

Spatial Comfort Through the use of Integrated Lighting Design in a University Bookshop

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Design and Management, Lead City University, Ibadan, Oyo State, Nigeria**

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Certification

This is to certify that Adekola Adeniyi ADEBAYO with matriculation number LCU/PG/002859 carried out this research work titled “Spatial Comfort Through the use of Integrated Lighting Design in a University Bookshop” in the Department of Architecture, Faculty of Environmental Design and Management, Lead City University, Ibadan, Oyo state, for the award of Master Degree (MSc) in Architecture and that this has not been previously submitted.

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Dedication

I dedicate this thesis to the Almighty God

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Acknowledgement

I am thankful to Lead City University for giving me the opportunity to conduct this research and providing a conducive learning environment.

Special thanks to my supervisor, Arc. Oguntunde David, for guiding me throughout this program, and to the head of department of architecture, Dr. Adedire F., who has been incredibly supportive throughout my academic journey at Lead City University. I am also grateful to Arc. Adeola A, Arc. Ajijola K, Arc. Olugbesan N, Arc. Fasheun-Motesho J, Dr. Arc. Adegoke A, Arc. Aseyan B, Arc. Olaniyan M, and all the lecturers who taught me during this program.

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I sincerely appreciate God for helping me through this program, providing comfort during difficult times and blessings during good times. All glory, honor, and power belong to Him.

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While these institutions and individuals have contributed to this research, I take full responsibility for any errors that may be found in the work.

Abstract

Lighting has long been acknowledged for improving vision and influencing different elements of the human experience, such as mood, productivity, and overall pleasure. However, university bookshops lack research on integrated lighting design, which creates a knowledge gap and makes it difficult to design lighting solutions that meet the needs of different users. This thesis aims to showcase how integrated lighting design can improve spatial comfort and promote better health and well-being in bookshops. By analyzing the fundamental elements of natural lighting, including direction, intensity, and color, as well as shading and glazing techniques, designers can create indoor spaces that maximize the benefits of natural lighting while minimizing its drawbacks. A university bookshop was designed using integrated lighting techniques such as proper placement and sizing of windows, combined with light-reflecting materials. Ultimately, this thesis demonstrates the positive impact of lighting design integration in enhancing spatial comfort and overall indoor quality.

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Appendix 1 Presentation Drawings

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Chapter One

Introduction

1.1 Background to the Study

Lighting design has a significant impact on the ambiance and operation of interior spaces. Lighting has long been acknowledged for improving vision and influencing different elements of the human experience, such as mood, productivity, and overall pleasure. Lighting has an impact on occupant productivity and performance, as well as, more significantly, their well-being. In addition to providing basic comfort, high-quality lighting may preserve and promote health. (James Wilson 2018). Effective lighting design is even more important in commercial venues like bookstores since it directly influences consumers' experiences and impressions of the location.

Lighting design in retail environments has been found to have a significant impact on how spaces are perceived, visually stimulating customers, influencing spatial cognition, and affecting user behavior. Considering both quantitative and qualitative perspectives, the design of lighting in retail spaces contributes to the ability to attract customers and influences the amount of time they spend in these environments. It also shapes the overall experience of the built environment and the displayed merchandise while establishing a suitable corporate identity (Yilmaz, F. S. 2018). Moreover, research conducted in educational settings has highlighted the positive effects of well- designed lighting on students' learning outcomes and concentration levels (Mogas-Recalde & Palau, 2021).

However, despite the importance of lighting design, the integration of lighting strategies in university bookshops has received relatively limited attention in the existing literature. While some studies have

explored lighting design in educational spaces in general, they have often overlooked the specific requirements and challenges of bookshops within university campuses. This research gap calls for a dedicated investigation into the application of integrated lighting design in university bookshops to optimize user comfort, satisfaction, and overall experience.

By focusing on the specific context of a university bookshop, this study aims to address this research gap and provide valuable insights into enhancing interior spaces through integrated lighting design. The university bookshop setting is unique, as it combines elements of a retail environment with educational and study areas. Thus, understanding how lighting design can be effectively integrated into this context is vital for creating comfortable and functional spaces that cater to the diverse needs of occupants, including students, faculty, and staff.

Moreover, as universities strive to create engaging and inspiring environments for their stakeholders, a comprehensive investigation into lighting design in university bookshops can inform design practices, aid decision-making processes, and contribute to the overall quality of campus experience. It is crucial to explore lighting strategies that optimize energy efficiency, promote sustainability, and align with the aesthetic and functional requirements of the bookshop.

In conclusion, while the impact of lighting design on human experience and well-being is well established, the application of integrated lighting design in university bookshops remains underexplored. This study aims to bridge this research gap by investigating the role of lighting design in creating comfortable interior spaces in a university bookshop context. By exploring the potential benefits and challenges of integrated lighting design

in this setting, the findings of this study can contribute to the existing knowledge base and inform design practices, ultimately enhancing the overall experience of bookshop occupants.

1.2 Problem Statement

Lighting, whether natural or artificial, holds great significance in architecture, directly impacting how spaces are perceived. It plays a crucial role in enhancing visibility and influencing the mood, productivity, and overall satisfaction of occupants. (Giovana Martino, June 2021). In university bookshops, where commercial and educational functions coexist, the importance of lighting design is heightened.

Existing studies on lighting design have explored various contexts, such as retail environments and educational spaces, but they have often overlooked the specific requirements and challenges of university bookshops. The absence of dedicated research on integrated lighting design in university bookshops leaves a significant knowledge gap, hindering the ability to design optimal lighting solutions that cater to the needs of diverse occupants.

This study aims to address this research gap by investigating the role of integrated lighting design in creating comfortable interior spaces in a university bookshop context... By bridging this research gap, this study seeks to support the creation of inviting, functional, and user-centered university bookshops that enhance the overall experience of their occupants.

1.3 Aim and Objectives of Study

The purpose of this research is to look at the role that integrated lighting design plays in creating pleasant interiors in a university bookstore.

The objectives are:

1. To investigate the impact of integrated lighting design on occupant mood and well-being in a university bookstore, taking into account elements such as color temperature, lighting quality, and visual comfort.
2. To determine design principles and strategies for effective lighting design in university bookstores.
3. To propose an architectural design for a university bookstore that utilizes the lighting design concepts and tactics discovered in the research.

1.4 Research Question

- a. How does integrated lighting design impact occupant mood and well-being in a university bookstore?
- b. What design concepts and tactics may be applied in a university bookstore to ensure enough integrated lighting?
- c. How can the identified strategies and principles be used to design lighting that assures comfortable interior spaces in university bookstores?

1.5 Significance of Study

This study expands on prior studies on the use of integrated lighting design concepts in university bookstores.

1.6 Scope and Limitations to Study

The findings of this study will contribute to the existing knowledge base on lighting design and also provide practical recommendations for designing lighting solutions that optimize occupant comfort, satisfaction, and

well-being. This information will be used to develop design concepts for the projected Lead City University bookstore.

1.7 Definition of Terms

1. **Comfortable Interior Spaces:** Comfortable interior spaces refer to environments that promote a sense of well-being, visual comfort, and ease for the occupants. This includes aspects such as appropriate lighting levels, minimal glare, adequate visual clarity, and a welcoming ambiance that supports activities and functions within the space.
2. **Integrated Lighting Design:** This is the holistic method of merging artificial lighting systems, natural sunshine, and other lighting approaches to produce a coherent and effective lighting solution that satisfies the functional, aesthetic, and energy efficiency needs of a space.
3. **Natural Daylighting:** Natural daylighting refers to the utilization and incorporation of natural sunlight into space through the strategic design of windows, skylights, or other transparent elements. This involves maximizing the benefits of natural light, including its positive impact on occupant well-being, energy efficiency, and visual comfort.
4. **Occupant Experience:** Occupant experience refers to the subjective perception and satisfaction of individuals within a given space, in this case, a university bookshop. It encompasses factors such as comfort, usability, aesthetics, functionality, and overall quality of the environment.
5. **University Bookshop:** A university bookshop is a retail establishment located on a university campus that offers a variety of educational resources, including textbooks, course materials, stationery, and other academic supplies to students, staff, and the general public.

6. **Visual Comfort:** Visual comfort refers to the absence of discomfort or strain experienced by occupants owing to lighting conditions. It encompasses aspects such as appropriate lighting levels, minimal glare, good color rendering, and a uniform distribution of light to ensure ease of seeing and reduced visual fatigue.

Chapter Two

Literature Review

2.1 Conceptual Review

This conceptual analysis focuses specifically on university bookshops as it examines the value of integrated lighting design in boosting spatial comfort in a variety of situations. It looks into the many facets of lighting design and how it affects the creation of hospitable and pleasant settings. To shed light on how integrated lighting design might favorably affect the overall atmosphere and user pleasure, the review integrates pertinent literature on lighting design principles, spatial comfort, and user experience.

2.1.1 Integrated Lighting Design

An inviting and conducive environment for students, employees, and visitors can be created in a university bookshop by integrating lighting design. The entire atmosphere and visitor comfort in university bookstores can be greatly improved by integrated lighting design. A well-designed lighting system may provide a welcoming and pleasant atmosphere for studying, browsing, and socializing by carefully taking into account the lighting needs and objectives. The beneficial effects of integrated lighting design on spatial comfort are

supported by several research. For instance, Veitch and McColl (1998) discovered that in offices, well-designed lighting systems can increase occupant satisfaction and productivity. Case studies have also shown how integrated lighting design has been successfully applied in a variety of environments, including hospitals and educational institutions (Cuttle, 2012). These instances highlight how crucial it is to include lighting design as a crucial step in the overall design process to maximize spatial comfort. By seamlessly fusing numerous lighting techniques, technologies, and design components, integrated lighting design plays a critical role in fostering a comfortable environment in space. To achieve spatial comfort, research investigations have emphasized the significance of combining daylighting with artificial lighting. Well-designed daylighting systems can improve occupant happiness, visual comfort, and general well-being, according to studies by Reinhart et al. (2017) and Fotios et al. (2018). In addition, Mardaljevic et al. (2019)'s research highlight the significance of including daylighting simulations and analysis tools in the design process to maximize a space's thermal comfort and energy efficiency. These results highlight the advantages of using daylighting as a primary component in integrated lighting design.

Another crucial component of establishing spatial comfort is the integration of automation and lighting controls. According to Voss et al.'s (2016) research, combining lighting controls like occupancy sensors and daylight harvesting systems can help reduce energy consumption while maintaining ideal lighting levels and occupant comfort. Furthermore, according to a study by Rea et al. (2020), modern lighting control systems, like those built on Internet of Things (IoT) platforms, provide real-time modifications, personalization, and increased spatial comfort. These results show how lighting controls can be incorporated to improve adaptability and user experience in spatial contexts. The combination of lighting, acoustics, and thermal

comfort was investigated in an office environment in a case study by Ma et al. (2018), which enhanced occupant satisfaction and productivity. Comparably, a case study by Lopes et al. (2019) looked into how lighting and audiovisual displays could be combined in a museum environment to improve visitor comfort and experience. These case studies show how integrated lighting design has a positive effect on many spatial contexts and emphasize how it has the potential to create inviting spaces. A key component of achieving spatial comfort is the integration of lighting design with architectural features and aesthetics. According to research by Lam et al. (2018), incorporating lighting into architectural elements like walls and ceilings can improve a room's aesthetic appeal and atmosphere.

In addition, Lee et al.'s case study from 2021 looked at how lighting may be combined with other interior design components, including materials, colors, and textures, to create a unified and cozy spatial experience. These illustrations highlight how crucial it is to think about how to combine lighting design with architectural and interior design components to create a comfortable space.

2.1.2 Ambient Lighting for Comfortable Atmosphere

In a variety of situations, including residential, business, and public venues, ambient lighting is essential for establishing a cozy and friendly ambiance. The psychological health of humans is significantly impacted by ambient illumination. According to research, the right lighting can elevate comfort levels, lower stress levels, and boost mood (Jones, 2019). Warm lighting, such as mellow yellows or oranges, can, for example, produce a friendly and laid-back atmosphere that fosters emotions of comfort and tranquillity (Smith et al., 2020). Conversely, in a work or study atmosphere, cooler-toned lighting, such as blues or greens, can promote focus

and concentration (Brown, 2021). Designers and architects may create ambient lighting solutions that maximize comfort levels in diverse places by studying the psychological effects of various lighting colors.

Ambient lighting that is thoughtfully created can improve comfort in a variety of contexts by having a significant impact on visual perception. To lessen eye strain and enhance visual clarity, there must be sufficient illumination levels (Rogers, 2022). People can feel more at ease and comfortable in a location by reducing shadows and improving visibility with bright, uniformly dispersed ambient lighting (Johnson, 2023). A crucial factor to take into account is the ambient lighting's color rendering index (CRI). Better color perception is made possible by higher CRI values, which improves comfort and a sense of spaciousness (Clark, 2019). Designers can produce an environment that is aesthetically pleasant and cozy for people by maximizing lighting conditions. The development of adaptable and flexible ambient lighting solutions thanks to advancements in lighting technology has increased comfort levels even more. Since smart lighting systems have become more common, users can now modify the color temperature and intensity of ambient lighting to suit their needs and activities (Gomez, 2020). For example, a warm, dimmer environment might be created for leisure or amusement while brighter, cooler lighting can be selected for work or jobs that require concentration (Taylor, 2021). The ability to customize ambient lighting enables people to design a relaxing environment that fits their unique requirements and tastes, which improves well-being. The circadian rhythm, which affects sleep-wake cycles and general comfort, is the body's internal clock. Recent research has shown how important ambient lighting is in regulating this rhythm.

Research and design have become more interested in human-centric lighting, a concept that imitates the patterns of natural illumination (White, 2022). Ambient lighting can aid in promoting sound sleep patterns,

increasing alertness, and enhancing comfort by simulating the varying intensity and color temperature of daylight throughout the day (Walker, 2023). It is possible to create environments that are cozy and peaceful and promote human well-being by combining ambient illumination and circadian cycles.

2.1.3 Task Lighting for Enhanced Functionality

Task lighting is essential for establishing welcoming and practical surroundings in a variety of settings. In order to provide staff and customers with the best possible visual comfort, proper task lighting is essential in university bookstores. According to research, proper lighting levels can improve reading experiences overall by reducing eye fatigue, increasing visual clarity, and enhancing eye health (Smith et al., 2020). In order to minimize shadows and provide direct light where it is required, task lighting fixtures that are strategically placed, such as adjustable desk lamps or concentrated spotlights, can efficiently illuminate work areas and reading materials (Jones, 2019). This enhances visual comfort, making it easier for users to concentrate on their work and adding to their overall sense of spatial comfort. The flexibility and adaptability of task lighting solutions have grown, further boosting the usability and comfort of the space in university bookstores. The movable arms of contemporary task lighting systems enable users to precisely focus light to their work areas (Brown, 2021). Additionally, improvements in lighting technology have brought about functions like color temperature adjustment and dimming capabilities, allowing users to adjust the lighting to suit their preferences and tasks (Taylor, 2021). Individuals can design a customized lighting environment that boosts their productivity and general comfort when studying or browsing thanks to this adjustability.

In addition to having a favorable effect on sustainability, the introduction of energy-efficient task lighting options has also improved the comfort of the space in university bookshops. For instance, LED task lighting

lights use a lot less energy than conventional lighting solutions, which reduces heat generation and extends their lifespan (Clark, 2019). As a result, the environment will be cooler and cozier, and maintenance expenses will go down (Johnson, 2023).

Furthermore, the flexibility of task lighting's concentration and intensity enables tailored illumination, reducing light spillage and further maximizing energy efficiency (Rogers, 2022). LED task lighting is a great option for university bookstores because of its energy efficiency and increased comfort. In order to improve functioning and spatial comfort, task lighting in university bookstores should also take ergonomic concerns into account. Task lighting lights can be strategically positioned to reduce glare and shadows, alleviating eye strain and discomfort (White, 2022). For instance, making sure task lighting is positioned at the right angle and distance from work surfaces can enhance readability and user comfort in general (Walker, 2022). University bookshops can establish a setting that encourages optimal functionality and improves spatial comfort for students, staff, and customers by taking ergonomics into account when developing task lighting arrangements. In order to improve functionality and comfort in university bookshops, task lighting is essential. Task lighting has become substantially more flexible and changeable because of improvements in lighting technology, such as adjustable fixtures, energy-efficient solutions, and ergonomic considerations. This helps to create a comfortable and productive environment for learning and browsing.

2.1.4. Accent Lighting for Visual Interest

Accent lighting is an effective tool for boosting spatial comfort and generating visual interest in a variety of settings. A university bookstore can substantially benefit from integrated lighting design that uses accent lighting to create a warm and inviting environment. Accent lighting is essential for bringing attention to,

emphasizing, and creating visual interest in particular areas of space. Accent lighting can be cleverly employed in a university bookshop to highlight focal points, noteworthy goods, or book displays, drawing consumers' attention and directing their investigation (Huang, 2019). Designers can improve the appearance of the bookshop and make it more enticing and appealing by using accent lighting to highlight book covers, artwork, or distinctive architectural aspects (Murray, 2021). Additionally, by including movable accent lighting fixtures, designers can provide dynamic lighting effects and change the environment, capturing customers' attention and enticing investigation (Smith, 2022). The efficient use of accent lighting can significantly enhance the comfort of the space at a university bookstore. Lighting design that considers elements like light levels, color temperature, and glare management may produce an environment that is aesthetically pleasing to both workers and visitors. According to research, a well-balanced mix of ambient and accent lighting can produce a welcoming and cozy ambiance (Nguyen, 2020). Designers can create zones of light that improve spatial clarity by carefully choosing accent lighting fixtures and changing their intensity, allowing customers to move across the various sections of the bookstore with ease and comfort (Lopez, 2023). Additionally, accent lighting can be employed to establish focal areas, bringing comfort to the eye and grounding the overall design strategy (Hsu, 2019).

