# Proposed Emergency Service Centre for Ogun State
## (A Study of Circulation and Natural Lighting in An Emergency Centre)

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## Certification

This is to certify that Akinola Gbenga Akinwunmi with matriculation number LCU/PG/002797 carried out this research work titled "A Study of Circulation and Natural Lighting in an Emergency Centre" in the department of Architecture, Faculty of Environmental Design and Management, Lead City University, Ibadan, Oyo State, for the award of Master Degree (M.sc.) in Architecture and that this has not been previously submitted.

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## Dedication

This research is dedicated foremost to Almighty God for his grace and mercy upon my life especially during the process of carrying out the research. I also dedicate this to all people that contributed and supported me to make the research a successful one. I appreciate you all.

**Acknowledgement**

I sincerely wish to express my gratitude to every institution where information and data was collected for the completion of the research work.

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**Abstract**

Buildings can be planned to optimize the utilization of natural sunlight and prevent unwanted artificial light intrusion by considering the time of day. Ever since humans began constructing their dwellings with openings for illumination, they have sought more efficient ways to harness natural light within their homes. Daylight has historically been harnessed in buildings because it comes at no cost; today, it remains free, but the creation and maintenance of window openings can be costly. Despite the extensive history of research on daylighting and architectural design, there has been a recent surge in in-depth investigations into this topic. Natural light, which is readily available and free in regions where electrical lighting is expensive, serves as a practical solution. However, it has transformed into a luxury in areas where electrical lighting is affordable and prevalent, enhancing the quality of life and work for its users. This research also delves into various aspects of daylight control from multiple viewpoints, including the quantity and quality of daylight, visual comfort associated with daylight, building orientation to optimize daylight, and the integration of daylight design in emergency centre planning.

**Keywords:** Daylight, Emergency centre, Natural Lighting, Emergency Service

**Word Count:** 184

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## Chapter One

## Introduction

### 1.1 Background to the Study

The field of emergency management deals with risk and risk avoidance. A diverse group of players and a wide range of issues are represented by risk. Emergency management and the emergency management system may be used in a wide variety of circumstances. This supports the idea that emergency management is essential to everyone's daily security and should be considered when making decisions every day rather than just in times of emergencies. (Haddow, George, Bullock, and Coppola 2017). Government must play a crucial role in emergency management. The Constitution places primary responsibility for public health and safety with the states, leaving the federal government to play a supporting role. When a state, locality, or individual entity is overburdened, the federal government's role is to provide assistance. The emergency management department of the government still operates under this fundamental philosophy. The legitimacy of emergency management as a government function has never been questioned because of this solid foundation. Federal, state, and local governments all have entities and organizations that perform emergency management duties (Haddow, George, Bullock, and Coppola, 2017).

Primary and specialized emergency services are the two categories into which emergency management services can be divided. Emergency services that offer the most fundamental care and assistance are considered primary emergency services. The general public has direct access to calling them. The Smart Emergency Response System SERS lists the three main emergency services in the following order.

- Police and law enforcement entities - These organizations are responsible for upholding the law, preventing and investigating crimes, and maintaining public order. Various similar law enforcement bodies exist, such as gendarmeries, but police forces are the most prevalent. In the United States, there are diverse entities like State Police, Highway Patrol Agencies, County Sheriff's Offices, Municipal Police Departments, and Federal Law Enforcement Agencies, among others.

- Fire departments (also known as Fire Rescue Departments, Fire Protection Districts, etc.) - These organizations are tasked with extinguishing fires, safeguarding against fires, conducting special operations and technical rescue responses, providing emergency medical services, and handling hazardous materials incidents.
- Emergency Medical Services agencies or First Aid and Rescue Squads - These entities offer emergency medical care, patient transportation, and technical rescue services.

Emergency services that are not one of the three primary emergency services are referred to as specialized emergency services. They may be offered by a separate governmental or private organization, a division or unit of one of the main emergency services, or both. Unless they are a division or unit of a primary emergency service, the public may typically contact and request specialized emergency services. They may frequently be asked by primary emergency services to handle particular emergencies or supplement already-employed emergency personnel. Some of these services, such as the Smart Emergency Response System SERS, may be site-specific and have jurisdiction only over certain regions or circumstances.

Depending on the jurisdiction, specialized emergency services may be permitted to use emergency lights on their vehicles. These lights are typically yellow or amber, unless they are already a part of a primary emergency service in which case, they use the emergency lighting setup used by that emergency service.

- Animal control service – Ensuring public safety in situations involving animals and providing animal assistance.
- Bomb squad – Specialized unit responsible for disposing of bombs, hazardous materials, and munitions.
- Border guard – Agency tasked with controlling and securing national borders.
- By law enforcement – Enforcing local ordinances and regulations.
- Civil defense – Providing protection during disasters and wartime, including civilian rescue efforts.
- Coast guard – Enforcing maritime laws and conducting rescue operations in national waters.
- Conservation officer – Enforcing wildlife protection and hunting/fishing regulations.
- Coroner – Confirming deaths and identifying causes of death.
- Medical examiner – Investigating the circumstances surrounding deaths.
- Emergency management – Coordinating responses to major emergencies and incidents.
- Firefighter – Rescuing individuals, suppressing fires, and preventing fires.
- Humanitarian aid – Offering basic assistance and care to people in need.
- Incident response team – Specialized teams responding to specific incidents.
- Lifeguards – Providing medical aid and rescuing individuals at pools, beaches, and dive spots.
- Military – Responsible for national defense, internal security, and emergency assistance in specific jurisdictions.
- National Guard – Focused on internal security within a nation.
- Paramedics – Providing medical aid and rescuing injured individuals.
- Park rangers – Enforcing laws in parks and nature reserves.
- Poison control center – Offering advice and guidance regarding poison exposure.

- Police officer – Enforcing laws, suppressing crime, and protecting the public.
- Police tactical unit – Handling hostage situations, counter-terrorism, and resolving dangerous incidents.
- Prison officer – Enforcing laws and responding to incidents within correctional facilities.
- Public utilities – Safeguarding and maintaining utility services and infrastructure.
- Public works – Assessing, cleaning, and repairing infrastructure.
- Roadside assistance – Assisting motorists in need and performing vehicle maintenance and repairs.
- Search and rescue – Rescuing missing, trapped, or at-risk individuals.
- Avalanche rescue – Rescuing victims in avalanches.
- Cave rescue – Rescuing victims in caves and underground areas.
- Mountain rescue – Rescuing victims in mountain and wilderness areas.
- Urban search and rescue – Rescuing victims in urban environments.
- Security forces – Focused on internal security.
- Security guards – Providing asset and property protection, as well as private enforcement.
- Ski patrol – Offering medical aid and rescuing individuals at ski resorts and mountain resorts.
- Tow truck – Moving disabled, impounded, or illegally-parked vehicles.
- Wildland firefighting – Suppressing wildfires.



Given its many uses, the proposed emergency center requires a layout that maximizes circulation and natural lighting. Exposure to natural light is good for human health because it has been shown to improve workplace environments and make people happier. Humans can only benefit from the production of vitamin D, which keeps our bodies healthy and our immune systems functioning. Additionally, the use of natural light increases efficiency and productivity because happier employees produce more effectively (people tend to work more efficiently when they are happy). This is because light and airy environments promote productivity. On the other hand, circulation is crucial to the safety, accessibility, and comfort of any architectural design.

The architectural elements of orientation, building shape, plan, section, windows, and building surface materials all contribute to natural light and efficient circulation. Whether it be for architecture or other sciences and arts, nature offers significant design solutions. However, with an emphasis on illumination, environmental improvement, atmosphere adjustment, and health care of natural light, the investigation into the methods of using it is becoming more in-depth. Although every location has different emergency center design objectives, it's amazing how similar the challenges faced by emergency department projects are. In addition, as the complexity of healthcare continues to increase, the factors influencing future emergency center designs are growing exponentially. Innovative solutions for flexibility, efficiency, and other operational goals are among the design solutions provided to each client.

After an emergency center is built, it can be challenging to change the architecture, so it is important to think through every possible scenario. Evidence-based designs are a concept that architecture has introduced. The need to investigate these associations is obvious given that any modification to the physical environment may have a variety of effects on how diseases develop. Since the beginning of time, people have believed that a building's physical environment can have an impact on its users. However, there is little evidence to back up this idea in architecture because randomized controlled trials, while common in medicine, are rarely used there. Retinal receptor cells come into contact with light, which is a component of the electromagnetic spectrum. They are taken in and sent to the brain by human eyes. We cannot imagine life on earth without lighting because light is an essential component of the universe of creation. Humans are bioclimatic creatures with a significant reliance on light.

For humans, any interruption in receiving desirable illumination can have a variety of effects. Lighting is always an inseparable part of the human environment; around 80-85% of our communications with the outside world are performed by visual senses (Almusaed & Almssad, 2006). Human needs, architectural considerations, and economic-environmental concerns must all be integrated in order for lighting quality in an environment to be effective. The ability to see clearly and easily, the capacity to communicate with the environment, aesthetics, health, and comfort are among the primary needs of humans. supplying sufficient, high-quality light for a thorough perception.

## 1.2 Statement Of the Research Problem

The creation of an environment with knowledge of users' sensory and functional needs is considered important, and it also looks at how emergency centers can support people's experiences following a disaster or perhaps even have a positive impact on them. Healing inequities built into the actual physical spaces has received little attention. Design is both a complex system in and of itself and a component of a much more complex system (disaster management). The important thing is that design is shown to be a crucial systemic component in disaster management by the evidence. We are aware of this and have based some of our redesign efforts on it, but not everywhere.

## 1.3 Research Questions

1. What are the functional requirements for an emergency service center?
2. What are the emergency situation prevalent in my study area?
3. What are the standard circulation patterns and natural lighting strategies best for emergency service centers?
4. **How** can a composite emergency service center which conforms to effective circulation and natural lighting standards be developed?

## 1.4 Aim and Objectives of the Study

### 1.4.1 Aim

The aim of this research is to evolve an architectural design proposal of a composite emergency service centre at Kara, Ogun State by adopting standard circulation pattern and natural lighting that will enhance building usability, and increase access to emergency service facilities by the populace. This will serve as a model for future applications in architectural education and composite emergency services facility design guide.

In achieving this aim, the following objectives are considered:

1. To examine the history of emergency service facility both locally and internationally;
2. To identify the emergency situations prevalent in the study area;
3. To identify the functional requirements for an emergency service center;
4. To examine the standard circulation patterns and natural lighting strategies best for emergency service centers; and
5. To develop a composite emergency service center design proposal for Ogun state, which conforms to effective circulation and natural lighting standards.

## 1.5 Justification For the Study

It is considered important to have a starting point when designing an emergency center, create an environment with knowledge of users' sensory and functional needs, and then consider how an emergency center can support users' experiences or perhaps even have a positive impact on them. In order to achieve the satisfaction of residents and caregivers, this study will significantly help design, plan, and light spaces in future emergency service center designs.

## 1.6 The Client/Users

To achieve a successful design program, one must take into consideration and outline the client and prospective users of the building.

The client is Ogun state government while the intended users of the emergency center are the residents of Ogun State and it enironment, and a few travelers in the case of accident emergency. Other users include the administrative staff and generally the intended workers for the building such as janitors etc. All these categories of users will be put into consideration during the design to make sure that a user-responsive design is delivered.

## 1.7 The Study Area

Ogun State is a state in southwestern Nigeria, created on February 3rd, 1976, from the Western State. Ogun State is bordered to the south by Lagos State, the north by Oyo and Osun States, the east by Ondo State, and the west by the Republic of Benin. The capital and most populous city of Ogun State is Abeokuta. Other significant cities in the state include Sagamu, Nigeria's top producer of kola nuts, and Ijebu Ode, the royal capital of the Ijebu Kingdom. The majority of Ogun State is covered in rain forest, with wooded savanna in the northwest. According to Wikipedia, Ogun State was the 16th most populous state in Nigeria in 2006 with a total population of 3,751,140 people. It also has a land mass that is 24th largest State in Nigeria with land area of 16,762 kilometer square. (Wikipedia)

As per information from Wikipedia, this state is commonly referred to as the "Gateway to Nigeria." It has gained recognition for its notable clustering of industrial estates and its vital role as a major manufacturing center within Nigeria. The state's close proximity to Lagos has further accelerated the development of nearby communities, such as Kara, where an emergency service center is planned to be established.

## 1.8 The Site

Kara is situated at the borderline between Lagos and Ogun state, it lies between latitude 06˚38'51.5"N and Longitude 03˚28'00.1"E. It contains detailed stratigraphic records of past environments and events. The climate of the area is tropical with distinct wet and dry seasons; an average wind speed of 10.6kmph, a mean annual rainfall of 230mm and a temperature range of about $21^{o}C$ - $33^{o}C$. The strongest and the first wet period lasts between April and July while the second and weaker wet period between September and November. In between these wet periods is a relatively dry period in August to September commonly referred to as the "August Break." The main dry season lasts from December to March and is usually characterized by harmattan winds from the North-east Trade Winds during November. Its vegetation is mainly the low land rain forest, guinea low land rain forest, fresh water swamp forest, and mangrove (Adeleye *et al,* 2018).

## 1.9 Scope of the Study

The idea of natural lighting and its circulation in emergency service centers is the main topic of this study. We'll talk about how to control daylight from a number of key perspectives, including the quantity and quality of daylight, visual comfort, building orientation for daylight, and daylight design when designing emergency service center buildings for various uses.

## 1.10 Definition of Terms

- **Emergency Service Centre**: a building used, often temporarily, to coordinate the response to an emergency and to deal with some of the problems that arise during the emergency. Emergency service can be categorized into 4 which are the ambulance service, the fire and rescue service, the police force and the search and rescue.

- **Natural lighting:** In simple terms, natural lighting is light that is generated naturally, the common source of which is the Sun. This is as opposed to artificial light, which is typically produced by electrical appliances such as lamps. Natural light is received during daylight hours and coves the visible spectrum with violet at one end. Natural lighting can play a major role in creating a comfortable environment, helping to regulate your body clock, improve concentration and create a calm, tranquil setting. Lighting has a tangible effect on performance/ productivity. It is an essential element in quality environments that support health and wellness while reducing energy use.
- **Circulation**: In architecture, circulation refers to the way people or object move through and interact with a building. In public buildings, circulation is of high importance; Structures such as elevators, escalators, and staircases are often referred to as circulation elements, as they are positioned and designed to optimize the flow of people through a building, sometimes through the use of a core. In some situations, one-way circulation is desirable

# Chapter Two

# Literature Review

## 2.1 Conceptual Review

### 2.1.1 Concept of Emergency Management in Nigeria

Nigeria, formerly known as the "Giant of Africa," is in the early stages of developing its emergency management infrastructure. In the early 1900s, the Fire Brigade was primarily responsible for extinguishing fires, protecting properties, and aiding communities in responding to disasters. However, it wasn't until 1999 that Nigeria began to adopt a more comprehensive approach to emergency management.

Since then, Nigeria's emergency management system has seen significant changes. These include improvements in organizational structure, increased funding, the establishment of emergency management education programs, enhanced training for emergency personnel, and greater international collaboration on emergency management matters. Despite these positive developments, the country's evolving disaster management system still faces numerous challenges, including issues related to poverty, inadequate funding for emergency management initiatives, and social marginalization, among others.

Like any other nation, Nigeria has experienced various disasters, some of which have occurred suddenly, while others have unfolded gradually over time. These disasters have resulted in the loss of numerous lives and inflicted severe damage on both the built and natural environments, as documented by the National Disaster Management Framework (NDMF) in 2010.

In 1990, the Federal Government of Nigeria established an inter-ministerial body in alignment with the United Nations International Decade for Natural Disaster Reduction (NDMF, 2010). This body was tasked with developing strategies to mitigate the risks associated with natural disasters. Subsequently, the government broadened the scope of risk reduction by passing Decree 119 and creating the National Emergency Relief Agency (NERA) as an independent agency under the Office of the President, three years later (NDMF, 2010).

In March 1999, the National Emergency Management Agency (NEMA) was established through Act 12, and this legislation was later amended by Act 50 of 1999. NEMA was granted authority by the Federal Government to manage all types of disasters (NDMF, 2010; Fagbemi 2011).

In November 2006, the Civil Aviation Act was enacted, with the Nigerian Civil Aviation Authority empowered to enforce aviation safety regulations, enhance security, penalize those who violated aviation laws, and establish procedures for compensating victims of air disasters (Opara, 2007). This law was intended to improve airline safety, but its implementation came after a series of airline disasters that occurred between 2005 and 2006 (Opara 2007).

To provide a comprehensive approach to disaster management, the National Disaster Management Framework (NDMF) was developed in 2010, with participation from various stakeholders including the Federal, State, and Local Governments, Civil Society Organizations (CSOs), and private sector entities (NDFM, 2010). The NDMF offers a regulatory framework that ensures effective and efficient disaster management and outlines the responsibilities of different parties involved in disaster management (NDMF, 2010). It signifies a shift in the focus of disaster management from response and recovery to other phases (NDMF, 2010).

### 2.1.2 Organization Of Emergency Management

NEMA (National Emergency Management Agency) serves as the primary federal-level disaster management organization in Nigeria, operating through its six zonal offices nationwide (Fagbemi, 2011). In line with federal government mandates, Local Emergency Management Agencies (LEMAs) have been established at the local level, while State Emergency Management Agencies (SEMAs) operate at the state level (NDMF, 2010; Fagbemi 2011). All three of these emergency management entities share the responsibility for developing capabilities in disaster prevention, preparedness, response, and recovery (NDMF, 2010).

In addition to NEMA, other key players in Nigeria's emergency management system include the military, police, paramilitary forces, and Civil Society Organizations (CSOs) (NDMF, 2010). Disaster Response Units (DRUs) also play specific roles (Opara, 2007).

The National Disaster Management Framework (NDMF), established in 2010, represents a collaborative approach involving a wide range of stakeholders, including the Federal, State, and Local Governments, CSOs, and private sector organizations. It provides a regulatory framework accessible to government representatives, local authorities, business owners, CSOs, and practitioners, ensuring effective and efficient disaster management. The NDMF also outlines the responsibilities of various parties engaged in disaster management, indicating a shift from a focus on response and recovery to other phases (NDMF, 2010).



Community organizations such as Community Based Organizations (CBOs), Faith Based Organizations (FBOs), and Non-Federal Governmental Organizations (NGOs) are often the first to respond in local communities after a disaster (NDMF, 2010). These efforts are supported by Emergency Management Volunteers (EMV), and SEMA and NEMA can provide additional resources as needed (NDMF, 2010). This collaborative approach ensures a coordinated response to disasters at various levels of government and within local communities.

### 2.1.3 History Of Day Lighting

Prior to the 1940s, natural sunlight was the primary source of light for buildings, with artificial lighting serving as a secondary option. However, the introduction of electric lighting brought about a significant transformation in workplaces within just two decades, providing the majority, if not all, of the lighting required by occupants.

In recent years, there has been a renewed interest in daylighting in building lighting design, driven by concerns about energy consumption and the environment. Although the underlying physics of daylighting have remained unchanged since its inception, the way buildings are designed to utilize natural light has evolved. Daylighting is often incorporated into building design as both an architectural statement and a means of conserving energy.

However, the benefits of daylighting extend beyond energy savings and architectural aesthetics. It's crucial to consider the psychological and physiological effects of natural light on building occupants. Natural light creates a comfortable and inviting environment while fostering a sense of connection to the outside world. These effects are just as significant as the cost savings for building owners and managers. In essence, daylighting contributes to a holistic and positive experience within buildings, enhancing the well-being of those who live or work there.

### 2.1.4 Sources Of Natural Light

The primary source of daylight is the sun, which provides illumination to both the interior and exterior of buildings through direct and indirect means. The sun emits radiant energy in a strong and concentrated stream. Some of this radiant energy, known as sunlight, travels directly through the Earth's atmosphere before reaching the surface. The remaining radiant energy scatters due to various atmospheric interactions, creating what we call diffuse light.

The amount of daylight a particular building receives is constantly changing due to the sun's shifting position in relation to the Earth. To simplify some basic issues related to daylight illumination, we often assume that the entire sky appears as a uniform hemisphere. This means that as the sun rises higher in the sky, the sky itself appears brighter. However, in reality, the overcast sky is brightest at the zenith (directly overhead) and only about one-third as bright at the horizon. On the other hand, the blue sky tends to be brighter near the horizon and darkest at a point perpendicular to the sun.

The portion of the sky visible from a specific point through a lighting opening directly influences the amount of useful daylight that point within a room receives. If there is no view of the sky from that location, then the daylight available at that spot in the room is typically insufficient for most purposes. This emphasizes the importance of having access to the sky and proper window placement in designing spaces that make effective use of natural daylight.

Plate 1: Showing Reflectance of Building Materials and Outside Surfaces

Reflectance of Building Materials and Outside Surfaces

| Material | Reflectance per cent |
|---|---|
| Asphalt ( free from dirt ) | 7 |
| Bluestone, sandstone | 18 |
| Brick : | |
| light buff | 48 |
| dark buff | 40 |
| dark red glazed | 30 |
| Cement | 27 |
| Concrete | 55 |
| Earth ( moist cultivated ) | 7 |
| Granite | 40 |
| Granolite pavement | 17 |
| Grass ( dark green ) | 6 |
| Gravel | 13 |
| Macadam | 18 |
| Marble ( white ) | 45 |
| Paint ( white ) | |
| new | 75 |
| old | 55 |
| Slate ( dark clay ) | 8 |
| Snow | |
| new | 74 |
| old | 64 |
| Vegetation ( mean ) | 25 |

Source: Google Search

Thin clouds have the effect of diminishing direct sunlight while increasing the presence of diffused light. Even on days when the sky appears somewhat hazy, sunlit cumulus clouds shine notably brighter than a completely clear blue sky. When the sun is observable, the radiance emanating from such a cloud-filled sky can range from approximately one-third to two-fifths of the total illumination originating from both the sky and the sun collectively. In situations where the sky is completely blanketed by white clouds, the quantity of light originating from these clouds can be on par with the amount of light emitted by the sun. For a significant portion of the day, the intensity of light from an entirely clear blue sky remains relatively stable.

### 2.1.5 Effects Of Light on The Body

The various spectrums produced by the different types of light have an impact on humans both physiologically and psychologically. The less tangible and more easily disregarded advantages of daylighting are these outcomes. The effects of daylighting include elevated spirits, decreased fatigue, and lessened eyestrain. Meeting a need for contact with the outside living environment is one of the significant psychological benefits of daylighting (Robbins, 1986). According to Ott (1997a), the body uses light in the same way that it uses water or food for metabolic processes. The different colors of natural light are vital to our health and stimulate fundamental biological processes in the brain.

### 2.1.6 Impacts Of Daylight on Building Users

Daylight offers numerous benefits in medical facilities, including increased brightness, reduced heating costs, and enhanced physical and mental well-being for both staff and patients. Patients require a comfortable environment where they can see clearly and be monitored by medical personnel. Clear signage, visual cues, and navigational aids are essential for guiding anxious and distracted patients and visitors as they enter the hospital. Additionally, patients value their connection to the outside world, which has various effects on their bodies, psyche, and overall health. Daylight plays a pivotal role in disease prevention (Hauge, 2015). Aripin (2017) has also highlighted the positive effects of natural lighting on emergency center staff and the overall environment.

