

**Proposed Diabetes Sanatorium for Edo State, Ubiaja, Edo State, Nigeria.  
(Integration of Universal Accessibility Concept in the Design of Sanatorium)**

**Georgina Itohan UNUEBHO**

**LCU/PG/003964**

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Design And Management, Lead City University, Ibadan, Oyo State, Nigeria.**

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## Certification

This is to certify that Georgina I. UNUEBHO, with matriculation number LG/PG/003964, carried out the research work titled "Integration of Universal Accessibility Concept in the Design of Sanatorium" in the Department of Architecture, Faculty of Environmental Design and Management, Lead City University, Ibadan, Oyo State, for the award of a Master of Science (M.Sc.) degree in Architecture and has not been previously submitted for any degree or certification.

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Date

Arc. J. A Demola Adeola  
(Supervisor)

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Date

Arc. (Dr.) Obaleye  
(Hod)

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## **Dedication**

This thesis is dedicated to the Almighty God and to the benefit of all mankind.

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## Acknowledgement

I express my gratitude to Lead City University's administration for granting me the chance to conduct this research and for creating a conducive learning atmosphere.

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Even though the above-mentioned institutions and persons have assisted in the process of this research work, I alone stand responsible for the errors, if any, found in the work.

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# Chapter One

## Introduction

### 1.1 Background to the Study

Healthcare institutions refer to the organized provision of medical services, including prevention, diagnosis, treatment, and management of illnesses or injuries to maintain or improve the health of individuals or communities. There are various levels of healthcare systems (HCSs) around the world namely, primary, secondary, and tertiary, highlighting similarities and disparities influenced by a country's history, customs, socio-cultural, economic, and political factors (Donev et al., 2013). General hospitals were the first primary healthcare institutions globally. In addition to medical supplies, they provide their patients with individualized medical and nursing care services (Zajac, 2003), complete medical treatment by housing acute services, including advanced surgical units and emergency care, as well as ambulatory services and numerous specialty departments (Carenzo et al., 2020).

As hospitals continued to evolve, change, and adapt to the shifting healthcare landscape brought about by advancements in medical technologies and demographic shifts, these specialized departments were divided into clinics, maternity homes, oncology centers, trauma centers, children's hospitals, psychiatric centers, rehabilitation centers, ambulatory facilities, chronic care facilities, long-term care facilities, and specialized care centers. These various specialty hospital types not only help treat specific medical ailments but also reduce the cost of healthcare and make them easily accessible (Dabhilkar & Svarts, 2019).

Sanatoriums are a type of healthcare institution dedicated to treating people with chronic diseases, including convalescing patients. The term "sanatorium" derives from the Latin "sanare," meaning to heal, cure, or treat. An example is the Paimio Sanatorium in Finland, designed by Alvar Aalto to create

a restorative environment through ergonomic furniture and abundant sunlight. Sanatoriums may also be referred to as chronic care centers, long-term care facilities, spas and health resorts, or specialized care centers (Armocida & Martini, 2020).

In the United States, sanatoriums were specifically established for tuberculosis treatment. These institutions, known as sanatoria, were designed for the comprehensive treatment of individuals who typically have a predisposition to spa treatment (Avci-Hosanli & Degirmencioglu, 2024).

Other terms used instead of sanatoriums include chronic care centers, long-term care facilities, and specialized care centers. These facilities often care for individuals with chronic diseases such as tuberculosis, leprosy, mental illness, diabetes, neurological disorders, endocrine conditions, and gastrointestinal issues. (Zwick & Pepperell, 2020).

A diabetes sanatorium, similar to oncology, orthopedic, or psychiatric hospitals, specializes in providing comprehensive care for individuals with diabetes. These facilities offer diagnosis, treatment, management, and education services tailored to diabetes patients. They vary in size and services offered, ranging from small residential centers to larger medical institutions. Typically, they employ a multidisciplinary team of healthcare professionals, including optometrists, physical therapists, nurses, social workers, Certified Diabetes Educators (CDEs), occupational therapists, and nutritional specialists.

A diabetes sanatorium is designed to provide comprehensive care, support, and resources for individuals living with diabetes. It goes beyond conventional healthcare by incorporating a compliance-oriented medical model, an environment for self-management education (SME), and a sociocultural framework. The aim is to foster patients' adherence to healthcare instructions within a biomedical model (Abdullayev, 2022).

Diabetes mellitus comes with so many health complications, such as eye damage, nerve damage, stroke, mental disorder, foot damage, and so on, making the patients unable to walk effectively or even causing them to leap and become mobility impaired, (Hamaoka, T., et al, 2023). In this regard, it is necessary to ruminate on accessibility considerations in a facility dedicated to its treatment. Accessibility can be classified as physical accessibility, affordability, proximity, geographical accessibility, etc. However, the focus of this thesis is on the physical accessibility of the sanatorium, using the concept of universal accessibility

Universal accessibility ensures that everyone can access and utilize resources without barriers, (Design, 2022). It addresses various factors affecting different segments of society, emphasizing timely and feasible access. Physical accessibility is crucial, (Persson et al., 2015), considering both permanent and temporary impairments due to health or age. Adopting universal accessible design solutions is essential to create inclusive environments, especially in healthcare, despite the challenges involved. However, the benefits outweigh the difficulties, making it imperative to accommodate diverse demographics and ensure that healthcare facilities are welcoming to all patients, (Lieberman & Grenier, 2020), (Raban & Włodarczyk, 2024), and (Vogel, Steinberger, DW O'Neill, & Lamb, 2021).

For disabled and elderly diabetes patients, physical accessibility is crucial due to the challenges posed by diabetes-related frailty, such as muscle loss, functional limitations, and difficulty in daily activities, (Yeung, Severinsen, & Good, 2022). The distinction between age-related frailty and disability is blurred by the effects of diabetes, leading to an increased risk of disability and the need for assistance, (Ahmad, Sargeant, Yates, Webb, & Davies, 2022). Even healthy elderly individuals can benefit from accessibility features due to diabetes-related organ damage, particularly in the brain, resulting in safety concerns during healthcare visits. However, in these structures or buildings, strategic considerations are made to ensure that they meet their purposes. Such considerations are flexibility, (Pilosof, 2021),

user centeredness, (Capolongo et al., 2020), Safety and Security, (Bani Issa et al., 2020), etc.. One of the key considerations considered for this thesis is universal accessibility, (Falchetta et al., 2020) & (Wang et al., 2020) which is crucial to the goal of the study that is seeking answers to how individual-patients, health workers, and visitors can navigate easily through the diabetes sanatorium. The resolution of accesses based on functions and departments to facilitate its approachability, usability and enhance accessibility in the sanatorium is considered in this thesis.

## **1.2 Research Problem**

Diabetes mellitus (DM), a chronic metabolic disease marked by high blood glucose (blood sugar) levels, is a condition caused by irregularities in the physical functioning of insulin and over time can cause catastrophic damage to the kidneys, eyes, heart, nerves, and blood vessels., (Federation ID, 2017). It is quickly rising to the top of the list of chronic non-communicable diseases in the world and it has a notable correlation with both morbidity and death, (Egbi & Ahmed, 2020), (Edo et al., 2015). Consistent with prevalence and risk factors for diabetes mellitus in Nigeria, the pooled diabetes mellitus prevalence of 5.77% observed in the meta-analysis suggests that 11.2 million Nigerians (which is one out of every 17 adults) are living with diabetes, (Uloko et al., 2018). While 24.6% population of Edo State, with 15.1% in urban areas and 9.5% in rural are living with diabetes. Without proper treatment and care, DM, especially T2D, can lead to other health issues like loss of sight, confusion, coma, kidney and liver diseases, and death.

Second, Esan Southeast Local Government Area is situated in Edo State in the southern regions of the Federal Republic of Nigeria. Its headquarters is Ubiaja, with a population of 245,777. It is home to over eighteen towns and villages. The majority of the population works as farmers, making agriculture the dominant industry in the region, (Idiegbeyan-ose et al., 2015). Despite its size, the local government region does not have enough or easily accessible healthcare services, (Ekechi et al., 2020). South-

South rural agrarian communities have a significant frequency of co-morbidities and diabetes mellitus (Egbi & Ahmed, 2020). This is as a result of inaccessibility to healthcare services due to of lack of awareness, geographical location, cost effectiveness, distant proximity, and physical accessibility. Therefore, it is imperative that Edo State have a cosy and easily accessible diabetes sanitarium.

### **1.3 Justification of the Study**

In Nigeria, all professionals, including the pharmaceutical industry, lawmakers, healthcare providers (HCPs), and the National Agency for Food and Drug Administration and Control, must collaborate closely to advance diabetes treatment approaches that are both acceptable and supported by appropriate infrastructure, regulations, and surroundings, (Kolawole et al., 2022). The building industry can also help through the design and construction of health care centres by improving their physical access to achieve health equity. The presence of dedicated diabetes facilities and educators would help provide adequate treatment and self-management education (SME), which is a prerequisite, for effective diabetes self-management, (Iregbu et al., 2023). It is in this regard that the design of a diabetes sanatorium comes into play.

Correspondingly, the executive governor of Edo State, Governor Godwin Obaseki, has transformed Edo State's healthcare system over the past seven years, ranking it in the top five for life expectancy and service delivery. In his plan to provide comprehensive healthcare to all three of the state's senatorial districts, he mentioned that the government was decentralising and building the state's healthcare system and strengthening the primary healthcare system, which will be bolstered by secondary, tertiary, and specialty hospitals, with the government allocating roughly 10% of the budget to meet these needs, (Iwok I., 2024).

In the healthcare industry, where individuals from all walks of life and various health conditions need to be taken care of, the idea of universal accessibility is extremely crucial. All users must have access

to the facilities. A new hospital's design, a clinic's renovation, or the inclusion of a wheelchair user consideration in the physical therapy building all require careful thought, (Larysa Baida and Olena Ivanov, 2019), and (CMS, 2017).

#### **1.4 Aim and Objectives of the Study**

The aim of the study is to integrate universal accessibility concept in the design of sanatorium tailored to the needs of individuals living with diabetes, with a focus on diabetes management, lifestyle modification, and prevention of complications that will be embedded in the universal accessibility concept to enhance its physical accessibility. The specific objectives of the study are to:

1. examine the concept and characteristics of sanatorium design
2. assess the architectural considerations for sanatorium design.
3. determine the architectural design considerations that improve universal accessibility in sanatoriums
4. design a sanatorium that will incorporate universal accessibility concept

#### **1.5 Research Questions**

1. What is the concept and characteristics of the design of sanatorium?
2. What are the architectural considerations for sanatorium design?
3. What are the architectural design considerations that improve universal accessibility in sanatoriums?
4. How do we design a diabetes sanatorium that incorporates the concept of universal accessibility?

## **1.6 Significance of the Study**

Numerous health issues associated with diabetes include impairment to the eyes, nerves, feet, stroke, and more, which can hamper a patient's ability to walk or even cause them to be confined to a wheelchair, (Hamaoka, T., et al, 2023). Since diabetes mellitus is a chronic condition that is probably terminal, patients with it need to control their condition well in order to live extended lives. Having dedicated facilities and instructors who specialise in diabetes would help provide enough care and self-management education (SME), which is necessary for diabetes self-management to be successful, Iregbu et al. (2023).

A specialty hospital for the treatment of particular diseases, associated conditions, and convalescence is once known by the name sanitarium. Because of their capacity to save lives, ability to provide complete healthcare services, ability to control diseases, and ability to contribute to medical advancements, they are essential parts of the healthcare system. This special kind of hospital serves as both a hospital and a convalescence home. Universal accessibility consideration plays a pivotal role in diabetes sanatorium design because it allows access for a wide range of users, regardless of their height, size, age, abilities, or disabilities. This is particularly important given the complications and disabilities associated with diabetes mellitus.

## **1.7 Scope of the Study**

The project's scope is to develop a diabetes sanatorium to be situated at Police Station Road, off New Agbor Road, in Ubiaja, Edo State. The facility will have a district medical centre, a central diabetes treatment centre, and a sanatorium resort. The design will be designed to be therapeutic and accessible to all. However, the research findings will be restricted to ideas related to universal accessibility that have the potential to improve both physical and usable accessibility.

## 1.8 Limitation of the Study

The research encountered setbacks in collecting essential literature because of difficulties in accessing reliable information. Moreover, the process of selecting an appropriate location proved to be more challenging than anticipated, adding to the overall complexity of the study.

## 1.9 Operational Definition of Terms

- I. **A sanatorium** historically served as a healthcare facility primarily for treating chronic illnesses, notably tuberculosis. Patients received care, rest, and therapies like fresh air treatment and proper nutrition. They were prevalent in the late 19th and early 20th centuries but declined with the advent of antibiotics. Nowadays, the term is less common, replaced by various alternatives like rehabilitation center, convalescent home, or long-term care facility. However, modern facilities catering to chronic illnesses may still offer similar services for extended care and rehabilitation.
- II. **Healthcare Organizations** encompass a variety of entities like hospitals, clinics, and public health agencies, all aiming to provide medical services and support to those in need. Their goal is to promote and maintain the health of patients through preventive care, diagnosis, treatment, and management of illnesses and injuries. Operating in both public and private sectors, they manage resources efficiently and adhere to quality standards and regulations to ensure patient safety and deliver high-quality care.
- III. **General hospitals** are healthcare facilities that provide a wide range of medical services, including emergency care, surgery, diagnostic tests, treatment for various medical conditions, and inpatient care.
- IV. **A disease** is a condition that affects the normal functioning of the body or mind, leading to physical, mental, or emotional health problems. It is typically characterized by specific

symptoms and signs and may be caused by factors such as infections, genetic disorders, environmental factors, or lifestyle choices. Diseases can be acute (short-term) or chronic (long-lasting) and can range in severity from mild to life-threatening.

V. **Diabetes Mellitus (DM)** according to WHO is a chronic disease characterized by heightened blood glucose levels due to inadequate insulin production by the pancreas, insufficient utilization of insulin by the body's cells, or a combination of both factors. There exist two primary forms of diabetes: type 1 and type 2. Type 1 diabetes typically emerges during childhood or adolescence and stems from an autoimmune response that destroys the pancreatic beta cells responsible for producing insulin, thus necessitating lifelong insulin treatment. On the other hand, type 2 diabetes, more prevalent among adults, arises when the body develops resistance to insulin's effects or fails to generate adequate insulin to regulate blood sugar levels effectively. Factors contributing to type 2 diabetes risk include obesity, sedentary habits, family history, and certain ethnic backgrounds. Poorly managed diabetes can result in severe complications such as cardiovascular ailments, renal impairment, neuropathy, and vision impairment, underscoring the significance of early detection, lifestyle adjustments, and appropriate treatment to avert complications and uphold overall well-being.

VI. **Accessibility** refers to the design and creation of environments, products, services, or systems in a way that ensures they can be used and accessed by everyone, including people with disabilities. It involves removing physical, sensory, and digital barriers, allowing individuals to move, communicate, and interact without obstacles. In broader terms, accessibility promotes inclusivity, ensuring equal opportunities for participation and engagement in everyday activities for all members of society.

## Chapter Two

### Literature Review

#### 2.1 Conceptual Review

##### 2.1.1 Definition and Historical context of Sanatorium

Sanatoriums are healthcare facilities designed to provide treatment for individuals with chronic illnesses, including those recovering from various ailments. They have been used for over 100 years to provide care for individuals with tuberculosis, neurological ailments, asthma, mental health problems, recovery from musculoskeletal injury, and for certain groups of people with diabetes, (Thornber, 2020; Armocida & Martini, 2020). During the second industrial revolution, many specialized health retreats sprang up as a spin-off of the modern medical and surgical disciplines such as tuberculosis care, endocrinology, psychiatric care, gynecology, neurology, and so on. Sanatoriums were defined as "establishments that treat chronic diseases" (Hewlett, et al) 1981). The term "sanatorium" varies in usage globally. In the Americas, it is mostly replaced by "health resort," although some old tuberculosis shelters still exist in Latin America. Elsewhere, "sanatorium" is a cherished term, derived from the Latin "sanare," meaning to cure. Originally created for tuberculosis climate therapy, the name remains appealing to developers for zoning approval. Using "spa," associated with Germanic tax-supported amenities, often provokes local opposition due to concerns about increased tourism, (Aitken, 2022).

In the United States, sanatoriums were specifically established for tuberculosis treatment. The English dictionary defines "sanatorium" as a noun that refers to a medical facility or institution specifically designed for the treatment and recuperation of individuals with chronic illnesses, especially tuberculosis, mental conditions. (Hjiej et al., 2014), defined sanatoriums as specialized facilities designed for the isolation and treatment of individuals with chronic illnesses, particularly tuberculosis.

These residential hospitals provided patients with ample fresh air, nutritious meals, and prescribed routines of rest and exercise. It typically provides a structured regimen of rest, fresh air exposure, proper nutrition, and medical supervision to aid in the recovery of patients. Sanatoriums are a quintessential example of the Modern Movement in architecture. Widely constructed across Europe from 1900 to 1950, these buildings now stand as significant architectural landmarks, renowned for their technical, functional, and spatial design features. Following the decline of tuberculosis after World War II, many sanatoriums that were not demolished have undergone continuous transformation and repurposing, (Grandvoinet, 2020).

### **Various Meaning of Sanatorium**

In Britain, a sanatorium is a specialized hospital typically located in the countryside, where individuals can receive treatment and rest, particularly while recovering from a prolonged illness.

In the early 20th century, Europe and North America saw the emergence of a new tuberculosis treatment approach. Sanatoriums, combining elements of hospitals and resorts, were designed to maximize patients' exposure to sunlight and fresh air. Their bright, open spaces left a lasting impact on both healthcare practices and modern architectural design.

In Russia, sanatoriums are present in every region, utilizing both natural factors and modern technical equipment for treatment and prevention they are mostly referred to as spa and resorts. A sanatorium is a medical and preventive facility that treats patients using mainly natural therapeutic physical factors (such as climate and mineral waters), combined with physiotherapy, therapeutic exercises, and nutrition, following a specific regimen to ensure complete treatment and rest for patients.

(Understanding Heritage of Early Modernist Sanatorium Architecture : Salutogenic Design , Healing Effects of Nature , Memory , and Impact on the Spirit of Place, 2023)

### 2.1.2 The Evolution of Sanatoriums

With abundant sunlight and enveloping heat, growing plants, and clean air, Mother Nature has created the most healthful sanatorium on Earth: the great outdoors. When the White Plague, Pulmonary Tuberculosis, threatened to maim or kill people – especially in industrialized nations – some two centuries ago, the artificial sanatorium came into being. Beginning in ancient Greece; to the almoner of the Middle Ages; the leper and holy hospices of the Seventeenth Century; to The National Hospital; to Soho, London; to Gorbardsdorf “Pfarrhaus”; to Klein Görnwalde; Carson City, Nevada, USA; to Loomis Sanatorium; to Rainbow Cottage; to Laconia Sanatorium; to Sarnubi. All these institutions have the same purpose of treating susceptible or actually diseased people in the midst of Mother Nature, (Sariem et al., 2020), (Oladimeji et al., 2021) & (Rosapep et al., 2022). The evolution of sanatoriums has been shaped by the changing understanding of diseases and advancements in medical science and healthcare practices. Historically, sanatoriums emerged in the late 18th and early 19th centuries as specialized facilities for the treatment of tuberculosis (TB), a highly contagious and often deadly respiratory illness, (Hatch & Niland, 2004), it will be impossible to talk about the sanatoria evolution without talking about the history of tuberculosis.

In the 19th century, tuberculosis was the leading cause of death in Europe and North America. By the end of the century, tuberculosis deaths in Germany surpassed those from all other infections. The concept of sanatoria for treating tuberculosis patients emerged, with Hermann Brehmer credited for starting the sanatorium movement in 1854 in Görbersdorf, Silesia. Initially met with skepticism, the sanatorium approach gained acceptance by the century's end, evidenced by the endorsement from Manitoba's provincial bacteriologist, Dr. Gordon Bell, in 1904. This study explores Dr. Bell's confidence in sanatoria and his emphasis on climate's role in treatment, despite the limited published works by sanatorium founders, (Zwick & Pepperell, 2020).

To comprehend the formation of sanatoria, it is essential to examine the prevailing beliefs about tuberculosis. Unlike acute diseases like cholera, tuberculosis was a constant threat without dramatic outbreaks. Early in the 19th century, tuberculosis was mainly attributed to heredity, poor living conditions, and lifestyle factors. The disease's characteristic symptoms and lesions were well-documented, leading to the term "tuberculosis." By mid-century, the understanding of the disease's pathology had advanced, but contagion was still not widely accepted outside Italy. Influential figures like Clark linked tuberculosis to poor living conditions and recommended fresh air and better nutrition, although the role of contagion remained controversial, (Wheeler, 1993).

The natural history of tuberculosis, especially its latent stages, was better understood after Koch's 1882 discovery of the *Mycobacterium tuberculosis* bacterium. This shifted the focus to identifying those at risk due to heredity and poor living conditions. Climatology, the study of the effects of climate on health, became crucial in tuberculosis treatment. Initially, warm climates were favored, but figures like George Bodington challenged this view, advocating for cold, fresh air, and exercise. Evidence from various studies, including the health of troops and animal observations, highlighted the benefits of dry, cold air and proper ventilation, leading to the establishment of sanatoria in suitable climates to support tuberculosis patients, (Pilosof, 2021).

### **2.1.3 The Founding of the Sanatorium**

In the 19th century, tuberculosis was a leading cause of death in Europe and North America, prompting the establishment of sanatoria dedicated to its treatment, (Zwick & Pepperell, 2020). These institutions, inspired by Hermann Brehmer, Peter Dettweiler, and Edward Trudeau, aimed to provide a cure through specific therapeutic regimens rather than serving as mere hospices. Brehmer, influenced by pathological studies and his belief in strengthening the heart and improving lung nutrition, opened his first sanatorium in Görbersdorf, Silesia in 1854. Despite initial skepticism from the medical

community and political hurdles, Brehmer's approach gradually gained recognition, laying the foundation for the sanatorium movement.

Peter Dettweiler and Edward Trudeau further developed and popularized the sanatorium model. Dettweiler, having recovered from tuberculosis at Brehmer's sanatorium, founded his own facility at Falkenstein, Germany in 1875, emphasizing rest over exercise. Trudeau, after his own remission in the Adirondack Mountains, established a sanatorium in Saranac, New York in 1885, inspired by Brehmer's methods. His facility, supported by influential patrons, provided free care for those in need and became a model for other sanatoria in North America.

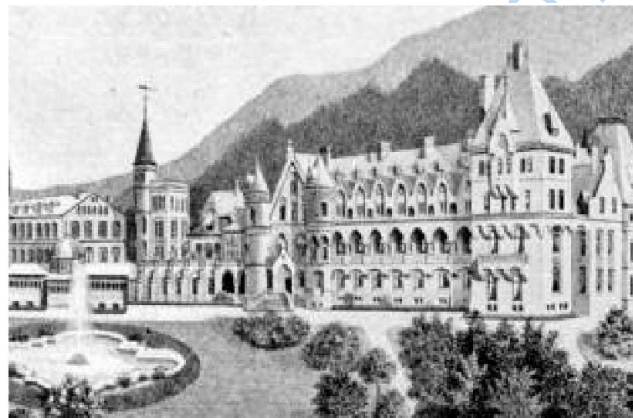


Plate 2.1: Picture of Early Sanatorium

(Source: Doğan, et al, 2023).

The debate over the best environment for tuberculosis treatment—whether cold northern climates or high altitudes were more beneficial—was significant in the early sanatorium movement. Observations suggested that mountain dwellers had lower tuberculosis rates, potentially due to the purity of the air, increased lung capacity from deep breathing, and the cold's antiseptic properties. Influential locations like Davos in Switzerland and Nordrach in Germany became renowned for their successful treatments. However, by the early 20th century, the specific benefits of altitude were questioned, and sanatoria

were established in various locales, acknowledging that while environmental factors played a role, they were not solely decisive in tuberculosis treatment, (Tesler, 2018).

#### **2.1.4 The Sanatorium Regimen**

The sanatorium regimen, known as "La cure hygiéno-diététique," emphasized lifestyle changes over medication to treat tuberculosis. Rooted in Galenic principles, it focused on fresh air, nutrition, rest and exercise, sleep, excretions, and state of mind as the key factors to be considered. Patients spent significant time on balconies to maximize exposure to fresh air, a practice validated by Edward Trudeau's experiment showing better survival rates in rabbits exposed to outdoor air compared to those in damp, dark conditions. Nutrition was crucial, with patients receiving abundant meals rich in milk, fats, and cod liver oil, and their weight was closely monitored as an indicator of progress, (Hjiej et al., 2014).

Exercise and rest were also key components of the sanatorium regimen, though there was some debate over their relative importance. Brehmer and his student Walther emphasized exercise, building mountain paths for patients, while Dettweiler and Trudeau advocated for more rest. Dettweiler's method of resting outside, even in winter, eventually became widely accepted. This approach allowed patients to rest in reclining positions on sheltered terraces, helping to improve lung circulation. By the end of the 19th century, a balanced approach of rest and gradual exercise depending on the disease stage became standard in sanatoria.



Plate 2.1: Picture of Early Tuberculosis Sanatorium

(Source: Doğan, et al, 2023).

Sanatoria also prioritized controlling infection and managing patients' mental well-being. Dettweiler, even before the discovery of the tubercle bacillus, encouraged patients to expectorate into flasks to prevent the spread of the disease. Once the infectious nature of tuberculosis was confirmed, sputum control became a public health focus. The mental state of patients was also carefully managed, with activities that avoided excitement and promoted relaxation. Brehmer also incorporated hydrotherapy, a practice he personally supervised, involving ice-cold douches to stimulate the body, though this was less common in other sanatoria.

The regimen required strict discipline and obedience, with physicians maintaining close oversight of patients' daily routines. The success of this approach relied heavily on the authoritative presence of the doctors, who enforced a rigid set of rules and regulations. By the early 20th century, the importance of sanatoria in treating tuberculosis was widely recognized, leading to the establishment of numerous institutions across Europe and North America. Germany, in particular, saw significant support for these institutions from the state, philanthropists, and voluntary organizations, with Brehmer's Kurhaus becoming a notable example of a well-equipped sanatorium serving various social classes, (Warren, 2006).

### **2.1.5 Sanatorium History in Nigeria**

There is no country without a sanatorium system, but there are many countries that have sanatoriums where patients with chronic diseases can find treatment and live in the midst of nature. These paragraphs give the history of sanatorium development in Nigeria, Abrams, (2016). It goes further to highlight the early establishments of sanatoriums or open-air treatment of pulmonary tuberculosis in Nigeria in West Africa. Every country has its own problems. In this monograph, the problem is peculiar to the emerging country - Nigeria. Between infectious diseases, non-infectious diseases, nutritional diseases, and the untoward effects of urban life as opposed to rural life, people cannot knowingly afford hospitals, infirmaries, sanatoriums, nurses, and auxiliary aids, etc., which advanced countries have, (Kuzmina, et al, 2023) & (Hobday & Collignon, 2022) .

Sanatoriums in Nigeria have a history rooted in the colonial period, reflecting broader trends in public health responses to tuberculosis and other chronic diseases. These facilities were established to provide isolation and specialized care, mirroring practices seen globally, particularly in Europe even though they were not practically named sanatoriums.

#### **I. Colonial Beginnings**

During the early 20th century, under British colonial rule, Nigeria saw the introduction of sanatoriums as part of efforts to manage infectious diseases, notably tuberculosis. The British colonial administration recognized the need for such facilities due to the prevalence of tuberculosis among both the local population and expatriates. Sanatoriums were built in locations with favorable climates, such as Jos and Plateau State, which were considered suitable for their cool and temperate environments. These locations were believed to aid in the recovery of tuberculosis patients by providing cleaner air and a more controlled environment for rest and recuperation.

## II. Post-Colonial Transition

Following Nigeria's independence in 1960, the healthcare system, including sanatoriums, underwent significant changes. The initial focus remained on tuberculosis treatment, but there was a gradual shift towards integrating these facilities into broader public health strategies. The decline in tuberculosis cases, due to improved public health measures and the advent of effective antibiotics, led to a repurposing of many sanatoriums. Some were transformed into general hospitals or specialized healthcare centers for other chronic diseases, while others faced neglect or were repurposed for non-medical uses.

## III. Modern Era

In contemporary Nigeria, the legacy of sanatoriums is seen in the continued emphasis on specialized healthcare facilities and public health strategies aimed at managing chronic diseases. The history of these institutions highlights the evolution of healthcare responses from isolation and specialized care to integrated public health and medical advancements. Although many original sanatoriums have been repurposed, their impact on public health policy and infrastructure development remains significant, reflecting a period of adaptation and change in the face of evolving healthcare needs, (Bande, 2023).

