Proposed Two-Storey Balay Silangan

in Janiuay, Iloilo

A Project Study

Presented to

The Faculty of the Department of Civil Engineering

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The Research Team

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TWO-STOREY BALAY SILANGAN

IN JANIUAY, ILOILO

Nonito Barnizo Jr; Pauline Grace Lerez; KC Salcedo; Desiree Anne Suelan

ABSTRACT

In the wake of the ongoing battle against illegal drugs, the rehabilitation and reintegration of individuals involved in drug-related offenses have become critical components of community development. With a significant number of drug offenders surrendering to authorities, there is a growing need for facilities that not only house them temporarily but also offer a path toward recovery and self reliance. Janiuay, one of the municipalities heavily impacted by drug-related issues, with a record of two hundred sixty (260) total drug offenders, has taken proactive steps to address this concern. This project study focuses on the proposed construction of a 441 sq. m. two-storey Balay Silangan facility in Janiuay, designed to rehabilitate and accommodate thirty (30) drug offenders, ultimately aiding them become productive and law-abiding members of the society. Moreover, the structure was designed using the provisions of the Ultimate Strength Design (USD) method and the National Structural Code of the Philippines (NSCP) 2015. By incorporating modern architectural design, green building technologies, and rehabilitation facilities, this project aims to create a sustainable and supportive environment for those seeking a fresh start. The estimated project cost is Php 19,500,000.00 which will be funded by the Municipal Social Worker Development Office. It is recommended that once the structure is fully functional, installation of safety and security devices should be carried out, such as fences, CCTVs, and other essential security measures.

Chapter I

Introduction

1.1 Background and Rationale

According to the Dangerous Drugs Board (2018), in light of drug individuals who had voluntarily surrendered due to the government's intensified campaign against the Philippine Drug Problem, the Philippine Drug Enforcement Agency (PDEA) oversaw the execution of a program led by Local Government Units (LGUs). This initiative aimed to offer family-centered residential reformation for drug offenders, drawing inspiration from the Bahay Pagbabago Reformation Center concept.

By encouraging all community institutions to join in addressing the risk of illegal drug abuse through shared social and corporate responsibility, the Reformation Center, also known as "Bahay Pagbabago," operated on a volunteer basis, with no costs incurred by patients, the government, or its agents. Its existence is supported by the corporate community as well as civic-minded/cause-oriented organizations.

The Bahay Pagbabago facility is intended for individuals who have surrendered due to involvement with drugs but are not users or dependents. and provides intervention, counseling, and a source of income with the goal of assisting them in becoming people who had successfully re-entered society tended to contribute more and adhered to the law, making them valuable members of the community. The Balay Silangan was designed in accordance with the model and concept of Bahay Pagbabago. This program also served as a tool for reforming drug personalities who used plea bargaining, in light of the Supreme Court’s judgment in the case of Estipona v. Judge Frank Lobrigo (GR No. 226679, August 15, 2017). This was an alternate intervention for drug personalities who are not eligible for admission to Department of Health (DOH) -supervised Treatment and Rehabilitation

facilities (Cuy, 2018).

Furthermore, the PDEA led operations against illegal drugs in Western Visayas, with 255 drug users surrendering and 2,584 arrests made between January 1 to December 19, a s a result of 1,849 operations conducted by Police Regional Office 6. With the goal of declaring the region drug-free by 2024, the PDEA administers the Balay Silangan program, according to the Philippine News Agency.

Moreover, existing rehabilitation centers in the Province of Iloilo were also constructed on selected municipalities, such as New Lucenawhich had 110 offenders and 57 completed their rehabilitation between the years 2016- 2022. Additionally, the Municipality of Pototan had its own rehabilitation center with 648 offenders and 647 completed their rehabilitation during the same year.The Municipality of Leganes also had its Balay Silangan with 87 offenders, and 65 completed their rehabilitation.

Balay Silangan will be located in Janiuay, Iloilo. The program serves as a reformatory measure, offering an alternative intervention for individuals involved in drugs but who do not use drugs and thus did not qualify for medical treatment and rehabilitation in Department of Health (DOH)-supervised facilities," explained PDEA Director General Aaron N. Aquino. (GOVPH, 2018)

On the other hand, according to PhilAtlas (2023), Janiuay, a municipality in Iloilo Province, occupied 179.10 square kilometers (69.15 square miles) and housed 66,786 people. In Western Visayas, it constituted 0.84% of the total population. With this population, a single rehabilitation facility for the entire province was insufficient. Under RA 11964, municipalities were categorized into five (5) classes, determined by their income levels derived from the average annual regular income over the three (3) fiscal years preceding a general income reclassification . Janiuay, Iloilo was considered a class A municipality because of its annual income of Php 306,066,190.36 as of 2022.

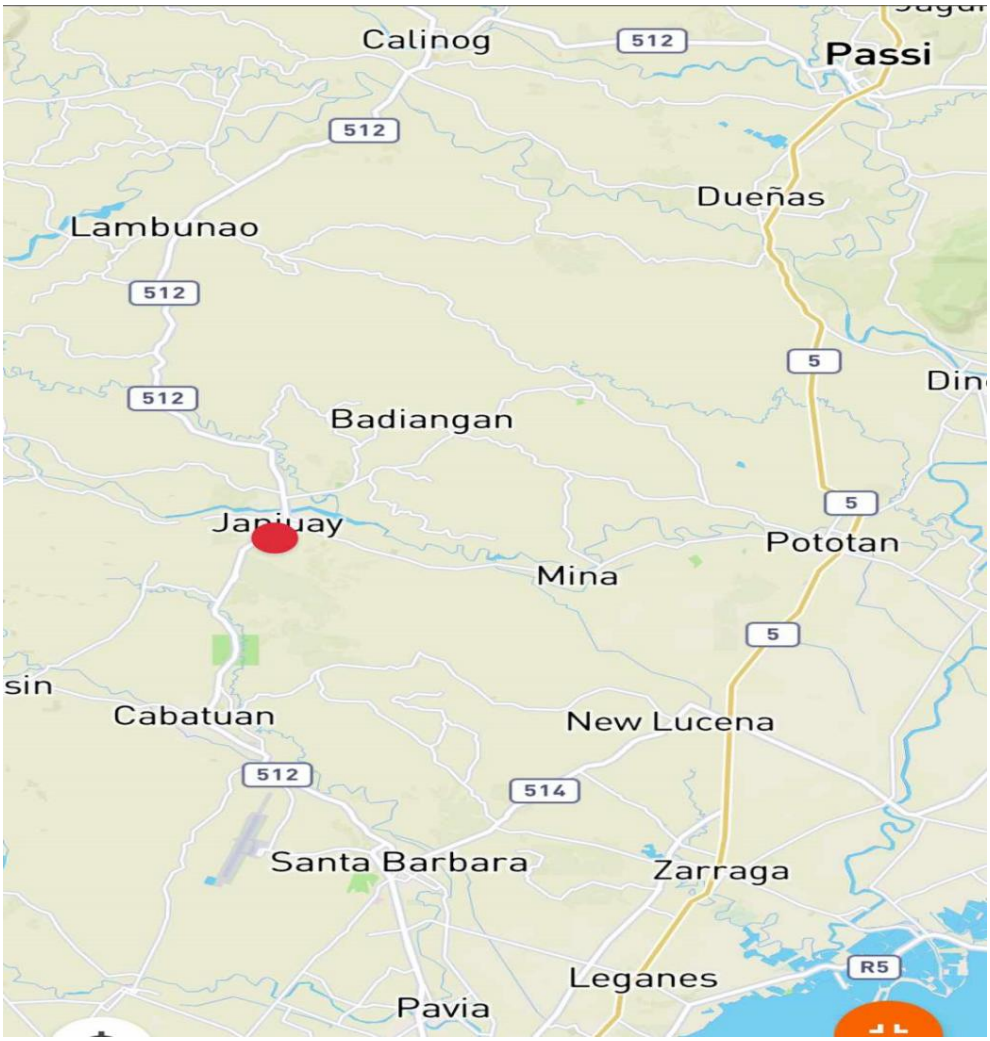


Figure 1

Janiuay Location and its nearby Municipalities

Figure 1 shows the location of Janiuay and its nearby municipalities given distances of its neighboring Municipalities: Cabatuan 19.5 km, Maasin 27.9 km, Lambunao 22.8 km, Calinog 30.7 km, Badiangan 16.1 km, Binggawan 38.7 km, Mina 23.5 km, and Pototan 32.3 km.

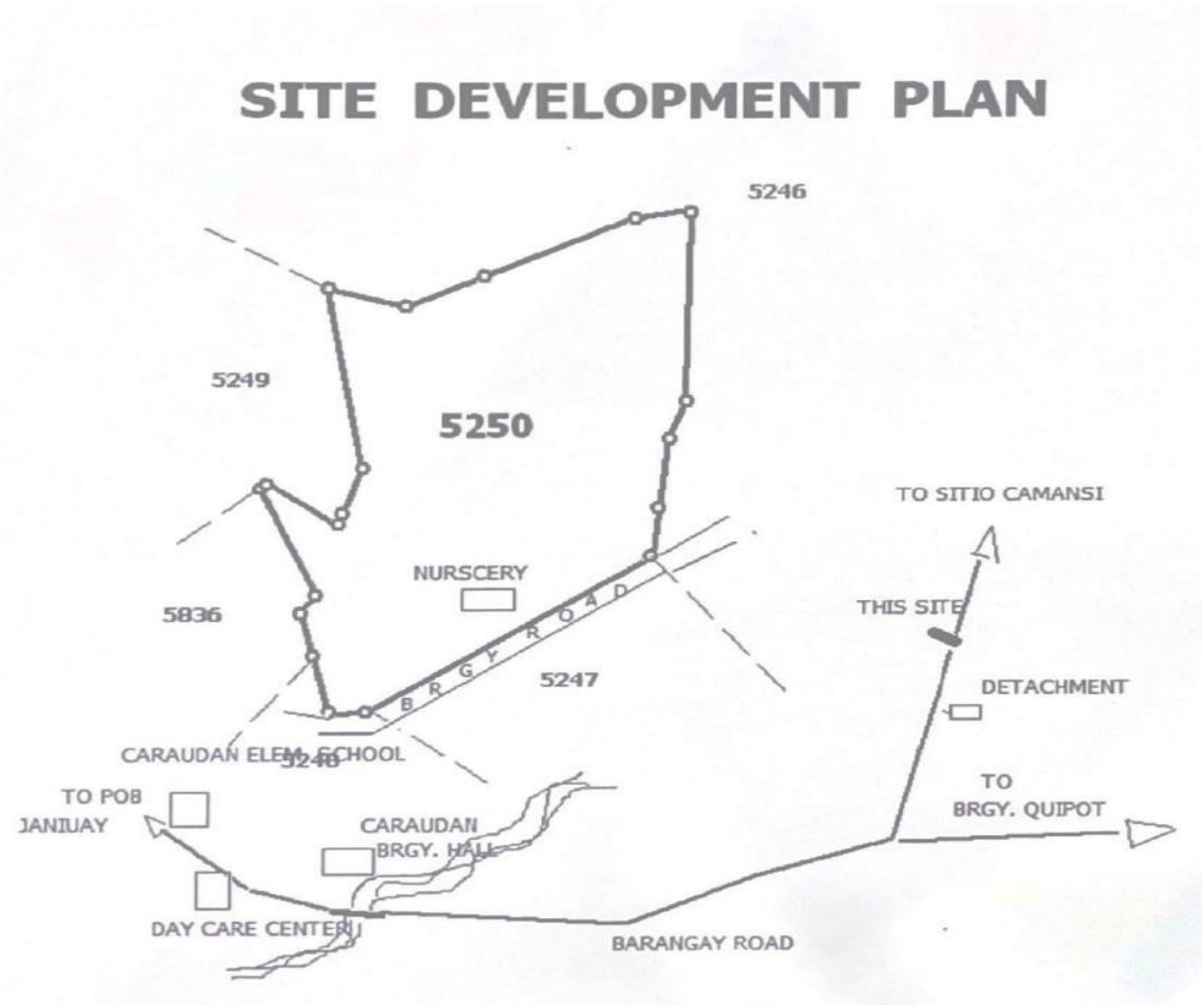


Figure 2

Balay Silangan Site Development Plan

Lastly, Figure 2 illustrates the site development plan, featuring a MENRO-managed nursery and facilities for Balay Silangan, including educational, PWD-accessible, isolation, parking, and residential structures.

1.1.1 Facilities

The proposed project Balay Silangan has a floor area of 441 square meters and has a capacity to accommodate 30 drug offenders and include the following facilities:

For support services, it includes an isolation facility which is separate from the in-house isolation room for infectious diseases and is only used in reaction to the New Normal. Though this facility can be utilized to isolate suspected COVID clients, it will mostly serve as a quarantine space for new clients in order to prevent COVID 19 cases at the center. The Center Head Office is available to both the staff office and the center's visitors. While the Office Staff Area serves as the primary workstation for the center's core staff. Counseling/interview room, the in-house psychologist was utilized the facility to conduct therapy and interviews. The room was free of outside noises. Observation room was used to discipline and guide people with behavioral concerns. Clinic, was used to treat minor injuries and illnesses. It included first aid supplies, was comfortable, well-ventilated, and devoid of grime and dust. Isolation Room, will had isolation rooms for medical purposes, particularly for customers with contagious disorders. Lobby / Waiting Area, was accessible via the Balay Silangan's main entrance. The lobby was accessible from the center's main office and office space. Toilet and bath, contained a PWD toilet, and the bath was accessible to wheelchair users without assistance.

In addition, the Residential Facility, included a sleeping area/ bed rooms. Each room could accommodate four to five people (maximum). A maximum of four (4) to five (5) individuals was required for monitoring, and it was strongly advised to minimize crowding. Living area, was be able to accommodate 10-12 people while also providing natural light, accounting for at least 80.0% of the center's total bed capacity. Dining area, was accessible from the living room and kitchen. It accommodated up to the facility's whole bed capacity and included a hand washing station. Laundry Room was be capable of accommodating at least six (6) persons at a time and was accessible to PWD and will properly have storm drains to prevent/minimize wet floors.

Lastly, for Educational Facility, it included a Study Area/Mini-Library. The center's entire rehabilitation of drug offenders will featured an area dedicated to offender education

that could accommodate at least 15 clients. This facility functioned as a school for drug offenders, preparing them for eventual reintegration into society.

1.1.2 Qualifications and Admissions

Based on the Department of Interior Local Government (DILG) Memorandum Circular No. 2021-044 (2018), drug offenders are split into pushers and users based on their gender and the severity of previous breaches. Furthermore, drug pushers and users are separated to reduce interaction. To be eligible for the program, the individual had to: be at least 18 years old; be a drug personality from a nearby municipality whose Memorandum of Agreement had been previously sent to the Philippine Drug Enforcement Agency (PDEA) and forwarded to Balay Silangan in Janiuay; be a drug personality who voluntarily surrendered and did not belong to the Philippine Drug Enforcement Agency (PDEA) or Philippine National Police (PNP) target list; have no other pending criminal case/s; avail of the plea bargaining agreement; have served jail terms for violating Republic Act No. 9165.

Following that, qualified offenders who are also plea bargainers have to submit the following documents: an endorsement letter from the Chairman of the Barangay Anti-Drug Abuse Council (BADAC), an affidavit of undertaking, and, if applicable, a court order for admission to the Balay Silangan Reformation Center (BSRC).

Apart from this, qualified offenders are subjected to the following upon admission: a medical and physical examination; a psychological evaluation, if available; profiling; a drug test; and any additional laboratory tests considered required.

Once the eligible pushers and plea bargainers had completed the aforesaid requirements, they will be given a program orientation by PDEA.

Finally, all offenders are required to stay for three months: one for a lecture and two for livelihood training and community service.

Figure 3

Distance of the Site from the Headquarter Detachment

Figure 3 shows the site's distance from the Headquarter Detachment. The distance is approximately 200 m.

1.2 Problem Identification

1.2.1 Large Number of Offenders

A large number of drug offenders/surrenderees underscored the pervasive issue of substance abuse in the municipality. It reflected both the scale of the problem and the willingness of individuals to seek help and rehabilitation. Understanding the root causes and providing effective support systems are crucial steps in addressing the complex issue.

Table 1

Number of Remaining Drug Offenders in every Municipality of Iloilo

Municipality	Total Drug Offenders	Total Completed as of January 18, 2023	Remaining
1.Barotac Nuevo	229	83	146
2.Oton	433	352	80
3.Dumangas	417	349	68
4.Batad	168	105	63
5.Carles	320	274	46
6.Passi City	234	193	41
6.Ajuy	331	290	41
6.Janiuay	**260**	**185**	**41**
9. Igbaras	83	2	39
10.San Enrique	183	145	38

Table 1illustrates the municipalities with the highest number of remaining drug surrenderees from the years 2016 to 2023. Notably, as of the specified dates, Janiuay held the sixth position in terms of the count of individuals who had surrendered due to involvement with drugs.

Table 2

Number of Remaining Drug Offenders in the nearby Municipalities of Janiuay, Iloilo

Municipality	Total Drug Offenders	Total Completed as of January 18, 2023	Remaining	Rank
Janiuay	260	185	41	6
Mina	140	112	28	13
Badiangan	83	68	15	18
Calinog	72	63	9	23
Maasin	63	62	1	30
Pototan	648	647	1	30
Binggawan	0	0	0	33
Cabatuan	157	157	0	33
Lambunao	108	108	0	33

Table 2 presents the respective rankings of the nearby municipalities of Janiuay, Iloilo, along with their corresponding remaining quantities of drug offenders.

According to the circular memorandum of DILG series of 2018, the average capacity of Balay Silangan is 25-30 offenders with designated areas present on the structure. Due to lack of facilities and a high number of offenders remaining, based on the given data, Janiuay failed to provide at least ninety percent (90%) who completed their rehabilitation.

1.2.2 Lack of Rehabilitation Center

The Municipality of Janiuay do not have a rehabilitation center. Thus, the number of offenders who did not complete their rehabilitation was high. According to the data retrieved from PNP Regional Office 6, 260 offenders came from Janiuay and 41 offenders

remained under rehabilitation. The absence of uncertain development of this Balay Silangan had slowed down the process of rehabilitation among offenders, resulting in delays in completion among offenders. The scarcity of rehabilitation centers in municipalities was a concern since it went against the mandate of Section 51 of Republic Act No. 9165, which stated that local government entities should appropriate a considerable amount of their respective yearly budgets to help or strengthen the implementation of said act, giving priority to preventative or educational programs and the rehabilitation or treatment of drug dependents. As per regulation, each class A municipality is supposed to possess its own Bahay Silangan, wherein it is stated in the Circular memorandum of DILG that these multi-sectoral bodies are responsible for formulating and implementing local anti-drug abuse initiatives. The DILG and DDB had issued policies, including JMC No. 2018-01, ensuring their functionality and effectiveness. This initiative aims to facilitate the rehabilitation of drug offenders and is a prerequisite for achieving the Seal of Good Local Governance. Given Janiuay's inadequacy of such a facility, it had been selected as the proposed site for this project. In addition, with the accordance of PSSG Luvelle Recabar, the construction of a Balay Silangan was warranted due to the significant number of total surrenderees, which had stood at 260 from 2016 to 2023. Among these cases, there are still more than 40 remaining, ranking it among the top 10 municipalities with the highest number of unresolved cases.

The absence of Balay Silangan in the municipality had led some offenders to undergo ineffective rehabilitation. According to Mr. Lucine (Social Welfare Officer 1), the lack of Balay Silangan in the municipality led to an ineffective process of rehabilitation because offenders only underwent rehabilitation in their own houses. He also added that because of this, they couldn’t monitor all the offenders and some came back to addiction. Further concern of this scenario was the safety of the families of offenders, where they

questioned their safety because of the past connections of the person under rehabilitation. That is the reason for a need to construct a rehabilitation center to monitor and assess effectively the process of rehabilitation among drug offenders and to ensure the safety of both offenders and their families.

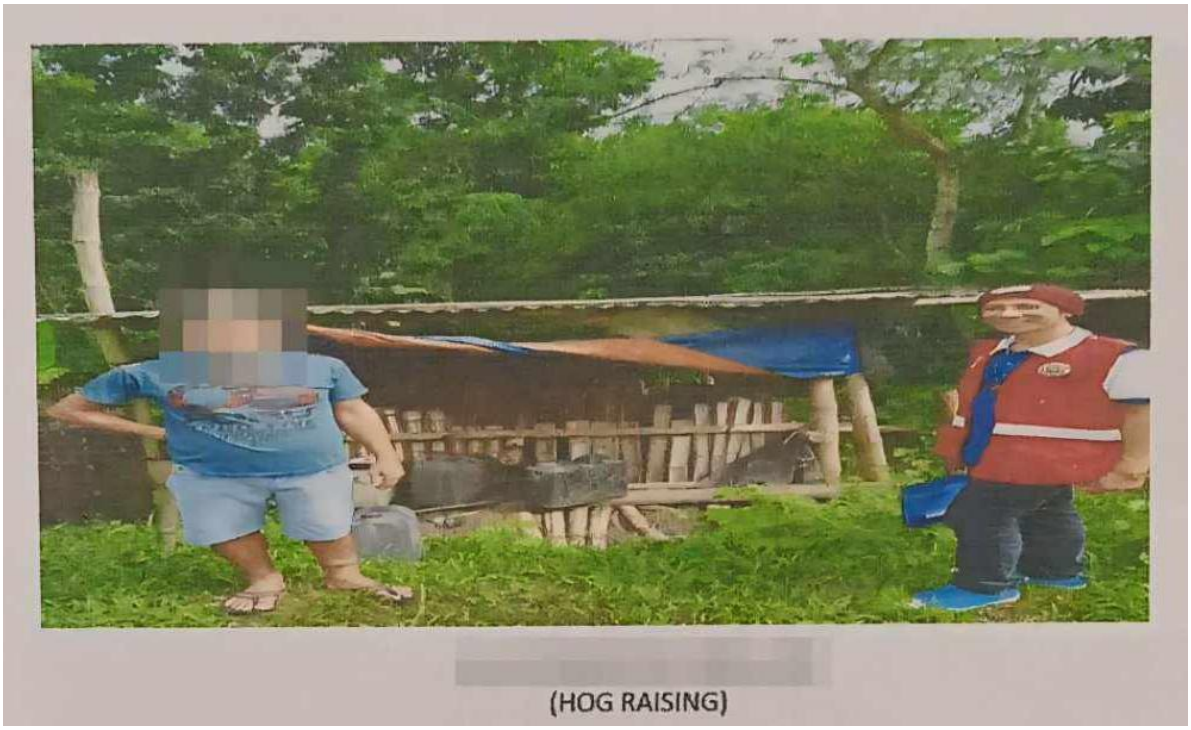


Figure 4

Livelihood Program Offered to Drug Offender in Tolarucan, Janiuay

Figure 5

Livelihood Program Offered to Drug Offender in Damo-ong, Janiuay,Iloilo

Figure 4 and 5 shows the services received by the drug offenders under After Care Program.

Figure 6

After Care Program, Activities and Sessions for Drug Offenders

Figure 6 shows the weekly sessions for drug offenders, which the Community Based Rehabilitation Program delivered about the Healthy Lifestyle and discussed lectures on ill effects of drug use last May 6, 2018.

Figure 7

After Care Program, Graduation Ceremony of Drug Offenders in Janiuay, Iloilo

Figure 7 shows the program completion of batch one of drug offenders after they completed their rehabilitation under After Care Program endorsed by Municipal Health Office (MHO) held at barangay Golgota covered gym on October 27, 2021.

According to PCPT Alwin C. Salmon of Janiuay Police Station, as per data from the Community-Based Rehabilitation Program (CBRP), there were 138 offenders who had successfully graduated, four (4) who had passed away, 83 who were currently residing abroad, and 35 individuals who are still undergoing rehabilitation.

Furthermore, in June of the current year, the Municipality of Cabatuan inaugurated its own Balay Silangan Reformation Center which aims at aiding minor drug dealers and individuals who use drugs (PWUDs). Shey Tanaleon, the public information officer of the Philippine Drug Enforcement Agency (PDEA) in Western Visayas, shared this update. (Philippine News Agency, 2023).

AAdditionally, the Municipality of New Lucena inaugurated its Balay Silangan on August 25, 2020, which was designed to accommodate a limited number of drug offenders. Mayor Liecel Mondejar-Seville proudly introduced "Balay Silangan," a reform program centered on the community with the goal of rehabilitating individuals who had voluntarily surrendered due to involvement with drugs in New Lucena. This initiative, spearheaded by Dr. Ma. Cristina S. Reala, Municipal Health Officer, served as an alternative intervention for individuals involved in drug-related activities (One New Lucena, 2020).

1.3 Objectives of the Study

1.3.1 General Objective

The main objective of this study was to propose a design for a two-storey Balay Silangan in Janiuay, Iloilo.

1.3.2 Specific Objectives

To achieve the main objective of the study, the following specific objectives were outlined:

a. Interviewed and assessed the population and proportions of drug offenders, as well as the facility capacity essential for the proposed design of the two-storey Balay Silangan.

b. Performed geotechnical investigations and topographic survey for the designated lot area.

c. Developed architectural, structural, plumbing, and electrical designs while integrating building codes and sustainable features into the project's design.

d. Generated estimates for the project costs.

e. Established a project schedule.

1.4 Significance of the Study

This proposal will be beneficial to the following:

Municipal Government: This will provide significant assistance to the municipal government, enabling them to handle additional duties and reducing their responsibilities. The realization of this design will furnish the municipality with valuable insight and information about construction, architecture, and structural design, serving as a beneficial reference for future development projects.

Researchers: The research study offered an opportunity for civil engineering students to apply theoretical knowledge and enhance skills in evaluation, analysis, design, estimation, and project cost management. It facilitated the quantification of their true capabilities and the utilization of expertise in an authentic civil engineering endeavor.

Future Researchers: The study will serve as a valuable research resource for future researchers and students interested in conducting a project study on rehabilitation centers. It may also impart knowledge to students who will engage in similar projects.

1.5 Scope and Limitations of the Study

The main objective of this study was to design a two-storey Balay Silangan in Brgy.

Caraudan, Janiuay, Iloilo, situated 8.2 kilometers from the town center, capable of accommodating 30 drug offenders, prioritizing residents of Janiuay and neighboring areas. Gender-segregated facilities, including sleeping quarters, restrooms, and kitchens, ensured appropriate accommodation for both male and female occupants, supervised by designated house parents to ensure security. Security and safety considerations were paramount, with measures such as door and window design, room partitioning, and perimeter fencing implemented to create a secure environment. Closed Circuit Television (CCTV) installation and strategic monitoring by guards further enhanced security. The proposed location, in Sitio Camansi, Brgy. Caraudan, Janiuay, is strategically situated approximately 200 meters from the Military Headquarters.

The scope of the study included the preparation of architectural and structural designs, electrical and plumbing plans, project scheduling, and cost estimation. According to the Revised Standard for Residential Care Facilities, (DSWD AO 015. s. 2012), the proposed project is allocated a budget of Php 19,500,000, with the primary funding expected to come from the Local Government Units (LGUs) in compliance with the Local Government Code and directives from the Department of the Interior and Local Government (DILG). The study was only limited to the design of the proposed building.

The study did not cover the structure's implementation, financing, actual construction, and maintenance. These concerns fell under the municipality's jurisdiction and the assigned employees working in the Municipal Engineering Office.

Chapter II

Review of Related Literature

2.1 Introduction

The country had long been plagued by the pervasive issue of illegal and dangerous drugs, which had inflicted severe harm upon numerous Filipino individuals following their initial, inquisitive experimentation.

Previous governments had made efforts to eradicate the illegal drug trade and substance misuse, but achieving significant success seemed unattainable, as it caused broken families, endangered communities, and put young people in jeopardy. The Philippine Drug Enforcement Agency (PDEA) had officially introduced a community-based rehabilitation initiative aimed at reforming drug offenders who had surrendered nationwide. Dubbed "Balay Silangan," the program established temporary shelters for drug offenders with the goal of reintegrating them into society as self-sustaining and law-abiding citizens.

The Balay Silangan reformation program adopted a household-focused strategy to encourage drug offenders to embrace a fresh start in life. The symbolism of the rising sun in the East, marking the dawn of a new day, reflected the program's ethos, signaling a chance for renewal for those undergoing rehabilitation.

This comprehensive program offered various interventions, including educational and health awareness initiatives, as well as psychological, spiritual, and physical activities such as counseling, moral recovery sessions, values development, and personal and life skills training. Additionally, to equip participants with employment opportunities, livelihood and skills training programs in soap manufacturing, massage therapy, basic carpentry, welding, and hairstyling were also provided.

Human life was highly valued, and all potential solutions were carefully assessed to

ensure the best outcomes for participants. The "Balay Silangan" program had stood even more proudly as it offered a family-centered, residential drug rehabilitation program.

Voluntary drug surrenderees had regained control of their lives, which were previously taken away from them by illicit substances, upon entering Balay Silangan. The Balay Silangan is a drug reformation program implemented by the Philippine Drug Enforcement Agency (PDEA), based on the model of the "Bahay Pagbabago" Reformation Center initially established in Bataan province.

The program seeks to help individuals convicted of drug-related crimes become productive, self-sufficient, and law-abiding citizens who could contribute to the nation's advancement and support the government's anti-drug initiatives. At Balay Silangan, participants had access to a range of interventions, including counseling, moral rehabilitation sessions, values development, training in personal and life skills, community involvement, and physical activities.

2.2 Related Articles

2.2.1 Replication of the Philippine Drug Enforcement Agency (PDEA) Balay Silangan program of General Santos City, South Cotabato

Dr. Alah Baby Vingno, officer-in-charge of the Integrated Provincial Health Office (IPHO), said Tuesday that studies were underway for the implementation of the program in partnership with PDEA-Region 12.

Furthermore, Vingno said the local government was mainly pushing for the establishment of a drug rehabilitation center that would be patterned after the PDEA’s pilot Balay Silangan in Malungon town, Sarangani province. “It would cater to drug dependents and replicate the mechanisms of Balay Silangan,” Vingno said.

The Malungon rehab facility currently included 30 drug offenders who chose plea bargain deals with the courts, with some classified as drug dependents but not

suffering from severe addiction. Under the program, the beneficiaries underwent information and education sessions, among them on the illegal drug campaign and the provisions of Republic Act 9165 or the Comprehensive Dangerous Drugs Act of 2002.

Vingno said the planned Balay Silangan would be established in the municipality of Tupi, the hometown of South Cotabato Gov. Reynaldo Tamayo Jr. (Estabillo, 2019).

2.2.2 Philippine Drug Enforcement Agency (PDEA) Balay Silangan Reformation Program

The Balay Silangan Reformation Program offered support for minor drug offenders who were not users or addicts. It outlined guidelines for administrative and operational requirements, including appropriate penalties for violations. Director General Aaron N. Aquino initiated the program, which was formalized into regulation in January 2018 by the Dangerous Drugs Board. This initiative represented a fresh strategy aimed at addressing the influx of drug offenders who had opted for plea bargains due to the lack of structured intervention for the program's target demographic. Balay Silangan signified a shift in approach, emphasizing compassion and understanding towards minor drug offenders. It acknowledged that these individuals often engaged in the drug trade due to economic hardship and lack of guidance.

This innovative approach prioritized rehabilitation over punitive measures, providing a pathway to a new life without legal repercussions. Additionally, it allowed these individuals to reform without sacrificing their freedom. The Balay Silangan stood for over five years since its implementation. As of 2021, the project

had impacted the lives of 948 people. These were the same people who would have been subjected to a paradigm of violence, trauma, and deprivation of liberty at high rates if not for Balay Silangan. This innovation had provided these people with education, livelihoods, and different types of support aimed at reintegrating and making a positive contribution to society.

2.2.3 Malungon to build new Balay Silangan Center

In line with its efforts to improve on its success in the rehabilitation and reformation of persons who used drugs (PWUDs), the local government unit of Malungon in Sarangani planned to build a new Balay Silangan Reformation Center, Mayor Maria Theresa Constantino announced.

Constantino revealed that LGU Malungon had already earmarked funds for the project and found a location where the new facility would be built. The LGU had proposed to the Department of the Interior and Local Government (DILG) to allocate the P10 million fund it would receive under the Local Government Fund-Assistance to Disadvantaged Municipalities (LGSF-ADM) Program for the new Balay Silangan Reformation Center.

The program offered broad interventions, including ongoing education and health promotion, as well as psychological, spiritual, and physical activities such as counseling, moral guidance, character development, and practical life skills training, among other offerings.

The Balay Silangan Reformation Program was launched in May 2023 in four pilot sites: Malungon, Sarangani for Mindanao; Cabanatuan City for Luzon; Capiz for Visayas; and Caloocan City for the National Capital Region. Of the four pilot sites, only the Balay Silangan Reformation Center in Malungon is functional,

according to PDEA XII and LGU-Malungon officials. Since its operation in May 2018, Malungon's Balay Silangan had already held two graduation rites for two batches of 30 drug offender clients.

2.3 Related Studies

2.3.1 Construction of Balay Silangan in San Antonio, Zambales

The Municipality of San Antonio, Zambales, through the Capital Outlay-Mayor's Office intended to employ the sum of Two Million Five Hundred Thousand Pesos (Php 2,500,000.00) being the Approved Budget for the Contract to payments under the contract for Concreting of Various Roads. Bids submitted in excess were immediately rejected upon bid opening.

The Municipality of San Antonio, Zambales, sought proposals for the construction of Balay Silangan. The project had to be completed within ninety (90) calendar days. Interested bidders had to have prior experience with similar projects. Details regarding eligible bidders could be found in the Bidding Documents, specifically in Section II.

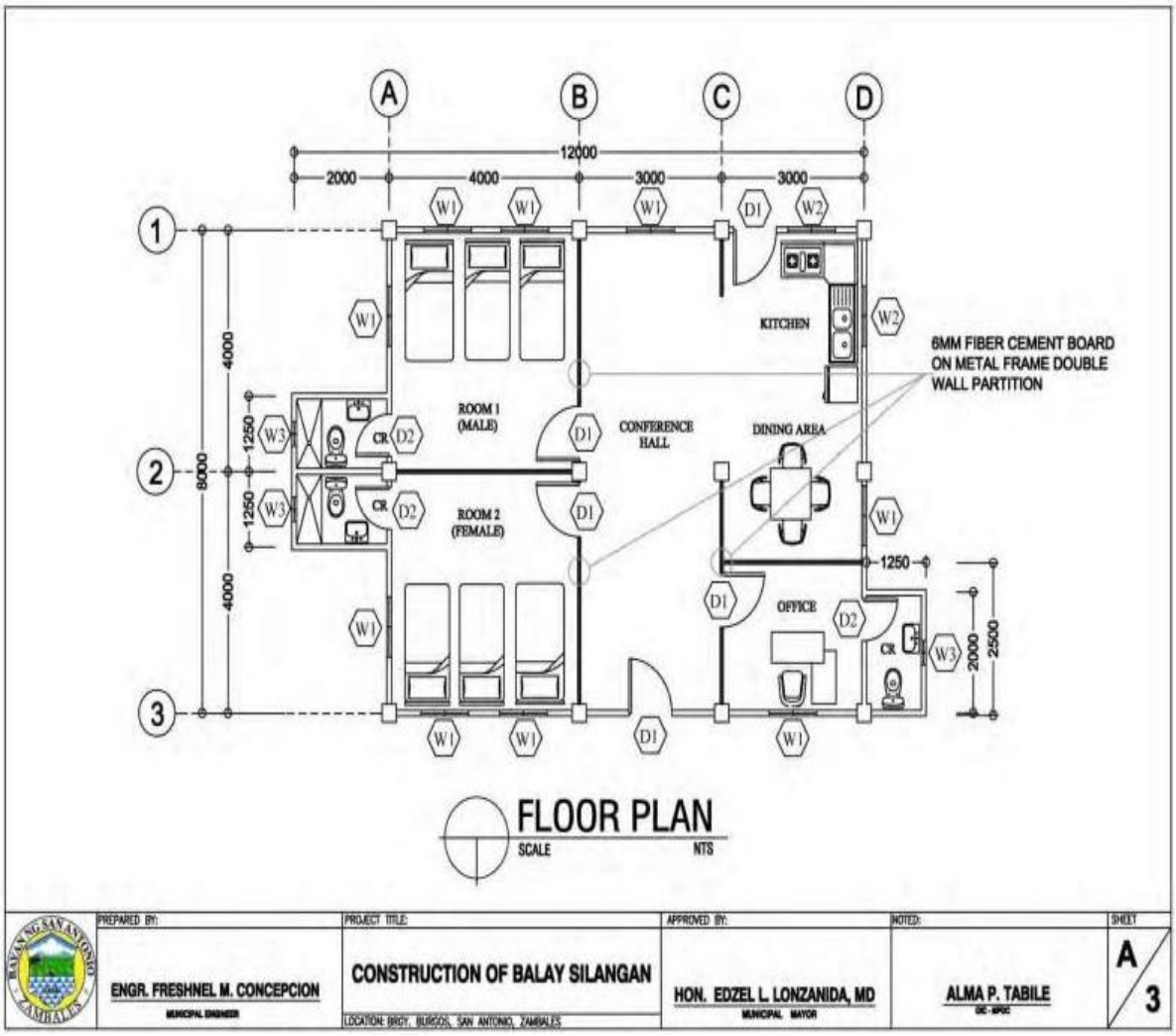


Figure 8

Floor Plan of the Balay Silangan in San Antonio, Zambales

2.3.2 Construction of Isolation Facility for Regional Rehabilitation Center for Youth (RRCY) in San Fernando, Pampanga City

The Department of Social Welfare and Development (DSWD) Field Office III, through the CRCF – Centrally Managed Fund intended to apply the sum of One Million One Hundred Eighty-nine Thousand Nine Hundred Ten (Php 1,189,910.33), being the Approved Budget for the Contract (ABC) to payments under the contract

for the Construction of Isolation Facility for Regional Rehabilitation Center for Youth (RRCY).

2.4 Synthesis

The persistent issue of illicit and hazardous substances has plagued the nation for an extensive period, causing immense harm to numerous Filipino individuals following their initial, inquisitive experimentation.

The Balay Silangan program acknowledged the significant influence of family in its success and extended a warm invitation to family members who desired to reconnect with their reformed relatives and demonstrate their unwavering support. The Balay Silangan program also prioritized the self-sufficiency and independent living of reformists, as its objective was to successfully reintegrate drug offenders into society upon program completion.