The use of color is another important aspect to consider when creating hospital environments that influence patients' perception of their surroundings. Ensuring visual comfort is essential for patient satisfaction in sustainable emergency centers. The combination of artificial and natural lighting design aims to create a pleasant atmosphere for patients. McSweeney et al. (2019) conducted a study comparing two scenarios: one with ample natural light and another with covered windows. They examined the impact of indoor sunlight exposure on stress levels in hospital settings, measuring changes in physiological stress using heart rate variability (HRV) and participant surveys on their experiences with natural light. Proper lighting in the emergency center setting enhances the body's biological rhythm, creates a more transparent environment with fewer occupational errors, shorter hospital stays, and less pain. It also reduces feelings of depression and enhances positive emotions in the hospital setting (Ming et al., 2011).

### 2.1.7 Daylighting In the Office

People who work in daylit, full-spectrum office buildings reported feeling happier overall. Better health, lower absenteeism, higher productivity, cost savings, and worker preference are specific advantages in these kinds of office settings. There are so many advantages for office workers that many European nations mandate that they work within 27 feet of a window (Franta and Anstead 1994). It has been demonstrated that using full-spectrum bright lights has a positive impact on employees in buildings where daylighting is not or cannot be integrated. Daytime and nighttime workers can modify their internal clocks or circadian cycles to conform to the work cycles thanks to full-spectrum bright lights. an increase in mental performance, a decrease in accidents, an increase in productivity, better sleep, and an increase in morale among night shift workers have also been attributed to better lighting (Luo, 1998).

#### 2.1.8 Daylight Control in The Rooms

Most buildings contain daylight, which is a common and freely distributed element. The use of daylight should be taken into account when planning and designing any structure with windows. Each type of building has a unique issue with day lighting, and the amount of daylight used should be sufficient for functional requirements.

The factors upon which good natural lighting depends are as:

1. The amount of daylight available at the site of a building,
2. The size and position of the openings which admit daylight into a building,
3. The use of appropriate transparent or translucent material for filling these openings to admit and distribute daylight and to satisfy such requirements as insulation from weather, heat, and sound.

##### 2.1.8.1 Daylight And Visual Comfort

Before delving into the concept of visual comfort, it's crucial to grasp some fundamental psychophysical principles that establish connections between the "sensations" people experience and the underlying physical causes, or stimuli. For example, there is a direct correlation between the perceived brightness of a room and the amount of light it receives. Additionally, we must consider "visual adaptation," a form of physiological adjustment that can alter our sensitivity to light intensity as well as changes in light and contrast.

Visual adaptation becomes evident in situations like when we gaze through an open door into a room while standing outside on a sunny day. In such circumstances, the interior of the room may initially appear dark, making it challenging to discern details of objects within. This effect occurs because our eyes have adapted to the brighter outdoor conditions. However, when we enter the room and allow our eyes some time to adjust to the lower light levels indoors, things gradually appear brighter, and details become more discernible. This phenomenon underscores that a room's visual comfort can be influenced by the external brightness and the conditions in adjacent spaces.

Architects must familiarize themselves with psychophysics to differentiate between two situations: the "linked situation," in which both the primary and secondary sensations directly vary with the stimulus, and the "unlinked situation," in which the secondary sensation does not vary in the same way as the primary sensation in response to the stimulus. This understanding of psychophysics is essential for creating environments that optimize visual comfort.

Table 1.1: The Sensation of Comfort in A living Room

| Stimulus - size of Bulb | Sensation of Light | Sensation of Comfort |
|---|---|---|
| 40W | Very dim | Uncomfortable (too dim) |
| 60W | Dim | Uncomfortable (too dim) |
| 100W | Bright | Not uncomfortable |
| 150W | Bright | Not uncomfortable |
| 200W | Very bright | Uncomfortable (too bright) |
| 300W | Extremely bright | Uncomfortable (too bright) |

Source: Google Search

#### 2.1.8.2 Color

Bright colors and lights draw people's attention. Color is very important in modern architecture and is widely used in building design and interior decoration. Color design is extremely complex; therefore, we will only look at the color relationship with light and how it affects visual comfort, interior color design, and the effects of light and color interactions on the design. To begin, color design influences visual adaptation in a room. For example, if the rooms are dark in color, the sky may be very glaring. Glare can be greatly reduced by reprinting the walls in off-white or a light color. Second, the color scheme in the interior can be influenced by the light.

#### 2.1.8.3 Orientation Of Buildings and Daylight

Building orientation has been a long-standing architectural concern, and significant advancements have been made in the past century due to scientific investigations. In earlier times, people relied on their knowledge to design homes facing south, south-east, or west, or they incorporated skylights to maximize sunlight. However, with the progress of science, we can now leverage various observations, experimental results, and calculations to determine the most suitable orientation for different types of buildings.

Research on building orientation spanning the last four decades has emphasized its crucial significance. Today, it is even factored into the computation of heat load for air-conditioning systems because the amount of solar radiation that enters a building plays a pivotal role. The extent of sunlight a building receives depends on its configuration and orientation. When properly oriented, various straightforward building shapes can efficiently make use of natural light.

In residential design, the most effective building orientations ensure that the kitchen receives morning sunlight, especially during winter, while the living room is well-illuminated in the afternoon. Establishing a universal standard for natural lighting orientation is challenging due to diverse climates, site-specific considerations, and variations in individual preferences and needs. Nevertheless, the following figures propose diagrams illustrating appropriate orientations for various rooms in different types of buildings.

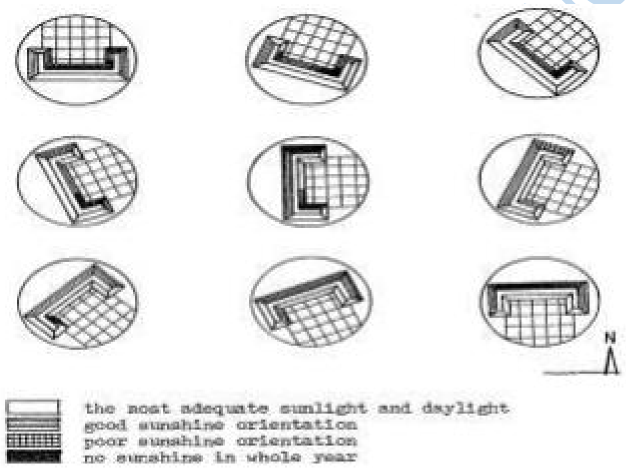



Figure 2:1 The condition of sunshine of a U-shaped building which faces to the various directions

Source: Google Search

#### 2.1.8.4 Daylighting In Health Care Facilities

Reduced lighting and heating costs, as well as improved physiological and psychological states for both patients and staff, are all advantages of natural light in hospitals and assisted-living communities. Daylighting can help patients, doctors, and nurses feel less stressed. Daylighting has been so successful that it is now used in hospital settings as part of the patient care program. Daylighting is also being used in assisted-living communities because it provides better lighting. "Daylighting provides a sense of spirituality, openness, and freedom from the prison-like confinements and intensity that characterize windowless spaces," according to Verderber (1983). The advantages of daylighting and a sense of openness extend to staff, visitors, and patients. Because patients recover faster in daylit recovery centers, daylighting has been shown to reduce a facility's operating costs. By providing pastoral views and natural light, the spatial quality from windows has also been cited as having a psychotherapeutic quality; thus, an environment becomes more therapeutic with more spatial quality (Vischer 1986; Verderber 1983).

- **Benefits for Patients and Workers**

Exposure to bright light has a significant impact on the natural biological rhythms of both patients and hospital employees. In cases of certain illnesses, such as Alzheimer's disease, these biological rhythms, known as circadian rhythms, play a crucial role in maintaining the well-being of individuals. Research from 1998 indicates that Alzheimer's patients who are exposed to bright light during the day experience improved circadian rhythms and are less likely to suffer from depression. These improved circadian rhythms also lead to reduced caregiving demands in Alzheimer's units. Additionally, having windows in patient rooms allows them to have a view of natural light and changing weather conditions, which fosters a sense of familiarity and helps them establish a connection to the time of year.

In assisted-living facilities, proper lighting is of utmost importance for the well-being of residents. It's worth noting that a 60-year-old person requires two to three times more light than a 20-year-old to maintain visual sharpness, and an 86-year-old may need up to five times the lighting levels. This increased need for lighting in older adults is due to age-related changes in the eye, including clouding of the lens, which reduces retinal illuminance and necessitates higher task luminance for effective visibility. Consequently, older adults generally require better contrast and higher levels of light for activities like walking down a hallway, especially if their vision is declining.

Falls are a prevalent and hazardous health concern for the elderly, and inadequate or improper lighting can be a contributing factor. Natural light, which provides vitamin D, also plays a role in the recovery process after a fall because vitamin D is essential for calcium absorption into bones and other tissues. Furthermore, better lighting can reduce the burden on caregivers by enabling the elderly to function more independently. Proper lighting not only enhances visibility but also has a positive impact on social interaction, appetite, mood, self-confidence, and anxiety levels among older adults.

- **Healing Environment**

The goal of the healing environment is to provide non-institutional surroundings and a sense of calmness for patients, staff, and visitors. Natural light is one of many ideas used to create these environments. With many different ideas for creating a healing environment, identifying natural light as having specific impacts on patients is difficult to accomplish.

### 2.1.9 Influence Of Daylight on Civic Planning

In the planning of urban areas, it's crucial to take into account the impact of neighbouring structures on daylight. Particularly in large cities, where the construction of tall, tower-like buildings is considered for economic and administrative reasons, as well as for aesthetic considerations, it's important to emphasize that such buildings don't necessarily have to result in a significant loss of daylight, which has been a major concern in urban areas.

However, the reality is that there have been cases where the presence of high buildings has negatively affected the rental values of nearby structures, only to have these high-rise buildings themselves face similar issues when even taller buildings are constructed nearby.

Some areas are at risk of being overwhelmed by their own development, with diminishing access to light and air, and streets becoming increasingly inadequate.

Currently, the standards for daylighting in lower floors of urban buildings are primarily governed by building codes and regulations that limit building heights and setbacks. One way to mitigate the loss of frontal light caused by tall buildings on the opposite side of the street is to provide for compensating lateral light from lower angles to reach the interiors of neighboring buildings. This approach can significantly improve the overall illumination within these buildings compared to what would be possible without such lateral light.

The effectiveness of this lateral light penetration depends on several factors, including the width of the frontage of the tall building, the availability of lateral light, and the dimensions of window openings and the spaces between structural piers. For buildings that rise to considerable heights, like 20 stories above street level, thorough scientific studies using daylight plans would demonstrate that adequate illumination standards cannot be met without lateral light, especially on streets that are 100 feet or 60 feet wide.

In any urban planning endeavor, it's necessary to acknowledge that some land may need to be set aside or used differently to create conditions that allow certain sites to be developed while maintaining a reasonable level of amenity. As we continue to build and incorporate these tall structures into our cities, we must prioritize the preservation of lateral light to the greatest extent possible. This might involve designing low-rise buildings that subtend even smaller angles than 45 degrees, reducing the width of tall buildings where feasible, and recessing external angles when it doesn't compromise the overall plan and aesthetic design.

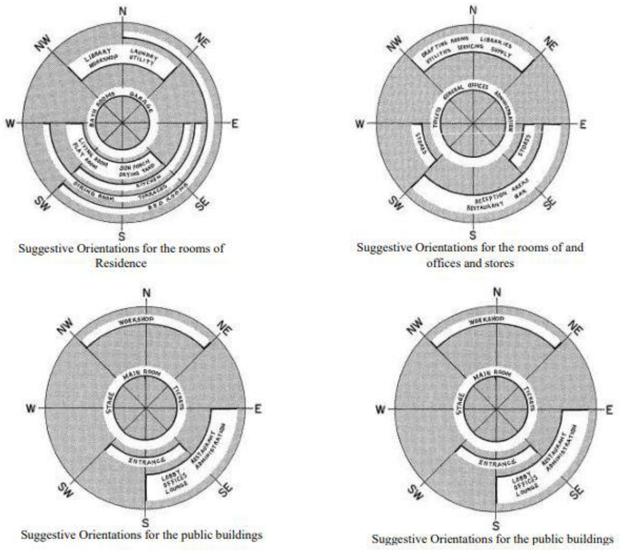



Figure 2:2 Suggestive Orientation Diagram for Different Buildings
Source: Google Search

### 2.1.10 Circulation

The building's circulation has a significant impact on how we feel about it, whether it's a comfortable or secure place. If the movement from where we've been to where we're going is unconscious and predictable, a building is said to have good circulation. Spatial circulation and organization are essential components of any design process. In most cases, it is ideal for the space's circulation to occupy at least 40% of the total area. And in the interior areas, comfortable circulation is frequently achieved with at least 3–4 feet wide pathways.

The term "circulation," as it is frequently used in architecture, describes how people and objects move throughout a building's interior as well as through its entrances and exits. All structures require safe, practical, and quick circulation in both normal and emergency situations. Numerous passageways, including lobbies, halls, stairs, stairways, and elevator hoist-ways, can be used to direct this circulation. There are two categories of circulation (the movement of people and goods) inside interior spaces in an emergency centre: both vertical and horizontal circulation.

1. Horizontal Circulation

Moving horizontally from one space to another through lobbies, doors, and corridors is known as horizontal circulation. Any of the various types of passageways, including lobbies, doors, and halls, can filter this circulation.

**Classifications of Horizontal Circulations**

- Corridors: Ideally, corridors would be 2400 mm deep and clear of obstructions. To ensure a clear width of 1800mm, radiators and other objects, like fire extinguishers, should ideally be recessed. This lessens the threat they may pose to a large number of disabled people, especially blind and partially sighted people. There should be enough tonal contrast between the ceiling, walls, and floor. It can aid navigation and help blind and partially sighted people assess the size and shape of a room or hallway.
- Lobbies: Lobbies should only be used in emergency situations. In an entrance lobby and other internal lobby, a wheelchair should be able to exit one door before using the next. Additionally, anyone assisting a wheelchair user must be able to move away from one door before using another. When installed in a well, floor mats must be flush with the surface, tightly fitting, without any holes, and with a solid surface that doesn't become slippery in wet conditions. The preferred mats are those made of short-fiber rubber or close-grained rubber. Avoid using mats with a rope, metal attachment, or soft core.

- Internal doors: Internal doors should have a minimum 800mm simple opening range. The visible opening distance of the door should be increased to 825mm when approaching from a hallway that is less than 1500mm deep and at a 90° angle. This is a minimum requirement; doors with wider visible opening widths would be more accessible; a clear opening width of 900 mm is advised whenever possible.

2. Vertical Circulation

The performance of an emergency centre depends on the vertical movement of traffic, both during normal operations and during emergencies. In actuality, the floor plan is significantly impacted by the location of elevators or stairs. Because of this, careful thought should be given to the type of vertical circulation to be provided, the number of units required, as well as their positioning, configuration, and architecture. Traffic can move from one floor to another in a multi-story building using ramps, stairs, elevators, or escalators. The driven machinery is frequently replaced by stairs when the generator is shut off, there is a mechanical issue, repair work is being done, or there is an emergency. Traditional elevators are occasionally used in homes, warehouses, and garages, but other types of human lifts exist.



**Classifications of Vertical Circulations**

There are two types of vertical circulation systems. Elevators, escalators, ramps, and other Class I systems are designed to move both people and goods. People cannot be moved using Class II systems like vertical conveyors and dumbwaiters. There are two subclasses of Class I systems: A and B. Class IA systems are accessible to users as a means of egress in both routine and emergency situations. Building codes or the "Life Safety Code" of the National Fire Protection Association contain this requirement for means of egress.

- Ramps: When there is enough room, a ramp or sloping surface may be used to connect different levels or floors. In some garages, any floor serves as a ramp to conserve space. Each floor is divided longitudinally, with segments that gradually slope upward and downward to the level above and below. When moving a lot of people or vehicles from one floor to another, ramps come in handy. They can therefore frequently be found in public structures like train stations, arenas, and exhibition halls. For all buildings, especially those that house people in wheelchairs, they are either legally required or highly desirable.

- Emergency egress stair: For the prevention of smoke and fires, interior stairways to escape rooms in some architectural designs must be enclosed with fire-resistant walls. Municipal code requirements must be followed during wall construction and rating. Self-closing fire doors should be used to cover any wall openings that are permitted. All non-combustible materials should be used to build stairs in buildings that are required by code to have fire-resistant construction. Open space under stairs that can be used as a means of egress should never be used for anything else, including closets.
- Planning of escalators: Moving stair placement should only be made after a thorough analysis of the project's potential traffic flow. They ought to be put in place where it will draw the most traffic and where it will be most practical for travelers. The building should be built and the signs placed so that it is obvious to visitors where to find the escalator. Since escalators are mechanical devices that occasionally malfunction, the designer must incorporate an alternate mode of transportation (typically a set of nearby stairs) for situations in which the escalator is not accessible to passengers. Both the loading area and the unloading area should have spacious areas. Careful consideration should be given to the possibility of a catastrophe arising from a confined escape from an escalator when pedestrian traffic is restricted below the escalator's capacity in the direction of travel. Similarly, planning for the landing

area should consider all available space for queuing as well as what will happen if an escalator is delayed for any reason as foot traffic moves forward.

- Stairs: Slightly steeper slopes can be used because stairs take up less room than ramps. Although this angle is frequently exceeded for practical reasons, the maximum stair slope for comfort is thought to be 1 on 2 (27°). The typical slope of exterior stairs is 20° to 30°, whereas the typical slope of interior stairs is 30° to 35°.

A staircase is a crucial component of any building, whether it is a home, office, or public space. It was created and constructed in accordance with the regional building codes. A staircase can be spiral, curved, circular, or straight. Stair planning and construction should adhere to ergonomic design principles to minimize user discomfort and prevent accidents. A set of steps that are arranged in a specific order to provide access from one floor of a building to another is known as a staircase. They ought to be offered in a handy area of the structure. Although elevators will be available for regular floor-to-floor travel in a multistorey building, stairs are required for an emergency exit in the event of a fire or other disaster.

**Characteristics of a Good Stair**

The following are the characteristics of a good stair.

i. Should be easily accessible from all sides of the building
ii. It should be properly ventilated
iii. It should have wide landing at end of each flight
iv. Normally there should not be more than 12 steps in a flight.
v. The rise and go of the steps should be so proportioned that the ascending and descending of the flight is easy.
vi. Hand rail must be provided at least on one side of the stair

vii. The inclination of the stair should be between 30 to 45 degrees.

**Types of Stairs**

The different types of stairs are:

i. Straight stairs
ii. Quarter-turn stairs
iii. Dog-legged stairs
iv. Open-newel stairs
v. Circular stairs
vi. Bifurcated stairs
vii. Geometrical stairs
viii. Spiral stairs

### 2.1.10.1 Design Consideration for stairs

Dwelling with no more than two flats must have an effective stair width of at least 0.80m and 17/29 rise-to-tread ratio. Stairs which are not strictly covered by building regulations may be as little as 0.50m wide and have a 21/21 ratio. Stairs governed by building regulations must have a width of 1.00m and a ratio of 17/28. In high rise flats they must be 1.25m wide. The length of staircase runs from > 3 steps up to < 18 steps. Landing length + n times the length of stride + 1 depth of step (e.g with a rise-to-tread ratio of 17/29 + 1 x 63 +29 = 92cm or 2 x 63+29 = 1.55cm). Doors opening intothe stairwell must not restrict the effective width.

The time required for complete evacuation must be calculated for stair widths in public buildings or theaters. Such staircases or front entrance steps are climbed slowly, so they can have a more gradual ascent. A staircase at a side entrance or emergency stairs should make a rapid desce

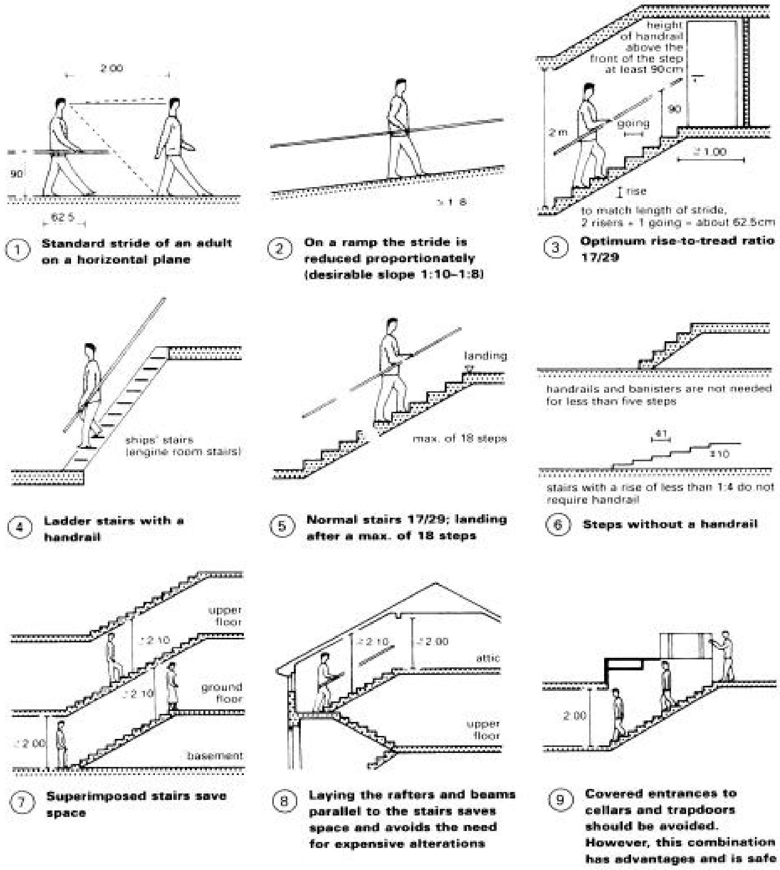
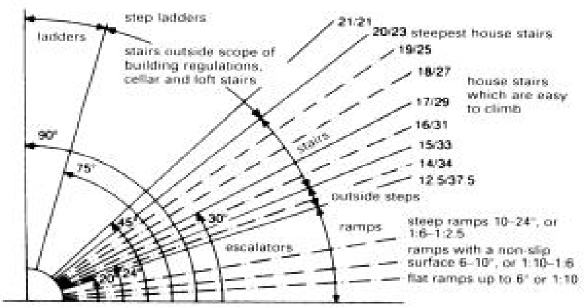



Figure 2:3 Staircase design considerations
Source: Architects' Data




(1) **Incline for ramps, outside stairs, house stairs, machinery access steps and ladders**

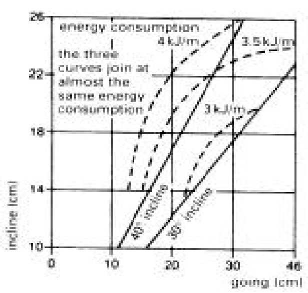
| height of storey | two-way stairs easy rise | | single, triple width and stairs in buildings easy rise | |
|---|---|---|---|---|
| | steps, no. | steps, height | steps, no. | steps, height |
| a | b | c | f | g |
| 2250 | – | – | 13 | 173.0 |
| 2500 | 14 | 178.5 | 15 | 166.6 |
| 2625 | – | – | 15 | 175.0 |
| 2750 | 16 | 171.8 | – | – |
| 3000 | 18 | 166.6 | 17 | 176.4 |

(2) **Height of storey and step rise**

| type of building | type of stairs | | effective width of stairs | rise, r[2] | going, g[3] |
|---|---|---|---|---|---|
| residential building with no more than two flats[1] | essential stairs (building regulations) | stairs leading to habitable rooms, cellar and loft steps which lead to non-habitable rooms | ≥ 80<br>≥ 80 | 17 ± 3<br>≤ 21 | $28^{+9}_{-5}$<br>≥21 |
| | stairs (additional) considered non-essential according to building regulations | | ≥ 50 | ≤ 21 | ≥21 |
| stairs (additional) considered non-essential according to building regulations (flats) | | | ≥ 50 | no stipulations | |
| other buildings | essential stairs according to building regulations<br>stairs (additional) considered non-essential according to building regulations | | ≥ 100<br>≥ 50 | $17^{+2}_{-3}$<br>≤ 21 | $28^{+9}_{-2}$<br>≥21 |

[1] Also includes maisonettes in buildings with more than two flats;
[2] but not <14 cm.; [3] but not >37 cm = stipulation of the ratio of rise r/g

(3) **Stairs in buildings**




(4) **Energy consumption of an adult climbing stairs**

Figure 2:4 Staircase design considerations
Source: Architects' Data

The experience one has of ascending and descending a stair varies greatly with the stair design, for example there is a significant difference between an interior domestic design and a grand flight of entrance steps. Climbing stairs takes on average seven times as much energy as walking on the flat. From the physiological point of view, the best use of 'climbing effort' is with an angle of incline of 30 degree and a ratio of rise of : rise of step, r = 17 and going of step, g = 29.

