IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 2, July 2023

# Creating a Blueprint for a Tri-Level SSCT International Residence

**Solloso, Marlon C.**
College of Engineering & Information Technology
Surigao del Norte State University, Surigao City, Philippines
marlonsolloso@yahoo.com

**Abstract:** *The Surigao State College of Technology's International House at the Del Carmen Campus serves as an on-campus edifice catering to both local and foreign students' lodging needs. This establishment symbolizes an educational domain that transcends academic confines, fostering a milieu of shared experiences and diverse perspectives within the academic. At the core of this initiative lies the overarching objective of crafting an SSCT International House that not only assures a sense of contentment but also guarantees resident satisfaction. To actualize this vision, the research embarked on a comprehensive trajectory commencing with preliminary site inspection and meticulous data acquisition. With the endorsement of the campus director, the researchers executed a thorough assessment and conceptualization of every aspect of the entire structure. This endeavor aligns with the prevalent concrete framing system, a staple structural methodology. The structural design was subjected to rigorous evaluation in alignment with the National Building Code of the Philippines, National Structural Code of the Philippines, Fire Code of the Philippines, Sanitary/Plumbing of the Philippines, BP344, and the Green Building Code. The design was calibrated to factor in the effects of wind and seismic parameters, in addition to dead and live loads germane to the structure's integrity. The driving tenets of the Green Building Code further anchor the project, infusing an ethos of economic viability and environmental consciousness, sans substantial escalation in costs. The fruition of this project has culminated in meticulous documentation that satisfies the institutional requisites. Through stringent evaluation and validation processes, the structural soundness was verified by professionals, attesting to the alignment with code mandates, thereby garnering the coveted "approved" status. The designation of the SSCT International House as an on-campus entity underscores its significance as a secure haven for students, aligning with the educational institution's commitment to fostering a safe and conducive environment for its learners.*

**Keywords:** blueprint, tri-level, residence, international residence.

## I. INTRODUCTION

International House serves as the designated residential facility for foreign students who will be staying at the institution for a predetermined duration. Opting to reside within or in close proximity to the campus in a residential college has emerged as a favored lodging option among international scholars [1]. This approach not only offers practical convenience but also fosters an environment where domestic and international students can unite, creating a communal setting centered around academic achievement, cross-cultural comprehension, and individual development. This coalescence contributes to a rich and diverse educational experience [2].

An alluring destination within the Philippines is the Siargao Islands, characterized by their distinctive tear-drop shape. As tourism in Siargao continues to flourish, an increasing number of foreign individuals are displaying interest in not only visiting but also settling in the area, often with a keen desire to pursue education while residing on the island. This trend has spurred a search for esteemed educational establishments that can cater to their chosen fields of study. In response, the Surigao State College of Technology (SSCT) - Del Carmen campus has emerged as a frontrunner, actively promoting a diverse array of courses and ensuring a high standard of education for these newcomers. Positioned in P-6, Brgy. San Jose, Siargao Islands, Surigao del Norte, this campus strives to fulfill the educational aspirations of both local and international students [3. 4].

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The concept of International House presents a pioneering initiative by offering the inaugural on-campus housing option designed exclusively for international students, with a strong emphasis on fostering diversity and inclusivity [5]. Overcoming language and cultural barriers is facilitated by the fact that the local populace possesses a grasp of a widely understood universal language, aided by their familiarity with interactions among individuals from various national backgrounds [6]. Additionally, the institution's advantageous placement within the burgeoning town of Siargao contributes to a safe and secure environment, given the area's minimal crime rate and heightened safety measures [7]. The proposed program offerings tailored for foreign students, while promising, also pose a challenge, as the institution must navigate significant adjustments to accommodate their specialized needs [8]. An essential consideration lies in the site development process, given the constraints of space availability at the SSCT Del Carmen Campus (SSCT Del Carmen Campus, n.d.). Although the campus enjoys relatively low susceptibility to landslides and floods, it's important to note its vulnerability to potential threats such as tsunamis and storm surges (Department of Science and Technology, 2022).