These benefits were provided by Balay Silangan's partner agencies, including the Department of Trade and Industry (DTI), Technical Education and Skills Development Authority (TESDA), and the Department of Social Welfare and Development (DSWD), among others, through a range of programs such as livelihood training, employment education, and financial assistance.

The Municipality of Janiuay had a percentage of drug offenders who implemented an effective anti-drug campaign program. The Balay Silangan Building is a structure for a comprehensive care program for individuals suffering from medicine dependence. This program combined substantiation-based treatments, indispensable treatments, and spiritual comforting to help individuals achieve long-term recovery. This program was delivered by a multidisciplinary platoon of health professionals, including psychologists, social workers, nurses, and indispensable therapists. This program had been proven to be effective in promoting long-term recovery from medicine dependence.

Chapter III

Methodology

This chapter provides technical information and procedures in the gathering and collecting of data and relevant materials on the study used in the analysis and design of the proposed structure. The following data contributed to the planning and designing stages of the proposed structure and underwent further analysis, investigation, and evaluation.

3.1 Design Constraints

This world is promptly changing, technological and material developments and their applications were constantly changing. With new innovations in construction, standard design procedures and materials were incorporated, adapting them to modern engineering practice. The optimization of the design implied efficiency and economic considerations in the suggested structure's construction.

3.1.1 Security and Safety

Security and safety are important considerations in creating a safe and secure environment for building occupants and to the people outside. Incorporating effective security and safety design options could help maximize security and a safe environment for the occupants within the building..

3.1.1.1 Doors

Doors serve as architectural elements that represented accessibility, security, and aesthetics, transcending their function as simple entry points. This succinct examination scrutinized the fundamental function of doors, placing particular emphasis on their capacity to mold the appearance and functionality of architectural spaces. (The Constructor, 2016)

Framed and Paneled Door. Paneled and glazed doors and windows are common in residential properties, featuring wood frames and shutter panels made of timber, plywood, piece board, and hardboard. These doors could be designed with various design concepts, making them highly decorative. Paneled and glazed doors have versatile designs and could be customized to meet specific house requirements and dimensions. The door frame could be made from wood or metal components like steel.

Flush Door. A flush door is a smooth, lightweight door with a plywood or Medium Density Fiberboard covering over a timber frame, commonly used in residential settings. Made from wood, steel, or other materials, it is affordable, aesthetic, and durable. Aluminum sheets protect the door's inside surface for toilets and showers. Frames can be constructed using traditional methods.

Metal doors. Metal doors, if utilized, are grounded in all Strategic Areas as they may retain static electrical charge. These doors were suitable for use in plant rooms, electrical rooms, waste management rooms, and similar service areas. Nonetheless, metal door frames are preferred due to their durability and robustness.

Automatic doors. Particularly those activated by beams for sliding or swinging, are advantageous in locations with significant foot traffic, such as main entrances and delivery points. They are also suitable for areas where quick, hands-free access was prioritized, such as entrances to the Emergency Unit. When installing these doors, it is important to ensure that they allowed ample time for opening and closing to accommodate disabled, frail, and pediatric patients as well as visitors.

Steel Doors. Steel is a reliable and efficient option for indoor and outdoor doors due to its durability and efficiency. It is widely used for constructing frames using points, Tee, channels, or pressed steel plates. Steel frames can be affixed with

conventional wooden shutters and were cost-effective compared to traditional wooden frames. Mild Steel (MS) sheets can be used for shutter construction. Steel doors are durable, requires minimal maintenance, and comes in various colors and finishes.

PVC Doors. Poly Vinyl Chloride (PVC) is a popular polymer used in manufacturing water tanks, pipes, and household fittings. PVC doors offer advantages like termite resistance, durability, anti-corrosion, lightweight nature, and moisture resistance. They are easy to produce and install but were not suitable for entry doors due to lack of weatherproofing.

Fiber Reinforced Plastic Doors. Fiber Reinforced Plastics (FRP) is a process of strengthening plastic using fiberglass, used in doors due to its superior quality and elasticity. Available in various colors and finishes, FRP doors are fire-resistant and had a unique structure with two leaves. They are in high demand in contemporary residential buildings.

Among the different door designs stated, the decision on what door design to be used into the structure depends on the alternatives' purpose, security, durability, and long-term cost. Based on the definitions, alternatives were viable, but steel type of doors had an excellent feature in terms of durability and security and required less maintenance. It is also weather resistant compared to other types of doors but with high cost as the downside.

3.1.1.2 Windows

Windows were extensively designed to optimize energy efficiency. They had significant functions in determining a home's energy consumption. Frame content considerations, although important in the context of an environmentally responsible strategy, had a relatively small impact due to their limited size. The performance of

these materials was crucial in terms of reliability and maintenance, and security as previously stated.

Fixed Windows. Fixed windows are installed directly onto the wall without any mechanism for opening or closing. They are primarily designed to allow light into the room. Fully glazed shutters are affixed to the window frame and are typically designed to withstand various weather conditions.

Sliding Windows. In this configuration, the window shutters are movable within the frame, allowing horizontal or vertical movement as needed. The shutters are equipped with roller bearings to facilitate their movement.

Metal Windows. Typically, mild steel are utilized for manufacturing metal windows due to its cost-effectiveness and strength. These windows are commonly used in public buildings such as rehabilitation centers. Other metals like aluminum, bronze, and stainless steel are also employed for window production, but they tended to be more expensive compared to mild steel. Metal shutters are often provided for casement windows to provide additional support to the panels.

Sash Windows. Sash windows were a type of casement window where the panels were fully glazed. They consisted of top, bottom, and intermediate rails, with small timber members known as sash bars or glazing bars dividing the space between the rails into smaller panels.

Observation Glass Windows. Glazed panels can be incorporated into windows to facilitate visual monitoring for safety, security, or patient observation purposes. Depending on the specific needs, obscured or frosted glazing of different degrees could be installed to allow observation of individuals behind the windows while preserving room security and privacy. Observation glass is recommended in the following rooms/areas: procedure room, rooms requiring an observation window like kitchens and pantries.

3.2 Technical Constraints

3.2.1 Roofing System

The roofing system serves as a crucial design constraint in the proposed design of a two-storey Balay Silangan with a roof deck in Janiuay, Iloilo. The selection of an appropriate roofing system had to regard the region's climate, structural requirements, and aesthetic considerations. Given the building's location, where heavy rainfall is common, a roofing system with excellent water resistance and efficient drainage capabilities was imperative to prevent water leaks and potential damage. Furthermore, the roofing system was designed to endure any localized severe winds that might arise. To ensure the long-term viability and functionality of the library building, consideration should also be made to the roofing system's affordability, durability, and ease of maintenance.

3.2.1.1 Truss System

Typically, roof trusses are produced of steel material. Steel roof trusses have become the standard in business and industrial building. The elevated strength-to-weight ratio of steel trusses was one of the main benefits. It not only made the item stronger; it could also withstand heavy loads that enabled it to be used for superior spanning capabilities. Steel trusses are also durable, which meant that minimal maintenance was required compared to the roof deck. Steel roof trusses are generally not fire resistant, but they could resist fire by using fire-retardant coatings. Steel truss is an eco-friendly type of roof system as steel and metal buildings received additional points with a reputable green building certification program such as Energy and Environmental Design Leadership (LEED). One of the primary factors for this is that steel trusses are manufactured using recycled material of up to 90% and were 100% recyclable at the end of their

lifetime.

3.2.1.2 Roof Deck Design.

The roofing system's structural base was known as the roof deck. In order to prevent any deformation that could lead to a roof failure, it has to be built to give appropriate support for all dead and live loads to which it would be subjected. It also needs to provide enough resistance to racking, flexural, and torsional stresses. The type of roof decking vary based on whether you had a commercial or residential need.

There are multiple choices for the roofing system: it is mainly a roof truss design and a roof deck design. The decision on what roofing to be incorporated into the structure depends on the alternatives' purpose, sustainability, and long-term cost. Based on definitions given, mentioned alternatives are viable, but the reinforced concrete roof deck slab had a long lifespan, requires less maintenance, withstood high wind pressure, and was easy to design. It also provides an extra space that could be used as a source of recreational activities making the roof deck design a more viable choice as compared to the roof truss designs. Nonetheless, roof deck design is also costly to install.

3.3 Green Building Technology

Green building technology considered architectural features that minimized their negative effects on the environment, including the climate and nearby natural areas. Efficiency is essential to green building technologies, including reduced waste and hazardous materials, energy, materials, and water use, as well as optimized maintenance and operations. The main goal of green building is to reduce the harmful effects that buildings had on the environment, such as the release of toxic

gases like carbon dioxide and the loss of natural resources as a result of careless material procurement.

The designs considered are ecologically sustainable methods of acquiring water and electricity. Green-technology integration might require high implementation costs; however, the initial expenditure involved with the green building have long-term benefits and future cost reductions in operation and maintenance. These innovations seek to lessen the structure's environmental effect and lower energy use. These technologies include a rainwater collecting system, a greenhouse, and the use of solar panels.

3.3.1 Lighting.

Both conventional and non-conventional electrical system usage was considered. It was possible to reduce the power consumption using low-power, energy-efficient fixtures. Choosing which electrical system to install in the structure is determined by the effects on the environment, sustainability, and durational expense.

3.3.1.1 Incandescent

Utilizing an incandescent bulb necessitated periodic replacement with fresh bulbs. According to a brief search on Wikipedia, the typical lifespan of this type of light was 1,000 hours. If you were to utilize an incandescent light bulb with an average lifespan of 1,000 hours, you would have needed to replace it around 15 times at a cost of Php30 each, resulting in a total expenditure of Php450.

3.3.1.2 Compact Fluorescent Light (CFL)

CFLs, or fluorescent lights, were designed as a replacement for incandescent lights due to their lower temperature. However, they contain mercury, posing health and environmental risks. Additionally, they have minor activation latency and took a long time to reach maximum brightness.

3.3.1.3 Light Emitting Diode (LED)

Lighting is also necessary for interiors during nighttime. An LED lamp is an electric light source that utilizes a light-emitting diode (LED) to produce illumination. LED lamps had a significantly longer lifespan and higher electrical efficiency compared to incandescent lamps. Additionally, they are more effective than the majority of fluorescent lamps.

3.3.1.4 Natural Lighting

Using natural light could lead to substantial reductions in energy consumption. Utilizing skylights for illumination can contribute to energy and cost savings, while also benefiting the environment by reducing the harmful effects of electricity, such as emissions of sulfur dioxide and mercury.

Comparing LED lighting fixtures, CFLs (compact fluorescent lamps), and conventional incandescent light bulbs, with the following factors: price, lifespan, energy usage, heat emission, and the number of replacements in ten years. The choice was made to employ the LED lighting fixture as the best alternative due to its many benefits. Since the heat produced by the light fixtures would require the air conditioning system to utilize more energy to keep the ideal temperature of the room and heat emission were also taken into account and considered.

3.3.2 Rainwater Harvesting System

The structure considered a rainwater harvesting system which helped cut costs in water usage. Particularly, the components of the system were composed of the topmost floor being a rainwater catchment, with the slab built similar to crowned roads to introduce slope to the catchment. Essentially, the purpose of this technology is to store additional water supply, since rehabilitation center required large amounts of water for maintenance and cleanliness of facilities.

3.4 Contemporary Issues Relevant to the Proposed Project

3.4.1 Lack of Budget of Rehabilitation Centers in the Philippines

Republic Act 10630, which amended the 2006 Juvenile Justice Act in 2013, mandated LGUs to build and maintain a Bahay Pag-Asa in their areas.

One of the most important things in project cost control is budgeting. Fifteen million pesos was the entire budget allotted for the building of the Balay Silangan. In order to save costs, the building used modern architecture, which offered a minimalist look with straightforward lines. The structure used a roof slab in order to provide more space and sustainability. The structural members' materials and design were affordable, but they also needed to be safe, meet usage requirements, and not compromise on quality.

The establishment of a rehabilitation facility for individuals who had committed drug-related offenses in the Philippines was crucial given the increasing and pressing problems linked to substance misuse. The Philippines had been confronted with an enduring predicament of drug-related issues, which had had a substantial effect on public health and safety.

3.4.2 Increasing Number of Drug Offenders

The longstanding issue of illegal and hazardous drug abuse in the country has been inflicting immense harm on numerous Filipinos, often beginning with a single, curious experimentation. With families torn apart, communities endangered, and the youth placed in jeopardy, previous administrations had endeavored to eradicate the illegal drug trade and substance misuse, yet achieving substantial success had proved elusive.

While some argued that tackling this social problem requires a strict approach, the Marcos administration was committed to continuing the battle against illegal

drugs within the confines of the law and with due respect for human rights and dignity. Recognizing the invaluable worth of human life and exploring all possible avenues for resolution, the "Balay Silangan" stands as a beacon, offering a family-centered, residential drug reformation program. For voluntary drug surrenders, entering the Balay Silangan signify reclaiming control over lives once robbed by illegal drugs.

Modeled after the "Bahay Pagbabago" Reformation Center pioneered in Bataan province, the Balay Silangan serves as the drug reformation initiative of the Philippine Drug Enforcement Agency (PDEA). It aims to assist drug offenders in reshaping themselves into productive, self-reliant, law-abiding citizens who could actively contribute to the nation's progress and support the government's anti-illegal drugs campaign. This comprehensive program includes counseling, moral recovery sessions, values education, personal and life skills development, community engagement, and physical activities.

Acknowledging the pivotal role of family in program success, the Balay Silangan extended a warm welcome to family members, offering them support and involvement. Additionally, the program ensures that participants were equipped to stand independently and lead self-sufficient lives, with the ultimate goal of reintegrating drug offenders into society upon program completion.

3.4.3 Surge of Drug Offenders Who Surrendered and Availed of the Plea Bargain

Before the inception of Balay Silangan, non-user/non-dependent drug offenders faced arrest, prosecution, and conviction regardless of their level of involvement in the drug trade. Consequently, law enforcement agencies, courts, and correctional facilities became overwhelmed. Unfortunately, there were no specific programs available for drug offenders who had entered into plea bargains. Treatment

and rehabilitation were often seen as temporary solutions for these issues, but they primarily targeted drug users and dependents rather than other violators of drug laws.

The introduction of the "Balay Silangan" marked a significant shift in addressing minor drug offenders. This innovative approach was rooted in compassion, recognizing the human aspect of the drug issue. It acknowledged that individuals in this category were often driven to engage in illegal drug activities due to limited opportunities for legitimate employment and a lack of guidance. This paradigm aimed to provide them with an alternative path to rebuilding their lives without subjecting them to enforcement operations or leaving them with a criminal record. Moreover, it allowed these individuals to undergo rehabilitation without being deprived of their liberty.

According to the Development Academy of the Philippines (2021), the Balay Silangan Reformation Program targeted small-time drug offenders who were neither users nor dependents. It included comprehensive guidelines outlining administrative and operational requirements, along with corresponding penalties for violations and non-compliance. Director General Aaron N. Aquino spearheaded the program, which was developed as a response to the growing number of drug offenders who surrendered and sought plea bargains, as there was previously no institutionalized intervention tailored to this specific group. The program was formally adopted by the Dangerous Drugs Board as a regulation in January 2018.

3.4.4 Sustainable Development Goal

The ninth Sustainable Development Goal (SDG) on Infrastructure, Innovation, and Industry by the United Nations focuses on creating safe and sound infrastructure while promoting economic development and improving human well-being. Its objective is to construct sustainable and resilient infrastructure in developing nations. The Philippines' infrastructure and industry needs to be updated as it develops and

faces new difficulties. To solve the present issues, the Janiuay Local Government Unit proposed the construction of Balay Silangan. Green construction features like daylighting and natural ventilation could be added to a structure to create sustainable infrastructure. Solar panel and rainwater harvesting system installation are additional options.

3.5 Design Framework

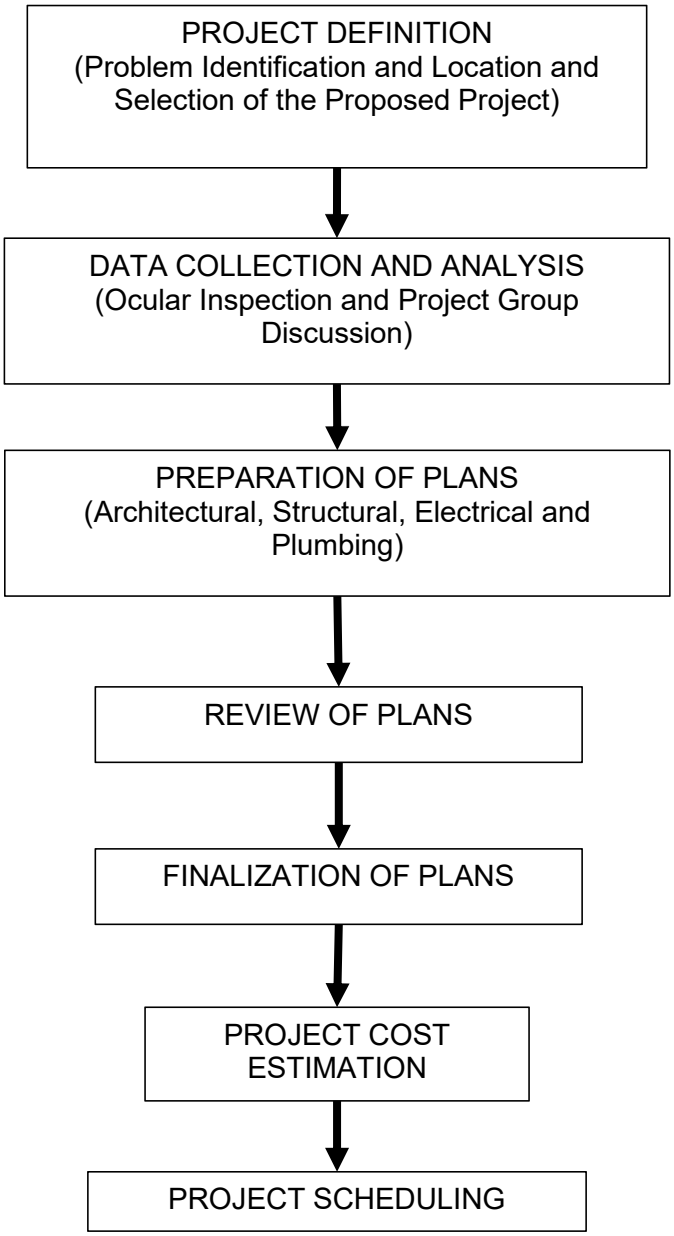


Figure 9

Conceptual Design Framework

Figure 9 illustrates the systematic flow of the construction project for the Balay Silangan in Caraudan, Janiuay.

3.6 Project Definition

The researchers had sent a letter of request to different municipalities regarding the lists of priority projects based on the Municipal Annual Development Plan (MADP). The lack of a rehabilitation center for drug offenders, also known as Balay Silangan, was seen as a problem in Janiuay, Iloilo. The need for this project study was conceived upon the identification of the stated issues.

The selection of the location of the project study was recommended by the Municipal's Engineering Office (MEO) of the Municipality of Janiuay. It was based on the availability of the land area and the suitability of the location in terms of space and soil topography. The proposed site is located at Sitio Camansi, Brgy. Caraudan, Janiuay, Iloilo. The facilities and design of the proposed structure were established based on and conceptualized from the design of Bahay Pagbabago.

3.7 Data Collection and Analysis

3.7.1 Selection of the Location of the Proposed Project

The MENRO and MSWD of the Municipality of Janiuay, Iloilo, officially approved the proposed location for the Balay Silangan project. The recommendation was based on a careful process of planning, extensive mapping, and strategic execution strategy for the envisioned rehabilitation facility. The chosen location within Gonzales/Sudario's property in Sitio Camansi, Brgy.

Caraudan, Janiuay, Iloilo, was consistent with the municipality's urban development goal.

This site selection was not arbitrary; by preference, it resulted from a thorough analysis of maps, existing plans, and joint efforts aimed at ensuring the project's successful completion. In collaboration with the Municipal Engineer of Janiuay, Iloilo, the Municipal Environment and Natural Resources Office (MENRO), and Municipal Social Welfare Development Office (MSWDO), important facts and data relating to the exact location of the Balay Silangan project were diligently acquired. The proposed lot area was 1000 sq. m. These sources provided critical insights into the geography, infrastructure needs, and regulatory considerations required for the effective implementation of the rehabilitation facility in the selected area. The Balay Silangan project received formal site approval in Sitio Camansi, Brgy. Caraudan, Janiuay, Iloilo, as a result of a well-coordinated and data-driven planning process led by the Municipality of Janiuay.

3.7.2 Ocular Inspection and Project Group Discussion

Interviews with the Municipal Mayor, Hon. Paulino M. Parian, Municipal Engineering Department, MSDWO, and MENRO of Janiuay were conducted to gather data about the history, socio-economic profile of Janiuay, the status of the drug offenders and rehabilitation centers of the municipality which included the number of drug offenders per year, why construction of rehabilitation center in Janiuay is important, and additional elements that elevated the proposal to the status of a top project. Images of the project site were captured, and crucial details were gathered during the on-site assessment. The collected information underwent categorization through collaborative group discussions. Additional relevant data were sourced from reputable studies, journals, and credible articles from both library resources and the internet to ensure comprehensive data collection. The gathered

data were used as the basis in the succeeding steps of the design process.

3.8 Preparation of Plans

3.8.1 Architectural Design.

The architectural design of the Balay Silangan was based on the aesthetic features and standards of Bahay Pagbabago. Included in the plan were the elevations, sections, floor plans, and the schedule of doors and windows, which were checked by a consulted architect. The total lot area of the project was 1000 square meters.

3.8.2 Structural Design

The proposed structure was evaluated according to the National Building Code of the Philippines (NBCP), which included the design of structural components such as slabs, beams, columns, footings, and other features. The National Structural Code of the Philippines 2015, as well as other regulations, laws, and procedures, were also applied. The plan included structural layout and design of elements, which were checked and approved by a consulted engineer. Furthermore, it integrated essential design elements such as material properties, data specifications, design loads, and other necessary design considerations.

3.8.3 Plumbing Plan

The plan incorporated the plumbing layout of the proposed structure, which adhered to the provisions outlined in the National Plumbing Code of the Philippines. Additionally, the plan included all the essential specifics regarding the design of the catch basin for rainwater harvesting.

3.8.4 Electrical Plan

The plan included the electrical layout of the proposed structure and was designed following the guidelines of the Philippine Electrical Code. Additionally, it also included all essential data regarding the design of the solar panels.

3.9 Revision and Finalization of Design

Revisions to the design were made in accordance with the technical corrections and suggestions of the Project Study Adviser, Civil Engineering faculties, and other experts in the field and professionals like Civil Engineer, Architect, Master Plumber, and Electrical Engineer. The finalization of the plans was made after the revisions.

3.10 Cost Estimation

Appropriate materials were identified for the project, and their respective quantities were determined. Furthermore, the allocation of costs for materials, labor, equipment, and other essential elements was carefully calculated and considered in accordance with the project's requirements.

3.11 Project Scheduling

Planning and scheduling played vital roles in construction project management. The project timeline incorporated project management techniques such as the Programme Evaluation Review Technique and Critical Path Method (PERT-CPM) as well as the utilization of Gantt Charts. Through scheduling, all the essential elements required to execute the project were identified. Furthermore, the total duration of the project was determined.

3.12 Resources and Facilities

The researchers used the following resources and facilities for the collection, design, analysis, and presentation of data:

Central Philippine University Henry Luce III Library. The researchers used the library to accumulate previous studies and published books. It was accessed online with the help of the university's virtual library assistant.

Internet. The researchers used the internet to access various information and previous studies. It was also used to share knowledge and insights, communicate, and transfer files.

MSWDO and MENRO of Janiuay, Iloilo. The office provided all the necessary information regarding the proposed project.

Smartphones and Laptop. The researchers used smartphones to take photographs for the documents. Laptops were also used to utilize the software and applications.

Google Docs. The researchers used this online platform to collaborate while making the papers.

Microsoft PowerPoint. The researchers used this application to make presentations needed for the proposal defense.

Microsoft Word. The researchers used this word processor application to input the data gathered to complete and furnish the papers in this study

Microsoft Excel. The researchers used this spreadsheet application to encode computations and formulas for the structural design. It was also used for cost estimates. **National Structural Code of the Philippines 2015 (NSCP 2015).** The researchers used this book as the basis for the design codes and provisions of the structural design.

Other Codes. The researchers used other codes such as the National

Building Code of the Philippines (NBCP), Philippine Electrical Code (PEC), and the National Plumbing Code of the Philippines (NPCP) as the basis for architectural, electrical, and plumbing plans.

Books. The researchers used the Project Construction Management book by Max Fajardo to guide the concepts and principles of construction project management. Also, the Simplified Construction Estimate book by Max Fajardo in making the material estimate.

Chapter IV

Project Area

4.1 Background and History

The project study was conducted in Sitio Camansi, Caraudan, Janiuay, Iloilo. Barangay Caraudan is a slopy region which serves as a way to the mountainous part of Janiuay. Janiuay's origin, like that of many other towns in Panay, can be traced back to the Spanish period.

In the summer of 1578, the Taraugis natives trickled down from the coast and established settlements north inland along the Suage River. The initial inhabitants, guided by the Gamuk, Futicong, Uganet, and Pagdakton families, established settlements in the barangays now identified as Matagub, Danao, Yabon, and Quipot, respectively. Over a century later, the Spanish arrived in these regions of Panay island where the four datus had established the barangays. During this extended period, the descendants of the Datu settlers flourished.

In the early part of 1738, Datu Buhawi of Yabon acknowledged the authority of the Spanish government and willingly subjected himself and his barangay to Spanish rule. Conversely, Datu Dumagtolu of neighboring Ubian resisted this move. He led his people into the mountains to oppose the Spanish colonizers. Francisco Bayo de Ocampo, the Spanish governor, recommended that the seat of government be transferred to the principality, and the following year (1770), settlements in the area they called "Janihuay" were consolidated within his administration. Although there is no reliable information, there are several legends about the origin of the name of this place. One is that it comes from the sons of the ruler Datu named "Han" and "Owei."

The other word is a combination of the words "hani" (whisper) and "owei" (wicker). In

June 2008, a powerful typhoon accompanied by heavy rainfall led to the overflow of the Suge River, resulting in significant damage to nearby communities and infrastructure along its banks. The flooding caused the river to shift its course, penetrating the riverbank approximately 200 meters away from its original position. Despite the flooding and erosion, the Suage Bridge remains structurally intact.

4.2 Land Area and Geographical Location

Moreover, according to PhilAtlas (2023), Janiuay is a landlocked municipality in the coastal province of Iloilo. The municipality of Janiuay is at 11º8’30” latitude and 12º30’ longitude and had a total area of 179.10 square kilometers or 17,910 hectares, accounting for 3.58% of the total area of Iloilo.

Two rivers flowing from the northwest ran parallel to each other through Janihuai. There were two significant rivers in the area: The Swage River and the Magapa River, both crucial for providing natural irrigation essential for the predominantly agricultural community of Janiuay. The Suage River Bridge held historical significance, having been a site of intense conflict during World War II between the Japanese Imperial Army and a coalition of Philippine and American forces, including authorized Ilonggo guerrilla fighters. The Magapa River Bridge, on the other hand, was constructed after the war ended. Janiuay was situated approximately 33 km (21 miles) away from Iloilo City.

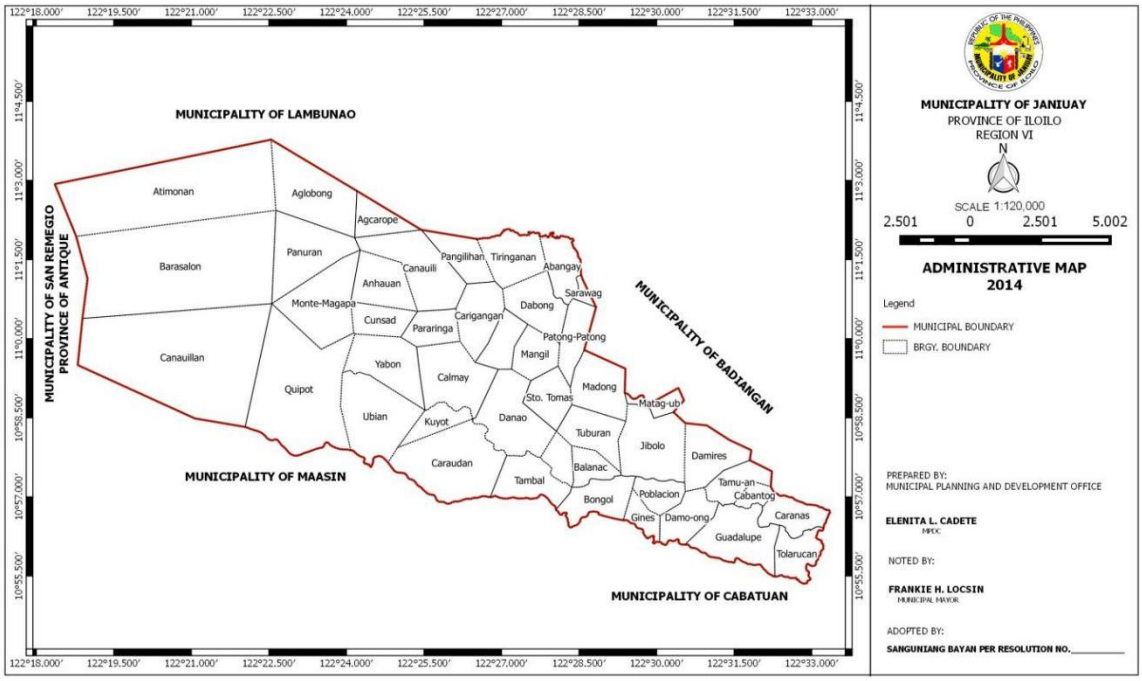


Figure 10

Location Map of Janiuay, Iloilo

4.3 Population and Economy

The Municipality is composed of 60 barangays, of which 44 were considered rural and 16 were urban. Its population, determined by the 2020 census, was 66,786 people. This number represented 3.25% of the total population of Iloilo province, or 0.84% of the total population of the Western Visayas region.

Caraudan belongs to the rural barangays of Janiuay with a total land area of 758.08 hectares and a total population of 1300. And according to the actual PSA census, there were 689 males and 611 females. This accounted for 1.75 of Janiuy's overall population.

Adjacent Barangays:

- Calmay, Janiuay, Iloilo
- Kuyot, Janiuay, Iloilo

- Tambal, Janiuay, Iloilo
- Danao, Janiuay, Iloilo
- Aguingay, Janiuay, Iloilo

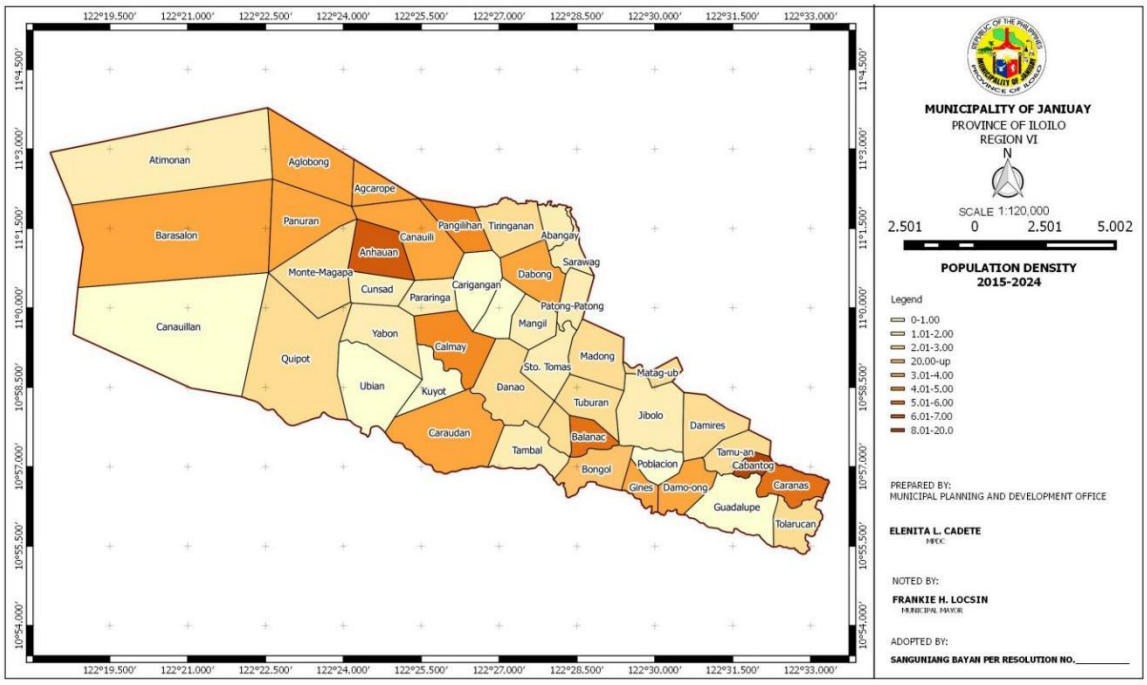


Figure 11

Population Density of Janiuay, Iloilo

With a total income and expenditures of Php. 306,066,190.36 and Php. 146,494,348.67, respectively, based on the Municipal Budget Office, 2022, Janiuay was an agro-based municipality, most notable of which was muscovado production, organic and inorganic. Rice mill operations, furniture making, and bamboo craft were among its livelihood industries. Production on rope retailing and other abaca native products spoke of the business opportunities coming from abaca fiber or Manila Hemp, which was abundant in the town and identified as Janiuay's One-Town-One-Product (OTOP). Other small industries

included hollow blocks and other concrete products, metal and iron works.

4.4 Topography and Slope

The eastern portion of the municipality, which encompassed 55% of the total land area, consisted of plains with slopes reaching a maximum of 8%. In contrast, the western part was mountainous and served as the municipality's forested area.

Approximately 34.05% of Janiuay municipality featured a very gently sloping or undulating topography, including Barangays Pangilihan, Abangay, Tiringanan, Canauli, Sarawag, Patong-Patong, Dabong, Carigangan, Mañacabac, Mangil, Calmay, Madong, Sto. Tomas, Tuburan, Madong, Jibolo, Damires, Tamu-an, Caranas, Guadalupe, Tolarucan, Damo-ong, Gines, and all urban barangays. This area spanned roughly 3,370.8219 hectares or 15.07% of the total land area.

Barangays with moderately sloping terrain included Aglobong, Agcarope, Panuran, Monte Magapa, Cunaad, Quipot, Ubian, and Caraudan. These areas cover approximately 2,108.1605 hectares or 13.089% of the total area.

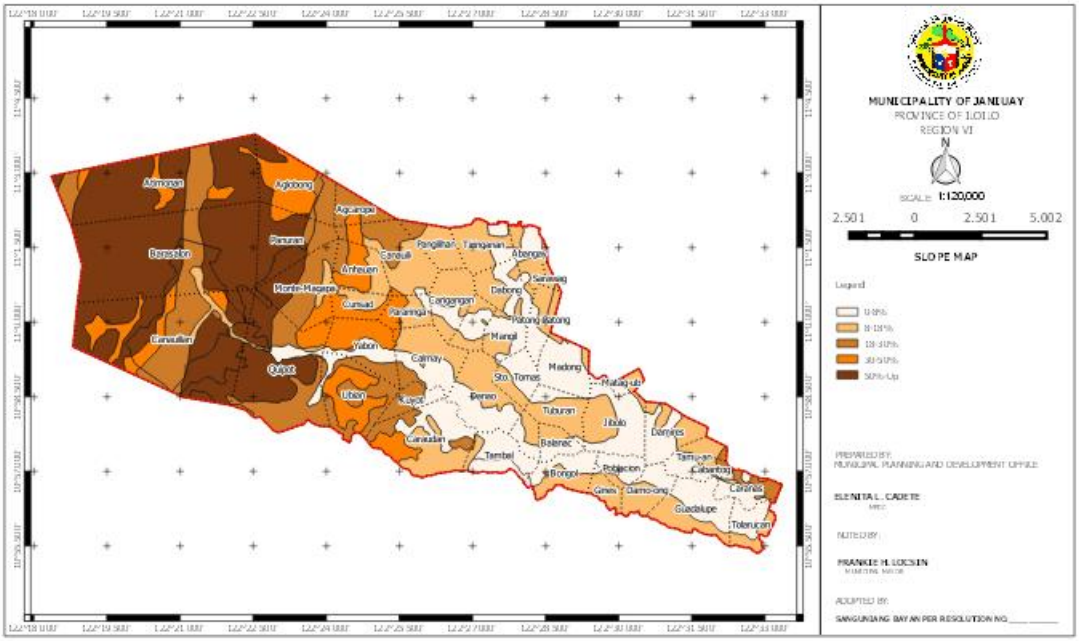


Figure 12

Slope Map of Janiuay, Iloilo

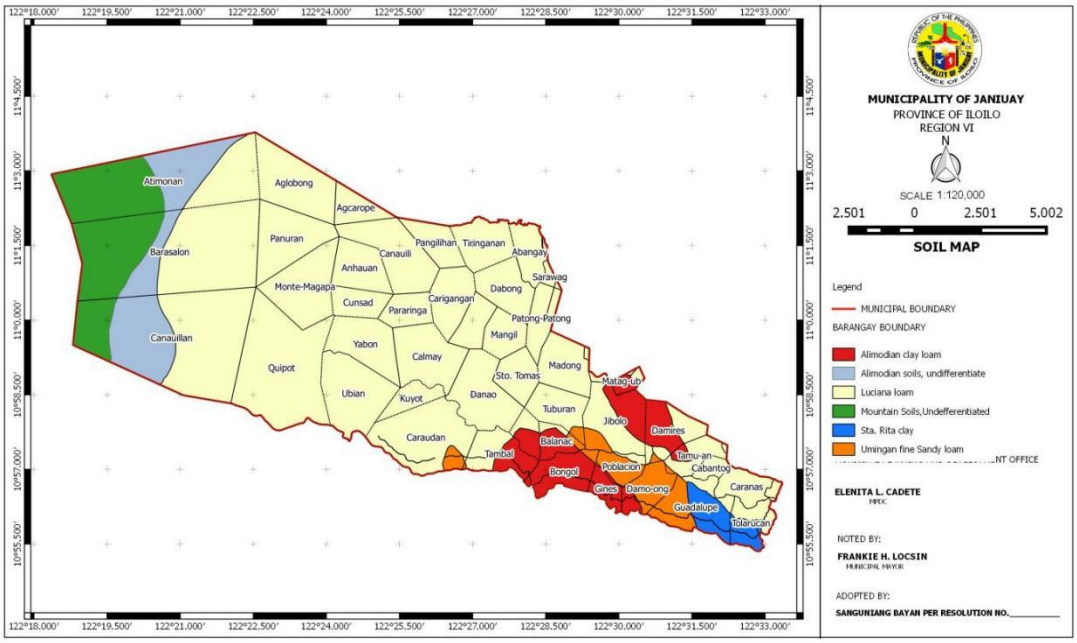


Figure 13

Soil Map of Janiuay, Iloilo

4.5 Hydrology and Climate

Situated at an altitude ranging from 0 to 100 meters above sea level, Janiuay experiences a Tropical monsoon climate (classified as Am). The average annual temperature in the area is 29.63ºC (85.33ºF), which is 2.41% higher than the national average in the Philippines. Janiuay typically receives approximately 90.52 millimeters (3.56 inches) of rainfall annually, spread across 159.28 rainy days (accounting for 43.64% of the year). The climate classification falls under type III, characterized by evenly distributed rainfall throughout the year.