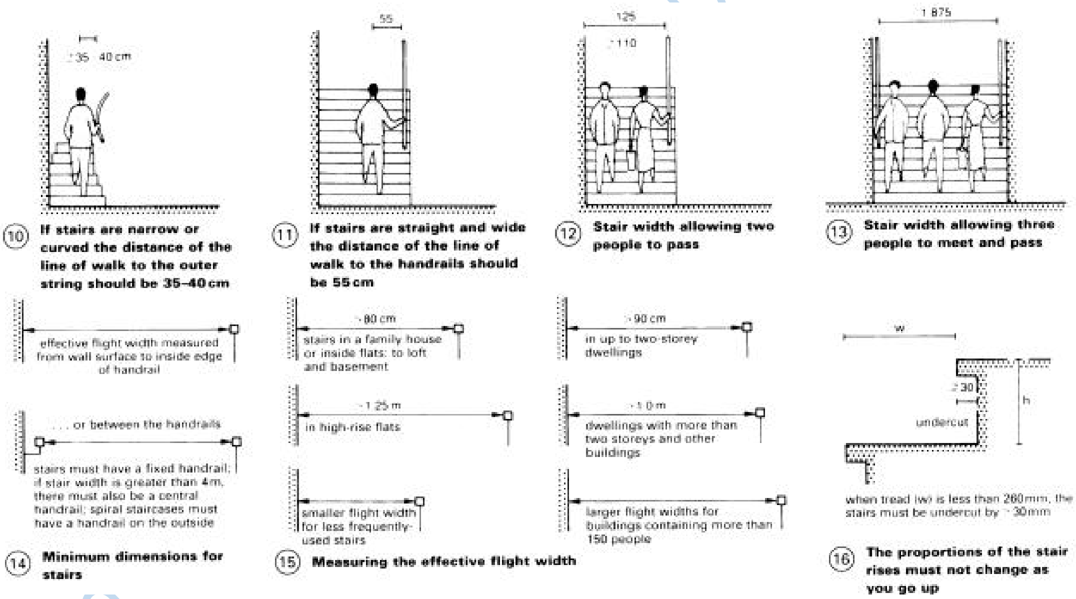



Figure 2:5 Staircase design considerations
Source: Architects' Data

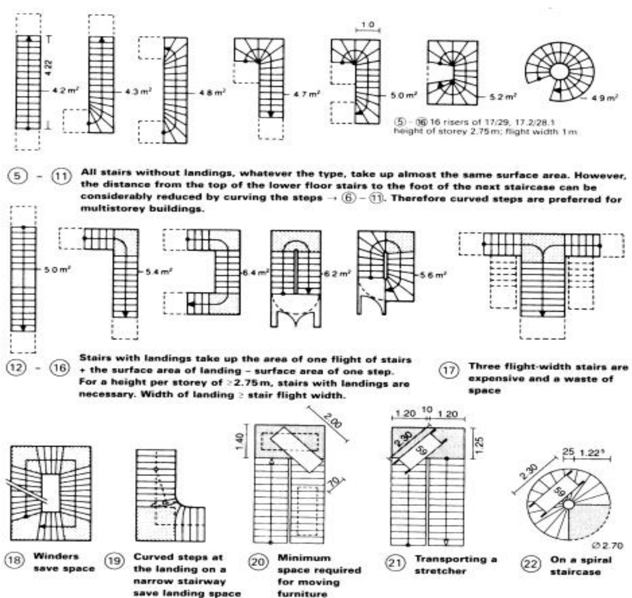


Figure 2:6 Types of Stairs Design
Source: Architects' Data

### 2.1.11 Internal Circulation In Emergency Centre

Architecturally speaking, a circulation space in the design of a building is typically located between larger spaces in a building, through which people can move to and from another space in the building (Kocabas, 2013). They are areas that are outside of the main rooms but internal to the structure of buildings. The major spaces within the same floor level or on the exterior ground level of the building are connected by circulation spaces, which are found inside and outside a building. Examples of building elements that facilitate horizontal circulation within buildings include entrances, foyers or receptions, lobbies, lounges, ramps and travelators (Onugha, Ibem, & Aderonmu, 2016).

Entrances are of utmost importance to building users. Notably, entrances are components of a building that make it easier to enter or move between spaces inside of it. They are also referred to as a building's entrances. Entrances should be designed with adequate consideration for all potential building users, given their function in buildings. Foyers, which connect the building's entrance point to other interior spaces, are closely related to entrances. Foyers are circulation spaces within a building that are located at the entrance. It is frequently referred to as an entrance hall, hallway, receiving area, entryway, or vestibule (Stefan, 2012). It can also be thought of as a space that serves as a transition within the building. Kocabaş asserts that the foyer begins at the front door and aids building occupants in understanding how to access other areas of the building. Additionally, lobbies and corridors are two additional linear building circulation pathways that connect different spaces.

Internal doors in public structures, such as emergency centres, typically open toward the hallways and lobby (Kocabas, 2013). In fact, according to Lacey (2004), the main function of a building's corridors is to inform users about it and help them navigate the building's interior spaces. Additionally, there are waiting rooms, which are horizontal circulation areas in a building that connect other areas of the structure and serve as a place for users to rest or relax. It is a location in emergency centre where people wait for the before they're been attended to while sitting down and relaxing.

A number of spaces and elements facilitate vertical movement inside buildings. They consist of ramps, escalators, elevators, and lifts. A common vertical circulation component in buildings is the staircase. They are built and designed to make it easier for people to move around the building from one floor to another. In a building with more than one floor, they are structurally made up of a series of steps with level landings placed at specific locations (Onugha, Ibem, & Aderonmu, 2016).The ramp performs the same purpose as the staircase, but it differs structurally from one because it lacks risers and threads.

### 2.1.12 External Circulation in Emergency Centre

When designing an emergency centre, it is crucial to ensure proper traffic pattern planning as this will guarantee ease and comfort of movement. Separating different types of traffic is necessary, as well as incoming and outgoing traffic. In an emergency centre, the following basic traffic types are present:

- Vehicular traffic
- Pedestrian traffic

1. Vehicular Traffic: There are three types of vehicular traffic.

(i) Passenger traffic.

(ii) Traffic from employees.

(iii) Service traffic.

i. Vehicular passenger traffic: Site entry: The access point needs to be placed carefully to avoid traffic accidents. To protect passengers from weather conditions like fog, sunlight, etc., a drop-off point could be established. To ensure proper and orderly traffic flow through the venue, the vehicular traffic flow should be well-organized and should be one-way.

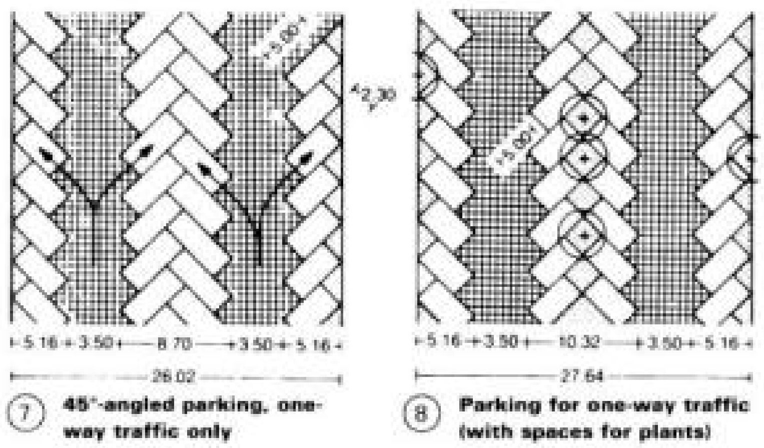



Figure 2:7 One way traffic parking arrangement,
Source: Architect’s Data

ii. Vehicular traffic from employees: There will be a different lot where employees can park. The rest of the commuter vehicular traffic must be connected to the staff vehicular traffic. Vehicles will be detoured off the main thoroughfare and directed to staff parking areas, which will be placed close to the emergency centre’s staff entrance.

iii. Vehicular service traffic: The service traffic should, to the greatest extent possible, be kept apart from the general traffic and should service facilities directly, such as offices etc. It should be properly constructed to prevent accidental use by general public vehicles and to guarantee that only the necessary vehicles use it.

iv. Passenger traffic: The site's pedestrian flow is essential because it accounts for a large portion of people entry. General public entry can be constructed to allow for peak foot traffic and to give pedestrians a quick and direct route into the emergency centre.

### 2.1.13 Factors That Affect Circulation

A number of characteristics were found to have a big impact on how well buildings' circulation spaces work. Circulation spaces can be used as effective circulation spaces for human traffic thanks to their physical, spatial, and geographic characteristics. Chief among these characteristics are, but are not limited to, the building's shape and geometry, the location of its circulation spaces and elements, the size of these elements, their shape, and the number of available circulation elements.

The building's geometry or shape has an impact on how people move through and around it. The size of the building, the size of the site, and the organization of spaces, or the spatial arrangement within the building, are all directly correlated with the building form. This in turn affects the layout of the building and how visitors interact with it. A building's size directly affects how far users must travel both horizontally and vertically, as well as how long it will take them to reach different areas of the building. This directly affects how they move through the building's various spaces and how they use them (Onugha, Ibem, & Aderonmu, 2016). Users' ability to easily locate the building's reception/waiting area can also be impacted by the building's shape, which can also affect how easily they can see the building's entrance.

The positioning of circulation areas or other building components is a crucial aspect that needs to be taken into account. When the building's circulation components are placed in awkward locations where users can't easily see and use them, this poses a significant challenge. One result of this is that the areas/components become inaccessible, which results in inadequate circulation systems inside the building (Onugha, Ibem, & Aderonmu, 2016). The location of the various circulation elements in buildings must be clearly defined through the use of suitable signage and other wayfinding components in order to prevent this scenario. This is crucial to ensuring that they are clearly visible to users from any location inside the structure.

Building circulation areas and other components' sizes are directly related to where they are located. In fact, it is well known that the size of circulation areas affects how well they can manage foot traffic and allow for simple movement of people even during peak hours. Inadequately sized circulation areas can hinder an effective circulation system, causing congestion both inside and outside of buildings. Authors (Onugha, Ibem, & Aderonmu, 2016) have advised architects to analyze traffic flow during peak hours to determine the carry capacity of facilities and services within and around public buildings in order to design circulation spaces/elements of an appropriate size. The shape of the circulation spaces and other elements is added to the size. The use of circulation spaces and elements is also influenced by their shape. For instance, the use of spiral staircases, staircases without risers, and staircases with tapering treads is discouraged to prevent accidents while moving inside and around buildings (National Disability Authority, 2015).

The amount of horizontal and vertical circulation elements and spaces that are accessible to users affects how they move through a building. More circulation features are provided, which reduces the amount of human traffic inside the building. For instance, having extra elevators or lifts in a building makes it easier to move around efficiently when taking the time and distance involved into account. In the event of an emergency, such as a fire outbreak, these additional circulation components can also be used as exit points from the building.

### 2.1.14 Requirements Of the Emergency Centre Design

i) For the Patients: The physical environment in which a patient receives care has an impact on patient outcomes, patient satisfaction, and patient safety. Patients require a well-lit environment.

ii) For Staff: The visual environment should be conducive to working from the perspective of the staff. A well-designed working environment can help with staff recruitment and retention, as well as boost morale.

iii) For the caretakers of patients: Their requirements differ from those of hospital personnel and professionals because caregivers may prefer to sleep during the night rather than stay awake.

Studies show that there are four situations in which lighting installations may cause visual discomfort. They are:

a) Visual task difficulty, in which the lighting makes the required information difficult to extract, under or over stimulation, in which the visual environment is such that it presents too little or too much information,

b) Distraction, in which the observer's attention is drawn to objects that do not contain the information being sought

c) Perceptual confusion, in which the pattern of illuminance can be confused with the pattern of reflectance in the visual environment.

Energy efficiency can be achieved by using the most effective and efficient lighting equipment and control that can keep the energy requirement minimum whilst achieving the lighting design objectives

## 2.2 Design Considerations

The quality of a building's lighting has a large impact on its functionality. In order to perform their tasks safely and comfortably, occupants require lighting that provides adequate visibility without causing discomfort or distraction. Adequate natural light allows users to complete tasks and influences the likelihood of the need for artificial lighting at certain times of the day. Daylight factor calculations can be used to assess the amount of daylight available in a building. Because natural light is a free and renewable resource, making the best use of it is critical in sustainable building strategies. Daylighting, shading, and lighting control strategies can all contribute to a naturally lit, cost-effective structure.

The majority of daylighting components are built into the original design; however, tubular daylighting devices, skylights, electric lighting controls, and optimized interior design may be considered in retrofit projects. The science of daylighting design is more complicated than simply introducing light into a home. When installing a daylighting fixture, keep heat gains and losses, glare control, and variations in daylight availability in mind. Window size and spacing, glass selection, the reflectance of interior finishes, and the location of interior partitions must all be taken into account. Furthermore, there are numerous types of daylight fixtures, each with its own set of design considerations.

**i. Windows:** Are by far the most common daylighting source. Windows specifically used for daylighting are generally implemented in the design phase since the window head height and glare control is easier to deal with during that time.

**ii. Skylights:** Is a common top lighting source, and they are implemented in the design phase. Skylights can be either passive or active, though the majority of skylights are passive. Active skylights are windows that have a mirror system within the skylight that tracks the Sun, and are designed to admit more sunlight by channelling the light into the home.

PLATE 4: Showing windows in a space
Source: Google Search 2023

PLATE 5: Showing Skylight in a space
Source: Google Search 2023

**iii. Tubular Lights:** also known as solar tubes, are light channels that allow light to enter from the roof and be reflected using mirrors into a home. They have become more popular for top lighting in recent years. This is largely because they can be installed in retrofit projects easier than skylights and are cheaper for the homeowner.

**iv. Redirection Devices:** Take incoming sunlight and direct it towards the ceiling space. They aim to reduce glare and to increase daylight penetration. These devices typically take on of two forms: louvered systems or a large horizontal element. Horizontal elements are commonly referred to as light-shelves22

**v. Solar Shading Devices:** Are often implemented to control the solar gains and potential glare from windows. These shading devices include overhangs and blinds

**vi. Daylight-Responsive Electric Lighting Controls:** Incorporate photocells to sense the available light and act accordingly by dimming or turning off the electric lighting system in response.

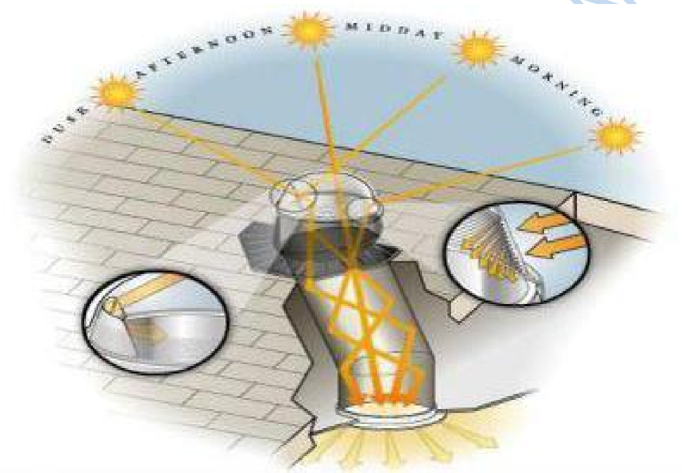



Figure 2:8 Showing Tubular Light

Source: Google Search 2023

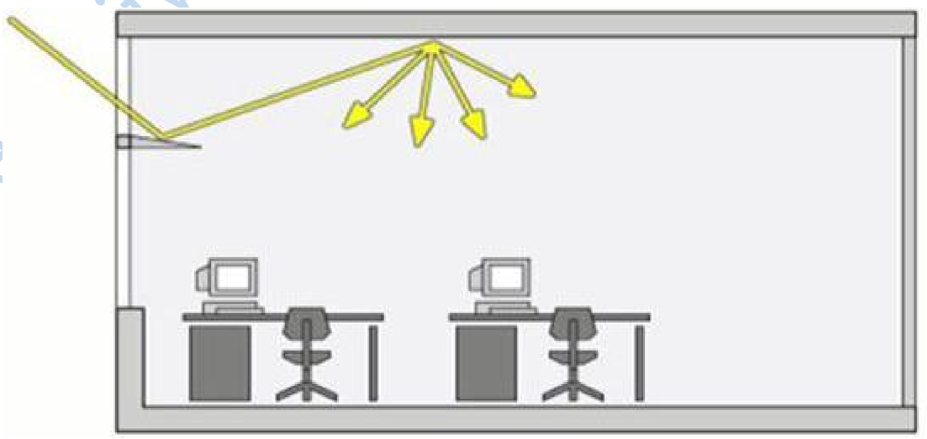


Figure 2:9 Showing reflection of light

Source: Google

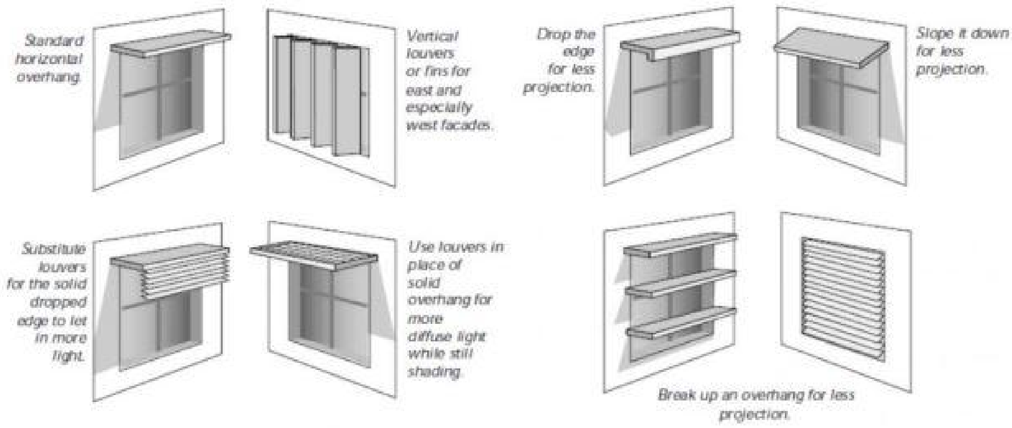



Figure 2:10 Showing Solar Shading Devices

Source: Google Search 2023

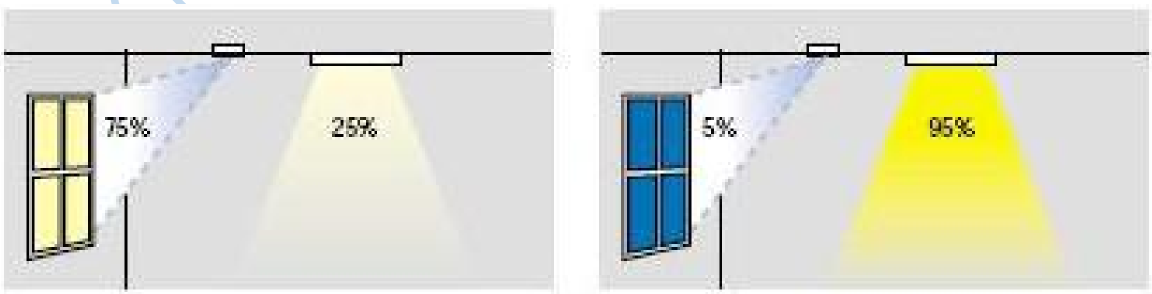



Figure 2:11 Showing Daylight-Responsive Electric light control

Source: Google Search 2023

### 2.2.1 Design Considerations To Be Taken To Solve Climatic Factor Issues

(a) Emphasis should be on the orientation of the building on the North and South direction i.e. the longest axis facing North and South with minimum opening on the east-west direction.

(b) Use of sun shading devices (horizontal and vertical) like canopies, pergolas and fins to prevent direct sunshine from entering the building.

(c) Use of reflective materials and choice of colour of material. Bright colours reflect heat while dark colours absorb heat.

(d) Use of adequate over-hanging eaves.

(e) Use of shading device like, trees, shrubs, and hedges to protect building from direct sunshine.

(f) Proper location and size of openings to influence wind flow and through the building. Preferably opening shutters should be flexible enough to ward off unfavourable wind movement.

(g) Proper bracing and rigidity of the building structure to withstand extreme winds.

(h) Use of wind-breakers to reduce devastating effect of winds.

(i) The use of reflective roofing materials to minimize the amount of solar radiation emitted.

(j) The introduction of expansion joints to cope with the differences in temperature.

(k) There should be adequate provision for surface water drainage to avoid flooding and marshy environment.

# Chapter Three

## Methodology (Case Study)

### 3.1 Introduction

Research is characterized as "an activity involving the systematic acquisition of new knowledge" (Walliman and Walliman, 2011). Meanwhile, Brown (2006) defines methodology as "the underlying philosophical framework that guides the research or serves as the basis for the research."

This chapter provides a comprehensive account of the research methods, approaches, and designs employed throughout the study. It rationalizes the choice of these methods by discussing their respective advantages and disadvantages, all while considering their practical suitability for the research. The chosen methodology should align most effectively with the research objectives, and it should be replicable in similar studies of the same nature.

### 3.2 Case Study

A case study is an empirical investigation into a contemporary phenomenon within its real-life context, particularly when the boundaries between phenomenon and context are unclear. It attempts to shed light on a decision or set of decisions, including why they were made, how they were implemented, and the outcome. An initial assessment of the existing building typology would be required to fully understand the principle behind designing any building typology. The documented buildings were initially assessed in terms of spatial, functional, equipment, and operational efficiencies and standards, which informs necessary provisions for future needs that may arise in such building typology.

The case studies were aimed out on four existing senate buildings which are:

1. Lagos State Emergency Service Management (LASEMA)

2. National Emergency Management Agency (NEMA)

3. Kenyon Emergency Service Cente

4. Greenpoint EMS Station

5. Public Safety Answering Center II

6. Parque De Bombers

### 3.2.1 Case Study 1 (Local)

Lagos State Emergency Service Management (Lasema)

**Location** – Lagos, Nigeria

**Year Built -** 2008

**Project Type** – Emergency Service Facility

Description

The Lagos State Emergency Management Agency (LASEMA) was established by LASEMA Law 16 of 2008 to manage emergencies and disasters in the state, in accordance with Decree 12 of 1999, as amended by Act No. 50 of 1999, which established the National Emergency Management Agency (NEMA). The Agency is in charge of overall emergency management coordination in Lagos State, collaborating closely with all stakeholders. It was established in

February 2007, and the legal framework establishing LASEMA was signed into law by His Excellency, Mr. Babatunde Raji Fashola (SAN) on July 22nd, 2008. The Agency was statutorily tasked with providing adequate and prompt response as well as long-term intervention in all types of emergency/disaster situations in the State within the "Lagos" territorial boundary. It performs this onerous task through Emergency/Disaster prevention preparedness, mitigation, recovery and relief.

