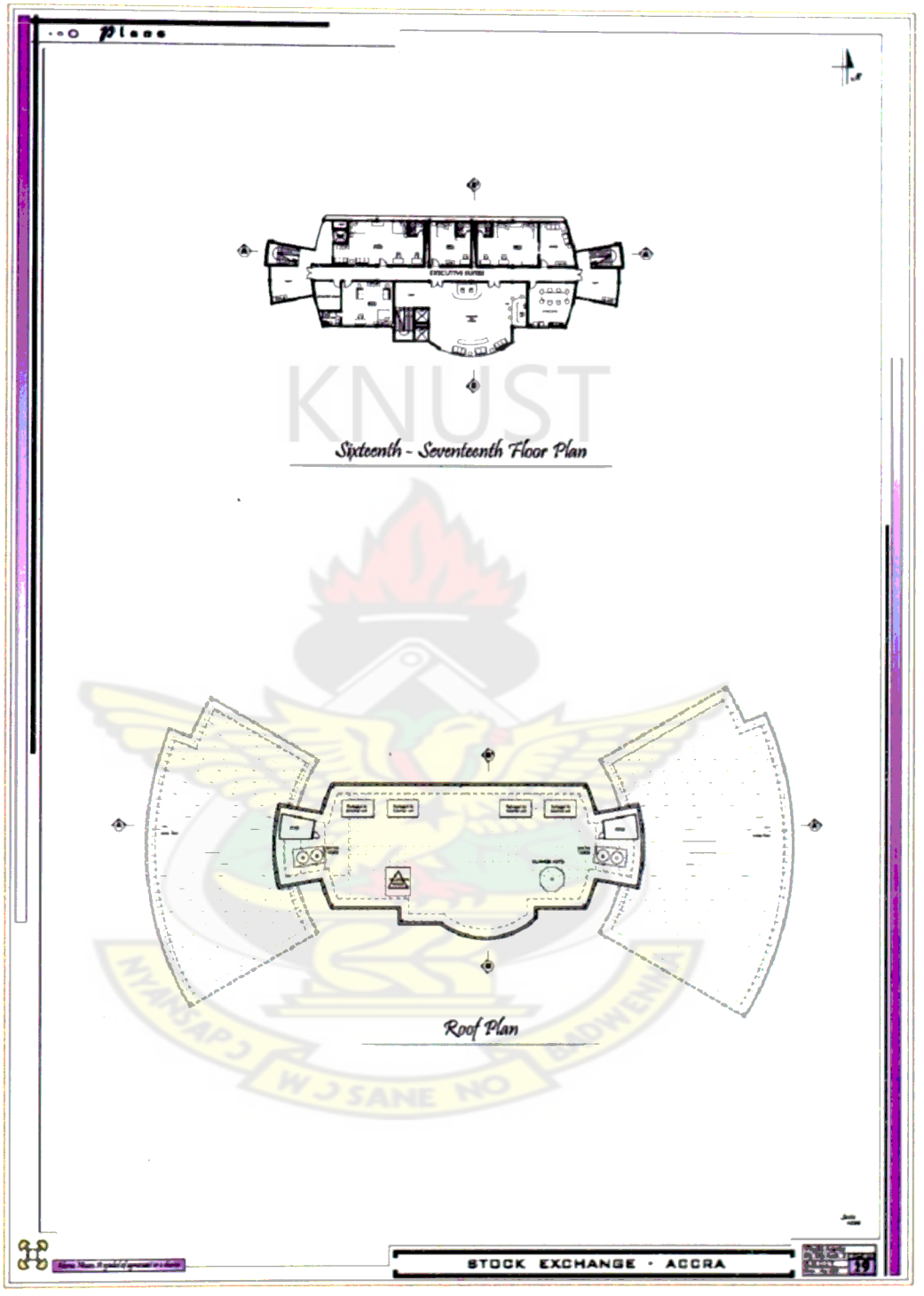


Fig 22 – Sixteenth - seventeenth floor plan and Roof plan

ii. Sections