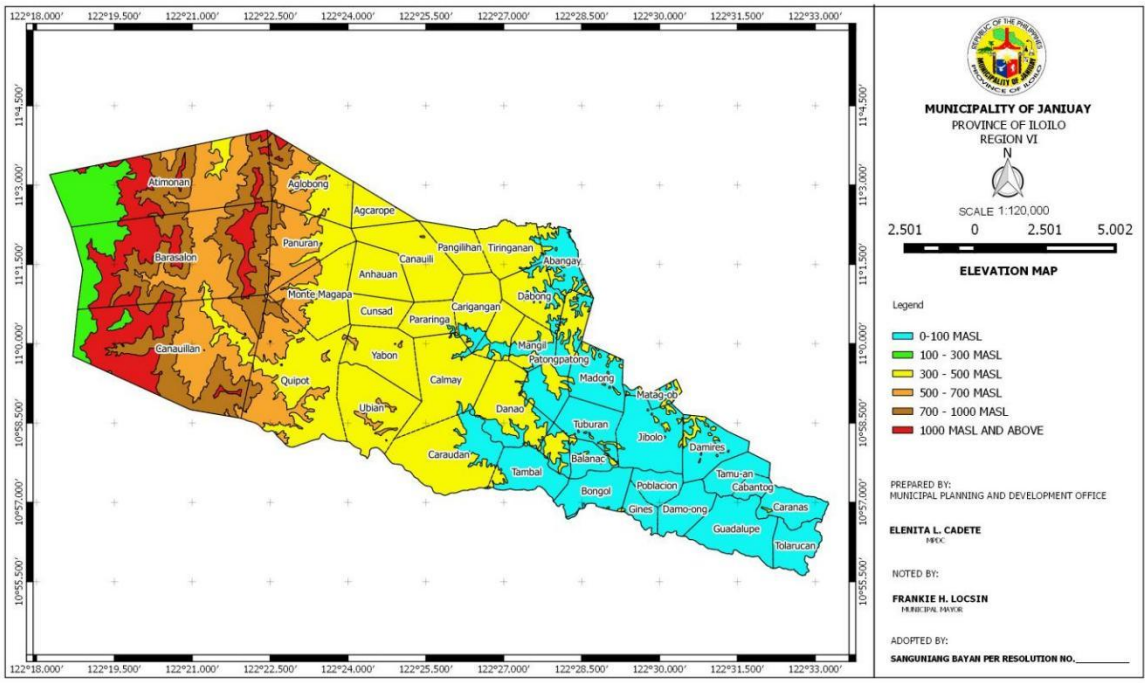


Figure 14

Elevation Map of Janiuay, Iloilo

4.6 Agricultural Production

The main sources of livelihood are the cultivation of rice, maize, sugar, copra, coffee, bananas, abaca fiber, and the raising of poultry (and Siamese birds), goats, and cattle.

These products are usually brought to towns with suitable markets. Rainfall generally determines trade in these products, as rivers dried up in the summer. Most of them came from the west, northwest, and southwest of town.

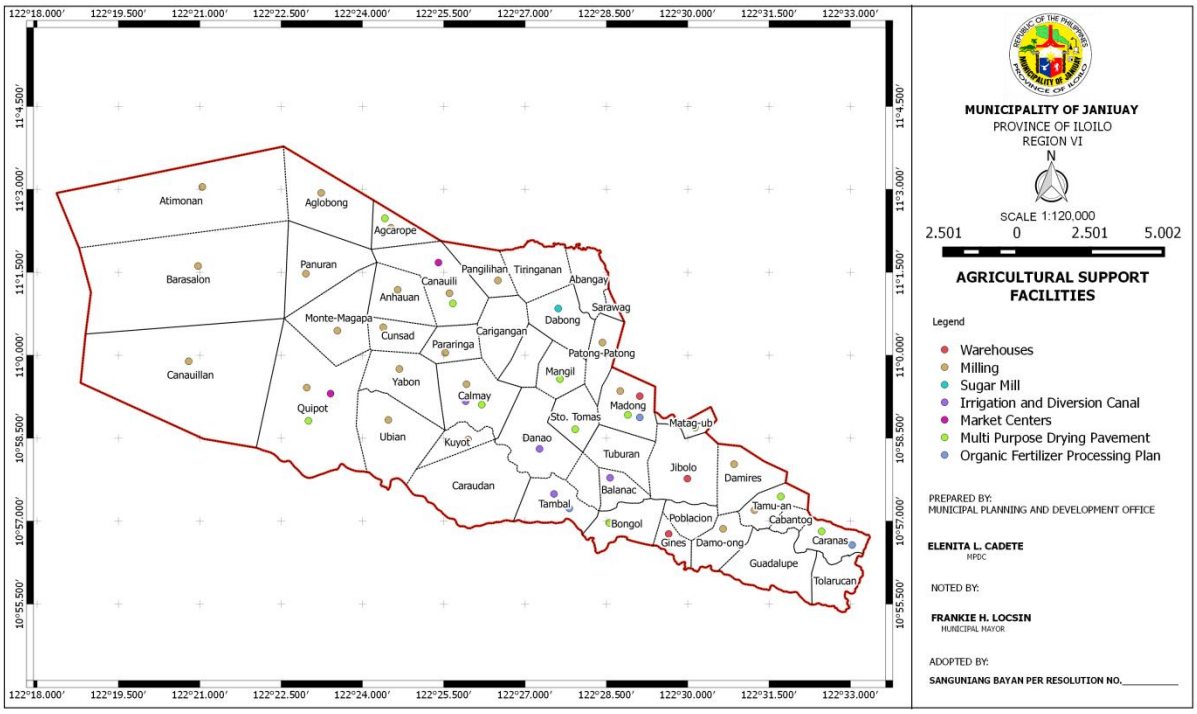


Figure 15

Agricultural Support Facilities of Janiuay, Iloilo

4.7 Project Location

The proposed site is located at Sitio Camansi, Caraudan, Janiuay, Iloilo. It is a government-owned property with a total area of 60,000 square meters. It is near the Municipal Environment and Natural Resources Office (MENRO) facilities, the Material Recovery Facility, and the Residual Containment Area. Beside it, there is also a Nursery for farming located at the site. It was also nearby to the Headquarters of 2nd Platoon, 74th Panay CDU Company, approximately 50 meters away from the site.

Figure 16

Proposed Project Location

4.8 Geotechnical Report

The geotechnical investigation was conducted by creating a borehole with a depth of 5 feet. The disturbed soil was then forwarded to the soil laboratory for further testing. The purpose of these tests was to obtain the soil type and its properties that were needed for the computation of the study.

Chapter V

The Proposed Project

5.1 Design of the Proposed Building

The purpose of the proposed project was to design a two-storey Balay Silangan that served as a rehabilitation center for drug offenders at Barangay Caraudan, Janiuay, Iloilo. Its main purposes were to: 1.) Provide rehabilitation for drug offenders in the town. 2.) Provide a safe and convenient rehabilitation center for drug offenders. 3.) Provide an efficient rehabilitation center and proper assignment of rooms to achieve successful results and treatment. 4.) Provide ample space and complete utilities for drug offenders.

The details of the design are as follows:

Facilities on the ground floor consisted of a conference room with a gross floor area of 12.75 square meters. Beside the conference room were staff offices connected with rooms for records, staff, and the director's office with a total gross floor area of 24.65 square meters. Adjacent to the conference room is a lobby with a gross area of 12.53 square meters. The women’s bedroom, which has a total gross floor area of 15.97 square meters, is beside the toilets for PWD, men, and women, each with two sinks, totaling a floor gross area of 21.33 square meters. The education facility has a gross floor area of 17.01 square meters with a capacity of 30 persons. Beside the educational facility is a multi-purpose room with a floor area of 17.01 square meters and a capacity of 20 persons. The medical clinic with connected ward, counseling, psychology room, isolation room, and pantry have a total gross floor area of 57.024 square meters.

Facilities on the second floor consisted of a kitchen and mess hall with a total gross floor area of 38.25 square meters and 66.78 square meters, respectively. The dining area

could cater to 30 persons. Also situated on the second floor adjacent to the dining area are living and study rooms with a total gross floor area of 33.96 square meters and a capacity of 10-15 persons.

Beside the kitchen is a laundry room with an adjacent toilet with a total gross floor area of 22.95 square meters. Three separate bedrooms have a total gross floor area of 56.39 square meters and could be occupied by 10 persons per room. Adjacent to the bedrooms, one toilet and two toilet sinks were provided exclusively for males with a floor area of 10.5 square meters. In front of the toilet is a dressing room with a total gross floor area of 6.87 square meters. The urinals for men were decided to be no-flush urinals to save water and prevent contact.

The roof is designed as a flat shed roof with an angle of 15 degrees and is good for rain harvesting.

5.2 Technical and Specifications

5.2.1 Architectural Design

The architectural plan of the proposed Two-Storey Balay Silangan in Janiuay, Iloilo, included a site development plan, perspective, floor plans, elevations, sections, schedules of doors and windows, and details of ramps and stairs. The architectural plan was based on the National Building Code of the Philippines and standard room assignments and area of DILG. Fire provisions were also considered in the design of the building.

The figures 16 and 17 show the primary and secondary fire escape routes for the first and second floors of the proposed structure. The location of fire hazards, such as the fire extinguisher and fire alarms, was also determined.

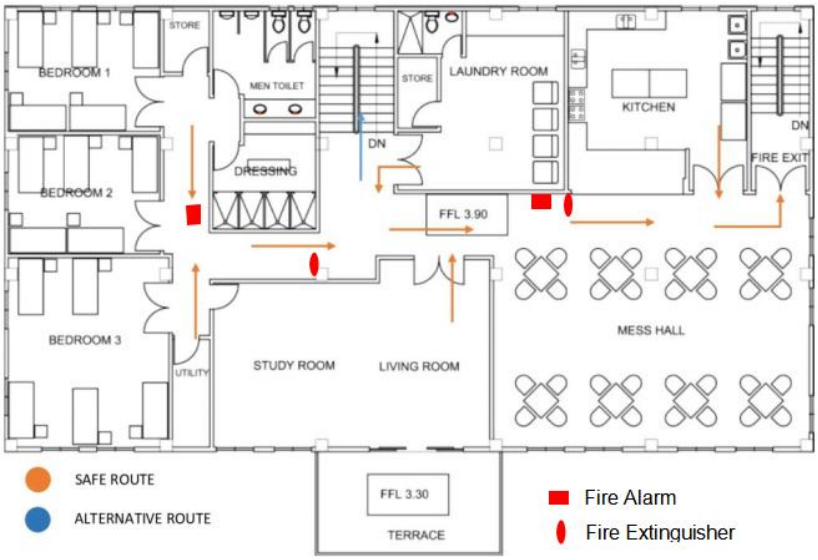


Figure 17

Second Floor Fire Escape Plan

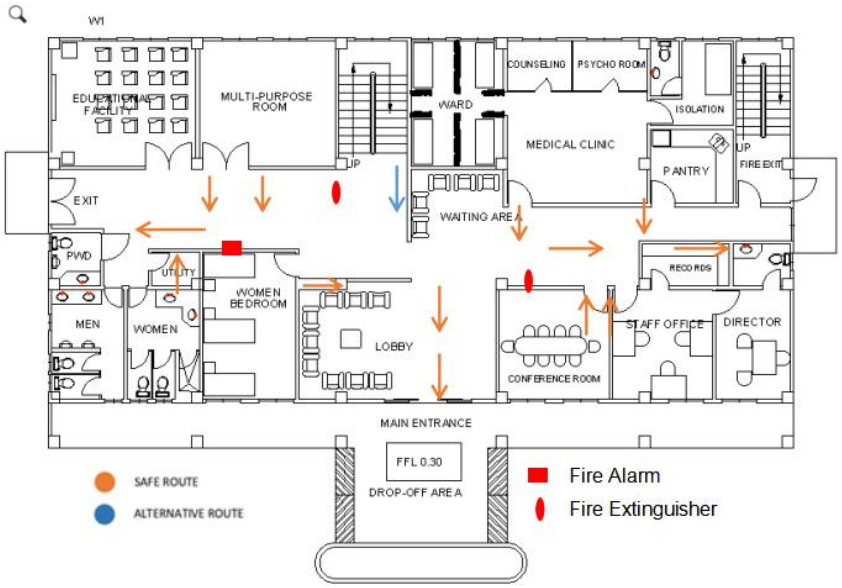


Figure 18

Ground Floor Fire Escape Plan

5.2.2 Structural Design

With the aid of the National Structural Code of the Philippines (NSCP) 2015, the structural plans were made alongside the design details. Slabs, beams, girders, columns, foundations, and shear walls were designed to meet the standards specified in the code. The American Steel Institute (ASI), American Standard for Testing and Materials (ASTM), American Institute of Steel Construction (AISC) 360-10, and American Concrete Institute (ACI) 318-14 were used as additional references for the structural design and analysis.

5.2.2.1 Design Load Specifications.

The following are the design loads for the structural design of members. The loads were based on the National Structural Code of the Philippines (NSCP) 2015 Table 205-1 (Sec 205), Table 205-3 (Sec 205), Table 204-2 (Sec 204).

Table 3

Roof Load Specifications

Loads	Values
Dead Load	
Rib Roof	0.03 kPa
Waterproofing (liquid Applied)	0.05 kPa
Ceiling, Suspended Steel Channel System	0.10 kPa
Ceiling, 9mm thk Gypsum Board (0.008 kN/m^3 x 9mm)	0.07kPa
Mechanical Duct Allowance	0.20 kPa
Assumed MEP	0.10 kPa

TOTAL	0.65 kPa
Live Load	
Roof	0.75 kPa

Table 4

Building Load Specifications

Loads	Values
Dead load	
Self-weight using assumed unit weight of concrete	23.6 kN/m^3
Super-imposed dead loads, DL 2	
Typical Floor Load	
Ceramic or Quarry Tile (20mm) Mortar Bed	0.77 kPa
Ceiling , Suspended Steel Channel System	0.10 kPa
Ceiling, 9mm thk Gypsum Board	0.07 kPa
(0.008 kPa x 9mm)	
Mechanical Duct Allowance	0.20 kPa
Interior Partition	0.10 kPa
Assumed MEP	0.10 kPa
TOTAL	1.34 kPa
Live Load	
Residential	1.9 kPa
Dining	4.8 kPa
Study Room/Library	2.9 kPa

5.2.2.2 Geotechnical Investigation.

The soil sample were acquired from the proposed project through undergoing different soil analysis from a 5 feet borehole. The soil sample were subjected to laboratory testing such as Sieve Analysis, Specific Gravity, Moisture Content, Unit Weight Analysis, Atterberg's Limit, and Compaction Test (See Appendix B) for the results. Reflected on the table below is the summary of geotechnical report of soil samples.

Table 5

Geotechnical Properties

Properties	Values/ Type
Liquid limit average (w%)	30.23
Plastic Limit average (w%)	72.15
Plasticity Index (%)	41.92
Specific Gravity	2.54
Moisture Content (%)	40.90
Unit Weight (kN/m3)	16.65
Soil Type	Soft Clay
Allowable Soil Bearing Capacity (kPa)	108.73

5.2.2.3 Seismic Analysis.

The design basis of an earthquake analysis of the proposed project was based on the seismic characteristics stated in NSCP 2015. In this section, the design base shear was computed to determine the accepted design for the tie beam.

Table 6

Seismic Properties

Description	Values
Seismic Importance Factor, I	1.0
Numerical Coefficient, R	8.5
Seismic Source Type	A
Soil Profile Type	Se
Seismic Zone Factor, Z (Zone 4)	0.40
Near Source Factor, Na	1.0
Near Source Factor, Nv	1.0
Seismic Response Coefficient, Ca	0.44
Seismic Response Coefficient, Cv	0.96
Period, T	0.29069

5.2.3 Electrical Design

The electrical plans for the proposed project included the design of the lighting system and power layouts for the ground and second floors. All electrical layouts and installations are in accordance with the requirements and provisions specified in the Philippine Electrical Code (PEC). The detailed specifications, design analysis, and schedule of loads are also found in the Electrical Plans. The electricity to be used in the structure will be provided by ILECO II. The ground floor and second floor are set up with lighting. Also, the outlets for the electrical supply are set up with electric fixtures and power appliances. Alternatively, the building is incorporated with solar power, which will help lessen the consumption of electricity.

5.2.4 Fire Detection and Alarm Systems

The design included a fire escape route, detection and alarm plan, based on

the provisions according to the Fire Code of the Philippines. The detailed specifications are found in the Fire Detection and Alarm Systems.

5.2.5 Plumbing Plans

The plumbing design for the proposed project was based on the provisions of the Philippine Plumbing Code, National Building Code, and the rules and regulations of the local municipality. Detailed specifications were found in the Plumbing plans: General notes and material specifications, plumbing layout, isometric view, septic vault details, plumbing details, and other important fixtures' details. The Janiuay Water District will be the source of the water supply for the proposed building. The septic tank is positioned on the rear side of the structure in consideration of occupants' safety and sanitation.

5.2.6 Technical Specification

Technical specifications of materials involve providing detailed information about the properties, composition, and performance characteristics of various substances used in manufacturing, construction, or other applications. These specifications are crucial for ensuring that materials meet the requirements of specific projects or products.

5.2.6.1 Material Properties. The following are the material properties used in the

design of the project:

Table 7

Material Properties of Concrete.

Concrete	Values	Unit
Concrete Strength, fc'	21	Mpa

Modulus of Elasticity, Ec	21, 538	Mpa
Unit Weight , y	23.60	kN/m3

Table 8

Material Properties of Reinforcing Bars.

Reinforcing Bars	Values	Unit
ASTM A615-Gr 40		
Yield Strength, fy	275	Mpa
Ultimate Strength, fu	414	Mpa

Table 9

Material Properties of Steel

Steel	Values	Unit
ASTM A36		
Yield Strength, fy	248	Mpa

Table 10

The Philippine Metric Reinforcing Bars

NOMINAL DIMENSIONS			
Bar Size (Size Designation)	Area (Square Millimeters)	Mass (Kilogram per Meter)	Diameter (Millimeters)
#8	50.3	0.394	8
#10	78.5	0.616	10
#12	113.1	0.888	12

#16	201.1	1.578	16
#20	314.2	2.466	20
#25	490.9	3.853	25
#28	615.8	4.834	28
#32	804.3	6.313	32
#36	1017.9	7.990	36

5.2.7 Project Cost and Estimation

The total project cost was determined to be Php 18,527,289.32. It covers the cost of labor, equipment, materials, and other necessary expenses for different specialized works. The detailed breakdown of project cost estimation and material quantity is provided in Appendix E.

5.2.8 Construction Work Schedule

The estimated project duration of the proposed two-storey Balay silangan is 320 days. The sequencing of activities and the S-Curve is provided in Appendiices.

5.3 Green Technologies

The proposed structure featured green engineering technologies to reduce the consumption of electricity or power supply while increasing the amount of natural light. Glass windows are installed in most parts of the building. The building is equipped with solar panels installed on the roof, which helped reduce overall energy consumption and lower greenhouse gas emissions. This is considered one of the distinctive characteristics of the building. It was designed to be efficient and adaptable to changing environments. Solar energy stored in batteries also ensure 100% uptime and provided more stable backup power to keep businesses running in

the event of a power outage. By using solar energy instead of municipal power, companies on solar farms reduced greenhouse gas emissions that also contributed to common health problems such as asthma. A 1.2 square meter solar panel could generate up to 400 watts of energy under ideal conditions. Covering 10.2 square meters of the roof of a two-story building with solar panels saved about 6468.52 kWh of electricity annually. The site area received 5.5 sun-hr of sunshine per day. Converting this daily power production of solar panels to monetary value, using commercial electricity prices of 4.75 PHP per kWh, 6468.52 kWh annually x 4.75 PHP/kWh was 30,725.50 PHP or 84.18 PHP/day. This was the amount of power saved in a day using the solar panel.

A rainwater collector system in the roof will be installed to reduce or eliminate the use of commercial water for purposes of toilet use. The feasibility of this green technology was computed as follows:

$$Rainwater\ Collected\ 1\ day = (\ e.\ Monthly\ Precipitation\ (mm)\ Ave.\ Rainfall\ Da\ )(\ 1\ L\ m\ 2\ )(Area\ of\ Roof)$$

As shown in Figure 19, the average rainfall for the month of July was 175.51 mm. This is equivalent to 175L per square meter of roof area. The average rainfall day, as observed, was equivalent to 18 days. The roof area of the proposed structure is 347.54 square meters. Using the formula stated above, the volume of rainwater collected was 5.06 cubic meters. The rate of commercial water in the area was Php 110 per cubic meter, converting this into a monetary value equal to Php 556.49 gross savings per day. This value multiplied by 18 days gave the savings for August of Php 10,016.82. A concrete tank that serves as a storage for harvested rainwater with 7,000 Liters of capacity was placed behind the building.

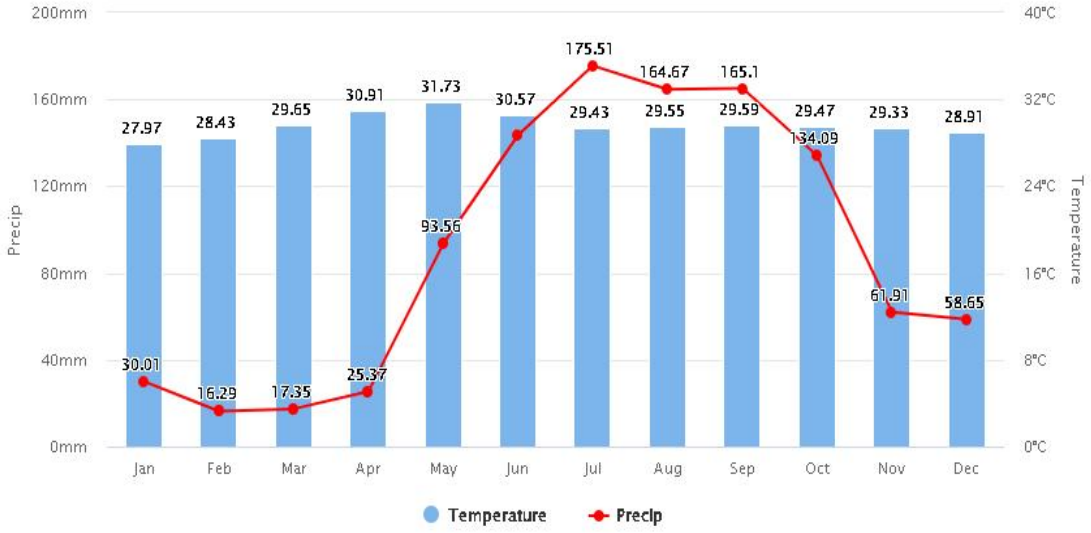


Figure 19

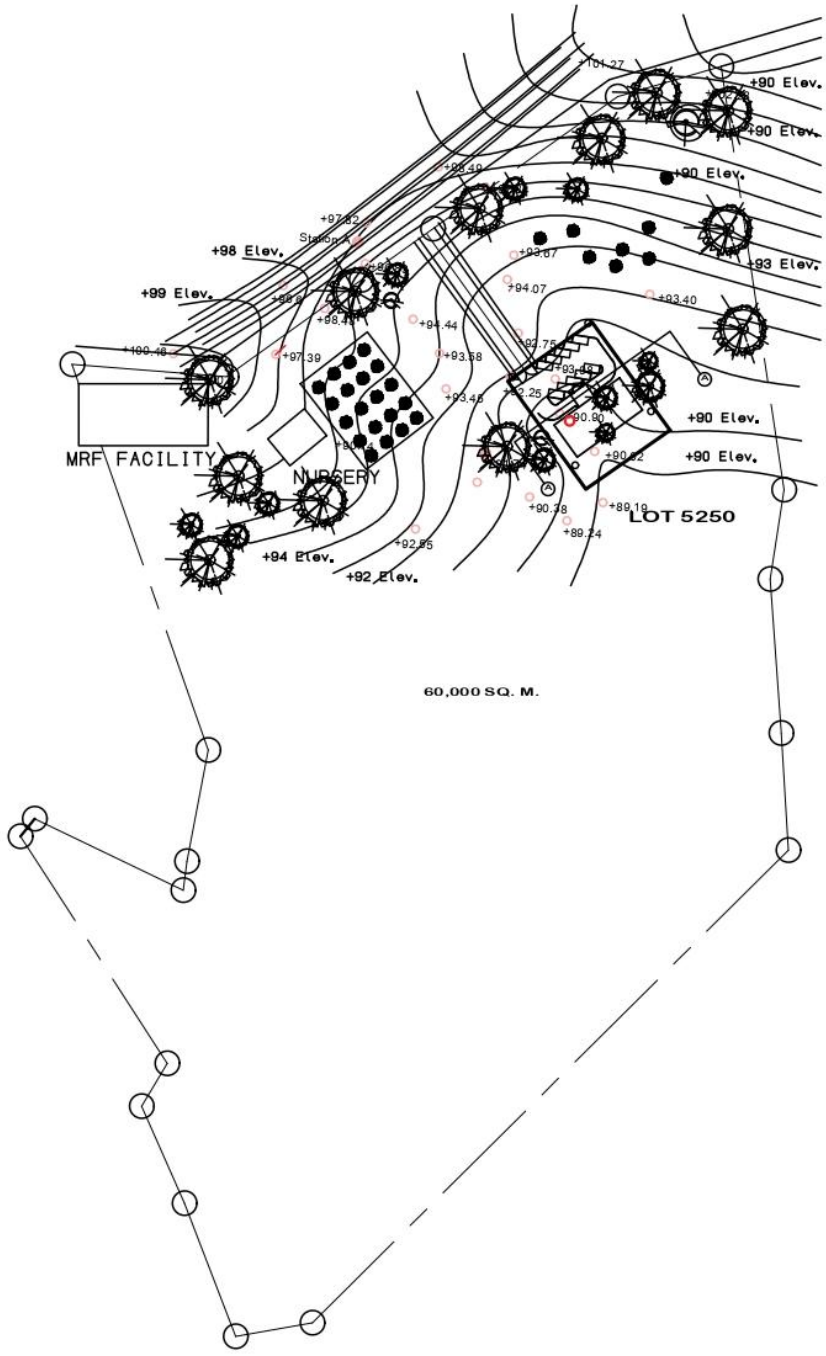
Average Temperature and Precipitation in Janiuay, Iloilo