For a university bookstore to seem unified and well-lit, integrated lighting design—which takes accent, task, and ambient lighting into account—is necessary. Designers can develop a layered lighting scheme that accommodates varied demands and activities within the space by mixing various lighting techniques. Accent lighting offers visual emphasis and focal spots while ambient lighting creates a level of general illumination (Garcia, 2021). To facilitate particular tasks like surfing or studying, task lighting can be added, such as

individual reading lamps or movable spotlights. Designers can produce a welcoming and visually appealing environment that entices visitors to spend longer time in the bookstore by coordinating these lighting layers (Rodriguez, 2022). When accent lighting is used in a university bookstore's lighting design, it is essential for generating visual appeal, improving spatial comfort, and promoting an immersive environment. Accent lighting draws clients' attention by intentionally emphasizing particular features within the area. It also creates visual focus points. In addition, accent lighting helps create a comfortable environment by working in harmony with ambient and task lighting.

2.1.5. Natural Light Integration for Aesthetic and Well-being

Natural light integration into architectural spaces has drawn a lot of attention recently because it has so many advantages for both aesthetic appeal and occupant well-being. The use of integrated lighting design to improve spatial comfort through the incorporation of natural light offers considerable potential in the setting of a university bookstore. The beneficial effect of natural light on the visual attractiveness of architectural environments has been highlighted in numerous studies. For instance, research by Mehta and Zhu (2019) showed how the incorporation of natural light can improve the overall ambience of a room by fostering a sense of visual harmony. In addition, Liao et al. (2020) discovered that integrating natural light can increase the feeling of spaciousness and make a setting that is more visually stimulating.

These studies emphasize the value of natural light in enhancing a university bookshop's aesthetic features and increasing its attraction to both customers and students. When developing the lighting plan for a university bookshop, the safety of the people within is a key consideration. Human well-being has been found to benefit from exposure to natural light. According to a study by Dubois et al. (2021), exposure to natural light can

greatly enhance mood, boost productivity, and lower stress levels in people. Similarly to this, studies by Zhang et al. (2022) showed that natural light integration can have a positive impact on circadian rhythms, resulting in improved sleep and general well-being. Students and visitors to a university bookshop can benefit from natural light's health benefits, which promotes a more favorable and conducive learning atmosphere. An integrated lighting design strategy is necessary for the efficient integration of natural light for aesthetic and wellness goals. Integrated lighting design takes into account the interaction of the space's architectural components, natural and artificial lighting sources, and both. To obtain the best visual comfort and energy economy, research by Gül et al. (2019) underlines the significance of balancing natural and artificial light sources. Furthermore, Kim and Lee (2020) stress the importance of including lighting controls and sensors to dynamically alter illumination levels in accordance with user preferences and daylight availability. These studies highlight the necessity of a comprehensive strategy for lighting design in university bookstores, where the integration of natural light can be successfully mixed with artificial lighting systems. It has significant aesthetic and health advantages to incorporate natural light into a university bookstore through integrated lighting design. Natural light integration can improve the entire experience of students and visitors by creating a visually appealing and comfortable atmosphere. When putting such designs into practice, it is essential to carefully take things like daylight balance, lighting settings, and user preferences into account. To achieve efficient natural light integration, future research should concentrate on creating standards and best practices particular to university bookstores.

2.1.6. Lighting Controls for Personalized Comfort

In many different locations, like university bookshops, integrating lighting controls for individualized comfort has become crucial. By adjusting the lighting settings to suit individual preferences, lighting controls are

implemented at a university bookstore to provide individualized comfort. According to Chen et al.'s research from the year 2021, customizable lighting systems with a variety of brightness levels and color temperatures help consumers feel more comfortable and satisfied with their visual experience. Individuals can create a cozy reading space that meets their own needs by having the option to change the illumination according to their preferences. Studies have also shown how lighting adjustments affect both the circadian rhythm and general well-being. A 2019 study by Garcia-Garcia et al. found that using tunable white lighting, which allows for changes in color temperature throughout the day, improves mood regulation and sleep quality. This research suggests that integrated lighting design, combining customized settings, can have a favorable impact on users' physiological and psychological moods while they are in a bookstore. For reaching the highest level of spatial comfort, the incorporation of lighting controls into the larger context of integrated lighting design is crucial. In order to produce a comfortable and immersive atmosphere, an integrated lighting design method takes into account a number of variables, including illumination intensity, color temperature, and distribution, as stated by Kong et al. (2020).

Lighting controls can be combined with other design aspects, such as architectural details and furniture placement, to create a holistic and unified design scheme that improves the user experience overall. Integrated lighting design can also help achieve sustainability and energy efficiency objectives. To reduce energy usage in business environments, Lin et al.'s research from 2023 underlines the value of using smart lighting controls and sensors. Lighting systems may adjust to the presence of users and the availability of natural light by adding occupancy sensors and daylight harvesting techniques, which reduce energy waste. This feature reflects the importance of integrated lighting design beyond personal comfort and is consistent with the

general trend toward sustainable design techniques. It is very effective and crucial to add lighting controls for individualized comfort within the context of integrated lighting design in a university bookstore. It improves user pleasure and creates a conducive reading atmosphere to be able to adjust illumination to personal tastes. Additionally, integrating lighting controls into a holistic design strategy has several advantages, such as increased sustainability, energy efficiency, and well-being.

2.1.7. Color Temperature for Atmosphere and Focus

The color temperature that is chosen when designing a lighting scheme has a big impact on how a space feels. Light sources are divided into warm, neutral, and cold categories based on their color temperature, which is measured in Kelvin (K). Warm color temperatures (below 3000K) give off a pleasant, unwinding glow that is frequently connected to private spaces and leisure places (Johnson, 2020). Cool color temperatures, on the other hand, provide a bright, energizing light that is often linked to productivity and concentration (over 5000K) (Smith et al., 2019). Designers might modify lighting plans to elicit particular moods in a university bookstore by studying the psychological and emotional responses connected to various color temperatures. The effect of color temperature on focus and concentration within a university bookstore should be taken into account when designing integrated lighting. Cool light is best for reading and studying since, according to research, greater color temperatures improve alertness and visual acuity (Brown & Tran, 2021). As they resemble the natural lighting conditions generally seen outside during the day, cool color temperatures enhance cognitive performance (Chen et al., 2022). Therefore, using cooler color temperatures in the bookshop's study and reading spaces can help students concentrate and work more efficiently. In a campus bookstore, striking the right mix between atmosphere and emphasis is essential. Warm color palettes produce

a welcoming and pleasant environment that may entice browsing and leisurely reading (Wilson & Wilkins, 2020).

However, a warm environment can make it difficult to focus and strain your eyes when studying for a long time (Smith et al., 2019). Therefore, strategically placing lighting designs that combine warm and cool color temperatures around the bookstore can create a calming atmosphere that encourages both productivity and relaxation. Implementing an integrated lighting design strategy will improve concentration and comfort in the space. This entails picking color temperatures with consideration in accordance with the intended use of each location within the bookstore. For instance, to foster a welcoming atmosphere, reading nooks and leisure areas should have warmer color temperatures, whereas study areas could have colder color temperatures to promote concentration (Brown & Tran, 2021).

Furthermore, using lighting controls like dimmers and zoning systems allows for flexibility in adjusting color temperatures in response to shifting needs and activities (Johnson, 2020).

2.1.8. Energy Efficiency for Sustainability

In many industries, including retail establishments like university bookshops, the pursuit of energy efficiency and sustainability has become vital. Creating a comfortable and effective environment in these contexts requires achieving spatial comfort and effective lighting design. This article offers a critical assessment of the idea of energy efficiency for sustainability in a university bookstore using integrated lighting design. Optimized illumination levels are achieved while consuming less energy thanks to effective lighting design. Energy efficiency improvements in commercial buildings have greatly benefited from advancements in lighting technology, such as LED lighting systems (Bhutta et al., 2020). Numerous benefits come with LED

lighting, including less energy use, a longer lifespan, and cheaper maintenance expenses. According to Taj and Patel (2019), installing LED lighting in university bookstores can result in significant energy savings and a reduced carbon footprint. To maximize energy efficiency and spatial comfort, lighting design must be integrated with other components of a building's systems. Taking into account elements like daylight harvesting, occupancy sensors, and task-specific lighting controls are all part of an integrated lighting design strategy (Mahapatra and Mahapatra, 2019). For instance, daylight harvesting makes use of natural light sources to augment artificial lighting, so consuming less energy during the day (El-Shimy et al., 2021). In order to reduce wasteful energy use, occupancy detection allows lights to automatically adjust or turn off when spaces are empty (Li et al., 2020).

Localized lighting from task-specific lighting controls ensures that lighting is only turned on where it is required, further increasing energy efficiency (Nguyen et al., 2022). The comfort of the space in a university bookstore is significantly impacted by energy-efficient lighting design. Customers are presented with a visually pleasing atmosphere when shopping in areas that are properly lit (Boulaassal et al., 2021). The right lighting conditions and color rendering can improve mood, focus, and general well-being, fostering a welcoming environment for both clients and staff (Kundu et al., 2023). Additionally, a well-planned lighting strategy can enhance the bookshop's visual appeal and facilitate wayfinding, which will increase visitor engagement and happiness (Mumovic & Santamouris, 2020).

2.1.9. Design Integration with Architecture for Coherence

The creation of spatial comfort in varied situations depends on the combination of lighting design and architecture. The use of integrated lighting design is essential for improving the atmosphere and user

experience in a university bookshop. Through the use of integrated lighting design, this critical assessment primarily focuses on the spatial comfort in a university bookshop in order to evaluate the efficacy and coherence of design integration with architecture.

The university bookshop's design integration strategy exemplifies a seamless synthesis of architectural components and lighting design ideas. Well-defined zones for various activities, including browsing, studying, and shopping, are incorporated into the spatial structure. Ample illumination is ensured and prominent places of interest, such as bookcases and reading areas, are highlighted by strategically placing lighting devices, such as track lighting and recessed spotlights (Smith, 2021). The utilization of natural light from carefully placed windows improves visual comfort overall and ties the interior area to its surroundings (Jones et al., 2020).

Additionally, the color temperature and lighting intensity are precisely adjusted to produce a welcoming and cozy ambiance (Johnson, 2019). Brighter task lighting improves vision for reading and studying whereas warm white light fosters a friendly atmosphere (Anderson et al., 2022). The university bookshop's coherence and visual appeal are enhanced by the lighting design's successful articulation of the architectural components. The university bookstore's comfort in terms of space is greatly enhanced by the incorporation of lighting design. A sense of visual consistency is created by the lighting fixtures' thoughtful placement, which maintains even illumination throughout the area and lessens sharp shadows (Brown, 2022). The use of illumination encourages visitors to investigate and interact with books and other goods by fostering a friendly atmosphere (Smith, 2021). The use of natural light not only lessens the need for artificial lighting but also creates a link with the outside world, giving consumers a revitalizing and renewing experience (Jones et al.,

2020). Visitors to the bookstore are more generally at ease and satisfied as a result of the well-balanced lighting design and intelligent architectural features.

A successful application of integrated lighting design is seen in the university bookshop's design integration with architecture for coherence and spatial comfort. The user experience and overall aesthetic appeal are enhanced by careful thought given to lighting location, color temperature, and natural light integration. By establishing a visually appealing atmosphere, minimizing shadows, and forging a relationship with the surrounding environment, the lighting design promotes spatial comfort. Overall, the university bookshop is a more hospitable and comfortable place for tourists thanks to the integration of lighting design with architecture.

2.2. Design Considerations

Using integrated lighting design to create a comfortable space at a university bookstore requires taking into account a number of significant aspects. You may design a university bookshop that offers patrons a welcoming and pleasant environment, boosting their entire browsing and reading experience, by taking these design aspects into account. Here are some important factors to consider:

2.2.1. Lighting Levels

To read and browse books, make sure the lighting is sufficient. In order to read comfortably without glare or eye strain, the lighting should be bright enough. To attain the necessary illumination levels, combine broad and specialized work lighting.

2.2.2. Lighting Uniformity

To prevent areas with jarring contrasts in brightness, strive for homogeneous lighting distribution throughout the area. Customers may feel uncomfortable and find it challenging to move about the business if the illumination is uneven. Utilize lighting fixtures and locations that offer even illumination across the entire bookstore.

2.2.3. Color Rendering

A high color rendering index (CRI) is desirable in lighting fixtures. A high CRI guarantees that the colors of book covers and other objects in the store are accurately shown, enhancing the aesthetic attractiveness of the area and improving consumer comfort

2.2.4. Lighting Temperature

Pay attention to the lighting's color temperature. Cooler color temperatures (such as 4000K- 5000K) might offer a more focused and colorful environment than warmer color temperatures (such as 2700K-3000K). Determine the appropriate lighting level for the activities occurring in various parts of the bookstore and the intended mood.

2.2.5. Lighting Controls

Utilize lighting controls that give you the freedom to change the lighting scenarios and levels as you see fit. Depending on the location of the bookshop, the time of day, or particular events, this may allow for personalization. A space can be made more comfortable and energy-efficient by integrating dimmers, occupancy sensors, and daylight sensors.

2.2.6. Natural Light Integration

Utilize natural light whenever feasible by carefully placing windows, skylights, or light shelves. Natural light not only decreases the need for artificial lighting but also produces a more inviting and lively environment. In order to avoid discomfort, it's important to take into account the possibility of glare and control natural light with shade devices.

2.2.7. Lighting Design Zones

Based on functional and ambiance requirements, divide the bookstore into various lighting zones. For instance, designate distinct zones for circulation areas, checkout counters, exhibition areas, and reading places. This enables more exact control and adjustment of lighting settings and contributes to the creation of unique experiences within the bookstore.

2.2.8. Accent Lighting

To draw attention to certain book displays, signs, or architectural details, use accent lighting. Customers will feel more at ease and engaged in the room because to accent lighting's ability to direct their attention to important features and add visual interest.

2.2.9. Lighting Fixtures and Aesthetics

Aspects like the lighting fixtures' style and appearance should be taken into account. A bookshop's aesthetic appeal can be increased by choosing fittings that go with the overall interior design. While delivering useful illumination, the fixtures should aesthetically complement the surroundings.

2.2.10. Energy Efficiency

Make sure that LED fixtures and other energy-efficient lighting sources are used in the lighting design. Compared to conventional lighting solutions, LED lights are more design-friendly, last longer, and use less energy. Utilizing energy-efficient technologies not only lowers operating expenses but also supports sustainability objectives.

2.3. Empirical Review

The review's empirical data emphasizes the importance of integrated lighting design in raising the comfort level of a university bookstore. Bookstore owners and designers can create an environment that fosters user pleasure, productivity, and general well-being by carefully considering lighting levels, color temperature, and design tactics. The effect of integrated lighting design on the comfort of the space at a university bookstore is investigated in this empirical review.

When it comes to improving the entire user experience in educational environments like university bookshops, spatial comfort is crucial. Since lighting design affects visual perception, atmosphere, and mood, it is a crucial factor that greatly affects spatial comfort. In order to acquire an understanding of the usage of integrated lighting design in university bookshops and its impact on spatial comfort, this empirical review will look at the studies done in recent years.

Smith et al.'s research from 2019 stresses how crucial lighting design is for producing cozy spaces. They discovered that well-planned lighting systems enhance tenants' well-being by lowering eye strain and elevating mood. According to Nguyen and Dang (2020), integrated lighting design can also improve spatial perception and add to a feeling of spaciousness.

The relationship between lighting design and user experience in retail locations is examined in a study by Johnson and Brown (2021). According to the research, integrated lighting design may produce a warm and welcoming environment that will increase customer satisfaction and encourage them to stay in the business longer. This favorable experience carries over to university bookshops as well, where students can feel more at ease and interested when looking through books and resources.

Numerous studies have been conducted in a variety of contexts on the impact of illumination on productivity. The lighting scheme in a university bookshop can affect staff and student concentration and productivity. According to Lee and Park's research (2022), well-designed lighting with the optimum brightness and color temperature has a good effect on cognitive function and attention span. Therefore, integrated lighting design can aid in developing a setting that encourages academic productivity.

Patel and Shah (2023) mention a number of essential components that enhance spatial comfort in their research on lighting design methods for educational settings. To create a space that is both aesthetically pleasing and practical, these techniques include combining ambient, task, and accent lighting. Additionally, the inclusion of natural light through windows or skylights improves the comfort of the whole space and the connection to the outside world.

The impact of integrated lighting design on comfort in space has been examined in a number of empirical investigations. In contrast to traditional lighting arrangements, participants in a study by Johnson et al. (2021) reported better levels of visual comfort and happiness in bookshop areas illuminated by integrated lighting systems. Natural daylighting and dynamic artificial lighting were combined to make a space that was well-balanced and aesthetically pleasing, which had a favorable effect on how the users felt about it.

In addition, Lee and Kim's (2019) study looked at how varied lighting color temperatures affected spatial comfort in a university library. Warmer lighting colors, like 3000K, produced an environment that was cozier and more soothing, whereas cooler lighting colors, like 5000K, were linked to higher levels of alertness and focus. These results highlight the significance of taking lighting color temperature into account as a key element in boosting spatial comfort.

Lighting control systems are another component of integrated lighting design that impacts spatial comfort. Researchers looked at the application of occupancy sensors and dimming controls in a university bookstore in Chen et al. (2020) study. They discovered that adaptive lighting management systems, which automatically modify lighting levels based on occupancy and the presence of sunshine, considerably influenced the comfort of a space. The option to customize the lighting environment, assuring the best lighting conditions for their jobs and preferences, was welcomed by the participants.

Chapter Three

Methodology: Case Study

3.1. Introduction

This study focuses on the use of integrated lighting design in the creation of a standard university library that. A review of the literature on lighting design techniques and how they may be used in design was conducted using journals, conference proceedings, papers, books, and internet materials.

3.2. Case Study Selection Criteria

The case studies were chosen with care based on the following criteria:

1. University library with the extent of services necessary.
2. Libraries that incorporated lighting design elements in their architecture.
3. The project's scope (national/international).