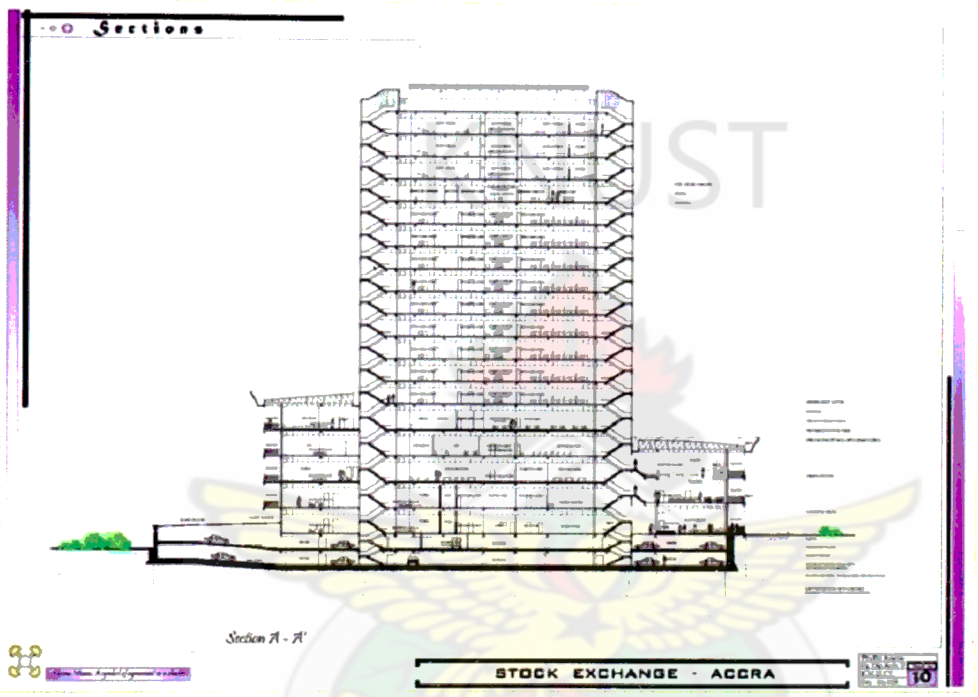


Fig 23 – Section A-A'

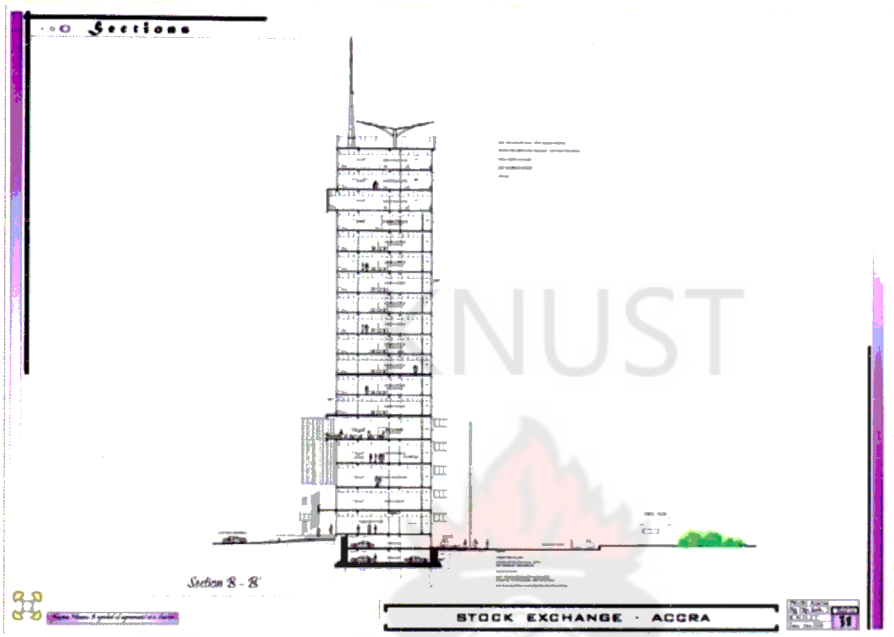


Fig 24 – Section B-B'