PERSPECTIVE VIEW

PERSPECTIVE PLAN

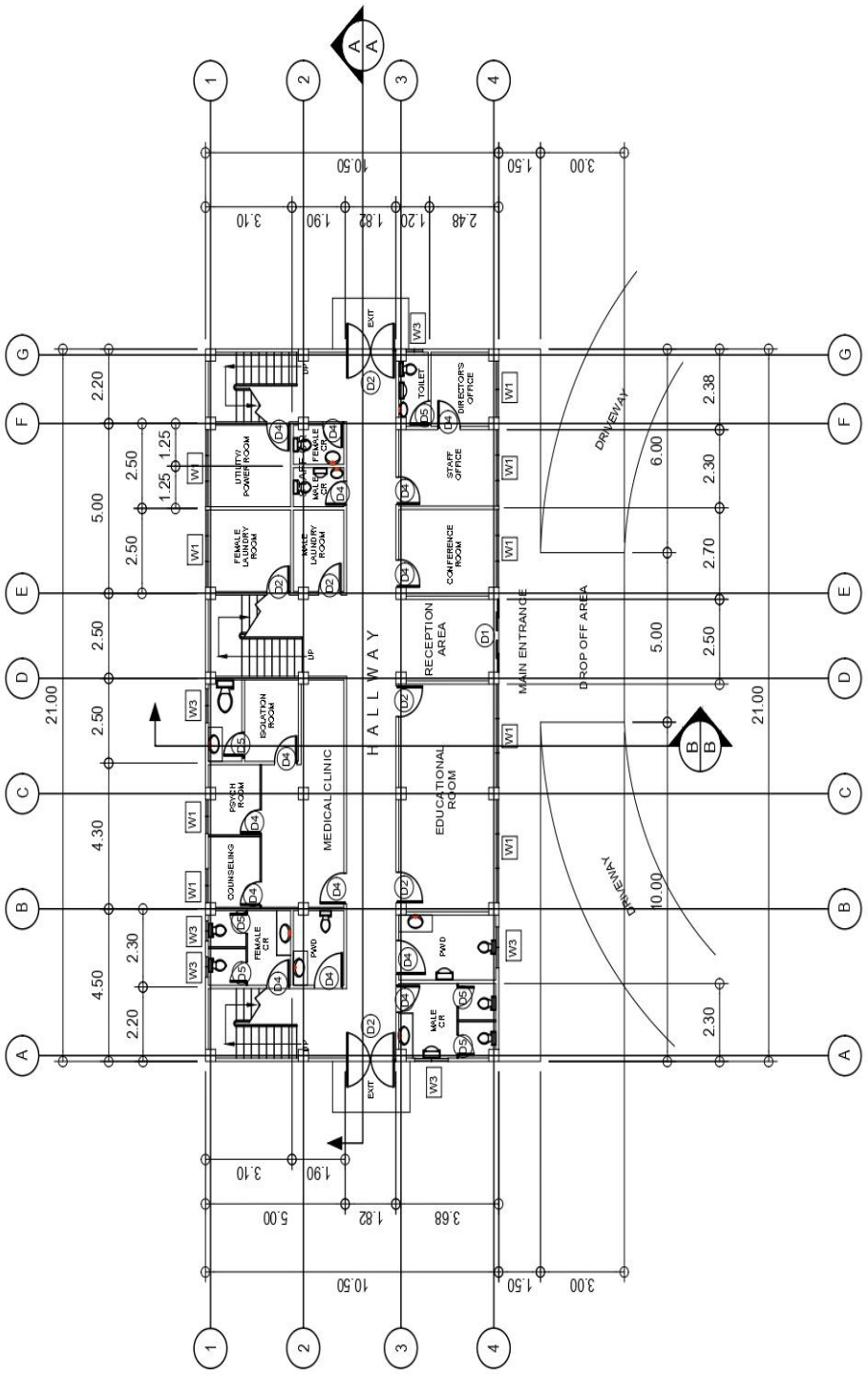
SCALE : NTS

ARCHITECTURAL PLANS



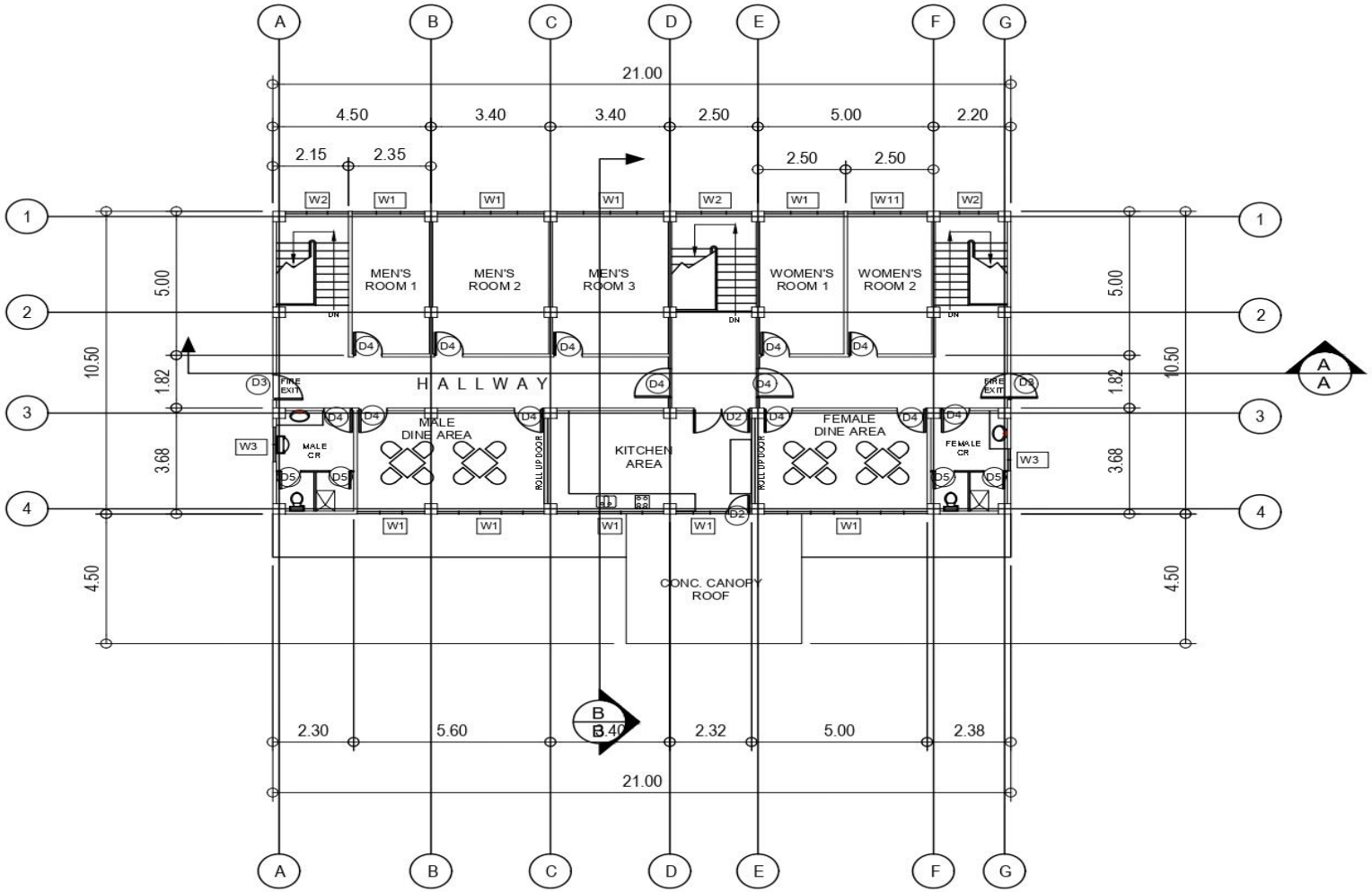
SITE DEVELOPMENT PLAN

SCALE : NTS



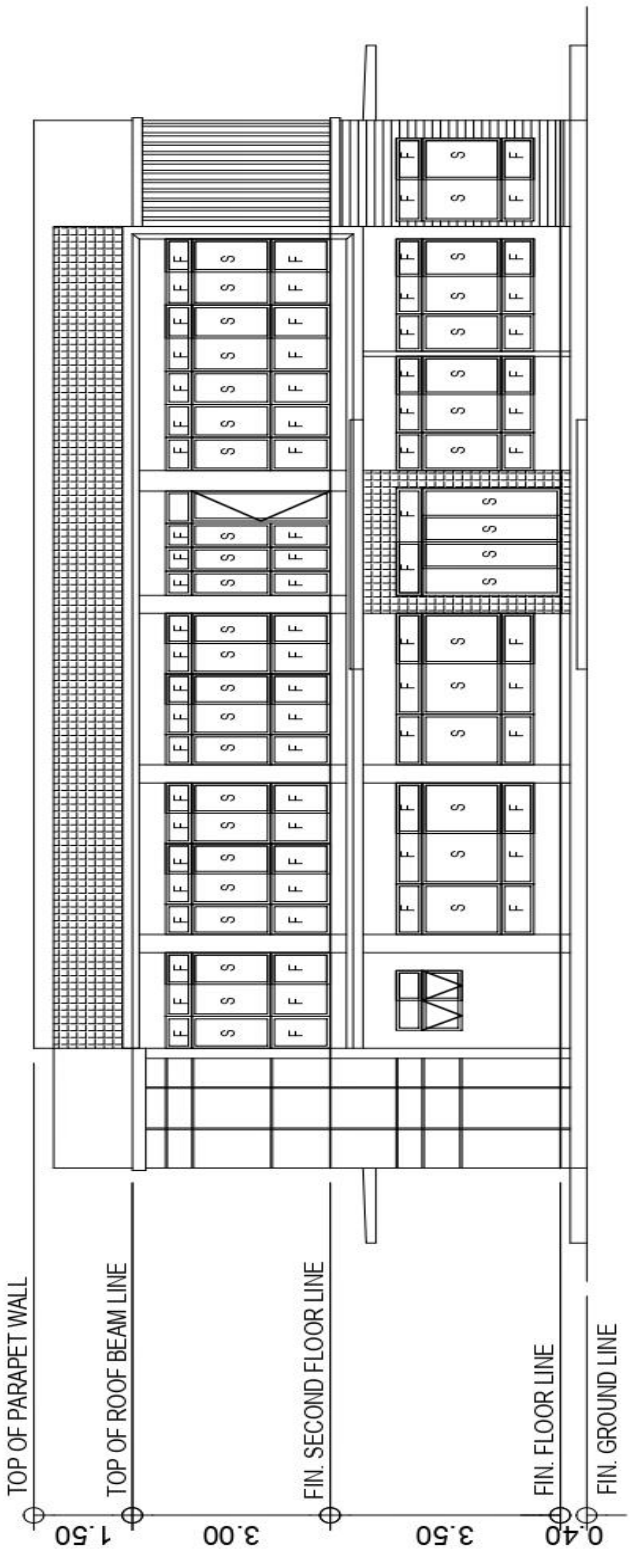
GROUND FLOOR PLAN

SCALE : 1 : 100



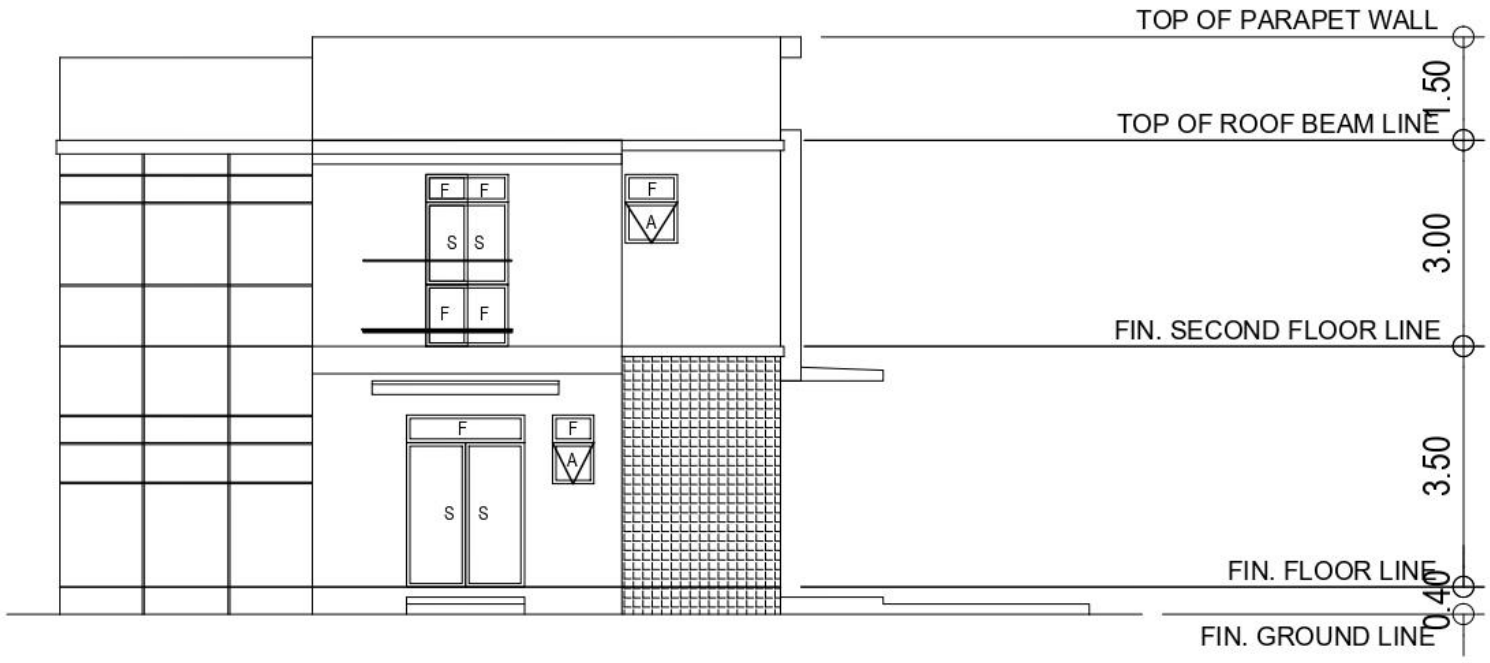
SECOND FLOOR PLAN

SCALE : 1 : 100



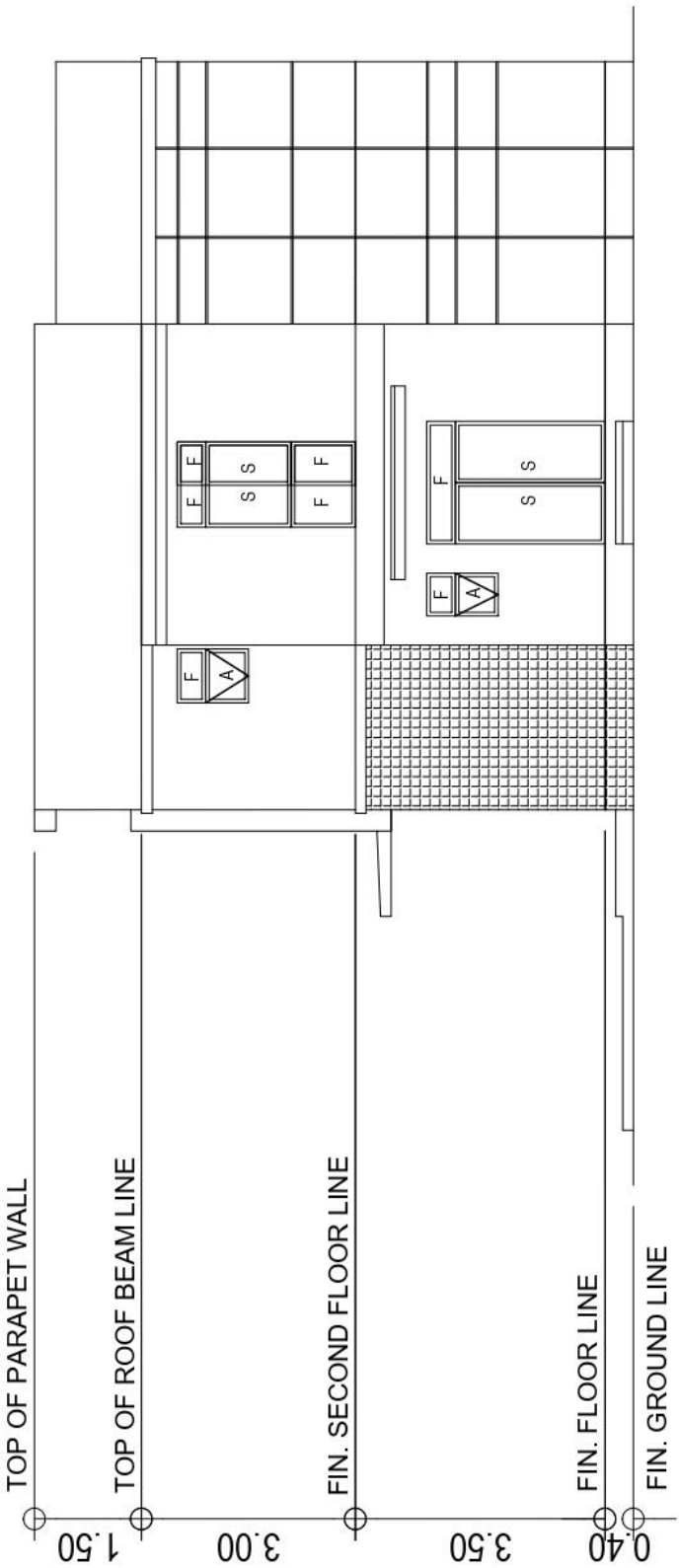
FRONT ELEVATION

SCALE : 1 : 100



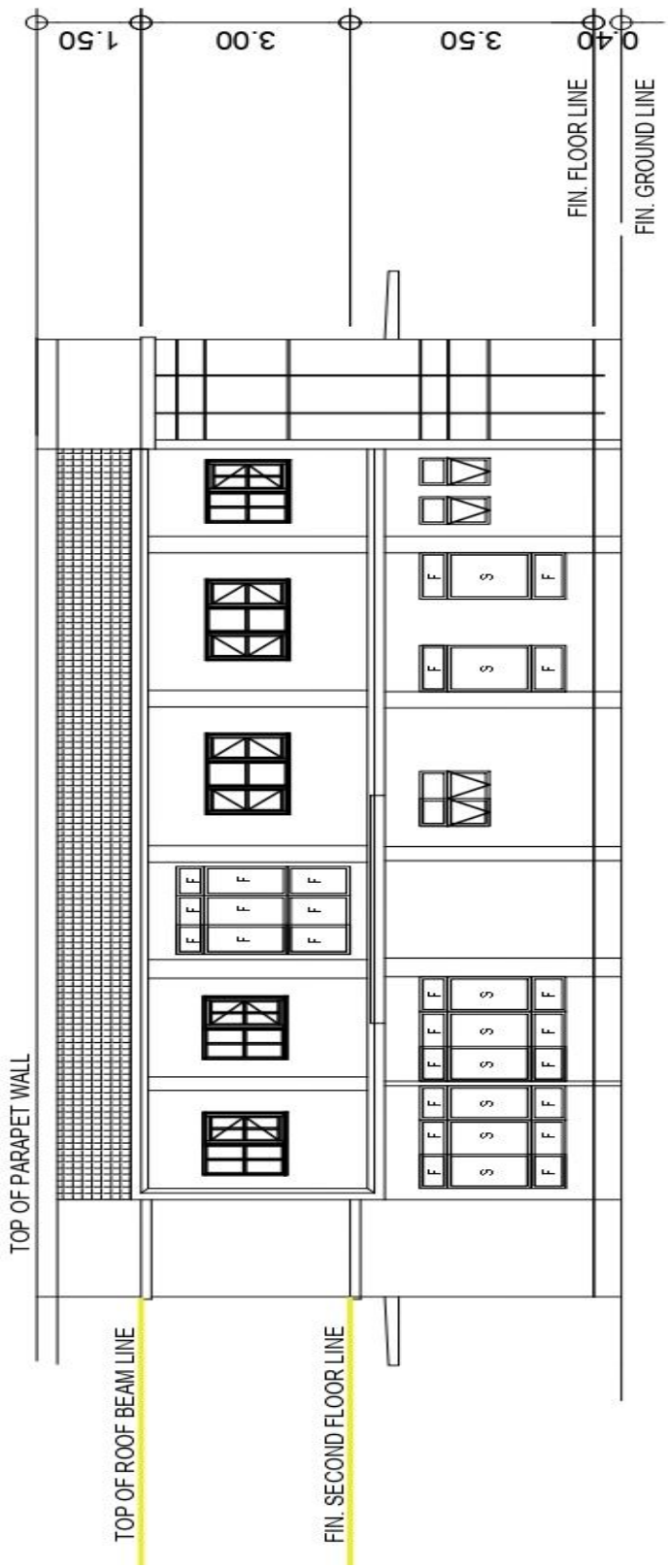
LEFT SIDE ELEVATION

SCALE : 1 : 100



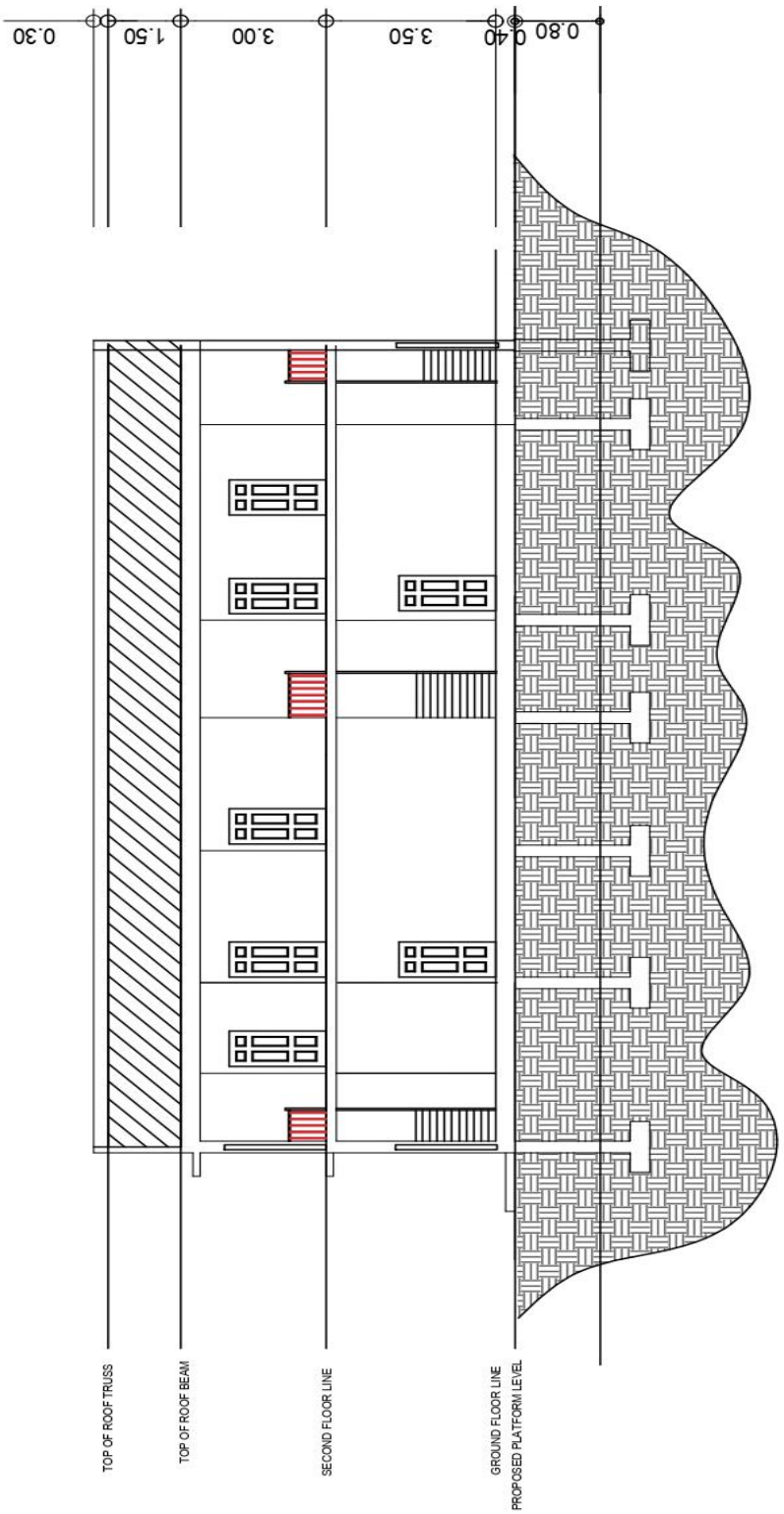
RIGHT SIDE ELEVATION

SCALE : 1 : 100



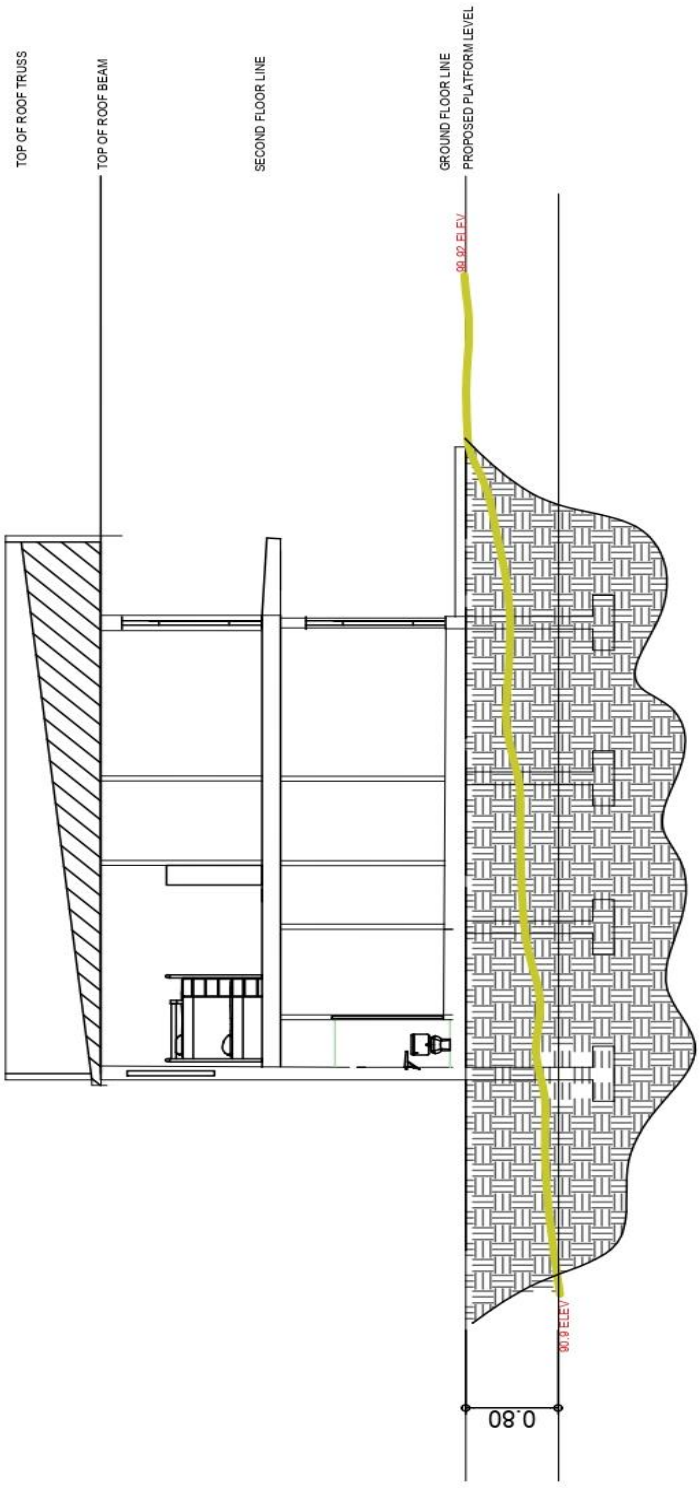
REAR ELEVATION

SCALE : 1 : 100



SECTION THRU A-A

SCALE : 1 : 100



SECTION THRU B-B

SCALE : 1 : 100

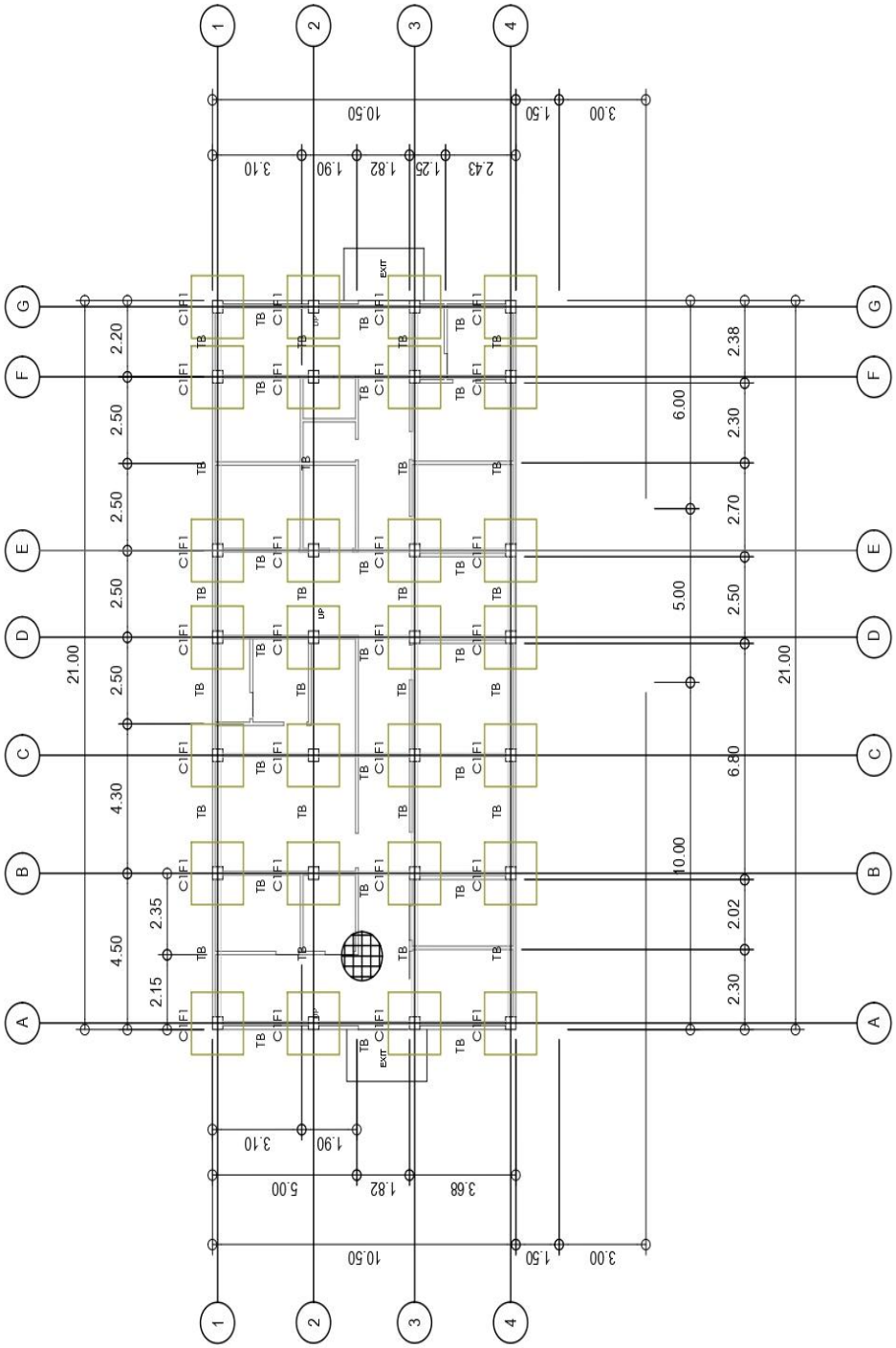
SCHEDULE OF DOORS

WDO. NO.	WIDTH (M)	HEIGHT (M)	DESCRIPTION
D1	1.60	2.10	2 Panels 6mm thk. glas sling doors on analok frame
D2	1.60	2.10	2 panel fire rated hollow core steel door w/ clear glass peek window on metal door jamb
D3	0.80	2.10	1 panel fire rated hollow core steel fire door w/ clear glass peek window and panic door latch on metal door jamb
D4	0.80	2.10	solid panel door on hardwood door jamb.
D5	0.60	2.10	PVC door on PVC door jamb.

SCHEDULE OF WINDOWS

WDO. NO.	WIDTH (M)	HEIGHT (M)	SILL HEIGHT FR. FLR. LINE	NO. OF PANELS	DESCRIPTION
W1	1.20	1.50	0.90	2	6mm thk. sliding glass on analok aluminum frame.
W2	1.20	2.40	0.90	4	6mm thk. sliding glass on analok aluminum frame.
W3	0.60	0.60	1.80	1	6mm thk. auwning glass on analok aluminum frame.

STRUCTURAL PLANS



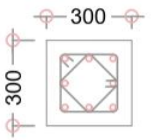
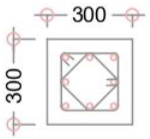
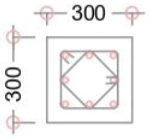
FOUNDATION PLAN

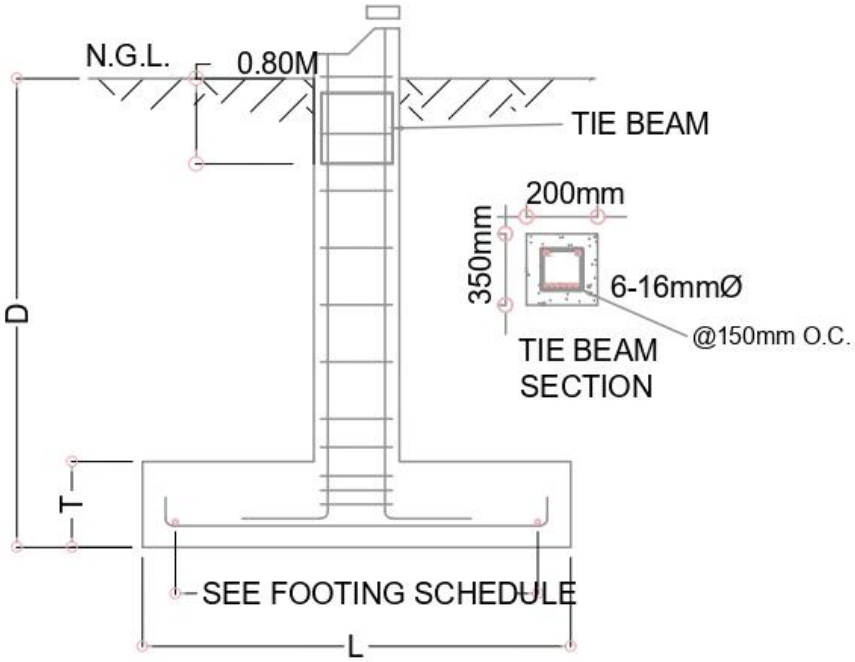
SCALE : 1 : 100

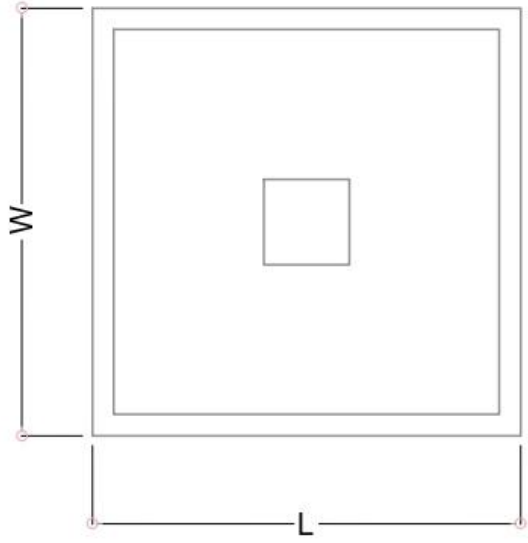
SCHEDULE OF FOOTINGS

MARK	DIMENSION (mm)			DEPTH FROM N.G.L. (D)	REINFORCING BARS		REMARKS
	WIDTH (W)	LENGTH (L)	THICKNESS (T)		PARALLEL TO WIDTH (BAR W)	PARALLEL TO LENGTH (BAR L)	
F1	1500	1500	380	2300	6-16mmØ	6-16mmØ	

SCHEDULE OF COLUMNS

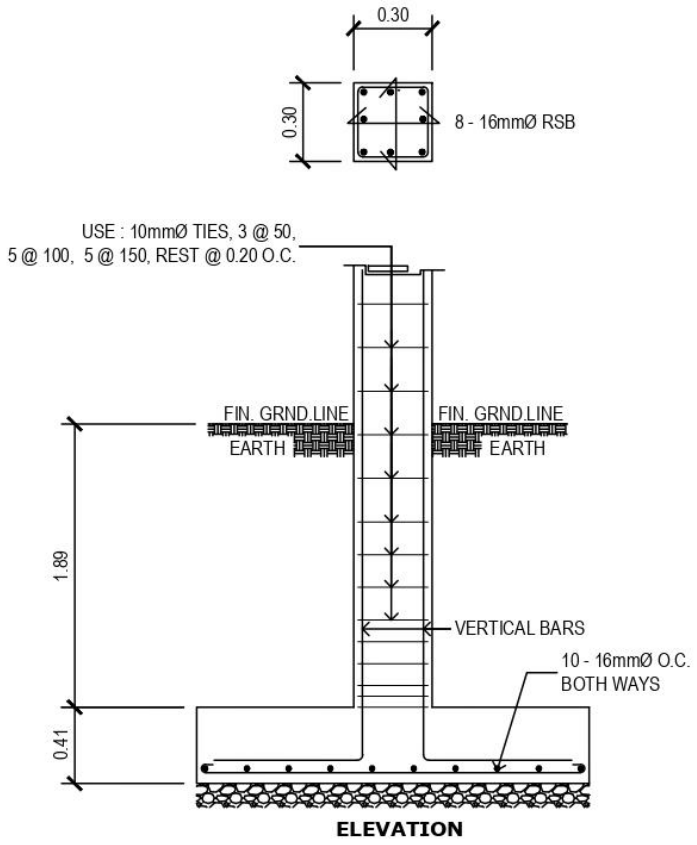
MARK	FOOTING TO GROUND FLR LEVEL	GROUND TO SECOND FLR LEVEL	SECOND FLR TO ROOF BEAM
C1	 8-16mmØ VERTICAL BARS W/ 10mmØ TIES 1@50 , 10@100, REST @150mm O.C.	 8-16mmØ VERTICAL BARS W/ 10mmØ TIES 1@50 , 10@100, REST @150mm O.C.	 8-16mmØ VERTICAL BARS W/ 10mmØ TIES 1@50 , 10@100, REST @150mm O.C.

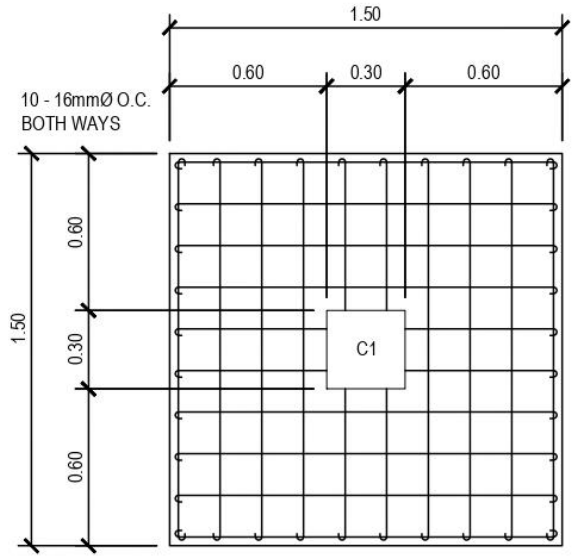




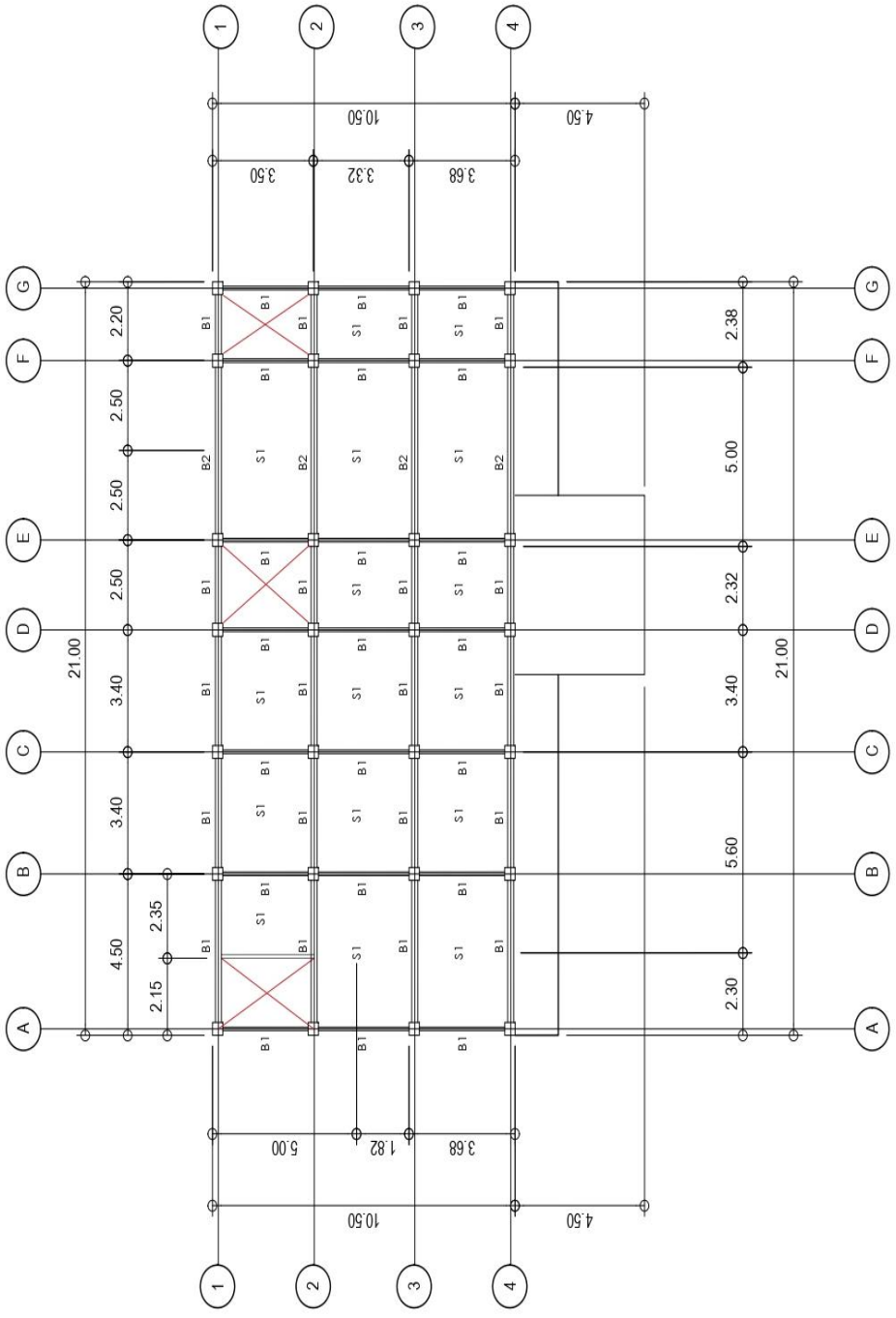
TYPICAL DETAIL OF FOOTING

SCALE NTS



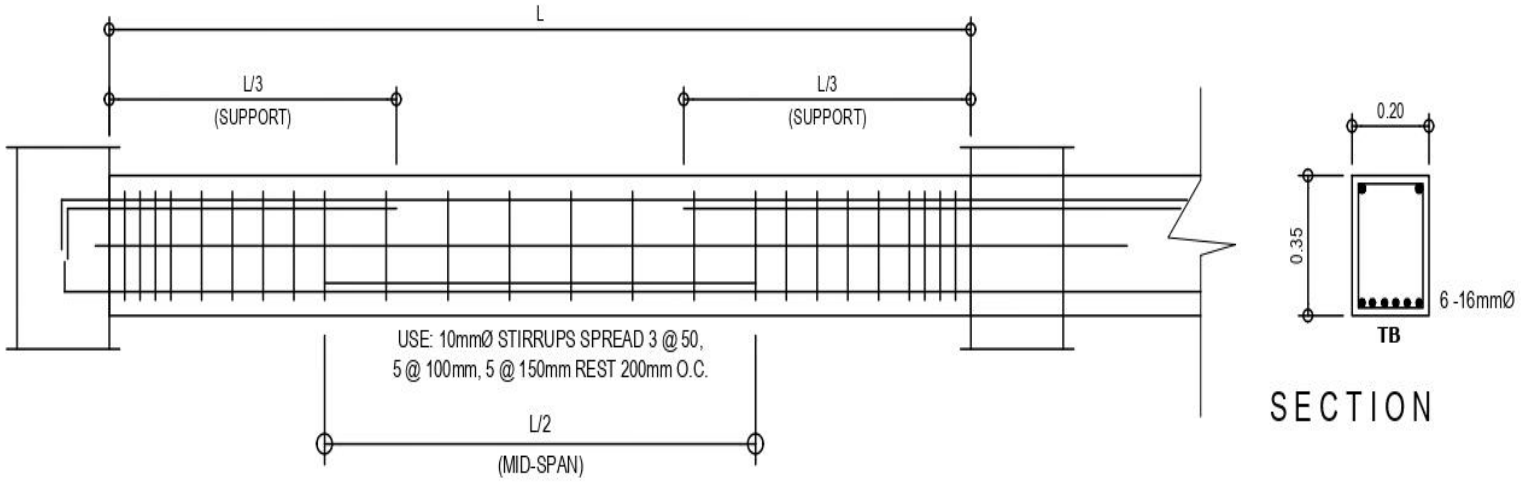


C1F1 DETAIL
SCALE : 1 : 20



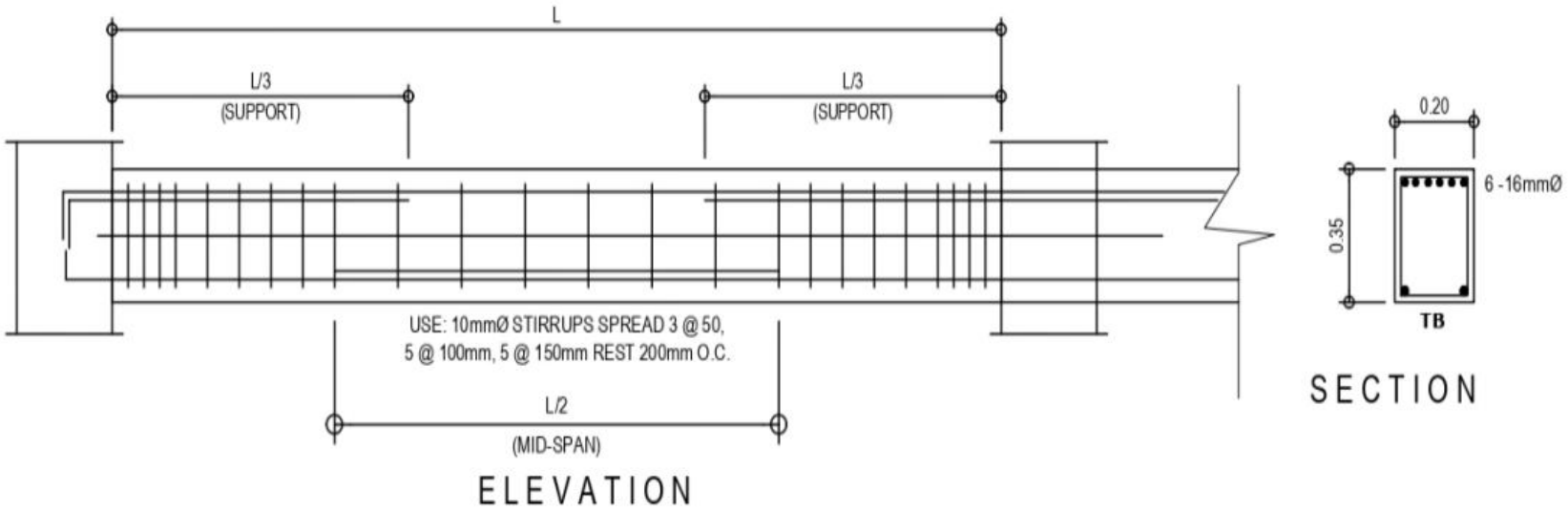
SECOND FLOOR FRAMING PLAN

SCALE : 1 : 100



TIE BEAM DETAIL

SCALE : 1 : 20



TIE BEAM DETAIL

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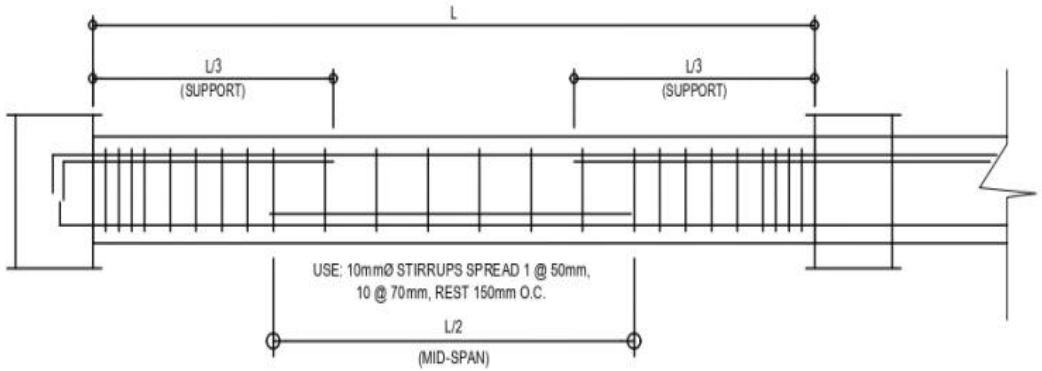
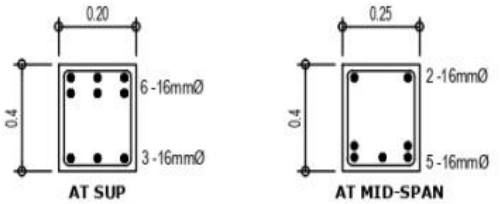