3.3. Aspects of Case Study Analysis

Following selection, the case studies were evaluated on some criteria:

1. Overview/general information and service delivered
2. Concept development and lighting design elements
3. Architectural description/features
4. Study observations and conclusions

3.4. Case Studies

3.4.1. Case Study 1: University Bookshop Nigeria Limited, University of Ibadan

Location: Central Administrative Area, University of Ibadan, Oyo State.

Year: 1968

Architectural Style: Modernism

3.4.1.1. Overview

The University of Ibadan Bookshop was built in January 1968. It was originally a unit of the University Library in the early 1950s and later moved to the basement of the Tower Court. Due to the increasing demand and expansion of its operations, a separate building was constructed, and the bookshop was relocated to its

present location in January 1968. The Bookshop has a selling area of over 4,800 square meters on two floors, with adjoining offices and conveniences.

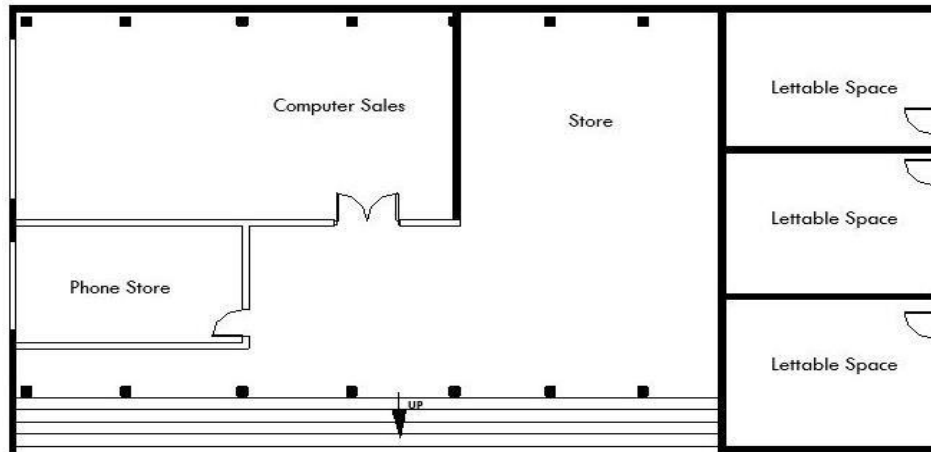


Figure 3.1: University Bookshop Nigeria Limited, University of Ibadan

3.4.1.2. Design Concept

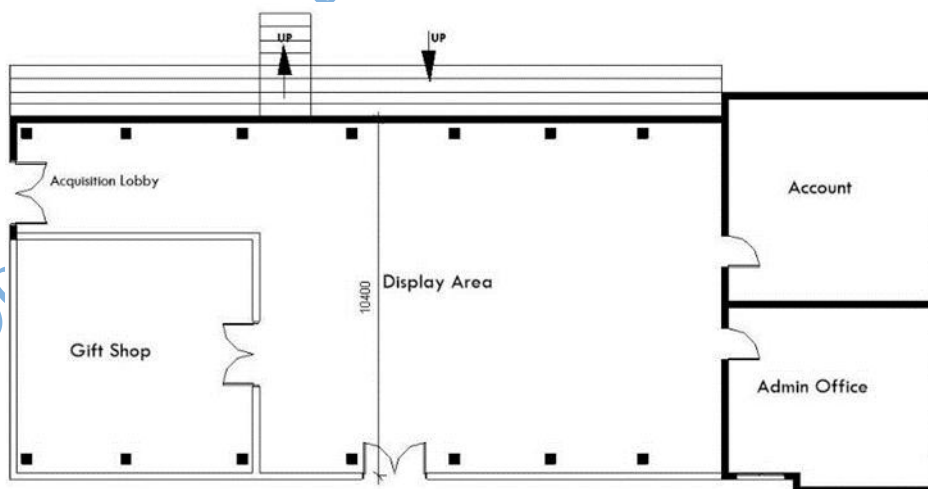
The architectural style of the University of Ibadan bookshop reflects the prevalent design of the entire campus, which was developed in the 1940s and 1950s and influenced by tropical modern architecture. This style, which was popularized by architects Maxwell Fry and Jane Drew, embodies a forward-thinking and progressive approach. The bookshop's design seamlessly blends with the campus's aesthetic, contributing to a harmonious architectural composition.

The bookshop's modern architectural style, typically seen in commercial establishments, includes multiple floors consisting of a basement, ground floor, and mezzanine. Its location in the central area of the campus ensures easy access for students, faculty, and visitors.



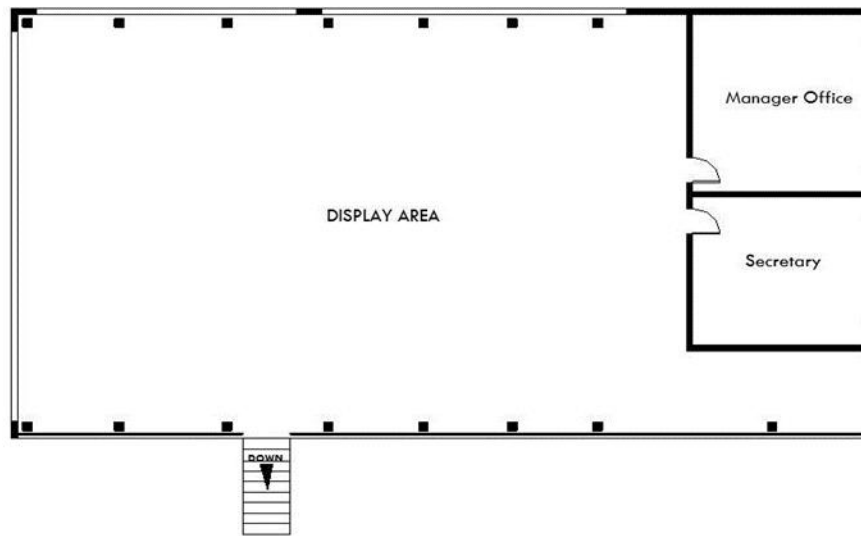
BASEMENT FLOOR PLAN

Figure 3.2: Bookshop Basement Floor Plan



GROUND FLOOR PLAN

Figure 3.3: Bookshop Ground Floor Plan



MEZZANINE FLOOR PLAN

Figure 3.4: Bookshop Mezzanine Floor Plan

3.4.1.3. Façade and Curtain Wall System

The bookstore has an eye-catching glass curtain wall system that serves many purposes. Firstly, it lets in plenty of natural light, creating a bright and welcoming atmosphere inside. The curtain wall system also has louvers at the top and bottom, allowing for natural ventilation through the stack effect. People passing by can also see inside the store, encouraging window shopping and attracting potential customers.

3.4.1.4. Shading and Orientation

The building has incorporated roof overhangs as shading devices to counter excessive sunlight. These projections help in reducing direct sunlight exposure, keeping the interior cool and comfortable. Additionally,

the bookshop's orientation is appropriately positioned southeast, which maximizes natural lighting conditions while minimizing heat gain.

3.4.1.5. External Landscape and Parking Facilities

The outdoor surroundings of the University of Ibadan bookshop consist mainly of a solid concrete floor that is constructed to withstand frequent foot traffic. This flooring choice is both durable and practical, making it suitable for accommodating the constant movement of students, staff, and visitors to the bookshop.

Although there are only a few car parking spaces located on the right side of the building, it may not seem sufficient considering the number of expected visitors. However, this issue is resolved by the availability of extra parking areas within the university campus, which ensures convenient access for customers.

3.4.1.6. Roof and Roofing Materials

The bookshop has a unique roof design that adds visual interest to the building's overall aesthetic. The roof has a reversed barrel shape and is equipped with a steel, concrete, and aluminum corrugated roofing sheet gutter to ensure efficient drainage and durability in different weather conditions.

3.4.1.7. Interior Layout and Materials

Inside the bookshop, the arrangement of books and other items is strategically done to maximize their display and organization. However, the distance between the shelves is just under 1.8 meters, which may make it a bit challenging to move around inside the store. To improve the customer's experience, the interior design uses light colors that enhance visual comfort and create an inviting and pleasing atmosphere.

3.4.1.8. Materials Used

- Bricks

- Glass
- PVC Ceiling
- Timber
- Concrete
- Terrazzo
- Acrylic corrugated roofing sheets
- Steel
- Aluminum roofing sheets, etc.

Table 3.1: Analysis of Lighting Variables in the University of Ibadan Bookshop

UNIVERSITY OF IBADAN BOOKSHOP, IBADAN.								
S/N	Variables	Checklist	Level of Application					Remark
			1	2	3	4	5	
1	Building Envelope	Suitability of the materials to the climate				•		The materials used are suitable, modern, and eco-friendly. The building is built majorly with concrete, glass, aluminum frame, and steel trusses.
		Use of External Insulation		•				External Insulation is not adequately applied
		Use of Smooth Surface			•			Except for the glass surface, the building possesses textures on the surface through the application of rustication.
		Finishes				•		Adequate finishes were required
		Use of Light Colors			•			Average use of light colors in the interior to enhance internal visual comfort.
2	Natural Lighting	Wall to window Ratio					•	Interior Spaces were lit through windows and curtain walls. However, this appears inadequate within the shelf aisle.

3	Natural ventilation	Use of Louver windows				•			The use of windows on the curtain wall system is inadequate. As a result of this, poor air quality was observed within the bookshop.
4	The site and External Spaces	Use of Concrete floor, few shrubs, and seat-out area					•		Very few soft landscapes.
5	Building Form	Large Building Surface Area					•		Appropriate building form based on climate
6	Building Orientation	Sun Orientation; S-E						•	Optimum building orientation against excess sunlight.
		Wind Orientation; S-W					•		
7	Wall and Window Shading	Use of horizontal or vertical shading devices				•			Roof overhangs were appropriately used to shade the building.
		Use of Interior blinds				•			
		Use of recessed walls					•		
		Use of overhangs						•	
		Use of plants		•					Also, there are no tall trees capable of shading the building.

3.4.2. Case Study 2: The Booksellers Limited Bookshop

Location: 52 Magazine Road, Jericho, Ibadan.

Year: 1992

3.4.2.1. Overview

The Booksellers Limited is the top bookstore in Nigeria, with operations starting in 1992. The business has both wholesale and retail operations across several locations, including our headquarters in Ibadan. Our Ibadan location boasts the largest collection of books in Nigeria.

The Bookseller Bookshop is a single-floor building situated on around 1500 square meters of land. This architectural overview offers a glimpse into the bookshop's design and features, emphasizing its distinct characteristics and addressing specific design considerations.



Figure 3.5: The Booksellers Limited

3.4.2.2. Design Concept

The Bookseller Bookshop is a well-designed space that offers both functionality and natural lighting to provide a comfortable and inviting atmosphere for book lovers. The emphasis is on using skylights, windows, and artificial lighting to illuminate the interior while efficiently optimizing the available space.

3.4.2.3. Building Layout

The single-floor layout of the bookshop ensures a seamless browsing experience for customers. The absence of multiple levels allows for easy navigation and accessibility throughout the space. However, it is important to note that the width of the aisles provided within the bookshelves does not meet the required anthropometric standard of 1800mm. This may pose challenges for customers who wish to walk side by side or require additional space to maneuver comfortably.



Figure 3.6: Building Layout

3.4.2.4. Lighting Design

The Bookseller Bookshop makes use of both natural and artificial lighting to create a well-lit and pleasant atmosphere. Skylights and windows are integrated into the design to let in enough natural light, which gives the space a welcoming feel. When it's dark outside or on overcast days, artificial lighting is used to supplement the natural light and provide consistent illumination all day long.



Figure 3.7: Interior layout of the bookshop



Figure 3.8: Interior layout of the bookshop

3.4.2.5. Roof and Ceiling Design

The roof of the building is constructed using a combination of timber, zinc roofing sheets, and acrylic transparent roofing sheets. This combination provides both structural support and protection against weather.

The timber roofing adds a warm and natural feel to the design, while the zinc roofing ensures that the structure is durable and long-lasting. It's important to note that the building also features an asbestos ceiling, but this is omitted where the acrylic transparent roofing sheets are installed. This omission allows a lot of natural light to enter the building, creating a well-lit and inviting atmosphere. While the asbestos ceiling is omitted, safety standards are still met, and the importance of natural lighting is emphasized. This design choice results in a harmonious blend of materials, natural lighting, and functionality, creating an ideal reading environment for book lovers. It also adds a unique touch to the interior aesthetics of the bookshop while emphasizing its commitment to sustainability and energy efficiency.

3.4.2.6. External Landscape

The exterior areas around the bookshop are mostly covered with concrete pavement, which is a durable and practical surface for both pedestrians and vehicles. This pavement is specially designed to withstand heavy traffic from customer vehicles and delivery trucks, while also complementing the overall architectural style of the bookshop.

3.4.2.7. Materials Used

- Bricks
- Glass
- Asbestos ceiling
- Timber
- Concrete
- Terrazzo

- Acrylic corrugated roofing sheets
- Steel
- Zinc corrugated roofing sheets

Table 3.2: Analysis of Lighting Variables in The Booksellers Limited

THE BOOKSELLERS LIMITED, JERICHO, IBADAN								
S/N	Variables	Checklist	Level of Application					Remark
			1	2	3	4	5	
1	Building Envelope	Suitability of the materials to the climate				•		The material used is majorly brick, zinc roofing sheets, glass, and timber frames.
		Use of External Insulation		•				
		Use of Smooth Surface Finishes			•		•	
		Use of Light Colors			•			
2	Natural Lighting	Wall to window Ratio					•	Interior Spaces were lit through windows and skylights.
3	Natural ventilation	Use of Louver windows			•			The use of windows is inadequate. As a result of this, poor air quality was observed within the bookshop.
4	The site and External Spaces	Use of Concrete floor, few shrubs, and seat-out area					•	Very few soft landscapes.
5	Building Form	Large Building Surface Area					•	Appropriate building form based on climate
6	Building Orientation	Sun Orientation; S-E					•	Optimum building orientation against excess sunlight.
		Wind Orientation; S-W			•			Optimum building orientation against the wind.
7	Wall and Window Shading	Use of horizontal or vertical shading devices		•				Roof overhangs were appropriately used to shade the building. Also, there are no tall trees capable of shading the building.
		Use of Interior blinds		•				
		Use of recessed walls			•			
		Use of overhangs					•	
		Use of plants			•			

3.4.3. Case Study 3: Stanford University Bookstore, Ca, USA

Architect: John Carl Warnecke

Style: Spanish Colonial Revival Architecture

Location: California, USA

Year: 1976

3.4.3.1. Overview

At the Stanford bookshop, you can find a diverse range of items including textbooks, novels, periodicals, school supplies, and Stanford-branded merchandise such as sweatshirts, t-shirts, and mugs. They also sell computers and related accessories. The store is often bustling with students and is a great place to immerse yourself in Stanford's unique culture while browsing through academic and non-academic publications. Additionally, there is a coffee shop upstairs that serves espresso drinks and pastries. The store's architectural design seamlessly blends modern and traditional elements, making it both functional and visually appealing.

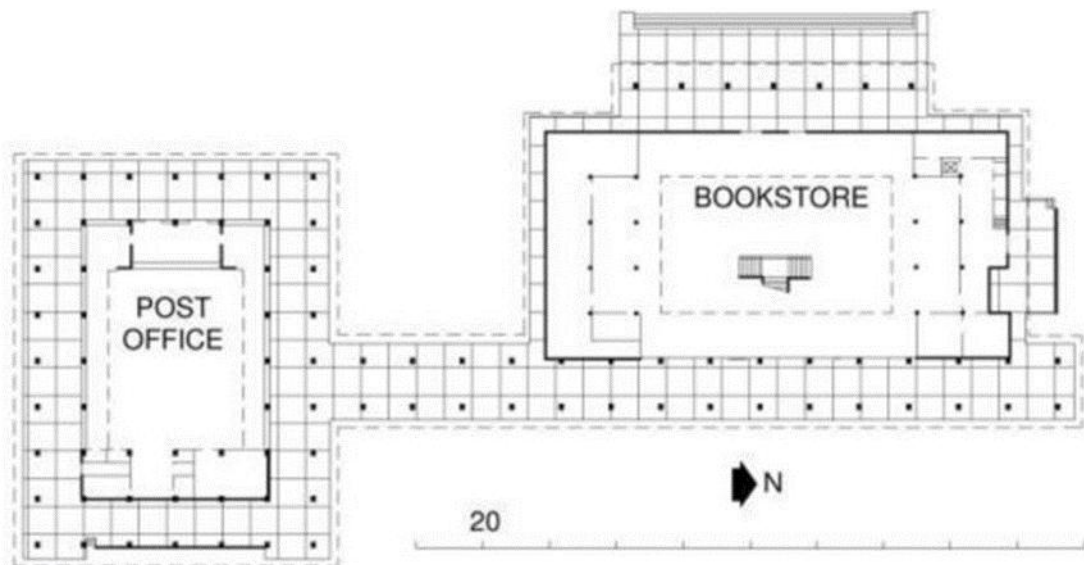


Figure 3.9: Layout of Stanford Bookshop

3.4.3.2. Design Features

The Stanford University Bookstore's architecture is a perfect blend of classic and contemporary elements, celebrating the rich history of the institution while embracing modernity. The building's exterior is a refined and welcoming combination of natural stone, steel, and glass, allowing ample natural light to fill the spacious interior.

The bookstore's design principles align with the overall aesthetic of Stanford University, which promotes research, innovation, and academic collaboration. The structure's clean lines, functional spaces, and thoughtful layout encourage exploration and intellectual exchange.

3.4.3.3. Interior Layout

When you step inside the Stanford University Bookstore, you'll immediately notice the open and tidy layout. The space is well-utilized, with different areas set aside for different genres, course materials, and university

clothing. The bookstore also has cozy study spaces and comfortable seating, inviting you to take your time browsing, reading, or engaging in academic conversations.