The law that set up the LASEMA did empower the Agency to coordinate the activities of all its stakeholders and NGO's who are categorized into Primary, Secondary and Tertiary responders in management of all emergency and disaster situations in the State as well as also to build their capacity toward increasing response capability

Building Appraisal

Merits

- Good planning for circulation
- Well-coordinated space arrangement
- Quick response to emergency
- Wide range of service

Demerits

| Variables | Adequate | Inadequate | Not Available |
|---|---|---|---|
| | (*) | (X) | (0) |

| | | |
|---|---|---|
| Architectural form | * | |
| Scope of Facility | | X |
| Construction Technology | | X |
| Building Material | * | |
| Sustainability of building | | X |

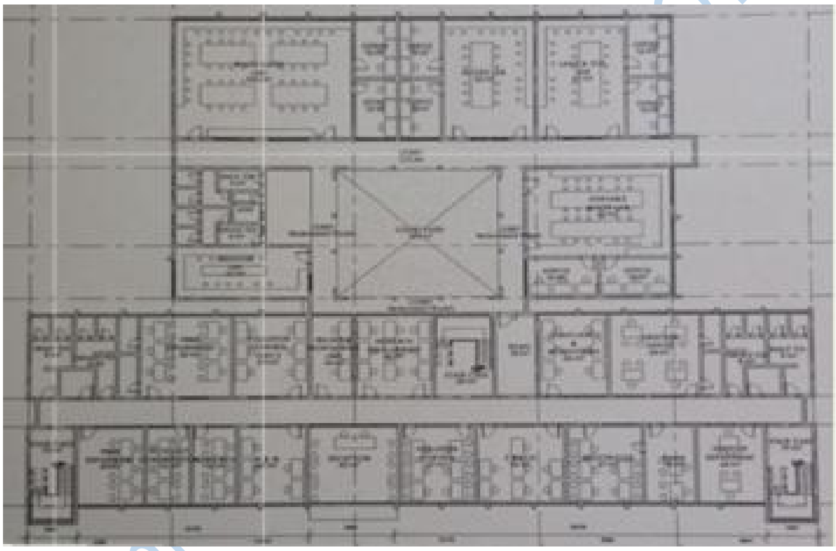


Figure 3:1 Floor plan of LASEMA Building
Source: (Google search)

PLATE 6: Approach view of LASEMA Building
Source: Researcher’s Field work

PLATE 7: LASEMA Operative in action (Google search)
Source: Researcher’s Field work

### 3.2.2 Case Study 2 (Local)

National Emergency Management Agency (Nema)

**Location** – Abuja, Nigeria

**Year Built -** Unknown

**Project Type** – Training, search and rescue. Finance and administration, relief and rehabilitation.

Description

To manage disasters in Nigeria, the National Emergency Management Agency was established by Act 12 as amended by Act 50 of 1999. As a result, NEMA has been addressing disaster-related issues since its inception by establishing concrete structures and measures. Such measures include public education to raise public awareness and reduce the effects of disasters in the country. The Agency has also put in place structures that allow it to detect, respond to, and combat disasters in real time. NEMA will continue to improve its capability and effectiveness in carrying out its duties with the continued overwhelming support of the Federal Government and other stakeholders in Disaster Management.

The building plan is rectilinear in the form. Most of the all the elements are housed within the form. The building possesses a simple yet functional architectural form with the use of good geometry.

Building Appraisal

Merits

- Simple & functional circulation.

-Well lit space

- Wide parking space with uninterrupted power supply

***Table 3***:

| **Variables** | **Adequate (*)** | **Inadequate (X)** | **Not Available (0)** |
|---|---|---|---|
| Architectural Form | * | | |
| Scope Of Facility | | X | |
| Construction Technology | * | | |
| Building Material | * | | |
| Sustainability Of Building | | X | |

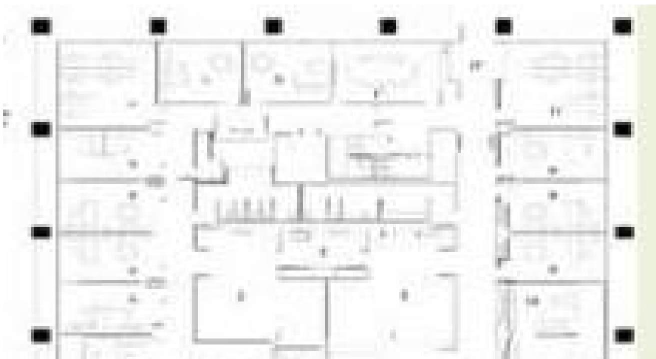


Figure 3:2 View of NEMA Building, Conference room Abuja (Google search)
Source: Researcher's Field work




PLATE 8: Approach view of NEMA Building, Abuja (Google search)
Source: Researcher's Field work

PLATE 9: View of NEMA Building, Conference room Abuja
Source: Researcher's Field work (Google search)

PLATE 10: View of NEMA Director's Office
Source: Researcher's Field work (Google search)



### 3.2.3 Case Study 3 (International)

Kenyon Emergency Service Center

Location – Houston, Usa

Year Built - 1906 And Began Full Humanitarian Service In 2007

Client:  Private Institute of Ihe Henyon Limited.

Description

Kenyon International Emergency Services provides a suite of integrated, configurable solutions to assist private and public sector organizations in managing the aftermath of an incident. Kenyon guarantees the most experienced personnel with the right equipment and data management tools to meet the demands of any incident, with over 115 years of experience responding to over 350 fatal and non-fatal incidents. Kenyon brings proven capability to any incident, regardless of size, scale, or location; by bringing knowledge, experience, and support, we can provide you with the confidence and reassurance you need when you need it the most.

Kenyon is the leading provider of full-spectrum disaster response services, including planning, incident management, and recovery. Our staff and services are the most knowledgeable in their field. This is why over 600 companies and governments around the world have chosen Kenyon as their disaster management partner.

**Building Appraisal**

**Merits**

- Almost all the functional spaces are being fully utilized
- Wide range of service coverage
- Well coordinated space arrangements
- Well-ventilated and lightened space

***Table 4***

| Variables | Adequate (*) | Inadequate (X) | Not Available (0) |
|---|---|---|---|
| Architectural Form | * | | |
| Scope Of Facility | | X | |
| Construction Technology | * | | |
| Building Material | * | | |
| Sustainability Of Building | * | | |



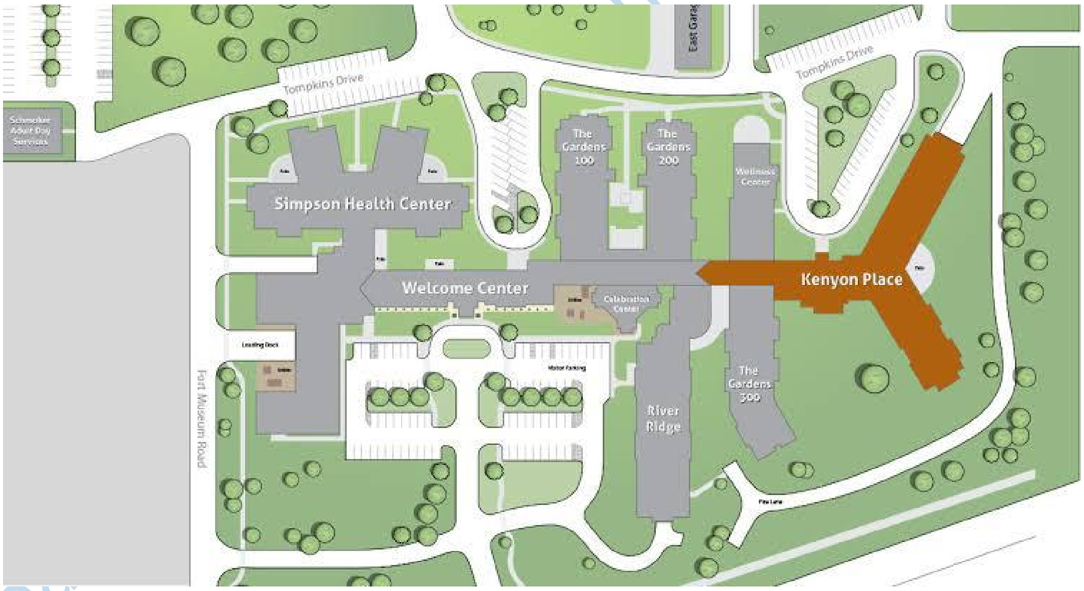



Figure 3:3 Layout Plan of Kenyon Emergency Service Center
Source: Google search

Figure 3:4 FloorPlan of Kenyon Emergency Service Center
Source: Researcher’s Field work


Figure 3:5 Aerial view of Kenyon Emergency Service Center
Source: Google Search

PLATE 11 Approach view of Kenyon Emergency Service Center
Source: Google Search


PLATE 12: a. Conference room

Plate 12: b. Meeting room of Kenyon Emergency Service Center

Source: Google Search

PLATE 13: Central atrium view of Kenyon Emergency Service Center

Source: Google Search

### 3.2.4 Case Study 4 (International)

Greenpoint Ems Station

**Location** – Brooklyn, United States.

**Architects -** Michielli + Wyetzner Architects

**Year Built –** 2013

**Project Type** – Fire Station

**Description**

The two-story, 12,400-square-foot facility houses FDNY ambulance crews and vehicles and occupies a prominent location in the rapidly developing neighborhood. The EMS Station's programmatic requirements prompted a split-level massing concept. The station's requirements resulted in the facility being divided into four sections. Because the space for housing vehicles necessitates a higher ceiling height than the rest of the station, one side of the station is taller than the other, which aids in the organization of its functions. There are four vehicle parking spaces and a vehicle support zone on the ground floor's east side. The lieutenant's office, captain's office, and other administrative space are located in the lower bay to the west.

The expressed form of the connecting stair and the continuous translucent glass second floor volume provide this civic building with a strong presence in its urban context.

Above the vehicle bay on the second floor are the locker rooms and bathrooms for the 54 women and 97 men who maintain the station’s three shifts. Across the atrium, to the west are a fitness facility, training room, and 700 square foot combined kitchen and lounge area. The ground floor sectional shift repeats at the roof line and is marked with a skylight that extends the depth of the building. This break in the massing articulates the entry sequence, opens views between the interior program areas and permits daylight to penetrate deep into the space. Low iron glass types change in opacity as movement through the building transitions from public to private.

**Building Appraisal**

**Merits**

- A double-height entry at the center coincides with the split in section, creating a strong arrival area that allows natural light deep into the building.

| **Variables** | **Adequate**<br><br>**(*)** | **Inadequate**<br><br>**(X)** | **Not Available**<br><br>**(0)** |
|---|---|---|---|
| Architectural Form | * | | |
| Scope Of Facility | | X | |
| Construction Technology | * | | |
| Building Material | * | | |
| Sustainability Of Building | * | | |



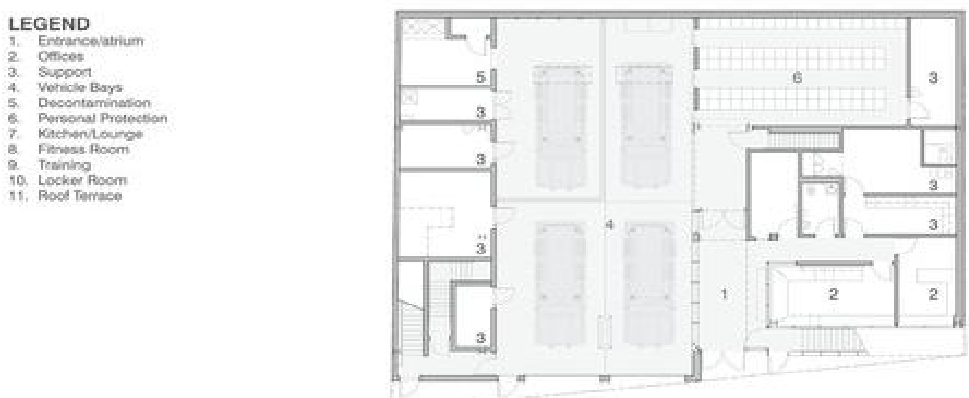


Figure 3:6  Ground floor plan of Greenpoint EMS Station

Source: Google Search



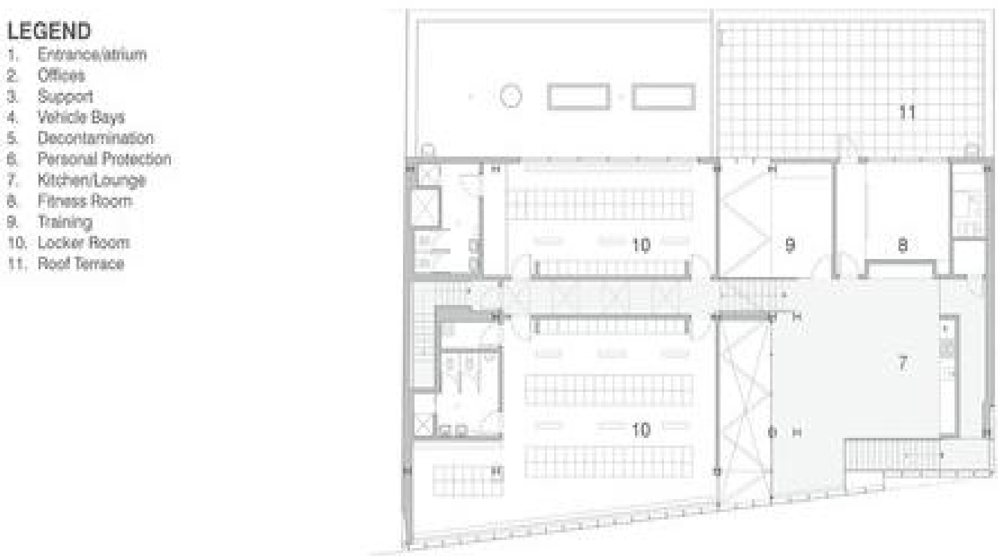
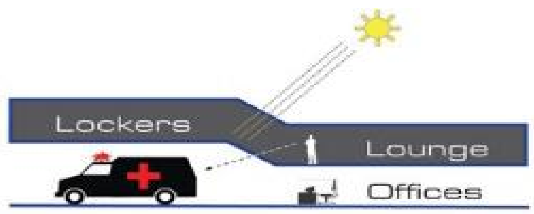



Figure 3:7  Second floor plan of Greenpoint EMS Station
Source: Google Search



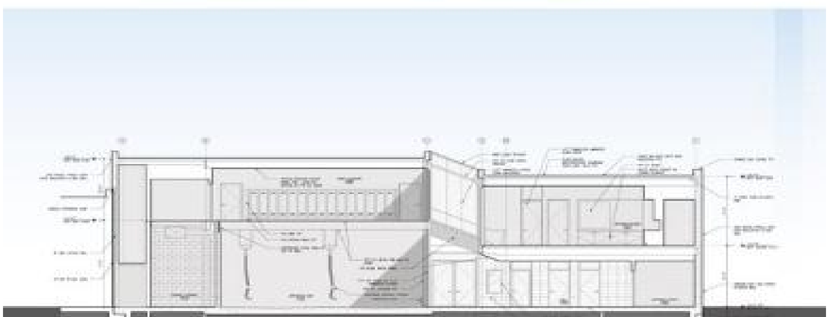



Figure 20:  Section through Greenpoint EMS Station
Source: Google Search

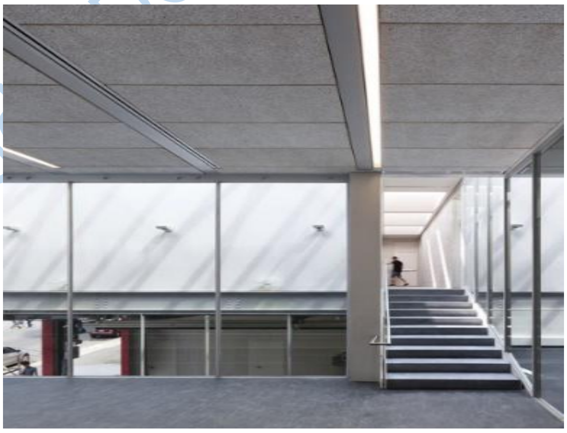


PLATE 10a. Exterior view

Plate 10b. Façade view of Greenpoint EMS

Source: Google Search

## Chapter Four

## Site Analysis and Design Synthesis

### 4.1 Study Area

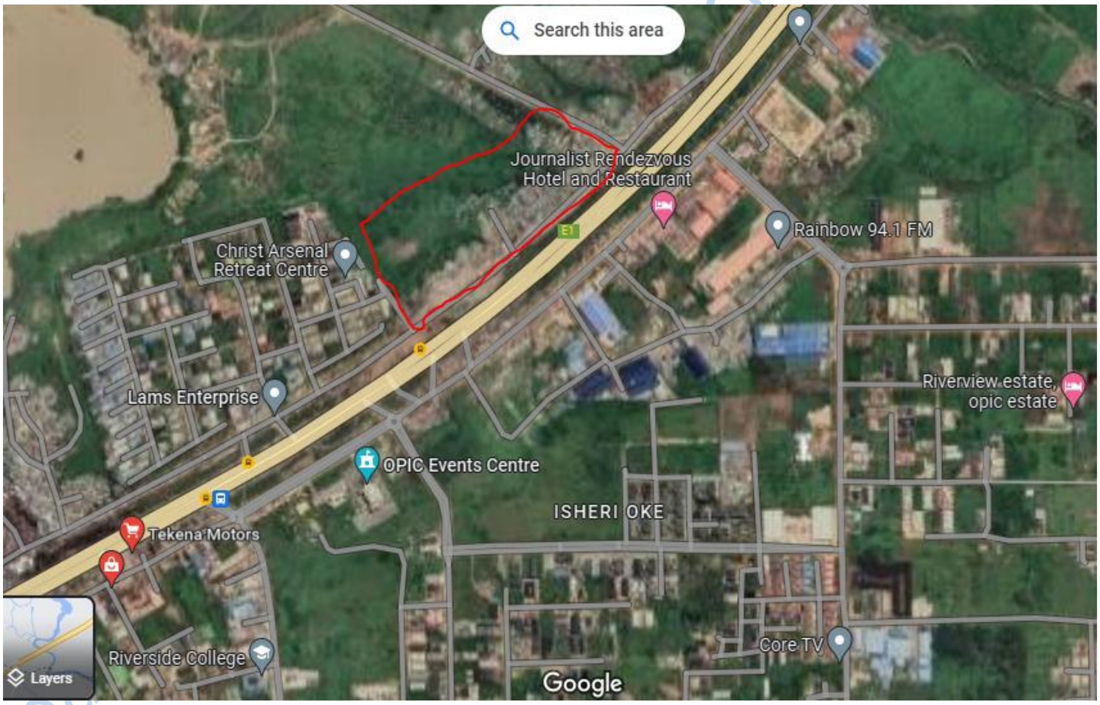
#### 4.1.1 Site Location

Ogun State is a state in southwestern Nigeria, created on February 3rd, 1976, from the Western State. Ogun State is bordered to the south by Lagos State, the north by Oyo and Osun States, the east by Ondo State, and the west by the Republic of Benin. The capital and most populous city of Ogun State is Abeokuta. Other significant cities in the state include Sagamu, Nigeria's top producer of kola nuts, and Ijebu Ode, the royal capital of the Ijebu Kingdom. The majority of Ogun State is covered in rain forest, with wooded savanna in the northwest. According to Wikipedia, Ogun State was the 16th most populous state in Nigeria in 2006 with a total population of 3,751,140 people. It also has a land mass that is 24th largest State in Nigeria with land area of 16,762 kilometer square. (Wikipedia)

According to Wikipedia, the state is known as the "Gateway to Nigeria" and is renowned for its high concentration of industrial estates and status as a significant manufacturing hub in

Nigeria. The proximity of the state to Lagos has also greatly facilitated the rapid growth of outlying communities like Kara, the site of the proposed emergency service center.






**Coordinate: 6.654810698759917, 3.394555888404059**

**Source**: www.google.com

### 4.1.2 Site Selection Criteria

(i) Location: The location of the site in relation to other facilities that collaborate with the building is the most crucial consideration when selecting a location for an emergency center. The site must be centralized because it is meant to serve as a hub for the community's crisis and emergency management. It must be reachable in terms of travel time between locations. This emergency center's location is centralized to meet a key requirement for site location.

(ii) Accessibility: After site location, accessibility is a crucial factor. This is so because accessibility depends on location. A site must be strategically placed within the area from which access is required in order to be sufficiently accessible. Routes for vehicular or pedestrian traffic are another crucial aspect of accessibility. The emergency center should be located in a place where there are routes for both vehicular and foot traffic around the building because it is a public structure.

(iii) Size: The size of the site is an important factor that needs to be taken into account. The site needs to be big enough to allow for equal distribution of functions. This improves worker productivity, coordination, and work-flow continuity. A site that is too small could result in excessive design restrictions. The Ogun State master plan includes a site that is big enough to house the emergency center and leave room for landscaping.

(iv) Services: If the chosen site increases the viability of the proposed project by being close to some basic social amenities like lodging, health care, telecommunication, electricity, water supply, and good motorable roads connected to interurban highways, then it will be more deserving of consideration.

(v) Scenic beauty: Ensuring a beautiful outdoor environment in addition to cozy interior settings can help employees relax and work more effectively. Because of this, employees are not exposed to unpleasant surroundings through the office windows, which could have a negative psychological impact and make them unhappy while they work.

## 4.2 Project Analysis and Design Synthesis

### 4.2.1 Brief Analysis

The aim of this project is to develop my design and creative abilities towards interpreting and conceptualizing the design brief of this project into a feasible design proposal.

The objectives are listed below:

- Comprehend, interpret and develop ideas in the brief to a meaningful design concept.
- Encouraging best use of building land topography and optimal utilization of services and infrastructure in the environment.
- Promoting higher standards of environmental performance and durability in buildings, seeking to ensure that users enjoy the benefits of a conducive, healthy, accessible and visually.
- Providing a design that may be easily managed and maintained.

### 4.2.2 Brief Development

Here's a list of spaces required for the proper functioning of the proposed emergency center design.

- Entrance porch
- Reception
- Emergency & Resuscitation
- Ambulance Bay
- Cafeteria
- Laboratory
- Network Management Center

- Training room
- General office
- Procurement
- Data center
- Dormitory
- Convenience
- General Allied Office
- Control room
- Sectary office
- Directory Office
- General finance department
- Assistant Directory
- Pollution control unit
- Conference hall
- Emergency Service Management
- Signal / Communication Department
- Traffic maintenance
- Data room
- Query & Enforcement
- Criminal investigation department
- General control unit
- Rehabilitation
- Dept. of Theft
- Civil matter department
- Equipment & Artillery

- Call centeQuality assurance

### 4.2.3 Design Criteria

Regardless of the site's shape or topography, it is a design principle that the building be created as a seamless part of it. Therefore, such language as bad-site seems like an easy way for the designers to get out of a difficult situation. The need for a site and environmental analysis arises from the fact that every site, regardless of its form, size, terrain, topography, etc., presents an opportunity to be utilized in the design process.