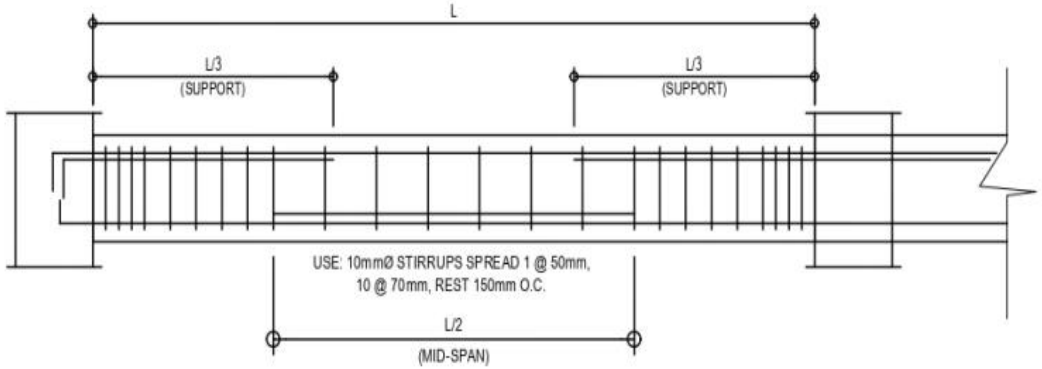
ELEVATION



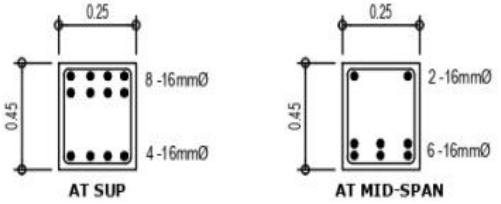
FB SECTION

SECOND FLOOR BEAM 1 DETAIL

SCALE : 1 : 20



ELEVATION

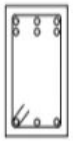


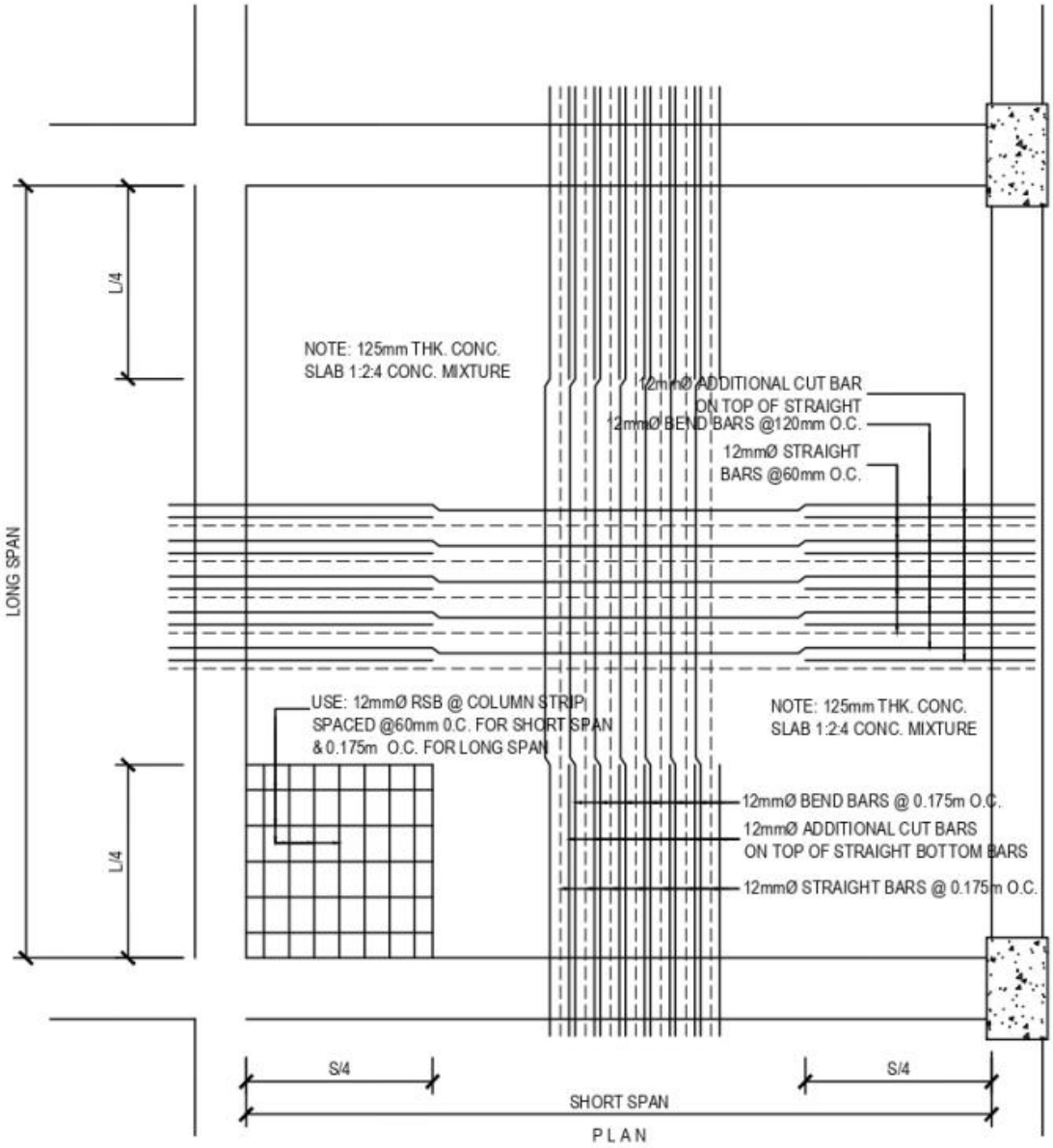
FB SECTION

SECOND FLOOR BEAM 2 DETAIL

SCALE : 1 : 20

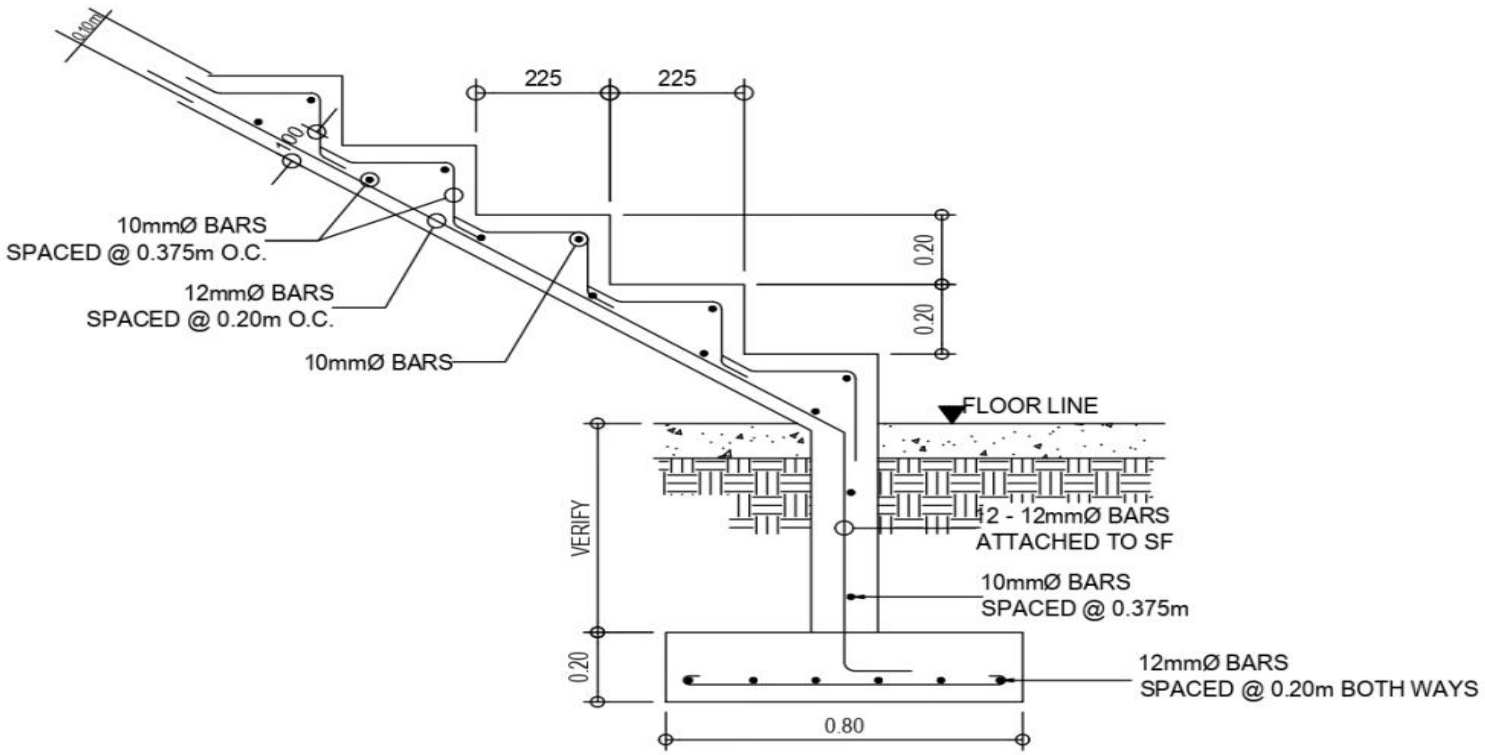
SCHEDULE OF FLOOR BEAMS

MARK	SIZES (mm)		REINFORCING BARS		
	BREADTH (B)	DEPTH (D)	AT SUPPORT	AT MID-SPAN	SPACING OF STIRRUPS
B1	200	400	 6-16mmØ RSB 3-16mmØ RSB	 2-16mmØ RSB 5-16mmØ RSB	10mmØ STIRRUPS 1@50 , 10@70, REST @150mm O.C.
B2	250	425	 8-16mmØ RSB 4-16mmØ RSB	 2-16mmØ RSB 6-16mmØ RSB	10mmØ STIRRUPS 1@50 , 10@70, REST @150mm O.C.



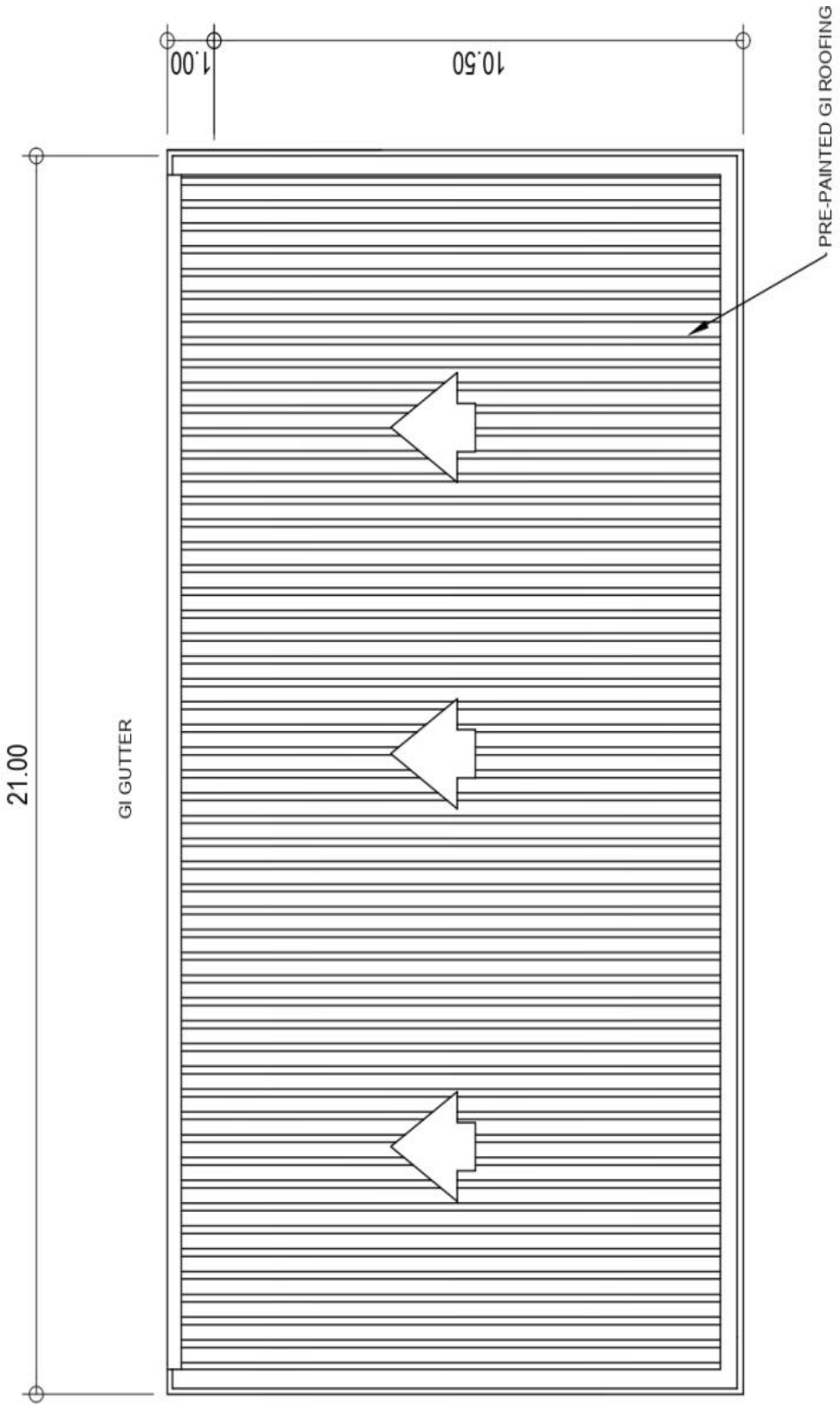
TWO WAY SLAB DETAIL

SCALE : 1 : 40



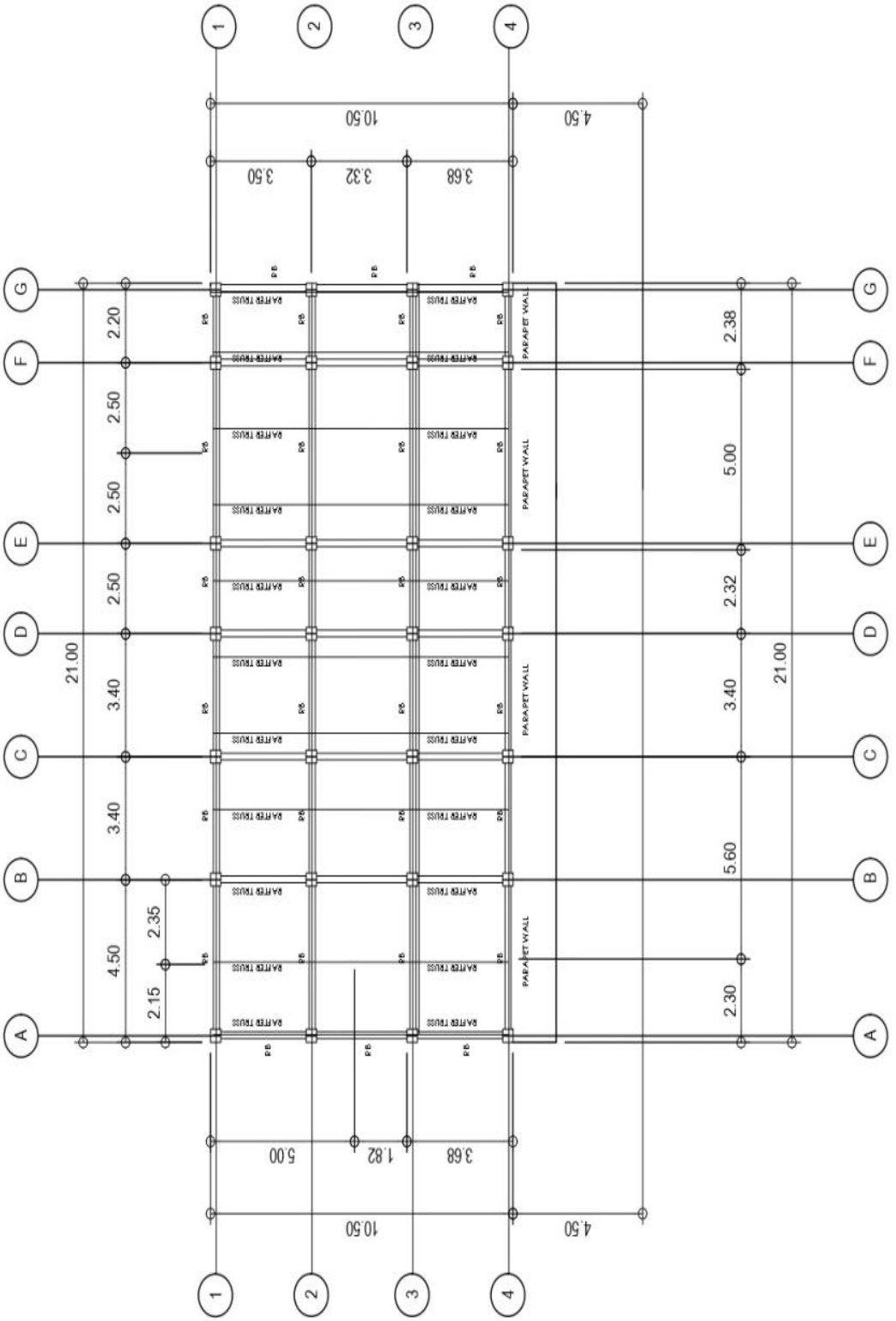
STAIR & STAIR FOOTING DETAIL

SCALE : 1 : 20



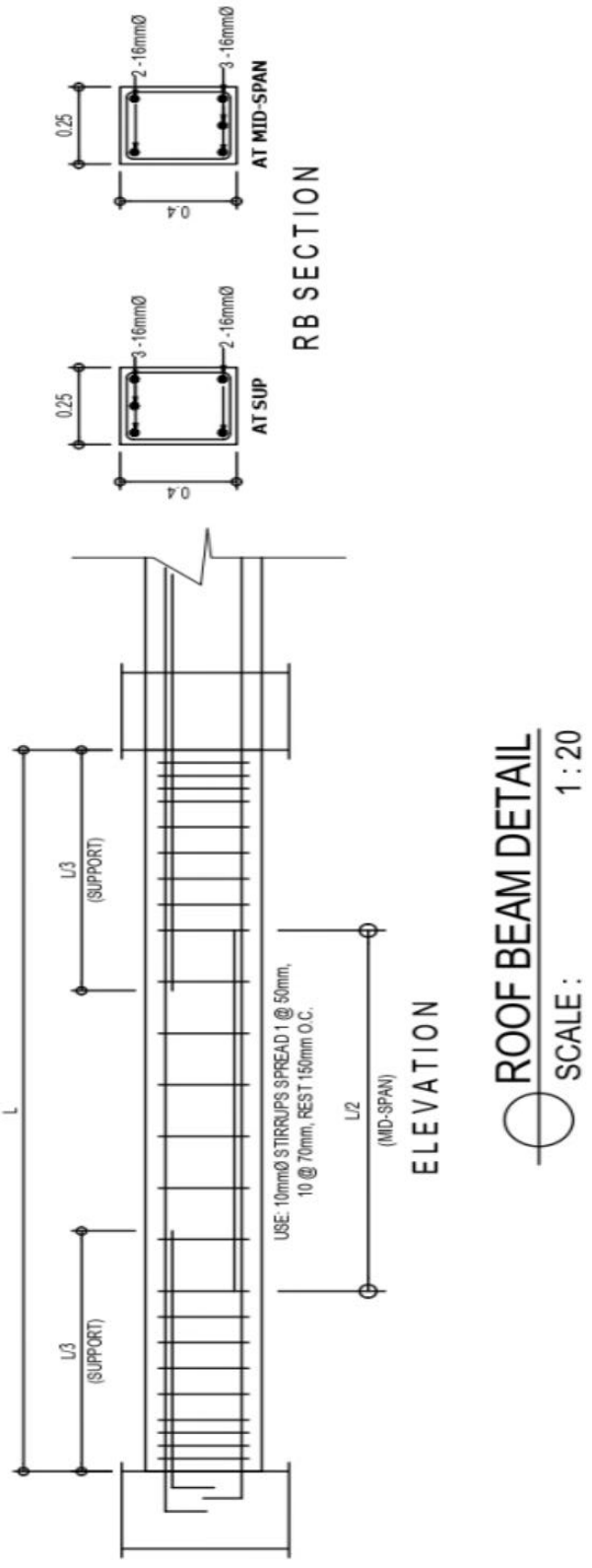
ROOF PLAN

SCALE : 1 : 100



ROOF BEAM PLAN

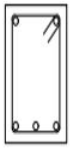
SCALE : 1 : 100

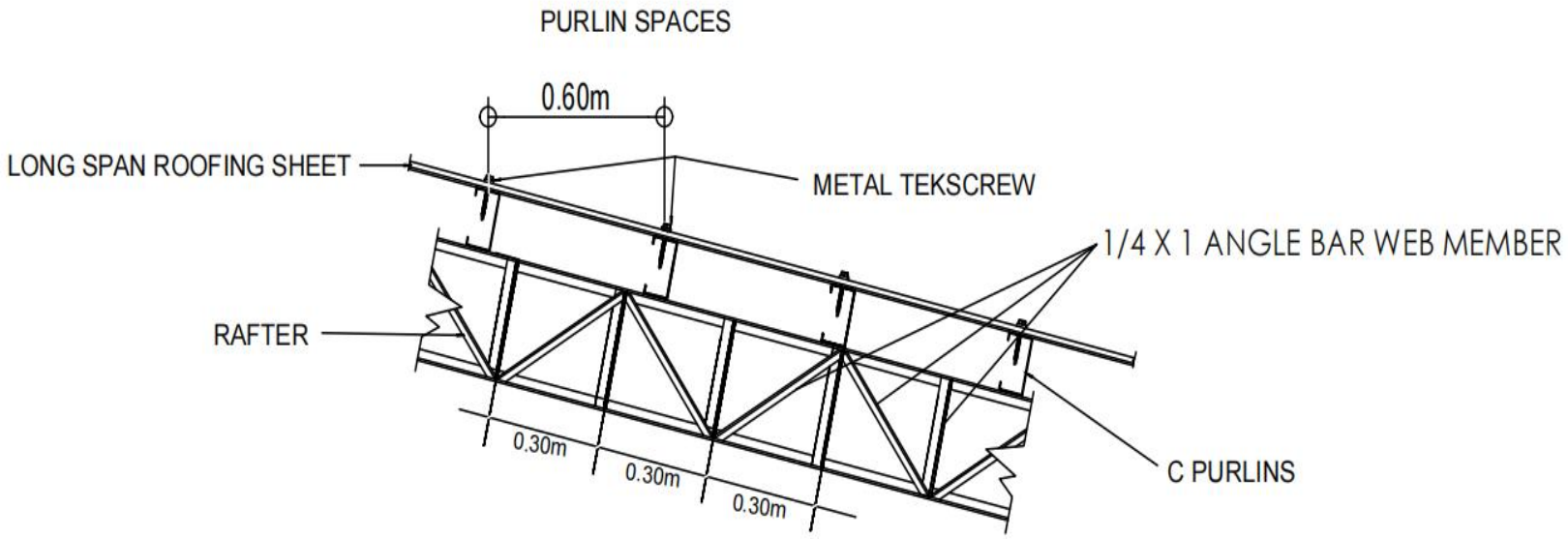


ROOF BEAM DETAIL

SCALE : 1 : 20

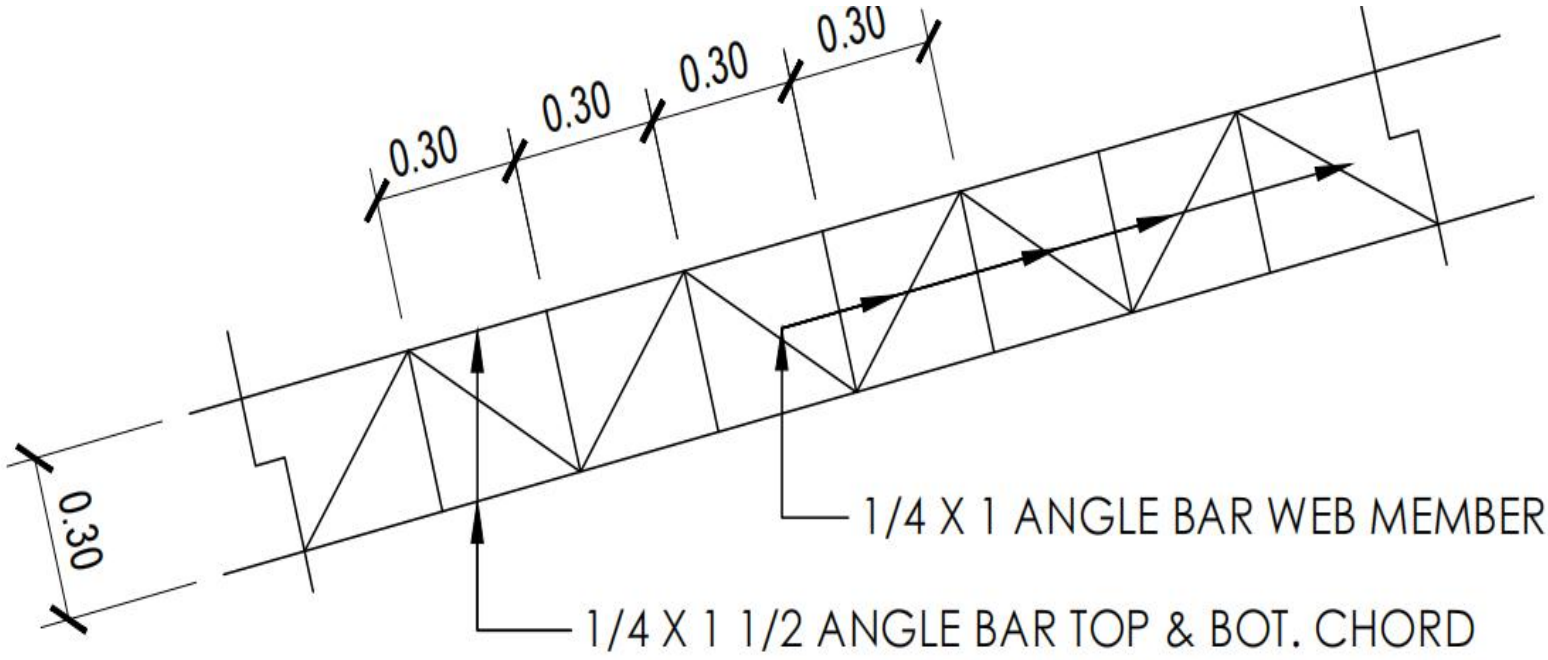
SCHEDULE OF ROOF BEAMS

MARK	SIZES (mm)		REINFORCING BARS		
	BREADTH (B)	DEPTH (D)	AT SUPPORT	AT MID-SPAN	SPACING OF STIRRUPS
RB1	200	400	 3-16mmØ RSB 2-16mmØ RSB	 2-16mmØ RSB 3-16mmØ RSB	10mmØ STIRRUPS 1@50mm , 10@70mm, REST @150mm O.C.