The concept of sanatoriums as being good business grew and still persists today, there are few sanatoriums in Nigeria today such as Marian Homeopathic Sanatorium located in Enugu State which specializes in homeopathy (recovery and wellness), and Amana Sanatorium in Kano State which specializes in drug rehabilitation. Large investments in land, buildings, and staff are supported in order to attract the rest orders of wealthy individuals. The result is that sanatoriums, in Nigeria and elsewhere, have often degenerated into commercial institutions, and their original essence was corrupted. It is not too late for sanatoriums, with all the support or the financing difficulty associated with them, to achieve their original essence. In the light of this, the history, the definition, and the real purpose of

sanatoriums and the places similar to them will be investigated. Useful foundations for their solution will be determined, (Bande, 2023), (Discourse et al., 2021) & (Anyanwu, 1997).

### **2.1.6 Types and Classification of Sanatorium**

Sanatoriums can be classified based on various factors including the types of patients they serve, the diseases they treat, and the level of care they provide. The followings are some common classifications of sanatoriums:

#### **Types of Sanatoriums**

##### **i Medical Sanatoriums**

The role of medical sanatoriums continuously increases in the healthcare system due to the dramatic growth in population morbidity, the acute shortage of treatment and prevention facilities, and the insufficiency of sick leaves, (Warren, 2006). Medical sanatoriums are specialized facilities focused on the treatment of long-term illnesses and chronic conditions. These institutions often cater to patients with diseases such as tuberculosis, respiratory conditions, cardiac issues, and other chronic health problems that require extended medical care and monitoring. Medical sanatoriums are equipped with advanced medical technology and staffed by healthcare professionals, including doctors, nurses, and therapists, who provide continuous care and support. These facilities aim to create a therapeutic environment that combines medical treatment with lifestyle adjustments, such as diet, exercise, and stress management, to enhance patients' overall health and recovery, (Dorato, 2020) & (Akinwale et al., 2017).

##### **ii Rehabilitation Sanatoriums**

Rehabilitation sanatoriums specialize in the recovery and rehabilitation of patients after surgeries, injuries, or illnesses that impair physical functions. These facilities offer comprehensive rehabilitation programs that include physical therapy, occupational therapy, and sometimes speech therapy. The

primary goal of rehabilitation sanatoriums is to help patients regain their independence and improve their quality of life through personalized rehabilitation plans. These plans often involve exercises to restore strength and mobility, training in daily living activities, and psychological support to address the emotional aspects of recovery. Rehabilitation sanatoriums play a crucial role in the transition from hospital to home by providing a supportive environment for gradual recovery, (Lew, Oh-Park, & Cifu, 2020).

### iii **Resort Sanatoriums**

Resort sanatoriums combine medical or therapeutic care with the amenities and services of a resort. These facilities are often located in scenic areas, such as mountains, beaches, or countryside, providing a peaceful and relaxing environment conducive to healing and well-being. Resort sanatoriums cater to individuals seeking to improve their health through wellness programs that include spa treatments, healthy diets, physical activities, and relaxation therapies. While they offer some medical and therapeutic services, their primary focus is on preventive care and promoting a healthy lifestyle. Resort sanatoriums attract guests looking for a holistic approach to health and wellness in a luxurious and comfortable setting, (Batyhina et al., 2020), (Kuciel-Lewandowska et al., 2020) & (Szromek, 2021).

## **Classification of Sanatoriums**

### i. **By Medical Specialty**

Sanatoriums can be classified based on their medical specialty, reflecting the specific types of conditions they treat. For example, respiratory sanatoriums focus on lung diseases like tuberculosis and chronic obstructive pulmonary disease, cardiac sanatoriums specialize in heart conditions, and orthopedic sanatoriums cater to musculoskeletal disorders and rehabilitation post-surgery. Other examples are life style modification or adjustment therapies; as well as medical care and close monitoring. This classification allows sanatoriums to tailor their facilities, equipment, and staff expertise to the particular needs of their patient population, ensuring specialized and effective

treatment programs. The specialization helps in providing focused care, leading to better outcomes for patients with specific health issues, (Grover, et al, 2020).

## **ii. By Geographical Location and Climate**

Sanatoriums are often classified by their geographic location and the climate of the area, as these factors can significantly impact the healing process. Some sanatoriums are located in mountainous regions, known for their clean air and moderate climates, which are beneficial for respiratory conditions. Others might be situated by the sea, where the salty air can also aid in treating respiratory and skin conditions. The choice of location and climate is crucial because it aligns with the therapeutic needs of the patients, providing an environment that supports their treatment and recovery. For instance, a sanatorium for cardiac patients might be located in a tranquil, stress-free setting to aid in their recovery, (Halder et al., 2020).

## **iii. By Ownership**

Sanatoriums can also be classified based on their ownership, which can be public, private, or charitable. Public sanatoriums are funded and managed by government agencies and typically aim to provide accessible healthcare services to a broad population, often subsidizing costs for patients. Private sanatoriums are owned and operated by private entities or individuals and usually offer more luxurious amenities and personalized care, often at a higher cost. Charitable sanatoriums are funded by donations and run by non-profit organizations, focusing on providing care to underserved and low-income populations. This classification affects the management style, funding, and often the quality and scope of services provided, (Eshchanov, 2020). A sanatorium can indeed take the form of more than one type or class of sanatorium, combining various characteristics and functions. For instance, a diabetes sanatorium can incorporate elements of medical, rehabilitation, and resort sanatoriums to provide comprehensive care for diabetic patients, (Adler-milstein, n.d.).

### **2.1.7 Diabetes Sanatorium**

A diabetes sanatorium is a specialized facility designed to provide comprehensive care for individuals with diabetes. Sometimes, they are established for the treatment of diabetes complications such, ophthalmology, musculoskeletal injury, eating disorders and metabolic disorder, cardiovascular diseases, gynecological and neurological diseases and other situational and temporal injury. These sanatoriums offer medical treatment and monitoring, focusing on managing blood sugar levels and preventing complications. Patients receive personalized treatment plans that include medication management, insulin therapy, dietary guidance, and regular blood sugar monitoring. The medical staff typically consists of endocrinologists, diabetes educators, dietitians, and nurses who work together to provide a holistic approach to diabetes management. The environment is structured to support lifestyle changes, with facilities for physical exercise, stress reduction programs, and educational workshops to help patients understand and manage their condition better, (Liang et al., 2020).

Additionally, diabetes sanatoriums incorporate elements of rehabilitation and resort-style amenities to enhance the overall well-being of patients. Rehabilitation services focus on teaching patients self-care practices, such as proper diet, exercise routines, and glucose monitoring techniques, which are crucial for long-term diabetes management. Resort-like features, such as comfortable accommodations, healthy meal options, and wellness programs like yoga and meditation, provide a relaxing and supportive atmosphere. This integrative approach ensures that patients not only receive medical care but also learn to maintain a healthy lifestyle, significantly improving their quality of life and reducing the risk of diabetes-related complications, (Szromek, 2021).

### **2.1.8 Facilities and Components of Diabetes Sanatorium**

Due to the unique nature of Diabetes Mellitus, the Diabetes Sanatorium (DS) Care system consists of five key components: the regional Diabetes Rehabilitation Center (DRC), the Transitional

Rehabilitation Program (DTRP) for Diabetes related complications, outpatient and sub-acute network sites for Diabetic Retinopathy, designated Diabetic support clinic teams in general hospitals, and a point of contact at other healthcare facilities. A Diabetes Sanatorium offers comprehensive interdisciplinary rehabilitation, coordinating complex medical, surgical, and convalescent care, along with long-term follow-up, (Polytrauma Rehabilitation Center Design Guide, 2014).

The facilities are as follows:

1. Medical Care /Facilities; (these Comprise In-patient and out-patient care)
2. Physical rehabilitation facilities/ care, and
3. Full-time nursing home

### **2.1.9 Concept of Universal Accessibility**

In the digital age, ensuring accessibility and equal opportunities for all has become increasingly significant in the past decade. Universal accessibility is described as the characteristic of an environmental design that enables all individuals to carry out their activities independently, fairly, and inclusively, (Heron, 2024). It attempts to improve and adapt environments while also providing equal access to buildings, services, resources, and activities for the population. The Convention on the Rights of Persons with Disabilities (CRPD), approved in 2006 by the United Nations (UN), emphasized the significance of this idea, (Corcuff et al., 2022). The concept of accessibility is now a consideration in most projects developing interactive systems, albeit to varying degrees. However, there are differences in how accessibility is understood across different professions, cultures, and interest groups. Terms such as "design for all," "universal access," and "inclusive design" are used interchangeably, all with the goal of enhancing the accessibility of interactive systems for a broad range of users, (Persson et al., 2015).

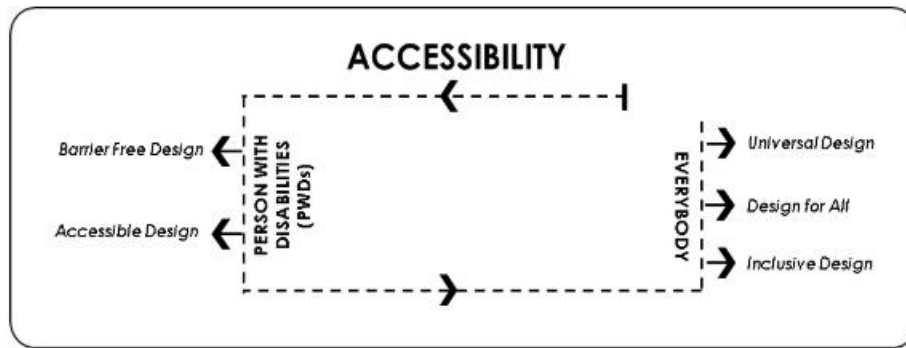


Figure 2.1: Related Names of Accessibility

(Source: Yusof & Jones 2014)

Based Universal accessibility represents a core principle ingrained within inclusive architecture, aiming to create spaces, products, and environments accessible to everyone, irrespective of their age, physical stature, or disabilities. It aims to optimize inclusivity for individuals with diverse abilities, ensuring that everyone can benefit, (Sauer et al., 2020). For instance, accommodating features such as desks with wheelchair-accessible space or adjustable heights caters to varying needs, allowing individuals to work comfortably in both sitting and standing positions. This aims to develop information society technologies accessible and usable by individuals of all ages, including the elderly, young, and those with various disabilities, thereby negating the necessity for post-design adaptations or specialized approaches, (Handy, 2020). Thus, within the framework of universal access, accessibility extends beyond physical or cognitive disabilities, becoming increasingly vital for society as a whole.

The concept of universal accessibility can significantly improve the accessibility of architectural design in diabetes sanatoriums and similar public buildings by ensuring that these spaces are inclusive and accommodating to individuals with diverse needs, including those with diabetes complications such as foot damage, stroke, nerve damage, and eye damaged. Universal design principles advocate for features such as ramps, elevators, and wide doorways to facilitate easy access for individuals with mobility impairments or those using assistive devices like wheelchairs. Additionally, incorporating

clear signage, color contrast, and tactile indicators can aid navigation for individuals with visual or cognitive impairments. Adjustable-height furniture, ergonomic seating, and accessible restroom facilities can enhance comfort and usability for all occupants, while features such as ample natural light and low-noise environments contribute to a supportive and inclusive atmosphere. By embracing universal accessibility principles, diabetes sanatoriums and similar public buildings can ensure that everyone, regardless of their abilities or health conditions, can access and benefit from the facilities and services provided.

#### **2.1.10 Universal Accessibility Principles**

Universal accessibility is refers to the ability of all people to have equal chances and access to a service or product from which they can benefit, irrespective of their socioeconomic class, race, heritage or physical limitations, (Design, 2022). The term "accessibility in architecture, refers to the planning, designing, and constructing of structures and areas that individuals with disabilities can use and access with ease and independence. It is more than merely compliance to construction codes and regulations, instead emphasizing the creation of inclusive, human-centered, and dignified environments, (Persson et al., 2015). There are various categories of disability, age-related disability and illness-caused disability. For individuals with disabilities and the elderly, staying in an environment that supports freedom, independence, and security is essential for facilitating mobility within the built environment. Therefore, architectural design plays a crucial role in minimizing the risk of falls and ensuring accessibility and functionality (Shahrom & Zainol, 2015). Disability arises from the interaction between a person's functional capabilities and the physical, cultural, and policy environments. When an individual cannot fully utilize their body functions and struggles to effectively engage with the available accommodations and support, they experience functional limitations associated with disability.

People with disabilities face interaction challenges due to physical impairments, activity limitations, and contextual factors, often leading to them being housebound and dependent. Proper housing and healthcare environments are essential for their rehabilitation. By incorporating features, products, and procedures that make these facilities accessible to everyone, universal design principles benefit all users (Dua, 2020).

### 2.1.10 Features of Universal Accessibility

Accessibility, in a general sense, whether physical accessibility, technological accessibility cognitive accessibility refers to the state of being easy to reach, approach, obtain, use, or understand, (Heron, 2024). Various physical barriers can obstruct and hinder this ease of movement, (Shuford, 2023). In its narrower context, physical accessibility refers to making services and facilities physically accessible for everyone, irrespective of age, gender, disability, or any factor that threatens to disadvantage a person. Features of physical accessibility deal with measures and procedures for barrier removal that not only benefit people with disabilities but are traditionally, universally, and collectively recognized as good practices that contribute to the safety, comfort, and wellness of all people, as well as the efficiency of services and facilities that are commonly used in everyday life, (Gillovic, McIntosh, 2020). Basic features of physical accessibility features are shown in Table 1 below.

Table 2.1: List of Design Features with Description of Universal Accessibility in Building

Features	Description
Accessible Parking	i Access aisles and van accessible spaces
	ii curbs
Accessible Approach and Entrance	i Surfaces and walkways
	ii Ramps

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	iii Elevators
	iv Door width
	v Door handles and thresholds
	vi Protruding objects
Access to Goods and Services	i Doors
	ii Aisles width, reach and turning space
	iii Table placement and height
	iv Ramps
	v Elevators
Toilet Rooms	i Entrance, turning space, mirrors and sinks
	ii Pipes, floor space, faucets and dispensers
	iii Toilets and grab bars
	iv Stalls and single-user restrooms
Wayfinding	i signage
	ii Tactile maps,
	iii auditory cues,
	iv braille signage
Lighting	i Light switches and sockets
	ii Glare and shadows

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Source: (Clinics & Oregon, 2013)

## 2.2 Design Considerations

### 2.2.1 Architectural Considerations for Sanatorium Design

In order to promote health and wellness in a healthcare facility while focusing the patients' healing and overall experiences the following design considerations will be considered for the for the design of a sanatorium.

**1. Location and Environment:** When designing a sanatorium, it is essential to choose a location with a favorable climate and scenic beauty, often situated in the countryside or near natural features such as mountains, forests, or water bodies. Ensuring the site has good air quality and abundant natural sunlight is crucial, as these elements are essential for patient recovery. Such a natural setting not only promotes physical healing but also provides a serene environment that enhances mental and emotional well-being, (Ganesh, Sinha, Verma, & Dewangan, 2021).

#### **2. Building Orientation:**

The architectural characteristics of sanatorium include light, windows, location, temperature, noise, floor plan, personalization of patient rooms, decentralized nursing stations, colors, finishes, decorations, artwork, separated waiting areas, navigability, and access to green space. These elements influence building orientation and enhance patient room comfort, which is also affected by the building envelope and materials. Key architectural principles, related to light, water, air, and earth, are essential for human comfort. Patient rooms, being crucial hospital spaces, must provide a comfortable indoor environment, as it impacts operations, recovery, and patients' psychological well-being. Architectural features significantly influence patient perception and the effectiveness of patient rooms, (Eijkelenboom, & Bluysen, 2022).

### **3. Therapeutic Landscape:**

The therapeutic landscape in sanatoriums is crucial for both preserving historical significance and adapting to new treatment functions. Frequent rearrangement and expansion of these landscapes align with various therapeutic purposes, ensuring the buildings' continued relevance and effectiveness. Retaining at least partial elements of the original therapeutic landscape is essential for maintaining historically defined, important landscapes. This approach addresses the delicate balance of preserving original architectural and landscape features while adapting to future uses. Thus, therapeutic landscapes play a vital role in the historical integrity, aesthetic value, and functional adaptability of sanatoriums, (Oeljeklaus, 2022).

### **4. Incorporating Natural Light and Ventilation**

Natural light and ventilation are crucial in designing sanatoriums, especially in tropical climate. Kumar, & Malhotra, (2021), highlights that while current projects prioritize external conditions, internal architectural aspects for maximizing natural light and airflow are often overlooked. Key design elements like room shape and orientation are critical from the project's start to enhance patient well-being, reduce stress, and improve recovery times. Optimizing these factors not only benefits patients by potentially lowering their need for medication but also makes sanatoriums more efficient, reducing energy use and operational costs. This study contributes valuable insights for architects and researchers aiming to create healthier and more sustainable healthcare environments. (Kumar, & Malhotra, 2021) & (Kumar, n.d.).

### **5. Therapeutic Facilities**

Therapeutic facilities in sanatorium design are essential components aimed at enhancing patient care and recovery. These include hydrotherapy pools utilizing natural mineral waters for therapeutic treatments, physiotherapy and exercise rooms equipped with modern amenities to facilitate physical

rehabilitation, and specialized treatment rooms strategically located for easy patient access. Support facilities such as dining areas are designed to accommodate dietary requirements and promote social interaction among patients. Common areas are planned as communal spaces for social activities, relaxation, and entertainment, fostering a supportive environment for healing. Additionally, staff areas are provided with adequate facilities including rest areas, offices, and meeting rooms to support efficient healthcare delivery. Integrating these elements ensures that sanatoriums not only prioritize patient comfort and rehabilitation but also support staff in delivering optimal care, (TAHPI, 2023).

## **6. Sustainability and Efficiency**

- Energy Efficiency: Incorporate energy-efficient systems and sustainable building practices to reduce the environmental footprint.

- a. Support spaces, such as storage and utility rooms, should be designed for shared use where possible to minimize the overall space required.

- b. Facility supply and transport areas should be grouped together to enhance operational efficiency.

- c. Duplication of departments (like PM&R, wheelchair repair, etc.) or specific spaces should be minimized, especially where resources are limited and the services are available at the main medical center. (Szromek, 2021).

- d. Integration with Nature:

- Biophilic Design: Incorporate elements of nature into the design to enhance the connection between patients and the natural environment, which can aid in healing and stress reduction.

## **7. Flexibility**

The design of a diabetes sanatorium (DS) must be flexible to adapt to changing workloads, care objectives, and technologies. In a diabetes sanatorium, rehabilitation and treatment take place throughout the entire space, including corridors, multipurpose zones, and alcoves where patients engage in social interaction, all contributing to the therapy program.

a. Every area within the building should be designed to support various functions and program activities. For example, patient rooms can also serve as counseling and interdisciplinary team rooms for patient evaluation, while dining rooms can be used for movie nights or occupational therapy group activities during non-dining hours.

b. Generic plans should be developed to accommodate changes in use and assignment. For instance, as alternative therapies become more common in diabetes care, exam rooms should be designed to easily convert into spaces for acupuncture or massage therapy with minimal disruption to existing spaces, (TAHPI, 2023).

## **2.2.2 Space Planning and Design Considerations for Diabetes Sanatoriums**

### **2.2.2.1 Inpatient Unit**

#### **a. General**

The inpatient unit is a fundamental component of a diabetes sanatorium, offering many functions beyond those of a typical hospital inpatient unit. Intensive patient treatment occurs in individual patient rooms as well as in other designated treatment and rehabilitation areas within the unit. Family members will be involved in this treatment process and will need additional spaces for their needs.

#### **b. Design Considerations**

- **Patient Room**

The patient rooms in a diabetes sanatorium must be spacious enough to allow for individualized treatment by multiple staff members and therapists, as well as to accommodate additional equipment necessary for patient care. Patients often use specialized wheelchairs or power-chairs (scooters), requiring ample maneuvering space and room for transferring from the chair to the bed. Given the longer length of stay, patient rooms are equipped with storage for personal belongings and furniture for tabletop activities, work, and in-room therapy, (Batyhina et al., 2020).

- **Nurse Stations**

Nurse stations should be placed centrally or decentralized near patient rooms to support intensive treatment. Extra workstations and seating are needed to facilitate collaboration among specialists.

- **Dining Room/Kitchen**

This area supports inpatient dining and serves as a therapeutic space for those needing meal assistance. It also helps patients and families learn meal preparation for specific dietary needs. The proximity of the kitchen and dining room enhances the effectiveness of speech and occupational therapy during mealtime activities.

- **Visitors' Multipurpose Room / Family Room**

Family members, integral to patient treatment, require space both within and outside the patient room. The inpatient unit includes a multipurpose room for family members to rest and engage in activities without disturbing the patient, providing a comfortable and supportive environment close to the patient.

- **Rehabilitation Gym**

Due to the acute nature of patient complications and the crucial role of therapy in diabetes sanatorium, an inpatient rehabilitation gym is essential for both individual and group physical therapy (PT) and occupational therapy (OT). Many patients may struggle to leave their rooms for inter-hospital transport, so patient rooms are designed to accommodate bedside therapy.

To ensure continuity of care, the main rehabilitation gym is located adjacent to the inpatient unit, facilitating easy transitions between patient rooms and the gym, and maximizing treatment time. A storage room is necessary for equipment not used daily, and two private exam rooms should be nearby to provide private treatment if the main gym is over stimulating or a private setting is required. Patient restrooms near the gym support general use and therapeutic activities, allowing therapists to assist with transfers and OT skills in a realistic bathroom environment. PT/OT/KT staff need a nearby space for

charting, with a room accessible to the gym featuring viewing windows to monitor patients while allowing staff to collaborate privately on patient care, (Handbook, n.d.).

- **Activities of Daily Living (ADL)**

A residential apartment is provided for ADL training, including a bedroom, bathroom, kitchen, dining area, living area, and small workstation. This apartment is most effective when located on the inpatient unit, adjacent to the physical and occupational therapy spaces. Occupational therapists can use this space to demonstrate tasks, such as transfers or kitchen activities that cannot be performed in the main gym. The apartment allows therapists to assess a patient's functional abilities in a typical living environment.

- **Recreation Therapy**

Recreation therapy is provided in two separate rooms: one for quiet tabletop activities and another for louder gaming activities. The group recreation therapy room should be directly connected to the inpatient unit to minimize travel time and maximize therapy time. Recreation therapy services also benefit from being close to the computer activities room, which is used for quiet computer training. Ideally, there should be a viewing window between these two spaces, allowing one recreational therapist to conduct a class in the group therapy room while also monitoring a patient in the computer activities room.

- **Speech, Language, and Hearing Therapy**

Speech, language, and hearing therapists collaborate closely with the physical and occupational therapy teams, as well as assisting with mealtime activities. Their office and treatment spaces should be located adjacent to either the PT/OT gym or the dining room, or ideally between both, to best support patients who require swallow studies that lead to meal modifications. Primary services include audiology diagnostic assessments and treatments, hearing aid evaluations, and the diagnosis and

treatment of speech and language disorders, including voice, articulation, fluency, and swallowing issues. (Polytrauma Rehabilitation Center Design Guide, 2014)

### **Room Guide Plates**

In (Polytrauma Rehabilitation Center Design Guide, 2014), the following spaces have been developed and analyzed with subject matter experts nationwide to create Room Guide Plates. These plates serve as a reference for what is required within a typical room of its kind:

- a. Patient Room and Bathroom
- b. Nurse Station
- c. Medication Room
- d. Dining Room and OT Kitchen
- e. Family Room/Multipurpose Room
- f. Laundry Room
- g. Gym, Rehabilitation Therapy
- h. Evaluation Room PT/OT
- i. Team Room
- j. Group Room, Recreation Therapy
- k. Testing Lab, Neuropsychology
- l. BROS Treatment/Office
- m. Assistive Technology Lab/Rehab Engineering
- n. Office, Speech Language Pathology
- o. Provider Office

### **2.2.2.2 Outpatient Unit**

#### a) General

The outpatient unit is an essential component of the diabetes sanatorium, offering specific cognitive training for patients through regular visits as part of their diabetes care. Unlike a typical hospital outpatient clinic, this unit focuses on diabetic patients, staff, and specialized treatment in a centralized area. Patients receive both group and individual assessments and treatments. Outpatient treatment ensures continuity of care after an inpatient stay and serves as the entry point for patients with delayed diabetes symptoms. It operates separately from transitional care, supporting individuals living in their communities. The necessary facilities include an outpatient clinic and PM&R resources within the sanatorium. The Outpatient Program consists of personalized plans, recognizing each patient's unique diagnosis and recovery needs. Its goal is to coordinate interdisciplinary care to promote patient independence, with treatments tailored to individual medical, functional, and clinical needs. Outpatients typically commute from home with family members.

#### b) Design Considerations

- Patient Lounge

The patient lounge is a space for patients to socialize, relax, and dine between treatments and appointments. Patients often have multiple, non-consecutive appointments at the diabetes sanatorium, on the same day, so the lounge provides a place for them to rest.

- Physical and Occupational Therapy Gym

This large room is dedicated to physical activities and rehabilitation therapy, focusing on exercise equipment to help patients return to their previous physical activities. It also supports occupational therapy treatments aimed at regaining independence. The gym should have adjacent supporting spaces such as private treatment rooms, restrooms (both functional and for training), storage rooms, and staff teaming areas.

- Gait Lab

The gait lab is designed to test patients' gait and balance abilities in a single room. This space should be flexible to accommodate new technologies for gait analysis. Ideally, the gait lab and other research and virtual reality spaces, such as the driver training room, should be located near the PT/OT gym.

- Balance and Vestibular Testing

These rooms assess and retrain the sensory and motor control of balance using visual biofeedback on stable or unstable surfaces in various visual environments. The NeuroCom and rotary chair rooms add another layer of balance study. These spaces should be near the gym or virtual reality spaces to facilitate staff communication.

- Room Guide Plates

The major spaces required in the Outpatient Unit are detailed in Room Guide Plates (Polytrauma Rehabilitation Center Design Guide, 2014), include:

- a. Exam Room
- b. Chiropractic Exam Room
- c. Procedure Room, Pain
- d. Gait Lab (and supporting spaces)
- e. Gym, Rehabilitation Therapy
- f. Speech Therapy Lab
- g. Balance Testing Room
- h. Vestibular Testing Room

### **2.2.2.3 Diagnostic Unit**

In a hospital, the diagnostic department or unit is specifically designed for performing various diagnostic tests and procedures. In a diabetes sanatorium, specialized facilities assess and diagnose patients' diabetic conditions with tailored diagnostic tools. Diagnosis involves identifying diseases or conditions based on a patient's signs, symptoms, medical history, and test results, guiding appropriate treatment plans. Effective diagnostic imaging departments enhance the medical experience, maintain quality cost-effectively, and employ techniques such as radiography, fluoroscopy, mammography, ultrasound, CT, MRI, and nuclear medicine, with careful planning and design considerations, (Roa et al., 2020) & (Eltahlawy et al., 2022).

- **Planning Considerations:** The planning phase is the first and most crucial step for establishing basic strategies. Effective planning of the diagnostic department ensures a highly efficient design that meets current and future needs, in accordance with ADA design standards. Key planning issues to address include:
  - i. **Department Location:** The department can be situated in the basement, ground floor, or both vertically. Horizontally, it can have centralized or decentralized configurations.
  - ii. **Workflow and Circulation:** Workflow patterns and the repetitive movement of different users are major drivers of the department layout. There are two types of workflows to consider: interdepartmental and intradepartmental.
  - iii. **Department Configuration:** The layout can be developed using various systems based on repetitive planning modules. The concept is based on 2 main points which are shown in table 2 below

Table 2.2: Different Planning Layout for Diagnostic Unit

Functional zones(There are 5 activity zones)	Plan typologies (There are 4 typologies)
--	--

A-Patient Zone	A- Single-Loaded Configurations
B- Examinations Zone	B- Double-Loaded Configuration
C- Central Staff Zone (control corridors, alcoves, and rooms)	C- Core Configurations
D- Personnel Zone	D- Cluster Configurations
E- Image Archive Zone	

(source: Eltahlawy et al., 2022).

- iv. Space Requirements: Determining the space for an imaging department involves two processes: functional programming and space programming.
- v. Quality of the Built Environment: The built environment is a key component of care quality. Many strategies can be employed to improve the patient experience such as, Environmental Infection Control (air, water, and surface) as shown in figure 2 below.

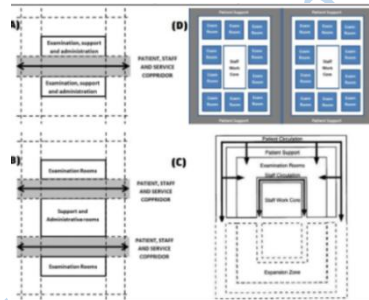


Figure 2.2: The 4 Layouts of Plan typology (a) Single-Corridor (b) Double, (c) Core Layout (d) Cluster Layout-

(Source: Eltahlawy et al., 2022).

Sustainability, Seismic and Excessive Vibration, Disabled Standards (ADA standards), and Physical Properties (size, weight, and radiation), (Roa et al., 2020)

- vi. Future Expansion and Development of New Service Lines: The department design should allow for future expansion through external expansion, internal conversion, or both. Flexibility and adaptability are crucial for accommodating future needs.