The bookstore's interior design is a mix of modern fixtures and classic wooden accents, which creates a warm and scholarly atmosphere. With plenty of shelves and display units, the bookstore offers a vast selection of books and merchandise to cater to a wide range of academic interests and preferences.

3.4.3.4. Sustainability and Accessibility

Stanford University Bookstore is committed to sustainability practices. The building incorporates energy-efficient lighting, climate control systems, and sustainable materials to align with the university's green initiatives.

3.4.3.5. Integrated Lighting

The bookshop uses a skylight as its focal point, allowing natural light to flood in and make the interior bright. The skylight is placed above the double-volume area, which maximizes the amount of daylight that comes in and creates a feeling of spaciousness. The sunlight creates beautiful patterns and shadows, which makes the space visually engaging. The natural light and artificial lighting work together to adequately light the bookshop, especially in the aisles.



Figure 3.10: Interior Layout of Stanford Bookshop showing Skylight

3.4.3.6. External Landscape

The bookshop's surroundings are filled with lush greenery, a beautiful water fountain, tropical trees, shrubs, and durable concrete pavement. This pavement is designed to withstand heavy traffic from customer vehicles and delivery trucks while also complementing the bookshop's overall architectural style. It provides a safe and functional surface for both pedestrians and vehicles.



Figure 3.11: Exterior view of Stanford Bookshop

3.4.3.7. Shading and Orientation

To combat the harsh effects of sunlight, the building features roof overhangs and covered terraces to provide shade. These architectural elements effectively minimize direct sunlight exposure and keep the interior cool and comfortable. Additionally, the bookshop's orientation is strategically southeast-facing, allowing for optimal natural lighting while reducing heat gain.

3.4.3.8. Fenestration

The bookshop has a beautiful and eye-catching large glazed window that serves multiple purposes. Firstly, it lets in plenty of natural light, creating a bright and welcoming atmosphere inside. The window has both sliding and fixed sections, which helps with natural ventilation. People passing by can also get a clear view of the bookshop, encouraging window shopping and potentially attracting new customers.

3.4.3.9. Materials Used

- Brick

- Glass
- Timber
- Concrete
- Stucco wall finish.
- Carpet
- Wood flooring
- Acrylic corrugated roofing sheets
- Steel
- Spanish roof tiles

Table 3.3: Analysis of Lighting Variables in Stanford Bookstore

STANFORD BOOKSTORE, STANFORD UNIVERSITY, USA.								
S/N	Variables	Checklist	Level of Application					Remark
			1	2	3	4	5	
1	Building Envelope	Suitability of the materials to the climate				•		The material used is suitable, modern, and eco-friendly.
		Use of External Insulation			•			Minimal use of external insulation
		Use of Smooth Surface Finishes			•			Minimal smooth surface
		Use of Light Colors				•		Finishes are adequately applied where necessary.
							•	The interior color complements the internal lighting design to enhance mood and comfort.
2	Natural Lighting	Wall to window Ratio					•	Interior Spaces were lit through windows and skylights.
3	Natural ventilation	Use of windows			•			The use of windows is adequate.
4	The site and External Spaces	Use of Concrete floor, shrubs, trees, and seat-out area				•		Adequate use of soft and hard landscapes.
5	Building Form	Large Building Surface Area				•		Appropriate building form based on climate

6	Building Orientation	Sun Orientation; S-E					•	Optimum building orientation against excess sunlight.
		Wind Orientation; S-W					•	Optimum building orientation against the wind.
7	Wall and Window Shading	Use of horizontal or vertical shading devices					•	Use of horizontal shading device on windows and curtain walls.
		Use of Interior blinds					•	Adequate use of blinds
		Use of recessed walls					•	Minimal use of recess wall
		Use of overhangs					•	Adequate use of overhangs and covered terraces, especially at the entrance.
		Use of plants					•	Adequate use of plants, trees, and shrubs.

3.4.4. Case Study 4: University of Canterbury Bookshop, New Zealand

Location: New Zealand

Architect: Miles Warren

Architectural style: Modern style

Year: 1975

3.4.4.1. Overview

The University of Canterbury Bookshop showcases a modernist architectural style. It embraces clean lines, simplicity, and functionality while incorporating elements of transparency and natural light.

3.4.4.2. Exterior Features

The glass curtain wall on the building's front facade is a prominent feature that allows ample natural light to illuminate the interior and provides visibility into the bookshop. The heavy presence of texture adorning the

exterior enhances the aesthetics of the facade and complements the glazing. The aluminum roofing sheet covering the single-story structure provides essential weather protection. The building's front facade prominently features a glass curtain wall, allowing ample natural light to illuminate the interior and providing visibility into the bookshop. The exterior is adorned with a heavy presence of texture, enhancing the aesthetics of the facade and complementing the glazing. The aluminum roofing sheet covers the single-story structure, providing weather protection.

3.4.4.3. Illumination

The bookshop has a skylight that enhances the natural lighting, flooding the interior space with additional illumination. Artificial lighting is thoughtfully placed in areas where natural lighting may not be enough, ensuring optimal visibility throughout the bookshop.



Figure 3.12: Interior layout of the Bookshop showing use of skylight and exterior glazing

3.4.4.4. Interior Design and Layout

As you step inside the bookshop, you'll notice the cozy and welcoming atmosphere created by the blue carpeted floor. The shelves are neatly arranged, offering convenient access to books and merchandise while allowing for easy navigation throughout the space.



Figure 3.13: Interior layout of the bookshop

3.4.4.5. Central Atrium and Staircase

In the center of the bookstore, there is a central atrium that serves as a focal point and allows for vertical movement. The straight-flight staircase is made of timber, providing access to the first floor. It's worth noting that this staircase may not be suitable for individuals with disabilities as it may not provide easy access to the suspended floor.

3.4.4.6. Roof System

The timber roof trusses are left exposed, adding a touch of natural warmth and character to the interior space. The ceiling material is installed on the roof soffit, providing a finished look while maintaining the visibility of the timber trusses.

3.4.4.7. Landscape and Surroundings

The bookshop is conveniently located within the university campus, making it easily accessible for students, faculty, and visitors. The external surroundings are adorned with shrubs, flowers, and trees, creating a delightful and welcoming atmosphere. The concrete flooring in the outdoor area is designed to withstand heavy foot and vehicular traffic, ensuring its durability.

3.4.4.8. Shading Devices

Although the bookshop has a design that allows for plenty of natural light, it does not have any shading devices to prevent too much sunlight from coming in. As a result, it may be necessary to use artificial lighting control or other methods to manage the amount of heat from the sun during sunny periods.

3.4.4.9. Materials Used

- Brick
- Glass
- Timber
- Veneer ceiling finish.
- Concrete
- Stucco wall finish.
- Carpet
- Wood flooring
- Dampalon or Acrylic corrugated roofing sheets
- Steel

- Aluminum Roof

Table 3.4: Analysis of Lighting Variables in the University of Canterbury Bookshop

UNIVERSITY BOOKSHOP, CANTERBURY UNIVERSITY, NEW ZEALAND.								
S/N	Variables	Checklist	Level of Application					Remark
			1	2	3	4	5	
1	Building Envelope	Suitability of the materials to the climate				•		The material used is suitable, modern, and eco-friendly.
		Use of External Insulation			•			Minimal use of external insulation
		Use of Smooth Surface			•			Minimal smooth surface
		Finishes					•	Finishes are adequately applied where necessary.
		Use of Light Colors				•		The interior color complements the internal lighting design to enhance mood and comfort.
2	Natural Lighting	Wall to window Ratio					•	Interior Spaces were lit through windows and skylights.
3	Natural ventilation	Use of windows			•			The use of windows is adequate.
4	The site and External Spaces	Use of Concrete floor, shrubs, trees, and seat-out area				•		Adequate use of soft and hard landscapes.
5	Building Form	Large Building Surface Area				•		Appropriate building form based on climate
6	Building Orientation	Sun Orientation; S-E					•	Optimum building orientation against excess sunlight.
		Wind Orientation; S-W			•			Optimum building orientation against the wind.
7	Wall and Window Shading	Use of horizontal or vertical shading devices	•					Inadequate use of shading devices
		Use of Interior blinds		•				Adequate of blinds
		Use of recessed walls			•			Minimal use of recess wall
		Use of overhangs					•	Adequate use of overhangs and covered terraces, especially at the entrance.
		Use of plants			•		Adequate use of plants, trees, and shrubs.	

3.4.5. Case Study 5: William Bookstore, William College, USA

Architects: Stefanie Greenfield, AIA

Style: Contemporary

Floor Area: 1394 m² Year: 2017

Location: 81 Spring St, Williamstown, Massachusetts 01267, United States

3.4.5.1. Overview

The Williams Bookstore is a modern, LEED Platinum Certified structure that rejuvenates the heart of a tranquil college town. It acts as a lively gathering place, drawing in both students and the general public. The building is made up of three levels and boasts retail shops, study zones, adaptable seating, a local coffee roastery, and rented office areas. Its layout emphasizes socializing and events, providing a range of options like author talks, book signings, studying, and community gatherings. The building's architectural style acknowledges the region's history while embracing a youthful and energetic look.

Do Not Copy, Lead City University, Nigeria



Figure 3.14: Williams Bookstore Exterior View

3.4.5.2. Integrated Lighting

The Williams Bookstore uses an integrated lighting design to make the space welcoming and comfortable. The building has large windows with shading devices, which provide natural light while minimizing the need for artificial light. To enhance the ambiance, artificial lighting fixtures are carefully placed to provide enough illumination for all areas and activities. The lighting design is energy-efficient and promotes a warm and inviting atmosphere.

3.4.5.3. Sustainability

The Williams Bookstore is an exemplary model of sustainability, having achieved LEED Platinum Certification. Its building envelope boasts extra-thick insulation, which enhances thermal comfort and energy efficiency. The interiors are adorned with recycled materials, including ceiling tiles, gypsum wallboard,

carpets, and rubber flooring. The roofing materials comprise high percentages of recycled content, while locally-sourced materials such as granite and brick help reduce the building's embodied carbon. These eco-friendly features minimize the negative environmental impacts of the building, promoting a sustainable approach.

3.4.5.4. Ventilation

Ensuring proper ventilation is essential for maintaining a comfortable and healthy indoor environment. The Williams Bookstore implemented efficient ventilation systems to ensure good air quality throughout the building. This design incorporates natural ventilation strategies, such as operable windows, to facilitate the exchange of fresh air. Additionally, mechanical ventilation systems were used to provide controlled airflow and maintain optimal indoor conditions, contributing to the overall well-being and comfort of all occupants.

3.4.5.5 Landscape

The architectural design takes into account the local context and matches the size and shape of nearby commercial buildings. Additionally, an outdoor roof terrace offers extra room for leisure and taking in the sights of Spring Street and the mountains nearby. The landscape design enhances the overall appearance and fosters a pleasant relationship between the building and its natural setting.

3.4.5.5. Interior Layout

The Williams Bookstore's interior layout is thoughtfully designed to cater to a variety of activities and encourage social interaction. The first two floors boast retail spaces, study areas, flexible seating, and a local coffee roaster, while the third-floor houses leased office spaces. The open floor plan incorporates movable furniture, walls, and bookshelves, making it adaptable for community activities and programs. The design

features dedicated areas for author readings, private studying, children's activities, and community meetings. The vibrant and colorful environment creates a welcoming atmosphere.

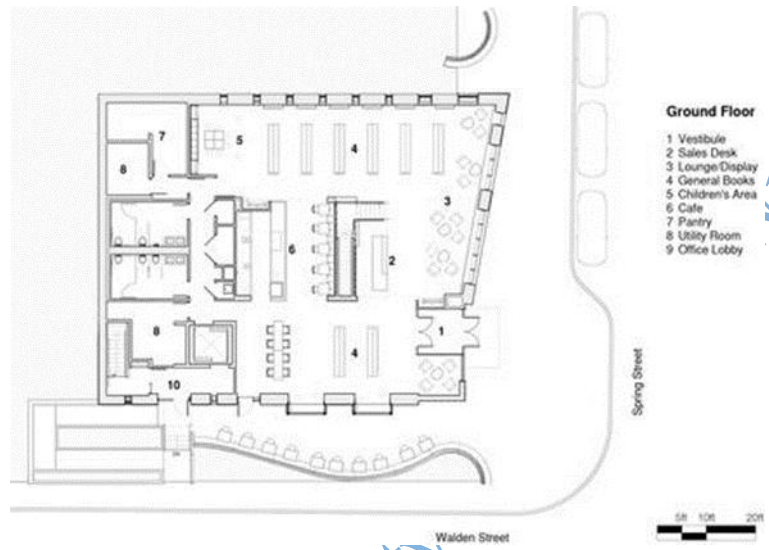


Figure 3.16: The Williams Bookstore Ground Floor

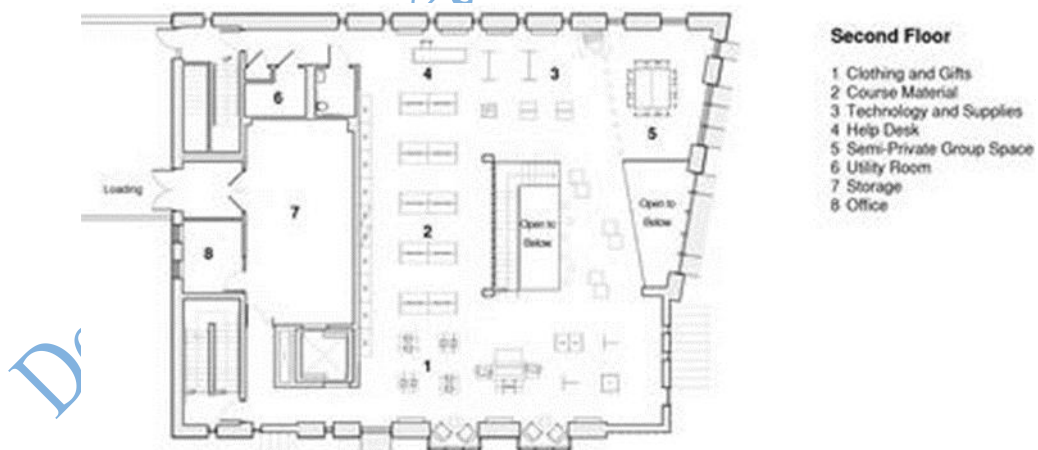


Figure 3.17: The Williams Bookstore Second Floor

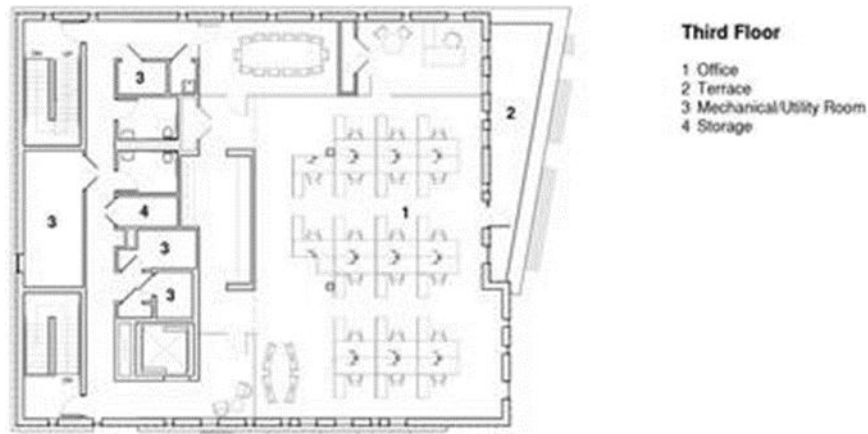


Figure 3.18: The Williams Bookstore Third Floor

3.4.5.6. Materials Used

The Bookstore's architectural design incorporates materials that are reflective of the local traditions and vernacular style. The combination of brick and wood siding not only pays homage to the heritage of the area but also adds a youthful and dynamic touch to the structure. By incorporating local materials like granite and brick, the carbon footprint associated with transportation is reduced. The interior materials are carefully selected, with a focus on using recycled and sustainable options wherever possible. Other materials used in the construction of the building include Zinc-coated copper, Structural steel, Insulated glass, Ceiling tiles, Gypsum wallboard, Carpets, and Rubber flooring.

Table 3.5: Analysis of Lighting Variables in the University of Canterbury Bookshop

THE WILLIAM BOOKSTORE, WILLIAM COLLEGE, USA								
S/N	Variables	Checklist	Level of Application					Remark
			1	2	3	4	5	
1	Building Envelope	Suitability of the materials to the climate				●		The materials used are suitable, modern, and eco-friendly.

		Use of External Insulation			•		Use of bricks and rustication to insulate against sound, heat, and fire.
		Use of Smooth Surface			•		Minimal smooth surface
		Finishes				•	Finishes are adequately applied where necessary.
		Use of Light Colors				•	The interior color complements the internal lighting design to enhance mood and comfort.
2	Natural Lighting	Wall to window Ratio				•	Interior Spaces were lit through windows.
3	Natural ventilation	Use of casement windows				•	The use of windows is adequate.
4	The site and External Spaces	Use of Concrete floor, shrubs, trees, and seat-out area				•	Adequate use of soft and hard landscapes.
5	Building Form	Large Building Surface Area				•	Appropriate building form based on climate
6	Building Orientation	Sun Orientation; S-E				•	Optimum building orientation against excess sunlight.
		Wind Orientation; S-W				•	Optimum building orientation against the wind.
7	Wall and Window Shading	Use of horizontal or vertical shading devices				•	Use of horizontal shading device on windows and curtain walls.
		Use of Interior blinds				•	Adequate of blinds
		Use of recessed walls				•	Minimal use of recess wall
		Use of overhangs	•				No notable roof overhangs
		Use of plants				•	Adequate use of plants, trees, and shrubs.