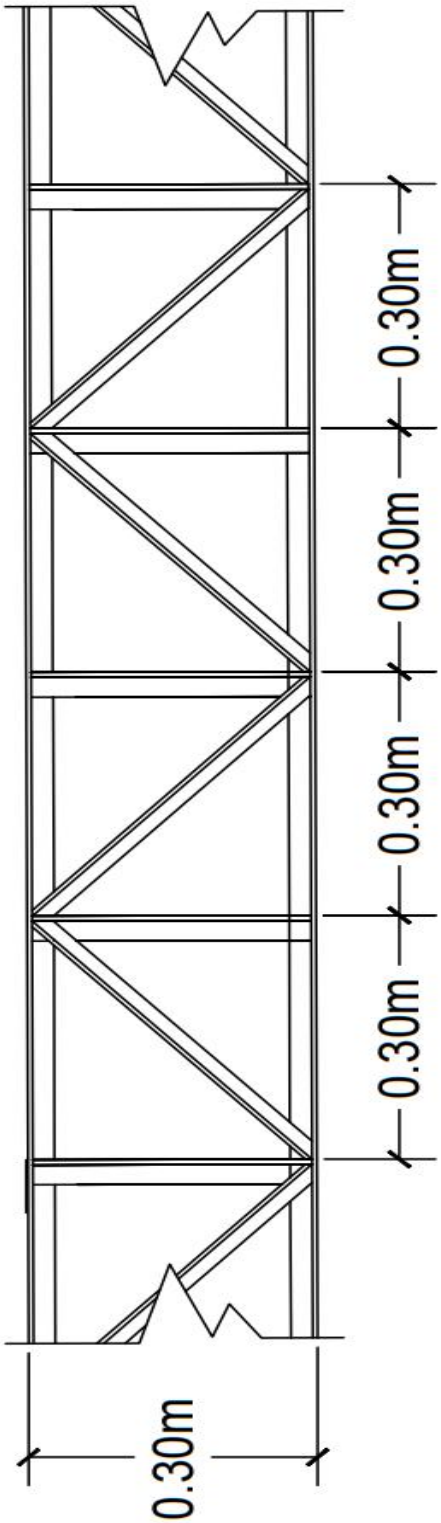
TYPICAL ROOF DIAGRAM

SCALE NTS



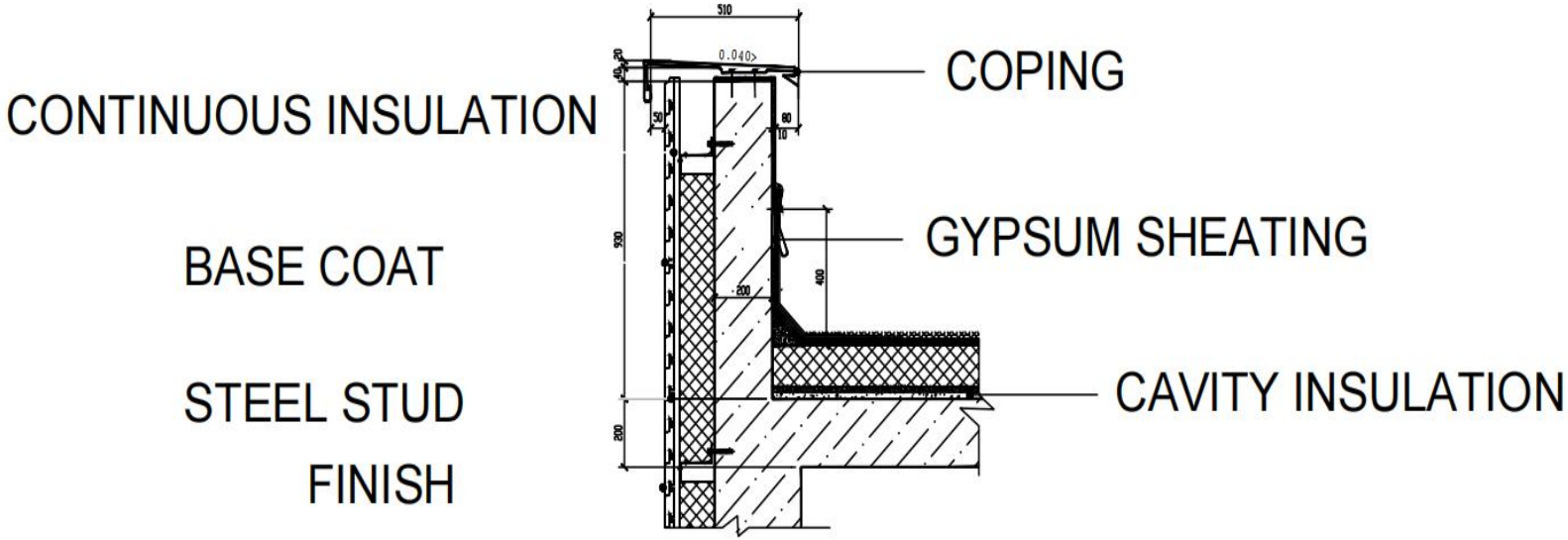
ROOF TRUSS DETAIL

SCALE : 1 : 20



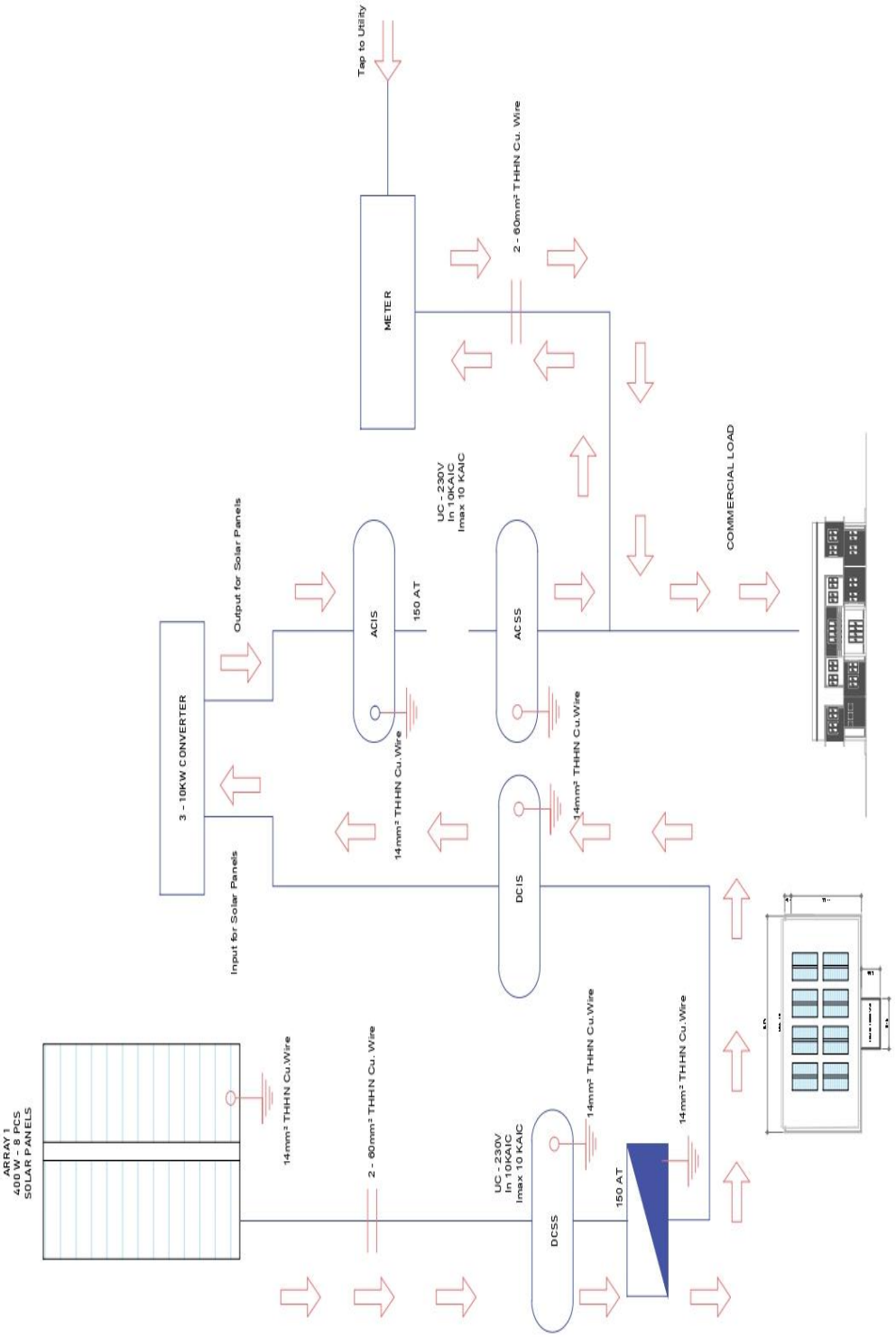
RAFTER DETAIL

SCALE NTS

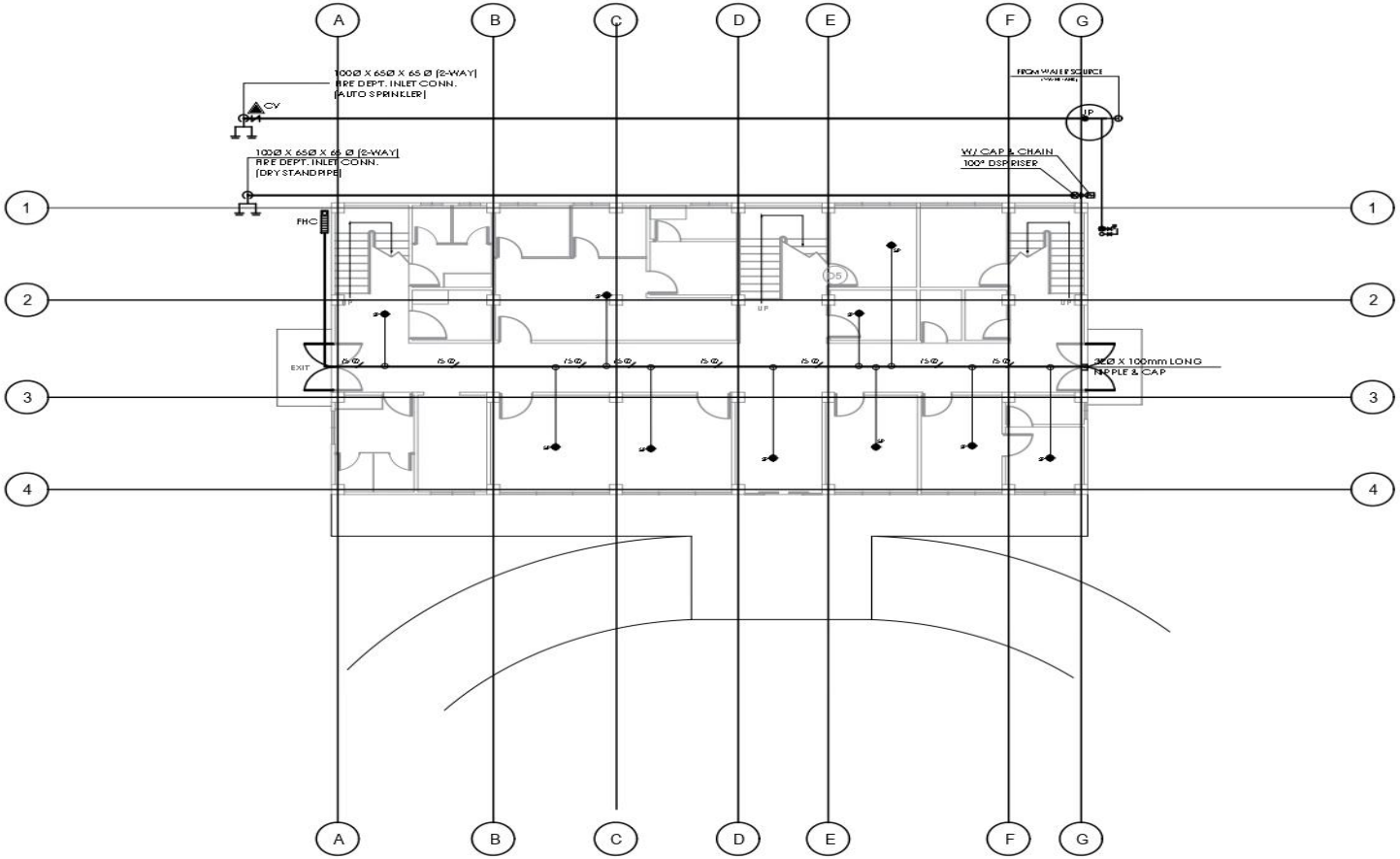


PARAPET WALL DETAIL

SCALE : 1 : 20

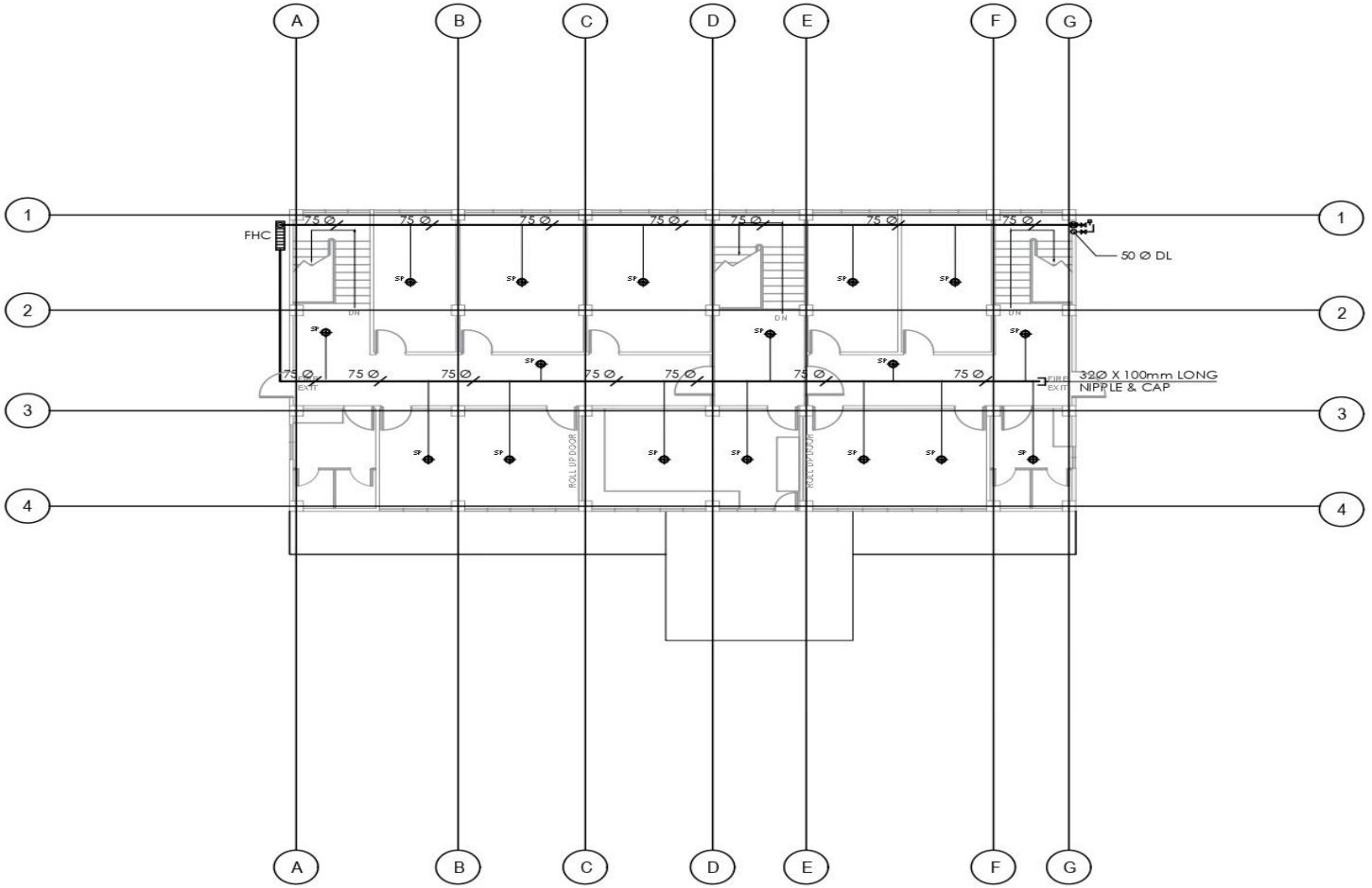

Tap to Utility
METER
2 - 60mm² THHN Cu. Wire
UC - 230V
In 10KAIC
Imax 10 KAIC
COMMERCIAL LOAD
3 - 10KW CONVERTER
Output for Solar Panels
ACIS
150 AT
ACSS
14mm² THHN Cu.Wire
DCIS
14mm² THHN Cu.Wire
Input for Solar Panels
ARRAY 1
400 W - 8 PCS
SOLAR PANELS
14mm² THHN Cu.Wire
2 - 60mm² THHN Cu. Wire
UC - 230V
In 10KAIC
Imax 10 KAIC
DCSS
14mm² THHN Cu.Wire
150 AT
14mm² THHN Cu.Wire
SOLAR PLAN
SCALE :
1 : 50

MECHANICAL PLANS



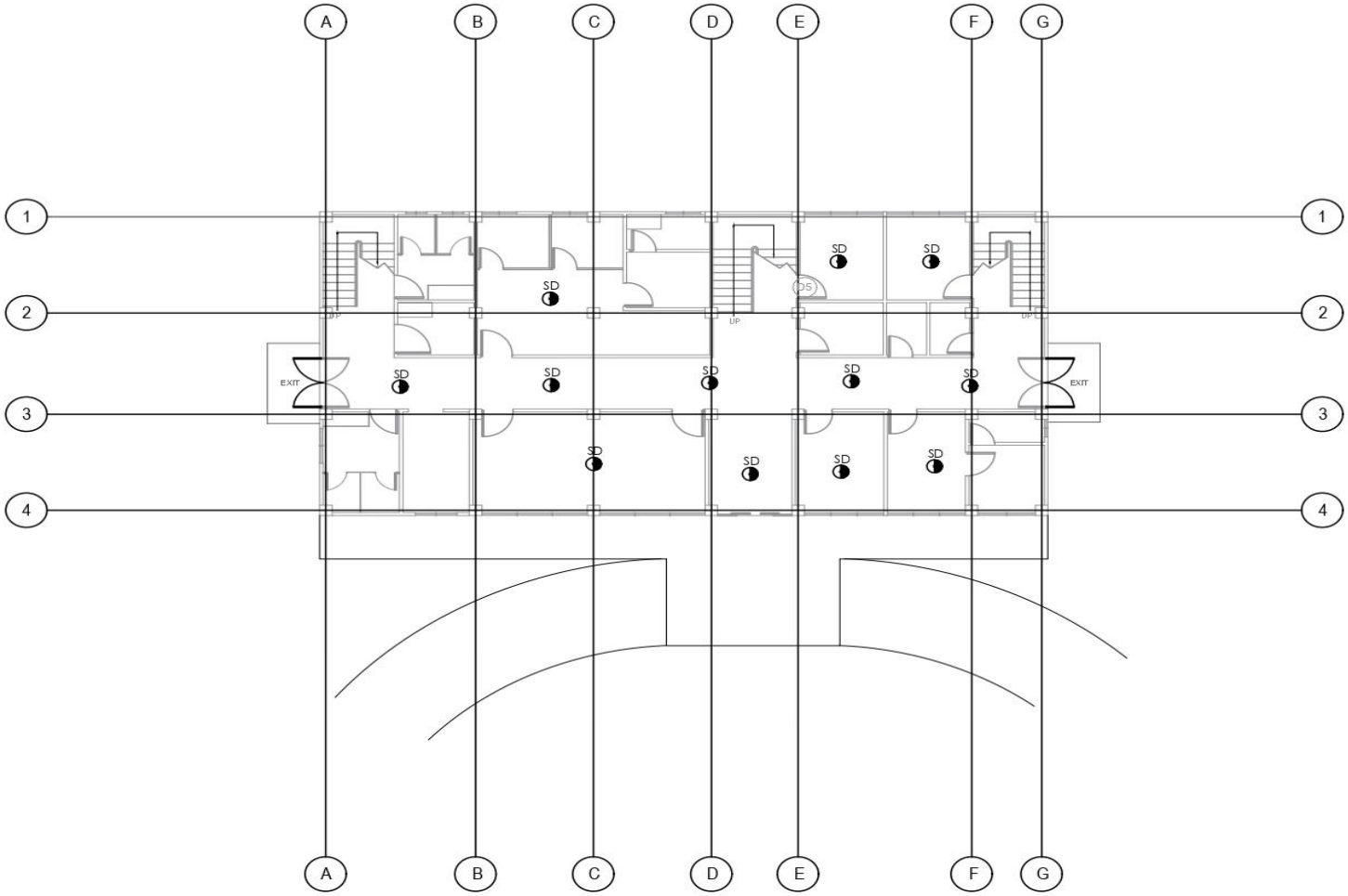
GROUND FLOOR FIRE PROTECTION LAYOUT (SPRINKLER) PLAN

SCALE : 1 : 100



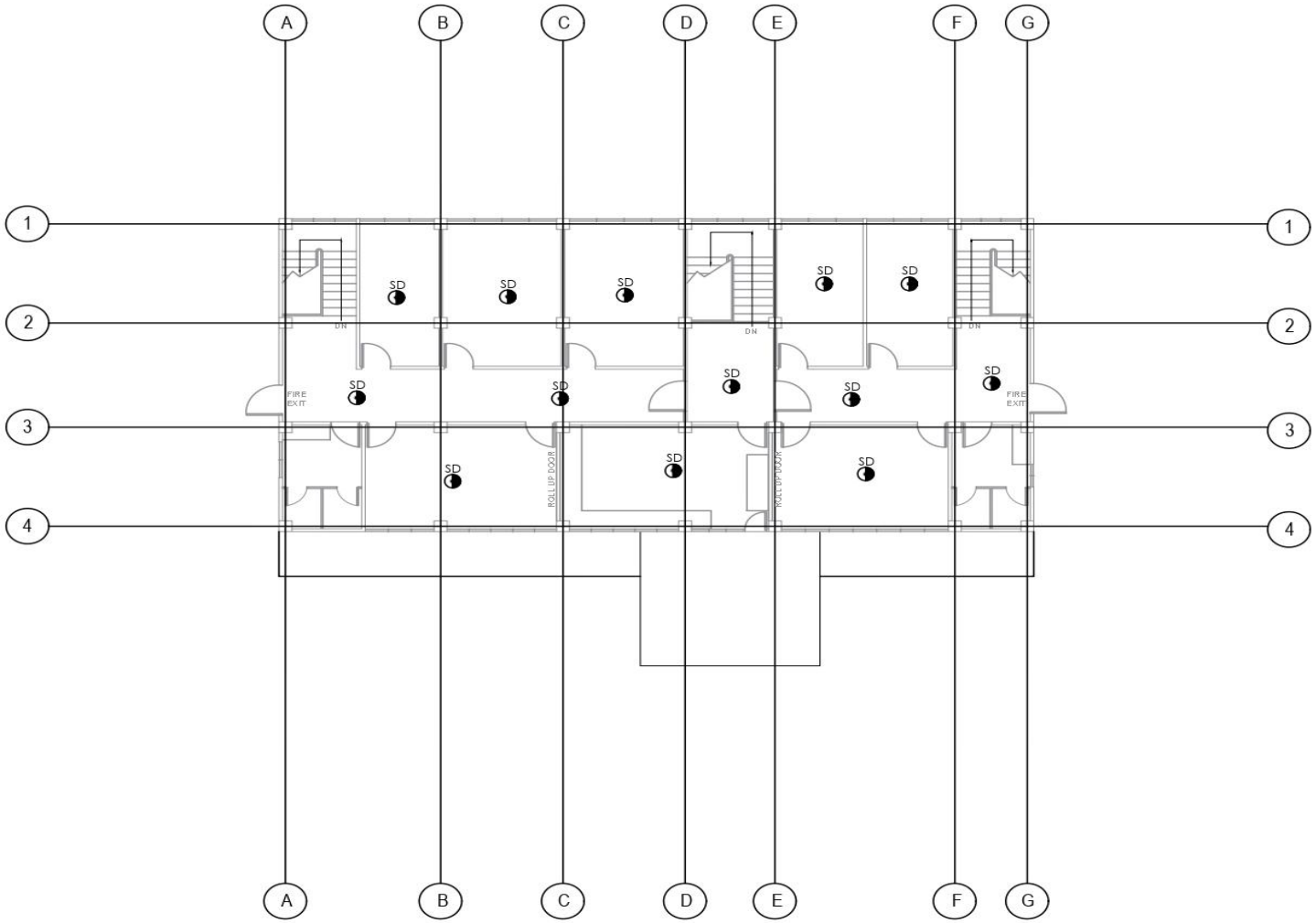
SECOND FLOOR FIRE PROTECTION LAYOUT (SPRINKLER) PLAN

SCALE : 1 : 100



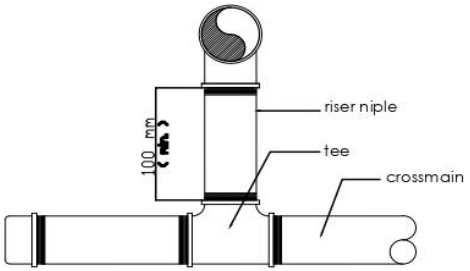
GROUND FLOOR SMOKE DETECTOR LAYOUT PLAN

SCALE : 1 : 100

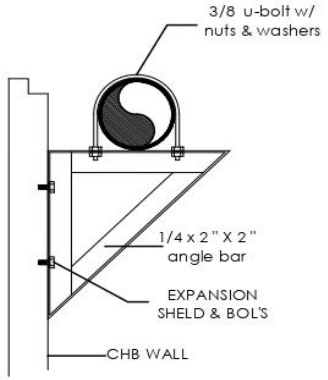


SECOND FLOOR SMOKE DETECTOR LAYOUT PLAN

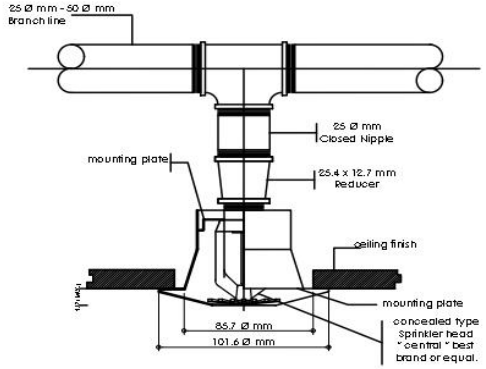
SCALE : 1 : 100



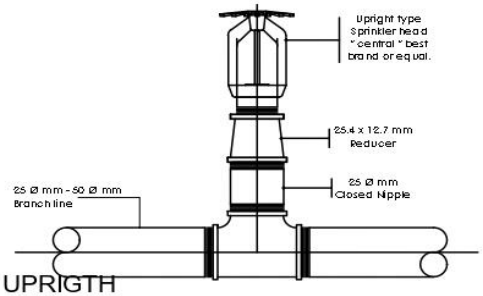
DETAIL OF FLUSHING CONNECTION
SCALE : NTS



DETAIL OF PIPE BRACKET
SCALE : NTS

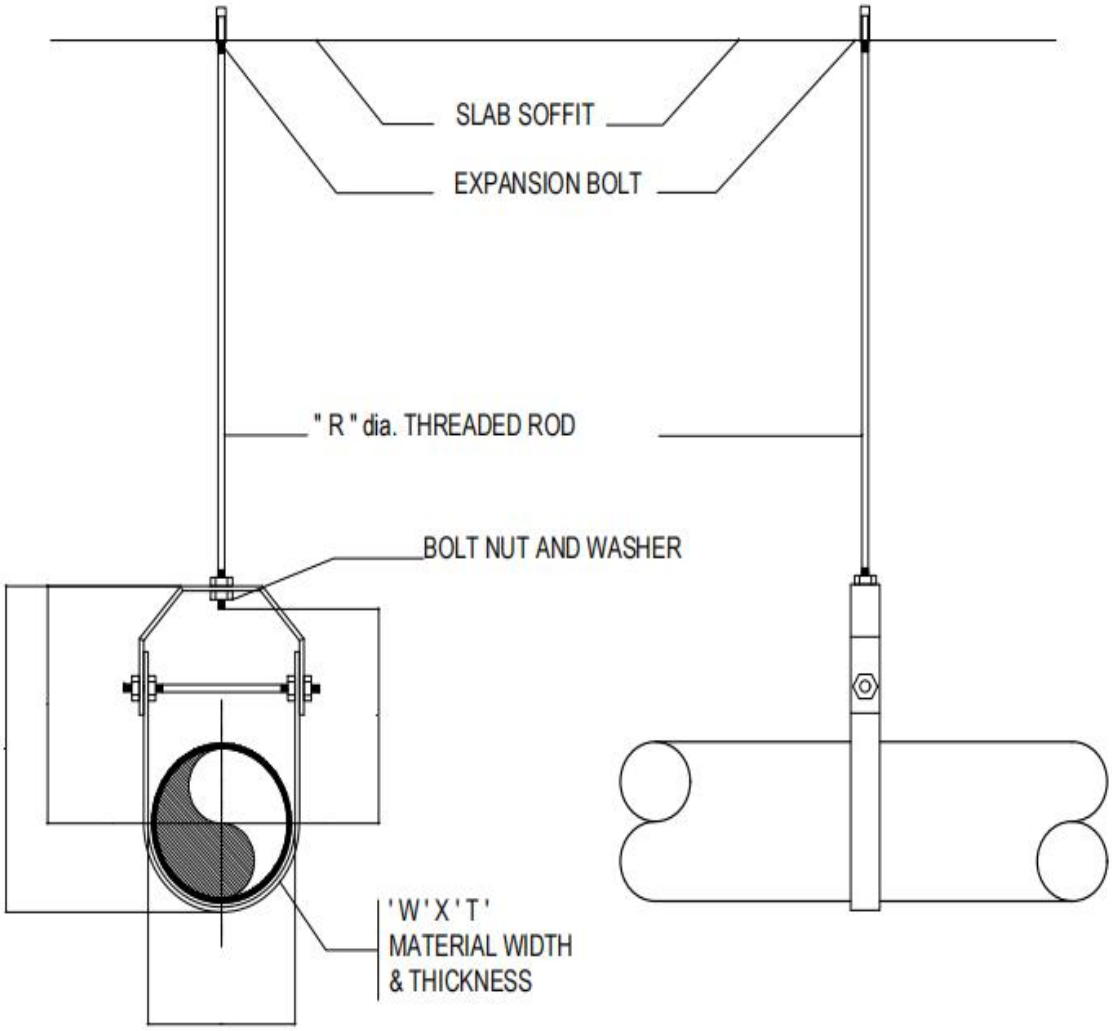


PENDENT



UPRIGTH

SCHEDULE OF PIPE BRACKET / BRACING			
PIPE SIZE	U - BOLT DIA.	ANGLE BAR	EXPANSION BOLT
50	10	50 X 50	10
65	10	50 X 50	10
75	10	50 X 50	10
100	12	65 X 65	12



DETAIL OF PIPE HANGER

SCALE : NTS

GENERAL NOTES :

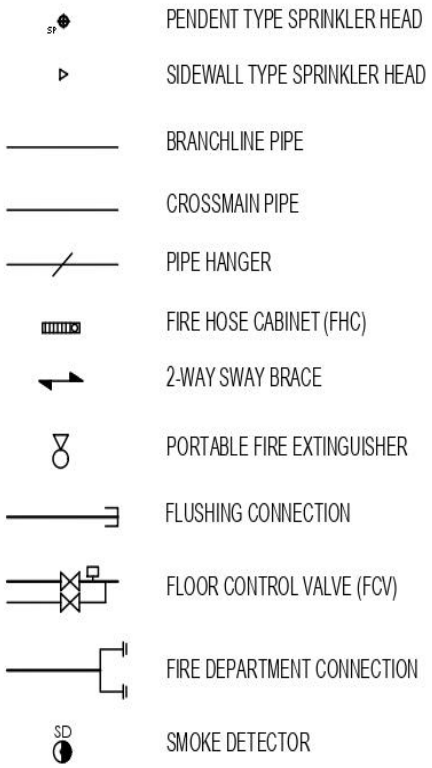
1. ALL INSTALLATION SHALL FOLLOW THE PERTINENT NFPA-13 STANDARDS.
2. FOR AREAS WITH AN EXISTING FIRE PROTECTION SYSTEM LAYOUT, DESIGN MODIFICATIOS SHALL BE SUBJECT TO ADMIN. APPROVAL.
3. IN AREAS WHERE NON-COMBUSTIBULE (ACOUSTIC TYPE TYPE OR THE LIKE) DROP CEILING INSTALLED, INSTALL PENDENT TYPE SPRINKLER HEADS WILL BE SAME TYPE OR BRAND AS WHAT HAVE BEEN.
4. IN AREAS WHERE NON-COMBUSTIBULE (PLYWOOD) DROP CEILING AN UPRIGHT TYPE SPRINKLER HEAD SHALL BE INSTALL ON CEILING VOID.
5. ALL AREAS ROOM SPACE, PENDENT TYPE SPRINKLER HEADS SHALL BE USED WITH ESCUTCHEON PLATES.
6. DISTANCE OF SPRINKLER HEAD (PENDENT OR UPRIGHT) TO A WALL OR HIGH PARTITION MUST NOT EXCEED 2.25M.
7. MAXIMUM DISTANCE OF A SPRINKLER UNIT FROM THE SLAB SHOULD BE 300MM.
8. MAXIMUM COVERAGE OF ONE SPRINKLER HEAD (PENDENT OR UPRIGHT TYPE) IS EQUIVALENT TO A ROOM DIMENSION OF 4.5 X 4.5M (AREA). IRREGULAR CEILING OR CEILING WITH OBSTRUCTION (NOT FLAT) SHALL BE SUBJECT TO THE FIRE PROTECTION CONSULTANT APPROVAL.
9. PIPES SHALL BE BLACK IRON (B.I.) PIPES, SCHEDULE 40 WITH FIRST AND FINAL COATING OF SAFETY RED PAINT. FITTINGS SHALL CONFORM WITH ASTM, A 53/A153.
10. ALL PIPE LINE SHALL BE B.I. PIPE SCHEDULE 40 AND TO BE SUBJECTED TO HYDROSTATIC TEST OF NOT LESS THAN 200 PSI FOR TWO HOURS. NO VISIBLE LEAKAGE FOR INSIDE SPRINKLER PIPING SHALL BE ALLOWED.
11. PIPE SLEEVE SHALL BE PROVIDED ON EVERY PIPES PASS THROUGH WALLS AND BEAM, AND FIRE SEALANT SHALL BE THE SAME FIRE RATING OF WALLS/PARTITION.

MATERIAL SPECIFICATIONS :

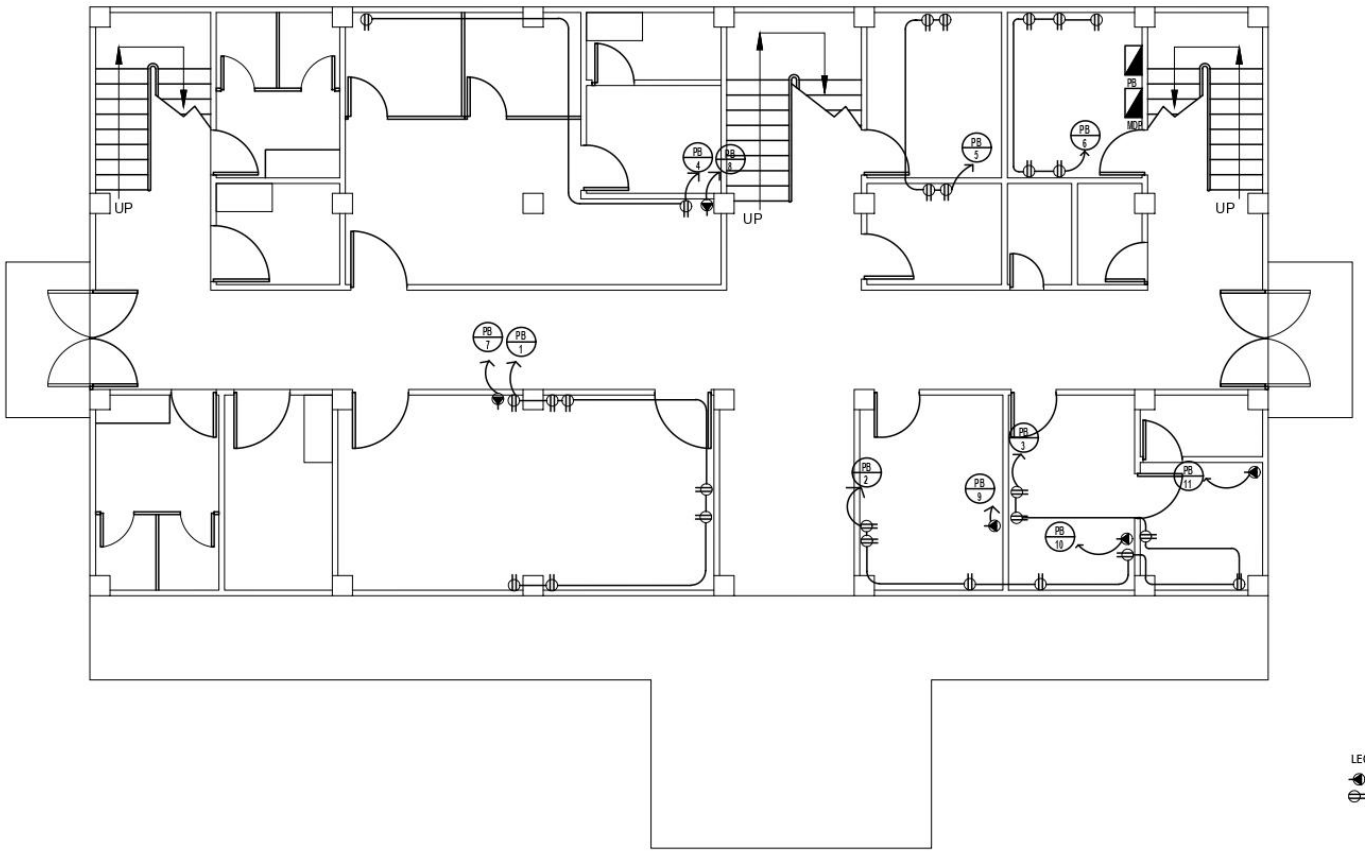
FIRE LINES — FIRE LINES SHALL BE BLACK IRON (B.I.) PIPES SCHEDULE 40 "STANDARD" CONFORMING TO ASTM A-120-1980 "APO" OR "SUPER" BRAND OR APPROVED EQUIVALENT.

SPRINKLER HEADS — ALL SPRINKLER HEADS, PENDENT (CONCEALED, UPRIGHT & SIDEWALL) SHALL BE RATED 57°C (135°F) TO 74°C (165°F) AHU, MACHINE ROOM, KITCHEN AREA SHALL BE RATED 212°F.

LEGEND :