Orientation – The location of the site is crucial in relation to a few nearby factors, which can be expressed in one of two ways: either with respect to the sunrise and sunset, or with alignment with the road. When it comes to sunrise, the shorter side of the building will be oriented east-west, and sun shading devices will be used if this cannot be done. Ibadan's predominant winds are trade winds from the southwest and northeast, so placing a building's orientation in an east-west direction will prevent it from having good airflow. The wind will be coming at the building at a 45-degree angle, forcing some of it to travel parallel to it while the rest will pass through it. The location of the site is crucial in relation to a few nearby factors, which can be expressed in one of two ways: either with respect to the sunrise and sunset, or with alignment with the road. When it comes to sunrise, the shorter side of the building will be oriented east-west, and sun shading devices will be used if this cannot be done. Ibadan's predominant winds are trade winds from the southwest and northeast, so placing a building's orientation in an east-west direction will prevent it from having good airflow. The wind will be coming at the building at a 45-degree angle, forcing some of it to travel parallel to it while the rest will pass through it. Depending on the direction of the wind, the building's east or west end will be completely still. The amount of wind that strikes the building determines how much air moves through it. When the force is strong, more of the wind will be diverted parallel to the building, which will result in little to no air movement inside. Additionally, the portion that eventually makes its way into the building may continue to move parallel to it due to its high rate of speed by emerging from other windows or from the entrance it used to enter the building. Typically, this is seen in buildings with double-loaded corridors.

### 4.2.4 Conceptual Development

The design concept expresses the idea underlying the designer's vision and helps to direct the multitude of visions as follow. Concepts embody architectural and cultural symbolism; the draw on a wide range of variety sources such as previous experience, typologies and standard solutions; they are stimulated by the site and clients brief. Concepts may be represented in diagrammatic form, through to quite elaborate drawings, all of which may be represented by some textual annotations. However, for the designer to fully develop a conceptual design into more formalized design for planning approval, he must bear in mind the functionality, cost, programme, and quality. Talking about functionality brought about the adoption of the "Form follows function" principle as one of the concepts for the design, which implies that the shape of a building or object should primarily relate to its intended function or purpose. This also means that the purpose of a building should be the starting point for its design. The phrase was coined by Louis Sullivan but the teaching was extended by Frank Llyod Wright.

This design idea is associated with the architect Ludwig Mies Van Der Rohe (1886-1969), one of the founder of modern architecture and a proponent of simplicity of style. Characteristics of Minimalistic Architecture

i. Simplicity in form and function

ii. Uncomplicated cladding and wall finish

iii. Clean open light-filled spaces

iv. Simple detailing devoid of decoration

v. Simple roof profiles

vi. Use of simple and common materials (Concrete and glass)

vii. Use of landscape windows or glazing of walls which allows one to perceive the landscape (brings together the relationship between building, human movement, site and nature which is one main point of minimalism ideology

### 4.2.5 Functional Relationship

The ideal references, in terms of size, quality, standard, and characteristics, for determining how the required spaces and other building components can be used, are the functional/spatial criteria. The primary goal of having a space-functional relationship is to comprehend how various spaces within a development interact with one another as well as to achieve some consistency in the flow of functions within each area, thereby achieving a sense of unity among the various functions and also increasing efficiency within the building.

### 4.2.6 Space Allocation/Schedule of Accommodation

According to the specific activity that was anticipated for each space, due consideration was given when allocating spaces for the various functions present in the emergency center. Maximum space standards from reference data books were used to determine the space requirement. Consequently, the table below shows the amount of space needed for this project:

### 4.2.7 Space Program For General Area

| SPACE | NUMBER | AREA |
|---|---|---|
| . Entrance Porch | 1 | 75sqm |
| . Reception | 3 | 75sqm |
| . Emergency & Resuscitation | 3 | 95sqm |
| . Ambulance Bay | 1 | 66sqm |
| . Cafeteria | 1 | 66sqm |
| . Laboratory | 1 | 66sqm |
| . Network Management Center | 3 | 66sqm |
| . Training Room | 3 | 66sqm |
| . General Office | 1 | 66sqm |

| SPACE | NUMBER | AREA |
|---|---|---|
| Conference Hall | 3 | 75sqm |
| Emergency Service Man | 1 | 75sqm |
| Pollution Control Unit | 1 | 95sqm |
| Signal / Communication Dept. | 2 | 66sqm |
| Traffic Maintenance | 1 | 66sqm |
| Data Room | 2 | 6sqm |
| Query & Enforcement | 1 | 66sqm |
| Criminal Investigation Dept. | 3 | 66sqm |
| General Control Unit | 1 | 66sqm |
| Rehabilitation | 1 | 66sqm |
| Dept. of Theft | 4 | 66sqm |
| Civil Matter Dept. | 4 | 66sqm |
| Equipment & Artillery | 1 | 25sqm |
| Call Centre | 1 | 66sqm |
| [illegible] | [illegible] | [illegible] |

### 4.2.8 Construction Methods and Materials

The choice of building materials for emergency center should be cautious because they could have an impact on the occupants' health, safety, and security. Generally speaking, when choosing building materials, one should take into account the material's nature, structural properties, functional characteristics, fire resistance, compatibility with other materials, cost of installation, maintenance requirements, climate, and aesthetics. The building, its surroundings, the climate, and the design of its recreational facilities will all have an impact on the design and material selection. However, the chosen materials for the ceiling, floor, walls, and roof must satisfy the following requirements:

i. The components must have a high tensile strength.

ii. They must be strong and durable.

iii. The materials should be easy to install, particularly in the workshops.

iv. The floor covering should be able to withstand vibration caused by heavy machinery being used in the workshops, such as in a generator room.

v. The substance should have a low combustibility.

vi. Materials, particularly those used with metal, should have low expansion properties.

vii. The content needs to be of a high caliber. Building with eco-friendly and non-toxic materials is also encouraged.

#### 4.2.8.1 Criteria For Selection Of Materials And Finishes

a) Functional Criteria

i. Primary purpose: Suitability to basic purpose.

ii. Secondary purpose: What are some probable but perhaps unanticipated users? For the particular element? Health and safety issues may play a major part.

b) Aesthetic Spatial Criteria

i. Truth in Materials: a basic philosophy in design since the crafts movement not imitate one another but be used in accordance with their own natural properties. At one level this philosophy insists on clarity when using structural or surface materials i.e. one should not imitate the other for instance surface tiles should not pretend to be brick and imitation structure should not be created with non-structural elements.

ii. Appropriateness to design concept: Would you put VCT in a luxury hotel?

iii. Spatial implication (how will material influence the perceive size/shape of space).

c) Economic Criteria

i. Initial cost: this might tend to be high for natural materials such as stone, lower for synthetic such as vinyl.

ii. Life-cycle cost: how long does the installation need to last-short or long term planning.

iii. Cost to maintain: is maintenance an issue in commercial carpet.

d) Environmental criteria

i. Healthy Environments

ii. Sustainability

iii. Upstream impact

### 4.2.9 Building Services

High standard engineering services with advanced controls are required to guarantee environmental quality, adaptability to meet changing requirements, and energy management. In order to divide the space, the engineering system and apparatus must be designed for both the individual areas and the entire structure. Acoustic treatment, lift services, ducting, communication systems, sewage and drainage, waste removal, ventilation and air conditioning, electrical distribution and lighting, fire safety, and other services should all be taken into account.

# Chapter Five

# Conclusion.

## 5.1 Conclusion

Costs for construction and maintenance are taken into proper consideration when designing buildings. However, since actual people will be working in these structures, consideration for their physiological and psychological well-being is necessary. Because of the enhanced performance, employers and building owners gain from the improved health of building occupants.

The health, productivity, and safety of building occupants have all been shown to improve with properly installed and maintained daylighting systems. Natural light promotes health and can treat some medical conditions. The relaxing atmosphere that natural light creates helps office workers feel less stressed. Workers' productivity rises as their health improves, and higher productivity brings financial rewards for employers. Additionally, students perform better in natural light. Studies conducted across the country have revealed that workers in daylit offices outperform those in dimly lit or windowless ones on standardized tests. The increased intake of vitamin D benefits workers' health in addition to their test-taking performance. Retail stores benefit from daylighting as well because it produces more uniform lighting that enhances color rendering. With better lighting, customers stay in stores longer and employees can recognize items more quickly. Natural light enhances patient recovery rates in medical settings and permits proper vision for the elderly in assisted living facilities. In industrial settings, productivity rises as a result of better color rendering and higher-quality lighting provided by natural light. Additionally, safer conditions are made possible by improved lighting.

## 5.2 Recommendation

The problem is to provide enough desired light to the interior and to exclude unwanted light from the room. Daylight design in architecture necessitates consideration of the quantity and quality of natural light. The size and placement of the fenestration determine the amount of natural light. Numerous computational techniques can be used to produce numerical estimates. In architectural design, the quality of daylight is crucial because good lighting can give people a pleasant and comfortable place to work and live. The two most crucial goals of high-quality day lighting are to eliminate glare and provide diffused light.

The following points must be taken into consideration as a general approach to the effect of daylight design in architecture, even though it is challenging to provide criteria for day lighting in all building designs:

1. Provide as much indoor daylight as possible; however ensure that it is glare-free;
2. Avoid strong sunlight sources which would become sources of glare & discomfort;

3. Control glare by using the proper type of glass, curtains, blinds or louvers and interior color rendering;
4. Ensure that the main visual task can be distinguished from its surroundings by being brighter, or more contrasting, or more colorful, or all of three;
5. Provide the suitable orientation capable of improving the daylight conditions of a building.
6. Consider the design and purposes of the building and evaluate the criteria of good and effective lighting relative to the total environment.

Designing for daylight must take into account the specific building's primary function, the local climate, and the field of visual work.



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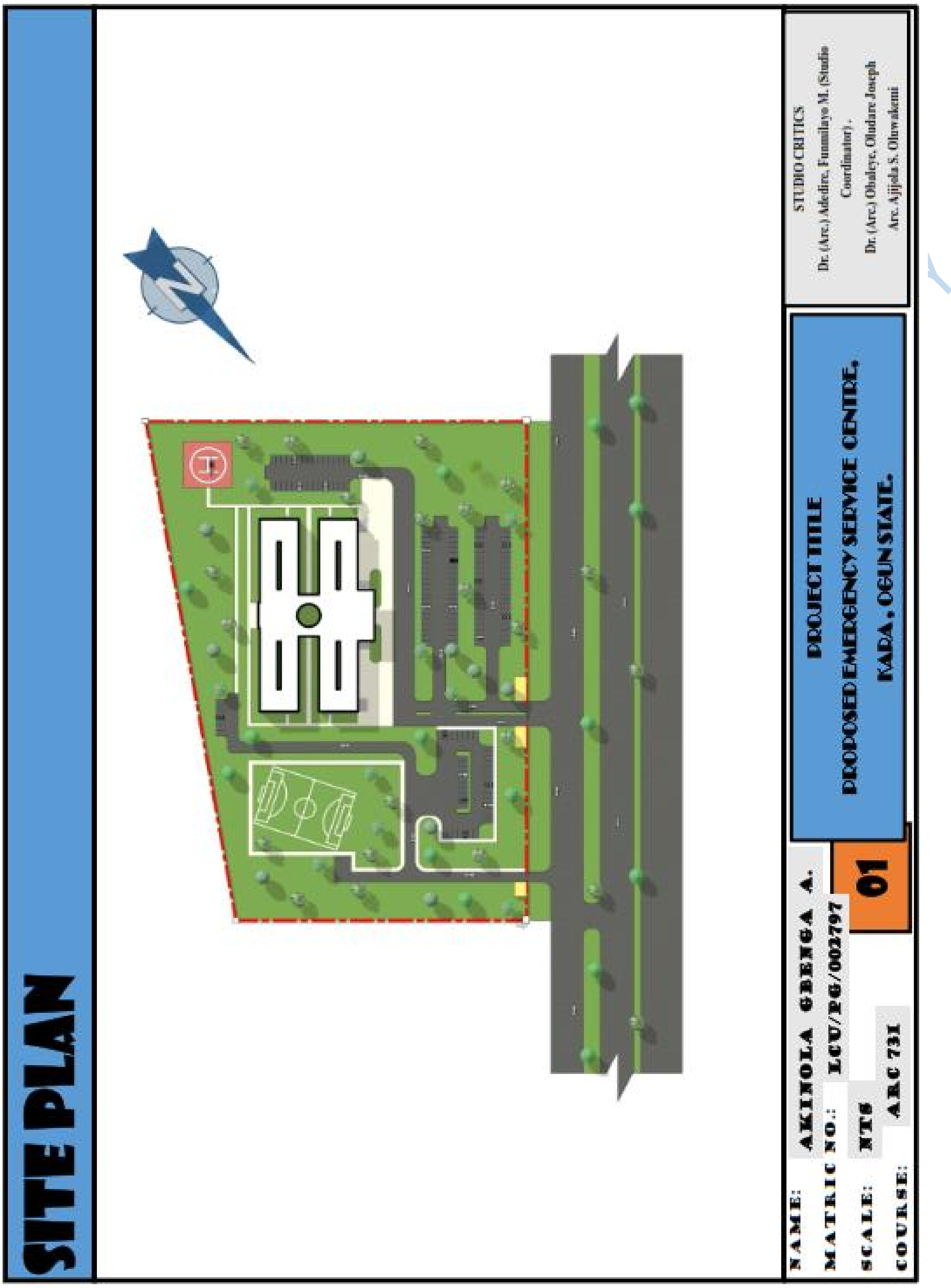
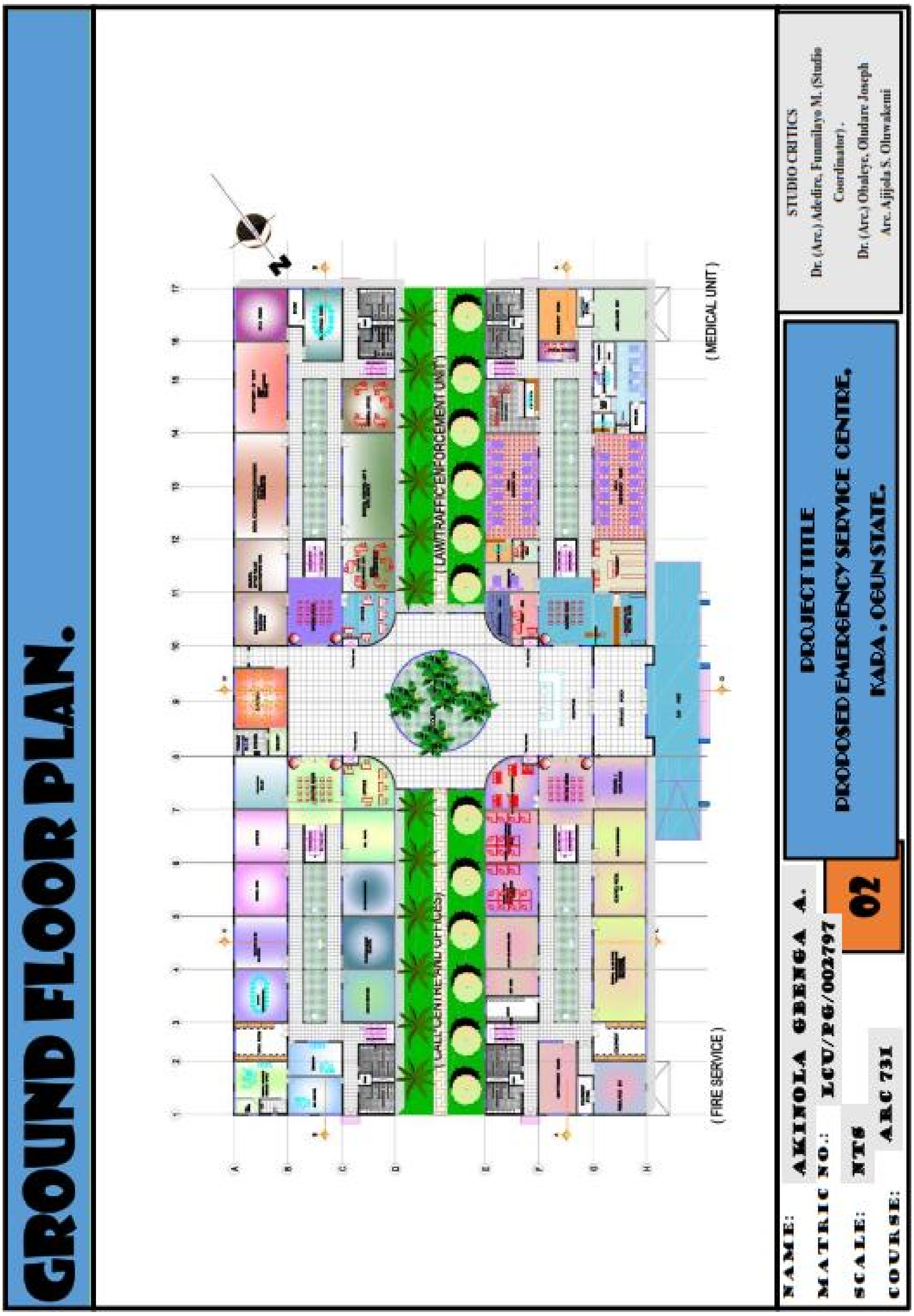
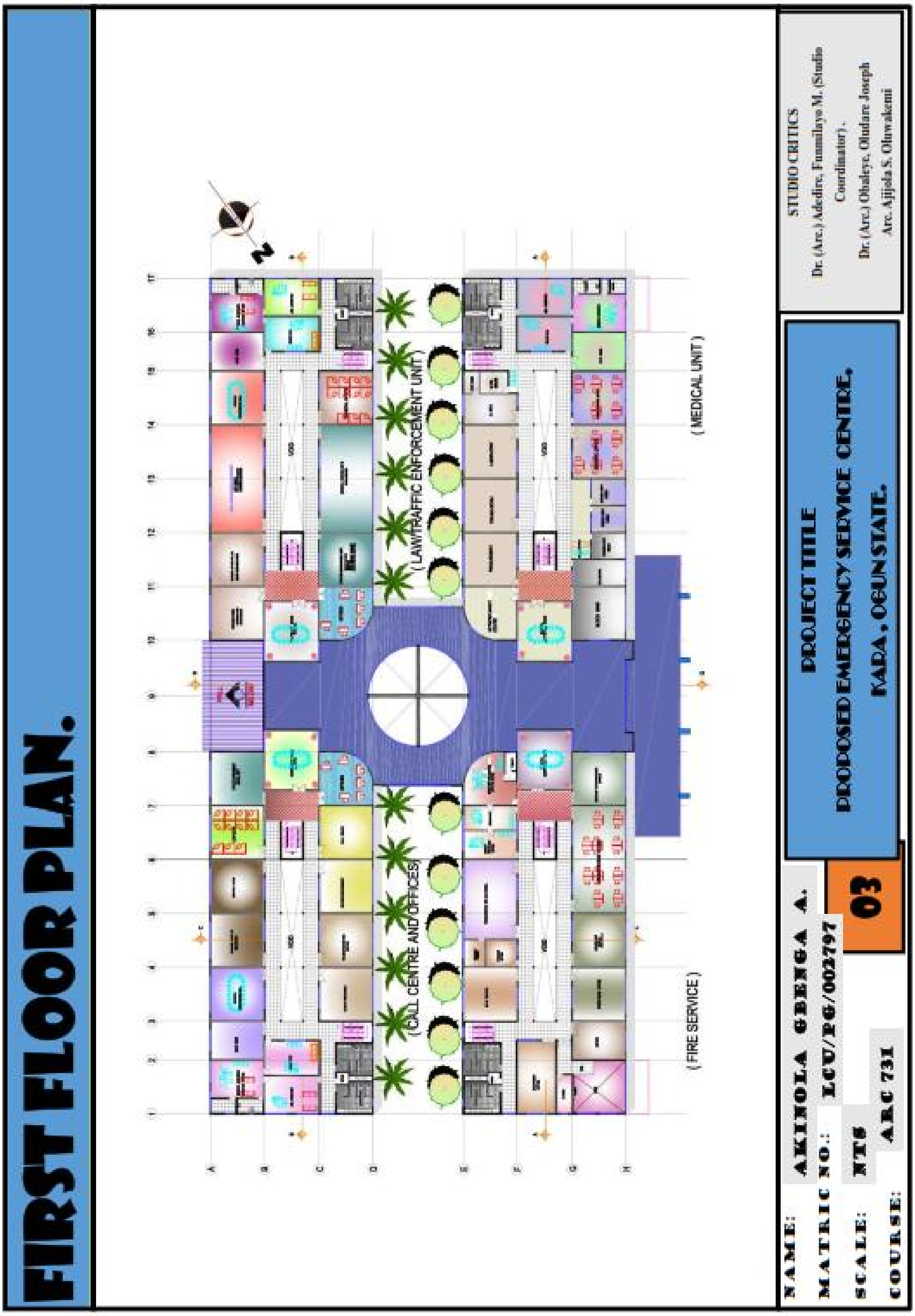