Chapter Four

Site, Project Analysis and Design Synthesis

4.1. Study Area

This section discusses the preliminary design proposal and the design decisions taken to arrive at the proposed university library. The proposed design is based on the spatial requirements, case studies, and the application of integrated lighting to ensure user comfort.

4.1.1. Site Location and Description

The proposed university bookshop is located at geographical coordinates 7.327320 and 3.882396, strategically positioned within the confines of the Lead City University Campus in Ibadan, Oyo State, and Nigeria. The site boasts an exceptional location, situated opposite the university sports complex and adjacent to the recently constructed faculty of the health sciences building. Moreover, its accessibility is enhanced, as it is bordered by roads on both the front and side, ensuring convenient entry and exit points.



Figure 4.1: Map of Lead City University Campus with proposed site highlighted
Source: Google



Figure 4.2: Site Location Plan.

Source: Researcher's fieldwork.

4.1.2. Site Selection Criteria

In this project, several locations on the university campus were carefully assessed to find the best spot for different buildings, including the proposed bookshop. To make the decision, the following criteria were considered.

4.1.2.1. Accessibility

When choosing a location for the bookshop on the university campus, it's important to consider easy accessibility as a key factor. The chosen site is surrounded by major roads and walkways on both the front and right sides, making it easily accessible for both vehicles and pedestrians without any obstacles.

4.1.2.2. Visibility

Visibility plays a crucial role in the site selection process for bookshops within universities. The chosen site at Lead City University offers a strategic advantage due to its positioning at the intersection of two key roads. The right-side road leads to the student residential area and the newly constructed faculty of the health science building, while the front road leads to significant university buildings such as the school chapel, senate building, faculty of law, and faculty of environmental design and management. The proposed building will enjoy high visibility from this location, becoming a prominent campus feature. In addition, the architectural excellence of the structure will enhance the overall streetscape of the university, creating a visually appealing and cohesive environment. The chosen site offers a strategic advantage on the Lead City University campus. Positioned at the intersection of two vital roads, the right-side road leads to the student residential area and the newly constructed faculty of the health science building, while the front road leads to prominent university buildings such as the school chapel, senate building, faculty of law, and faculty of environmental design and management. The proposed building will enjoy high visibility from this location, becoming a prominent campus feature. Furthermore, the architectural excellence of the structure will enhance the overall streetscape of the university, thereby creating a visually appealing and cohesive environment.

4.1.2.3. Site Area and Future Expansion Potential.

A bookshop will be situated in a spacious area on the university campus, which will facilitate the construction of buildings and cater to their immediate necessities. The chosen location was carefully evaluated, keeping in mind future expansion possibilities.

4.1.2.4. Proximity to Academic Buildings and student hostels.

One effective way for bookstores to reach their target audience is by placing them near academic and student residential areas. This not only makes it convenient for people to access books and publications, but it also contributes to a lively campus atmosphere. By promoting academic engagement and intellectual exploration in the university community, this approach can help create a sense of integration and community.

4.1.2.5. Availability of Infrastructure.

Choosing the right spot for a bookshop at a university campus is a crucial task that requires careful consideration. Access to essential utilities and services such as electricity, water supply, road networks, and waste management must be taken into account to ensure the smooth operation of the facilities.

4.2. Project Analysis and Design Synthesis

4.2.1. Brief Analysis

Lead City University is a renowned institution situated in Ibadan, Oyo State, Nigeria. It has affiliated primary and secondary schools nearby. However, the absence of a dedicated bookshop on the university campus is a significant challenge, making it difficult for students, staff, and parents to access textbooks, stationery, and other academic materials. They have to visit external bookstores to get these materials.

The proposed university bookshop aims to provide a comprehensive solution to the academic material accessibility challenges faced by Lead City University and its affiliated primary and secondary schools. The bookshop will focus on convenience, multifunctionality, light design concepts, and sustainable practices. It will serve as a vibrant space that nurtures learning, collaboration, and exploration, enhancing academic access

and comfort. Ultimately, this architectural design project aims to elevate the educational experience for students, staff, and parents within the Ibadan community.

4.2.2. Brief Development

After conducting a thorough examination of five case studies that encompassed four university bookshops and one private bookshop, it became evident that there were notable similarities in their spatial functionalities. These studies aimed to determine the necessary planning standards and the distinct roles these spaces fulfill within a bookshop.

- Store or warehouse
- Convenience
- Vestibule
- Display area
- Payment point
- Gift shop
- Circulation area.
- Preview areas
- Staff lounge.
- Administrative offices.
- Seminar or event hall.
- Publishing division

In addition to the spaces previously discussed, the second case study examined Booksellers Nigeria Limited and discovered a distinctive aspect called the publishing division. This division goes beyond the typical functions of a university bookshop and serves purposes outside of academia.

4.2.3. Design Criteria

Bookshops located on university campuses are crucial facilities that cater to the academic community by offering access to textbooks, reference materials, and other educational resources. They play a significant role in supporting the educational requirements of both faculty and students. It is essential to give careful attention to the layout, usability, and aesthetics of these bookshops to create a functional, safe, and visually appealing environment. Before the design process, the following design criteria were meticulously considered:

1. **Ventilation:** To create a comfortable shopping environment, bookshop buildings need efficient ventilation systems that allow for good air circulation and reduce unpleasant odors and dust buildup. This will be accomplished via the use of passive (natural) or active (artificial) ventilation methods. Both methods are essential in ensuring a comfortable space and a pleasant experience for those inside the building.
2. **Lighting:** Our goal is to ensure that the bookshop has sufficient and suitable lighting to create a welcoming and attractive environment for customers. This will enhance the mood, ambiance, visibility, and readability of book titles and products.
3. **Accessibility:** The bookshop is carefully designed with accessibility in mind, making it easily accessible for people with disabilities, and ensuring smooth circulation throughout the display areas considering the possible numbers of users.

4. **Aesthetics:** To make the bookshop visually appealing and inviting to customers, we will incorporate various structural forms, fins, a well-designed roof, thoughtful color selection, and creative planning. Our goal is to enhance their overall shopping experience.
5. **Safety:** To guarantee the safety of those inside the bookshop building and protect the property, we will incorporate various safety measures in the design. These measures will consist of fire exits, fire suppression systems, emergency lighting, and strict safety protocols. By making safety a top priority, we aim to create a secure environment for both customers and staff, ensuring confidence and peace of mind for all.
6. **Structural Stability:** The design of the bookshop building will prioritize structural efficiency to allow for a variety of activities and to withstand dead, live, and seismic loads. This will be accomplished by carefully selecting materials and implementing sturdy construction methods. These measures will ensure the building's durability and ability to endure the test of time. By making structural stability a priority, the bookshop will offer a secure and dependable environment for those who use it.
7. **Site and Landscape:** The site and landscape of the bookshop building will be carefully considered in the design process. The building's location, parking areas, green spaces, and outdoor event areas will be planned per building regulations to ensure optimal functionality and aesthetic appeal. Landscaping features will be incorporated to complement the architecture and create an inviting and harmonious atmosphere.

4.2.4. Conceptual Development

4.2.4.1. Site Concept

The university bookshop's site plan was designed with a naturalistic approach to blend the cubist- inspired building with its surroundings. The goal was to create a harmonious coexistence between the architectural design and the natural elements. The building was placed at the center of the site, surrounded by green areas, driveways, walkways, car parks, and shrubs, enhancing aesthetics and fostering a connection between the built and natural elements.

To ensure easy accessibility, access points were positioned on both the southern and eastern axes for vehicles and pedestrians. Lay-bys were integrated to facilitate smooth traffic flow, and delivery vans were given a dedicated driveway behind the building to minimize disruptions to the main entrance. Staff parking lots were discreetly placed on the west side, creating a serene work environment. A bicycle parking system was also included to encourage eco-friendly commuting options.

Overall, the university bookshop's site plan seamlessly blends the building with its natural surroundings, resulting in a functional and aesthetically pleasing space. The integration of green areas, parking facilities, waste management, safety measures, and sustainable practices demonstrates a holistic approach, creating an exceptional site for the university bookshop that offers a welcoming and inspiring space for all visitors and staff.

4.2.4.2. Building Concept

The university bookshop's design concept follows the cubism architectural style, which emphasizes the unity of form and function. This approach blends aesthetics and practicality to create an innovative and dynamic space that caters to the needs of students, faculty, and visitors.

The cubism style's geometric shapes, fragmented forms, and multiple perspectives provide a unique and artistic expression for the bookshop. This design enables unconventional spatial configurations that maximize efficiency and flexibility, enhancing the overall experience.

The key elements of the design concept include a meticulously planned interior layout that prioritizes traffic flow, easy access to various sections, and user-friendly navigation. The structural components will serve dual purposes, such as display units doubling as storage spaces, creating a seamless blend of aesthetically pleasing forms and functional elements.

The building's exterior will showcase cubist-inspired elements, with facades featuring geometric patterns and playful use of materials, capturing the essence of the cubism style. Inside, different areas will be designated for specific functions, such as study zones, interactive reading areas, and event spaces for book fairs and launches.

The design incorporates ample natural light through curtain walls and skylights, creating an engaging and energy-efficient environment. The ventilation will be optimized using the stack effect, allowing fresh air to enter through windows and curtain walls and escape through ventilation blinds positioned at the atrium wall.

The design will be flexible, allowing for adaptability to future changes in bookshop requirements and trends, ensuring longevity and relevance. Overall, the integration of the cubism architectural style with thoughtful spatial considerations will transform the university bookshop into an inspiring space that fosters a love for reading, learning, and community engagement.

4.2.5. Functional Relationship

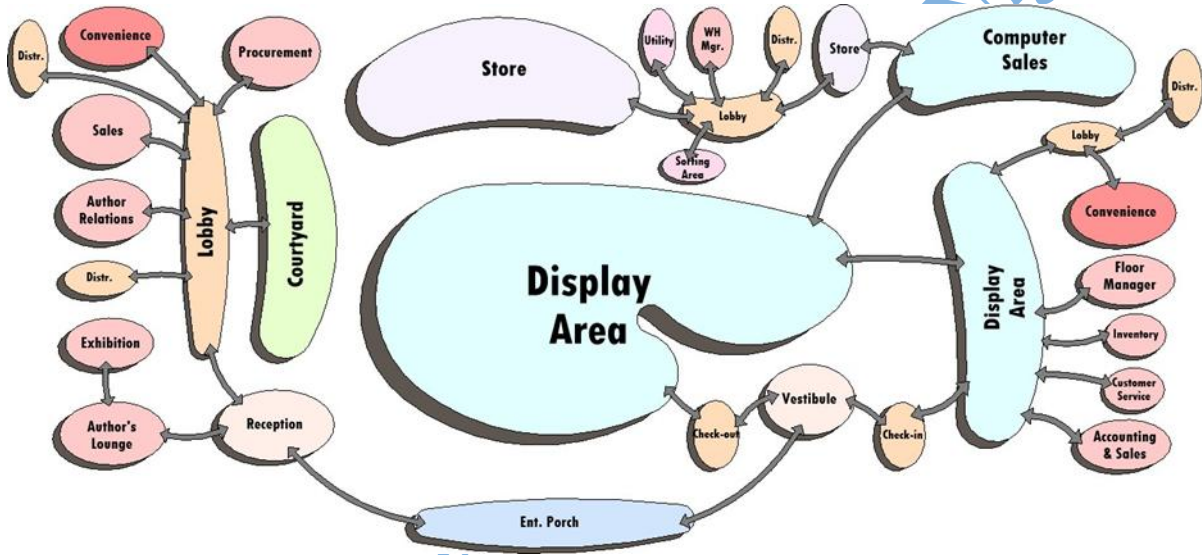


Figure 4.3: Showing bubble diagram for the ground floor plan

Source: Researcher's fieldwork

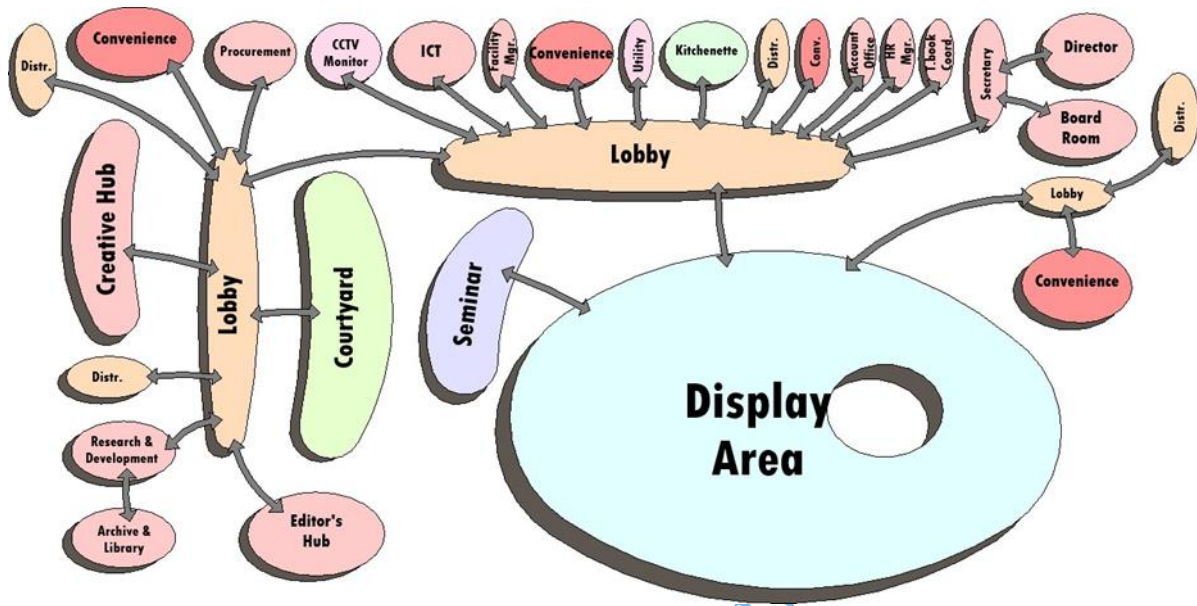


Figure 4.4: Showing bubble diagram for first floor plan
 Source: Researcher's fieldwork

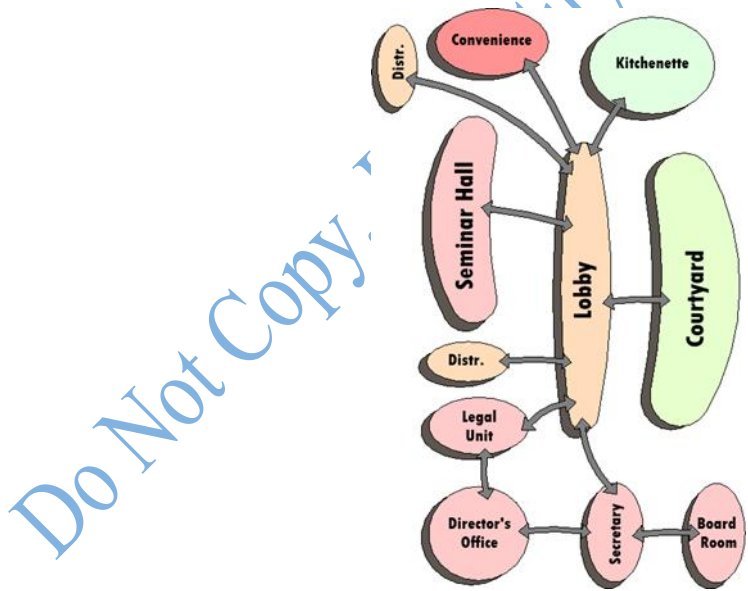


Figure 4.5: Showing bubble diagram for the second-floor plan
 Source: Researcher's fieldwork

Table 4.1: Space Allocation/ Schedule of Accommodation

Space/Units/Zones	Purpose	Floor Area(m ²)	Estimated Users
Accounting & Sales office	Area where sales transactions are recorded, financial data is managed, and sales analytics are conducted.	20	4 staff
Acquisition & sorting Area	Incoming books and publications are sorted, organized, and processed for display or storage.		10 or more staff
Archives & Library	A source of historical records, rare books, and reference materials, serving as a valuable resource for researchers, authors, and staff. A key part of the publishing unit within the bookshop building.	24	4 users at once
Author's Lounge	A comfortable and inspiring space where visiting authors can relax, work, and interact with staff.	36	9 authors
Board Room	A meeting space for key decision-makers, stakeholders, and management to discuss strategies, business plans, and bookshop development.	24	10 staff
CCTV Monitor Room	A control room equipped with surveillance cameras to monitor and ensure the security of the bookshop's premises.	14	4 staff
Computer Sales Section	A dedicated area for showcasing and selling digital products, such as computers,	150	15 or more customers can use the space.
Conveniences	accessories, cameras, software, and other digital devices that aid academic learning.		
	Refers to restroom facilities for visitors and staff to ensure their comfort and convenience while in the bookshop.		4 number PWD toilets and 18 toilets in all including staff ensuite
Customer Service	The central point of contact for customers to seek assistance, information, or support regarding their book purchases and inquiries.	15	4

Book display area	An organized section within the bookshop where books are showcased and presented for customers to browse and explore.	2000	50 customers can access the display area concurrently
Designer and Typesetters Hub	A creative workspace for graphic designers and typesetters to work on book layouts and designs.	40	15 staff
Director Office	The office of the bookshop's director serves as the central administrative hub for decision-making and oversight.	30	1 staff with 2 visitors
Editorial Office	A space where editors review manuscripts, provide feedback to authors and oversee the publication process.	40	15 staff
Electrical Panel Room	A secure room housing the electrical panels and systems that manage the bookshop's electrical infrastructure.	15	
Exhibition Room	A space used for book launches, author signings, book fairs, and other literary events to showcase new releases and attract visitors.	25	2 to 4 persons.
Facility Manager Office	The office of the facility manager is responsible for overseeing maintenance, repairs, and safety protocols in the bookshop.	15	1 staff
Fitting Room	A space where customers can try on or preview merchandise such as apparel, stationery, or book-related merchandise.	5	1
Floor Manager Office	The workspace of floor manager is responsible for supervising staff and ensuring smooth operations on the sales floor.	20	1 staff
Human Resources Office	The department is responsible for recruitment, employee relations, training, and staff development within the bookshop.	20	3 staff
ICT Office	The Information and Communication Technology Office is responsible for managing the bookshop's technology infrastructure and IT-related tasks.	30	12 staff
Inventory Office	A space where inventory management is conducted, including tracking stock levels, restocking, and managing supply chains.	13	4 staff