The SSCT International House is designed in alignment with the principles of the Green Code, a comprehensive framework that prioritizes the well-being of communities and urban areas by enhancing safety, health, and welfare considerations [10]. This approach fosters heightened resource efficiency across buildings, bolstering economic sustainability while concurrently mitigating the adverse impacts of climate change and reinforcing the overall resilience of constructed spaces [11]. The Green Code's provisions encompass a spectrum of strategies that collectively contribute to improved indoor environmental quality, a diminished strain on natural resources, and the cultivation of stronger neighborhood connectivity [12].

The decision to undertake this study stems from the researcher's aspiration to contribute to the advancement of design and investigative knowledge in the international context, which holds potential benefits for both the researchers and the stakeholders involved [13]. The research aims to serve as a valuable learning experience for the proponents, facilitating their development in the realm of international design and investigation [14]. Furthermore, the researcher envisions the study to serve as a reference point for future endeavors within the institution [15].

The primary objective of this research is to formulate an optimal design for an international house that will cater to prospective foreign students of the SSCT Del Carmen campus, ensuring an environment that fosters their sense of security and comfort during the learning process. Simultaneously, the study seeks to cultivate a diverse and inclusive academic community, aligning with the institution's broader goals [16]. Additionally, the research aspires to cultivate an authentic international perspective, in harmony with the growing to

## II. METHODS

The diagram depicted in Figure 1 illustrates the sequential progression of the study, commencing with problem analysis and culminating in the study's ultimate completion. The process is initiated by the collection and subsequent analysis of data. The amalgamation of all acquired data assumes a crucial role as it serves as the foundational input for shaping the design. This step is vital as it underpins the anticipated behavior of the structure. Following this, preliminary designs are developed to align with the stipulated criteria for the main school building. These designs undergo assessment in accordance with the National Building Code of the Philippines and the Structural Building Code of the Philippines. This evaluation process ensures that the preliminary design is scrutinized for safety and cost-effectiveness, both of which are paramount in the realm of civil engineering. The ultimate outcome of this process is the formulation of the SSCT International House design, characterized by meticulous and precise analysis due to adherence to structural construction codes. This comprehensive approach guarantees that the design is exact and well-suited, guided by established codes and standards.

The researchers devised a systematic framework as shown in Figure 2 as a foundational guide for conducting a study aimed at facilitating the seamless progression of the project's development. This encompassing framework encompasses stages such as feasibility study, design conceptualization, as well as the creation of architectural, structural, electrical, plumbing, and mechanical designs. To ensure the project's success, it is imperative that it adheres to specified codes and objectives. Initially, the researcher embarks on a feasibility study to pinpoint a suitable location for constructing the three-story international house. Subsequently, the process transitions into the conceptualization of the building, aligning with the envisaged designs.

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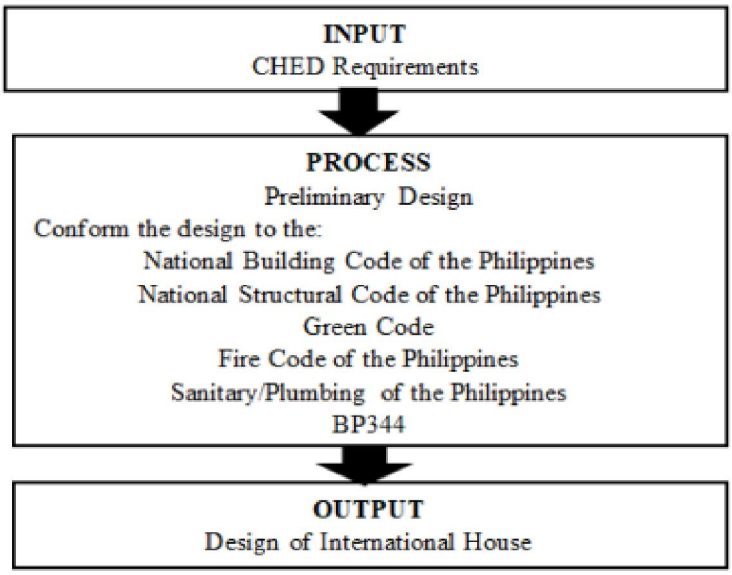