iii. Elevations

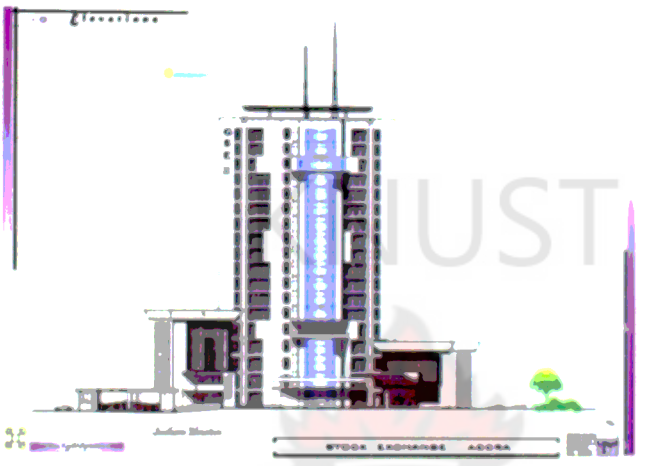


Fig 25 – Southern Elevation

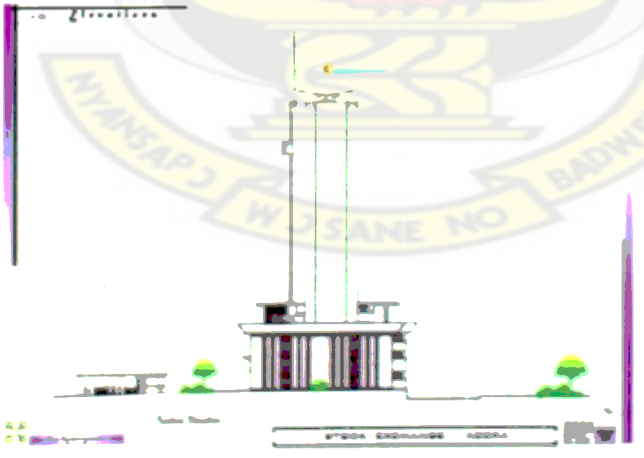


Fig 26 – Eastern Elevation

Fig 27 – Northern Elevation

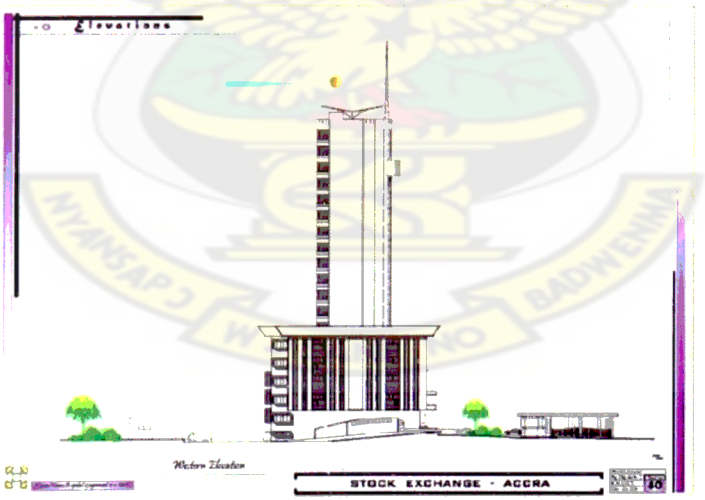


Fig 28 – Western Elevation

iv. Structure and Three dimensional impressions

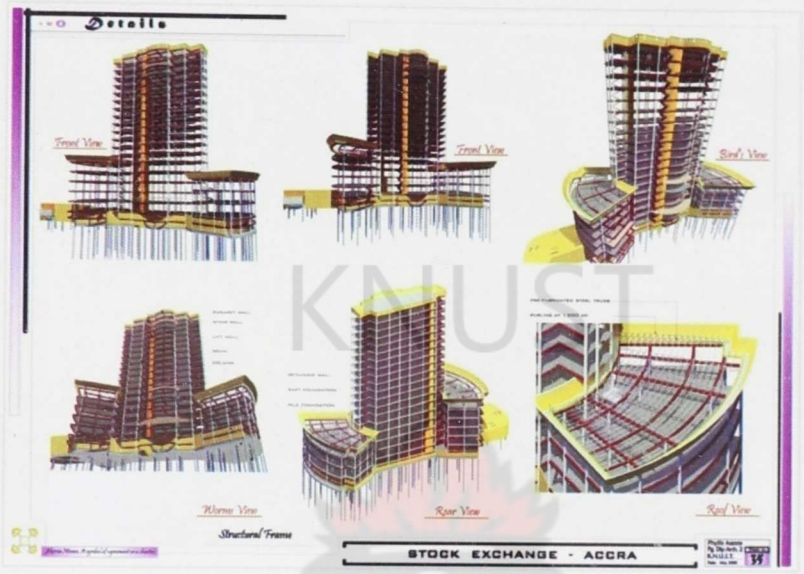


Fig 29 – Structural frame

Fig 30 – 3d impression (Exterior)