Legal Office	The legal department is responsible for handling contracts, copyrights, intellectual property, and legal matters related to the bookshop's publications.	20	3 staff
Manager's Office	The office of a departmental manager or supervisor overseeing specific bookshop operations.	27	
Marketing & Author Liaison Office	A workspace where marketing campaigns are planned and connections with authors and publishers are managed to promote book sales.	15	4 staff
Merchandise Sales Store	An area for selling book-related merchandise, such as bookmarks, book-themed apparel, and souvenirs.	10	1 staff
Outdoor technical Area	This consists of the fire suppression system room to store FM200 cylinders and fire hydrant pumps.	36	
Payment Point	A designated area where customers can make payments for their book purchases.		7
Reception	The welcoming area is where visitors are received and inquiries are addressed.	36	10 visitors
Repair Services Office	A space within the computer sales area where basic gadgets are repaired.	9	2 staff
Research and Development Office	This office is responsible for exploring new publishing opportunities, market trends, and innovative book-related ventures.	21	2 staff
Sales Office	An area where sales representatives work, interact with customers and manage sales inquiries.		
Secretary Office	A workspace for administrative assistants who handle clerical tasks and support various departments within the bookshop.	18	6 persons
Seminar and Event Hall	A versatile space for hosting seminars, workshops, book discussions, and other literary events.	48	40 users
Staff Changing Room	A designated space for employees to change and store personal belongings.	15	10 staff
Staff Lounge	A relaxation area where bookshop employees can take breaks, have meals and socialize.	40	10 staff

Text Coordinator Office Vestibule	Book	A workspace where the coordinator manages textbook orders and collaborations with educational institutions.	15	2 staff
		The entrance hall or lobby of the bookshop provides a welcoming and initial impression to visitors.	41	20 customers
Warehouse		A storage area for books and merchandise inventory in the bookshop.	300	
Warehouse and Acquisition Manager Office	and	The office of the warehouse manager is responsible for overseeing the acquisition and supply activities at the warehouse.	15	

Source: Researcher's field survey

4.2.6. Construction Methods and Materials

In the design of this project, utmost consideration was given to sustainability by using eco-friendly materials and construction methods. Various factors were considered in the selection of these materials, such as aesthetics, durability, climate, availability, functionality, and compliance with regulations and bylaws.

Substructure: The reinforced concrete used in constructing the substructure of the bookshop and publishing space ensures a robust and stable foundation.

Landscape: To enhance the appeal of the outdoor space and promote eco-friendliness, the landscape design effectively incorporated precast concrete interlocking stones and concrete curbs.

Shading Device: Utilizing aluminum composite panel boards for covering steel substrates is an extremely effective technique to curtail heat gain and enhance energy efficiency via shading.

Walls: The bookshop's walls consist of a combination of concrete blocks, columns, and glazed curtain wall systems. The internal partitions also feature glass to facilitate the flow of natural light and create an impression of openness.

Wall finishes: To ensure a truly healthy indoor environment, Airlite paint needed to be used on the interior walls. This superior paint not only enhances aesthetics, but also provides vital protection against mold, microbes, and germs, thereby significantly improving the overall well-being of all occupants within the space.

Window: in a bid to achieve adequate internal daylight illumination and ventilation, large casement was used in office areas, louver windows were integrated in the upper and lower panel of the glass curtain walls to aid ventilation through stack effect.

Lift and Stairs: within the bookshop display area, timber and steel assembled stairs were used to access the first-floor section of the bookshop. Also, glazed panoramic lift was adopted to help the elderly and people with disability move from the ground floor to the first floor.

Floor Structural System: due to the massive span of columns in the bookshop zone of the building, waffle grid floor system was adopted due to its effectiveness in such situations.

Floor Finishes: In choosing the flooring materials for the store area, sustainability was undeniably a crucial factor. The options that were ultimately selected were laminate flooring, PVC tiles, and polished concrete. These materials were painstakingly chosen for their exceptional durability, low maintenance requirements, and visually appealing appearance.

Door: The bookshop's design incorporates various types of doors, including steel roller shutter doors, aluminum and glass doors, wooden panel doors, and fire-rated exit doors. These doors were deliberately selected to ensure optimal safety, security, and convenient accessibility throughout the shop.

Roof: the bookshop building roof comprise of three major elements, which are:

- a. Atrium covered with laminated plexiglass transparent roof material installed over steel frame trusses to structural engineers recommendations.
- b. Aluminum roofing sheet installed on timber roof trusses with solar panels installed on it.
- c. Reinforced concrete roof slab with damp proof felt and PVC pipe drain.

Ceiling: within the bookshop, ceiling materials were strategically used in each space. Majorly, the offices possess POP false ceiling while 600mm x 600mm gypsum ceiling boards were applied at the large display area.

4.2.7. Building Services

The bookshop's design will incorporate mechanical, electrical, and plumbing services that prioritize functionality, efficiency, and safety. These services will be tailored to the diverse needs of visitors, staff, and protection of valuable assets like books and electronics. Each floor will be equipped with Electrical Panel Rooms that house essential components for seamless power distribution and easy maintenance.

Power is supplied to the building from the existing university IBEDC connection which is complemented by solar powered inverters.

A generous ceiling duct of 900mm will be incorporated to ensure optimal space utilization and simplifies maintenance procedures for various services. A discreet duct measuring 1200mm will also conceal water supply, sewage pipes, and inspection chambers, while a panoramic lift with adjacent doors ensures accessibility for all individuals.

Natural lighting is a top priority in the bookshop design, and carefully selected artificial lighting fixtures are installed on the false ceiling soffits, suspended floor slab soffits and at the external areas to create a harmonious ambiance within and outside the bookshop.

The fire suppression system, will use the FM-200 (HFC-227ea), which extinguishes Class A, B, and C fires without leaving any residue or water behind, safeguarding valuable assets and promoting sustainable practices. In addition, fire hydrants are provided at recommended distance at the car park area to cater for external fire accident.

Chapter Five

Conclusion

5.1. Project Appraisal

The thesis focused on designing a university bookshop that prioritizes user comfort through the use of lighting strategies. Through the case study analysis, effective lighting strategies were identified that were efficiently incorporated into the bookshop design.

The use of curtain walls, atriums and artificial lighting tools, building orientation, and shading devices, as well as the use of plants and natural materials were all found to be highly effective in the design of a standard university bookshop.

5.2. Conclusion

In conclusion, the integration of biophilic design strategies and innovative lighting systems can greatly enhance spatial comfort in various settings, including bookshops. Mimicking natural elements and utilizing

natural light can have a positive impact on the well-being of individuals and create a more enjoyable and relaxing atmosphere. As demonstrated by the success of these strategies in other bookshops, it is clear that incorporating these elements into lighting design can greatly benefit the overall comfort and satisfaction of individuals in various environments.

5.3. Recommendations

Integrated lighting design plays a crucial role when it comes to creating a comfortable and inviting environment in bookshops. The following recommendations are proffered to stakeholders in the design industry:

- Consider the role of technology: As technology continues to advance, there are more opportunities for innovative lighting solutions such as programmable lighting and smart controls and therefore further research should be carried out on lighting design and solutions.
- Lighting can enhance the overall experience of users in any space, so it should always be prioritized in design.

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Appendix 1
Presentation Drawings

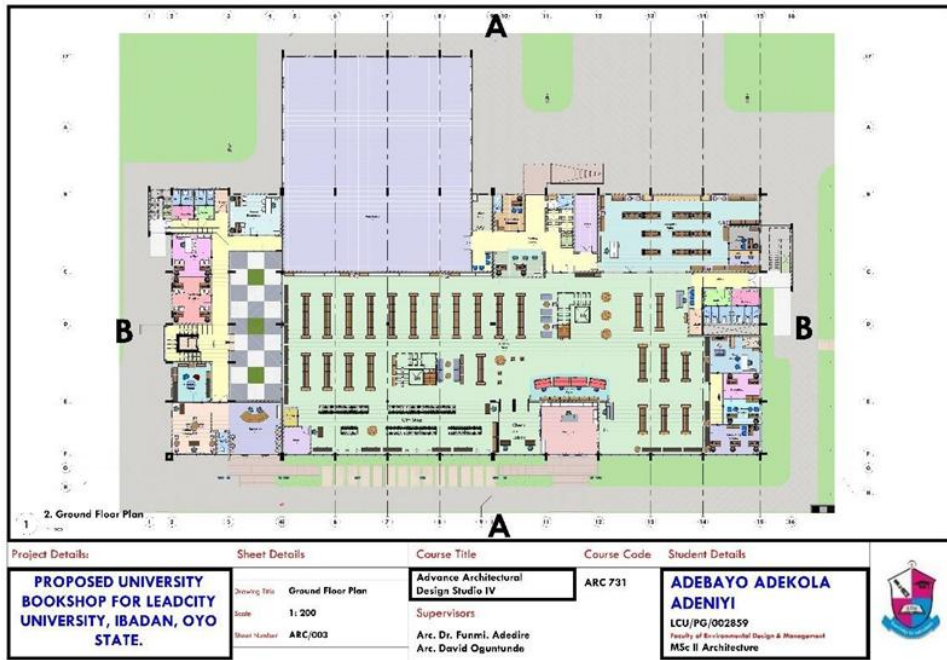


Project Details:	Sheet Details	Course Title	Course Code	Student Details
PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Drawing Title: Site Plan Scale: 1:450 Sheet Number: ARC/002	Advance Architectural Design Studio IV Supervisors: Arc. Dr. Funmi. Adedite Arc. David Oguntunde	ARC 731	ADEBAYO ADEKOLA ADENIYI LCU/PG/007859 Faculty of Environmental Design & Management MSc II Architecture

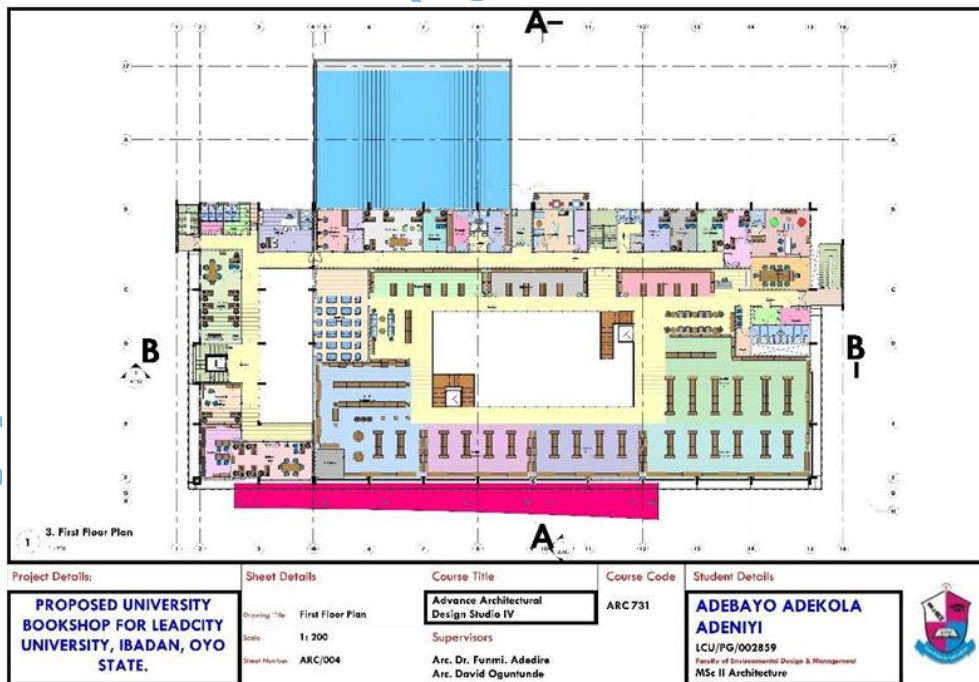


Appendix 1.1: Site plan

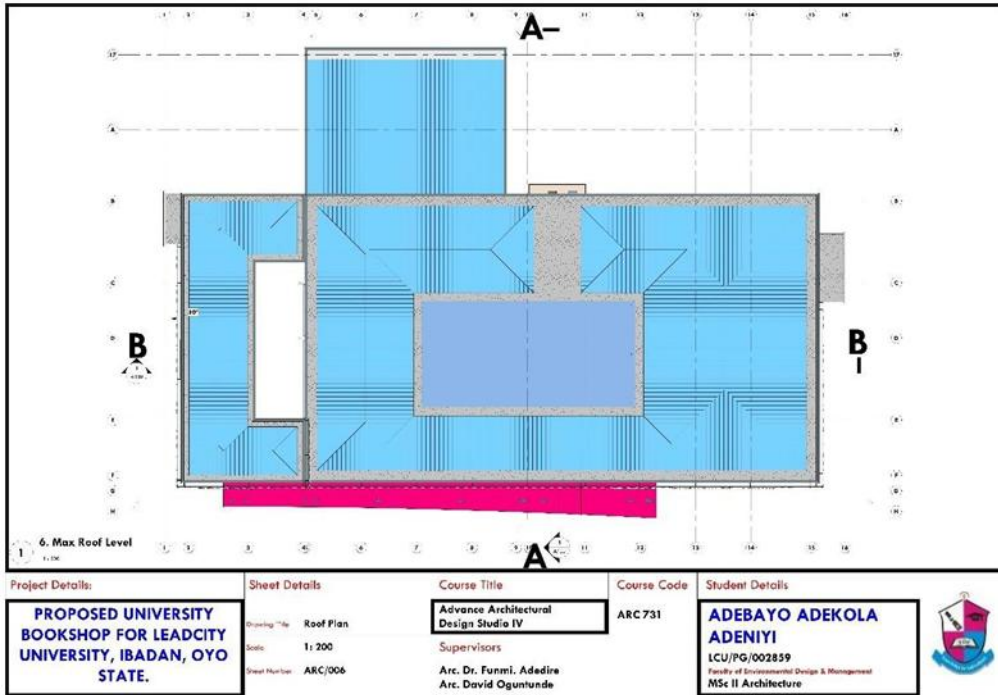
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Appendix 1.2: Ground Floor Plan



Appendix 1.3: First Floor Plan



Appendix 1.4: Roof Plan

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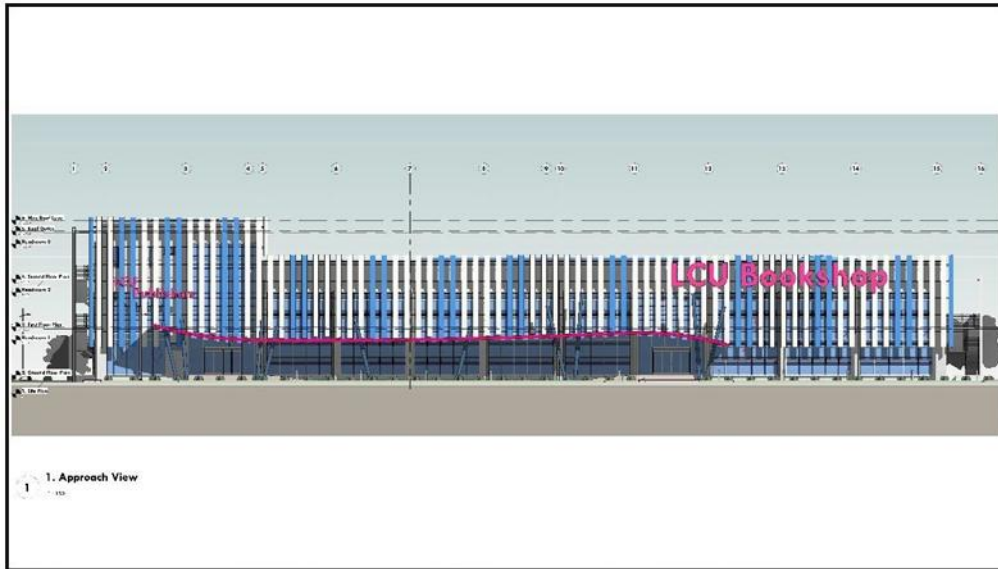
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PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Drawing Title: Section A-A Scale: 1: 125 Sheet Number: ARC/007	Advance Architectural Design Studio IV Supervisors Arc. Dr. Funmi. Adedire Arc. David Oguntunde	ARC731	ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture

Appendix 1.5: Section A-A



Project Details:	Sheet Details	Course Title	Course Code	Student Details
PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Drawing Title: Section B-B Scale: 1: 150 Sheet Number: ARC/008	Advance Architectural Design Studio IV Supervisors Arc. Dr. Funmi. Adedire Arc. David Oguntunde	ARC731	ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture

Appendix 1.6: Section B-B



Project Details:	Sheet Details	Course Title	Course Code	Student Details
PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Drawing Title: Approach Elevation Scale: 1: 150 Sheet Number: ARC/009	Advance Architectural Design Studio IV Supervisors Arc. Dr. Funmi. Adedire Arc. David Oguntunde	ARC731	ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture

Appendix 1.7: Elevation

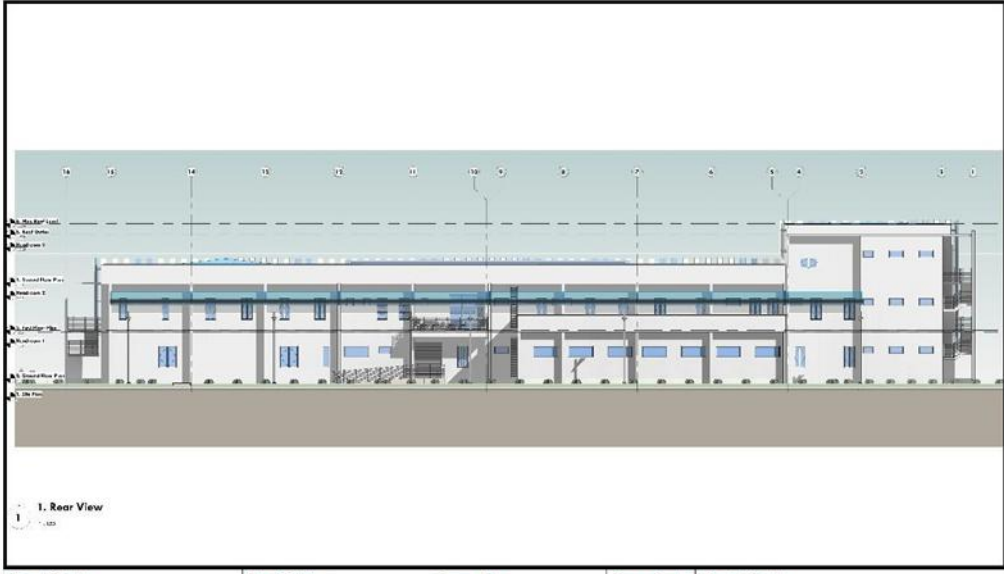
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1. Left Side View

Project Details: PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Sheet Details Drawing Title: Left Side View Scale: 1:150 Sheet Number: ARC/010	Course Title Advance Architectural Design Studio IV Supervisors Arc. Dr. Funmi. Adedire Arc. David Oguntunde	Course Code ARC731	Student Details ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture	
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Appendix 1.8: Elevation



1. Rear View

Project Details: PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Sheet Details Drawing Title: Rear View Scale: 1:150 Sheet Number: ARC/011	Course Title Advance Architectural Design Studio IV Supervisors Arc. Dr. Funmi. Adedire Arc. David Oguntunde	Course Code ARC731	Student Details ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture	
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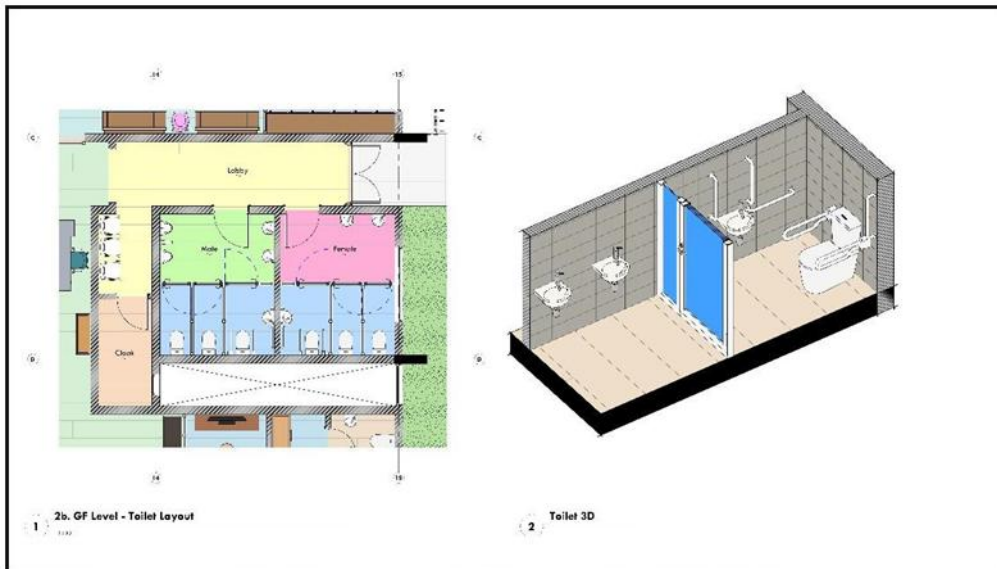
Appendix 1.9: Elevation

1. Right Side View

Project Details:	Sheet Details	Course Title	Course Code	Student Details
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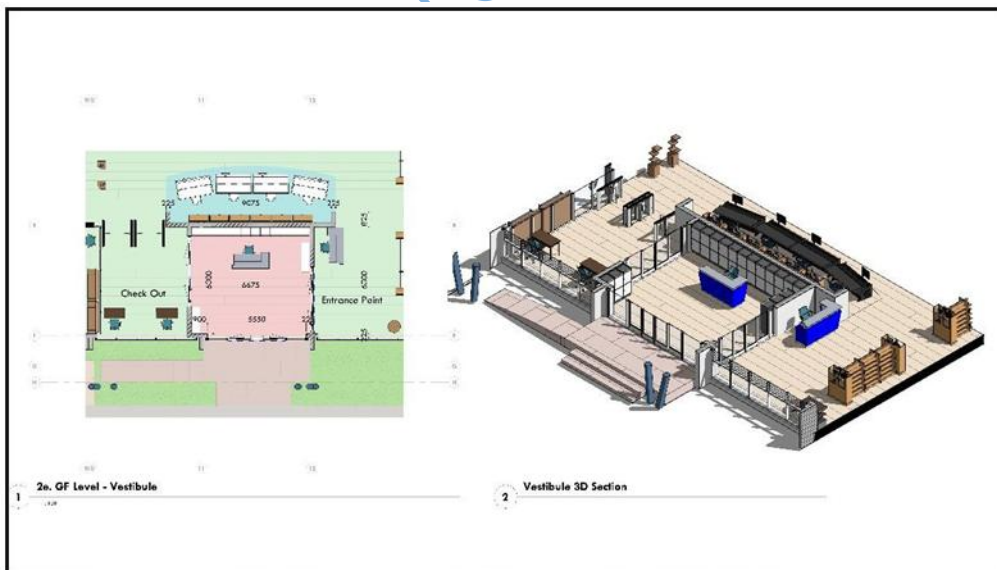
Appendix 1.10: Elevation

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Project Details:	Sheet Details	Course Title	Course Code	Student Details
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Appendix I.II: Call-Out



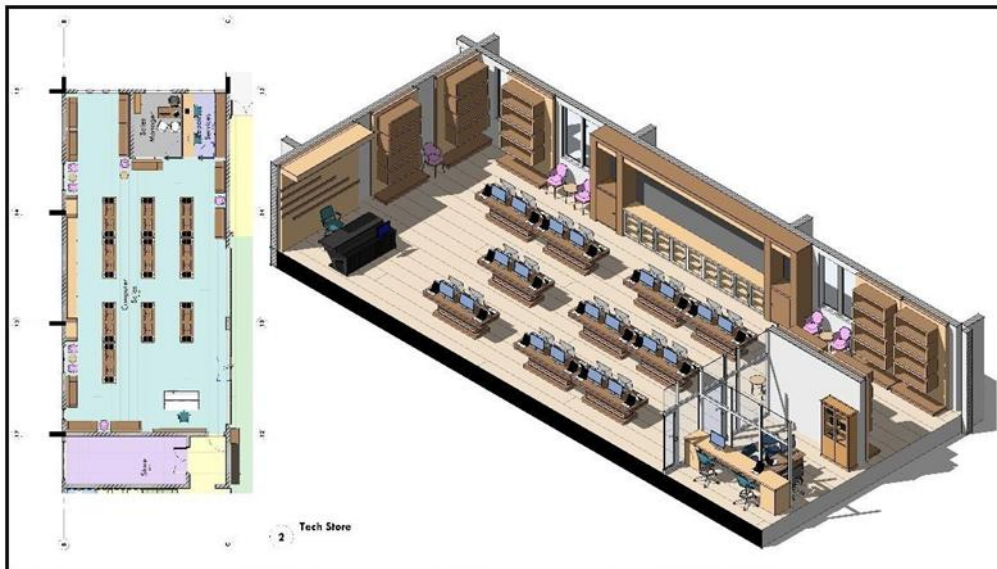
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Appendix 1.12: Call-Out

Project Details:	Sheet Details	Course Title	Course Code	Student Details
PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Drawing Title: Call Out Plan & 3D Section Scale: NTS Sheet Number: ARC/016	Advance Architectural Design Studio IV Supervisors Arc. Dr. Funmi. Adedire Arc. David Oguntunde	ARC731	ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture

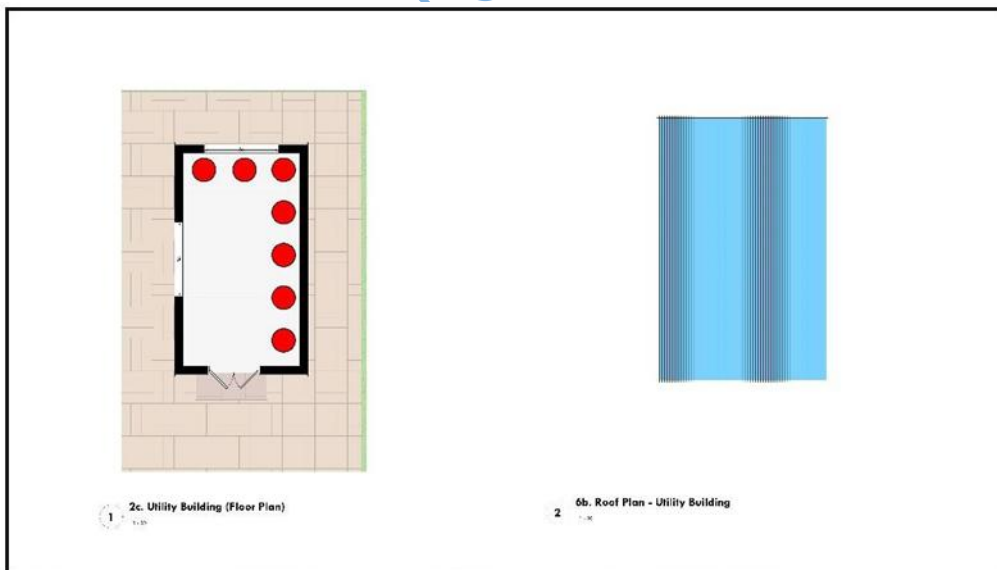
Appendix 1.13: Call-Out

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Project Details: PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Sheet Details: Drawing Title: Call Out Plan & 3D Section Scale: NTS Sheet Number: ARC/017	Course Title: Advance Architectural Design Studio IV Supervisors: Arc. Dr. Funmi. Adedire Arc. David Oguntunde	Course Code: ARC731	Student Details: ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture	
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Appendix I.14: Call-Out



Project Details: PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Sheet Details: Drawing Title: Utility Building Plan Scale: 1: 50 Sheet Number: ARC/019	Course Title: Advance Architectural Design Studio IV Supervisors: Arc. Dr. Funmi. Adedire Arc. David Oguntunde	Course Code: ARC731	Student Details: ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture	
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Appendix 1.15: Utility Building (FM200 Cylinder Store)



Appendix 1.16: Aerial View

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3D View 3

Project Details: PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Sheet Details Drawing Title: 3D View Scale: NTS Sheet Number: ARC/026	Course Title Advance Architectural Design Studio IV Supervisors Arc. Dr. Funmi. Adedire Arc. David Oguntunde	Course Code ARC731	Student Details ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture	
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Appendix I.17: 3D View



3D View 2

Project Details: PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Sheet Details Drawing Title: 3D View Scale: NTS Sheet Number: ARC/027	Course Title Advance Architectural Design Studio IV Supervisors Arc. Dr. Funmi. Adedire Arc. David Oguntunde	Course Code ARC731	Student Details ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture	
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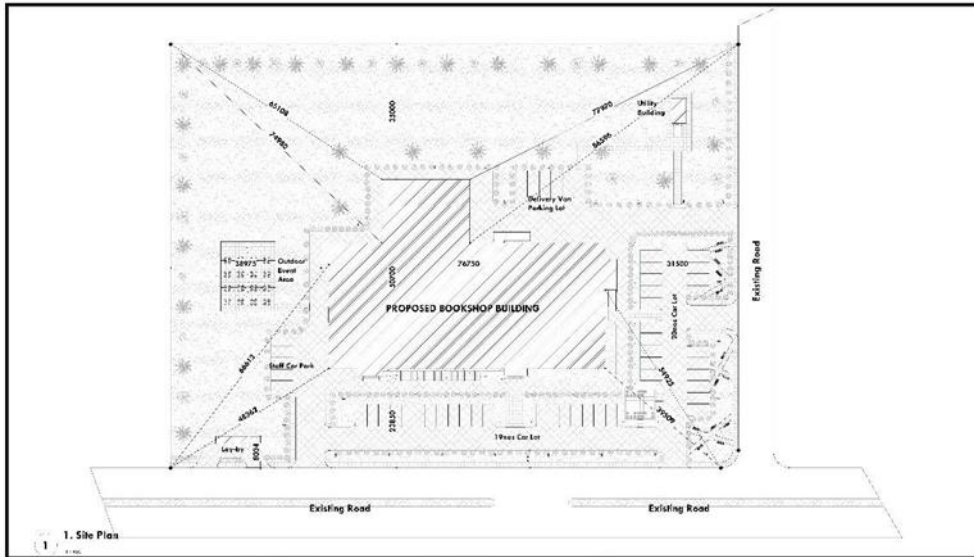
Appendix 1.18: 3D View



Appendix 1.19: 3D View

**Appendix 1
Presentation Drawings**

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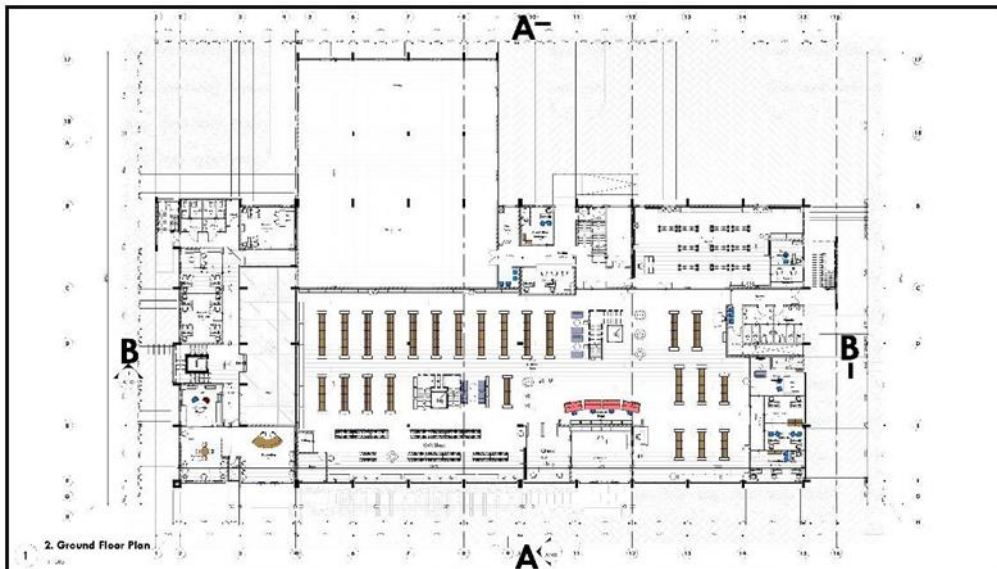
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Project Details:	Sheet Details	Course Title	Course Code	Student Details
PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Drawing Title: Site Plan Scale: 1:450 Sheet Number: ARC/002	Advance Architectural Design Studio IV Supervisors: Arc. Dr. Funmi. Adedire Arc. David Ogunlunde	ARC 731	ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture



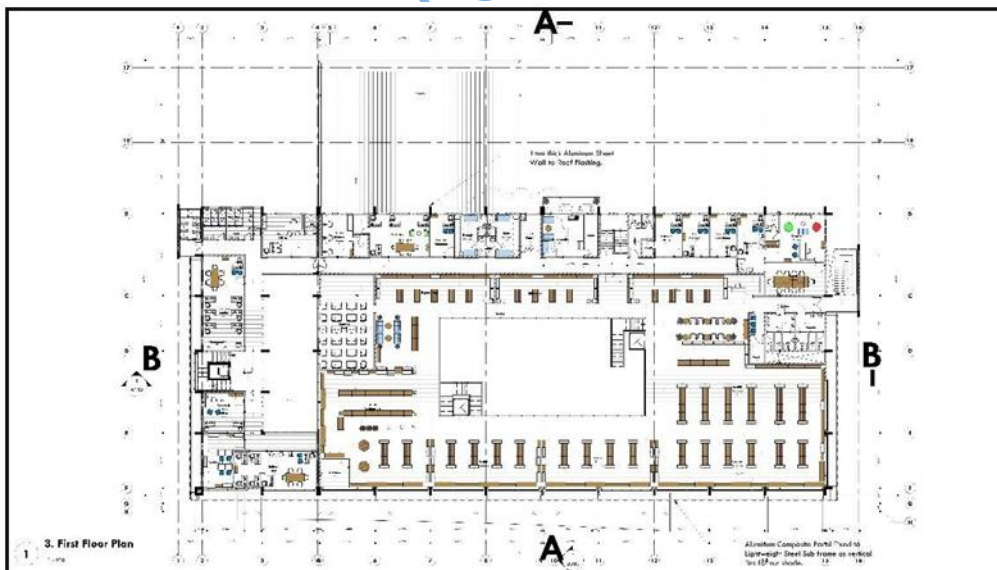
Appendix 2.1: Site Plan

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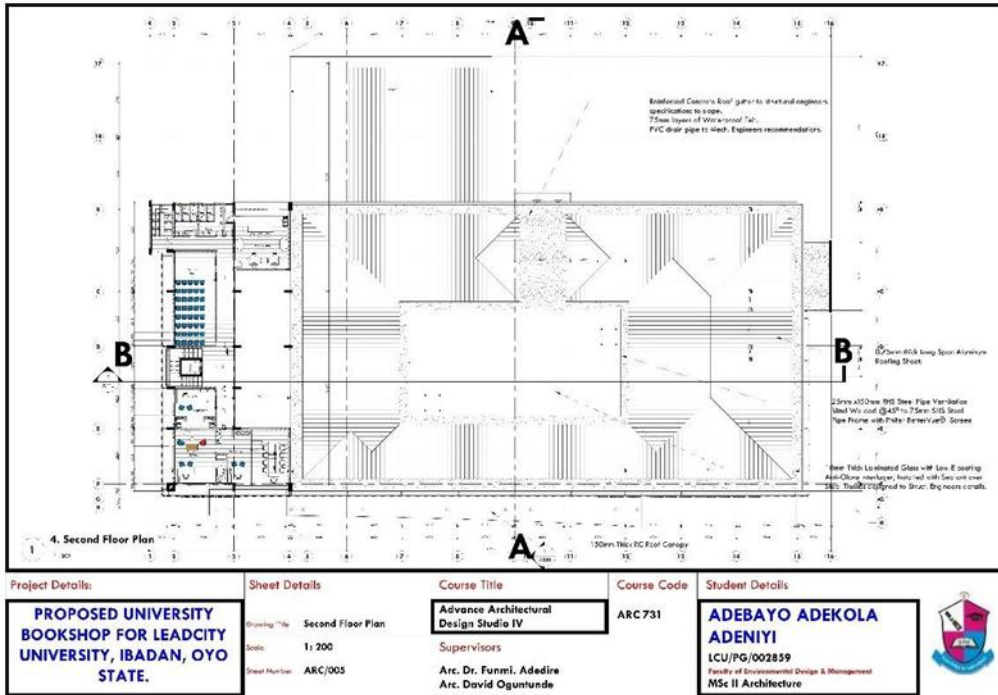
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Appendix 2.2: Ground Floor Plan