**Figure 1.**Flowchart of the Study

Within this framework, architectural design encompasses a conceptual approach focused on the fundamental components or elements integral to the structure. Structural design involves a systematic evaluation of a structure's stability, strength, and rigidity. The primary objective of structural analysis and design is to develop a structure that can withstand all applied loads without failure during its intended lifespan. Electrical design entails the strategic planning and creation of electrical components, schematics, power systems, and telecommunications infrastructure. In plumbing design, two distinct systems are considered: the water supply system and the system responsible for water disposal. This entails the movement of fluids through pipes, valves, and tanks. Mechanical design, on the other hand, pertains to the planning of building services like plumbing, air conditioning, sprinkler systems, and security measures. Following the establishment of the workflow, the structure's cost estimation is performed. Cost estimation involves approximating the project's expenses. Its purpose is to provide a benchmark for cost control and to ensure that the resources expended during project execution align with the costs assessed during the feasibility phase of the project.

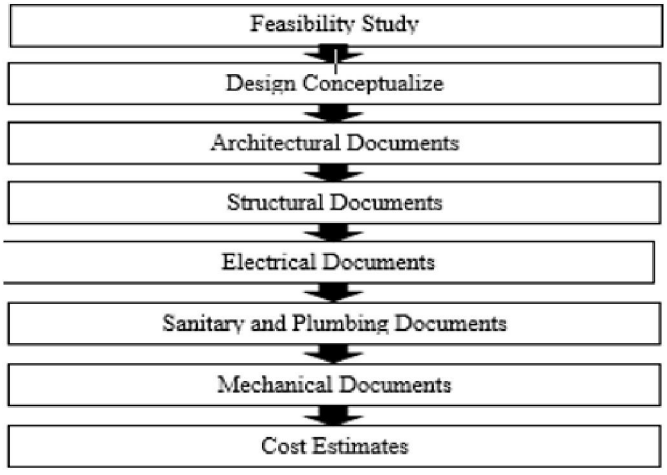


**Figure 2.**Project Flow

### 2.1 Project Setting

The proposed International House as shown in Figure 3, will be situated within the premises of the Surigao State College of Technology, specifically located at P-6, Barangay San Jose, Del Carmen, in the enchanting Surigao Islands, Surigao del Norte. This designated area within the campus, measuring 816 square meters, is earmarked to serve as the

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site for this venture. The precise geographical coordinates for the project are marked at N9°52'49.89" latitude and E125°58'16.3247" longitude. This forthcoming structure is designed to cater to foreign students and guests, enjoying a strategic placement in the renowned Surigao Islands, often referred to as the "Surfing Capital of the Philippines."


**Figure 3.**Location of the Project

### 2.2 Instruments

This study employs a selection of computer software applications as tools for conducting the research.

Drafting software refers to computer-aided programs employed for crafting blueprints across diverse domains, including architecture, bridges, and computer chip design, among others.

Graphic software, presented by Google, offers a versatile platform for both 3D and 2D modeling, known for its user-friendly interface. This software is particularly useful in domains like architecture, film production, and game design, enabling the transition from two-dimensional concepts to three-dimensional structures through an innovative technique involving pushing and pulling.

Recognized on a global scale, Structural Design Software stands out as a preeminent solution for structural analysis and design. It offers an array of analysis methods encompassing traditional static analysis as well as modern approaches like p-delta analysis, geometric non-linear analysis, Pushover analysis (Static-Non Linear Analysis), and buckling analysis. Moreover, it encompasses a variety of dynamic analysis techniques ranging from time history analysis to response spectrum analysis.

Microsoft Office, inclusive of Microsoft Excel, Microsoft Word, and Microsoft Project, plays a pivotal role in facilitating the research at hand. These applications expedite the creation of reports, construction estimates, PERT-CPM analyses, and related tasks, thereby streamlining documentation and data input processes. Notably, Microsoft Project assists researchers in cost estimation and establishing a comprehensive work breakdown structure. Furthermore, it provides scheduling functionalities, serving as a cornerstone for monitoring construction progress in terms of adhering to planned timelines.