- **Design Consideration:** Effective design addresses the needs of different users, improves interactions between them and technology, and harmonizes form with function. The design process involves three stages, (Malone, 2009):

1. Concept Design: Creating a sequence of block diagrams.
2. Schematic Design: Evolving block diagrams into single-line or double-line graphics.
3. Design Development: Refining the interior and exterior details of the schematic design.

The design of the diagnostic department includes key architectural components that make up each diagnostic suite, such as procedure rooms, control areas, digital image management areas, reading rooms, and support spaces (dressing areas, toilets, and waiting areas). These components can be integrated into a single radiology room, (Eltahlawy et al., 2022).

#### **2.2.2.4 Sanatorium Accommodation**

Sanatoriums provide conditions which enable patients to actively fight the long-term consequences of the disease. The system of treatment, joint with prophylaxis, diet, exercise, rest, and a stable social environment, helps the individual to learn how to cope with the disease in situations essential for life. The individual learns to monitor the metabolic condition, to undertake any necessary changes in everyday life, and to strictly follow the proposed lifestyle, (Activities, n.d.). Diabetic patients need physiologically correct accommodation; comfort for the patient in a sanatorium is important in the healing process. The development of architectural design of diabetes sanatorium accommodation is aimed at achieving therapeutic and preventive goals according to the climatic features and the uniqueness of the environment. It envisages the principles of flexible small material resources for massive physical exercises, human environment form space, as well as individual environment of the

society participants, (Mannan et al., 2021). The key spaces are bedrooms for patients and care-givers, bathrooms and toilets, socialization spaces, nurses' stations.

## Design Consideration

### i. Barrier-free Design

Barrier-free and inclusive design includes Step-free accessibility, visually and tactilely contrasting design, and adherence to the two-sense principle (at least two of the three senses of sight, hearing, and touch should be addressed). The building's circulation should remain unobstructed by deliveries or machinery. Doors should be open where possible or easy to open, with sufficient width to accommodate all wheelchair users. The accommodation area should incorporate essential functions like lifts, toilets, and doctors' examination spaces, ensuring they are accessible to people with disabilities, (Agency, 2019).

- ii. **Flooring:** Tactile flooring should be installed at the entrances to assist blind individuals in navigation. Avoidance of slippery floors.

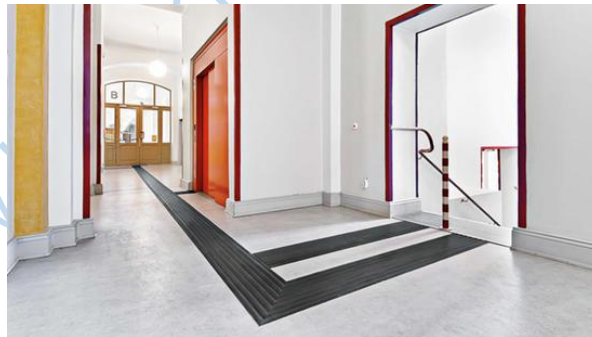


Plate 2.2: Accessible Flooring Layout.

Source: (Agency, 2019).

- iii. **Building services:** Building services should include ramps, staircases, lifts, and wide corridors designed for accessibility. Ramps should have a gentle slope of 1:20, and steps should be

minimized. There should stair lifts incorporated to stairs. For multiple floors, lifts are necessary.



Plate 2.3: Stair with Car Lift for Mobility Impaired Persons.

Source: (Agency, 2019).

- iv. **Accessible toilets and washrooms:** the toilets and bathrooms should have grab bars for support. There should be wide enough for a wheelchair to turn around. The door should be double swing doors.
- v. **Lighting:** The lighting in the accommodation should be distributed evenly. The large variation in lighting levels should be avoided and should not be too bright or too dark. Glossy, shiny, and polished surface finishes should be avoided. Reflections, shadows, and glare should be kept minimum, (Ab Rahman et al., 2018).

### 2.2.3 Architectural Design Considerations that Improve Universal Accessibility

The design considerations are intended to highlight for designers the importance of applying universal accessibility design principles and requirements to buildings and facilities, (Alfa & Medayese, 2019).

These are often regarded as 'minimum' standards and typically include wheelchair access, parking spaces close to entrances, visible and audible alarm systems, accessible elevators, and more. Some clients prefer to go beyond these standards by adding features such as automatic doors in multiple locations, hands-free sensors for operating doors and restroom fixtures, changes in flooring texture for

visually impaired individuals, spiral ramps to higher floors, and toilet facilities designed for adults needing caretaker assistance.

### **2.2.3.1 Use Clear and Intuitive Signage/Way-finding**

Ensures that healthcare is physically accessible to individuals with mobility impairments. This allows individuals using wheelchairs, walkers, or other mobility aids to navigate the building easily. Here is a list of features with clear and intuitive wayfinding that goes into making a disabled friendly sanatorium and public buildings, (Alfa & Medayese, 2019).

- a) Wide Entrances, Corridors and Pathways,
- b) Wide Doorways,
- c) Ramps,
- d) Lifts and ancillary facilities,
- e) Accessible Toilets and Washrooms, and
- f) Parking Spaces.

### **2.2.3.2 Pathways Configuration**

1. Pathways should be wide enough for two wheelchair users to pass each other comfortably.
2. Pathways should ideally be straight; if they must be winding, ensure large turning radii and ample turning space while avoiding sharp turns.
3. Pathway edges should be clearly marked and protected to prevent wheels from falling off, and any projections should be appropriately sized to prevent accidental bumps without obstructing the path.
4. Channel gratings should have slots perpendicular to the main traffic flow and be small enough to prevent crutches or wheels from getting stuck, and pathways should be well-lit for visibility, (Hong Kong SAR Government, 2013).

### **2.2.3.3 Entrances and Exits**

1. Entrances should be located in prominent, easily noticeable areas and be marked in a distinctive, welcoming manner.
2. Provide effective lighting to ensure entrances are clearly visible.
3. Ensure entrances do not intersect with vehicular traffic for safety.
4. Entrances and exits should be on level ground to accommodate the widest range of users.

#### **2.2.3.4 Doors Configuration**

1. Doors should be prominently located with ample space for easy access.
2. Doors should be designed for easy operation.
3. Doors intended for wheelchair access should have a level landing area beyond the door swing.
4. The entrances should have doorways that are sufficiently wide (at least 1000mm) to facilitate easy wheelchair passage. (Alfa & Medayese, 2019)



Plate 2.4: Double Swing Double Acting Door.

Source: (Agency, 2019).

#### **2.2.3.5 Ramps and Sloping Grounds**

1. Ramps and sloping grounds should have the gentlest possible gradients and be straight whenever feasible.
2. If winding ramps or slopes are necessary, ensure large turning radii, ample turning space, and avoid sharp or steep turns.
3. Provide sufficient intermediate landings for rest, ideally with chairs or benches, and continuous handrails at two mounting levels for assisted walking.
4. Ensure channel grating slots are perpendicular to the traffic direction and small enough to avoid trapping crutches or wheels, and ensure effective lighting or footlights for visibility. (Design Considerations 5, 2019)



Plate 2.5: Ramp as Accessible Component.

Source: (Design Considerations 5, 2019)

#### **2.2.3.6 Stairs and Steps**

1. Handrails should be installed on both sides of stairs, with central handrails for excessively wide stairs, and intermediate landings with chairs should be available for rest, especially on long staircases.
2. Warning signs should be placed at appropriate distances before the first and last steps, and each step in a flight should have consistent tread width and riser height.

3. Step nosings should be in contrasting colors to the treads and risers for visibility, and effective lighting or footlights should ensure every step is clearly visible without causing glare or shadows.
4. Staircases with headroom less than 2000mm should have guardrails or barriers to prevent people from walking under them. (Alfa & Medayese, 2019)

### 2.2.3.7 Lifts and ancillary facilities

Lift installations are designed with accessibility features, including:

1. Wheelchair signs and high and low button panels.
2. Braille signs at call buttons and contrasting color braille floor numbering signs at landing door jambs.
3. Audio announcements and visual plasma display information inside the lifts for the visually and hearing impaired.
4. Mirror or high reflective wall surfaces should be avoided to reduce hallucination. (Hong Kong SAR Government, 2013)

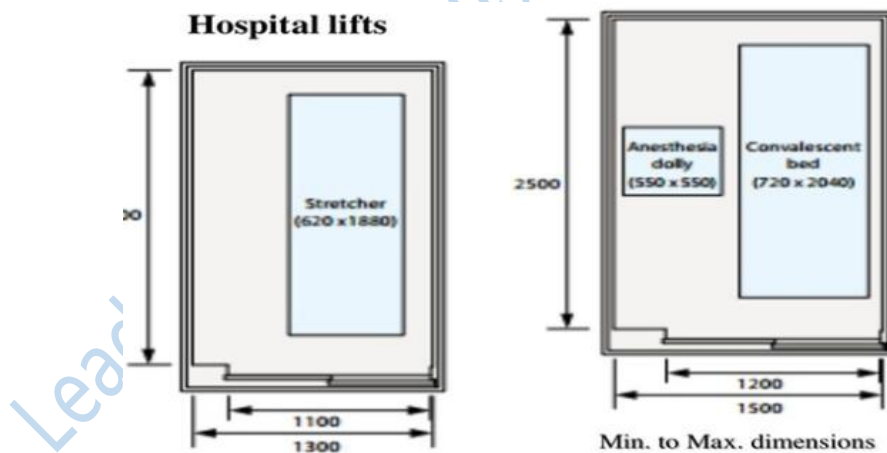


Plate 2.6: Lift Configuration for Accessibility.

Source:(Design Considerations 5, 2019)

### **2.2.3.8 Accessible Toilets**

#### **Special features in accessible toilet design:**

1. The floor surface material must be non-slippery, easy to clean, and should not trap dirt or water, with effective drainage to keep the floor dry. Drain covers should be flush with the floor to prevent tripping.
2. Cubicle locks should be easy to operate without requiring strong finger force.
3. Basins should include counters or flat surfaces for placing items, with notches at the edges to hold walking sticks and umbrellas.
4. Soap dispensers should be within reach for both tall and short individuals, and hand dryers should be positioned to avoid obstruction or posing a hazard. (Ab Rahman et al., 2018)

#### **Provisions for visually impaired persons:**

1. A braille map at the entrance wall of the toilet is useful for indicating the locations of basins, cubicles, urinals, hand dryers, and exits.
2. Guidance features should be provided to help visually impaired persons navigate out of the toilet.
3. At least one urinal should be floor-mounted to facilitate tapping with a visually impaired person's foot or guiding stick.

#### **Provisions for persons of physical disability:**

1. Grab bars should be installed at one urinal, one basin, and inside one toilet cubicle.
2. At least one basin, mirror, and urinal should be mounted at a lower level for easier access.
3. Hand dryers for wheelchair users should protrude to provide knee space without causing obstruction.
4. Mirrors inside disabled toilets should be tilted towards the floor for use by wheelchair users. (Mau et al., 2019).



Plate 2.7: Accessible Toilets Grab Bars for Support

. Source: (Mau et al., 2019).

### 2.2.3.9 Accessible Car Parks

1. Disabled parking spaces should be located close to access points like lifts.
2. There should be a smooth and safe accessible route from disabled parking spaces to major facilities, entrances, or lift lobbies.
3. Disabled parking spaces should provide ample side space and headroom for wheelchair users to comfortably get in and out of the car, and to handle their wheelchairs. (Commission, 2006)

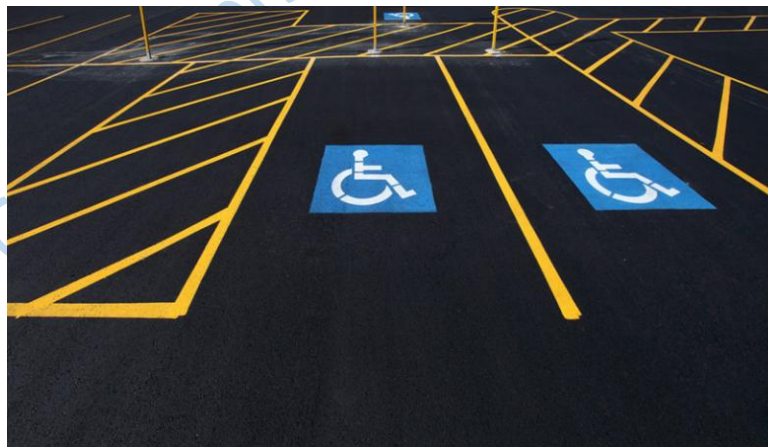


Plate 2.8: Disable Parking Marked Accessible Symbol.

Source: (Mau et al., 2019).

### **2.2.3.10 Materials for Floor and Surface Finishing**

The building and finishing materials must be durable, safe, clean, acoustically compatible, attractive and affordable. The flooring especially within the walkways, lobbies, out-patient department (OPD), halls and offices etc. must be Americans with Disabilities Act (ADA) compliant, (Kent, 2023).

#### **General Surface Requirements**

To meet Americans with Disabilities Act (ADA) standards, flooring must be firm, stable, slip-resistant, and level. Loose gravel, sand, cobblestone, or mud can pose a hazard to those using wheelchairs or other mobility devices.

#### **Gratings**

Certain areas like parking lots and sidewalks incorporate ground grates for water drainage. To ensure safety for individuals with mobility devices, these gratings should have openings no larger than half an inch in one direction. Any elongated openings should be oriented perpendicular to the main walking direction. Although grates serve an important function for drainage, they can pose hazards to pedestrians, (Kennon, & Harmon, 2022).

#### **Slip Resistance**

Friction between the ground and your shoe determines the level of slip resistance of a floor. OSHA recommends that the friction level is measured at a level of 0.5. Accessible surfaces should be slip-resistant to minimize possible risks or hazards to individuals with disabilities who use mobility aids, including canes or crutches, (Kennon, & Harmon, 2022).

**Surface Smoothness:** While friction is crucial for safety, the smoothness of the surface also matters. Rough surfaces like bricks, cobblestones, or rocks can be challenging for people with uneven gaits or mobility devices to navigate. Additionally, falls on such surfaces can be particularly painful, (Godsey, 2017).

## Uniform Level

When there are changes in floor level, specific standards must be observed for safety. For minimal level changes, such as a quarter of an inch, no special treatment is needed. However, for level changes between a quarter inch and larger, the Americans with Disabilities Act (ADA) has different requirements.

Combinations of floor finishes with different textures should be used to aid persons with vision impairments to identify and differentiate the various areas, and to warn them of approaching hazards. Avoid heavy patterns or textures on floor finishes and carpets. Glare index, coefficient of friction and acoustic properties of surfaces should be considered when choosing floor finishes.

Americans with Disabilities Act (ADA)-compliant flooring must be level, slip-resistant, and firm, maintaining its navigability regardless of environmental forces or external objects. When selecting flooring to ensure Americans with Disabilities Act (ADA) compliance and accessibility, consider the following top options:

- **Hardwood:** A timeless choice, hardwood combines style and long-lasting functionality.
- **Laminate:** This material is durable, easy to clean, and offers a beautiful appearance.
- **Ceramic:** Commonly used in bathrooms and kitchens, ceramic tiles are water-resistant and versatile enough for any area.
- **Vinyl:** Easy to install, vinyl is durable, water-resistant, and quick to replace.

These materials are excellent choices for creating an ADA-compliant and accessible space, (Clouse, Wood-Nartker, & Rice, 2020).

### 2.3 Empirical Review

Universal accessibility is the hallmark of an environmental design that enables all individuals to engage in activities independently, equitably, and inclusively. It seeks to create adaptable environments that offer equal access to buildings, services, resources, and activities. The United Nations' 2006 Convention on the Rights of Persons with Disabilities (CRPD) emphasizes this concept to enhance the lives of people with disabilities and promote social development across various life spheres, such as health, independence, education, employment, and housing, ensuring their inclusion, (Duman & Uzunoğlu, 2021).

The importance of universal accessibility is increasingly evident today due to societal changes, demographic shifts, and an aging population, leading to more people with disabilities in urban areas. Since the adoption of the United Nations' 2006 Convention on the Rights of Persons with Disabilities (CRPD), numerous countries have made strides in creating more accessible environments. Universal accessibility is pivotal for fostering social and economic participation, impacting quality of life, and sense of belonging, health, social inclusion, participation, and employment, (Guedes, 2024).

By promoting social participation, universal accessibility facilitates access to employment, decision-making, and diverse activities, aligning with the sociopolitical goal of improving community quality of life. Accessible environments benefit everyone, including the elderly with reduced mobility, parents with children in strollers, and tourists with luggage. Universal accessibility is essential across various aspects of citizens' lives, including public services, education, housing policies, leisure, healthcare, cultural, social and political participation, transportation, information, built environment, and territorial development., (Handy, 2020).

### 2.3.1 Diabetes and Sanatoriums

In parallel, sanatoriums have historically played a significant role in the management and treatment of diabetes example Kazakhstan Sanatorium, Karlovy Vary, Marianske Lazne spa and resort. These facilities provide specialized care, focusing on education, lifestyle modification, and medical interventions to help individuals effectively manage their condition. By providing a structured environment and access to multidisciplinary teams, sanatoriums aim to improve outcomes and quality of life for people living with diabetes. Understanding the fundamental concepts of diabetes and the role of sanatoriums is crucial for developing a comprehensive understanding of their relationship and significance in addressing this widespread health concern, (Hobday & Collignon, 2022) & (Mukhtar et al., 2020).

This review sets the stage for understanding the relationship between diabetes and the role of sanatoriums in its treatment. Diabetes is a chronic condition characterized by high levels of glucose in the blood, often due to the body's inability to produce or use insulin effectively. It affects millions of people worldwide, with both type 1 and type 2 diabetes presenting unique challenges for individuals and healthcare systems. The epidemiology of diabetes further outlines the prevalence, distribution, and impact of the disease, offering valuable insights into its global burden (Saha et al, 2020).

### 2.3.2 Challenges to Universal Accessibility in Design

1. **Inclusion vs. Equality:** While accessible features like ramps allow entry, they often force users to take separate paths, undermining the goal of equality. Universal accessibility solves this with features like no-step entries and automatic doors, offering equal access to all.
2. **Individual Burden:** People with disabilities must plan extensively for accessibility, contributing to social exclusion and higher depression rates. Universal accessibility eliminates this burden by

incorporating accessibility features into the initial design, enabling spontaneous and equal access. (Internet et al., 2017).

3. **Separate but Unequal Features:** Accessible features often create additional challenges, such as the physical effort required to use long ramps. Universal design integrates seamless, inclusive elements that benefit everyone, minimizing navigation obstacles.
4. **Limited Solutions:** Accessibility adaptations often address specific needs, requiring frequent modifications. Universal accessibility, with broad and inclusive features, reduces the need for changes and provides environments that cater to a wide range of abilities.
5. **Lack of Aesthetic Integration:** Accessible features are often less visually appealing, failing to consider the style preferences of people with disabilities. Universal design incorporates tasteful, attractive elements that enhance both functionality and aesthetics, offering equal and appealing options for all users.
6. **Perceived Increase in Costs:** The belief that universal design is significantly more expensive can be a barrier. If accessibility is added later rather than integrated from the start, it appears as an extra cost. Properly planned universal design need not be more expensive, but misconceptions about cost persist, particularly in housing where adaptable features can be more costly. Furthermore, universal accessibility makes use of larger spaces, which results in extra costs. (Bringolf, 2017).
7. **Waste of space;** in accessible design maximum spaces are needed for the passage of more two wheelchairs at a time especially in a public building. Maximum spaces are needed for wheelchairs turning and maneuvering. By considering all factors a larger spaces are used which appears to ordinary designer as wastage, (Guedes, 2024).

## Chapter Three

### Research Methodology-Case Studies

#### 3.1 Research Design

This chapter outlines the research on integrating the universal accessibility concept into sanatorium design. It covers the research methodology, types and sources of data, research population, sample design, data collection instruments, and data analysis methods.

##### Data collection instrument

To achieve the study's aims and objectives, specific data collection tools and analysis strategies are tailored to each objective. Objective one focuses on exploring sanatorium design concepts and characteristics using website articles, research journals, and published works. Objective two involves examining architectural considerations through website articles, research journals, and case studies. Objective three assesses how architectural design can enhance universal accessibility in sanatoriums, relying on research journals, articles on universal accessibility, and relevant case studies. Finally, objective four aims to design a sanatorium incorporating universal accessibility principles, utilizing case studies and design guidelines for data collection.

#### 3.2. Case Study Method

A case study constitutes a compilation of educational materials presenting real-life problems that necessitate either collective or individual efforts to seek solutions, aiming to elucidate the problem context using actual circumstances. Converting it into a situational task, followed by reflection and utilization of solution resources, is imperative (Kurbanova, A.Dj. Komilov, 2021). The case study methodology is important because it provides in-depth, contextualized insights into complex

phenomena, allows for the exploration of real-life situations in detail, and facilitates the use of multiple sources of evidence for a comprehensive understanding, (Rashid et al., 2019). Using case study method, the descriptive research approach was used in this study because it was the best fit for the project's goals. This method of analysis reveals what information is significant and correct in relation to the study topic or the problem of application findings facts in order to produce a fair and appropriate reduction. Visual inspection through pictures and analysis through literatures were used to conduct the research.

During the investigation, a simple random sampling method was used to randomly select six samples. The building types were carefully chosen, and a criteria schedule was applied consistently to all 6 samples. Table 3 depicts the sample size and location

Table 3.3: Sample size and location

Sample Size	Location
1. Rehab Cairo, Rehabilitation Center and Resort	Cairo, Egypt
2. Steno Diabetes Centre Copenhagen (SDCC)	Denmark, Europe
3. Kazakhstan Sanatorium	Essentuki, Russia
4. Barbara Davis Center for Childhood Diabetes	Aurora, United States
5. Sanatorium Perla Baltyku	Kołobrzeg, Poland
6. The House of Disabled People's Organisations	Blekinge Boulevard, Denmark

Source: (Author's Work)

### 3.2.1. Case Studies Selection Criteria

- i The Rehab Cairo, Rehabilitation Center and Resort was selected because of its site zoning, medical and rehab facilities, and sustainable practices.

- ii Steno Diabetes Centre Copenhagen (SDCC) selection criteria lies in its contemporary architectural style building materials, accessibility components, and sustainable practices.
- iii Kazakhstan Sanatorium was selected because of the sanatorium regimen and accessibility features.
- iv Barbara Davis Center for Childhood Diabetes was selected for the study of medical facilities outdoor accessibility features.
- v Sanatorium Perla Baltyku prioritize the integration of natural elements and thoughtful environmental design to enhance the healing process,
- vi The House of Disabled People's Organisations (HDPO) serves as a compelling example of how universal design principles can be effectively implemented in architectural practice. Located in different regions, it stands as a prominent real-life demonstration of accessible building design. Here's a comprehensive description of how HDPO fulfills universal design considerations:

### **3.3. Case Studies Indicators Analysis**

The indicators are divided into six that were derived from literature review on architectural considerations for sanatorium design and architectural design consideration for universal accessibility improvement. These indicators will be used to appraise each case study except the house of disabled peoples' organisation which serves as one of the design guides to this study. Based on the aforementioned, the following indicators are examined:

- 1) universal accessibility components
- 2) Flexibility
- 3) sustainability,
- 4) therapeutic landscape,

- 5) Medical facilities
- 6) therapeutic facilities,

### 3.3.1 Case Study 1: Rehab Cairo, Rehabilitation Center and Resort

#### A) Description of Building

Location:	Administrative Capital - Cairo –Egypt
Building Typology:	Medical Centre & Resort Health
Building Style:	Postmodernism
Building materials:	Stone & Wood & Glass
The Site Area:	217,350 SQM

Rehab Cairo is a facility and retreat focused on movement and psychological rehabilitation, catering to individuals of various ages who have suffered from sports injuries or accidents resulting in partial or total loss of mobility. It is a comprehensive medical-sports initiative.



Plate 3.9: Site Layout of Rehab-Cairo, Rehabilitation Centre and Resort.

Source: (Archdaily.Com)

The landscape design concept is stripped backbone components; vertebrate, spinal cord and nerves, so the units of the villas were distributed as vertebrate, and the spinal cord is represented in the main path,

the linker of all elements of the project that connects the length of the project, and the sub-paths, the nerves of the project that connect the villas with movement activities.

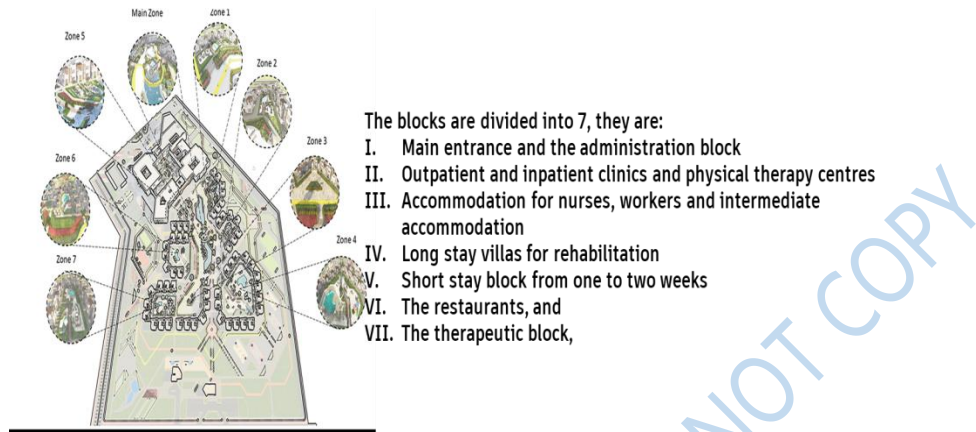


Plate 3.10: Different Zones in The Site Layout In Rehab-Cairo, Rehabilitation Centre And Resort.

Source: (Archdaily.Com)



Plate 3.11: A Part of Floor Plan In Rehab-Cairo, Rehabilitation And Resort.

Source: (Archdaily.Com)

The building form is based on the concept of Arab building forms where the idea of the cool courtyard is relied upon.



Plate3.12: Front View of Rehab-Cairo Rehabilitation Centre And Resort.

Source: (Archdaily.Com).

## **B) Building Appraisal and indicators Analysis**

**1) universal accessibility components:** The universal accessibility components in Rehab Cairo, Rehabilitation Center and Resort include:

- a) Features such as ramps, elevators, and wide corridors for wheelchair users.
- b) Clear Wayfinding: Signage with clear visuals and tactile elements for navigation by visually impaired individuals. This can be seen in plate 44 below how different hues of colour used to landscape the walkways and paths to make it accessible.
- c) Considerations for lighting, and space layout to accommodate sensory needs. Transparent walls are used in work areas to allow outside light to flow in and to aid accessibility within the enclosed spaces.
- d) Material usage: for exterior landscape, seamless concrete paving are used the interior floor finishes are made of wood for acoustic uses, mosaic stone which is non-slippery material which are universal accessible compliant. The walls are glazed to allow in natural light for comfort.



Plate 3.13: 3 Dimensional View of Rehab-Cairo Rehabilitation Centre and Resort.

Source: (Archdaily.Com).

- 2) **Flexibility**; ensures that buildings remain functional and relevant, accommodating the changing needs of occupants and technological advancements. The design employs Modular Layouts: Using movable walls and partitions that allow for reconfiguration of spaces, planning for potential future expansions or contractions without disrupting the existing structure, and choosing materials and components that are long-lasting and can be reused or repurposed such natural wood and stone for façade.

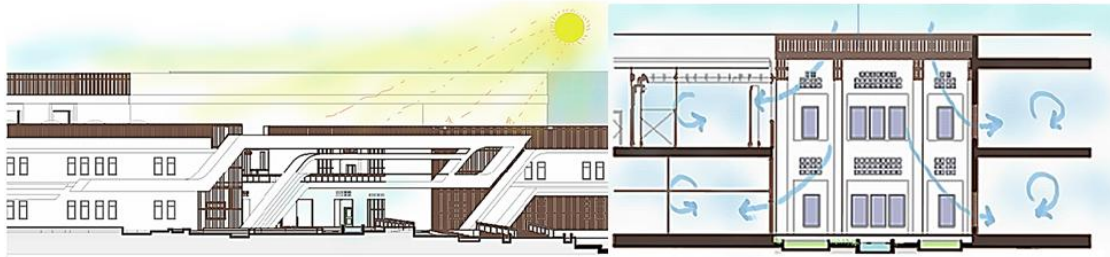


Plate 3.14: Elevation of Rehab-Cairo Rehabilitation Centre and Resort.

Source: (Archdaily.Com)

- 3) **Sustainability**: there is incorporation of sustainability through biophilic practices, with use of natural vegetation.