Appendix 1: Site Plan

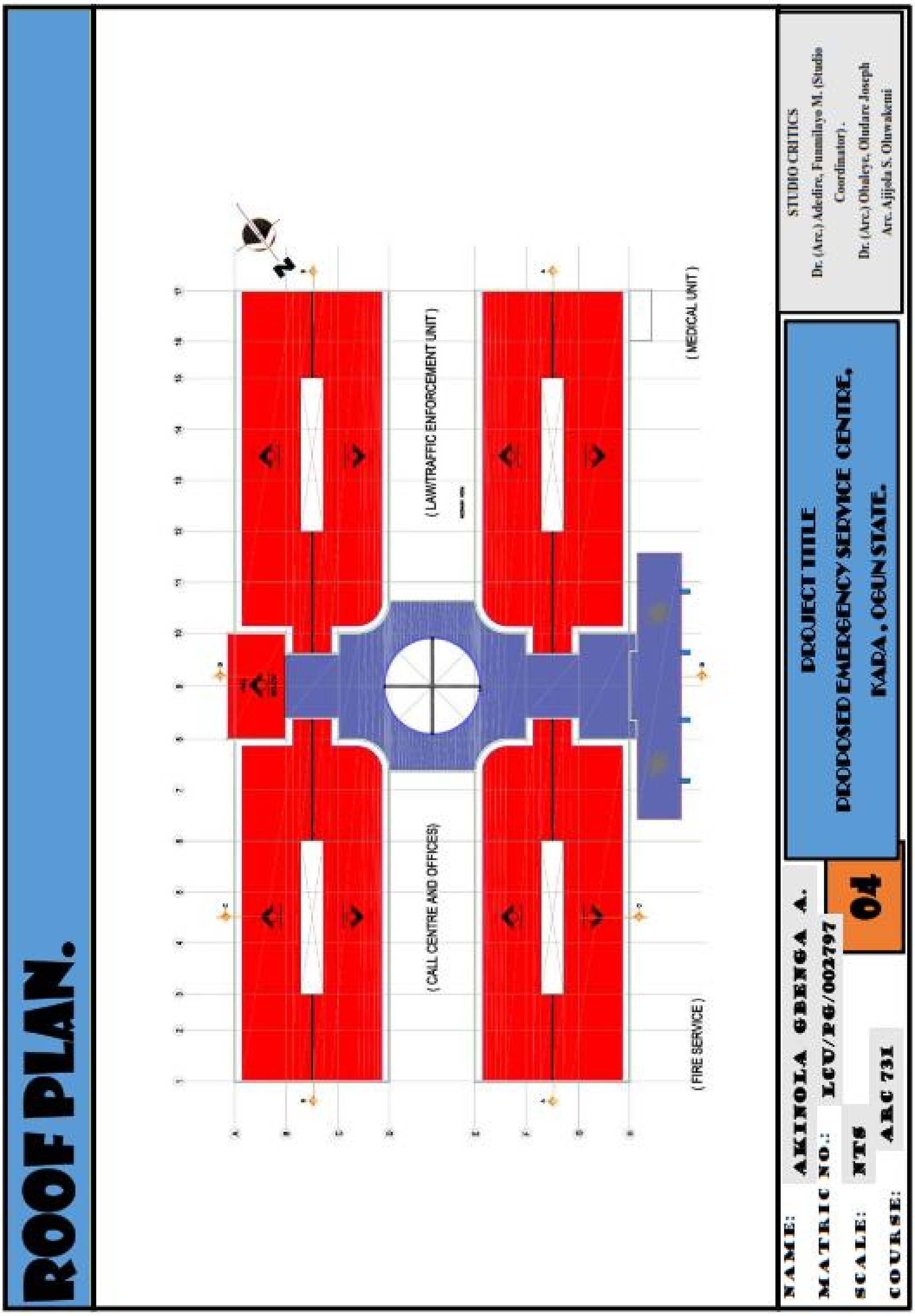
Appendix 2




Appendix 2: Ground Floor Plan




Appendix 3: First Floor Plan

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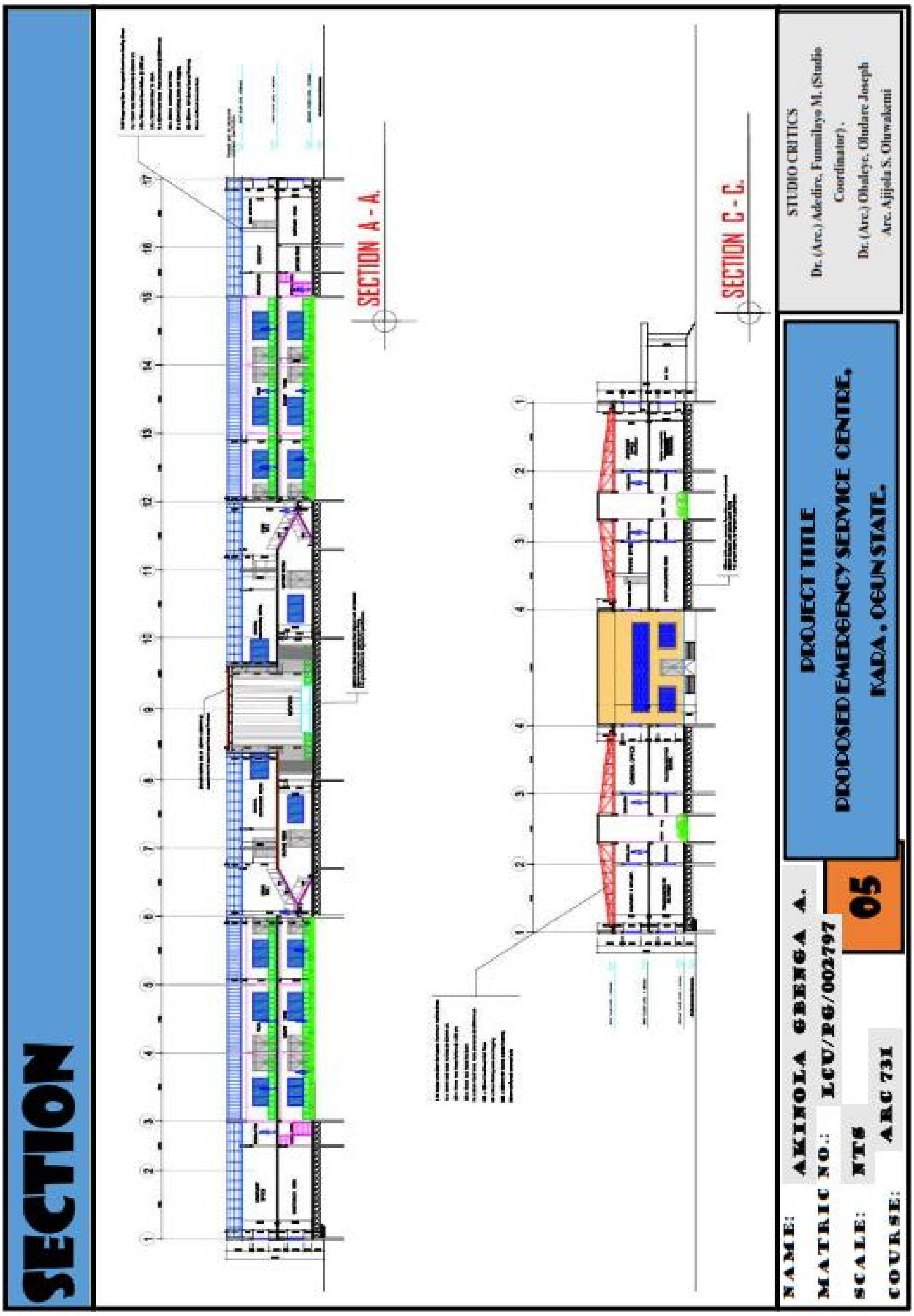


Appe

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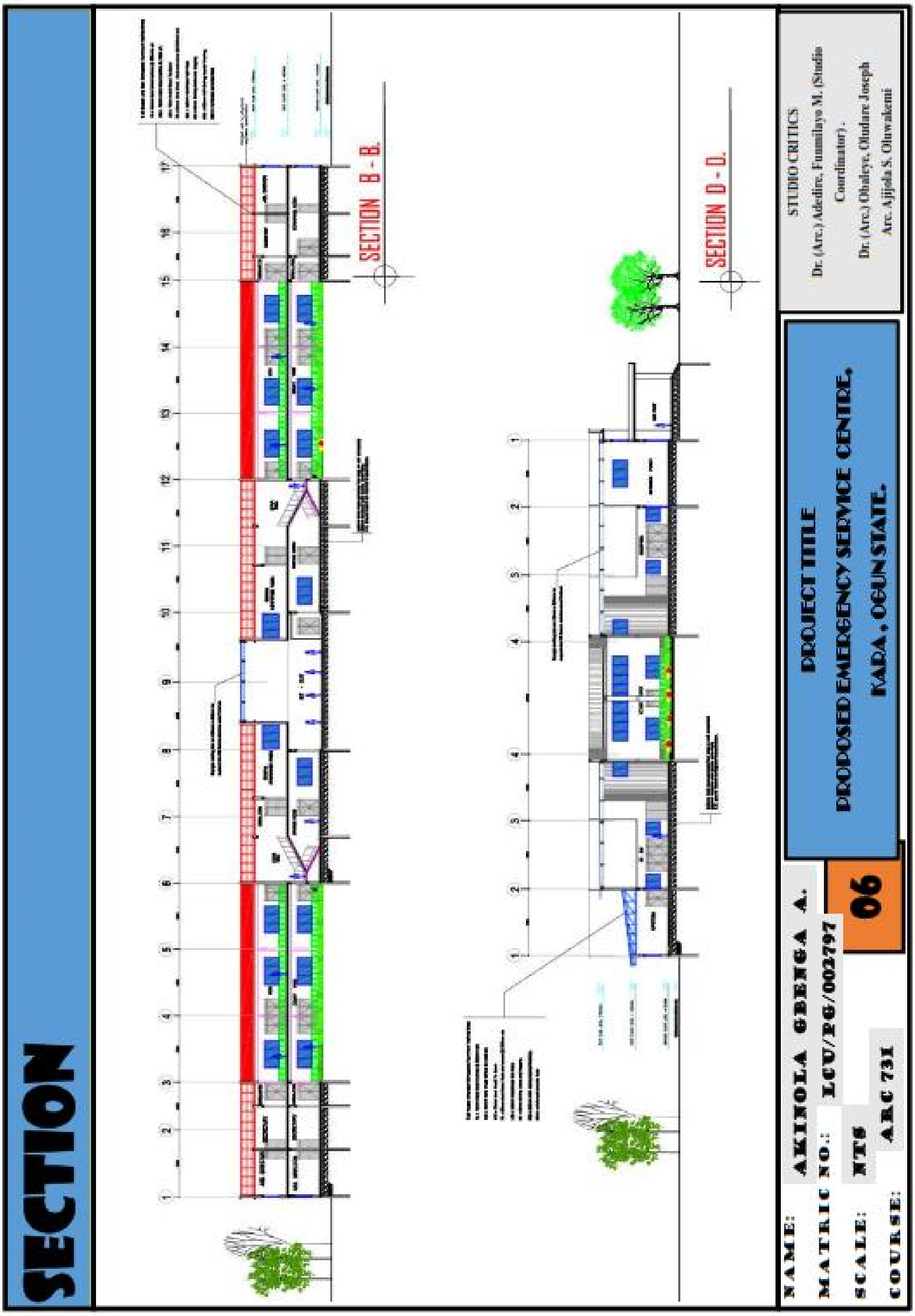


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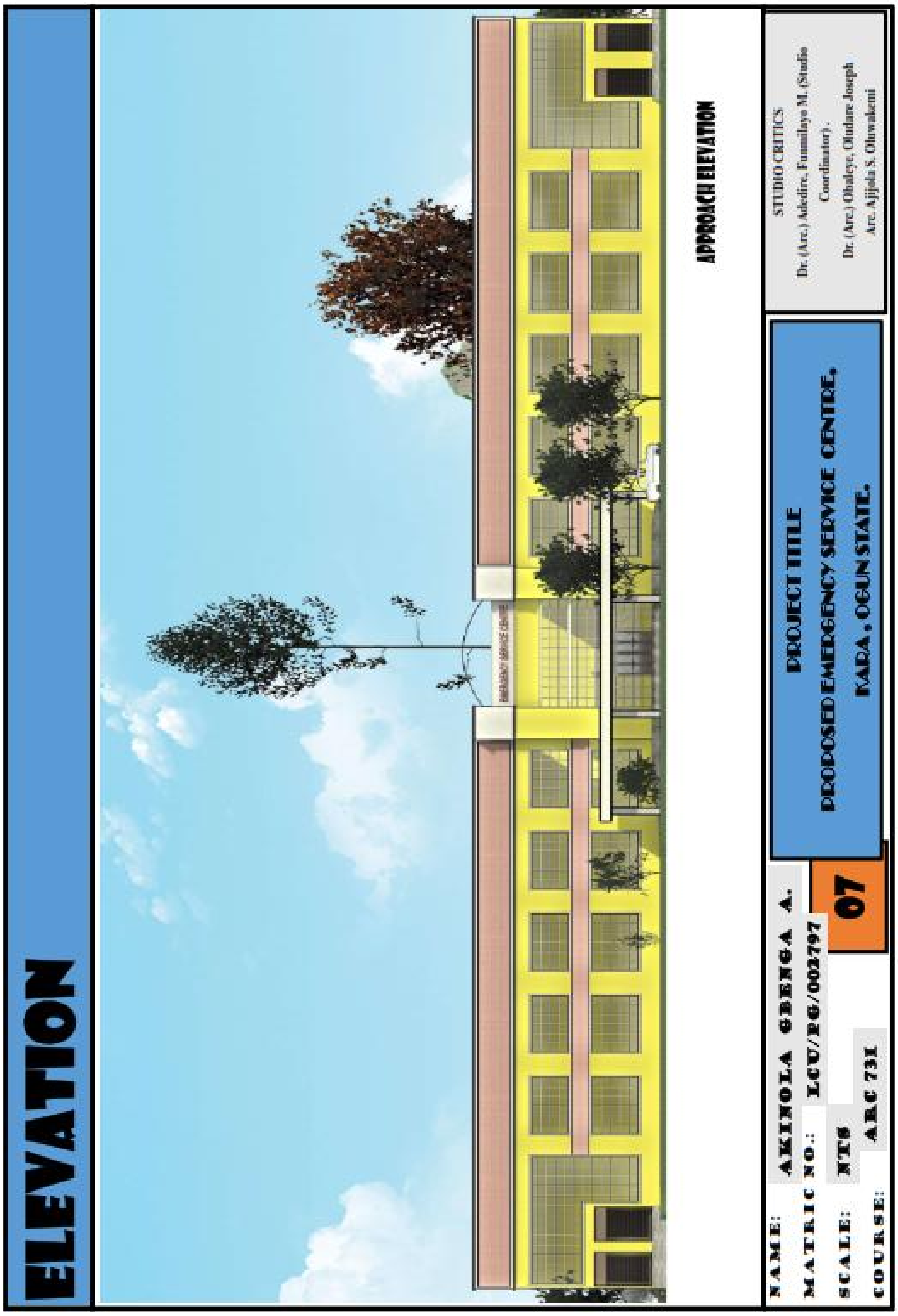
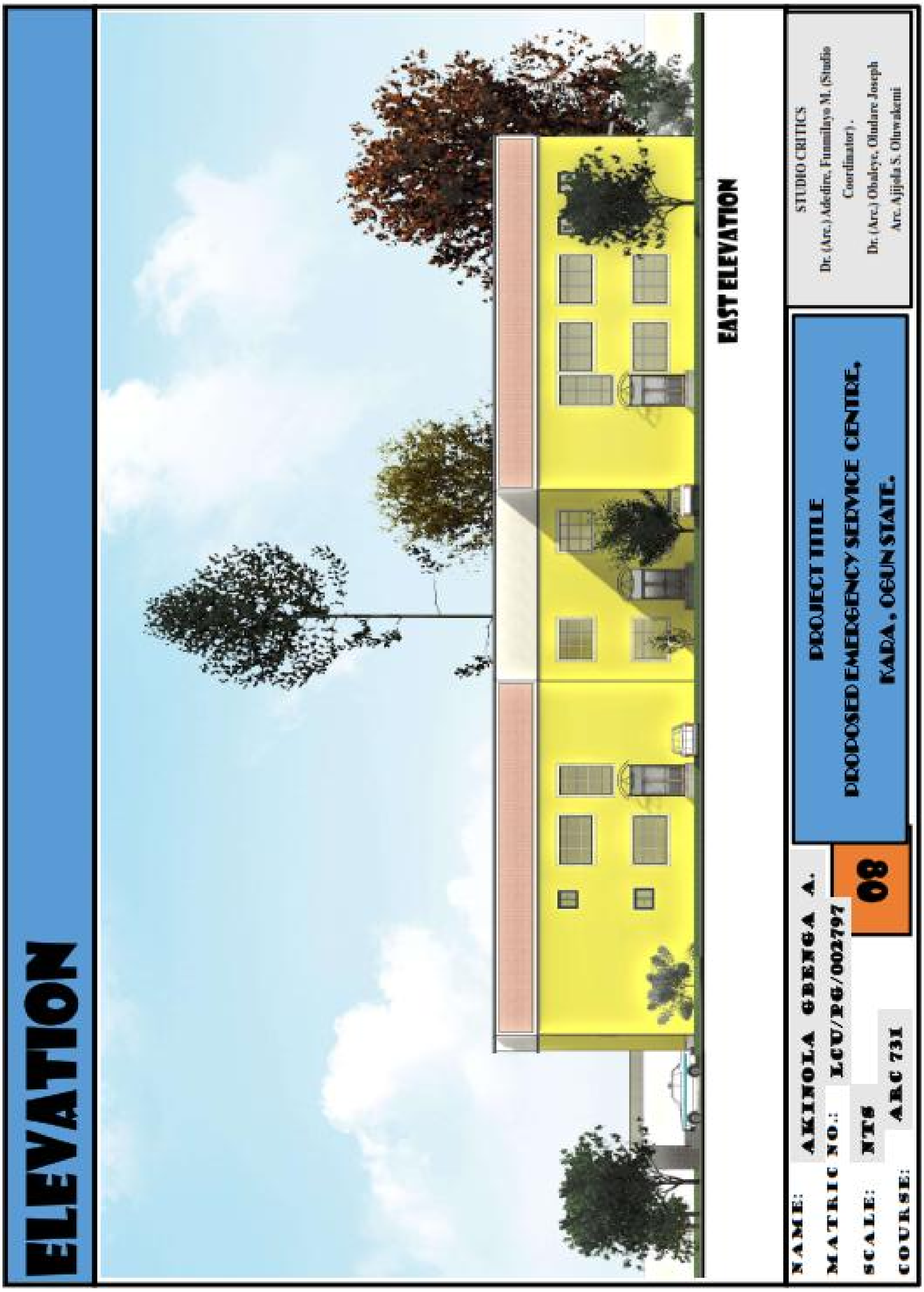
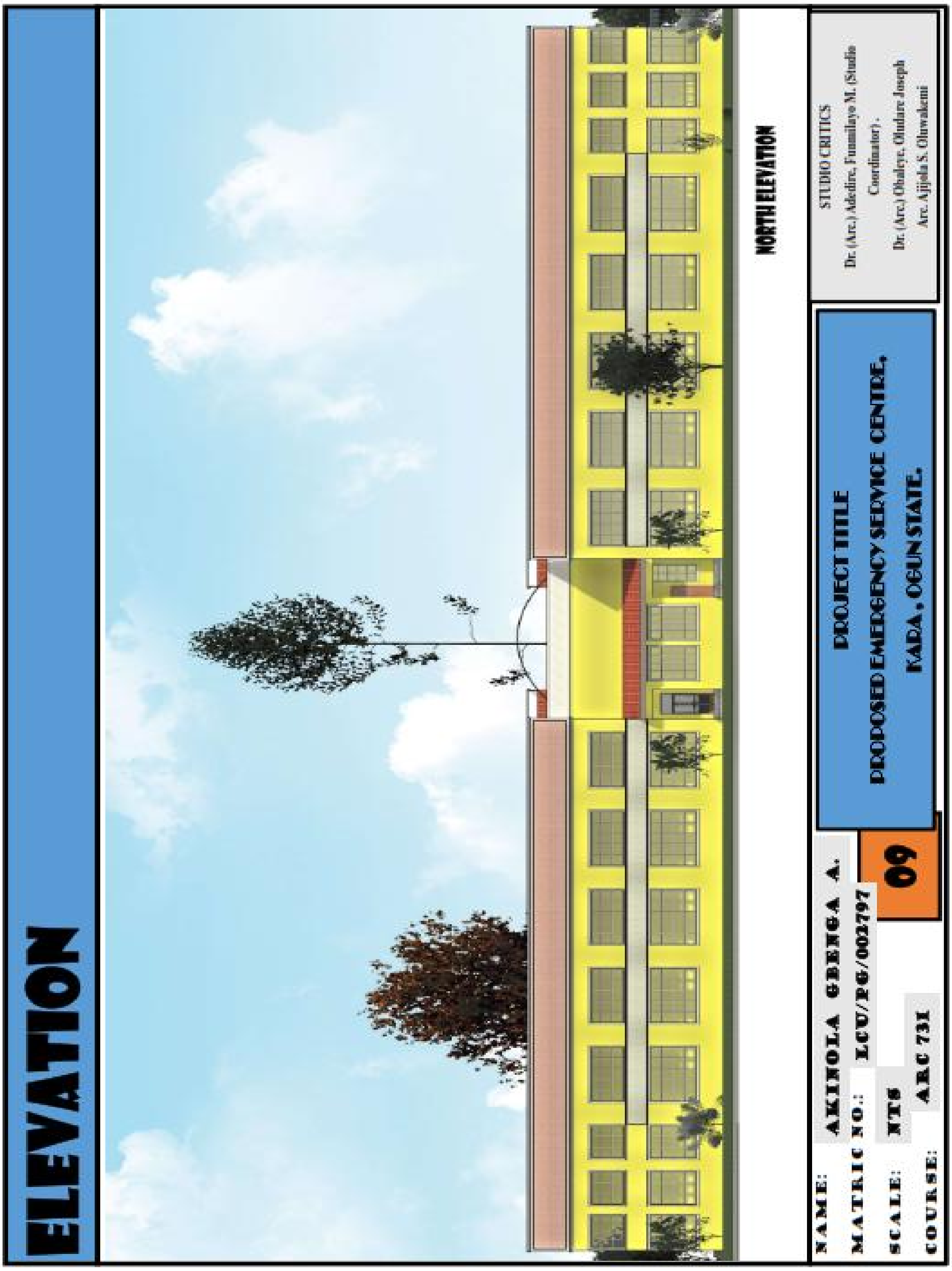