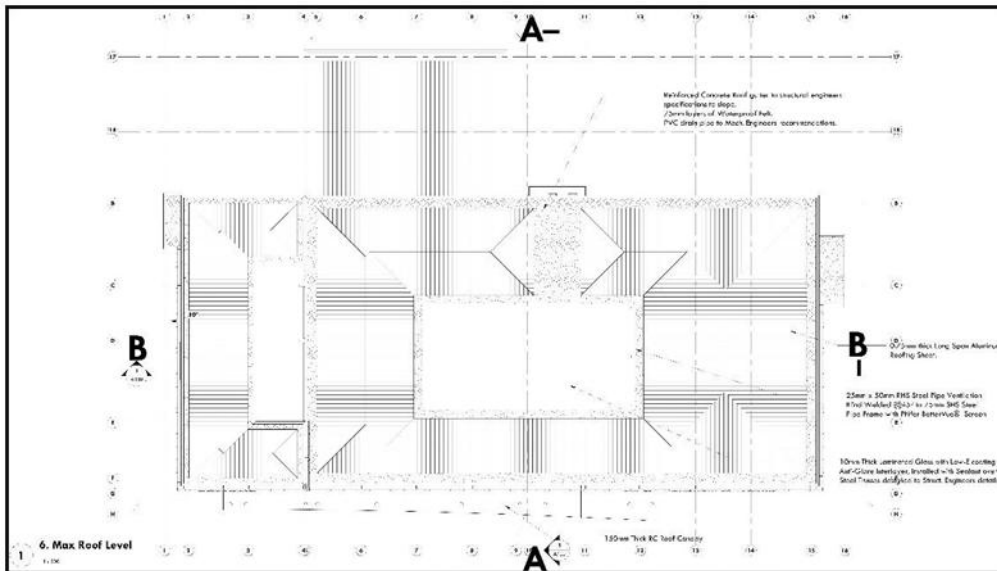


Project Details	Sheet Details	Course Title	Course Code	Student Details
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Appendix 2.3: First Floor Plan

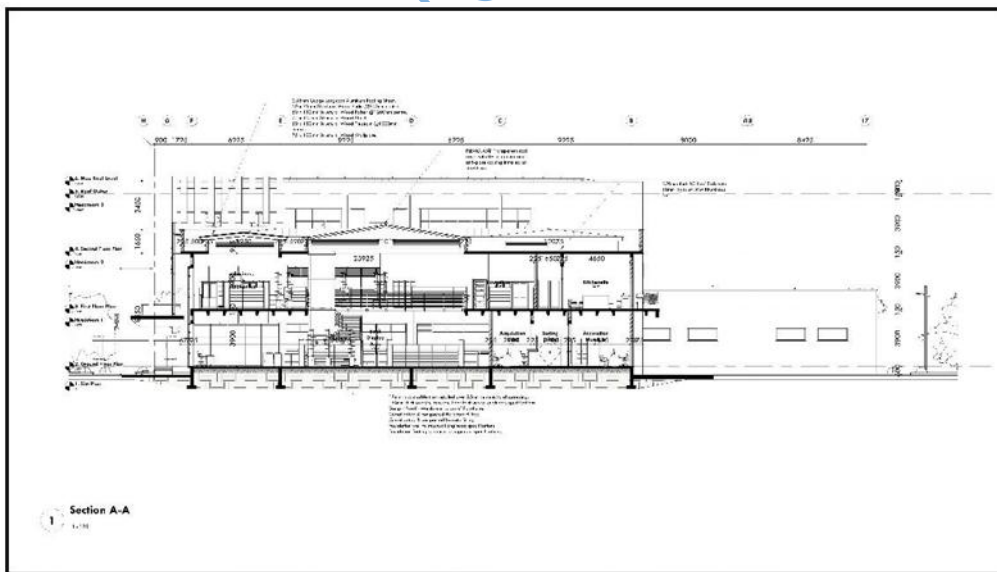


Appendix 2.4: Second Floor Plan



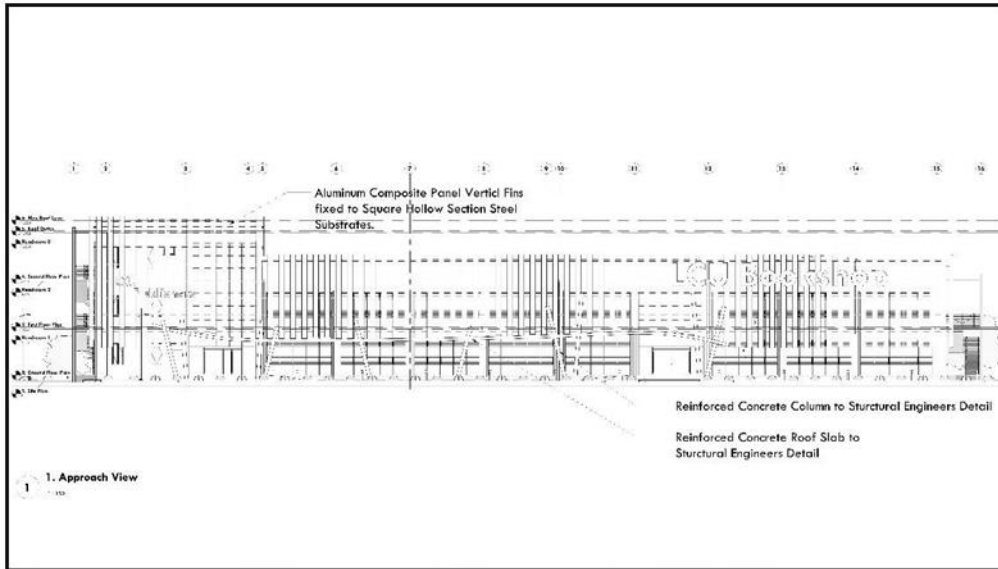
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Appendix 2.5: Max Roof Level



Project Details: PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Sheet Details Drawing Title: Section A-A Scale: 1: 125 Sheet Number: ARC/007	Course Title Advance Architectural Design Studio IV Supervisors Arc. Dr. Funmi. Adedire Arc. David Oguntunde	Course Code ARC 731	Student Details ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture	
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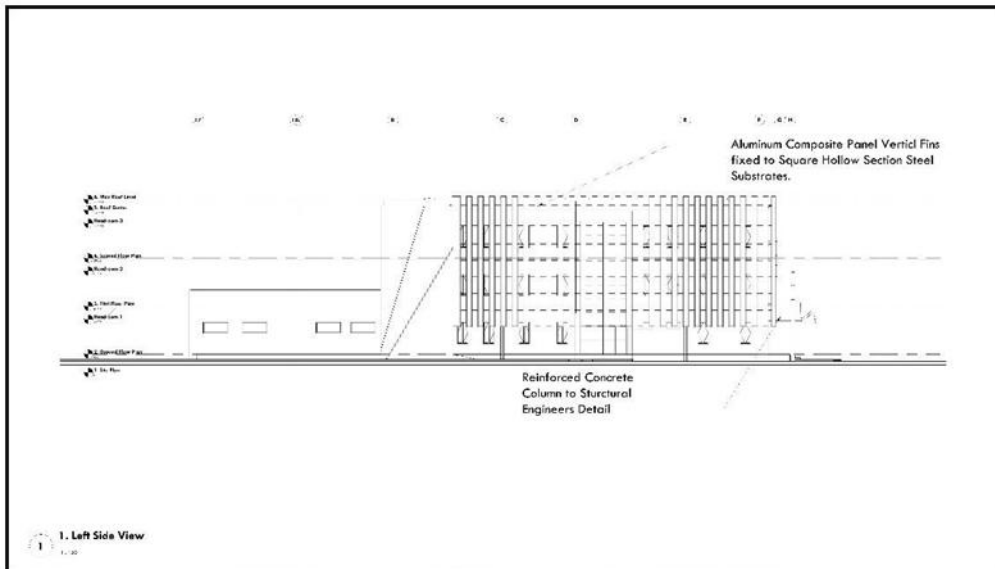
Appendix 2.6: Section A-A



Project Details:	Sheet Details	Course Title	Course Code	Student Details
PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Drawing Title: Approach Elevation Scale: 1:150 Sheet Number: ARC/009	Advance Architectural Design Studio IV Supervisors: Arc. Dr. Funmi. Adedire Arc. David Oguntunde	ARC731	ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture

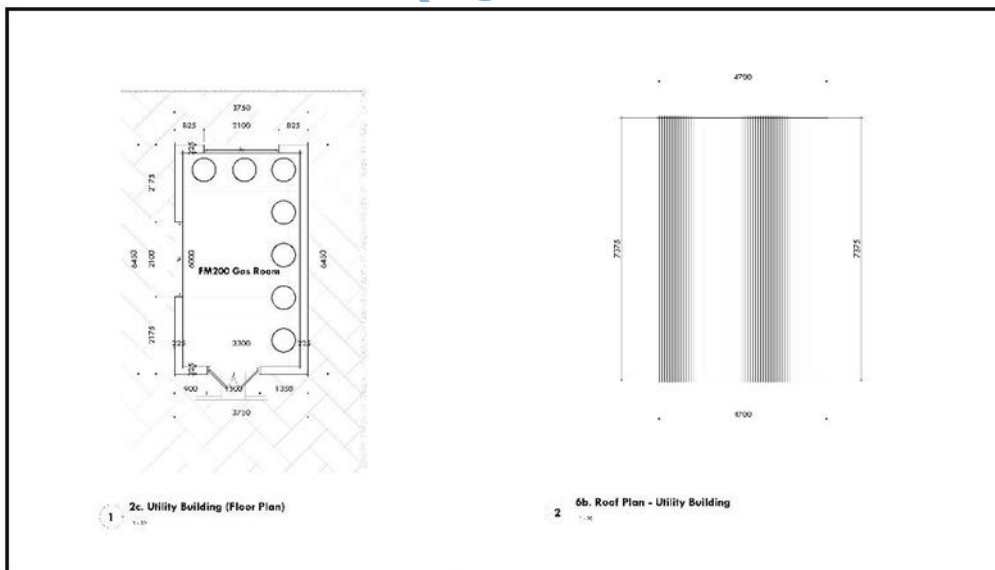
Appendix 2.7: Elevation

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Project Details:	Sheet Details	Course Title	Course Code	Student Details
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		Supervisors		
		Arc. Dr. Funmi. Adedire Arc. David Oguntunde		

Appendix 2.8: Elevation



Project Details:	Sheet Details	Course Title	Course Code	Student Details
PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Drawing Title: Utility Building Plan Scale: 1:50 Sheet Number: ARC/019	Advance Architectural Design Studio IV	ARC731	ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture
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		Arc. Dr. Funmi. Adedire Arc. David Oguntunde		

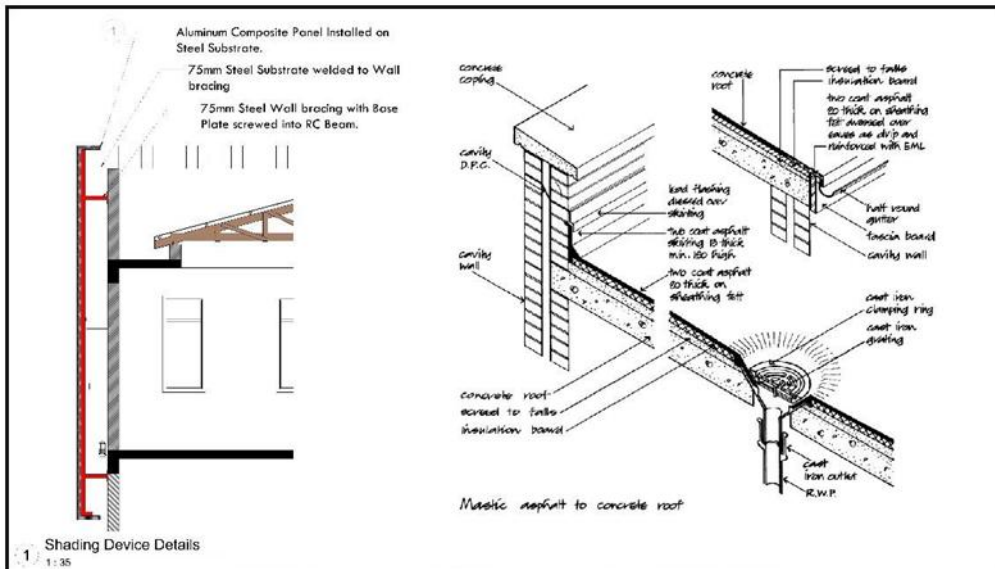
Appendix 2.9: Utility Building Plan

Foundation Details
1:15

reinforced concrete column
waffle floor around column to resist shear
reinforced concrete main beam
two mass reinforcement to concrete floor
reinforcement of two mass open site to waffle floor
glass fibre reinforced plastic moulds are pulled to close, demould, centering and are struck by compressed air through hole in top of mould
Waffle grid in-situ cast reinforced concrete floor

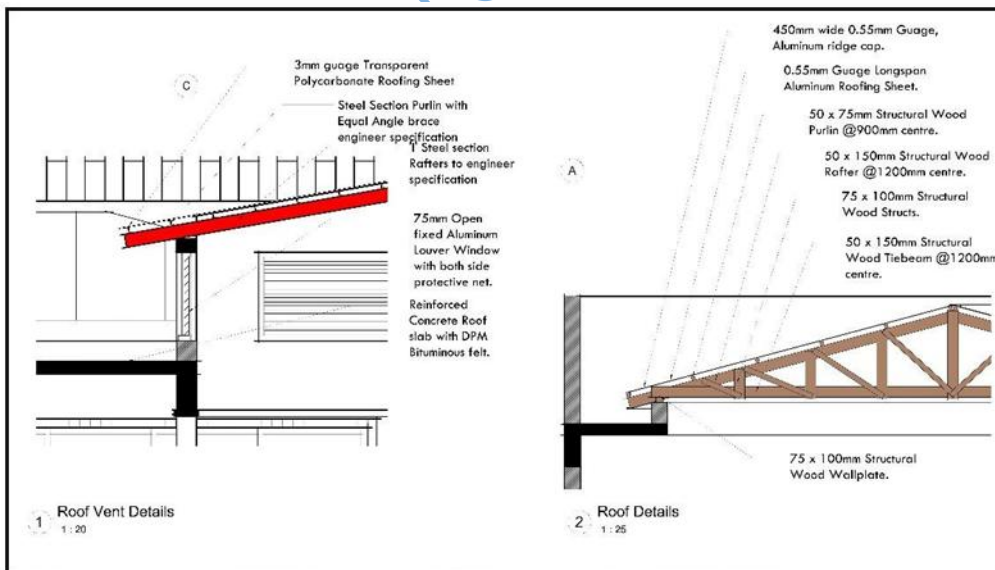
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Appendix 2.10: Details



Project Details:	Sheet Details:	Course Title:	Course Code:	Student Details:
PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Drawing Title: Scale: Sheet Number:	Advance Architectural Design Studio IV Supervisors: Arc. Dr. Funmi. Adedire Arc. David Oguntunde	ARC731	ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture

Appendix 2.11: Details



Project Details:	Sheet Details:	Course Title:	Course Code:	Student Details:
PROPOSED UNIVERSITY BOOKSHOP FOR LEADCITY UNIVERSITY, IBADAN, OYO STATE.	Drawing Title: Scale: Sheet Number:	Advance Architectural Design Studio IV Supervisors: Arc. Dr. Funmi. Adedire Arc. David Oguntunde	ARC731	ADEBAYO ADEKOLA ADENIYI LCU/PG/002859 Faculty of Environmental Design & Management MSc II Architecture

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Higher National Diploma (Architecture) 2016 - Osun State College of Technology Esa-Oke

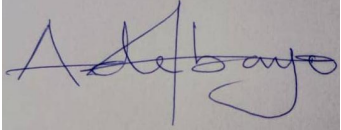
D. Work Experience with Dates

Architect & MEP QC/QA - Industries & BSD Engineering Consultants Limited, 2018

E. Publications

Unuebho et al. A Review of Strategies for Actualizing Low-Carbon Housing in Nigeria

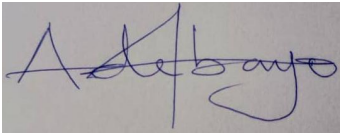
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University Compliance Certificate

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