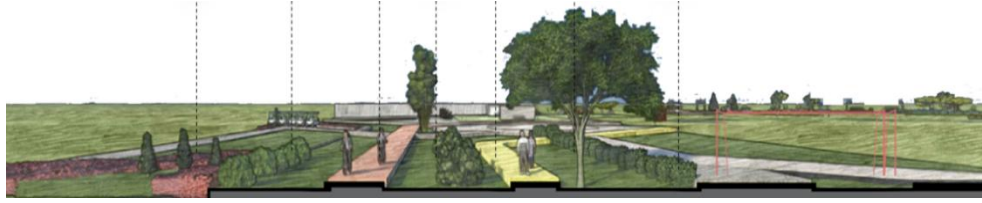


Plate 3.15: Sustainable Features Used In Rehab-Cairo Rehabilitation Centre and Resort.

Source: (Archdaily.Com).

- 4) **Therapeutic landscape:** the therapeutic landscape at rehab Cairo, rehabilitation center and resort are outdoor therapy spaces, healing gardens, walking paths, water features, and rest areas thoughtfully planned outdoor spaces. These elements work together to create a holistic environment that supports physical, mental, and emotional recovery, enhancing the overall therapeutic experience for patients.
- 5) **Medical facilities:** they are Out-patient and Inpatient Clinics which are located at zone two of the site layout. See Plate 9
- 6) **Therapeutic facilities:** there is a therapeutic block, which is the highest of the blocks of the buildings, contains swimming pools and recreational elements, oriented south to obtain the greatest amount of natural lighting which is zone 7. Recreational areas and programs designed to be inclusive and accessible to all guests, regardless of physical ability.

### 3.3.2: Case Study 2: Steno Diabetes Centre Copenhagen (SDCC)

#### A) Description of the Building

Location: Herlev Hospital, Borgmester Ib Juuls Vej 83, DK-2730 Herlev, Denmark

Building type: Public building

Site Area: 18200 Sq. M.

Program / Use / Building Function: Diabetes Hospital

Name of the Architect: Rikke Steinicke, Lotte Bigom-Eriksen

Name of the Owner: HOSPITAL HERLEV, DENMARK

Built up area (Inc. non FAR): 46,025 SQ. M.

Ground Coverage: Height of the Building: 35%

Height of the Building: 23M

Year: 2017

The Steno Diabetes Centre Copenhagen (SDCC) exhibits a contemporary architectural style characterized by its functional and minimalist design. The center features clean lines, ample natural light, and spacious interiors aimed at fostering a welcoming and conducive environment for patients.



Plate 3.16: Site Layout of Steno Diabetes Centre Copenhagen.

Source: (Archdaily.Com)



Plate 3.17: Floor Plans of Steno Diabetes Centre Copenhagen.

Source: (Archdaily.Com)

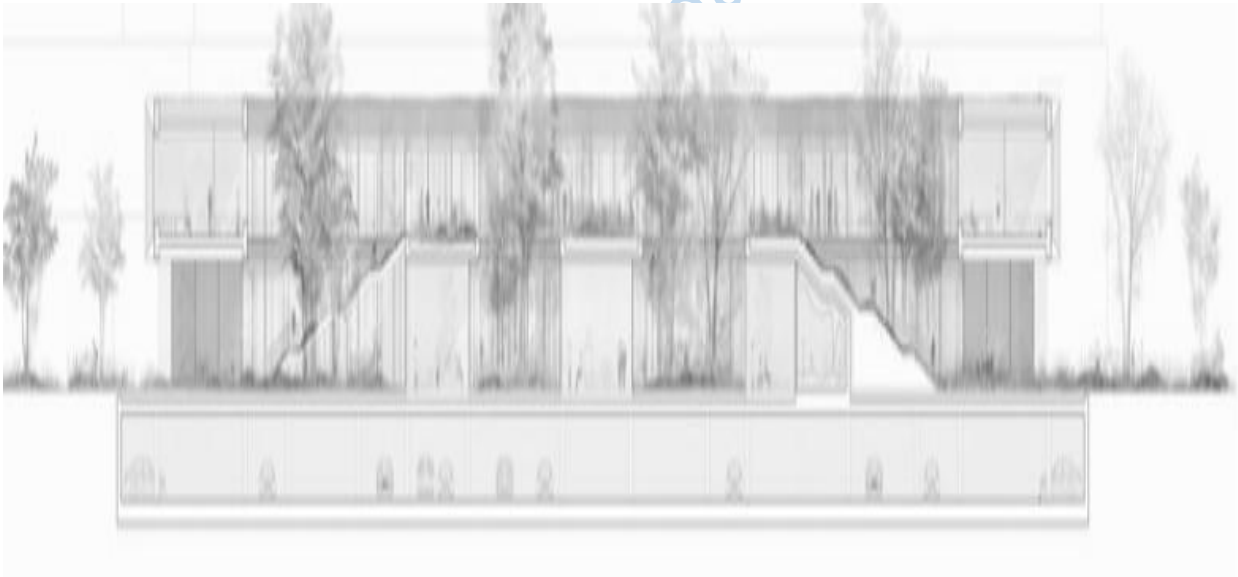


Plate 3.18: Elevation Of Steno Diabetes Centre Copenhagen.

Source: (Archdaily.Com)



Plate 3.19: 3 Dimension View of Steno Diabetes Centre Copenhagen

. Source: (Archdaily.Com).

## B) Building Appraisal and indicators Analysis

- 1) **Universal Accessibility:** SDCC's design prioritizes ease of navigation for patients with mobility. Visitors who arrive by car can use the SDCC building's underground car park with 241 spaces where 20% are accessible parking or the spacious parking lot by the main entrance. Some universal accessibility components used is ramps, wide corridors and pathways, lifts, steps, accessible toilets, and handicap doors.



Plate 3.20: Pictures Showing Ramp and Wide Corridor As Accessibility Component In Steno Diabetes Centre, Copenhagen-

Source: (Archdaily.Com)

**Natural Light:** The large windows are made of glass for continuation of outdoor spaces to improve user's experience. Abundant natural light and access to outdoor green spaces contribute to a healing environment and to aid sensory compatibility which is part of U.A. goals. The various materials are large windows are made of glass for continuation of outdoor spaces to improve users experience. The floor finish is thermo-wood, and ceramic suitable for wheelchair access.



Plate 3.21: Pictures Showing the Use of Glasses For Daylight Capture In The Interior Spaces.

Source: (Archdaily.Com)

- 2) **Sustainability:** SDCC employs sustainable building practices to minimize environmental impact and enhance indoor air quality through the use of green spaces such as court yards and roof top lounge, to reduce excess heat.



Plate 3.22: Showing the Use of Natural Vegetation As Biophilic Element For Sustainability.

Source: (Archdaily.Com)

- 3) **Lacks Flexibility:** The architectural layout of SDCC may not provide sufficient flexibility to accommodate future expansions or modifications to meet changing healthcare demands. Designing a diabetes sanatorium based on SDCC's design may encounter constraints related to available space and scalability.



Plate 3.23: Showing the Ariel View of Site Layout Steno Diabetes Centre, Copenhagen.

Source: (Archdaily.Com)

- 4) **Therapeutic Landscape:** at Steno Diabetes Center is meticulously designed to support the holistic well-being of patients through the integration of natural elements and thoughtfully curated outdoor spaces. They are healing gardens and therapeutic walking paths



Plate 3.24: Showing Roof Top Lounge and Therapeutic Landscape in Steno Diabetes Centre  
Copenhagen.

Source: (Archdaily.Com)

- 5) **Medical Facilities:** Steno Diabetes Center is renowned for its comprehensive approach to diabetes care and research. The medical facilities at Steno Diabetes Center typically are: Diabetes Clinics, Rehabilitation Services, Diagnostic Services, Endocrinology Services, Patient Education Programs, Inpatient and Outpatient Care, Nutrition Counseling, Foot Care Clinics, Eye Care Services, Mental Health Support, and Research Facilities. These facilities work together to provide comprehensive, multidisciplinary care aimed at improving the quality of life for individuals living with diabetes.
- 6) **Therapeutic Facilities:** The structure features a spacious two-story garden, six smaller courtyards and a public rooftop garden, with anodised aluminium façade frames featuring large glass sections that blur indoor-outdoor boundaries.

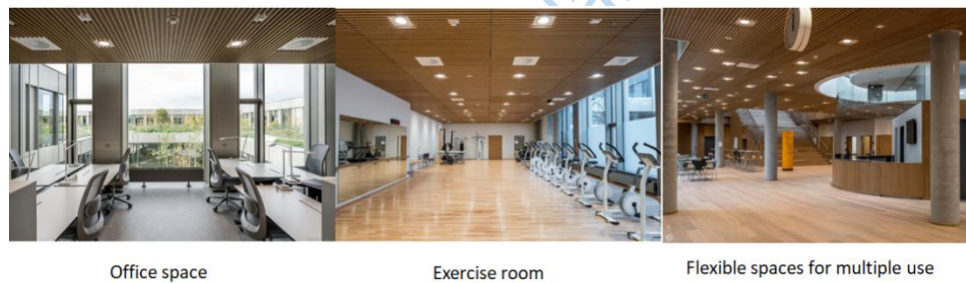


Plate 3.25: Showing the Interior Of Steno Diabetes Centre, Copenhagen.

Source: (Archdaily.Com)

### 3.3.3 Case Study 3: Kazakhstan Sanatoriums

#### A). Building Description

Location:                      Pyatigorskaya St., 44, Essentuki, Stavropol region, 357600 Russia

Building Typology:                      Spa & Health Resort

Building Style:                      modernism

Building materials: Brick, Concrete, & Glass

The Site Area: 117,350 SQM

Year: 2012



Plate 3.26: Aerial View of Site Layout, Kazakhstan Sanatorium.

Source: (Archdaily.Com).

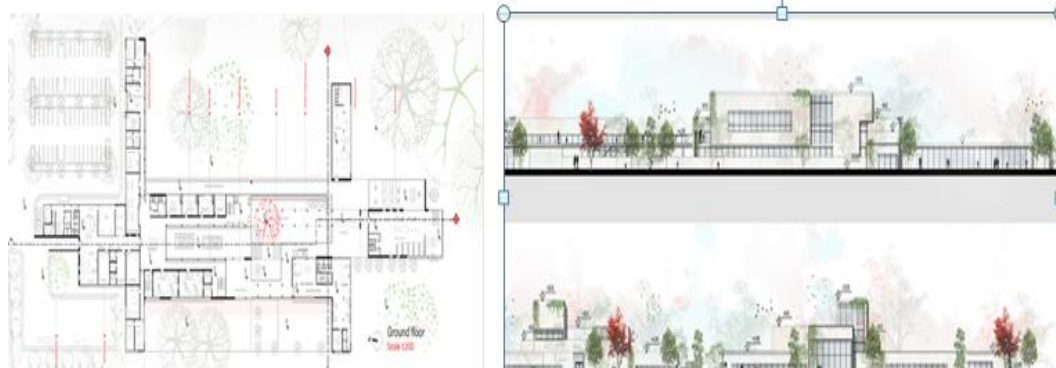


Plate 3.27: Showing Floor Plan and Elevations.

Source: (Archdaily.Com).

Kazakhstan's sanatorium architecture blends modern functionality with influences from traditional Kazakh design and contemporary international styles. They often incorporate elements that reflect the natural surroundings, such as expansive windows for natural light and views, and open spaces that

promote relaxation and well-being. The architecture aims to create a serene and healing environment while incorporating sustainable practices and modern amenities to enhance the overall patient experience.

## **B) Building Appraisal and indicators Analysis**

- 1) **Universal Accessibility:** the only noticeable accessibility components used are wide passage ways, colour usage for columns to be clearly seen by visually impaired persons. The colour red was use. The building does comply with universal accessibility rules, because ramp was used, handicap parking spaces, special doors; the corridors have no wall projections that may be access barrier to those who are mobility impaired. The glass windows are large which allow in adequate daylighting.



Plate 3.28: Showing Ramps as Accessibility Component, Kazakhstan Sanatorium

. Source: (Archdaily.Com)

- 2) **Sustainability:** this is seen in this case study through the use of vast green areas to lessen the impact of the buildings in the environment. The use of durable and easy-to-maintain materials ensures the building's longevity and functionality.
- 3) **Flexibility:** the Building design is flexible in such that there are spaces for future expansion and the use of scalability for reuse of interior spaces.

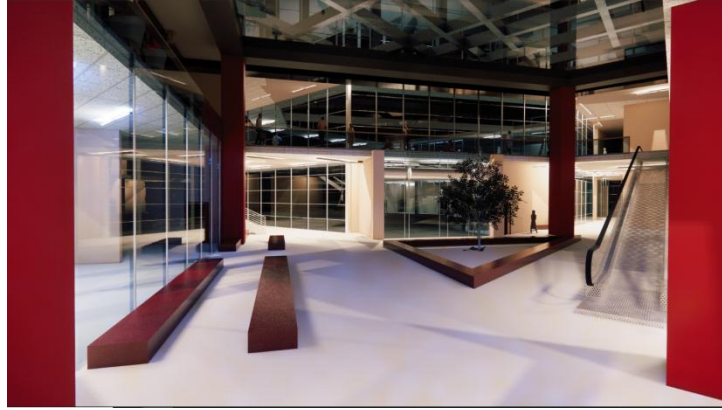


Plate 3.29: Showing Interior Space in Kazakhstan Sanatorium.

Source: (Archdaily.Com)

- 4) Therapeutic Landscape: The sanatorium is situated in a serene environment, with landscaped gardens and walking paths that encourage outdoor activities and relaxation. The sanatorium is strategically oriented to maximize natural light and sun exposure, crucial for patient's treatment.
- 5) Medical Facilities: Sanatoriums in Kazakhstan offer a holistic approach to healthcare, blending traditional and modern medical practices. They are equipped with advanced medical technology and staffed by specialized professionals, particularly in fields like endocrinology for diabetes care
- 6) Therapeutic Facilities: The clinic includes specialized therapeutic facilities such as exercise rooms, therapy pools, and relaxation areas



Plate 3.30: Showing a Part of 3 Dimension View of Kazakhstan Sanatorium.

Source: (Archdaily.Com)



Plate 3.31: Showing Therapeutic Interior Space, Kazakhstan Sanatorium

. Source: (Archdaily.Com)

### 3.3.4 Case Study 4: Barbara Davis Center for Childhood Diabetes

#### A) Description of the Building

Location: 775 Aurora Ct # A140, Aurora, CO 80045, United States.

Building Typology: Health Facility

Building Style: modernism

Building materials: Concrete & Glass

Architect: Anderson Mason Dale Architects.

Year: 2005

The Site Area: 110,000 square meters

The center is renowned for its expertise in diabetes research, education, and patient care. The architectural design of the center likely reflects a welcoming and patient-centered approach, with modern amenities and facilities to cater to the unique needs of children with diabetes and their families.



Plate 3.32: 3 D view of Barbara Davis Centre for Diabetes.

Source; (CU Medicine,2024)



Plate 3.33: Showing Wide Corridors in Barbara Davis Centre For Childhood Diabetes.

Source; (CU Medicine,2024)



Plate 3.34: Exterior Space Showing Handicap Parking Space in Barbara Davis Centre for Childhood Diabetes.

Source; (CU Medicine,2024).

## B) Building Appraisal and indicators Analysis

- 1) **Accessibility:** The architectural design prioritizes accessibility, incorporating safety measures like fire alarms, emergency exits, and clear wayfinding signage for the safety of patients, staff, and visitors during emergencies. Accessible features such as parking spaces, entrances, and elevators are provided to accommodate patients with mobility challenges and families with strollers. Wide corridors and doorways throughout the facility ensure easy movement for all users.
- 2) **Therapeutic Facilities:** The architecture likely incorporates playful and colorful elements to create a child-friendly environment. This could include themed decor, interactive play areas, and artwork designed to appeal to children and help reduce anxiety associated with medical visits. These also include a well-designed waiting area that prioritizes comfort and privacy for patients and their families. Comfortable seating, natural lighting, and amenities such as water fountains and restrooms would contribute to a positive patient experience.
- 3) **Lacks flexibility:** The center may lack facilities tailored specifically to the needs of adult patients with diabetes, and have limited capacity to accommodate a large number of patients or provide

extensive inpatient services, as it primarily focuses on outpatient care and research. Design elements optimized for outpatient care may not meet the needs of patients requiring long-term hospitalization in sanatorium.

4) **Medical Facilities:** there are medical facilities such as out-patient and inpatient facilities, and other medical support services.

5) Lacks visible Sustainable Practices

6) Lacks Therapeutic Landscape

### 3.3.5 Case study 5: Sanatorium Perla Baltyku

#### A) Description of the Building

Location: Sikorskiego 3, 78-100 Kołobrzeg, Poland,

Building Typology: Medical spa & Resort Health

Building materials: Concrete & Glass

The Site Area: 300,350 SQM

Sanatorium Perla Baltyku, is a twelve-story high-rise building nestled in a coastal park. With 523 beds available in single, double, and triple rooms, each equipped with TVs and telephones, the institution offers comfortable accommodation options. Additionally, it features a dining area and panoramic views. Moreover, Sanatorium Perla Baltyku provides therapeutic facilities tailored for respiratory, kinetic system, and cardiac disorders, ensuring comprehensive care for its guests.



Plate 3.35: Showing The Vicinity Of Sanatorium Perla Baltyku Overlooking the Sea.

Source: (Sanatoriums.Com. N.D.)

## B) Building Appraisal and indicators Analysis

- 1) **Sustainability:** with features such as spacious balconies or terraces overlooking the Baltic Sea. The building may have a modern and functional layout, with large windows to maximize natural light and views of the surrounding landscape.



Plate 3.36: Showing Therapeutic Landscape of Sanatorium Perla Baltyku.

Source: (Sanatoriums.Com. N.D.)



Plate 3.37: Showing Interior Space of Sanatorium Perla Baltyku.

Source: (Sanatoriums.Com. N.D.)



Plate3. 38: Nutrition and Culinary Area inside Sanatorium Perla Baltyku

Source: (Sanatoriums.Com. N.D.)

- 2) **Therapeutic Landscape:** Sanatoriums often feature tranquil surroundings, such as natural landscapes, gardens, or views of scenic areas. These elements contribute to a peaceful and healing atmosphere for patients. access to outdoor recreational spaces, it could positively impact the overall well-being of diabetes patients who may benefit from activities such as walking or gardening for diabetes management.
- 3) **Accessibility:** Prioritizing accessibility ensures inclusivity for all patients. Maximizing natural light enhances mood, productivity, and patient outcomes.

- 4) **Therapeutic Facilities:** Sanatoriums may include specialized treatment facilities such as therapy rooms, rehabilitation centers, hydrotherapy pools, and exercise rooms. These facilities support the various medical and therapeutic interventions provided to patients.

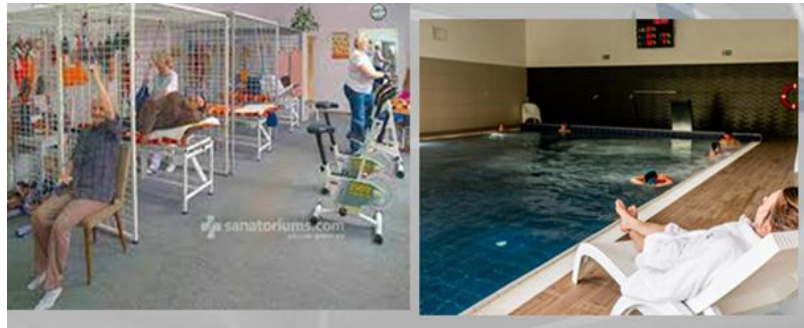


Plate 3.39: Showing Therapeutic Facilities in Sanatorium Perla Baltyku.

Source: (Sanatoriums.Com. N.D.)

- 5) **Flexible Spaces:** Adaptable spaces accommodate changing healthcare needs efficiently.
- 6) **Lacks Comprehensive Medical Facilities:** Sanatoriums typically have a layout optimized for patient care, with separate areas for treatment, rehabilitation, and relaxation.

### 3.3.6 Case Study 6: The House of Disabled People's Organisations

#### A) Building Description

Location: Blekinge Boulevard, 2630 Taastrup, Denmark

Building Typology: Administrative Building

Building Style: Contemporary

Building materials: Concrete, Aluminium & Glass

Architect: Cubo + Force4,

The Site Area: 12,600 square meters,

The architects aimed to create 'The World's Most Accessible Office Building.' With high ambitions and a complex task at hand, the project prioritized intense user involvement and a new strategic approach. These efforts were deemed essential in realizing the goal of constructing a building that sets the standard for accessibility on a global scale.



Plate 3.40: 3d- House of Disable People Organisation.

Source: (Archdaily.Com)

### Universal Accessibility Features

#### 1) Accessibility in Structure and Layout:

**Entrances and Exits:** HDPO ensures multiple accessible entrances equipped with ramps or lifts to accommodate wheelchair users and individuals with mobility aids.

**Clear Pathways:** Wide corridors and doorways throughout the building facilitate easy movement and navigation for people with various mobility needs.

**Emergency Exits:** Clear signage and accessible routes to emergency exits ensure the safety of all occupants during emergencies.



Plate 3.41: Showing Ramp in the Courtyard as Accessibility Components in House Of Disabled Organisation.

Source: (Archdaily.Com)

## 2) Adaptive Technology and Equipment:

**Assistive Devices:** The building incorporates assistive technologies such as accessible elevators with tactile buttons, hearing loops in meeting rooms, and adjustable height desks to cater to diverse user needs.

**Smart Technology:** Use of smart technology to control lighting, heating, and ventilation systems in a user-friendly manner.



Plate 3.42: Showing Adaptive Elements in House of Disabled People's Organisation.

Source: (Archdaily.Com)

### 3) Interior Design Considerations:

**Color and Contrast:** Interior spaces are designed with contrasting colors on walls, floors, and furnishings to aid individuals with visual impairments in wayfinding and orientation.

**Furniture and Fixtures:** Ergonomically designed furniture and fixtures ensure comfort and ease of use for all users, including those with physical disabilities.



Plate 3.43: Showing the Use of Colour Contrast in Interior Spaces in House of Disabled People's Organisation.

Source: (Archdaily.Com)

### 4) Amenities and Facilities:

**Restrooms:** Accessible restrooms equipped with grab bars, lowered sinks, and accessible toilet facilities meet the needs of individuals with mobility challenges.

**Kitchen Facilities:** Inclusive kitchen facilities with adjustable countertops and accessible appliances allow for independent use by people of all abilities.

### 5) Environmental Considerations:

**Natural Lighting:** Maximizing natural light throughout the building reduces reliance on artificial lighting, benefiting users with visual impairments and creating a more inviting atmosphere.

**Acoustic Control:** Sound-absorbing materials and acoustic design principles minimize noise levels, enhancing the comfort and usability of spaces for individuals with hearing impairments.

#### 6) Outdoor Spaces:

**Accessible Pathways:** Accessible pathways and outdoor areas ensure that the building is fully integrated into its surrounding environment, promoting inclusivity and engagement with nature.



Plate 3.44: Site Layout Showing Handicap Parking Spaces in House of Disable People's Organisation.

Source: (Archdaily.Com)

#### 7) User-Centric Approach

**Consultation and Feedback:** HDPO incorporates user feedback and consultation from disabled people's organizations in the design process to ensure that the building meets the actual needs and preferences of its diverse user base.

**Training and Awareness:** Ongoing training programs for staff and users alike promote awareness and understanding of accessibility features and encourage respectful interaction within the facility.

## 8) Community Impact

**Advocacy Hub:** Beyond its physical design, HDPO serves as a hub for disability rights advocacy and community engagement, fostering inclusivity and empowerment among its users and the broader community.

**Educational Resource:** The building's design and functionality serve as an educational resource for architects, designers, and policymakers interested in promoting universal design principles in future projects.

The House of Disabled People's Organisations exemplifies a successful integration of universal design principles, ensuring equitable access and usability for all individuals, regardless of ability or disability. By prioritizing inclusivity from design inception through implementation and operation, HDPO sets a benchmark for accessible building design in real-world applications.

### 3.6 Summary of Case Studies Findings and Deductions

The bar chart illustrates the degree of adoption of various design aspects among different case studies, rated on a scale where 9-7 is excellent, 6-5 is good, and 4-0 is poor.

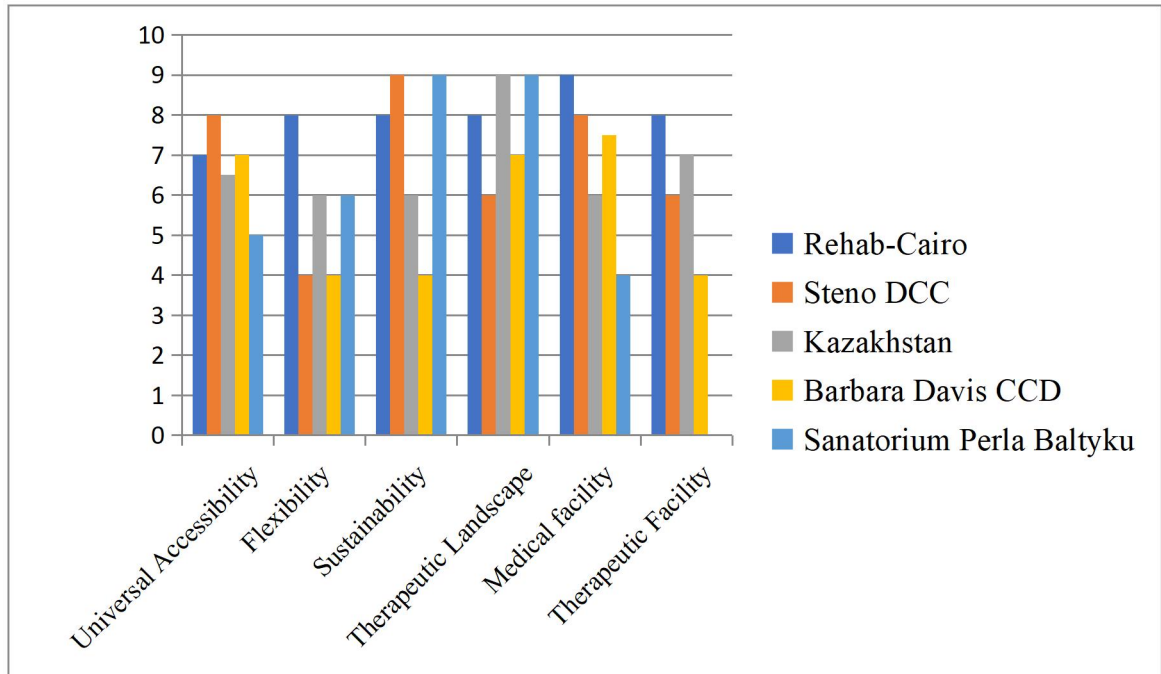


Figure 3.3: Showing the Degree of Case Studies' Integration of Indicators

Source: (Author's Work)

Rehab Cairo, Rehabilitation Center and Resort and Steno Diabetes Centre Copenhagen (SDCC) consistently demonstrate high scores, particularly in universal accessibility, flexibility, and therapeutic facilities. Kazakhstan Sanatorium shows notable excellence in sustainability and medical facilities, while Barbara Davis Center for Childhood Diabetes excels in therapeutic landscapes and therapeutic facilities. Sanatorium Perla Baltyku exhibits moderate to low scores across most categories, indicating areas for improvement. Overall, the chart reveals variability in the adoption of these design aspects, highlighting strengths and areas needing enhancement among the case studies.



#### 4.1.1 Site Location

The proposed site is at Ikeko-Ogbe, Ubiaja, Edo State, which is located on the hill overlooking a Cliff with spring water that supplies Ubiaja town fresh water close to the local government secretariat in Ubiaja. This is a strong and good advantage for the proposed development. The choice of Ubiaja for the diabetes sanatorium is significant due to its role as a regional center, good climate, offering vital healthcare services to surrounding communities and addressing the rising prevalence of diabetes. The town's infrastructure, coupled with its supportive community, makes it an ideal location for this essential healthcare facility. Its coordinates are  $6^{\circ} 38' 32.1''\text{N}$  E and latitude  $6^{\circ} 23' 24''\text{N}$  with Site Elevation 221m.