Fig 31 – 3d impression (Interior)

3.3.7. Design summary

- The stock exchange is an 18 storey with 2 basement levels and of the international style.
- Parking has been provided to cater for the no of staff and visitors to the building.
- The trading floor a very important part of the exchange has been inculcated in design for the direct trading of stocks.
- Conferencing facilities as well as an auditorium have been provided to help in further exchanges and revenue generation.

CHAPTER FOUR

4.0. CONSTRUCTION TECHNOLOGY AND SERVICES

4.1. Construction technology

4.1.1. Sub – structure

a. Foundation - Pile and raft foundation

Piles[1] are used primarily in areas where near-surface soil conditions are poor. They are made of timber, concrete, or steel and are located in clusters. The piles are driven down to strong soil or rock at a predetermined depth, and each cluster is then covered by a cap of reinforced concrete. A pile may support its load either at the lower end or by skin friction along its entire length. The number of piles in each cluster is determined by the structural load and the average load-carrying capacity of each pile in the cluster.

The raft foundation would serve as a tie for the pile and as a base for the rest of the building to sit on.

4.1.2. Super – structure

The building is having the post and beam structural system. The principal material to be used here is reinforced concrete which is less costly in comparison with steel, which is somewhat more flexible in design.

4.1.3. Finishes (Specifications)

4.1.3.1. Sub-basement and lower ground floor

a. Car park

Entry: The entry to the car park should be by a ramp as specified by design.

Floor: The base concrete should be the final and thus should be fair faced. Use high quality acrylic fillers for excellent resistance to abrasion and chemical attack. Line marking would be done with high quality acrylic base paint.

Wall: The walls should be the retaining wall as per design specification. The wall should be fair faced and painted. The paint should be washable white gloss emulsion paint finish. The columns are to be highlighted with yellow acrylic paint bands in the mid section.

Ceiling: Ceiling is to be the soffit of the slab above. Niches should be left to receive the lighting fixtures.

Windows: Openings should be left in retaining wall to allow for window during casting avoiding chiseling later.

4.1.3.2. Ground floor to seventeenth floor

a. Entrances

Floor: Marble tiles to be the finish as well as on the steps. Skirting should also be marble.

Ceiling: Ceiling is to be finished in POP. Corner moldings are also to be in POP.

b. Receptions

Floor: Base is to be under laying concrete Screed to 2.5mm maximum at all levels. Marble tiles to be the finish. Grout all joint to max 2mm 0f grout to match marble colour. Skirting should also be done in marble.

Wall: Wall should be plastered at a minimum thickness of 2.5mm and finished in white emulsion paint. Spaces should be left in wall during rendering to receive sockets.

Ceiling: Use the concrete slab as the structural soffit. Drop ceiling from the concrete slab with metal ceiling hangers. Wooden ceiling members should be well treated and dried before use. Soft wood battens of 25mm x 50mm at 500mm centres. Ceiling to be finished in 300mm x 600mm perforated panels for sound insulation.

Doors: All doors at the reception area should be 1500mm x 1500mm 1h fire rated. The main reception door should open outwards.

Windows: All windows frames and glass panels should be pre cut to sizes and arranged on site to design specifications.

c. Kitchens

Floor: Subfloor is to be concrete structural slab as per the engineer's specifications. Brown, white and black terrazzo finish cast in situ and cut after during period. Terrazzo coverage should be 2000mm x 2000mm terminating just at the cabinet locations. Minimum thickness at any level 40mm. Skirting is to be pre manufactured terrazzo tiles. Grinding is to be done as per the required specifications.

Wall: Walling should be done from worktop to ceiling soffit in 150mm x 300mm tile finish. Tile bedding is to be 20mm maximum in thickness. Lay tiles after 3hours of applying tile adhesive. Joint finish should be a 3mm white coloured water proof tile grout. Plain white ceramic tile or similar with minimal designs in other colours is accepted.