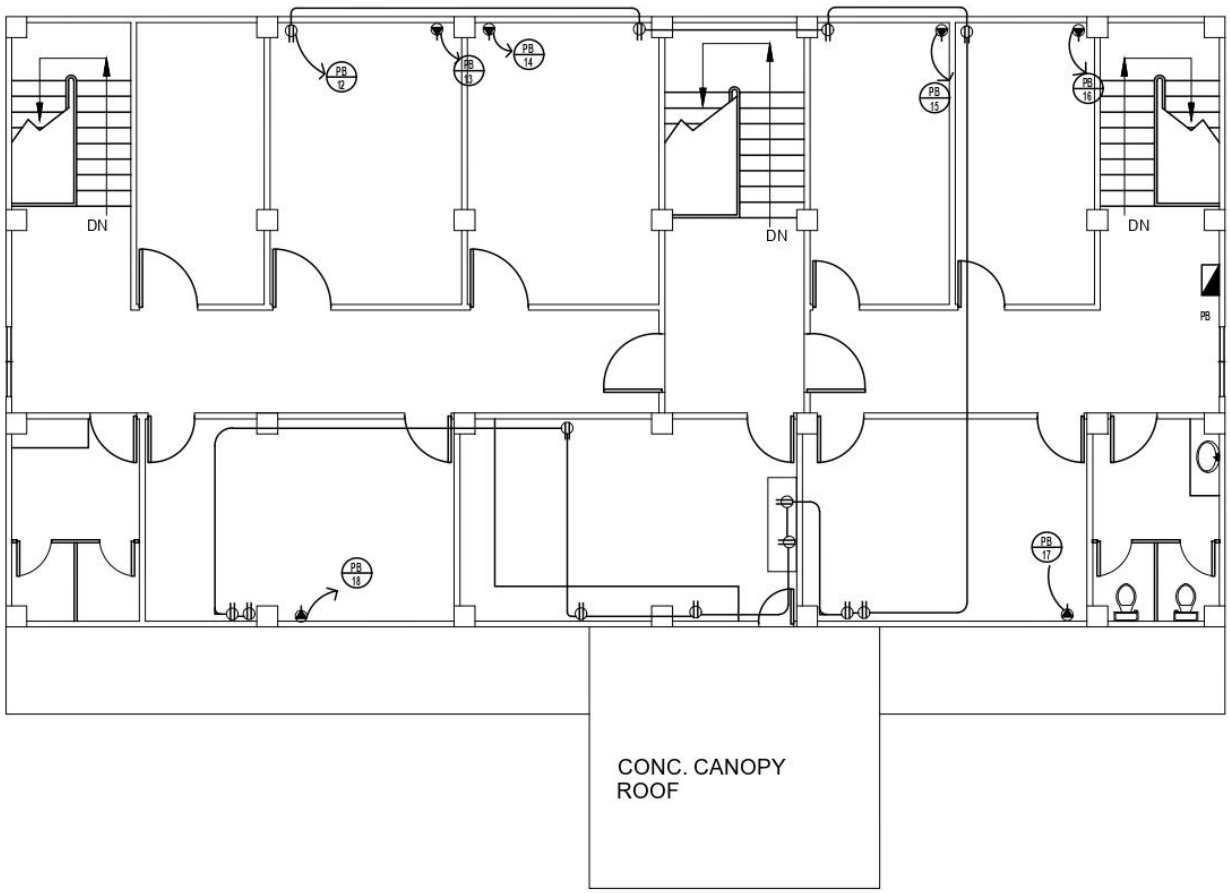


ELECTRICAL PLANS



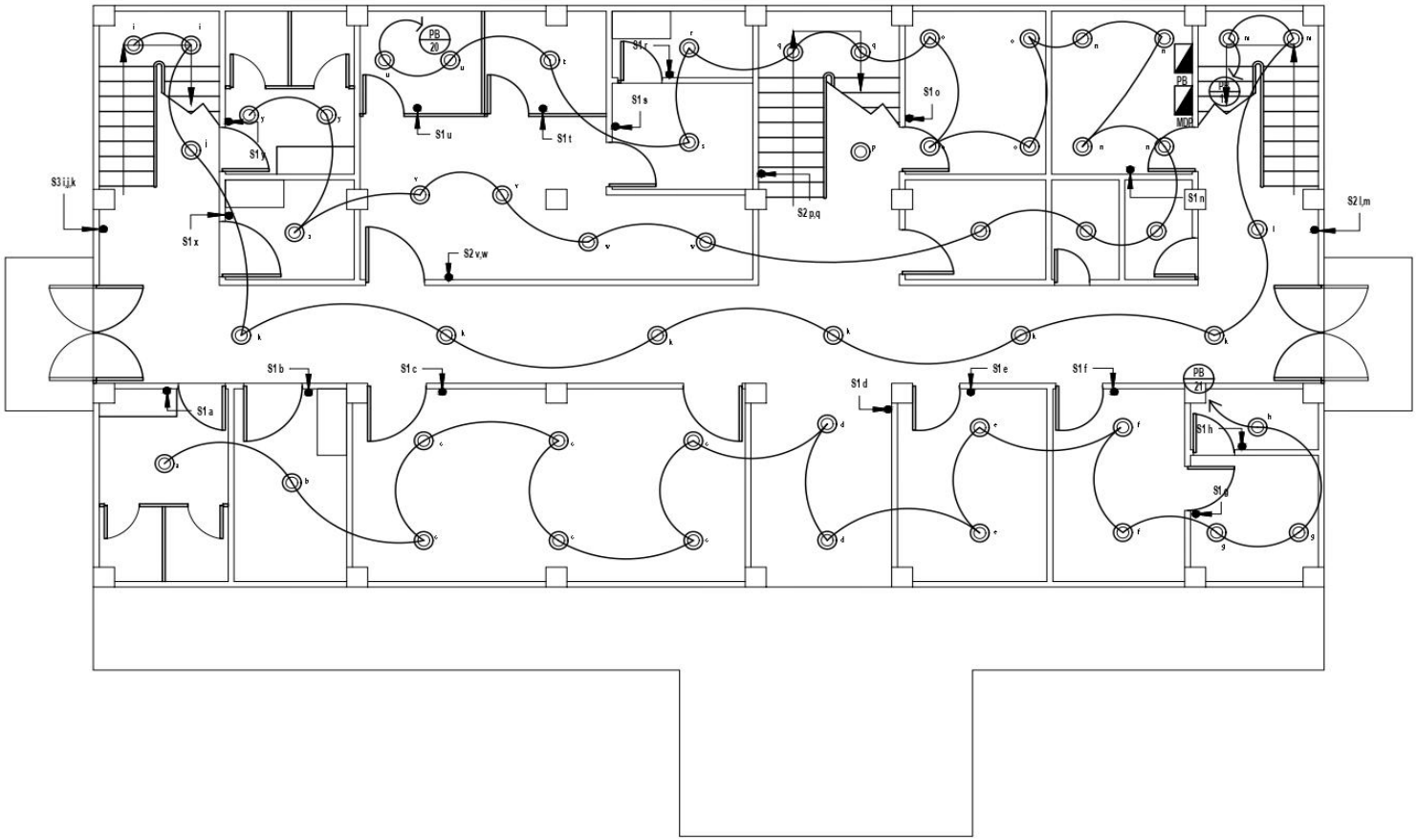
GROUND FLOOR PLAN POWER LAYOUT

SCALE : 1 : 100



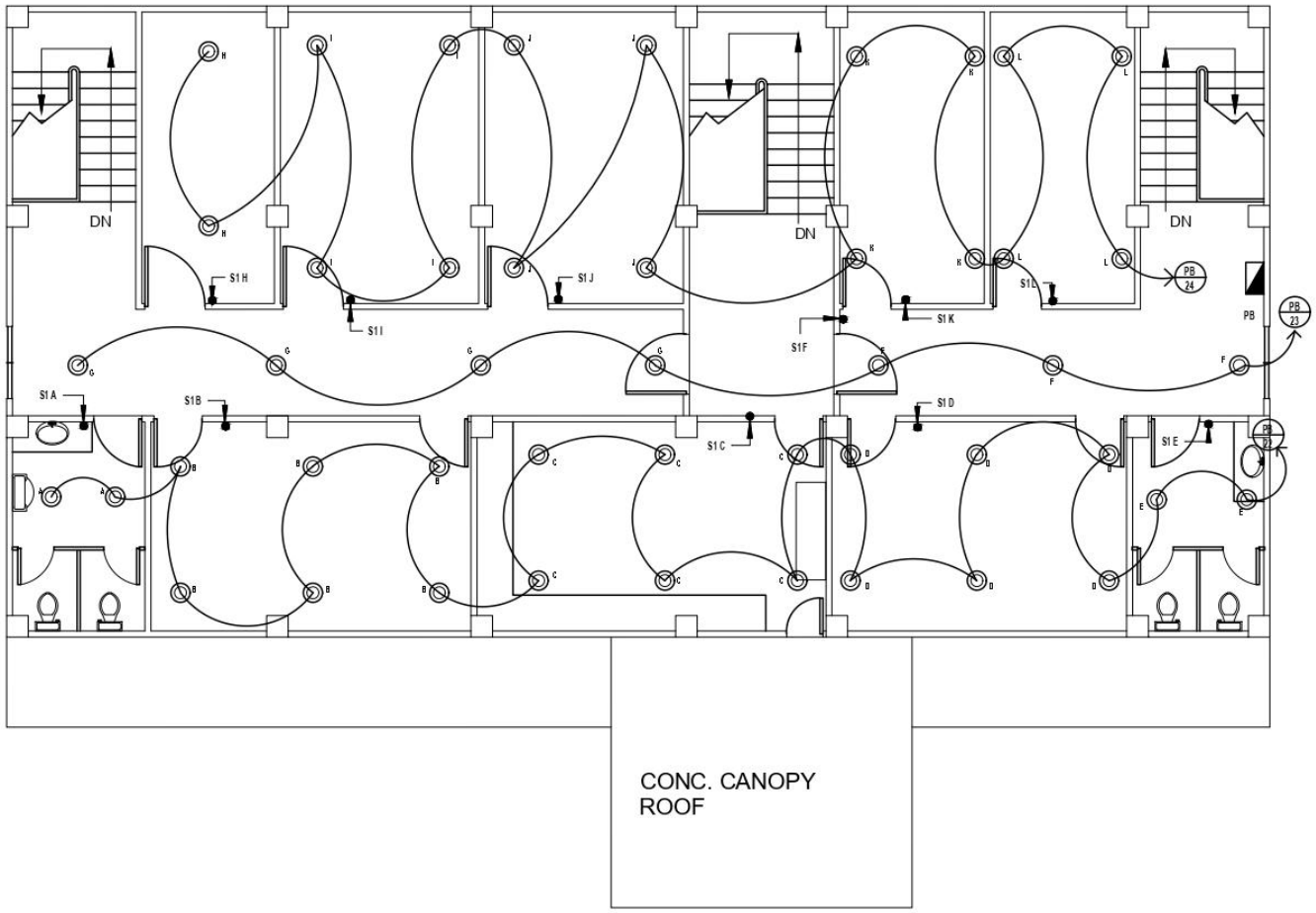
SECOND FLOOR PLAN POWER LAYOUT

SCALE : 1 : 100



GROUND FLOOR PLAN LIGHTING LAYOUT

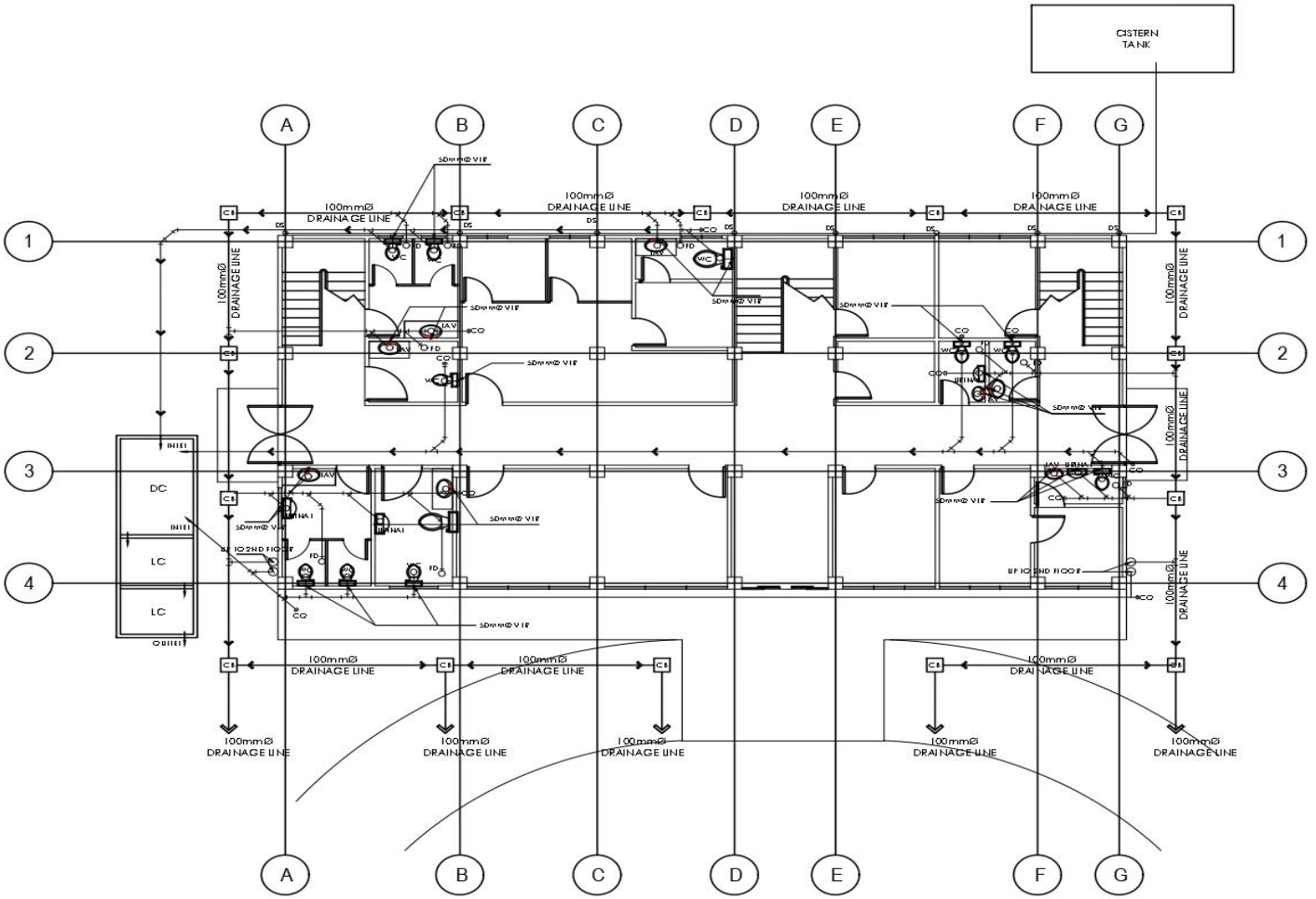
SCALE : 1 : 100



SECOND FLOOR PLAN LIGHTING LAYOUT

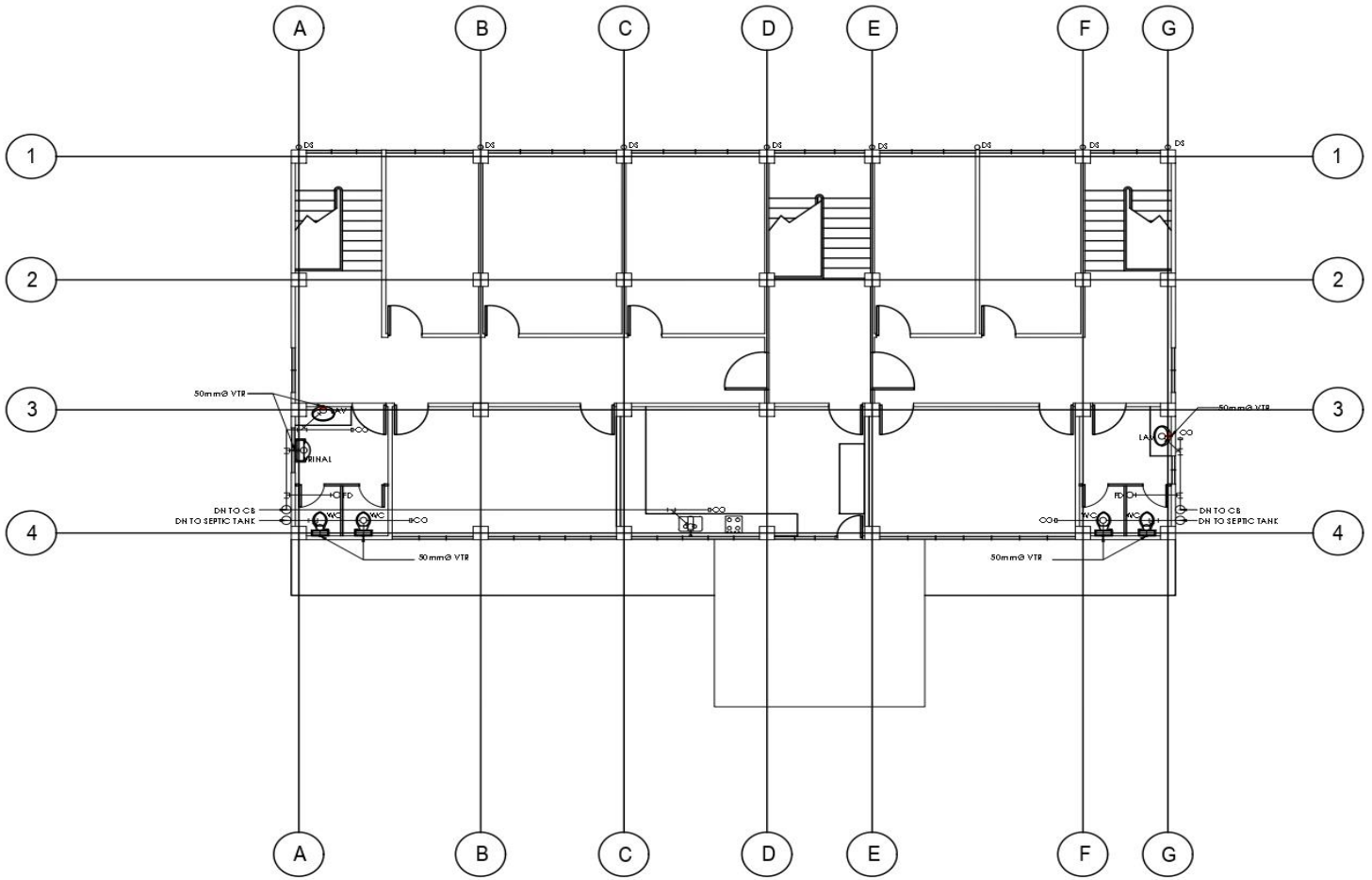
SCALE : 1 : 100

PLUMBING PLANS



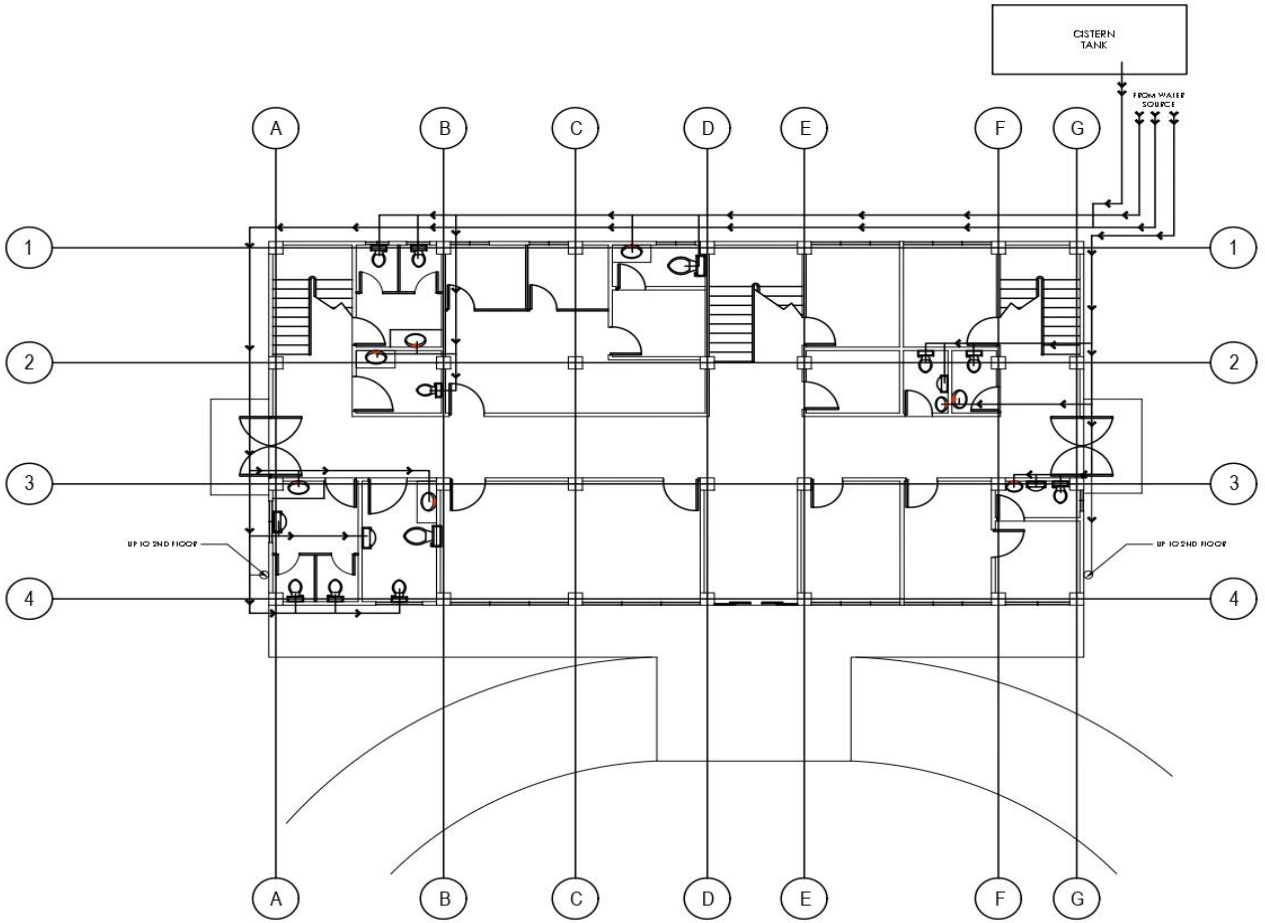
GROUND FLOOR SANITARY LINE PLAN

SCALE : 1 : 100



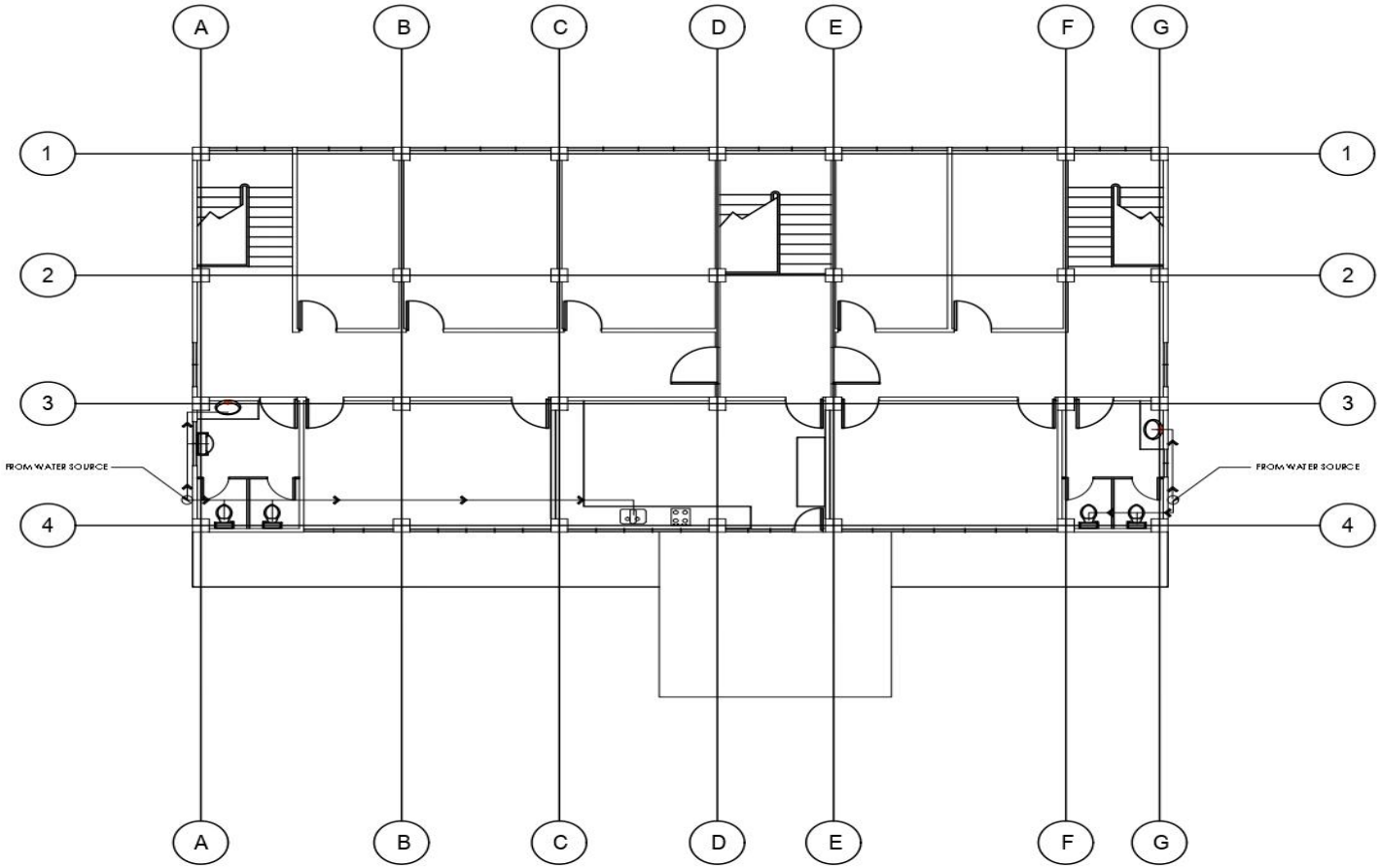
SECOND FLOOR SANITARY LINE PLAN

SCALE : 1 : 100



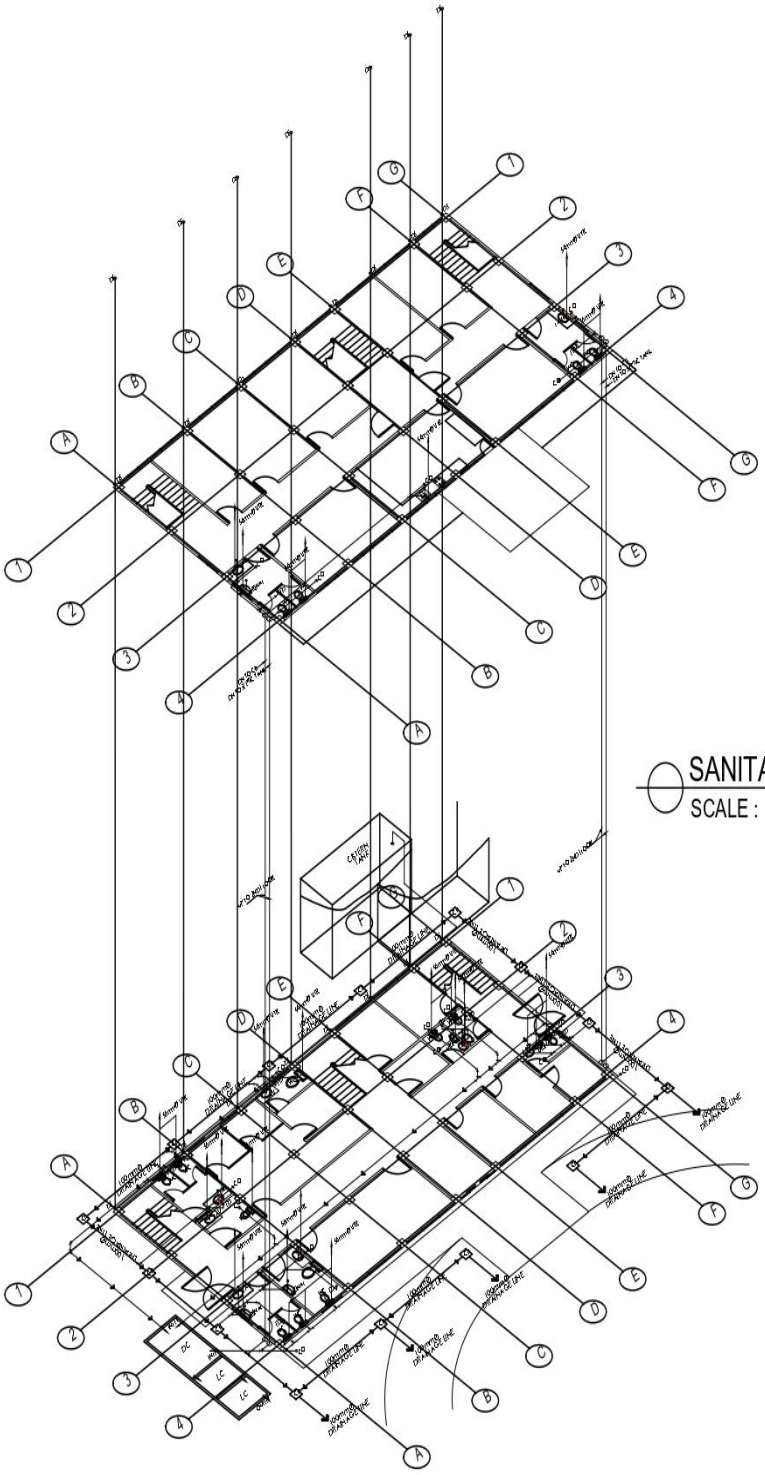
GROUND FLOOR WATER LINE PLAN

SCALE : 1 : 100



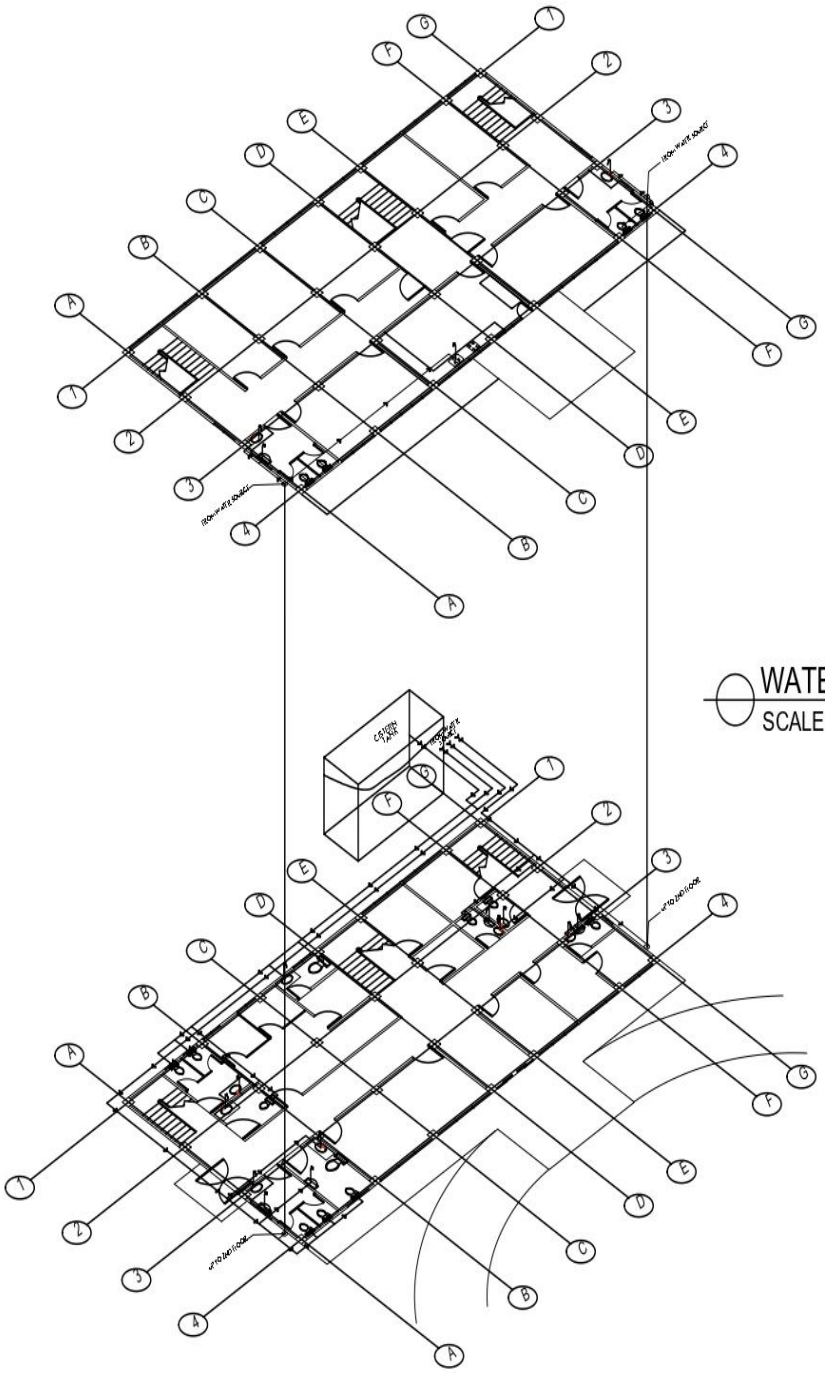
SECOND FLOOR WATER LINE PLAN

SCALE : 1 : 100



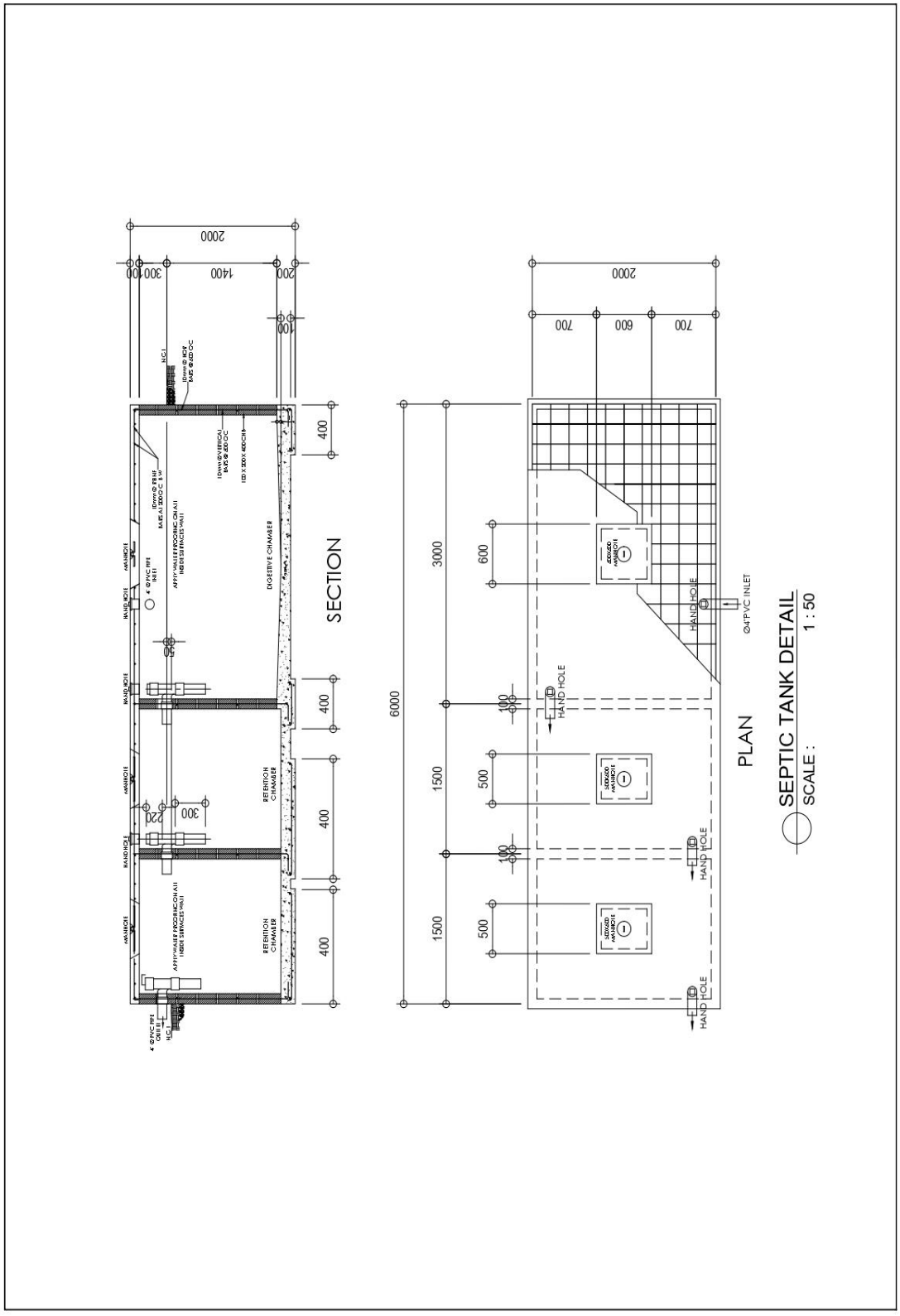
SANITARY LINE ISOMETRIC VIEW

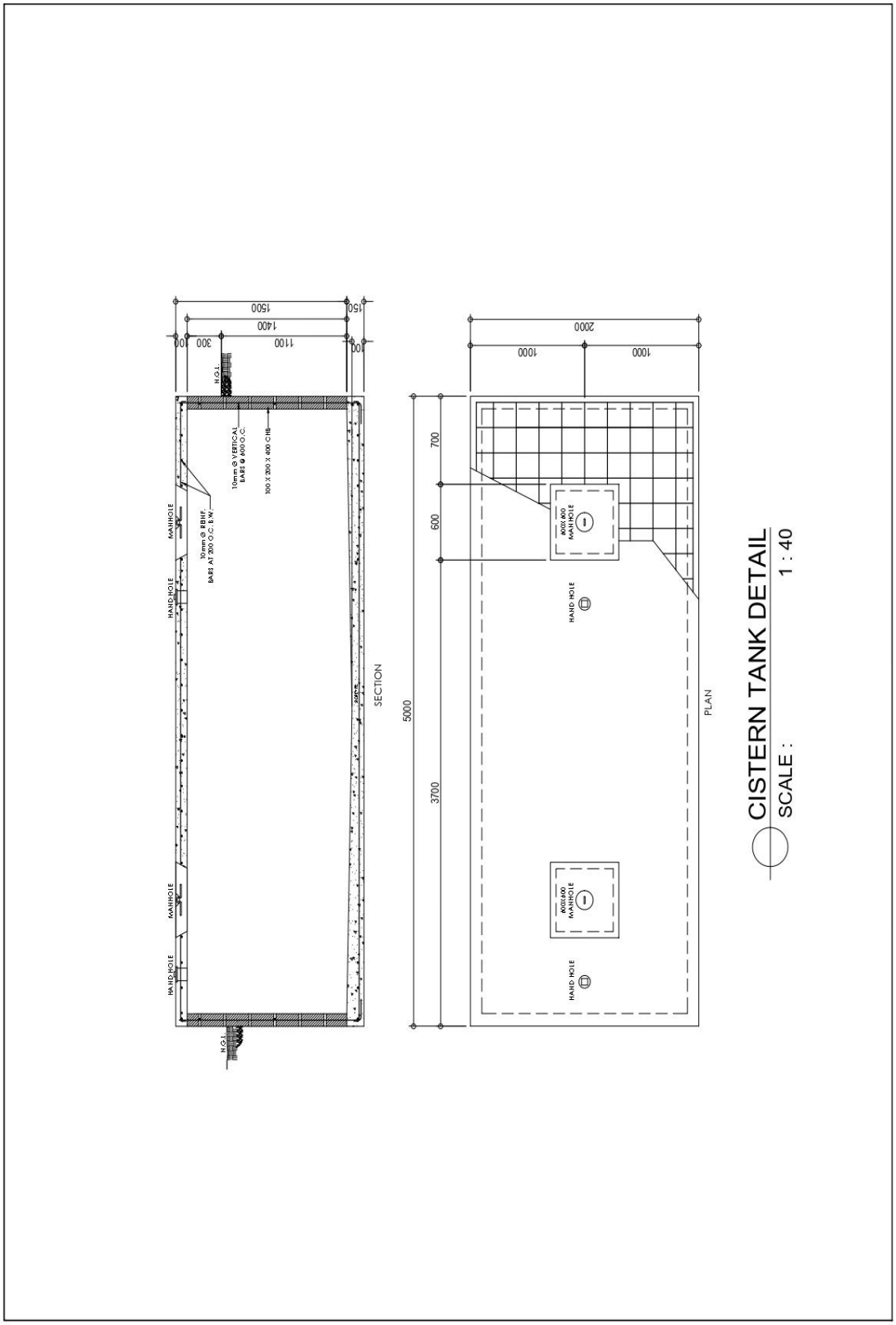
SCALE : 1 : 100



WATER LINE ISOMETRIC VIEW

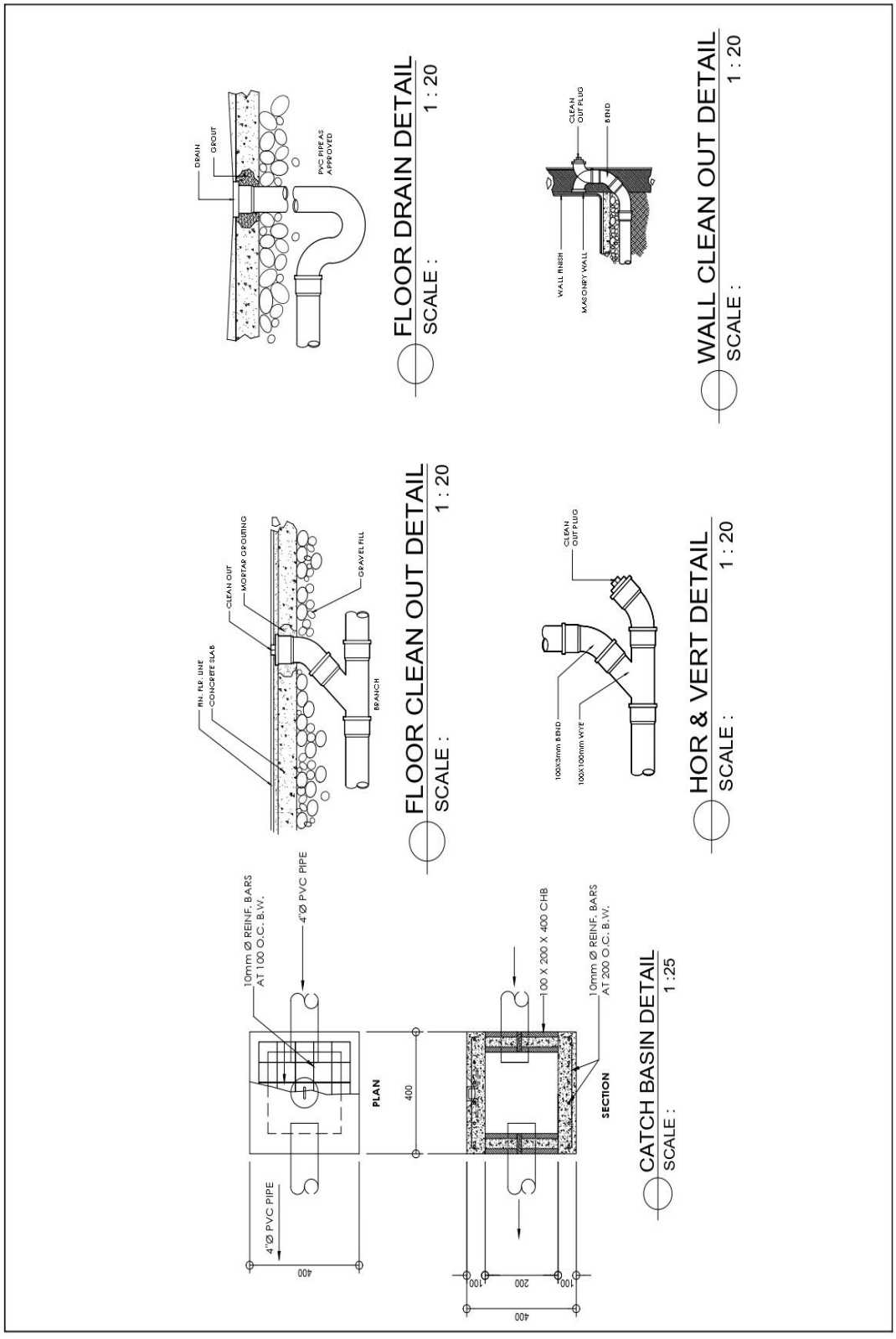
SCALE : 1 : 100


SECTION
PLAN
SEPTIC TANK DETAIL
SCALE : 1 : 50
2000
1400
300
100
200
400
6000
3000
1500
600
500
100
700
HAND HOLE
Ø4"PVC INLET
DIGESTIVE CHAMBER
SEDIMENTATION CHAMBER



CISTERN TANK DETAIL

SCALE : 1 : 40


DRAIN
GROUT
PVC PIPE AS APPROVED
FLOOR DRAIN DETAIL
SCALE : 1 : 20
WALL FINISH
MASONRY WALL
CLEAN OUT PLUG
BEND
WALL CLEAN OUT DETAIL
SCALE : 1 : 20
RN. FLR. LINE
CONCRETE SLAB
CLEAN OUT
MORTAR GROUTING
GRAVEL FILL
BRANCH
FLOOR CLEAN OUT DETAIL
SCALE : 1 : 20
CLEAN OUT PLUG
100X3mm BEND
100X100mm WYE
HOR & VERT DETAIL
SCALE : 1 : 20
10mm Ø REINF. BARS AT 100 O.C. B.W.
4"Ø PVC PIPE
4"Ø PVC PIPE
400
PLAN
400
100 X 200 X 400 CHB
10mm Ø REINF. BARS AT 200 O.C. B.W.
SECTION
400
200
100
100
CATCH BASIN DETAIL
SCALE : 1:25

UNDERTAKING:

I _____ do hereby agree that the top slab of septic vault shall not be constructed, or put into place, not after inspection by the master plumber in-charge of the construction and after appropriate inspection report forms have been signed by this master plumber, that indeed, the septic vault is water tight/waterproofed. This signed report form shall then be attached by me when applying for the Certificate of Occupancy.

The undersigned also acknowledge to abide with the provision as stated on the table b-1 of the National Plumbing Code of the Philippines.

Owner

LEGEND:

———————	SOIL PIPE LINE
———————	WASTE PIPE LINE
——— – ———	WATER PIPE LINE
⋈	GATE VALVE
CB	CATCH BASIN
CO	CLEAN OUT
WC	WATER CLOSET
LAV	LAVATORY
FD	FLOOR DRAIN
FAU	FAUCET
DC	DIGESTIVE CHAMBER
LC	LEACHING CHAMBER

SPECIFICATIONS:

All plumbing works shall conform with the provisions of R.A. 1378, plumbing code of the Philippines 1985 and the rules and regulations of the local health office.

All plumbing fixtures, pipes, fittings and accessories shall be approved quality, free from all defects and deformations.

All vent thru roof pipes shall be extended from roofing at least 300mm.

Septic vault shall be constructed waterthight / waterproofed to eleminate seepage and located at the safe distance from an existing wate supply well.

Outflow from septic vault shall be discharged directly to the street sewer. Drain pipes and catch basin discharging outflow to the septic vault shall also be constructed watertight / waterproofed to prevent leakage to percolate.

Whenever available potable water requirements for a building use for human habitation shall be supplied from existing municipal or city water works system as per section 102, chapter 9 of the national building code.

All plumbing works shall be done by experience plumbers under the direct supervision of a registered master plumber or sanitary engineer.