## III. RESULTS AND DISCUSSION

The researcher has undertaken a comprehensive analysis and design process for the structure, taking into account both aesthetic and structural aspects while ensuring compliance with codes and CHED (Commission on Higher Education) requirements. Motivated by the burgeoning tourism development in Siargao, the institution is extending an opportunity to foreign students residing on the island to pursue higher education. To meet this demand, the SSCT Del Carmen Campus has stipulated that the building must possess a modern design that facilitates easy adaptation for foreign students' accommodation needs.

The researcher successfully addressed the institution's requirements, including the integration of solar panels to uphold the building's energy efficiency in alignment with green codes. The building is strategically situated behind the classrooms and faculty building, adjacent to the campus dormitory. With a land area of 638 sq. m, the researchers

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effectively met space requirements and occupancy criteria. The building's layout encompasses various functional areas such as a kitchen, dining area, offices, assembly hall, lobby, laundry facility, entertainment space, library, and bedrooms. Each bedroom comfortably accommodates two individuals and is equipped with a private bathroom and balcony.

Leveraging the capabilities of graphic software, the following image portrays the perspective view as shown Figure 4 of the SSCT International House, a design meticulously crafted by the researcher in adherence to specified requirements. The building's modernized design positions it favorably for global competition.

**Figure 4**. Perspective view of the project

Floor plans as shown in  play a crucial role in understanding the layout and organization of a building's interior spaces. They provide a visual representation of the distribution of Figure 5rooms, corridors, and various functional areas across different levels of the structure. This introduction outlines the key features and highlights of the first, second, and third floor plans of the building, offering insights into the arrangement and purpose of each level.

- First Floor Plan: The first floor plan serves as the foundation of the building's spatial design, dictating the initial interactions and flow of occupants within the structure. This level often encompasses essential public spaces, including the main entrance, reception area, and common gathering spaces. The placement of foundational amenities such as lobbies, administrative offices, and shared facilities is carefully orchestrated to establish a welcoming and efficient entry point for both visitors and inhabitants.
- Second Floor Plan and Third Floor Plan: Moving up to the second floor and third floor, a new layer of functionality and purpose unfolds. The design of the second floor plan often prioritizes connectivity, ensuring a seamless transition between different sections while accommodating distinct requirements for privacy, collaboration, and interaction of occupants rooms.

In essence, the three floor plans collectively contribute to the building's holistic design, catering to a range of activities, occupants, and spatial needs. The careful arrangement of spaces across these levels ensures a harmonious balance between functionality, aesthetics, and user experience, ultimately defining the building's overall character and usability.

The critical design information utilized to develop the slab design is presented in Figure 6. The depicted figure visually portrays the plans and sections relevant to the slab's configuration. With a thickness of 200 mm, the slab incorporates 12 mm diameter straight bars for reinforcement, complemented by bent bars positioned at 200 mm intervals at the central axis. It is noteworthy that both one-way and two-way slabs share uniform steel reinforcement bar diameters and spacing. By adhering to the prescribed steel specifications governing the slab's reinforcement for both its longer and shorter spans, the subsequent outcomes were verified.