Ceiling: Beige ceiling tiles to be installed with adhesive stapled or nailed into position on furring strips. If you are using furring strips, it is important to calculate where the edges of

the tiles will be before installing the furring strips. The edges of the tiles must fall on the face of the furring strip for a good installation.

Doors: Doors in the kitchen should be 900mm x 2200mm metal doors and 1h 30min fire rated. The main door should open outwards.

Windows: Window assembly as specified by schedule.

d. Conference rooms

Floor: Screed to a maximum of 2.5mm at all levels. Underlay latex and adhesive to permanently receive woolen carpet finish. Nail around the perimeter. Hardwood skirting board secretly nailed to wall.

Wall: Sancrete block wall base. 25mm x 25mm horizontal wooden battens held to wall by 4" nails. Insulation material secretly screwed to wall battens. Perforated panel finish glued to insulation hardwood.

Ceiling: Ceiling base as soffit of the overlaying slab. 30mm x 30mm battens to be nailed to slab. Dropped metal ceiling hangers. Acoustic panels as finish, preferably wood panels. Jointing should be on the battens and in colour black. Corner moldings are to be in hardwood and sprayed to reveal grains.

Doors: 1500mm x 2200mm double door prefabricated as scheduled.

Windows: Window assembly as specified by schedule.

e. Restaurant and servery

Floor: Base as under laying concrete slab. Screed to 2.5mm maximum at all levels. Marble tiles to be the finish. Grout all joint to max 2mm 0f grout to match marble colour. Skirting should also be done in marble.

Wall: Sancrete block wall base. A maximum of 2.5mm plastering at all levels to be finished in white textured emulsion paint to prevent touching of walls.

Ceiling: Ceiling is to be finished in POP. Corner moldings are also to be in POP.

Doors: 1500mm x 2200mm double door prefabricated as scheduled.

Windows: Window assembly as specified by schedule.

f. Offices spaces

Floor: Natural stone effect full bodied non slip porcelain tiling. Tile from wall to wall with 5mm clearance from wall. Use 600mm x 600mm gray designed porcelain tiles. Tile bedding is to be 20mm maximum in thickness. Lay tiles after 3hours of applying tile adhesive. Joint finish should be a 3mm gray coloured water proof tile grout.

Wall: Sancrete block wall base. A maximum of 2.5mm plastering at all levels to be finished in white textured emulsion paint to prevent touching of walls. Place a dado on wall at 800mm height around the whole perimeter.

Ceiling: Drop ceilings to receive air conditioning. Use the concrete slab as the structural soffit. Drop ceiling from the concrete slab with metal ceiling hangers. Wooden ceiling members should be well treated and dried before use. Soft wood battens of 25mm x 50mm at 500mm centres. Ceiling to be finished in 300mm x 600mm perforated panels for sound insulation.

Doors: 1500mm x 2200mm double door as main door to reception and 900mm x 2200mm for the other doors. Pre fabricated as scheduled.

Windows: Window assembly as specified by schedule.

4.1.3.3.Other spaces

a. Lifts

Lift well to be in reinforced concrete. Refer to manufacturers specification drawings for lift details.

b. Stair cases

Floor (steps): Base is to be the underlying r/c concrete stair as per engineer's specification. Screed to a max of 20mm at all levels. Finish steps in brownish granite tile slabs already polished by manufacturer. Skirting should be done in granite. Plaster stair waist and base to 2mm max at all levels and finish in beige emulsion paint.

Wall: Sancrete block wall base. Plastering should be 20mm minimum at every level. Beige gloss paint to allow for washing. Place a handrail on wall at 800mm height around the whole perimeter corresponding with stair flight.

Guardrails: Upright 20mm x 20mm mild steel balusters. Intermediate rail 20mm x 20mm. Bars to be primed by the manufacturer. Finish in galvanized Steel. Spigot connections to base bracket bolt fixed to substructure beneath, as detailed. Welded joints to be ground and polished. Long runs of handrail to be achieved. Maple wood handrail fixed as detailed.

c. Porches and terraces

Floor: Base is to be the underlying r/c concrete stair as per engineer's specification. Screed to a max of 20mm at all levels. Finish in brownish granite tile slabs already polished by manufacturer. Skirting should be done in granite.