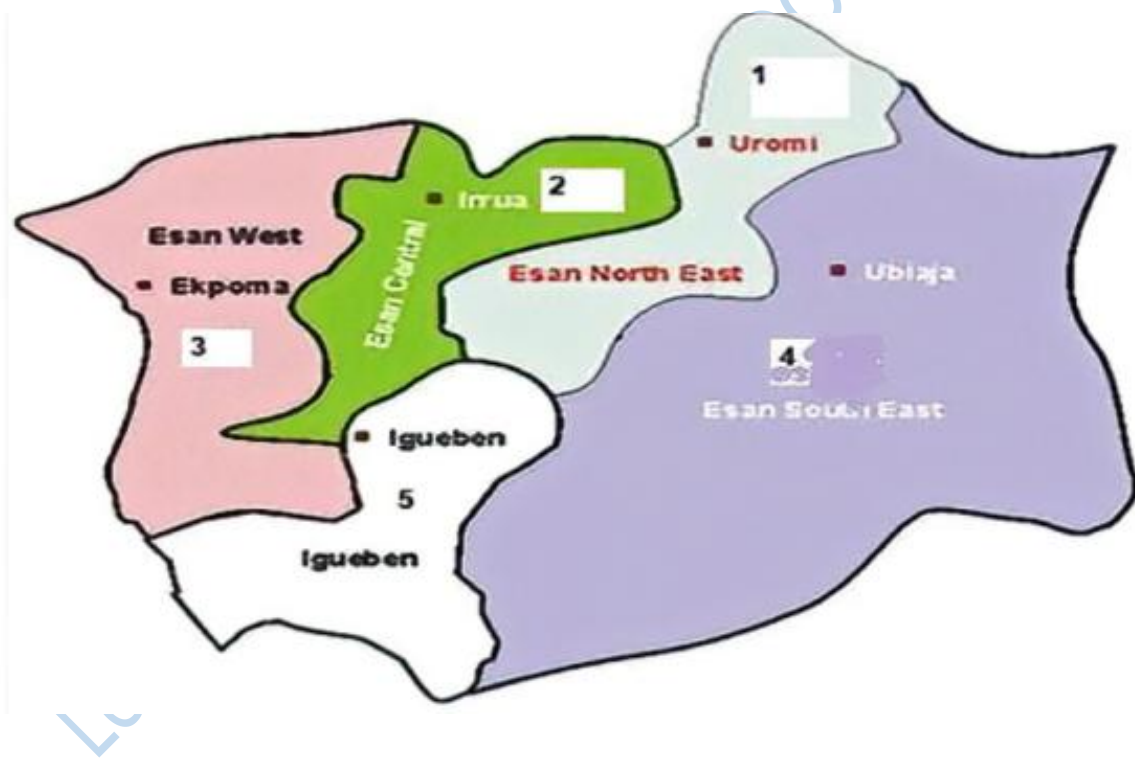


Figure 4.5: Map of Esan Land Showing Esan South East LGA, Ubiaja.

Source: (Google Search, 2024)



Figure 4.6; Site Location Map.

Source: (Google Search, 2024)

#### 4.1.2 Site Selection Criteria

Selecting a site for building a sanatorium involves several important criteria to ensure the facility is effective, accessible, and conducive to patient recovery. Such criteria are climate and weather condition, land use, proximity to other healthcare services and infrastructure, availability of public transport system, environmental quality, safety and security, community support inter alias.

##### 4.1.2.1 Climate and Weather

Ubiaja Generally has a mild and stable climate, free from extreme weather conditions; this ensures patient comfort throughout the year. The site boasts of adequate sunshine and fresh air to support overall health and recovery. The site is in a clean, pollution-free environment that supports health and well-being. It has a serene and quiet location, in a natural setting, that promote relaxation and recovery.

#### **4.1.2.2 Proximity to Infrastructure**

There is availability of essential utilities such as water, electricity, sewage, correctional facility and Police station. These are some of the services and infrastructure around the proposed site; electricity and water supply services, good road network, fire station, banks, and transportation terminals, among others. The site is in close proximity to other healthcare facilities for referrals and emergency services, such as general hospital Irrua specialist hospital branch. There is a good access to local markets, suppliers, and human resources to ensure smooth operations. Lastly, there is availability of staff accommodation and amenities around the proposed site.

#### **4.1.2.3 Land Use, Space and Zoning**

The proposed site has sufficient land area to accommodate the building, including outdoor spaces for recreation and therapeutic activities, and potential for future expansion if the need arises. Cost of land acquisition and construction in the area is very low which makes it easier to acquire large expanse of land. Following the land use zoning in the area that zone is in compliance with Edo land use zone and ordinance.

#### **4.1.2.4 Safety and Security**

Ubiaja has no record of crime rate and insecurity which makes the site a safe location with low crime rate to ensure the safety of patients, staff, and visitors to the sanatorium. It also has a close proximity police services for emergencies.

#### **4.1.2.5 Community Support**

The people of Ubiaja are welcoming and supportive which will enhance opportunities for community engagement and support networks for patients.

### 4.1.3 Site Analysis

There is a need to analysis the based base on physical, cultural, geological, acoustic, and climatic analysis visible and has influence on the site. These includes vegetation, access roads, topography, South-west and North-west trade wind, sun rise and sun path, Noise sources, soil type and aquifer, the economic activities of the people, wind direction and others. The site is shown in [plate 20 below](#) having area and perimeter of the site is 88568.971square metres, and 1212333.0metres respectively.



Figure 4.7: The Site Perimeter and Dimension.

Source: (Google Map, 2024)

#### 4.1. 3.1 The People's Socio-Economic Activities

Ubiaja is an agrarian community which belongs to rain forest according to geopolitical zone of the country. The people engage in a variety of socio-economic activities that are integral to the communities' livelihoods and overall well-being. Predominantly, agriculture forms the backbone of the

town's economies, with many individuals involved in farming crops, raising livestock, and participating in related activities such as fishing and forestry. These agricultural activities not only provide food and income but also sustain local markets and trade networks. In addition to farming, they often engage in small-scale artisanal work, such as weaving, carpentry, and tailoring contributing to both cultural preservation and economic diversity. Local service provision also plays a crucial role, with many residents working as teachers, healthcare workers, shopkeepers, and transportation providers. These services ensure that essential needs are met within the community. Furthermore, rural economies are often supplemented by microenterprise and small business ventures. Community cooperation and social networks are vital, as the dwellers frequently participate in communal activities, sharing resources and labor through practices like cooperative farming and collective maintenance of infrastructure. Overall, these socio-economic activities foster a sense of community, resilience, and self-sufficiency among the populations.

#### **4.1.3.2 The People's Cultural Value**

The Esan people of Ubiaja, located in Edo State, Nigeria, possess a rich cultural heritage deeply rooted in their customs, social structures, and traditional practices. Central to their cultural identity is the Esan language, which plays a vital role in daily communication and the transmission of traditions. The Esan community places a high value on extended family ties and respect for elders, who are revered for their wisdom and consulted on important matters. Traditional institutions, including the Onojie (king) and the Council of Elders, are pivotal in governance and the preservation of customs. Celebrations such as the Ihuen or Iruen Festival highlight their vibrant cultural expressions, featuring music, dance, and communal feasting. Spirituality is interwoven with daily life, with ancestor worship and traditional religious practices complementing the influence of Christianity. The Esan people are also known for their artistic craftsmanship in weaving, pottery, and carving, as well as their musical and dance

traditions that narrate historical events and social values. Core values such as honesty, integrity, hard work, and diligence are esteemed, alongside a rich culinary tradition that includes dishes like pounded yam and egusi soup. These cultural values and practices foster a strong sense of unity, identity, and continuity among the Esan people of Ubiaja.

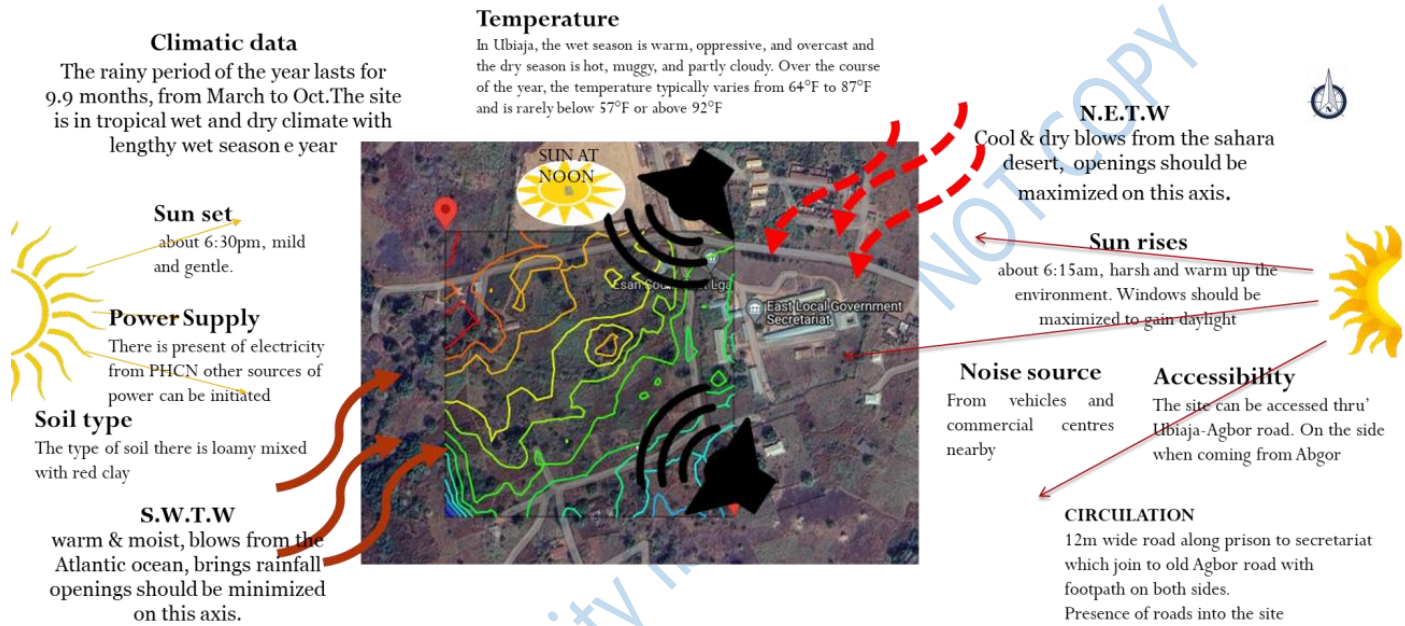


Figure 4.8: Site Analysis.

Source: (Google Map, 2024)

#### 4.1.3.3 Road and Accessibility

The site is about 300m away from the major road leading to Agbor from Ubiaja with other streets surrounding it, which makes transportation problem minima to the occupants and visitors of the facility. It has easy and convenient access for both vehicles and pedestrian. The main entrance to the site takes its route from a major road from the Ubiaja- Agbor road.

#### **4.1.3.4 Temperature**

Edo State is in the coastal zone according to Nigeria's climatic classification for architectural design. Ubiaja's climate is marked by high humidity and uncomfortable heat for eleven months each year. There's no need for heat conservation because the daily temperature variation exceeds 10 degrees, and the humidity remains high almost all year round. To address this, ventilation should be prioritized, especially along the north and south axes, and the use of compact courtyard. Since the maximum monthly temperature always stays above the comfort threshold, there are no specific measures needed to prevent cold discomfort.

#### **4.1.3.5 Wind Direction**

The northeast trade wind brings cold, dust, and harmattan, causing discomfort. In contrast, the southwest trade wind brings cool humidity, providing a comforting effect. Proper ventilation is an essential part of the building's effective design. The long sides of the building (east and west) are positioned to receive the maximum amount of air. The shorter sides of the proposed mall face the direction of the northeast trade wind. To solve the problem of driving rain, shading devices as balcony, roof overhang and trees to break its speed are used in the design.

#### **4.1.3.6 Acoustic**

The sources of noise into the site are majorly from vehicles on the access roads since the site is bounded by roads on three sides. Buffers can reduce noise from roads and other sources to levels that allow normal outdoor activities to occur. A 100-foot wide planted buffer will reduce noise by 5 to 8 decibels (DBA).

#### **4.1.3.7 Soil and Ground Cover of the Site**

The soil in Ubiaja is red and fertile, making it suitable for agricultural production. It also has a high load-bearing capacity. Given this, pad and strip foundations may be appropriate to support individual

point loads, such as columns, and to distribute a line of loads uniformly to the ground. The site has few trees, including two mango trees, and some sections are used as a cassava farm. Dominant weeds include spear grass and wild sunflowers. Ubiaja is situated within the tropics and experiences two distinct seasons: wet and dry. This climate supports a diverse range of vegetation, including thick undergrowth, short grasses, and evergreen trees in the immediate vicinity. Almost every 2 miles of land in Ubiaja is cultivated with either cash crops or arable crops. The ground cover consists of 46% cropland, 14% trees, 29% shrubs, and 11% grassland. Within 10 miles, the distribution is 45% cropland and 26% shrubs, and within 50 miles, it is 38% cropland and 27% shrubs. So the site is no exception.

#### 4.1.3.8 Average Rainfall and Precipitation

Situated at an elevation of 221 meters, the location receives 1,800 to 2,000 millimeters (71 to 79 inches) of annual rainfall, placing it in a rainforest region. Climatic graphs are available for every location on Earth, based on 30 years of hourly weather model simulations. These graphs offer reliable insights into typical climatic patterns and expected conditions, including temperature, precipitation, sunshine, and wind. The simulated weather data has a spatial resolution of approximately 30 km, which means some local weather phenomena, such as thunderstorms, local winds, or tornadoes, might not be accurately depicted.

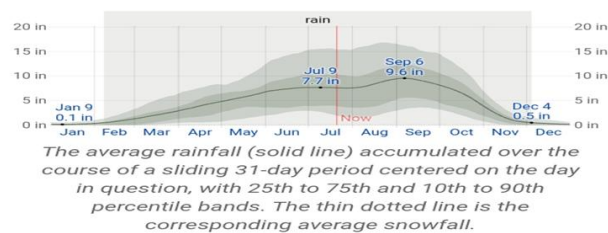


Figure 4.9: Average Rainfall and Precipitation of The Site.

Source: (Google Search, 2024)

### 4.1.3.9 Site Topography

With the analysis shown on the site Elevation profile, it appears that the site slopes towards the South-west direction of the site more than 6metres. There will be basement floor to take care of the gradient. Drainages will be channeled in place for water collection which will drains into the cliff after the westward part of the site.

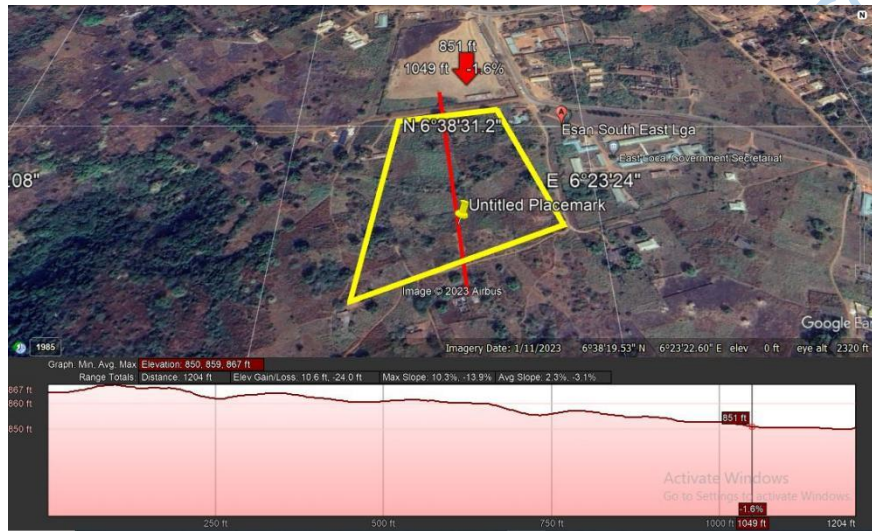


Figure 4.10: Site Elevation Section.

Source: (Google Map, 2024)

## 4.2 Brief Analysis and Design Realization

### 4.2.1 Design Brief

The meta-analysis found that the pooled diabetes mellitus prevalence (PDMP) in Nigeria is 5.77%, indicating that about 11.2 million Nigerians (or one in every 17 adults) have diabetes (Uloko et al., 2018). In Edo State, 24.6% of the population has diabetes, with 9.5% in urban areas and 15.1% in rural areas. This condition can lead to vision loss, confusion, foot ulcers, foot amputations, coma, cardiac

attacks, kidney and liver diseases, several forms of disabilities-permanent, temporal, and situational disabilities, and even death.

To mitigate the effects mentioned above, there is a need to design a state-of-the-art diabetes sanatorium to address the rising prevalence of diabetes in the state that incorporates universal accessibility considerations. The facility will provide comprehensive health care, education, rehabilitation, and support to individuals with diabetes, promoting a holistic approach to managing the condition.

#### **4.2.2 Spatial Requirement`**

The brief is interpreted from literature review and case studies to incorporate the following facilities such as medical, rehabilitation, and nursing care facilities, having spaces: administration wing, out-patient department, physical therapy department, in-patient department, emergency, diagnostics, and other services. The design of the diabetes sanatorium cannot be done without the required spaces. As seen in table 4.4 below, the design shows the spaces in the diabetes sanatorium. The spaces were generated as a result of different case studies and research conducted on the nature of sanatoriums with the use of healthcare facilities guidelines. It can be seen that the proposed diabetes sanatorium design met the requirements for the minimum spaces that served various functions in the sanatorium.

#### **4.2.3. Space Allocation/ Schedule of Accommodation**

The brief is further analyzed by assembling the various required spaces into six different zones and units as seen in Table 5 below. The zones and units are as follows; the out-patient department, the In-patient zone, the emergency department, medical support, (which is further sub-divided into units such as physical therapy unit, diagnostic unit, nutrition and culinary unit, life-modification unit, tele-medicine unit, and pharmacy), administration department, and other services.

Table 4.4: Schedule of Accommodation and Space Allocation

<b>Zone</b>	<b>Unit</b>	<b>Spaces</b>	<b>M<sup>2</sup></b>
OUT-PATIENT DEPARTMENT		i. Waiting Area	608
		ii. Nurses' Station	25
		ii. Records Room	45
		iv. Injection Room	22
		v. Insulin Injection Room	45
		vi. OPD Bed Rest Room	45
		ii. Cardiologist Consult Room	45 30
		ii. Neurologist Consult Room	32 30
		x. Dermatologist Consult Room	30 36
		x. Psychiatrist Consult Room	32 234
		xi. Psychologist Consult Room	<b><u>1244</u></b>
		ii. Endocrinologist Consult Room	
		ii. Counseling Room	
		iv. Diabetes Retinopathy	
	<b><u>Total=</u></b>		
<hr/>			
IN-PATIENT DEPARTMENT		i. Waiting Area	92
		i. Inpatient Female Ward	50
		i. Inpatient Male Ward	50
		7. Inpatient Children Ward	39
		7. Doctors Room	24
		i. Nurses' Station	24
		i. Dialysis	24
		i. ICU	132
		3. Inpatient Residential Suites	600
		<b><u>Total =</u></b>	<b><u>1035</u></b>
<hr/>			
EMERGENCY		i. Waiting Area	92
		i. Emergency Reception Area	89

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i.	Nurses' station	20
v.	Doctors Room	28
v.	Resuscitation room	42
i.	Operation Theatre	45
i.	Scrub Room	10
i.	Recovery Room	68
	<b><u>Total =</u></b>	<b><u>394</u></b>

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MEDICAL SUPPORT	a)Physical Therapy Department		
		i.	Waiting Area 72
		ii.	Physiologist Office 20
		iii.	Physical Fitness Hall 172
		iv.	Examination Room 33
		v.	Diabetic Foot Care 18
		vi.	Shock Wave 30
		vii.	Hydro Therapy 18
		viii.	Mobility Rehabilitation Hall 57
			<b><u>Total =</u></b> <b><u>309</u></b>

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	b)Diagnostic Department		
			<b><u>Labouratory</u></b>
		i.	Waiting Room 78
		ii.	Phlebotomy 18
		iii.	Blood Bank 24
		iv.	Dark Room 11
		v.	Sterilization 46
		vi.	Emergency Shower 13
		vii.	Storage 26
		viii.	Rest Room 32
		ix.	Lab 72
			<b><u>Total =</u></b> <b><u>320</u></b>

			<b><u>Radiology</u></b>
		i.	Waiting Area 114
		ii.	Staff Offices 48
		ii.	Changing Rooms 57
		iv.	Computed Tomography 26
		v.	Proteus Exam Room 55
		vi.	Control Room 33
			<b><u>Total =</u></b> <b><u>333</u></b>

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<hr/>			
c)Nutrition & Culinary	i.	Teaching Kitchen	49
	ii.	Diabetes Restaurant	103
	iii.	Nutritionist office	38
	iv.	Dietician Office	67
		<b><u>Total =</u></b>	<b><u>257</u></b>
<hr/>			
d)Life Modification Unit	i.	Training Halls	143
	ii.	Occupational Therapy	38
	iii.	Awareness / Education Hall	63
	iv.	Nurses 'Station	33
	v.	Monitoring Staff Office	33
			57
	vi.	Children Game Arcade	
	vii.	Indoor Recreational Activities	45
			55
	viii.	Indoor Rehabilitation	33
	ix.	Storage	<b><u>500</u></b>
		<b><u>Total =</u></b>	
<hr/>			
e) Tele-Medicine	i.	Clinical Portal	24
	ii.	Tele-Consults	24
	iii.	Digital Health Monitoring Room	30
			23
	iv.	Information &Technology	63
			<b><u>134</u></b>
<hr/>			
f) Pharmacy		<b><u>TOTAL =</u></b>	
	i.	Bulk Store	36
	ii.	Dispensary	18
		<b><u>Total =</u></b>	<b><u>54</u></b>
		<b><u>Grand Total=</u></b>	<b><u>2107</u></b>
<hr/>			
ADMINISTRATION DEPARTMENT	i.	M.D Office	30
	ii.	Ass. M.D Office	27
	iii.	Office Workstation	45
	iv.	Open Office (2)	114
	v.	Matron Office	27
	vi.	Nursing Work Station	35
	vii.	Finance Manager	45
<hr/>			

	Office	27
viii.	It/Com. Head Office	27
ix.	Neurologist Office	27
x.	Cardiologist Office	26
xi.	Nephrologists	27
xii.	Podiatrist	26
xiii.	Ophthalmologist	26
xiv.	Meeting Rooms	<b>662</b>
	<b>Total =</b>	
<b>Other Services</b>		
i	Central sterilization hall	108
ii	Central kitchen	150
iii	Morgue	254
iv	Laundry	57
v	Housekeeping	32
vi	furniture store	46
vii	Electro-mechanical room,	20
viii	Generator room,	20
ix	maintenance workshop	110
x	Medical and non -medical store	108
xi	Linen and house wear store	38
xii	Saloon, spas and beauty Shops	85
xiii	Prayer hall	265
xiv	Electrical room	20
xv	CCTV Surveillance	45
xvi	Parking lots for workers &Visitors	45
xvii	Gift /Flower Shop	30
xviii	Lunch Room	51
xix	Snack Store	30
xx	Groceries Store	25
xxi	Storages	72
xxii	Staff Accommodation	127
	<b>Total =</b>	1035
		<b>2718</b>
	<b>GRAND TOTAL-----</b>	<b>9160M<sup>2</sup></b>

Source: (Author's Work)

#### 4.2.4. Conceptual Development

Through the schedule of accommodation analysis and spatial sizes, the total area required was 9160metres square. This was arranged into bubble diagram proportionally as shown in figure 4.11 below; having (OS) other services as 2718m<sup>2</sup> which takes the biggest area of space, (MS) medical support 2107m<sup>2</sup> next to it, (OPD) out-patient department 1244m<sup>2</sup>, and (IPD) inpatient department 1055m<sup>2</sup>, followed by (Ad) administration 662m<sup>2</sup> and emergency 394m<sup>2</sup>. Striving to harmonise all the departments into a cohesive and unified entity reflects the essence of healing, encompassing the wellness of body, mind, and soul.

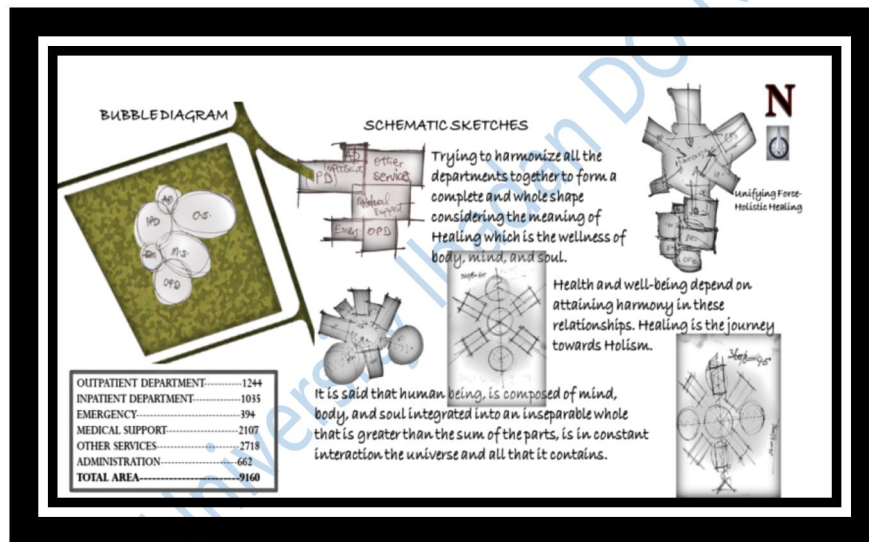


Figure 4.11: Conceptual Development

Source: (Authors Work)

#### Theoretical Conceptualization

Taking into account the contradictions and complexities associated with diabetes, as well as the architectural aspects of sanatoriums and themes identified during the literature analysis, the concepts of spirit, mind, and body were chosen for theoretical conceptualization. This approach aims to connect personal, collective, local, and universal dimensions in the interpretation.

Health and well-being depend on attaining harmony in these relationships. Healing is the journey towards Holism. It is said that human being, is composed of mind, body, and soul integrated into an inseparable whole that is greater than the sum of the parts, is in constant interaction the universe and all that it contains. Holistic health balances and harmonizes all aspect of health-physical, mental, emotional, social and moral-spiritual.

The diabetes sanatorium is a holistic retreat that combines medical care, rehabilitation, and convalescent care to promote diabetes healthcare—physical and emotional healing, personalised care, and integrative diabetes management—fostering relaxation, education, and long-term diabetes maintenance. The concept that informs the form of this design is **Holism**. Holism in medicine offers a comprehensive approach that prioritizes the overall well-being of individuals by considering the intricate connections between physical, mental, emotional, and environmental health. By integrating a variety of therapeutic practices and emphasizing patient involvement, holistic medicine seeks to promote a balanced and healthy life.



Figure 4.12: Theoretical Conceptual Development

Source: (Authors Work)

## 4.2.5. Spatial Organization

Table 4.5: Spaces Organisation on different level

<p><b>1. BASEMENT PLAN</b></p> <ul style="list-style-type: none"> <li>• Central sterilization hall</li> <li>• Central kitchen</li> <li>• Morgue</li> <li>• Laundry</li> <li>• Housekeeping</li> <li>• Furniture store</li> <li>• Electro-mechanical room,</li> <li>• Generator room,</li> <li>• maintenance workshop</li> <li>• Medical and non -medical store</li> <li>• Linen and house wear store</li> <li>• Saloon, spas and beauty stores</li> <li>• Prayer hall</li> <li>• Electrical room</li> <li>• Parking lots for workers</li> </ul> <p><b>2. GROUND FLOOR</b></p> <ul style="list-style-type: none"> <li>• Main entrance/ reception desk</li> <li>• Physical therapy department</li> <li>• Out-patient unit</li> <li>• Labouratory</li> <li>• In-patient unit</li> <li>• Radiology</li> <li>• Accessible bedrooms/nursing home</li> <li>• Teaching kitchen/restaurant</li> </ul> <p><b>3. FIRST FLOOR PLAN</b></p> <ul style="list-style-type: none"> <li>• Physiotherapy unit</li> <li>• Nursing home</li> <li>• Diabetes retinopathy</li> </ul>	<ul style="list-style-type: none"> <li>• In-patient unit</li> <li>• Admin unit</li> <li>• Residence bedroom</li> <li>• Exhibition/Award room</li> </ul> <p><b>4. SECOND FLOOR PLAN</b></p> <ul style="list-style-type: none"> <li>• Electro-physical therapy unit</li> <li>• Residence room</li> <li>• Life modification/training</li> <li>• In-patient unit</li> <li>• Admin unit</li> <li>• Offices for dietician</li> </ul> <p><b>5. THIRD FLOOR PLAN</b></p> <ul style="list-style-type: none"> <li>• Mobility Rehabilitation Unit</li> <li>• Residence Bedrooms</li> <li>• Life Modification/Training Hub</li> <li>• Staff Residence</li> <li>• Residence Bedrooms</li> </ul> <p><b>6. FOURTH FLOOR</b></p> <ul style="list-style-type: none"> <li>• Residence bedroom</li> <li>• Staff residence</li> <li>• Residence bedroom</li> </ul> <p><b>7. FIFTH FLOOR PLAN</b></p> <ul style="list-style-type: none"> <li>• Residence bedroom</li> <li>• Rooftop lounge</li> <li>• Residence bedroom</li> </ul>
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Source: (Author's Work)

As shown in schedule of accommodation and spatial sizes, the total area required was approximately 9160metres square which in no way can be on one level. The diabetes sanatorium design was divided into 7 levels: the basement floor services, ground floor, first floor, second floor, third floor, fourth floor,

and fifth story. The spaces were organized according to the vertical organization of spatial relationships. The vertical organization is typically made up of similar-sized, -shaped, and-functioning spaces that are repeated. It also comprises of a single linear space that arranges a series of spaces along its length that differ in size, form, or purpose. As seen in table 6, the general and common spaces such as the OPD consultation rooms, physical therapy spaces, emergency, pharmacy, restaurant, among others are located at the ground floor level, while other spaces for support services like the morgue, laundry, prayer halls maintenance departments are on the basement floor, for easy access. It also comprises of a single linear space that arranges a series of spaces along its length that differ in size, form, or purpose.