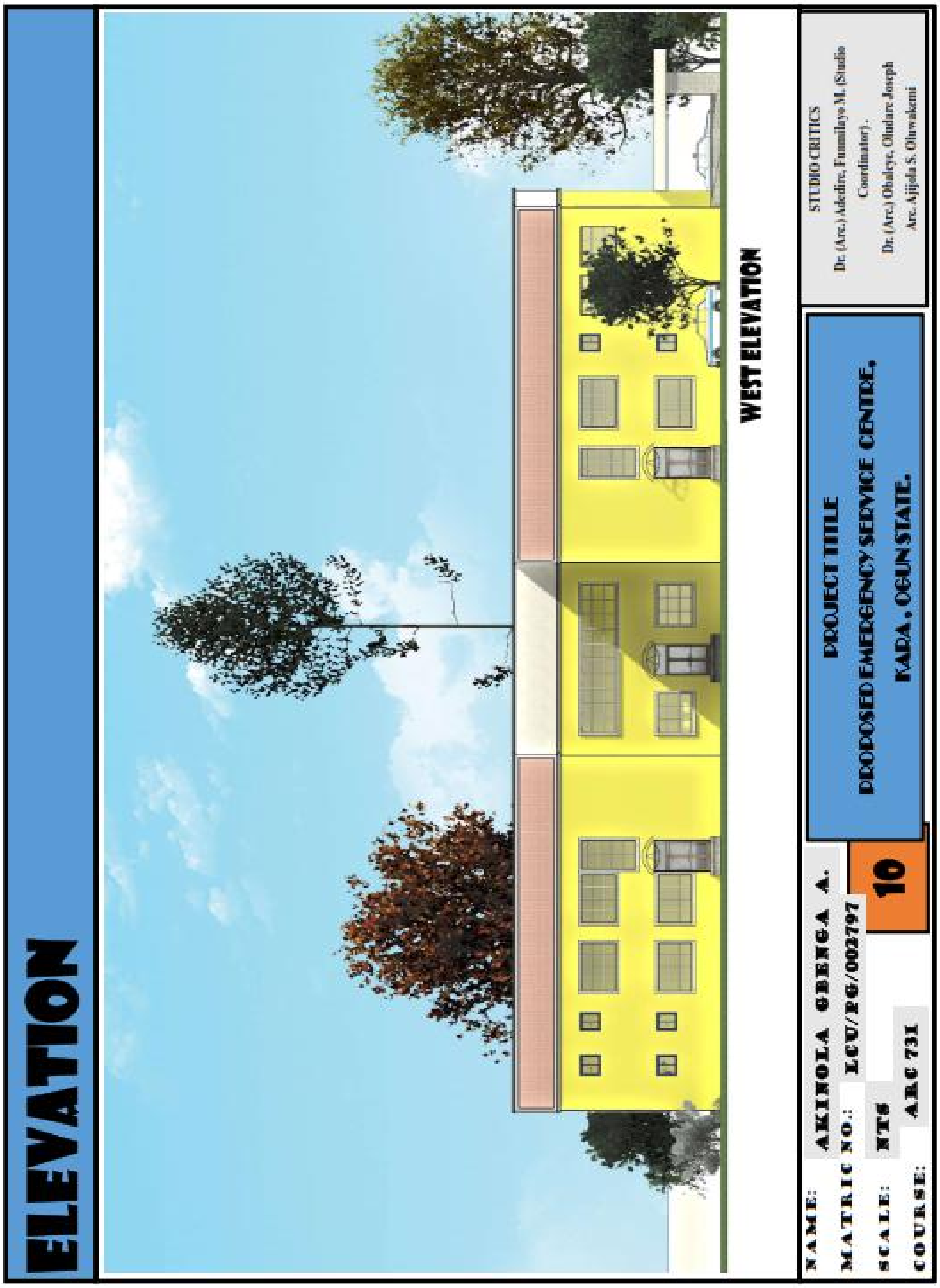

Appendix 7: Elevation




Appendix 8: Elevation

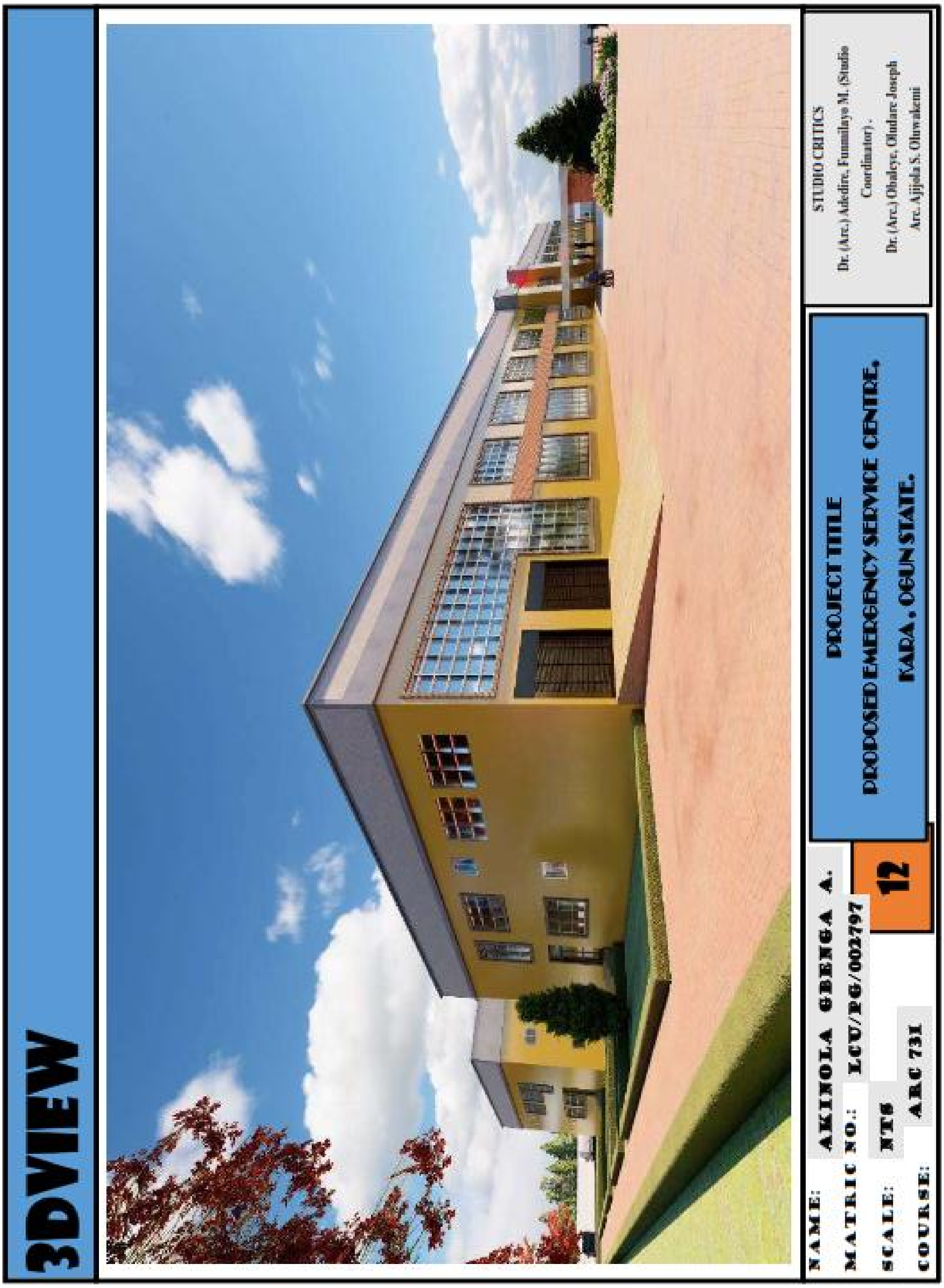



Appendix 9: Elevation

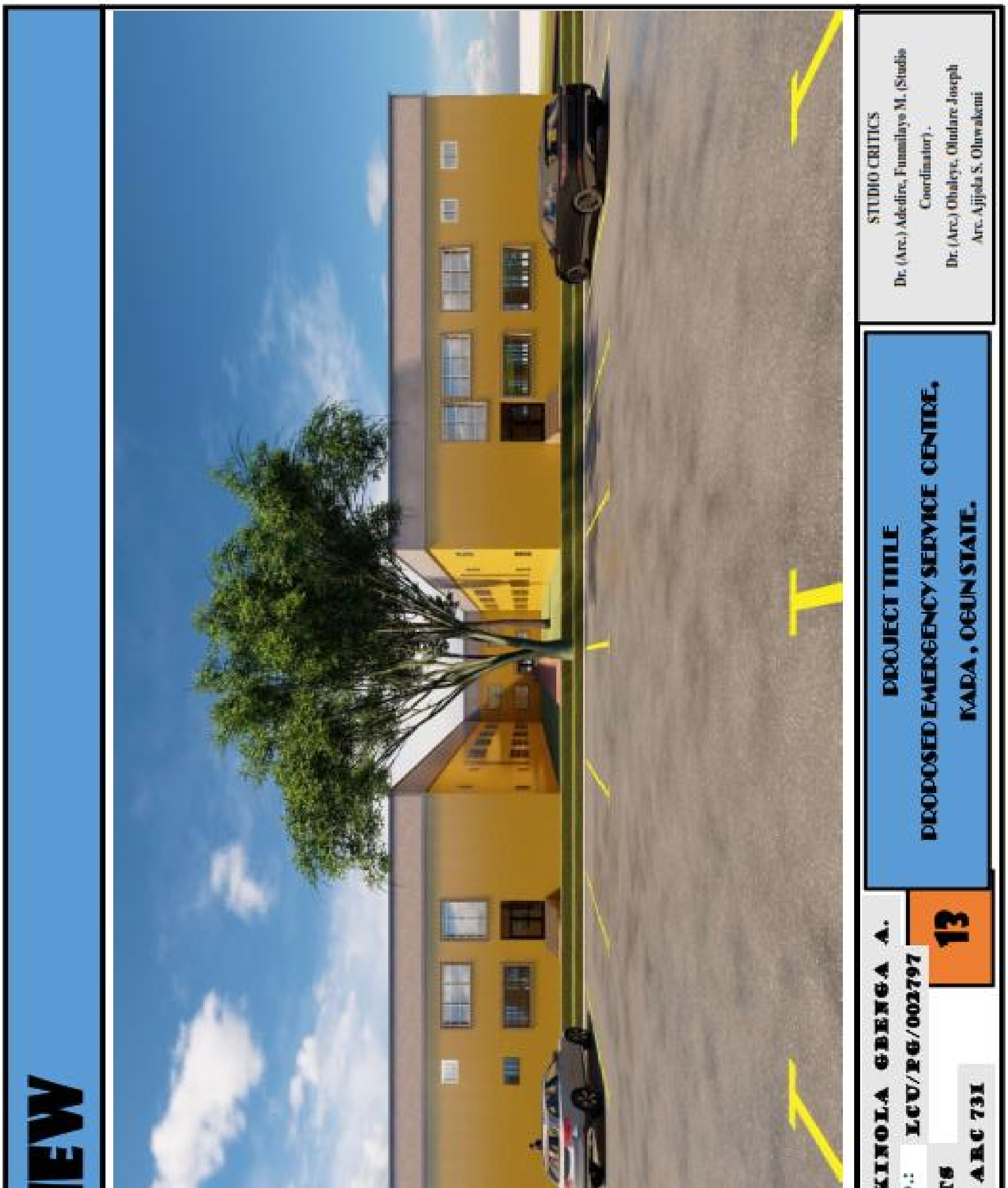



Appendix 10: Elevation


Appendix 11: 3d View



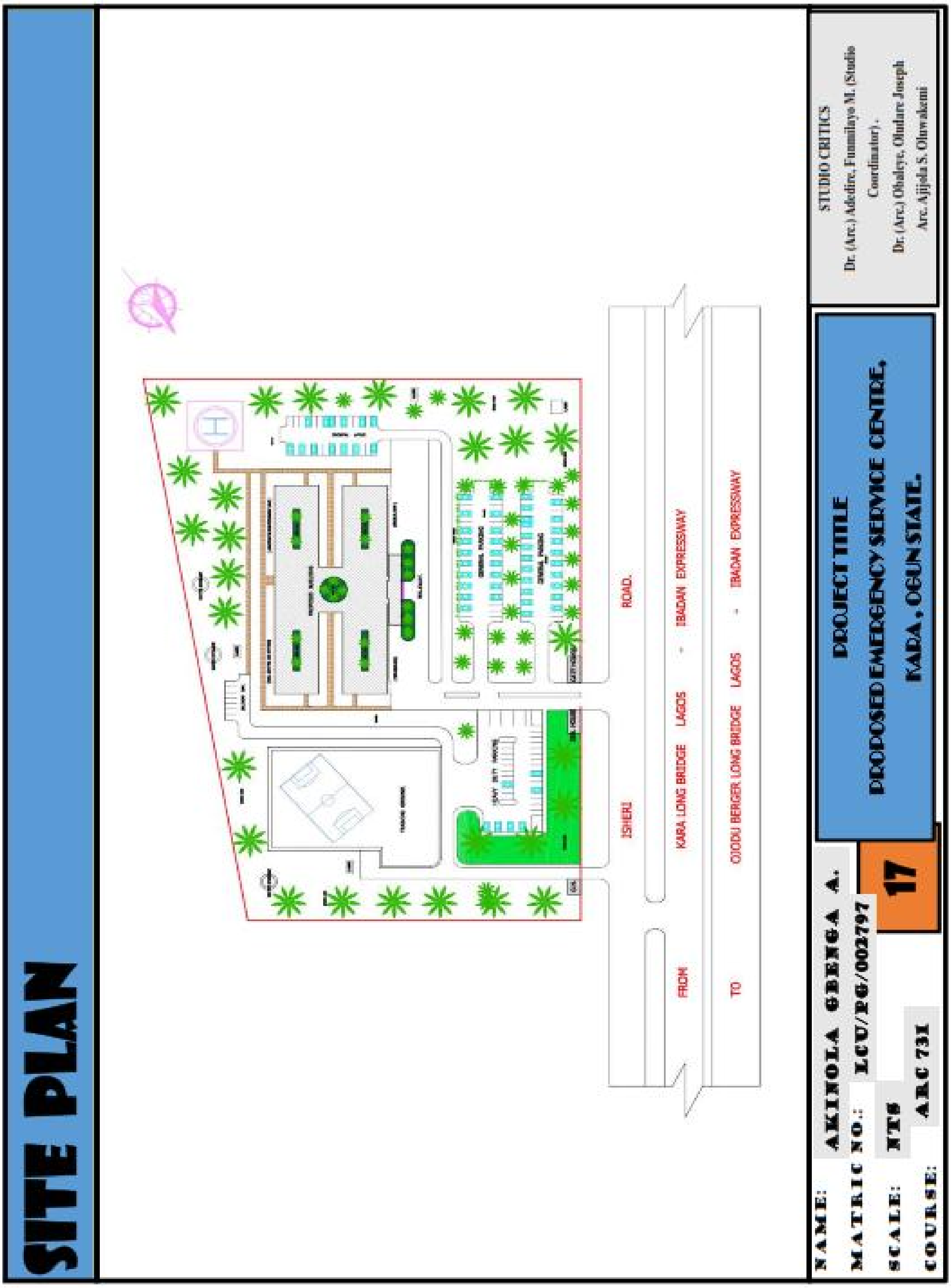

Appendix 12: 3d View



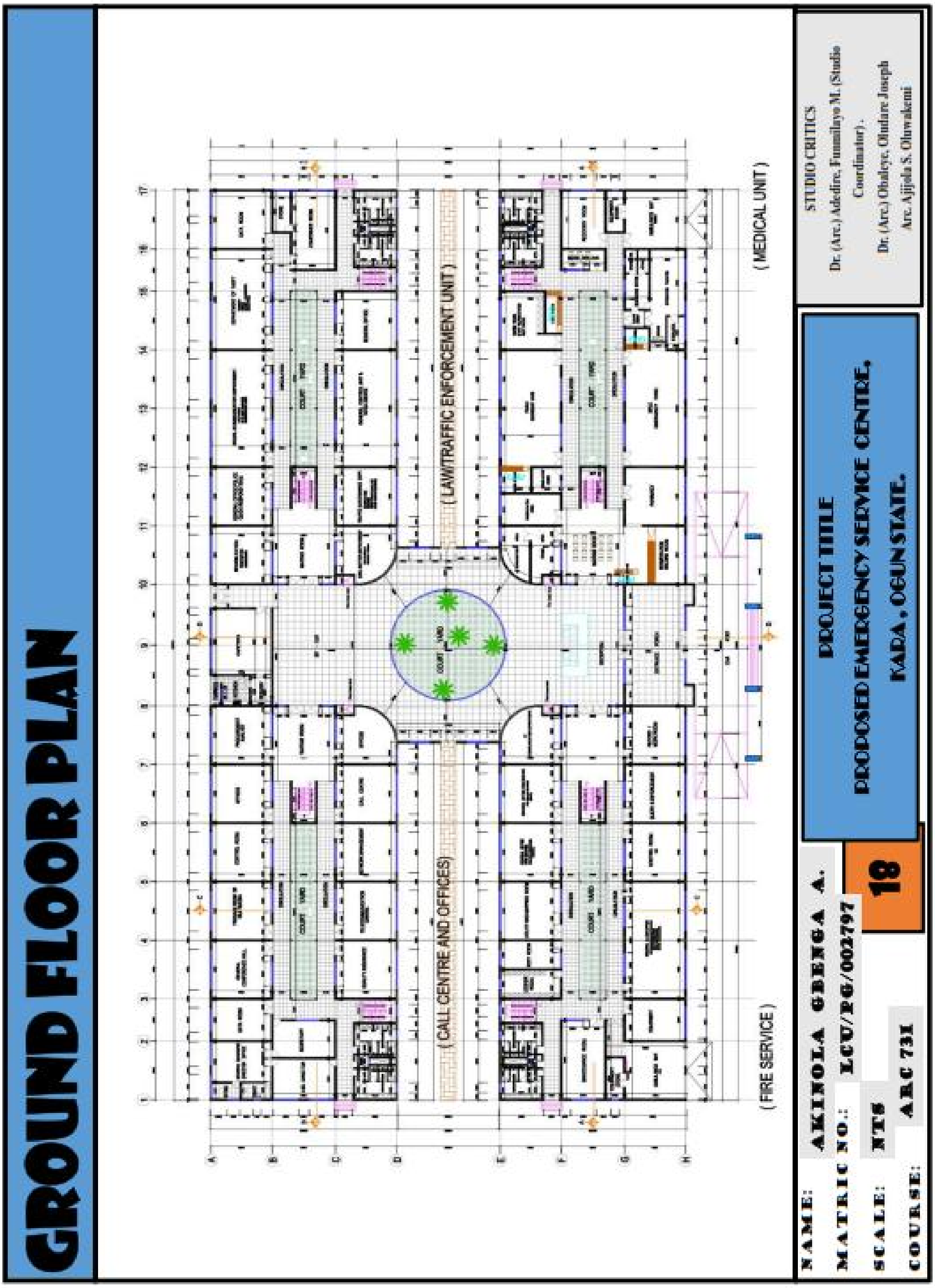

Appendix 13: 3d View


Appendix 14: 3d View

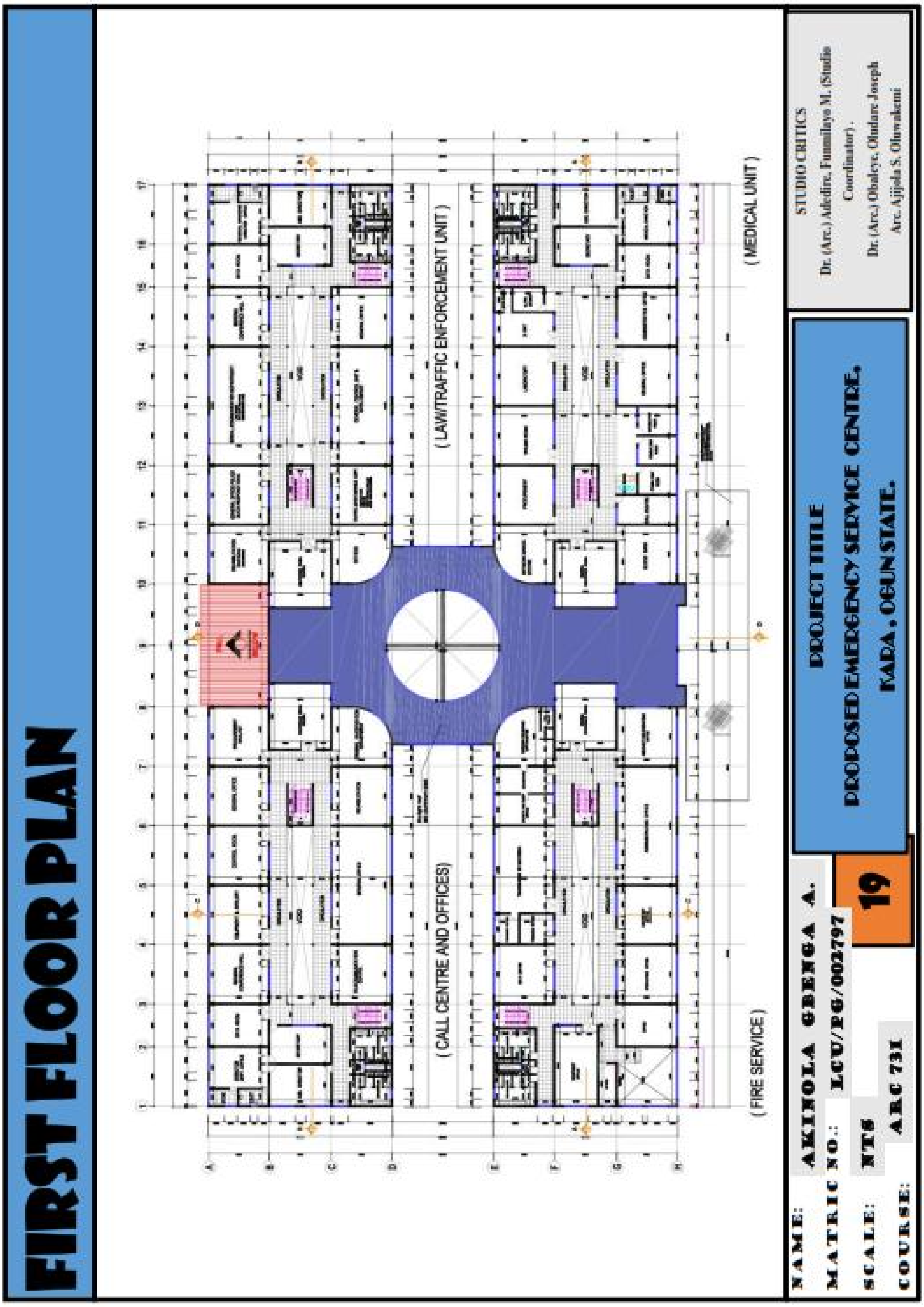

Appendix 15: 3d View



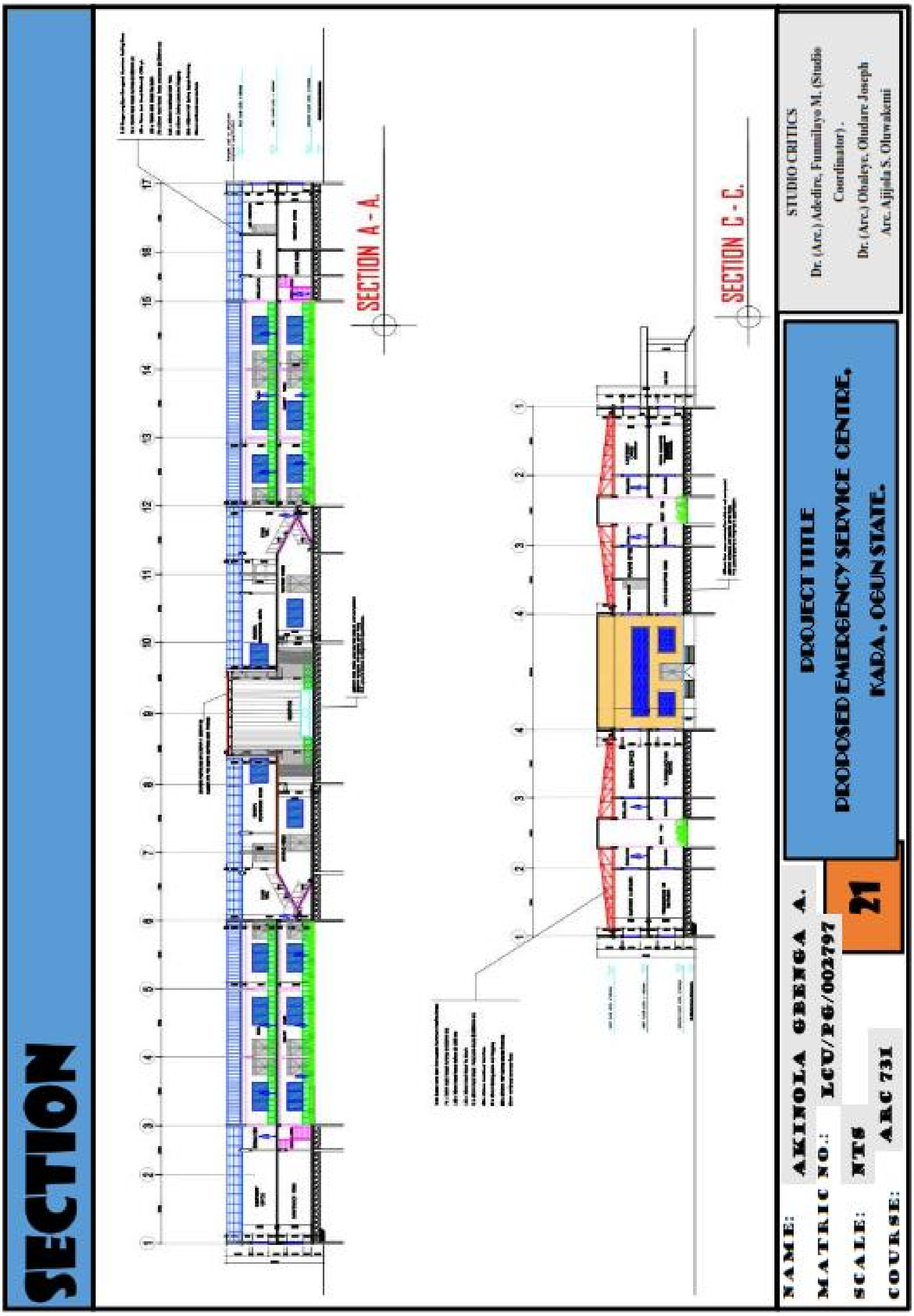

Appendix 16: Site Plan




Appendix 17: Ground Floor Plan




Appendix 17: First Floor Plan

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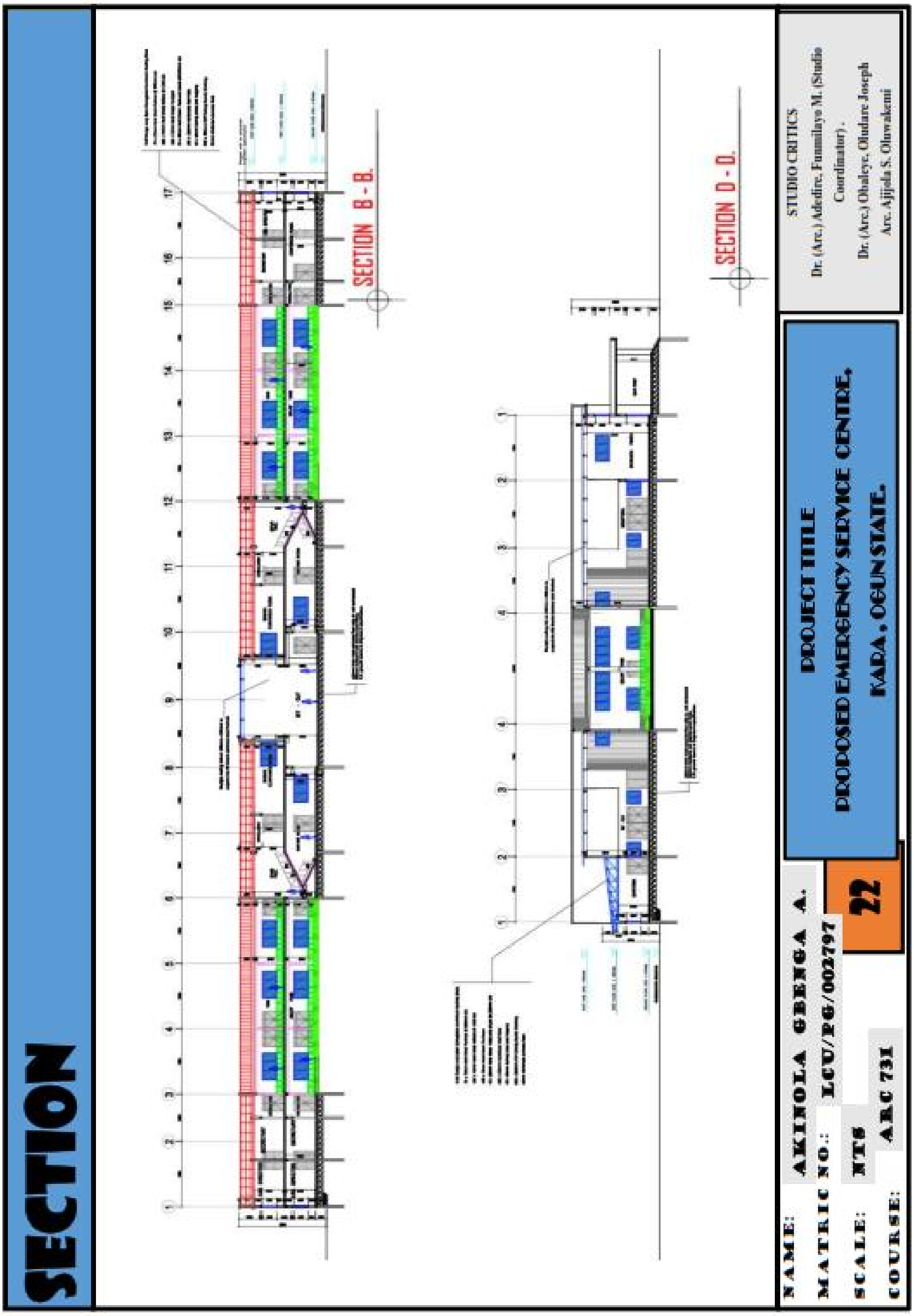