Wall: Sancrete block wall base. Plastering should be 20mm minimum at every level. Washable beige gloss paint to allow for washing.

Ceiling: Ceiling is to be finished in POP. Corner moldings are also to be in POP.

Guardrail: Upright 20mm x 20mm mild steel balusters. Intermediate rail 20mm x 20mm. Bars to be primed by the manufacturer. Finish in galvanized Steel. Spigot connections to base bracket bolt fixed to substructure beneath, as detailed. Welded joints to be ground and polished. Long runs of handrail to be achieved. Maple wood handrail fixed as detailed.

d. Ducts

Wall: Mild steel panels welded at joints and galvanized to finish. All welded joints to be grounded and polished.

Doors: 1800mm x 500mm doors to allow for walk in. Doors to be fixed with 2 galvanized steel butt hinges. Doors to be colour coded as specified by design.

4.2.Services

4.2.1. Electricity supply

As a result of the existing electricity poles, power would be tapped into a step up trans former in the power back up house. Distribution would be controlled from there to the other parts of the building. Due to the nations power position a power back up generator house has been designed to cater for such circumstances.

4.2.2. Water supply and rain water harvesting

Water from the mains would be directed to a storage tank in the basement from which daily rations would be pumped to overhead tanks on the roof top. The overhead tanks would thus create enough pressure for the users below.

Provision has been made to harvest rain water. Roof drains have been provided to harvest rain water and channel them to a storage tank in the basement from where it would be pumped into overhead tanks, and down to the users of the facility.

4.2.3. Lighting

Exterior lighting and interior lighting has been provided. Garden lights to serve as a form of aesthetic element in the night as well as aid vision.

4.2.4. Ventilation

Efforts have been made to enhance cross ventilation in most parts of the building. This would be supported by air condition systems. Provision has been made for a central system which would be supplemented by packaged units to cater for parts of the building as well as times of breakdown in the central system. Extractors have been provided in the basement as well as other parts of the building to help ventilate spaces.

4.2.5. Information systems

Information transmission is of great essence and improving by the day. Provision has been made for internet services, webcasting as well as remote information transmission.

4.2.6. Telephone

Provision has been made for telecommunication masts on the rooftop to help generate income for the building since the telecommunication companies would pay yearly or within specific times for the space. Telecommunication would be enhanced with mobile telephone services.

4.2.7. Television

TV points have been provided in the office spaces as well as reception areas, restaurants and on the executive suite floors. This would make it easier to connect and give cleaner finishes, avoiding unsightly wires.

4.2.8. Security control

There has been the use of CCTV cameras in design. They would be operated generally by humans since they would not be automated. Security posts and booths have been provided at the main entrance to the facility as well as at the basement parking entry. Security lifting has also been provided at vantage points.

4.2.9. Fire fighting

Two fire escape stairs with openings on the side which would in turn ventilate the stair well in case of a fire has been provided for. The fire lobbies leading to the escape stair have an hour fire rated doors which open into them. Handy fire extinguishers have been provided at vantage points in the building such as on the walls of the basement, corridors as well as the fire lobbies provided on each floor.

4.2.10. Surface drainage

The site slope has been used to slope the building surface areas for effective drainage. Curbs have been provided to help direct surface run water. Lawns have also been provided to help absorb part of the runoff. Small gutters have been provided to direct water just before descending the basement ramp.

CHAPTER FIVE

5.0. COSTING AND CONCLUSION

5.1. Costing - Comparative cost analysis

PRICE ADJUSTMENT

Date of current index = April 2009

Date of Base index = 2002

Base index (Ib) = 100*

Current Index(Ic) = 298.22*

Adjustment Factor = Ib/Ic $= \frac{298.22}{100} =$ **2.9822**

Source : Ghana statistical services

COST OF I6 STORY OFFICE BLOCK (HERITAGE TOWERS) *		US$
(A)		26,000,000.00
GROSS FLOOR AREA OF HERITAGE TOWERS		
(B)		15,063.86m^2
COST PER M2 (A/B)		
(C)		US$ 1,725.99
GROSS FLOOR AREA OF PROPOSED GSE BUILDING		
(D)		19,255.00m2
		US$
ESTIMATED COST OF GSE BUILDING = (C)x (D)	(F)	33,233,937.45
		US$
ADJUSTMENT FOR TIME DIFFERENCE (F)x 2.9822		99,110,248.26
		US$
TOTAL ESTIMATED COST OF CONSTRUCTION		**99,110,248.26**