#### **4.2.6. Design Considerations**

##### **4.2.6.1 Architectural Considerations for Sanatorium Design**

###### **1. Site Location and Environment**

In order to be close to nature, the site situated in the countryside of Edo State, near natural features which is a cliff of Waterfall Mountain at Ubiaja. It is in a location with a favorable climate and scenic beauty. It site has good air quality and abundant natural sunlight, as these elements are essential for patient recovery. Such a natural setting not only promotes physical healing but also provides a serene environment that enhances mental and emotional well-being.

###### **2. Building Orientation**

The building orientation of the diabetes sanatorium is crucial for optimizing its functionality, comfort, and energy efficiency. The orientation ensures that living and working areas receive adequate natural light throughout the day. Maximizing southern exposure (in the northern hemisphere) or northern exposure (in the southern hemisphere) can help reduce reliance on artificial lighting and contribute to a healthier indoor environment.

The buildings are positioned to take advantage of natural views and breezes, enhancing patient comfort and well-being. Additionally, buildings should be positioned to capitalize on natural views and breezes, enhancing ventilation and providing a comforting environment that promotes overall well-being see site plan, figure 12.

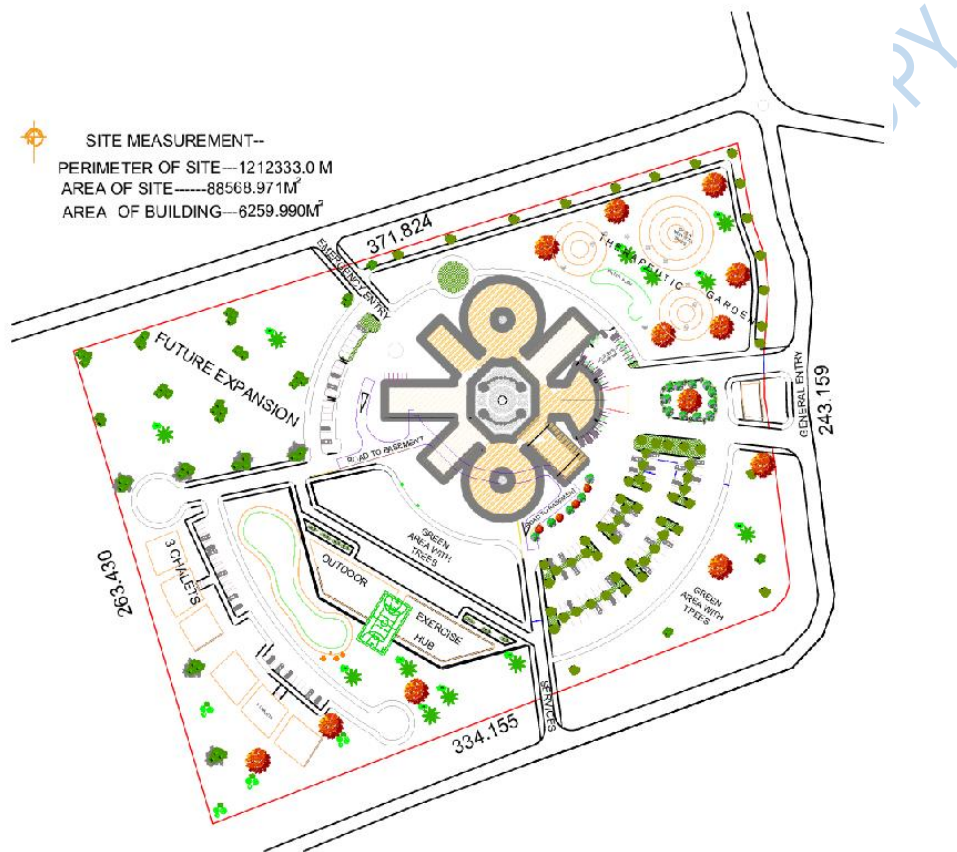


Figure 4.13: Diabetes Sanatorium Site Plan

Source: (Authors Work)

### 3. Therapeutic Landscape

The sanatorium is designed with a great landscape that is therapeutic. It has a large expanse of green areas incorporated into the design while preserving some of the natural and existing landscape elements such as trees site topography as shown plate 4.46 below.

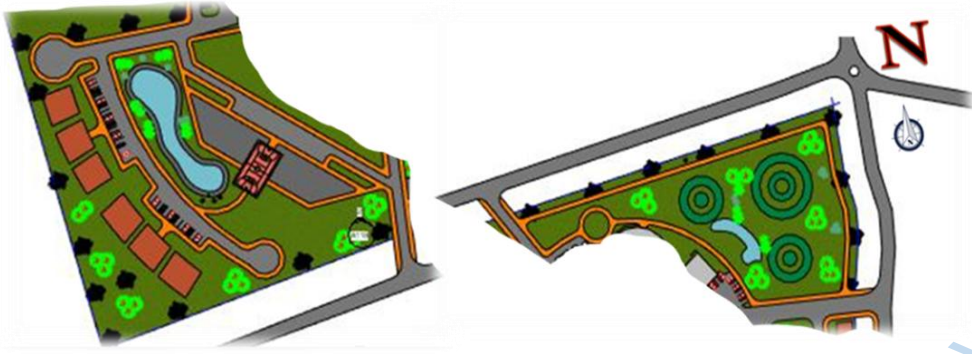


Plate 4.45: Showing Therapeutic Landscape

Source: (Authors Work)

#### 4. Natural Light and Ventilation

The diabetes sanatorium is designed having the following features to satisfy the above consideration. -

Open and Bright Spaces: interiors are designed with large windows and open courtyards to create bright, airy spaces as seen in plate 45 below.

Calming and soothing color palettes were chosen which contribute to a peaceful atmosphere.

- Comfort and Privacy: patient rooms are designed to be comfortable and private, with views of nature and easy access to outdoor areas.



Plate 4.46: Showing Floor to Ceiling Glazed Windows For Day-Lighting in The Interior Spaces

Source: (Authors Work)

## 5. Therapeutic Facilities

- Hydrotherapy Pools: swimming pool was integrated into site plan water fountain placed at the centre of the main court yards.

- Physical therapy and Exercise Rooms: Provide spaces for physical therapy and exercise, equipped with modern equipment.



Plate 4.47: 3 D Showing Recreational Activities Space

Source: (Authors Work)

- Treatment Rooms: Design specialized rooms for various treatments, ensuring they are easily accessible from patient areas, (TAHPI, 2023).

- Support Facilities:

- Dining Areas were provided to create pleasant dining spaces that accommodate dietary needs and promote social interaction.

- Common Areas were created for communal areas for social activities, socialization, relaxation, and entertainment.

- Staff Areas were provided adequate facilities for staff, including rest areas, offices, and meeting rooms.

## **6. Sustainability**

- Biophilic elements like water bodies, trees and shrubs, green areas in the interior spaces, were incorporated into the design to enhance the connection between patients and the natural environment, which can aid in healing and stress reduction.

## **7. Flexibility**

The diabetes sanatorium (DS) design has so many flexible spaces to adapt to changing workloads, care objectives, and technologies. In the design, rehabilitation and treatment take place throughout the entire space, including corridors, multipurpose zones, and alcoves where patients engage in social interaction, all contributing to the therapy program. There is also expanse of land reserved for future use.

### **4.2.6.2 Architectural Design Considerations that Improve Universal Accessibility**

#### **1. Provision of clear and intuitive wayfinding Features**

Literature review shows that a facility designed with the incorporation of the following features -wide entrances, corridors and pathways, wide doorways, ramps, ancillary accessible toilets and washrooms, and parking spaces, is compliant with the above consideration. All the entrances, corridors, doors and pathways in this facility are adequate and accessible by wide range of users. There are ramps at every egress and ingress points. There are accessible parking spaces as well as accessible toilets. see ground floor plan, entrances, ramps, and corridors.

## 2. Provision of Handicap Pathways

In the architectural design of the diabetes sanatorium, pathways configuration consideration was implemented to ensure accessibility and safety for all users.

- i. **Pathway Width:** Pathways are designed to be wide enough to comfortably accommodate two wheelchair users passing each other.
- ii. **Pathway Layout:** Pathways are ideally kept straight; however, when winding pathways are necessary, they feature large turning radii and ample turning space to avoid sharp turns.
- iii. **Pathway Edges:** The edges of pathways are clearly free obstacles and obstructions
- iv. **Channel Gratings and Lighting:** Channel gratings are installed with slots perpendicular to the main traffic flow and are small enough to prevent crutches or wheels from getting stuck. Additionally, pathways are well-lit to ensure visibility.

## 3. Provision of Handicap Doors

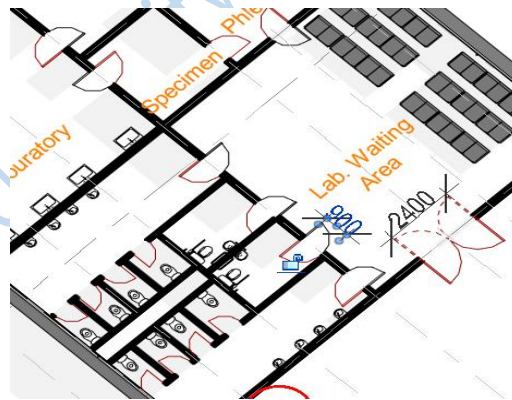


Plate 4.48: Part of Floor Plan Showing Accessible Spaces and Toilets

Source: (Authors Work)

The following ways are how doors configuration considerations were integrated in the in order to be accessible and user-friendly:

- i **Prominent Location:** Doors are prominently located with ample space around them for easy access.
- ii **Ease of Operation:** Doors are designed for effortless operation to accommodate all users. The doors handles are placed at 750mm above finished floor level
- iii **Wheelchair Access:** For wheelchair access, doors have a level landing area beyond the door swing to facilitate smooth entry and exit.
- iv **Sufficient Width:** Entrances feature doorways that are sufficiently wide (at least 900mm, 32inches) to allow easy passage for wheelchairs.
- v Wide doors (at least 32 inches) Swing-away hinges that allow the door to swing (flush panel double acting doors) completely free of the doorway, offering wider access for strollers, wheelchairs and other mobility devices. Lever-style door handles/locksets instead of knobs.

#### 4. Provision of Ramps



Plate 4.49: Showing Ramp As Accessibility Component

Source: (Authors Work)



Plate 4.50: Ground Floor Plan Showing Ramps at Every Entrances and Exits

Source: (Authors Work)

Designing with this consideration, the following steps were taking to enhance accessibility and safety:

- i. Gentle Gradients: Ramps and sloping grounds are designed with the gentlest possible gradients and are kept straight whenever feasible.
- ii. Winding Ramps and Slopes: When winding ramps or slopes are necessary, they feature large turning radii, ample turning space, and avoid sharp or steep turns.
- iii. Intermediate Landings: Sufficient intermediate landings are provided for rest, ideally equipped with chairs or benches, along with continuous handrails at two mounting levels to assist with walking.

##### **5. Provision of Accessible Toilets**

In designing the accessible toilets for the diabetes sanatorium, the following special features and provisions were integrated to ensure universal accessibility and ease of use for all individuals:

- i **Floor Surface Material:** The flooring chosen is non-slippery vinyl or non-slip floor tiles, easy to clean, and designed to prevent trapping dirt or water. Effective drainage systems are in place to keep the floor dry, with drain covers flush with the floor to prevent tripping hazards.
- ii **Cubicle Locks:** All cubicle locks are designed to be deadbolt features the second lever handle fixed at 900mm above finished floor level, easy to operate without requiring strong finger force, enhancing accessibility.
- iii **Soap Dispensers and Hand Dryers:** Soap dispensers are placed within reach (600mm) for both tall and short individuals, and hand dryers are strategically positioned to avoid obstruction or posing a hazard.

#### **Provisions for Persons with Physical Disabilities:**

- i **Grab Bars:** Grab bars are installed at (700mm) at one urinal, one basin, and inside one toilet cubicle to provide necessary support.
- ii **Lower Fixtures:** At least one basin, mirror, and urinal are mounted at a lower level for easier access.
- iii **Hand Dryers:** Hand dryers for wheelchair users are designed to protrude, providing knee space without causing obstruction.
- iv **Tilted Mirrors:** Mirrors inside the disabled toilets are tilted towards the floor for use by wheelchair users.

By integrating these features into the design of the diabetes sanatorium, we ensure a comfortable and accessible environment for all patients, catering to their diverse needs and promoting universal accessibility.



Plate 4.51: Showing Accessible Toilet

Source: (Authors work)

## 6. Provision of Accessible Car parks

In architectural design for the diabetes sanatorium, several key considerations for disabled parking spaces incorporated to enhance accessibility and convenience:

- i **Proximity to Access Points:** Disabled parking spaces as seen in [plate 222 below](#) are strategically located close to access points such as the drop off zone and the main entrance with ramp to ensure easy and quick access to the building
- ii **Smooth and Safe Accessible Route:** A smooth and safe accessible route is provided from the disabled parking spaces to major facilities, entrances, and lift lobbies. This ensures that individuals with mobility impairments can navigate the area comfortably and safely.

These considerations ensure that the parking facilities are universal accessibility and cater to the needs of all users, promoting ease of access and mobility within the sanatorium premises.

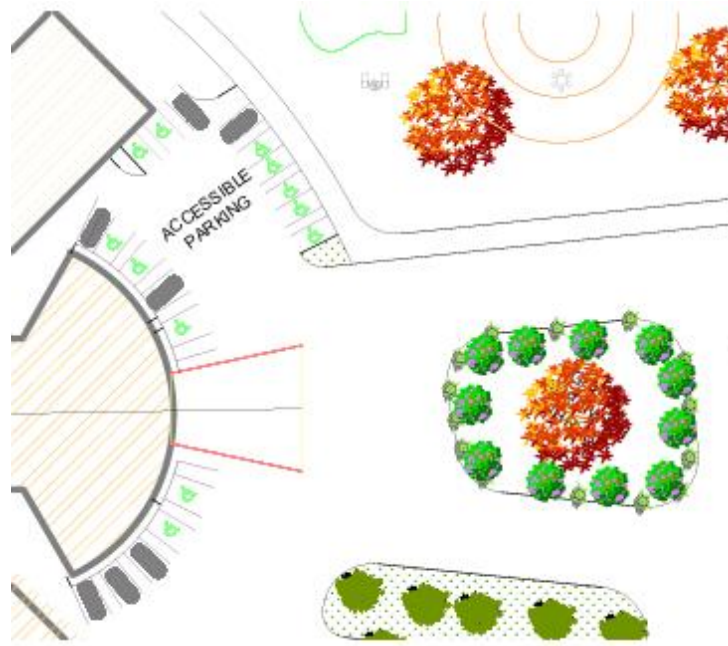


Plate 4.52: Part of Site Plan Showing Handicap Parking Spaces.

Source: (Authors Work)

#### 4.2.7. Construction Methods and Materials

The importance of material selection in any building project, as well as construction procedures, cannot be overstated. Material selection can be influenced by the availability of construction materials, the architect's and client's preferences, and other factors such as flexibility, sustainability, and compatibility of the materials in the regions where they will be used.

Another important criterion for material selection in order to produce optimal functional and accessible building, which is a critical part of this design, is the consideration of who the building's users are. Weather and fire resistance must be taken into account. The materials chosen for the various elements of the buildings are listed below

#### **4.2.7.1 Floor Construction and Materials.**

In designing the diabetes sanatorium, a healthy flooring system was implemented for durability and comfort. This included laying a concrete layer over a hardcore base with sand blinding, followed by a sand and cement screed for a smooth finish. Thermal insulation and a damp proof membrane (DPM) were incorporated to resist heat loss and ground moisture, ensuring a stable environment. The damp proof course on walls further enhanced moisture control for a healthier indoor environment. The basement floors can be constructed and treated to withstand moisture, provide insulation, and ensure long-term durability and comfort. These are the steps taken to guarantee this:

##### **1. Damp Proof Membrane (DPM):**

The DPM is properly installed and overlaps with DPM on walls to create a continuous barrier against moisture.

##### **2. Moisture Control:**

Moisture levels in the basement are monitor and manage through adequate ventilation, dehumidifiers if necessary, and proper drainage systems.

##### **3. Floor Finishes:**

Appropriate flooring materials that are resistant to moisture and suitable for basement conditions, such as ceramic tiles, vinyl flooring, and epoxy coatings are used.

#### 4. Sealing and Maintenance:

The floor and joints are sealed to prevent water ingress. Regularly they should be inspected and maintained to address any signs of moisture or damage promptly.

#### Floor Finishes and Materials

For those who have disabilities, proper flooring specifications are very crucial. Texture and traction resistance, color, pattern, and contrast are them. Color contrast and pattern contrast can aid impaired people in distinguishing between various architecture aspects. For wheelchair users and those with mobility issues, surface roughness and slip resistance value (RSV) are particularly crucial to prevent falling off. Floors in circulation areas like corridors and passageways should be built of tactile flooring. The following are the types of flooring that are used in the VTC's various spaces:

##### a) Circulation and Waiting Areas

Tactile Flooring Strips: these are polyurethane self-adhesive guides for visually impaired people to help guide them in space. They are aligned in paths and lines so that visually impaired people follow a path with their stick. The strips are compatible with homogenous and heterogeneous vinyl floors, LVT glue-down tiles and Linoleum. The flooring should contrast with wall.

##### b) Therapy, Out-patient, and Inpatient Departments

Flooring made of wood plastic composite (WPC) is a suitable choice for wheelchairs because it has flat surfaces that make wheelchairs and other mobility equipment easy to glide over. They are simple to keep up. When WPC flooring is scratched, as happens frequently when using wheelchairs, it can be resurfaced. The surface texture reduces the risk of slipping and falling.



Plate 4.53: WPC Non-Slippery Floor Finish

-Source: (Google Search, 2024)

c) Gymnasium and Restaurant Floors

i. Soundproof Floor Underlayment: Decoupling the flooring surface from the subfloor is necessary for soundproofing a hardwood or tile floor in order to limit noise transmission. Underlayment materials that are frequently utilized include cork rolls, felt, and polymers.

ii. Mass Loaded Vinyl: it is a dense, rubber-like substance used in a variety of applications, including underlayment, machinery, and automobile soundproofing. A sound barrier is created by the material's bulk.

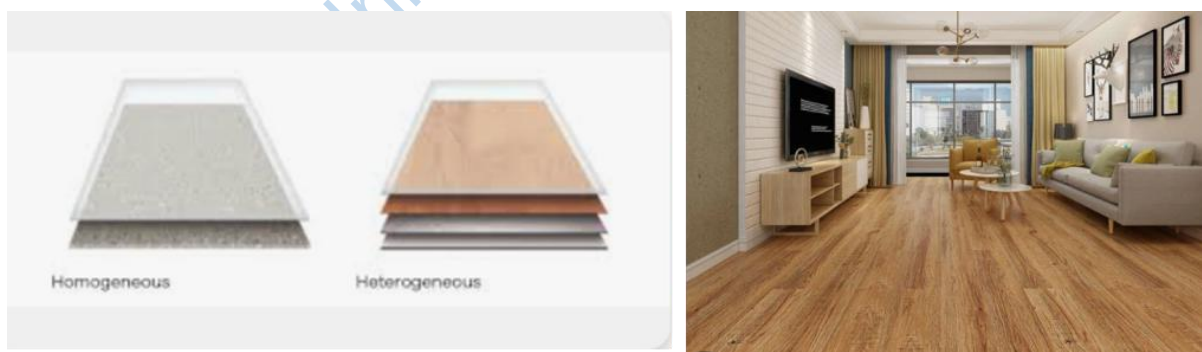


Plate 3.54: Vinyl Floor Finish-

Source: (Google Search, 2024)

d) Offices

Stone Plastic Composite (SPC) Flooring: is a vinyl flooring material that has a rigid core made from powdered limestone, polyvinyl chloride and stabilizers. It is also called stone polymer composite flooring. It is slip and water resistant, contracts during high temperature swings which can improve the stability and longevity of the floor. It is more durable in terms of impact and very suitable for wheelchair and walker.



Plate 4.55: Stone Plastic Composite Floor (SPC)

Source: (Google Search, 2024)

e) Toilets and Kitchens

Prepare flooring areas as necessary using latex self-leveling screed. Lay polysafe non-slip vinyl flooring throughout using appropriate adhesives and cove form at edges of rooms. It is vital to adhere to this, so as to avoid users and occupants slipping. The flooring should contrast with the wall.



Plate 4.56: Polysafe Non-Slip Vinyl Floor Finish

Source: (Google Search, 2024)

#### 4.2.7.2. Wall Construction, Materials, and Finishes

Different types of walls, including partition, load-bearing, non-load-bearing, and inner walls, are constructed using materials such as masonry, concrete, glass panels, and GRP/GRC cladding. The massiveness of a material helps in sound insulation. Increasing wall thickness is another way to improve insulation properties by adding more mass especially in special spaces like radiology, lifts, and theatres. Therefore, for external walls, 225mm blocks or concrete, glass, and aluminium composite are used to enhance daylighting, aesthetics, and structural integrity.

Utilizing color contrast is crucial for spatial awareness, especially aiding wayfinding for visually impaired individuals. Applying color contrast at points where surfaces and functions change helps highlight differences, such as between walls and ceilings, floors and walls, handrails and walls, sanitary fittings and walls, door faces and frames against walls, stair treads and risers, as well as

around corners and pillars. This approach ensures each element stands out distinctly, facilitating easy identification for all users and meeting universal accessibility for wayfinding and intuitive use.

#### 4.2.7.3 Ceiling

Acoustic ceiling panels is used in ceiling finishes because they are rigid and leading in sound absorption due to their sound absorbing and light diffusing properties. To accomplish the universal accessibility goals, this will he help people with auditory disability to cope with rehabilitation activities.



Plate 4.57: Acoustic Ceiling Panel

- Source: (Google Search, 2024)

#### 4.2.7.4 Building Materials for Roof

Structures can have a variety of roof types, including flat roofs, space decks, and steel trussed roofs. Precast concrete flat roofing come together. Layers of 4 mm TNT pseudo plastic membrane are applied to the tops and laid out to fall. Through PVC tubing that travels through predetermined ducts to the closest storm drain, the roof is drained.

#### **4.2.8. Building services**

The Building services (mechanical, electrical, and plumbing systems) in our diabetes sanatorium are designed with precision and care to provide a safe, comfortable, and efficient environment. These systems are not only reliable and sustainable but also tailored to meet the specific needs of patients and healthcare providers, ensuring the highest standards of care.

##### **1. Mechanical Systems**

###### **HVAC (Heating, Ventilation, and Air Conditioning):**

**Heating:** since the sanatorium is located within tropical climate, there is no need for heating

**Ventilation:** the ventilation system, including fresh air supply through the help of vast windows placements, air filtration, and exhaust systems to maintain air quality to reduce the risk of airborne infections.

**Air Conditioning:** Central air conditioning system to maintain optimal temperature and humidity levels, crucial for patient comfort and equipment performance.

**Zoning:** the HVAC system is zoned to accommodate different areas such as patient rooms, treatment areas, administrative offices, and common areas.

**Control Systems:** the use of smart thermostats or building management systems for efficient control of the HVAC system. A thermostat is responsible for turning on and off the air conditioner's compressor and fan. The thermostat senses indoor temperatures and uses this data to determine when the rest of the HVAC system needs to run and when to stop; i.e. it's a switch connected to a temperature sensor.

## **Medical Gas Systems:**

**Oxygen Supply:** the oxygen supply system, including storage tanks, distribution networks, is centrally placed at the basement for safety measures.

**Vacuum and Compressed Air:** vacuum and compressed air systems used for medical procedures and equipment operation will be installed ensuring that these critical utilities are always available and functioning properly.

## **2. Electrical Systems**

### **Power Supply and Distribution:**

The electrical system for the sanatorium from PHCN shall be the main power supply, capable of handling the high demand of a healthcare facility. Backup power systems, including generators and uninterruptible power supplies (UPS), will be in place at the basement floor to ensure that critical systems such as life support, medical equipment, and essential lighting remain operational during power outages. Power will be distributed through a network of electrical panels and sub-panels, with special attention given to high-demand areas.

### **Lighting:**

Lighting in the sanatorium is designed with both functionality and comfort in mind. General lighting throughout the facility will use energy-efficient LED fixtures, providing bright and uniform illumination. Specialized task lighting will be installed in treatment areas and operating rooms to ensure precise visibility for medical procedures. Emergency lighting systems, including illuminated exit signs and pathway lighting, will be strategically placed to guide occupants safely in case of an emergency.

### **Communication Systems:**

To facilitate efficient communication within the sanatorium, we will integrate a nurse call system, allowing patients to easily contact medical staff. A public address system will be installed for announcements and emergency notifications. The data and IT infrastructure, including network cabling and Wi-Fi, will support the facility's technological needs, ensuring seamless connectivity and data management.

### **3. Plumbing Systems**

#### **Water Supply:**

The plumbing design includes a comprehensive potable water system, with reliable sources and storage tanks ensuring a steady supply of clean water. Hot water will be provided through a series of boilers and water heaters, distributed efficiently throughout the facility to meet the needs of patients and staff.

#### **Drainage and Waste Management:**

Our design incorporates an effective sanitary drainage system to ensure the hygienic removal of wastewater. We will also implement a robust system for the disposal of medical waste, adhering to all health and safety regulations, thus maintaining a clean and safe environment.

#### **Specialized Plumbing Systems:**

For facilities offering dialysis, our design includes a specialized water treatment system to provide the high-quality water necessary for these treatments. Fire suppression systems, including sprinklers and hydrants, will be installed to ensure the facility meets all fire safety standards.

## Chapter Five

### Conclusion and Recommendation

#### 5.1 Project Appraisal

The focus of this study was to design a diabetes sanatorium with integration of universal accessibility concept, for Edo State, in Esan South East local government area, Ubiaja, Edo State, Nigeria. To achieve this, various architectural design considerations were studied and integrated during into the design. These considerations include provision of clear and intuitive wayfinding features, provision of handicap pathways, provision of handicap doors, provision of ramps, provision of accessible toilets, provision of accessible car parks, flexibility, sustainability, therapeutic landscape, therapeutic facilities, and corresponding building materials. Collectively, these measures have suggestively enhanced the accessibility of the proposed building.

#### 5.2 Conclusion

In conclusion, the concept of a diabetes sanatorium represents a holistic approach to healthcare, blending elements of medical treatment with the rejuvenating environment of a spa or health resort. Originating from a tradition of providing therapeutic rest and rehabilitation after surgery, sanatoriums have evolved to cater not only to physical health but also to mental and emotional well-being. This dual emphasis makes them invaluable for diabetes patients, offering a serene setting conducive to healing and management of their condition.

Moreover, beyond their residential facilities, diabetes sanatoriums typically extend their services through outpatient care, ensuring continuity in treatment and support. This integrated approach enhances patient outcomes by addressing both acute medical needs and long-term management

strategies. By incorporating specialized medical expertise within a tranquil environment, these facilities empower patients to take an active role in their health journey.

Furthermore, the design of a diabetes sanatorium should prioritize universal accessibility, given the disease's potential for severe complications like limb amputation, foot ulcer, stroke, visual impairment, among others. Ensuring barrier-free access and accommodation throughout the facility not only promotes inclusivity but also safeguards patient safety and comfort. By integrating universal design principles, sanatoriums can create environments that support independence and dignity for all individuals, regardless of their physical abilities, thereby fostering a truly supportive and inclusive healthcare setting.

### **5.3 Recommendations**

To achieve the aim of designing a diabetes sanatorium that integrates universal accessibility concept in its design, there is a need to incorporate some considerations to enhance its accessibility and usability. Hence, the following are recommended based on the objectives of this study. Integrating these recommendations can help create a diabetes sanatorium that not only meets its design goals of holistic care and wellness but also ensures universal accessibility, fostering an environment where all patients can receive equitable and dignified healthcare services.

1. Patient rooms and common areas should be designed to aid patient comfort and convenience. Ensure rooms are spacious, well-ventilated, and equipped with facilities for self-care. Common areas should be inviting and designed to promote social interaction and relaxation, contributing to a positive healing environment.
2. Diabetes sanatorium should have a sustainable and healing environment by integrating natural elements such as green spaces, natural light, and calming color schemes. Utilize eco-friendly

materials and technologies to minimize environmental impact and enhance overall well-being of patients and staff alike.