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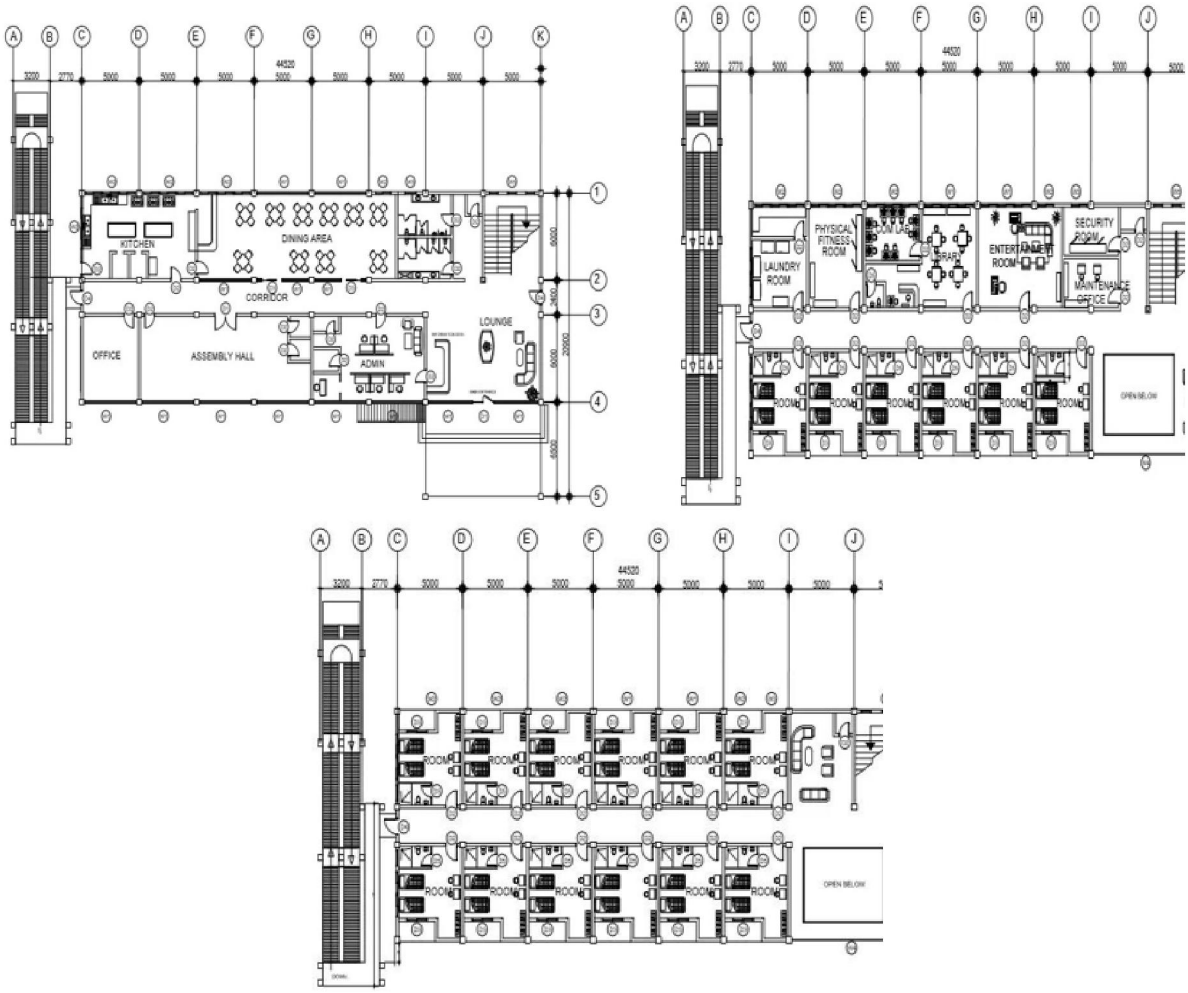


**Figure 5**. Floor plans of the project

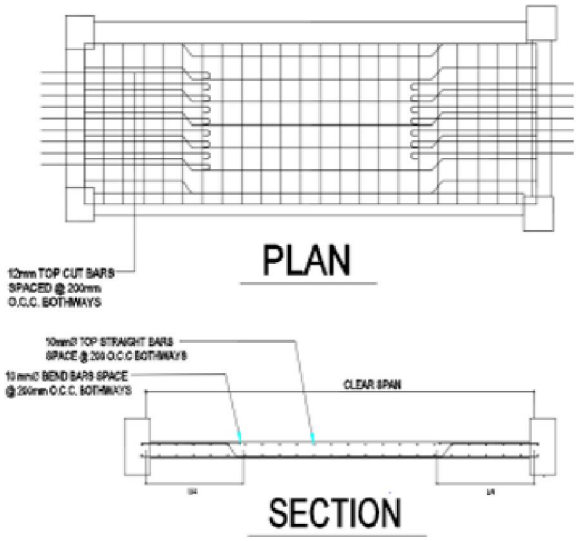


**Figure 6**. Structural Slab Design of the Project

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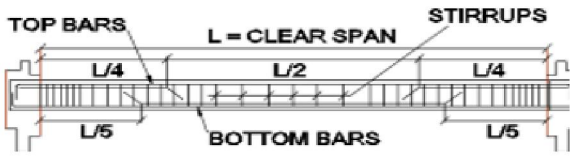