ADD CONSULTANCY FEES (10%)	9,911,024.83
	US$
TOTAL	109,021,273.10

NOTE:

Heritage Towers Project completed in 2001

Estimated services cost = Approx. 15% (total estimated cost of construction)

= (0.15 x 99,110,248.26)

= 14,866,537.24 US$

5.2. Conclusion

Analysis of stock exchanges from abroad and from Ghana shows that:

The architectural and spatial planning of stock exchanges differ in scope and the tasks are major factors that accounts for these differences.

Their development is closely liked to socio-economic development and the advancement made in the area of information technology and building technology.

Structurally the form and planning of stock exchange is a further improvement in office designs.

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- **On line resources**

http://en.wikipedia.org

APPENDICES

Appendix1 - List of tables

Appendix 2 - List of plates

Appendix 3 - List of figures

Appendix 4 - Companies listed on the GSE

1. Accra Brewery Company,
2. AngloGold Ashanti,
3. Aluworks,
4. Ayrton Drugs,
5. British American Tobacco Ghana,
6. Benso Oil Palm Plantation,
7. CAL Banks, CFAO Ghana,
8. Clydestone Ghana,
9. Camelot Ghana,
10. Cocoa Processing Company,
11. Ecobank Ghana,
12. Enterprise Insurance,

13. Ecobank Transnational,
14. Fan Milk Limited, Ghana Commercial Bank,
15. Guinness Ghana Breweries,
16. Golden Web,
17. HFC Bank,
18. Mechanical Lloyd,
19. Pioneer Kitchenware,
20. Produce Buying Company,
21. PZ Cussons Ghana,
22. Standard Chartered Bank Ghana,
23. Starwin Products,
24. Super Paper Products,
25. SG-SSB,
26. Sam Wood Limited,
27. Trust Bank Limited,
28. Total Petroleum Ghana,
29. Transol Solutions Ghana,
30. Unilever Ghana.
31. Unique Trust Financial Services

Appendix 5 - The main stock exchanges in the world

1. American Stock Exchange
2. Australian Securities Exchange

3. Athens Stock Exchange
4. Belgrade Stock Exchange
5. Bermuda Stock Exchange
6. Bolsa Mexicana de Valores
7. Bolsa de Valores de Colombia
8. Bolsa de Valores de Lima
9. Bombay Stock Exchange
10. Bucharest Stock Exchange
11. Budapest Stock Exchange
12. Cairo & Alexandria Stock Exchange
13. Casablanca Stock Exchange
14. Channel Islands Stock Exchange
15. Euronext Amsterdam
16. Euronext Brussels
17. Euronext Lisbon
18. Euronext Paris
19. Frankfurt Stock Exchange
20. Ghana Stock Exchange
21. Helsinki Stock Exchange
22. Hong Kong Stock Exchange
23. Islamabad Stock Exchange
24. Istanbul Stock Exchange

25. Jakarta Stock Exchange

26. JASDAQ

27. JSE Securities Exchange

28. Karachi Stock Exchange

29. Korea Stock Exchange

30. Kuwait Stock Exchange

31. Lahore Stock Exchange

32. London Stock Exchange

33. Madrid Stock Exchange

34. Malaysia Stock Exchange

35. Milan Stock Exchange

36. Nagoya Stock Exchange

37. Nigeria Stock Exchange

38. National Stock Exchange of India

39. NASDAQ

40. New York Stock Exchange

41. Osaka Securities Exchange

42. Philippine Stock Exchange

43. Santiago Stock Exchange

44. São Paulo Stock Exchange

45. Shanghai Stock Exchange

46. Shenzhen Stock Exchange

47. Singapore Exchange

48. Stockholm Stock Exchange

49. Taiwan Stock Exchange

50. Tehran Stock Exchange

51. Tokyo Stock Exchange

52. Toronto Stock Exchange

53. Warsaw Stock Exchange

54. Zurich Stock Exchange