3. Implement barrier-free design principles throughout the sanatorium, including ramps, wide corridors, and doorways that accommodate wheelchairs and walkers. Ensure all areas, including patient rooms, bathrooms, and treatment facilities, are easily accessible without obstacles or hazards.
4. Provide accessible medical equipment and technology that accommodates diverse patient needs. This includes adjustable-height beds, grab bars in bathrooms, auditory and visual alarms, and accessible communication tools for patients with hearing or vision impairments.
5. Provide spaces that will encourage training and team or group activities that will foster a culture of inclusivity and sensitivity to the needs of patients with disabilities

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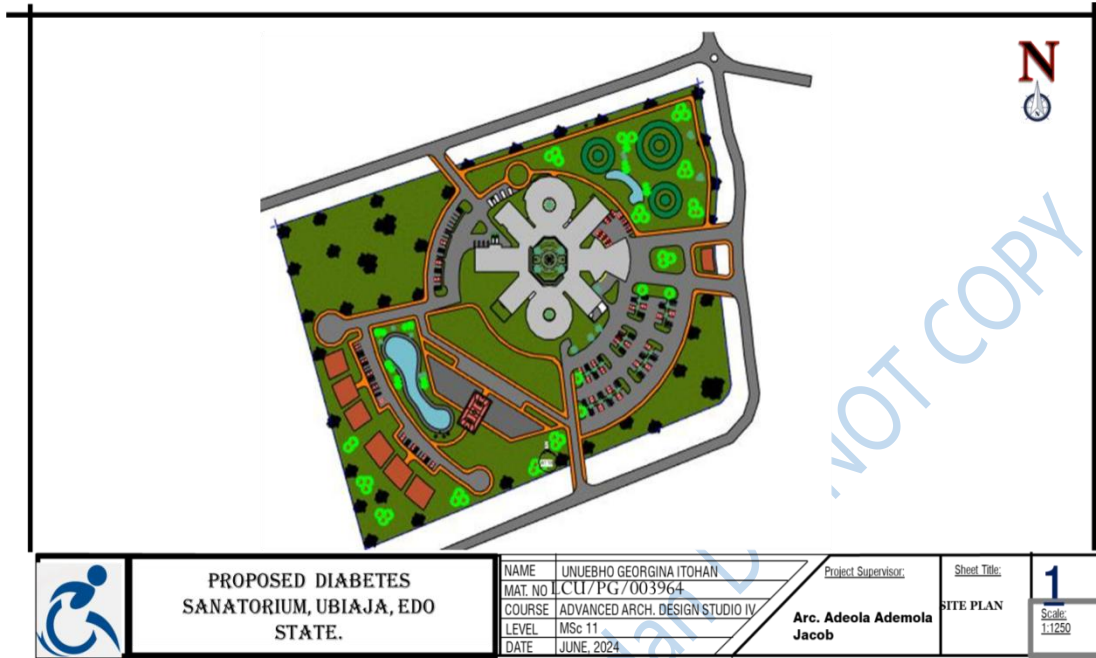
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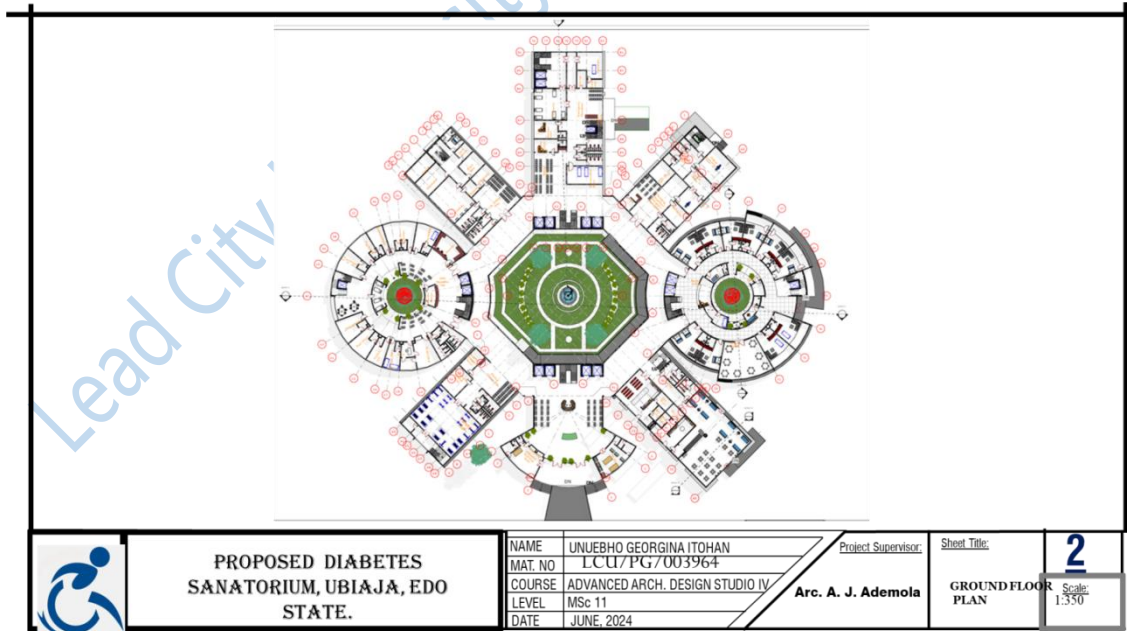
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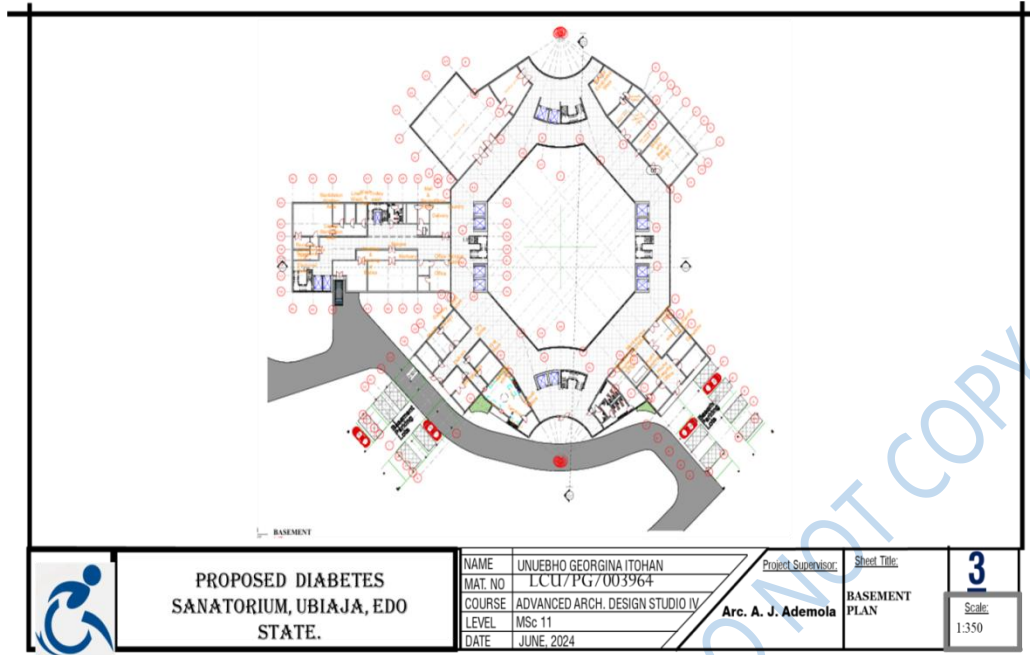
Appendices- Appendix 1: Presentation Drawing