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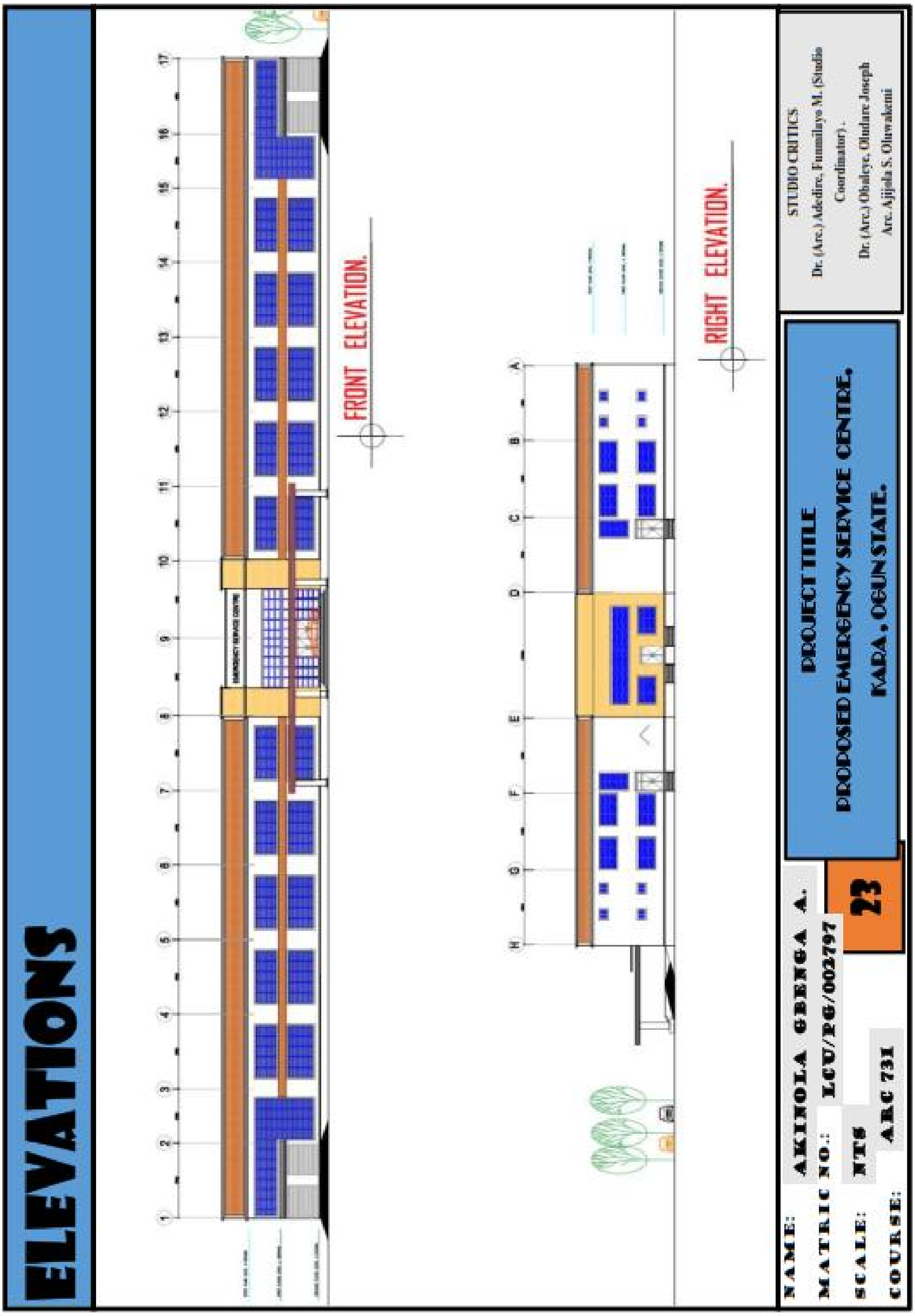
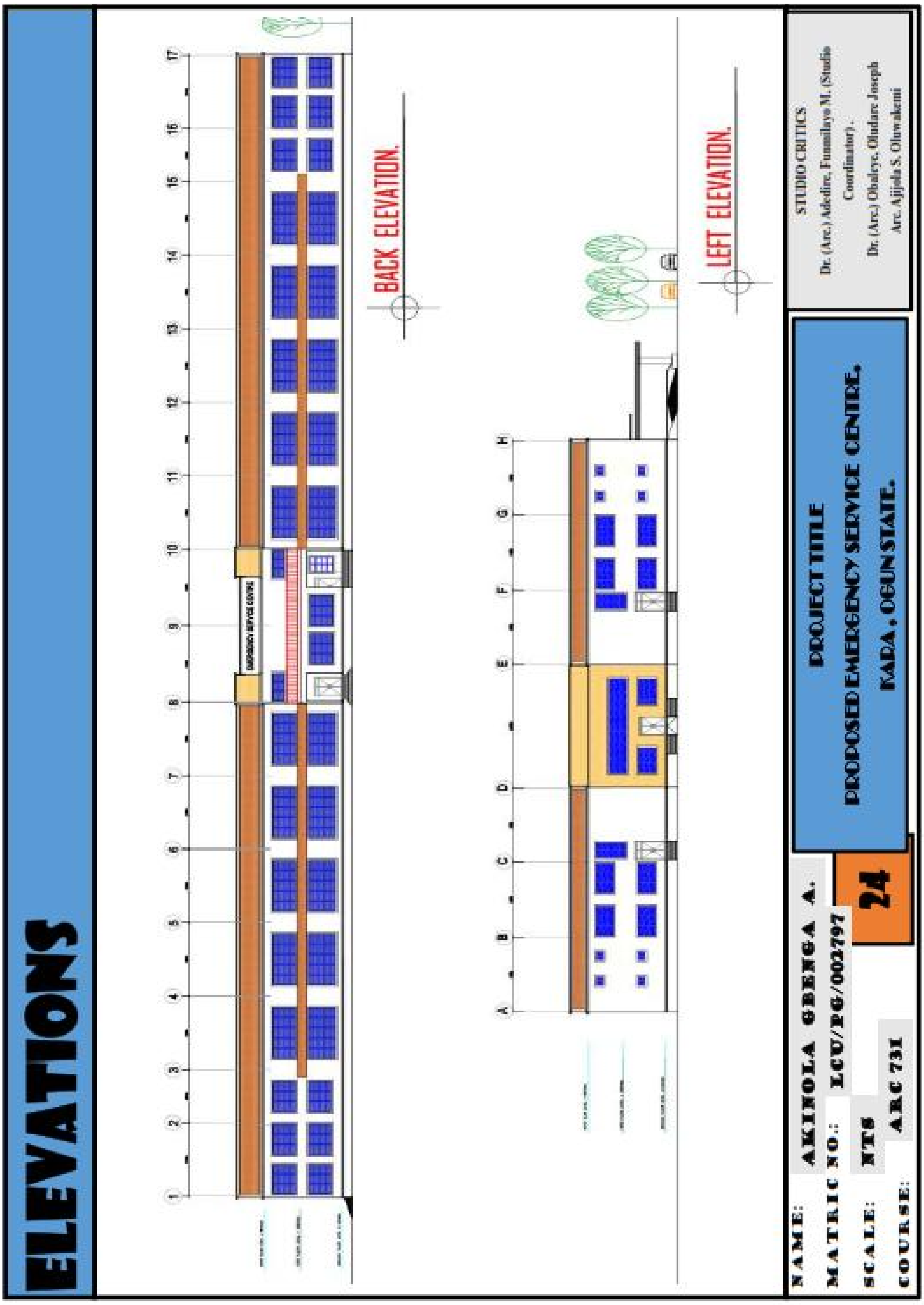
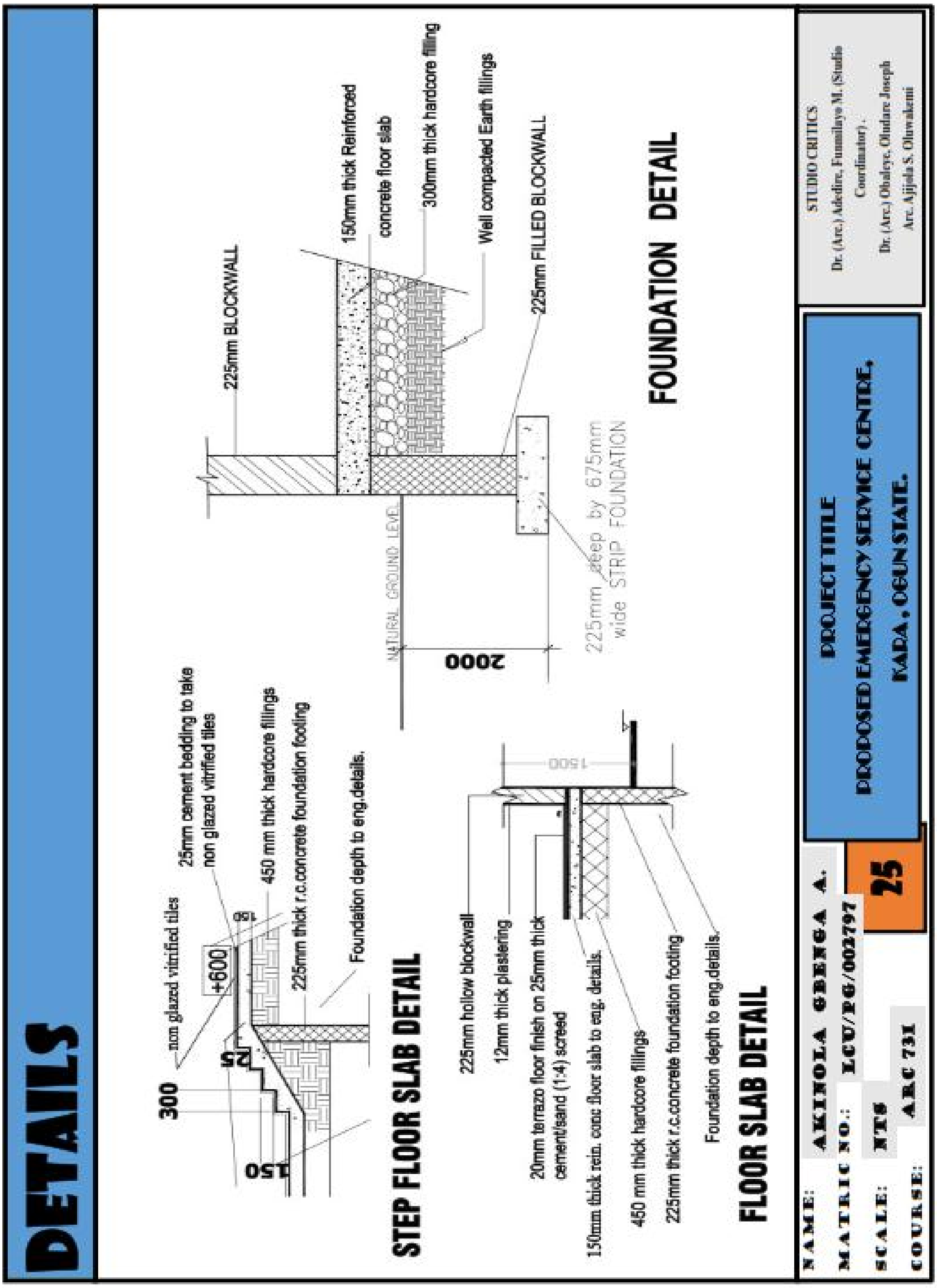


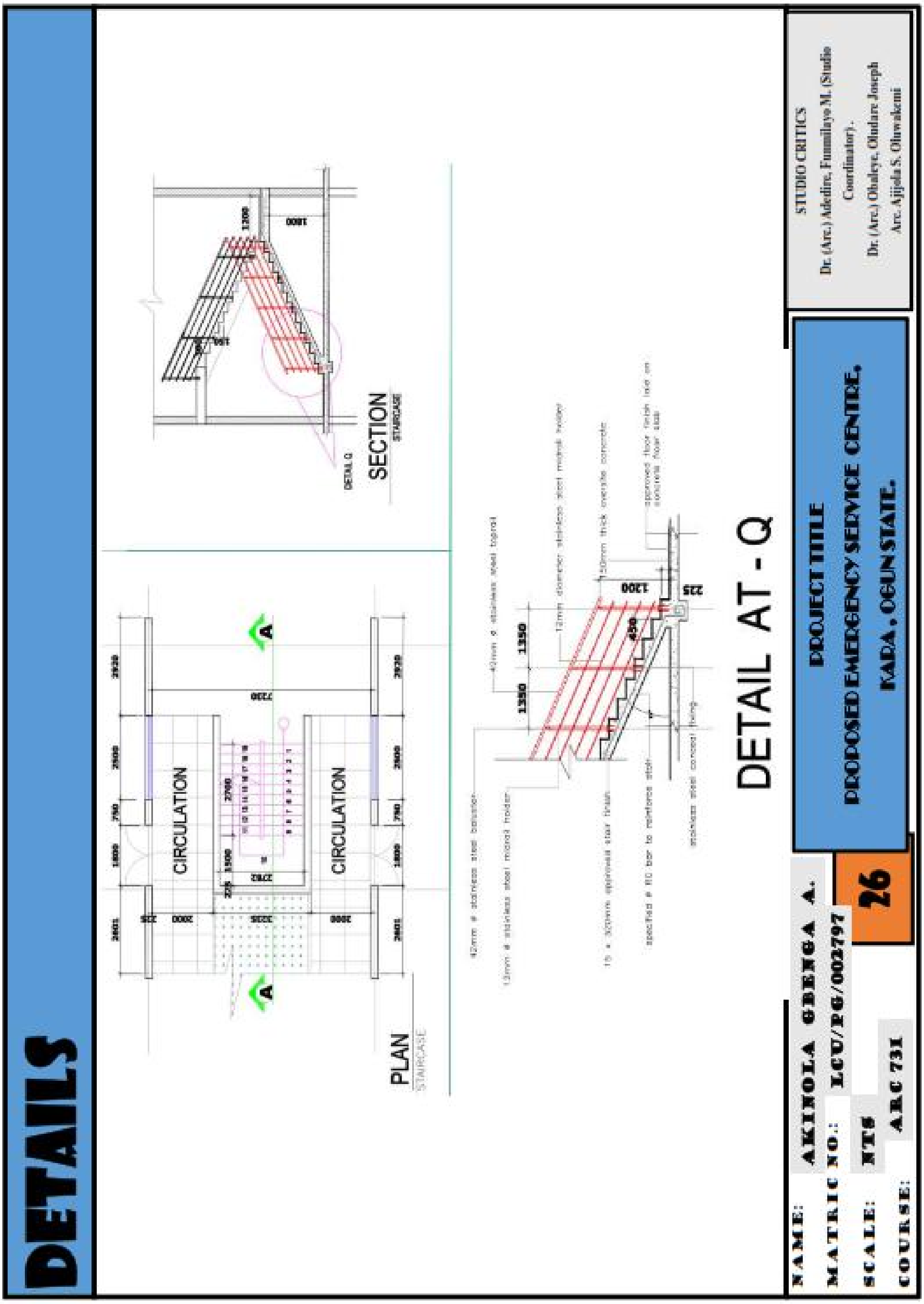

Appendix 20: Elevations




Appendix 21: Elevations




Appendix 22: Details




Appendix 23: Details

## Biodata

### A. Personal Data

1. Full Name: AKINOLA Gbenga Akinwunmi,

2. Address: 34, Ayodele Crescent, Oke- Afa, Isolo, Lagos State

3. E-mail Adress: akinwunmi7022@gmail.com

4. Phone Number: 08023376633, 09031448589,

5. Date of Birth: 05th November 1976,

6. Place of Birth: Abeokuta north, Ogun state

7. Nationality: Nigerian

8. Marital Status: Married

9. Name and Address of Next of Kin: AKINOLA Titilayo

08028790333

### B. Educational Background

1. Educational Institutions Attended with Dates and Qualification:

| Qualifications | Institution | Date |
|---|---|---|
| MSc Architecture | Lead City University, Ibadan, Oyo State. | 2021 - Date (Ongoing) |
| BSc. Architecture | Bells University of technology, Ota, Ogun State. | 2019 |
| HND] – Building | Lagos state polytechnic, Surulere, Lagos | 2005 |
| [ND] – Architect | The polytechnic, Ibadan, Oyo State | 1999 |
| Secondary School Certificate | Titcombe College (ECWA) Egbe, Kogi | 1994 |

| | | | |
|---|---|---|---|
| | state. | | |
| Primary School leaving Certificate | St. Michael primary School, Ota, Ogun State | 1986 | |

**C. Professional Affiliation:**

- Member Of Nigerian Institute Of Building (N.I.O.B)
- Member Of Nigerian Institute Of Building In Maintenance And Facilities
- Management (NIBIMFAM)
- Member Of Corporate Institute Of Risk And Safety Management (CIRSM)
- Member Of Association Of Nigerian Chartered Architects (ANCA) In-view

**D. Working Experience with Dates**

Majoroh partnership 2002 - 2010

Design and Construction Company 2010 - 2012

Post: ARCHITECT

Crossvissions project.

Sabo- Yaba, Lagos

Post: ARCHITECT 2013 till date.

SOME OF THE PROJECTS SUPERVISED/COORDINATED WITH DATES

| S/N | DESCRIPTIONS | COMPANY | CLIENT | DATE | REMARK |
|---|---|---|---|---|---|
| 1 | 4-Bedroom Duplex at Kolapo Ishola GRA, Akobo, Ibadan. | CROSSVISSION PROJECT | Mrs. Priscilia Oguala | 2023 | Ongoing |
| 2 | Block of Flats at NLC/FMBN Housing Estate, Mowe, Ogun | CROSSVISSION PROJECT | Federal Mordgage of Nigeria,Abuja. | 2019-2022 | Partially Completed |

| | | | | | |
|---|---|---|---|---|---|
| | State | | | | |
| 3 | 4-Bedroom Duplex at Haven Homes Estate, Lekki-Lagos. | CROSSVISSION PROJECT | Haven Homes Ltd | 2016-2017 | Completed |
| 4 | 5-Bedroom Duplex at Force Avenue, Old GRA, PortHarcourt. | CROSSVISSION PROJECT | Mr. Chris Oyirinda, Port-Harcourt. | 2014-2016 | Completed |
| 5 | Renovation work for Eredo Primary Health Care Center at EREDO. Lagos. | CROSSVISSION PROJECT | PPG | 2014. | Completed |
| 6. | Renovation work for Ejire P.H.C .Center At EJIRE. Lagos | CROSSVISSION PROJECT | PPG | 2013 | Completed |
| 7. | Renovation work for Iwaya .Yaba P.H.C .Center At EJIRE. Lagos | CROSSVISSION PROJECT | PPG | 2013 | Completed |
| 8 | Block of Male Hostel (3-storey building) at Landmark University Omu-Aran' Kwara State. | Design and Construction Company | Bishop Oyedepo<br>Ministry Incorporation, Ota, Ogun State | 2010 -2011 | Completed |
| 9. | Mutual House (4-storey Office completex) at fajuyi Road, Ado - Ekiti | Design and Construction Company | Mutual Assurance PLC, Lagos | 2009 -2010 | Completed |

| | | | | | |
|---|---|---|---|---|---|
| 10. | CONSTRUCTION OF 4-BED ROOM FULLY & SEMI-DETACHED DUPLEX AT ADMIRALTY ESTATE, LEKKI LAGOS | .Majoroh partnership | Admiralty homes Ltd. | 2008 -2009 | Completed. |
| 11 | CONSTRUCTION OF BLOCK OF CLASSROOMS & ADMIN. OFFICES,RONIK,LAGOS | Majoroh partnership | CARONIC Properties Ltd, Ikeja, Lagos | 2006 – 2007 | Completed |
| 12 | 4-BED ROOM DUPLEX AT OSBORNE ESTATE IKOYI LAGOS | Majoroh partnership | Abukan Investment Ltd, V/I, Lagos | 2003 – 2004 | Completed |

**E. Skills**

Good team player

Ability to work under pressure

Ability to learn new experience through training and technology

Highly motivated, adaptable, organized and target oriented.

TRAINING

Design and Building construction

Building services and Maintenance Facilities

**F. Hobbies**

Foot Ball and drawing

**G. Publication**

*"Assessment of Architecture Students' Knowledge in a Typical Private University"*

……………………………………                    ……………………………………

Signature                                                            Date

**The University Compliance Form**

This is to certify that the theses by, Akinola Gbenga Akinwunmi with matriculation number LCU/PG/002797 in the Department of Architecture, Faculty of Environmental Design and Management Lead City University, Ibadan, is in full compliance with the University format and style of Theses.

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Signature Date

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