**Figure 15.** *Section of Beams for One-Storey*

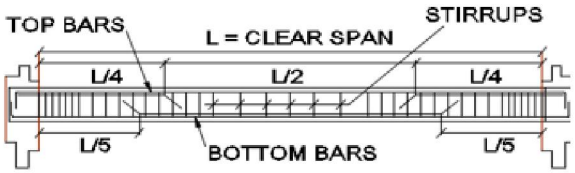


**Figure 7**. Structural Beam Design of the Project

Figure 7 illustrates the section particulars pertaining to the beams within the structure. The upper bars signify tension bars, whereas the lower bars correspond to compression bars. The design adheres to consistent dimensions, featuring a width of 300mm and a depth of 420mm. For reinforcement, a 25mm diameter bar is employed for both the top primary straight bars and bend bars. In the context of the three-storey configuration, specific dimensions are applied: the girder beam spans 300 mm by 450 mm, the roof beam maintains dimensions of 300 mm by 400 mm, and the floor beam retains measurements of 300 mm by 400 mm.

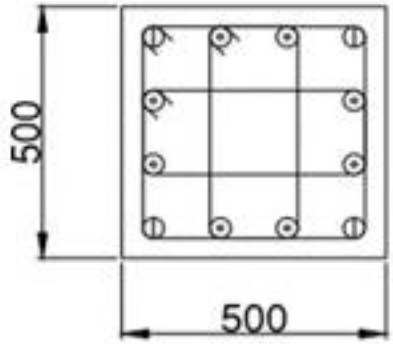


**Figure 8.**Column Design of the Project

In the realm of structural engineering, columns stand as integral components that provide essential support and stability to buildings. Their dimensions and reinforcements as shown Figure 8, play a pivotal role in ensuring the structural integrity and safety of a construction project. The selection of appropriate column dimensions, along with strategic reinforcement placement, are critical decisions that directly impact a building's ability to withstand various loads, including gravity and lateral forces such as wind and seismic activity.

Column dimensions (500-mm x 500-mm) encompass considerations of height, width, and depth, all of which are influenced by factors such as the building's height, load-bearing capacity, and architectural design. The proportions of these dimensions are fundamental in distributing loads efficiently and preventing issues like buckling or excessive deflection. Equally crucial is the placement of reinforcements within columns. Reinforcing bars, commonly known as rebars, are strategically positioned within columns to enhance their load-carrying capacity and resilience.

The type, diameter, and arrangement of rebars (12-36-mm diameter) within columns are meticulously calculated to ensure that they can effectively resist applied loads, provide flexibility against lateral movements, and withstand potential forces arising from natural phenomena like earthquakes. The integration of these rebars contributes to a column's ability to absorb energy and deform without compromising the overall stability of the structure.

The design of footing in Figure 9 holds immense significance as it forms the bedrock upon which entire structures rest. Footings, as a vital component of foundations, serve as the link between the building and the ground, distributing loads efficiently and ensuring stability. When it comes to three-storey buildings, the intricacies of footing design become even more crucial due to the vertical and lateral forces at play.

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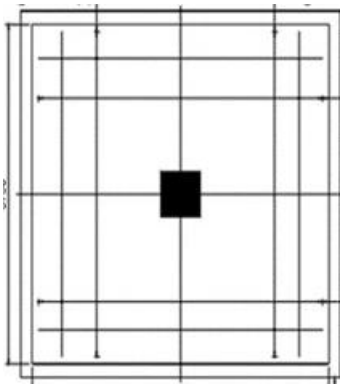

**Figure 9.**Footing Design of the Project

The design of footings in three-storey buildings requires a delicate balance between load-bearing capacity, soil conditions, and structural integrity. These footings are responsible for supporting the weight of the entire structure, along with any additional live loads, such as occupants and furnishings. Moreover, they must also counteract lateral forces, like wind and seismic activity, which become more pronounced as the building height increases.