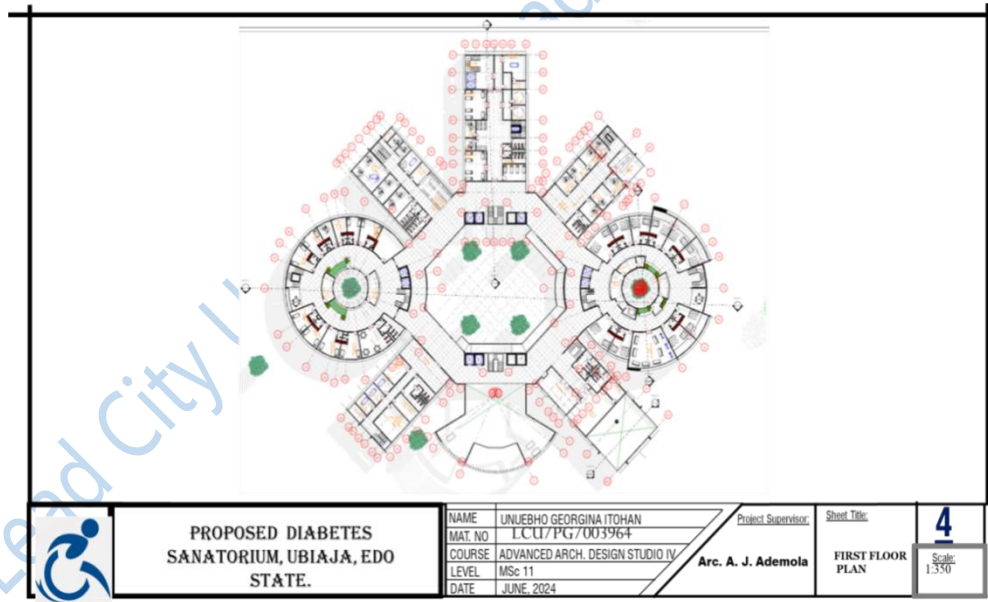
Appendix 1; site Plan



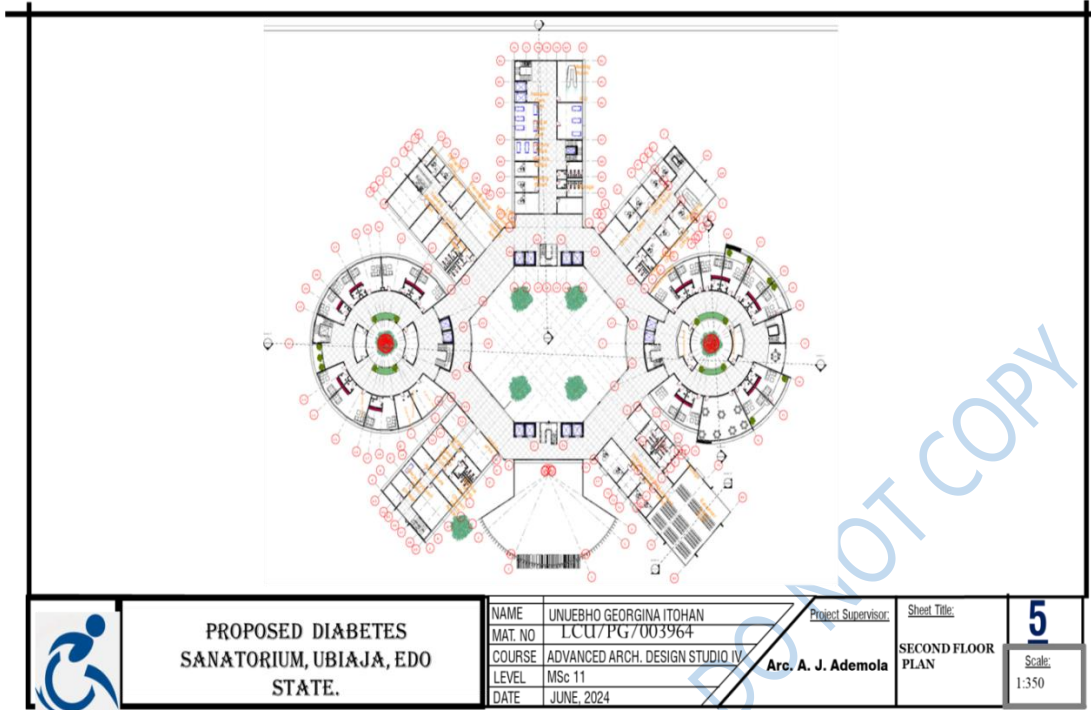
Appendix 2: Ground Floor Plan



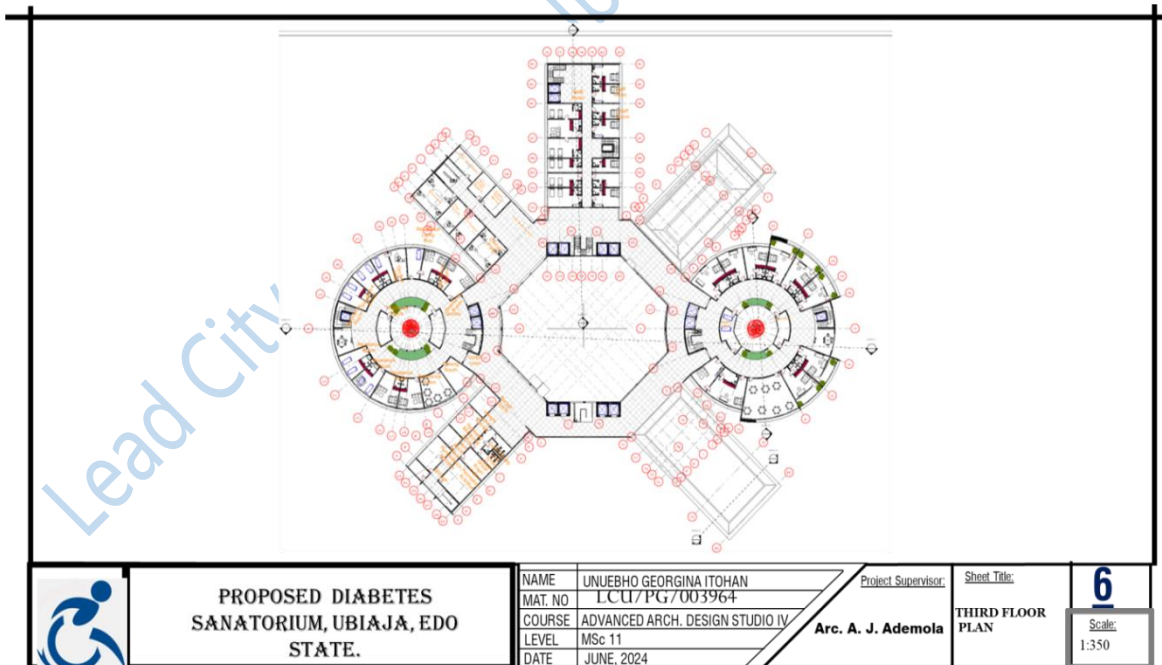
**Appendix 3: Basement Floor Plan**



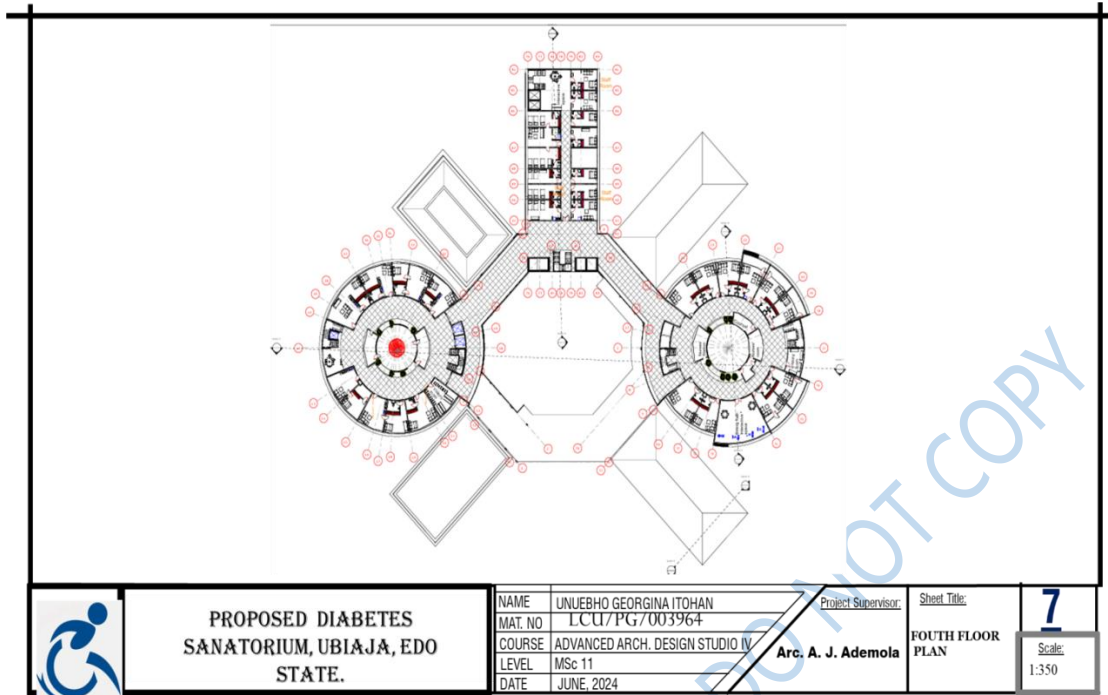
**Appendix 4: First floor Plan**



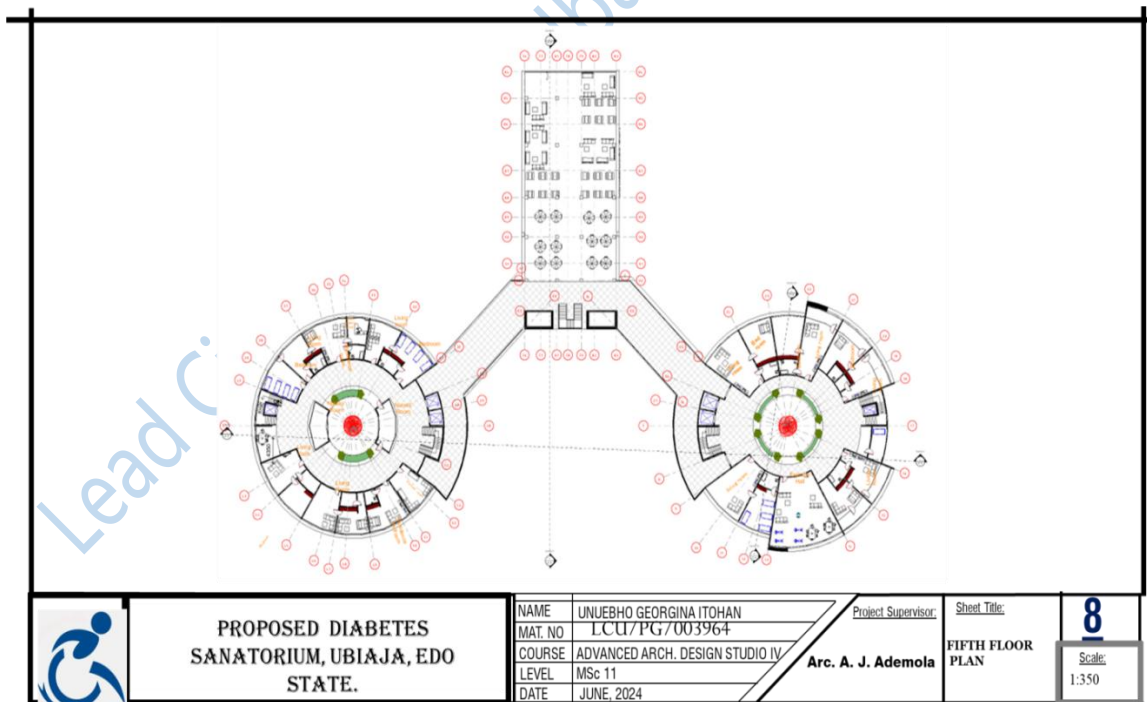
**Appendix 5: Second Floor Plan**



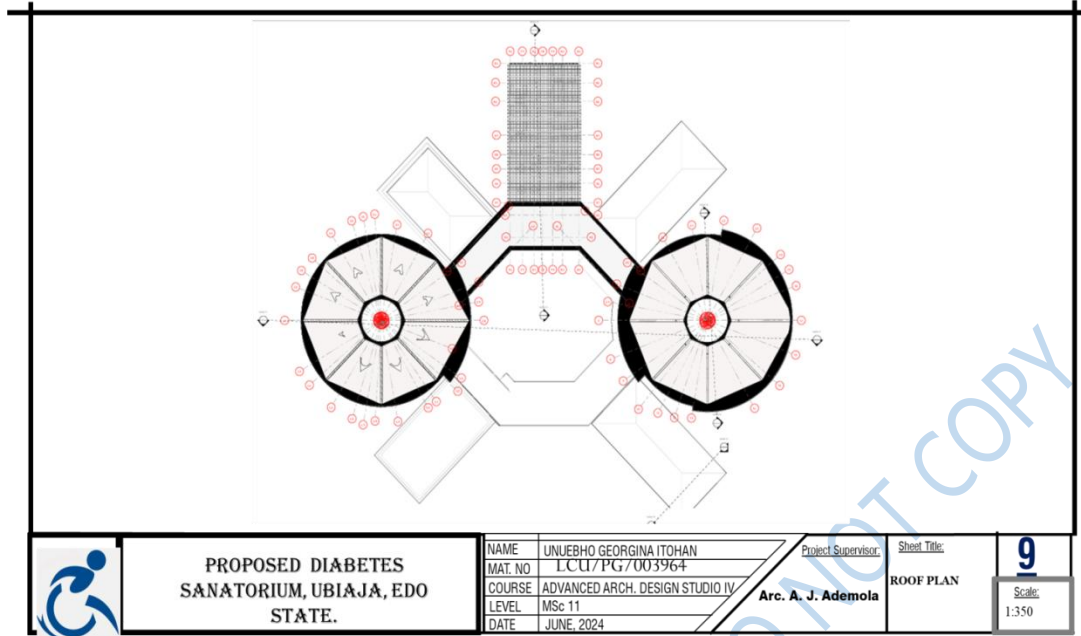
**Appendix 6: Third Floor Plan**



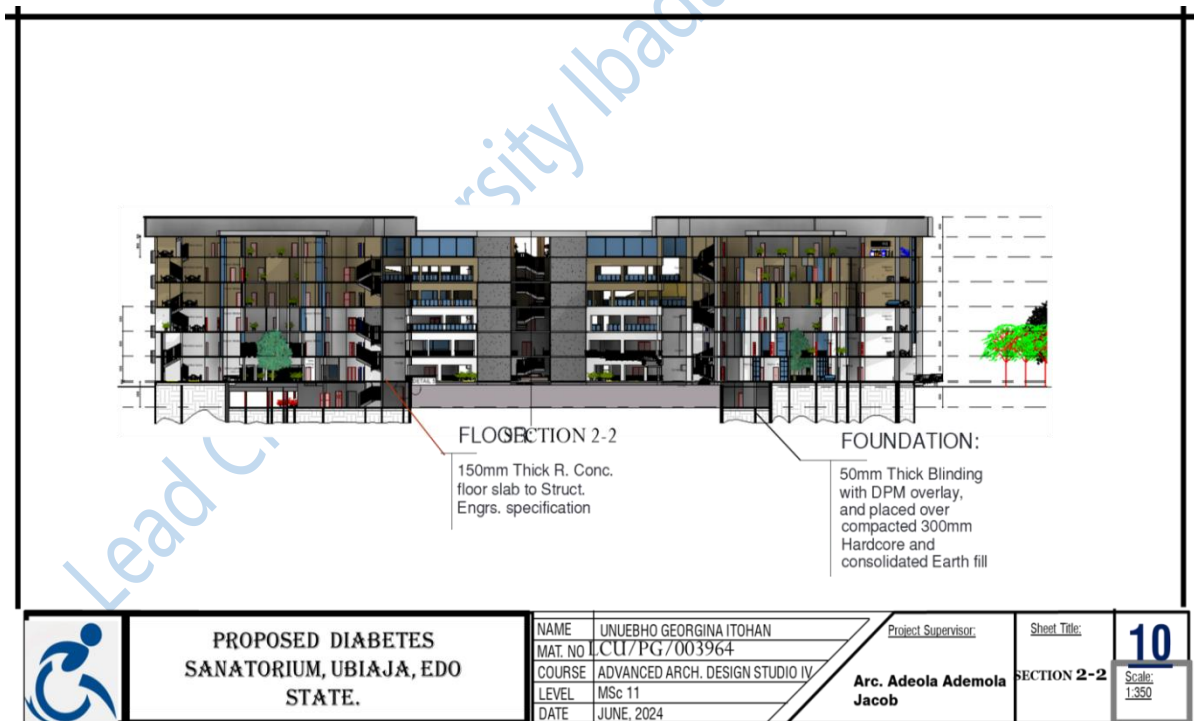
**Appendix 7: Fourth Floor Plan**



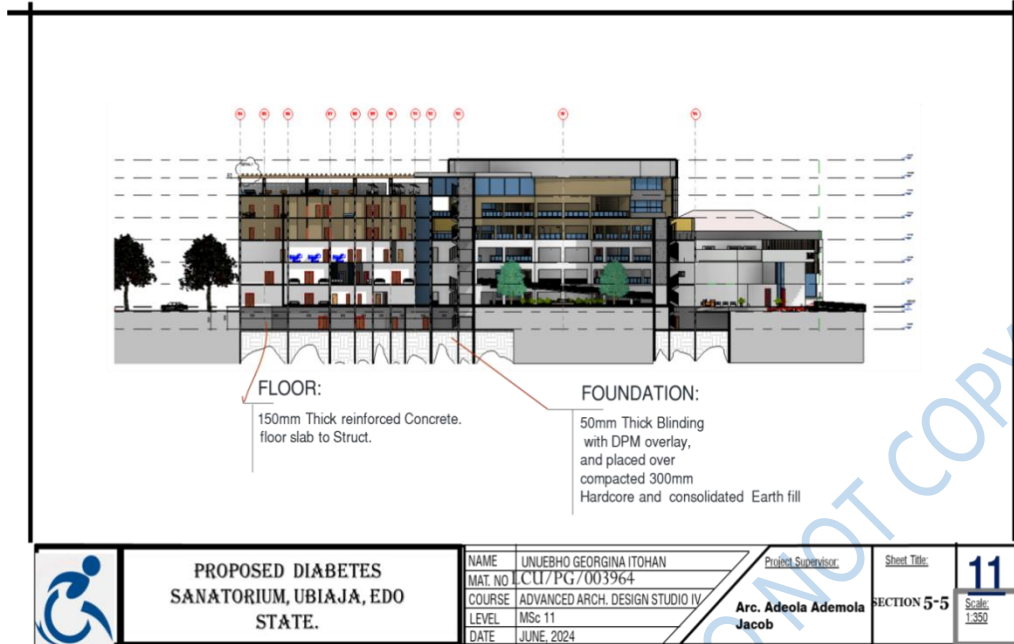
**Appendix 8: Fifth Floor Plan**



**Appendix 9: Roof Plan**



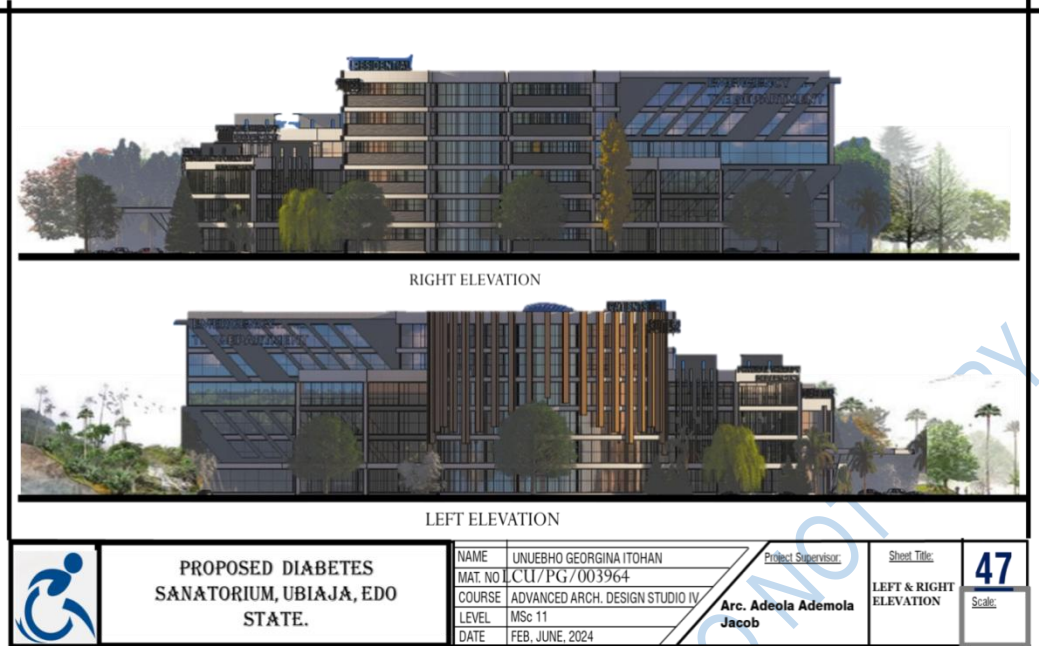
**Appendix 10: Section 1**



Appendix 11: Section 2



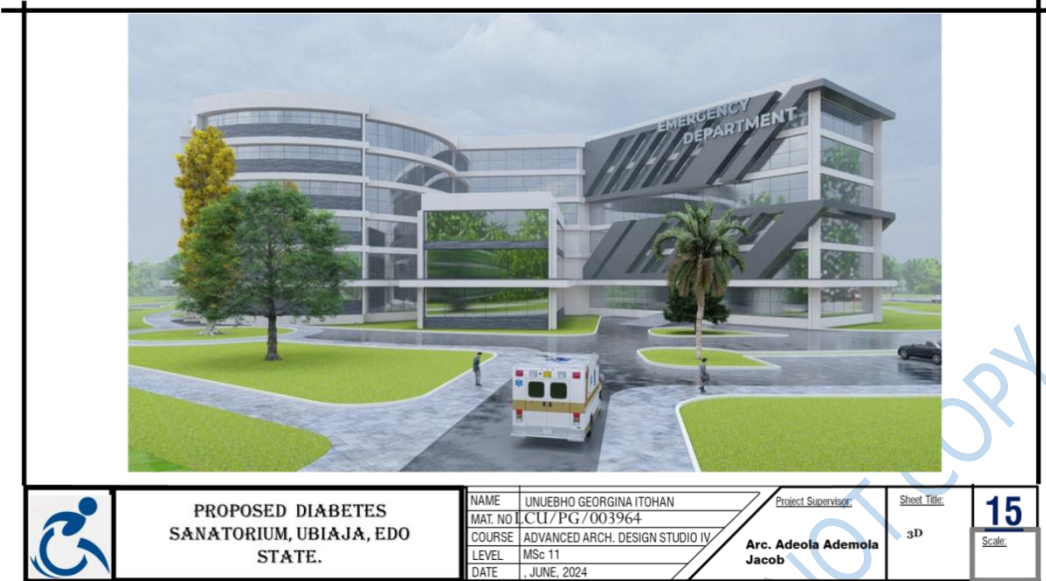
Appendix 12: Elevation 1



**Appendix 13: Elevation 2**



**Appendix 14; Perspective View 1**



Appendix 15: Perspective View 2

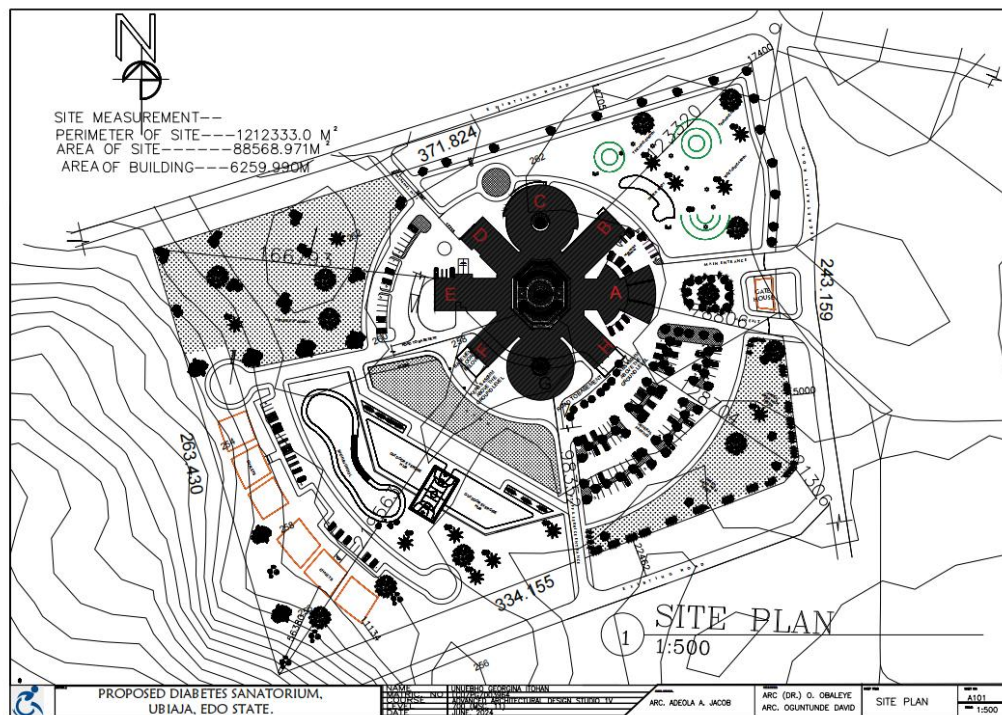


Appendix 16: Perspective View 3

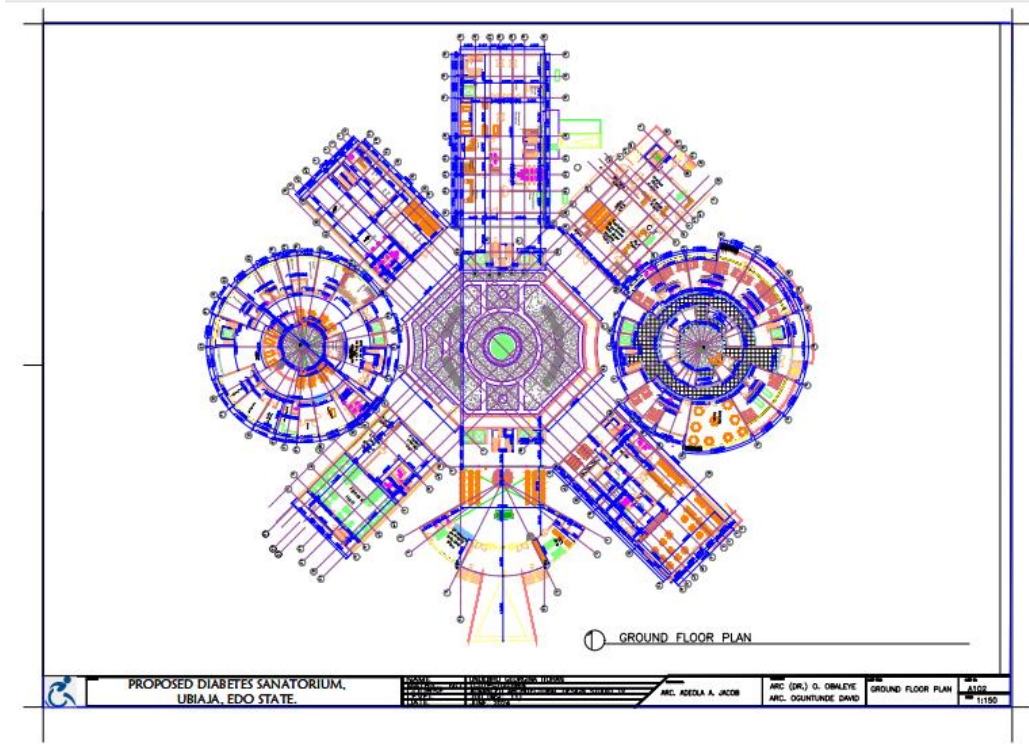


Appendix 17: perspective View 4

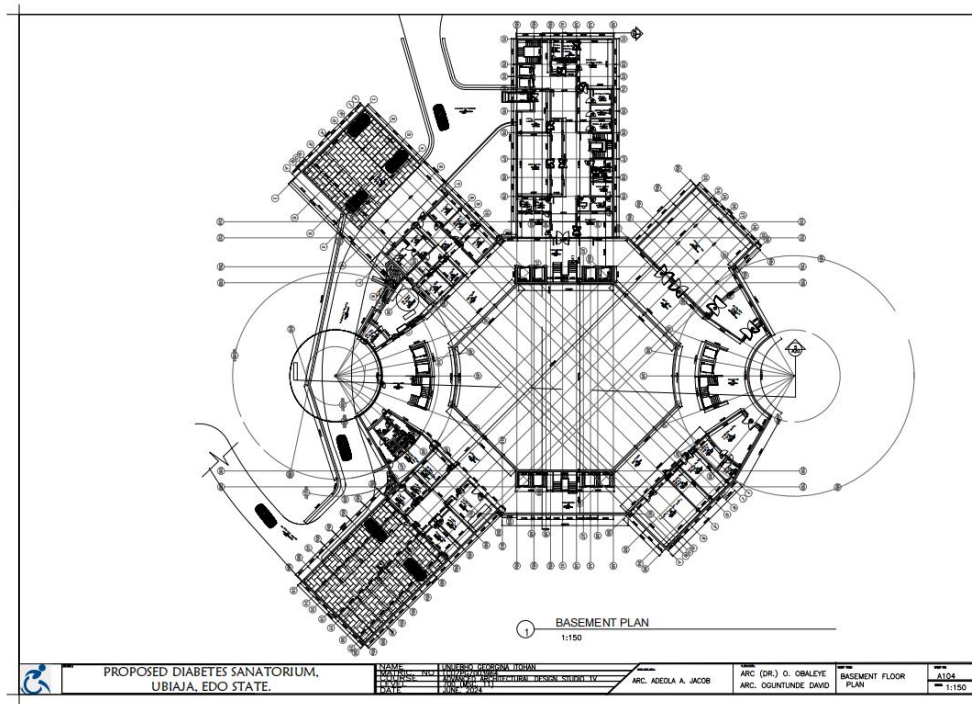
Appendices- Appendix 2: Working Drawing



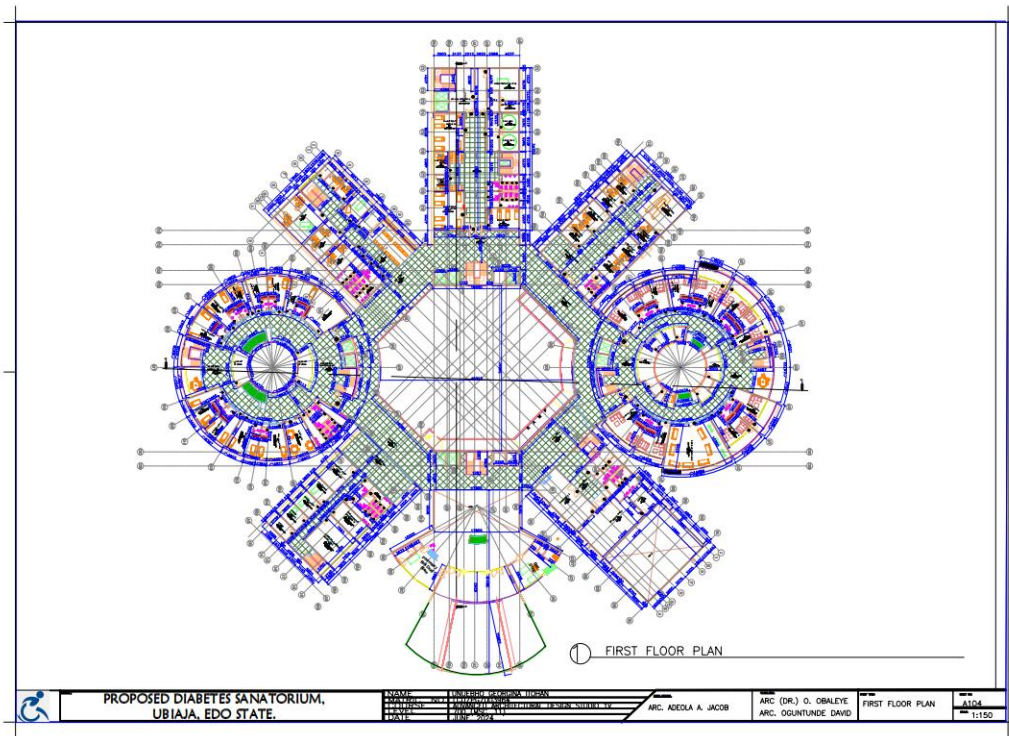
Appendix 18: Site Plan



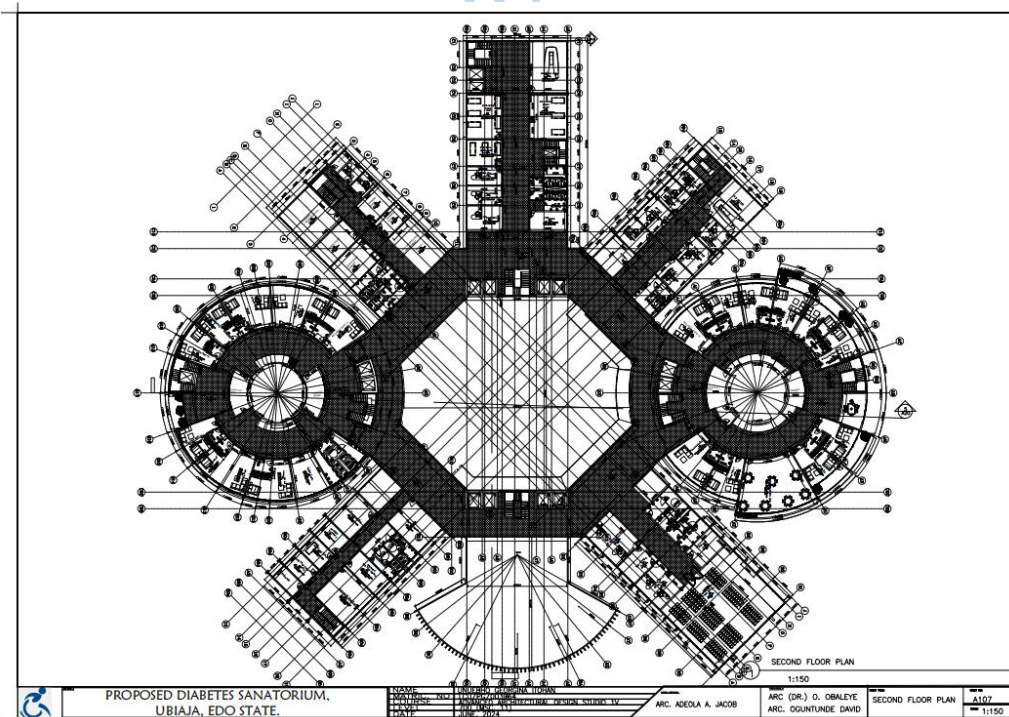
**Appendix 19: Ground Floor Plan**



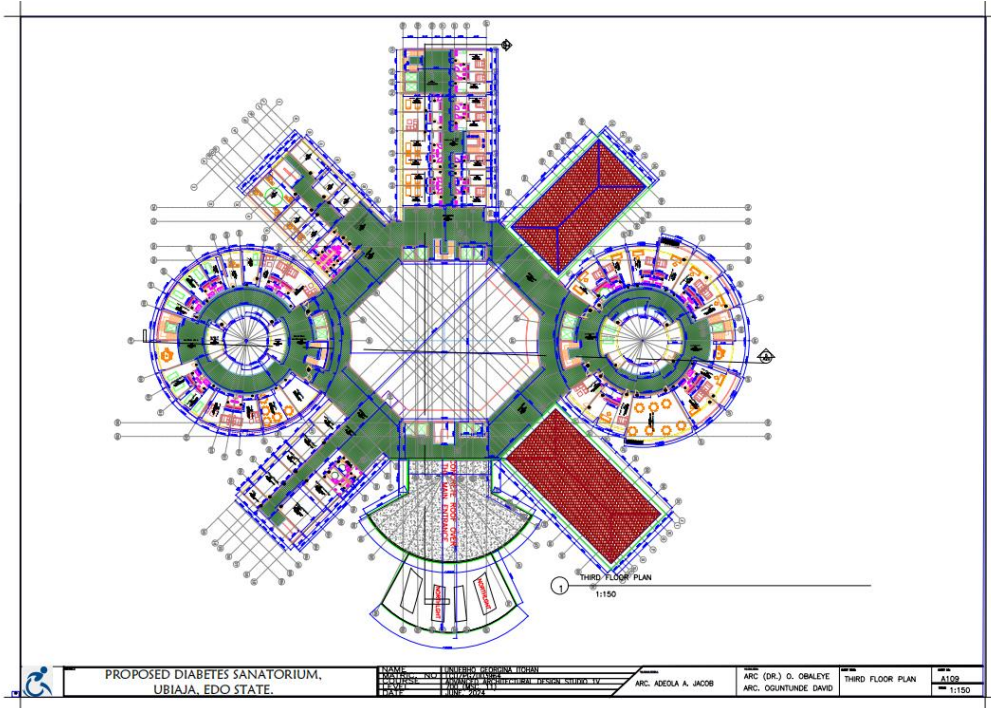
**Appendix 20: Basement Floor Plan**



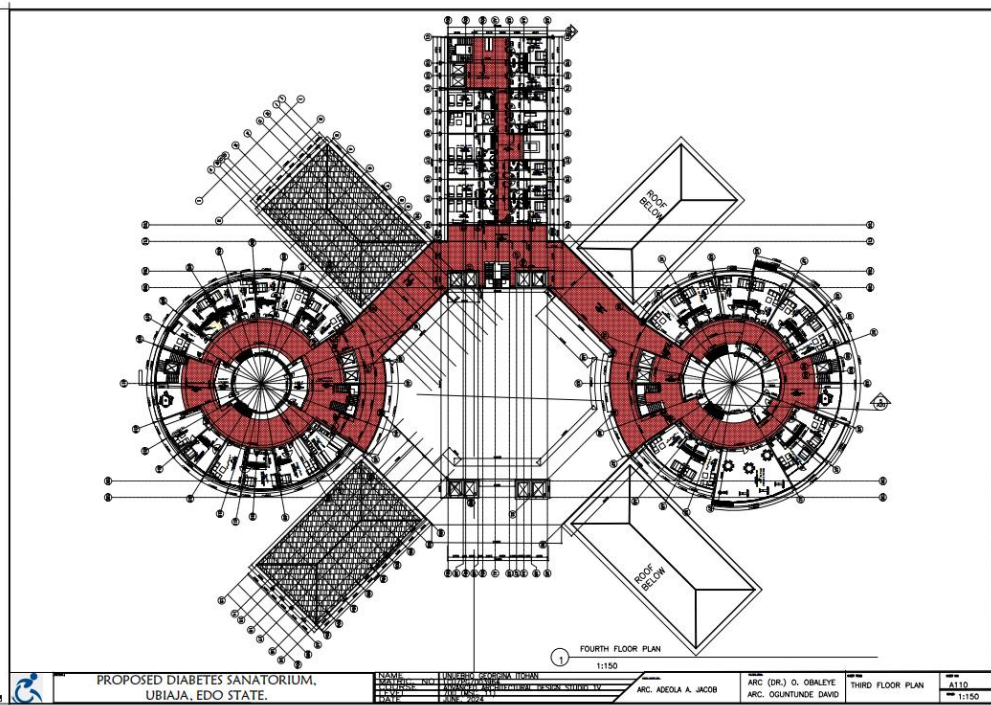
**Appendix 21: First Floor Plan**



**Appendix 22: Second Floor Plan**

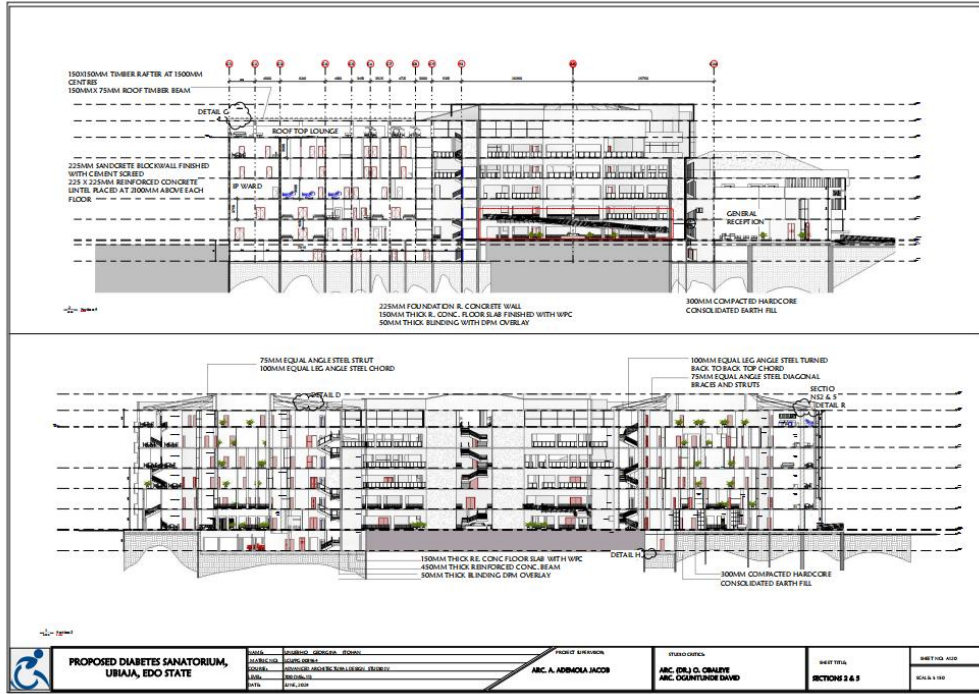


Appendix 23: Third Floor Plan

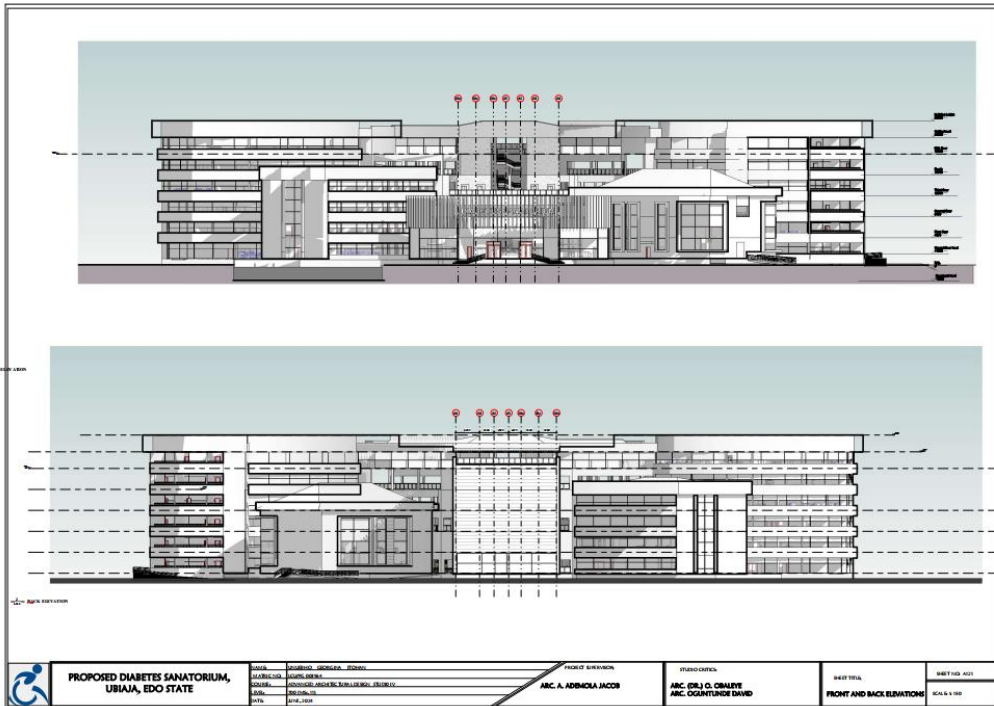


Appendix 24: Fourth Floor plan

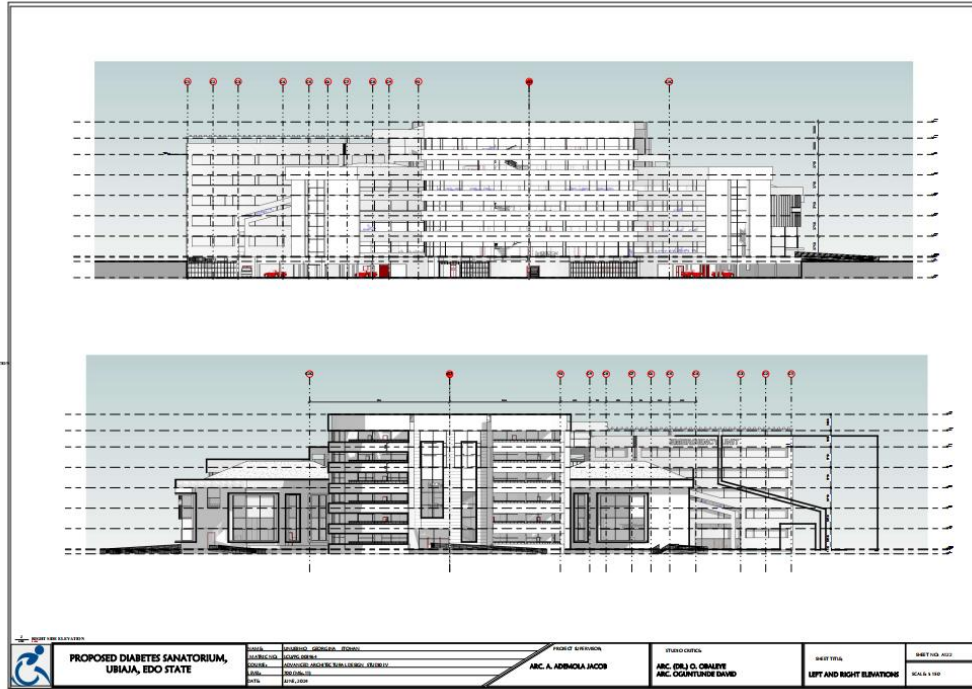




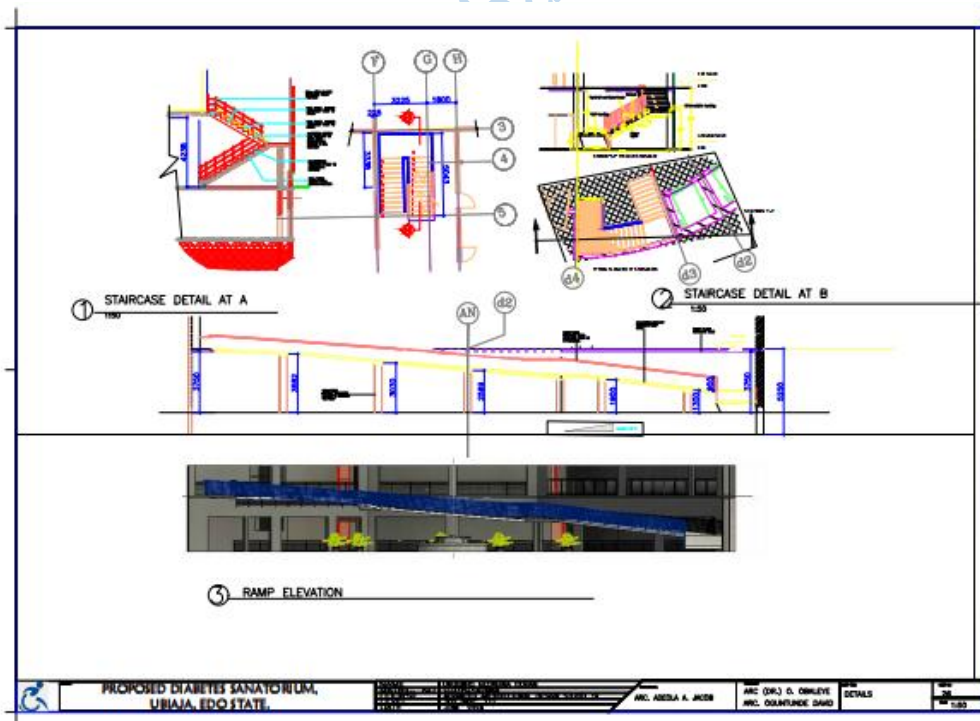
Appendix 27: Sections 1 & 2



Appendix 28: Front and Back Elevations



Appendix 29: Left And Right Elevations



Appendix 30: Details

## Bio-data

### A. Personal Data

Full Name: Georgina Itohan Unuebho,  
Address: 4, Mustard Street, Kolapo Ishola Residential Estate, Akobo, Ibadan, Oyo State.  
Email Address: unuebhogeorgina@gmail.com  
Phone Number: +2347053756818  
Date of Birth: 27<sup>th</sup> October, 1994  
Place of Birth: Ubiaja  
Nationality: Nigerian  
Marital Status: Single  
Name and Address of Next of Kin: Angela Ononigboria Unuebho  
. Address: 19b, Ekewan Road, Benin City, Edo State, Nigeria.

### B. Educational Background

Educational Institutions Attended with Dates and Qualification:

Lead City University, Ibadan, Oyo State- MSc Architecture 2022 - 2024 (Ongoing)  
Joseph Ayo Babalola University, Ikeji Ara-keji, Osun State- BSc. Architecture 2020- 2024  
Auchi Polytechnic, Auchi, Edo State, Nigeria- Higher National Diploma (HND) 2009-2010  
Auchi Polytechnic, Auchi, Edo State, Nigeria- National Diploma (ND) 2014-2016  
WASSCE 2008

Primary School leaving Certificate

2003

**C. Work Experience with Dates**

Loan Officer at LAPO Micro Finance Bank Ikot-Ansa Branch, Calabar, Cross-River State, Nigeria.

2012-2014

Architectural Technologist at Riddles 1904 Nig. Ltd (NYSC), Abeokuta, Ogun State., Nigeria

2017-2018

Architectural Technologist at Domus Consultium, Benin City, Nigeria 2018-2020

**D. Publications –**

Paper title: A Review of Strategies for Actualizing Low-Carbon Housing in Nigeria

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Date

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