The size, shape, and depth of footings which are 3-m x 3-m and a depth of 3.5, meticulously determined through rigorous analysis of the building's characteristics and the underlying soil conditions. The design process involves intricate calculations and considerations of load distribution, settlement, and bearing capacity, all of which aim to prevent issues like foundation settlement and tilting.

TABLE 1: CONFORMANCE OF THE DESIGN

| ITEMS | Conform to NBCP | Conform to NSCP |
|---|---|---|
| Architectural | ✓ | ✓ |
| Structural | ✓ | ✓ |
| Plumbing | ✓ | ✓ |
| Electrical | ✓ | ✓ |
| Mechanical | ✓ | ✓ |

Adherence to established codes and standards is paramount to ensure safety, durability, and the overall integrity of a construction project. In the Philippines, two prominent sets of guidelines govern the design and construction of buildings: The National Building Code of the Philippines (NBCP) and the National Structural Code of the Philippines (NSCP). These comprehensive codes outline stringent requirements and specifications that architects, engineers, and builders must follow to guarantee the structural stability and safety of the built environment.

The National Building Code of the Philippines (NBCP) serves as a comprehensive framework that encompasses various aspects of building design and construction. Enforced by the Department of Public Works and Highways (DPWH), the NBCP outlines regulations pertaining to architectural design, fire and life safety, plumbing, mechanical systems, and more. It provides guidelines on building heights, occupancy classifications, structural loads, and materials, ensuring that structures are planned and executed in a manner that mitigates potential hazards and safeguards the well-being of occupants and the surrounding community.

Complementary to the NBCP, the National Structural Code of the Philippines (NSCP) is dedicated specifically to structural engineering. This code, developed by the Structural Engineers Association of the Philippines (SEAP), addresses the design, analysis, and construction of various structural elements, including foundations, beams, columns, and slabs. The NSCP outlines provisions for structural loads, seismic design, material strengths, and structural stability, ensuring that buildings can withstand natural forces and dynamic loads without compromise.

In this context, this discussion delves into the meticulous conformance of a design with the National Building Code of the Philippines (NBCP) and the National Structural Code of the Philippines (NSCP). By meticulously adhering to the stipulated guidelines, architects, engineers, and construction professionals align their projects with industry best

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practices, ultimately contributing to the creation of robust, safe, and resilient structures that stand as testaments to both technical proficiency and commitment to public welfare.

## IV. CONCLUSIONS AND RECOMMENDATIONS

### 4.1 Conclusions

- The researchers' analysis of projected foreign student numbers led to a significant outcome in projecting the number of rooms to accommodate the potential occupants within the house.
- The evaluation concludes that the design and aesthetics of the SSCT International House successfully align with modern standards. The project satisfactorily fulfilled the institution's objectives, including the integration of solar panels to enhance energy efficiency in accordance with global green codes. Both the design and structural analysis of the building conform to the requirements stipulated by the National Building Code of the Philippines and the National Structural Code of the Philippines.
- The research concludes that all requisite documents were appropriately approved by professionals, affirming the study's completion in accordance with the National Building Code of the Philippines and the National Structural Code of the Philippines.
- Consequently, the proposed Three-Storey SSCT International House attains a highly commendable rating in terms of quality, adaptability, and relevance, as assessed within the project's acceptability framework. This outcome affirms that the institution can assure prospective foreign students of the International House's exceptional quality and design.

### 4.2 Recommendation

- A suggestion put forth is to consider expanding the available area to accommodate a greater number of rooms. This recommendation arises from the researchers' inability to achieve the desired room count as mandated, owing to the rapid surge in tourism on Siargao, Philippines. With the tourism growth, it's anticipated that occupant’s numbers will also see a corresponding increase.

## V. ACKNOWLEDGMENT

The author expresses his gratitude to the author's family for their continuous support during the research process.

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