Chapter VI

Project Implementation

6.1 Implementing Scheme

The project study, Proposed Balay Silangan in Barangay Caraudan, Janiuay Iloilo, was presented to the Barangay Office as an orientation to the project proposal. It was then sent to the Provincial Planning and Development Office and the Department of Public Works and Highways for a review of project specifications and cost estimates, as well as any changes if possible. Upon the approval of the PPDO and DPWH, the contents of this study, which consisted of the plans and designs, would only serve as a reference for the actual project proposal in the future.

6.2 Financing

The primary source of funds for the Proposed Balay Silangan in Barangay Caraudan, Janiuay, Iloilo will come from the budget of the Barangay and Municipality. The budget will be assisted by the Municipal Mayor and through the fund raising campaign of the barangay.

6.3 Construction Management, Operation and Maintenance

The Provincial Engineer's Office, Provincial Planning and Development Office, and Department of Public Works and Highways will be solely responsible for project management during construction. It was suggested that during the course of construction, the inspector must be employed to check if plans and specifications are strictly followed. The provincial administration will be responsible for the operation and maintenance of the structure.

Chapter VII

Summary, Conclusions and Recommendations

7.1 Summary

As a Class A municipality in Iloilo province and ranked 6th for drug offenders, the Municipal Social Welfare and Development Office (MSDWO) of Janiuay decided to address this need by proposing the design of a two-story Balay Silangan for Janiuay and its neighboring municipalities. The proposed Balay Silangan in Barangay Caraudan is essential infrastructure for the community.

The Balay Silangan is considered the first facility in the barangay capable of accommodating large gatherings, including sports, social events, and other important occasions. Currently, the barangay lacks sufficient structures for such events due to the damage caused by Typhoon Frank in 2008.

The design structure included an isolation facility, the Center Head Office, Office Staff Area, conference room, pantry, mess hall, utility room, kitchen, counseling/interview room, observation room, clinic, lobby/waiting area, toilet and bath, sleeping area/bedrooms, living area, dining area, laundry room, and study area/mini-library. The overall floor space is approximately 441 square meters. The Balay Silangan could accommodate 30 surrenderees. With the implementation of this project, it would create an improvement in the local unit.

7.2 Conclusion

The proposed study successfully provided the design of a two-storey Balay SIlangan in Janiauy, Iloilo. The design focused mainly on the structural aspect of the Balay Silangan.The proposed building underwent comprehensive inspection, covering architectural, structural, plumbing, and electrical plans, along with the integration of green

technology were made in accordance with existing codes, rules, and regulations. Cost estimates and material quantities were aligned with the estimated construction timeline. The identified problems such as the large number of offenders and lack of rehabilitation center were addressed as shown in Table 11.

Table 11

Problems addressed in Chapter I

Problem Definition	Solutions Incorporated in the design
Large number of offenders	Designed a Two-storey Balay Silangan to help drug offenders transform into law- abiding members of the society.
Lack of rehabilitation center	Designed a Two-storey Balay Silangan with needed facilities having a total floor area of 441 m^2.

We successfully collected data on the proposed two-story project through thorough soil testing and investigation, which would be used to design the building's foundation. This procedure was designed to evaluate the permitted soil carrying capacity and project site dimensions for the proposed two-story Balay Silangan building. The Balay Silangan will serve as a rehabilitation facility for drug offenders from Januiay, Iloilo, and surrounding municipalities. The aforementioned accomplishments included the achievement of all research objectives.

General Objective

The main objective of this study was met by designing for a two-storey Balay Silangan in Janiuay, Iloilo.

Specific Objectives

During the course of this investigation, the following specific objectives were achieved:

a. Interviewed and assessed the population and proportions of drug offenders, as well as the facility capacity essential for the proposed design of the two-storey Balay Silangan.

- The following data that are needed were obtained with the help Social Work Officer (SWO1) Julie P. Lucine, Head of the Municipal Social Welfare Developent Office (MSWDO) and Police Officers headed by Police Captain Alwin Salmonby of Janiuay, Iloilo.

b. Performed geotechnical investigations and topographic survey for the designated lot area.

- The data needed for geotechnical investigations and topographic survey for the designated lot area were obtained with the help of Engr. Lyndon Erl C. Beup.

c. Developed architectural, structural, plumbing, and electrical designs while integrating building codes and sustainable features into the project's design.

- Completed all engineering plans were provided though the help and guidance of different professionals and incorporated green building technologies in the design.

d. Generated estimates for the project costs.

- The researchers utilized their expertise in Quantity Surveying to accurately conduct the cost estimation, culminating in a projected project cost of Php 18,527,289.32.

e. Established a project schedule.

- The researchers efficiently formulated the project timetable based on the finalized project cost projections. Through the utilization of PERT-CPM methodology, they projected that the project would reach completion within 320 days.

7.3 Recommendation

The proposed two-story Balay Silangan would function as a comprehensive rehabilitation center for drug offenders, providing an encouraging environment in which they can recover and reintegrate into society. The project should include detailed designs, specifications, cost estimates, and a structured rehabilitation program schedule. This structure will allow drug offenders to acquire counseling, skills training, educational programs, and livelihood services aimed at rehabilitation and reintegration. Counseling rooms, skill training rooms, leisure areas, and housing for persons undergoing rehabilitation will be among the facilities that would be provided. The Balay Silangan must prioritize accessibility and inclusivity, with ramps for easy access, facilities for people with disabilities, and separate rooms for men and women to ensure comfort and privacy. Given the pressing need for effective drug rehabilitation programs, the first recommendation is to move forward with the implementation of the Balay Silangan project proposal.

Soil investigations were conducted to assess various soil characteristics and properties, with the option for additional tests upon request by the engineer. Furthermore, it is advised to conduct a thorough review and evaluation of the structural analysis and design to ensure the accuracy of calculations and design methodologies, thus ensuring the

structural integrity.

The design and analysis of the Two-storey Balay Silangan were done under the supervision of the faculty members from the Civil Engineering Department and accredited Engineers. Modifications can be incorporated based on feedback from the Municipal Engineering Office (MEO) and the Municipal Social Welfare and Development Office (MSDWO). Additionally, it is important to note that material costs are subject to fluctuations, necessitating a reassessment before commencing construction to ensure accurate budgeting.

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APPENDICES

APPENDIX A

LETTERS AND CERTIFICATIONS

COLLEGE of ENGINEERING
CENTRAL PHILIPPINE UNIVERSITY
ILOILO CITY PHILIPPINES
Tel Nos (033) 329 1971 (to79) local 1082
Fax No (033) 320 3004
CIVIL ENGINEERING DEPARTMENT

September 9,

Mayor Paulino M. Parian
Municipality of Janiuay
Iloilo, Province

Dear Mayor Parian,

Greetings!

The Bachelor of Science in Civil Engineering (BSCE) curriculum in the Philippines requires civil engineering students to develop a practice-based design or research which incorporates the various aspects of a typical engineering undertaking. At Central Philippine University (CPU), Iloilo City, Service Learning (SL) is integrated in this program by requiring all students to conduct a community-oriented design project (CODP) over a period of two semesters.

CE 4131 (Civil Engineering Project I) and CE 4231 (Civil Engineering Project II) are subjects taken by senior BSCE students of CPU. These courses are geared towards the use of civil engineering background in probable community development projects or industry research. Students are grouped by thre members with a civil engineering faculty adviser to undertake a research or project study on the design of civil engineering projects such as water supply system, public market, slaughterhouse, hospital, drainage system, transportation research among others.

This CODP activity requires the students to undergo two defense presentations, a project proposal defense this semester and a final project study defense next semester. During the project proposal stage, the students have to focus on the problems and convince the panel that indeed there is a need for the project. Once the proposal is approved, they could now proceed to the actual research or project study which will include the application of their civil engineering knowledge through technical drawings and details. The project design and details will be refined during the final project study defense. Admittedly, the project study may have deficiencies considering the fact that they are made by students and not by practicing professionals. However, with the help of advisers, we hope that the students can come up with a satisfactory project study. A hard-bound copy of the completed project study will be given to the partner community.

If you are interested in this endeavor, please inform us of your priority projects (in its conceptual stage) of which we could be of assistance through Mr. KC Salcedo, The Team's Project Leader, you may reach him through mobile phone number at: 09508901151 (TNT) or email at: kc.salcedo-20@cpu.edu.ph. The completed project study will be beneficial both to the students as well as the partner community in a sense that (a) the students will have the chance to work on real community projects and apply their civil engineering knowledge as well as understand the value of community service and (b) a priority project of the partner community will have its preliminary design which can be referred to in future project proposals.

Looking forward to a successful partnership with your community.

Thank you.

Yours truly,

ENGR. MARY EARL DARYL A. GRIO
Chairperson, Civil Engineering Department

Favorably Endorsed:

ENGR. DANY C. MOLINA
Dean, College of Engineering

APPROVED

PAULINO M. PARIAN
MUNICIPAL MAYOR

REVIEW, CONTINUING EDUCATION and CONSULTANCY CENTER
Central Philippine University
Jaro, Iloilo City
Tel. No. 329-1971 local 1008 email: rceccsec@cpu.edu.ph
Website: rcecc.cpu.edu.ph

May 13, 2024

CERTIFICATION

This is to certify that the paper entitled **"Proposed Two-Storey Balay Silangan in Janiuay, Iloilo"** by **Nonito E. Barnizo Jr, Pauline Grace S. Lerez, KC S. Salcedo, and Desiree Anne C. Suelan** has undergone Turnitin Similarity Checking with a passing percentage of 10% and has passed the requirements chapters (1-7).

Prepared by:

PINKY E. LUTERO-TONGOL
Staff-in-charged

Approved by:

LENNY ROSE P. MUCHO, EdD
Director, RCECC

DEPARTMENT OF LANGUAGES, MASS COMMUNICATION AND HUMANITIES
College of Arts and Sciences
Central Philippine University
Telephone No: (033)329-1971 local 1060
Fax: (033) 320-3685 | www.cpu.edu.ph | dlmch@cpu.edu.ph

CERTIFICATION

This is to certify that the Project Study entitled **PROPOSED TWO-STOREY BALAY SILANGAN IN JANIUAY, ILOILO** by *Nonito E. Barnizo Jr., Pauline Grace S. Lerez, KC S. Salcedo, Desiree Anne C. Suelan* was checked for grammar and other mechanics of writing.

Issued this 23rd of July 2024.

XYLENE ANN B. TEÑOSO, LPT
Faculty Member

COLLEGE of ENGINEERING
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Tel Nos (033) 329 1971 (to79) local 1082
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CIVIL ENGINEERING DEPARTMENT

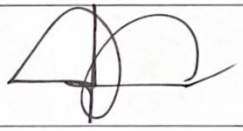
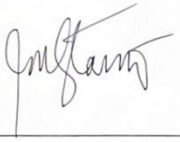
CERTIFICATION

CE 4230: CIVIL ENGINEERING PROJECT STUDY II

This document certifies that the group, as referenced below, has successfully completed a comprehensive consultation and review of various aspects of the project study.

Consequently, the relevant details have been approved for the final output of the Civil Engineering Project Study II.

Project Study Title	Proposed Two-Storey Balay Silangan in Janiuay, Iloilo
Team No.	6
Team Name	Team 6
Team Members	Nonito E. Barnizo Jr.
	Pauline Grace S. Lerez
	KC S. Salcedo
	Desiree Anne C. Suelan

ASPECT	NAME	DATE	SIGNATURE
Structural Analysis and Deisgn	Engr. John Lorenz S. Tuala	15-AUG-24	
Plans, Drawings, and Details	Engr. Lyndon-Erl C. Beup	AUG. 12, 2024	
Cost Estimate and Project Schedule	Engr. Linie Rose D. Santacera	10-10-24	

COLLEGE of ENGINEERING
CENTRAL PHILIPPINE UNIVERSITY
ILOILO CITY, PHILIPPINES
Tel Nos (033) 329 1971 (to79) local 2189
Fax No (033) 320 3004
CIVIL ENGINEERING DEPARTMENT

October 9, 2024

HON. PAULINO M. PARIAN
Municipal Mayor
Janiuay, Iloilo

Dear Mayor Parian,

Greetings!

The 4th year civil engineering students at Central Philippine University (CPU) have completed a project study in one of your priority projects. This project study was conducted for about a year and is one of the requirements for the course, CE 4231 – CE Project II. It is entitled **"PROPOSED TWO-STOREY BALAY SILANGAN IN JANIUAY, ILOILO"** and authored by: **NONITO E. BARNIZO JR, PAULINE GRACE S. LEREZ, KC S. SALCEDO AND DESIREE ANNE C. SUELAN.**

This project study had undergone two defense presentations, a project proposal defense, and a final project study defense. During the project proposal stage, the students were able to convince the faculty panel of the existing problems and necessity of the said project. During the final defense, the proposed project design, and details to address problems previously discussed were presented and refined. Admittedly, the project study may still have deficiencies considering the fact that they are made by students and not by practicing professionals. Anyhow, thank you for giving the students an opportunity to work on real community projects and to apply their civil engineering knowledge as well as understand the value of community service. We certainly hope that this project study will be useful as reference for the actual project.

Thereby, on behalf of the students, I am respectfully forwarding a copy of the said project study for your perusal.

Yours truly,

ENGR. SHEVANEE RUTH C. DELA CRUZ
Project Study Coordinator/Head, Civil Engineering Department

ENGR. MARY EARL DARYL A. GRIO
Dean, College of Engineering

Received by (Name/Position): _____

Date Received: _____

APPENDIX B

GEOTECHNICAL REPORT

SIEVE ANALYSIS

Total Weight of Soil (g)	280.5				
Sieve No.	**Weight of each Sieve (g)**	**Weight of Sieve + Soil (g)**	**Weight Retained (g)**	**Percent Passing (%)**	**Percent Retained (%)**
4	371.3	378.1	6.8	97.5758	2.4242
10	351.7	387.5	35.8	84.8128	12.7629
20	381.6	522.9	141.3	34.4385	50.3743
40	344.1	393.4	49.3	16.8627	17.5758
100	319	338.8	19.8	9.8039	7.0588
200	306.3	324.7	18.4	3.2442	6.5597
Pan	227.2	234.4	7.2	0.6774	2.5668
		Total Retained Weight =	**278.60**		**99.3226**

ATTERBERG LIMIT TEST - LIQUID LIMIT

SAMPLE 1	**Trial 1**	**Trial 2**	**Trial 3**		
No. of Blows	58	27	12		
Mass of Wet Soil (g), M2	12.4	11.4	10.9		
Mass of Dry Soil (g), M3	18.3	17.4	17.4		
Mass of Water (g), M3-M2	5.9	6	6.5		
Water Content (%)	32.2404	34.4828	37.3563	**Average WC (%)**	**34.6932**
SAMPLE 2	**Trial 1**	**Trial 2**	**Trial 3**		
No. of Blows	57	33	12		
Mass of Wet Soil (g), M2	12.9	13.1	9.8		
Mass of Dry Soil (g), M3	17.1	19.2	16.1		
Mass of Water (g), M3-M2	4.2	6.1	6.3		
Water Content (%)	24.5614	31.7708	39.1304	**Average WC (%)**	**31.8209**
SAMPLE 3	**Trial 1**	**Trial 2**	**Trial 3**		
No. of Blows	48	28	19		
Mass of Wet Soil (g), M2	17.1	14.6	16.3		
Mass of Dry Soil (g), M3	21.3	19.7	22.3		
Mass of Water (g), M3-M2	4.2	5.1	6.0		
Water Content (%)	19.7183	25.8883	26.9058	**Average WC (%)**	**24.1708**

ATTERBERG LIMIT TEST - PLASTIC LIMIT (40-60 BLOWS)

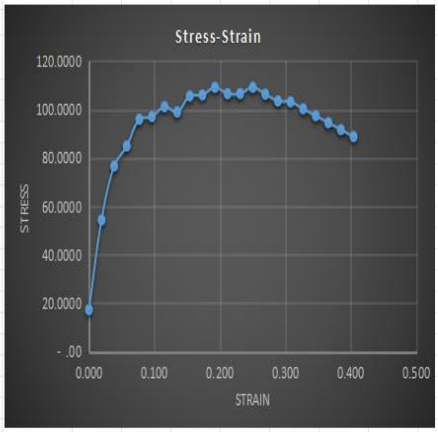
	Trial 1	**Trial 2**	**Trial 3**
Mass of Empty Can (g)	10.00	11.10	11.60
Mass of Empty Can + Wet Soil (g), M2	10.90	12.40	13.10
Mass of Empty Can + Dry Soil (g), M3	11.30	12.90	13.60
Mass of Wet Soil (g)	0.90	1.30	1.50
Mass of Dry Soil (g)	1.30	1.80	2.00
Water Content (%)	69.2308	72.2222	75.00
WC avg. (%)	**72.1510**		

COMPRESSIVE STRENGTH TEST (UNCONFINED SOIL BEARING CAPACITY)

Sample Description: Grayish Clay-CL
Date of Testing: 3/18/2024
Sample Dimensions:
Diameter, D = 1.25984 in
Height, H = 2.59843 in
Cross-sectional area, A = 1.24659 in^2
Proving ring Calibration = 3000 lb/in

SAMPLE 1

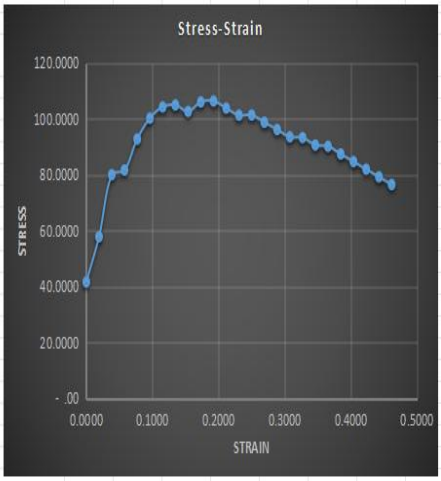
Deformation Dial Reading, ΔL (in)	Unit Strain, ε	Cross-Sectional Area, A (in²)	Proving Ring Dial, (in)	Applied Axial Load, P(in)	Load Per Unit Area	
					Lb/in²	Lb/ft²
(1)	(2)	(3) = ACS/(1-Σ)	(4)	(5) = (4)*Proving Ring Calibration	(6) = (5)/(3)	(7) = (6)*144
0.00	0.000	1.247	0.000050	0.1500	0.1203	17.3273
0.05	0.019	1.271	0.000160	0.4800	0.3776	54.3805
0.10	0.038	1.296	0.000230	0.6900	0.5322	76.6382
0.15	0.058	1.323	0.000260	0.7800	0.5896	84.9007
0.20	0.077	1.351	0.000300	0.9000	0.6664	95.9618
0.25	0.096	1.379	0.000310	0.9300	0.6743	97.0934
0.30	0.115	1.409	0.000330	0.9900	0.7025	101.1565
0.35	0.135	1.441	0.000330	0.9900	0.6872	98.9563
0.40	0.154	1.473	0.000360	1.0800	0.7330	105.5517
0.45	0.173	1.508	0.000370	1.1100	0.7362	106.0164
0.50	0.192	1.544	0.000390	1.1700	0.7580	109.1464
0.55	0.212	1.581	0.000390	1.1700	0.7399	106.5457
0.60	0.231	1.621	0.000400	1.2000	0.7403	106.6103
0.65	0.250	1.662	0.000420	1.2600	0.7579	109.1401
0.70	0.269	1.706	0.000420	1.2600	0.7385	106.3393
0.75	0.289	1.752	0.000420	1.2600	0.7190	103.5386
0.80	0.308	1.801	0.000430	1.2900	0.7162	103.1364
0.85	0.327	1.853	0.000430	1.2900	0.6963	100.2690
0.90	0.346	1.907	0.000430	1.2900	0.6764	97.4016
0.95	0.366	1.965	0.000430	1.2900	0.6565	94.5342
1.00	0.385	2.026	0.000430	1.2900	0.6366	91.6668
1.05	0.404	2.092	0.000430	1.2900	0.6167	88.7994



Sample Description: Grayish Clay-CL
Date of Testing: 3/18/2024
Sample Dimensions:
Diameter, D = 1.25984 in
Height, H = 2.59843 in
Cross-sectional area, A = 1.24659 in^2
Proving ring Calibration = 3000 lb/in

SAMPLE 2

Deformation Dial Reading, ΔL (in)	Unit Strain, ε (in/in)	Cross-Sectional Area, A (in²)	Proving Ring Dial, (in)	Applied Axial Load, P(in)	Load Per Unit Area	
					Lb/in²	Lb/ft²
(1)	(2)	(3) = ACS/(1-Σ)	(4)	(5) = (4)*Proving Ring Calibration	(6) = (5)/(3)	(7) = (6)*144
0.00	0.0000	1.2466	0.00012	0.360	0.2888	41.5856
0.05	0.0192	1.2710	0.00017	0.510	0.4012	57.7793
0.10	0.0385	1.2965	0.00024	0.720	0.5553	79.9703
0.15	0.0577	1.3230	0.00025	0.750	0.5669	81.6353
0.20	0.0770	1.3505	0.00029	0.870	0.6442	92.7631
0.25	0.0962	1.3793	0.00032	0.960	0.6960	100.2254
0.30	0.1155	1.4093	0.00034	1.020	0.7238	104.2222
0.35	0.1347	1.4406	0.00035	1.050	0.7288	104.9537
0.40	0.1539	1.4734	0.00035	1.050	0.7126	102.6197
0.45	0.1732	1.5077	0.00037	1.110	0.7362	106.0164
0.50	0.1924	1.5436	0.00038	1.140	0.7385	106.3477
0.55	0.2117	1.5813	0.00038	1.140	0.7209	103.8137
0.60	0.2309	1.6209	0.00038	1.140	0.7033	101.2797
0.65	0.2502	1.6625	0.00039	1.170	0.7038	101.3443
0.70	0.2694	1.7062	0.00039	1.170	0.6857	98.7437
0.75	0.2886	1.7524	0.00039	1.170	0.6677	96.1430
0.80	0.3079	1.8011	0.00039	1.170	0.6496	93.5423
0.85	0.3271	1.8526	0.00040	1.200	0.6477	93.2735
0.90	0.3464	1.9072	0.00040	1.200	0.6292	90.6061
0.95	0.3656	1.9650	0.00041	1.230	0.6260	90.1372
1.00	0.3848	2.0265	0.00041	1.230	0.6070	87.4032
1.05	0.4041	2.0919	0.00041	1.230	0.5880	84.6692
1.10	0.4233	2.1617	0.00041	1.230	0.5690	81.9351
1.15	0.4426	2.2363	0.00041	1.230	0.5500	79.2011
1.20	0.4618	2.3163	0.00041	1.230	0.5310	76.4670

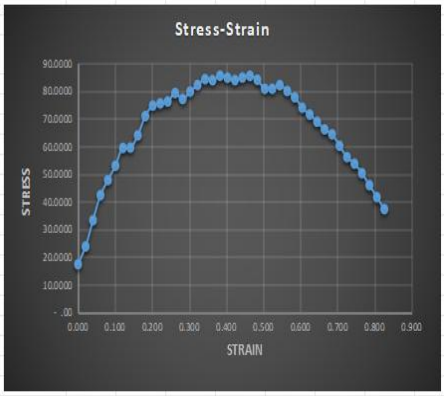


Sample Dimensions:

Diameter, D =	1.25984	in
Height, H =	2.48031	in
Cross-sectional area, A =	1.24659	in^2
Proving ring Calibration =	3000	lb/in

SAMPLE 3

Deformation Dial Reading, ΔL (in)	Unit Strain, ε (in/in)	Cross-Sectional Area, A (in²)	Proving Ring Dial, (in)	Applied Axial Load, P(in)	Load Per Unit Area	
					Lb/in²	Lb/ft²
(1)	(2)	(3) = ACS/(1-Σ)	(4)	(5) = (4)*Proving Ring Calibration	(6) = (5)/(3)	(7) = (6)*144
0.00	0.000	1.247	0.00005	0.150	0.1203	17.3273
0.05	0.020	1.272	0.00007	0.210	0.1651	23.7692
0.10	0.040	1.299	0.00010	0.300	0.2310	33.2574
0.15	0.060	1.327	0.00013	0.390	0.2939	42.3265
0.20	0.081	1.356	0.00015	0.450	0.3319	47.7904
0.25	0.101	1.386	0.00017	0.510	0.3679	52.9748
0.30	0.121	1.418	0.00020	0.585	0.4125	59.4030
0.35	0.141	1.451	0.00020	0.600	0.4134	59.5290
0.40	0.161	1.486	0.00022	0.660	0.4441	63.9450
0.45	0.181	1.523	0.00025	0.750	0.4925	70.9182
0.50	0.202	1.561	0.00027	0.810	0.5188	74.7055
0.55	0.222	1.602	0.00028	0.840	0.5244	75.5163
0.60	0.242	1.644	0.00029	0.870	0.5291	76.1874
0.65	0.262	1.689	0.00031	0.930	0.5505	79.2761
0.70	0.282	1.737	0.00031	0.930	0.5355	77.1104
0.75	0.302	1.787	0.00033	0.990	0.5540	79.7799
0.80	0.323	1.840	0.00035	1.050	0.5706	82.1700
0.85	0.343	1.897	0.00037	1.110	0.5853	84.2806
0.90	0.363	1.957	0.00038	1.140	0.5827	83.9038
0.95	0.383	2.020	0.00040	1.200	0.5939	85.5254
1.00	0.403	2.089	0.00041	1.230	0.5889	84.7993
1.05	0.423	2.162	0.00042	1.260	0.5829	83.9335
1.1	0.443	2.240	0.00044	1.320	0.5893	84.8566
1.15	0.464	2.324	0.00046	1.380	0.5938	85.5001
1.2	0.484	2.415	0.00047	1.410	0.5839	84.0754
1.25	0.504	2.513	0.00047	1.410	0.5611	80.7921
1.3	0.524	2.620	0.00049	1.470	0.5612	80.8069
1.35	0.544	2.735	0.00052	1.560	0.5703	82.1216
1.4	0.564	2.862	0.00053	1.590	0.5555	79.9983
1.45	0.585	3.001	0.00054	1.620	0.5398	77.7353
1.5	0.605	3.154	0.00054	1.620	0.5136	73.9629
1.55	0.625	3.324	0.00055	1.650	0.4965	71.4903
1.6	0.645	3.512	0.00056	1.680	0.4783	68.8780
1.65	0.665	3.724	0.00057	1.710	0.4592	66.1260
1.7	0.685	3.962	0.00059	1.770	0.4467	64.3245
1.75	0.706	4.234	0.00059	1.770	0.4181	60.2028
1.8	0.726	4.545	0.00059	1.770	0.3895	56.0811
1.85	0.746	4.905	0.00061	1.830	0.3731	53.7207
1.9	0.766	5.328	0.00062	1.860	0.3491	50.2701
1.95	0.786	5.830	0.00062	1.860	0.3190	45.9388
2	0.806	6.437	0.00062	1.860	0.2889	41.6076
2.05	0.827	7.185	0.00062	1.860	0.2589	37.2763



Unconfined Compressive Strength :

Qu 100.3398 Lb/ft²

Undrained Shear Stregth :

Su 50.1699 Lb/ft²

SOIL BEARING CAPACITY:	
Angle of Friction :	21°
Factor of Safety:	3.00
Base Width:	1.00 m
Depth of Footing:	2.00 m
Unit Weight of Soil (γ) :	16.65165063 $\frac{kN}{m^3}$
Cohesion :	2.41 $\frac{kN}{m^2}$
Effective Stress/ Overburden Pressure (q):	33.30330126 $\frac{kN}{m^2}$

BASE WIDTH

0.9144 say= 1 m

DEPTH OF FOOTING

1.524 say= 2 m

	Trial 1	Trial 2	Avg.	
Sat. Unit weight of Soil (N/m^3)	16864.54412	16438.75714	16.65165063	kN/m^3

COHESION 2.41 kN/m^2

Unconfined Compressive Strength : Qu 100.3398 Lb/ft²

Undrained Shear Stregth : Su 50.1699 Lb/ft²

EFFECTIVE STRESS/OVERBURDEN PRESSURE

33.30330126 kN/m^2

BEARING CAPACITY FACTORS:

e=	2.7183
π =	3.1416
$N_q =$	**7.0700**
$N_c =$	**15.8100**
$N_\gamma =$	**6.2000**

SQUARE FOOTING: $q_{ult} = 1.3\,cN_c + qN_q + 0.40\gamma BN_\gamma$ **326.1830** kN/^2

$q_{net} = q_{ult} - q$ **292.8797** kN/m^2

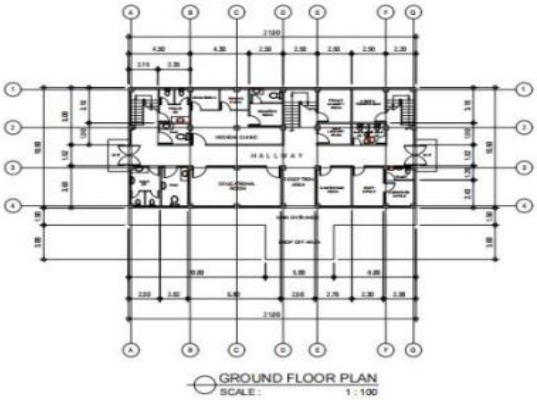
$q_{allowable} = \frac{q_{ult}}{FS}$ **108.7277** kN/m^2

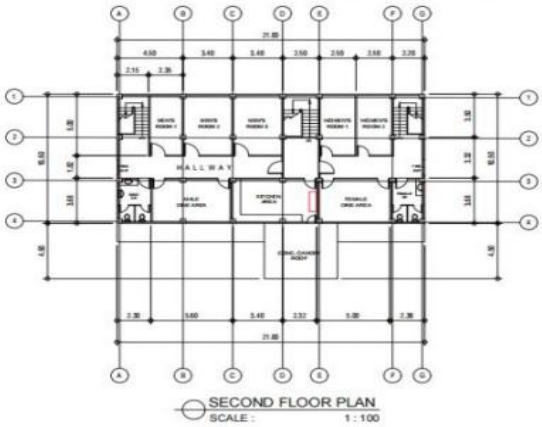
SOIL TYPE: B

APPENDIX C

SEISMIC ANALYSIS

Seismic Analysis





Gravity Loads		
Dead Loads:		
SDL (floors)	1.34	kPa
SDL (roof)	0.65	kPa
Live Loads:		
L1st	2.9	kPa
L2nd	4.8	kPa
Lroof	2.8	kPa

LOADS		
1st Floor:		
Column (square)	0.3	m
Height of Column (hc)	3.3	m
No. of Columns	28	
Plan Size (21m x 10.5m)	220.50	m^2
Tibutary Load:		
DL of column	98.1288	kN
Total	98.129	kN
2nd Floor:		
Thickness of Slab	0.125	m
Column (square)	0.3	m
Height of Column (hc 1st)	3.3	m
Height of Column (hc 2nd)	3	m

No. of Columns	28				
Beam	0.4	m (h)			
	0.2	m (b)			
Plan Size (21m x 10.5m)	220.50	m^2			
Tibutary Load:					
DL of Slab					
Plan Size (21m x 10.5m)	220.50	m^2			
Thickness of Slab	0.125	m			
Wt of Slab	650.48	kN			
DL of Beam	no. of beams		ln (m)	DL of beam	
@ 4.5m	4		4.2	31.718	kN
@ 3.40m	8		3.1	46.822	kN
@ 2.5m	4		2.2	16.614	kN
@ 5m	4		4.7	35.494	kN
@ 2.20m	4		1.9	14.349	kN
@ 3.5m	7		3.2	42.291	kN
@ 3.32m	7		3.02	39.912	kN
@ 3.68m	7		3.38	44.670	kN
			Total	271.872	kN
DL of Column	no. of columns		height (ln)	DL of Column	
Column at first floor	28		3.3	98.129	kN
Column at 2nd floor	28		3	89.208	kN
			Total	187.337	kN
SDL 2nd floor	295.47	kN			
LL 2nd floor (0.25)	264.60	kN			

Total Tributary Load (2nd floor)			**1,669.754**	kN
Roof:				
DL of Column	no. of columns	height (ln)	DL of Column	
Column at 2nd floor	28	3	89.208	kN
DL of Beam	no. of beams	ln (m)	DL of beam	
@ 4.5m	4	4.2	31.718	kN
@ 3.40m	8	3.1	46.822	kN
@ 2.5m	4	2.2	16.614	kN
@ 5m	4	4.7	35.494	kN
@ 2.20m	4	1.9	14.349	kN
@ 3.5m	7	3.2	42.291	kN
@ 3.32m	7	3.02	39.912	kN
@ 3.68m	7	3.38	44.670	kN
		Total	271.872	kN
Plan Size	220.50	m^2		
SDL roof	143.33	kN		

Plan Size	220.50	m^2		
SDL roof	143.33	kN		
LL roof	617.40	kN		
Total Tributary Load (roof)	**1121.81**	kN		

Seismic Properties

Description	Values		
Seismic Importance Factor, I	1		
Numerical Coefficient, R	8.5		
Seismic Source Type	A		
Soil Profile Type	Se		
Seismic Zone Factor, Z (Zone 4)	0.4		
Near Source Factor, Na	1		
Near Source Factor, Nv	1		
Seismic Response Coefficient, Ca	0.44Na	0.44	
Seismic Response Coefficient, Cv	0.96Nv	0.96	
Structure Period, T $T = C_t(h_n)^{\frac{3}{4}}$	0.29069	Ct = 0.0731	hn = 3.3+2.8 = 6.3 m

Seismic Weight	**2889.6876**	kN

STATIC FORCE PROCEDURE

Design Base Shear:

Vreq'd	$V = \frac{C_v}{T} \cdot \frac{I}{R} \cdot w$	1122.7243	kN
Vmax	$V_{max} = 2.5\, C_a \cdot \frac{I}{R} \cdot W$	373.9596	kN
Vmin1	$V_{min_1} = 0.11\, C_a\, I\, W$	139.8609	kN
Vmin2	$V_{min_2} = 0.8\, z\, N_v \cdot \frac{I}{R} \cdot W$	108.7882	kN

Base Shear, Vstatic	**373.9596**	kN

Check Concentrated force at top, Ft:

Ft = 0.07 T V	7.61	kN
Ft < 0.25 V	93.4899	> Ft
		Hence, Ft is needed

Base Shear Distribution

Floor	Wt (kN)	h (m)	Wi hi (kN-m)	Fx (kN) = (V-Ft) Wihi / TotalWihi

Base Shear Distribution

Floor	Wt (kN)	h (m)	Wi hi (kN-m)	Fx (kN) = (V-Ft) Wihi / TotalWihi
1	98.13	-	-	-
2	1,669.75	3.00	5,009.26	151.96
Roof	1,121.81	6.30	7,067.37	222.00
		Total	12,076.63	373.9596

Fx = Vstatic (Equilibrium)

SIMPLIFIED DESIGN BASE SHEAR

Vreq'd $V = 3.0 \cdot \frac{C_a}{R} \cdot W$ 448.7515 kN

Vsimplified > Vstatic (Simplified Method Results to a more conservative Design)

Vertical Distribution

$F_x = \frac{3C_a}{R} \cdot W_i$

	Floor	Forces on each floor	
Fx1	1st	15.24	kN
Fx2	2nd	259.30	kN
Fxroof	Roof	174.21	kN
	Total	448.7515	kN

Base Shear Distribution:

Floor	Wi (kN)	h (m)	Wi hi (kN-m)	Fx (kN) = (V-Ft) Wihi / TotalWihi
1	98.13	-	-	-
2	1,669.75	3.00	5,009.26	186.14

Base Shear Distribution:

Floor	Wi (kN)	h (m)	Wi hi (kN-m)	Fx (kN) = (V-Ft) Wihi / TotalWihi
1	98.13	-	-	-
2	1,669.75	3.00	5,009.26	186.14
Roof	1,121.81	6.30	7,067.37	262.61
		Total	12,076.63	448.7515

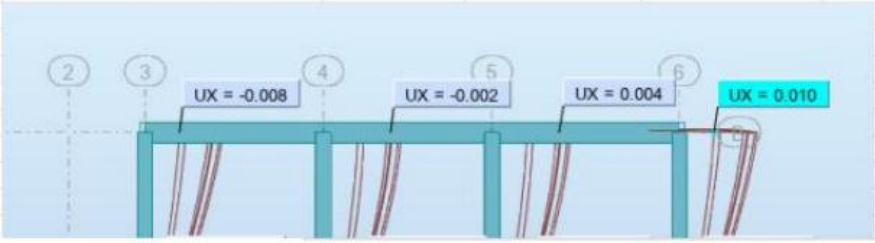
Fx = Vsimpified (Equilibrium)

Using Robot Structural Analysis

Analysis Type:

1. Seismic (Equivalent Lateral Force Method)
2. Modal with Automatic Definition of Seismic Cases

Nodal Displacement in X direction



Seismic Weight

Case 17 : ASCE 7-16 Ecc X+ Direction_X
Analysis type: Static - Seismic

Mass eccentricities ex = 5.000 (%) ey = 0.000 (%)
Excitation direction:
X = 1.000
Y = 0.000
Z = 0.000
Data:
Soil : A
S_1 : 0.100
S_s : 0.250

Spectrum parameters:
F_a = 0.800 F_v = 0.800
S_{MS} = 0.200 S_{M1} = 0.080
S_{DS} = 0.133 S_{D1} = 0.053
T_o = 0.080 T_S = 0.400
T_L = 2.000
I = 1.000 R = 8.500
Fundamental period:
Approximated method T = 0.244 (s)
RC frames C_t = 0.016 (0.0466) x = 0.90

Base Shear

Case 8 : Seismic UBC 97 Ecc X+ Direction_X
Analysis type: Seismic-UBC 97

Mass eccentricities ex = 5.000 (%) ey = 0.000 (%)
Base shear value 300.105 (kN)
Base shear coefficient for the combination SRSS : 1.160
Base shear coefficient for the combination CQC : 1.160
Base shear coefficient for the combination 10% : 1.159
Base shear coefficient for the combination 2S : 1.159

Excitation direction:
X = 1.000
Y = 0.000
Z = 0.000

Data:
Zone : 4
Soil : Se
Seismic source type : A
The smallest distance to a known seismic source (km) : 4.000

Structure range:
Top story Story 2
Bottom story Story 1
Effective height H_n = 6.300(m)

Base shear
k = 1.000
C_s = 0.016
$C_{s\ max}$ = 0.026
$C_{s\ min}$ = 0.010
Effective seismic weight W = 2477.61(kN)
Shear force V = 38.865(kN)

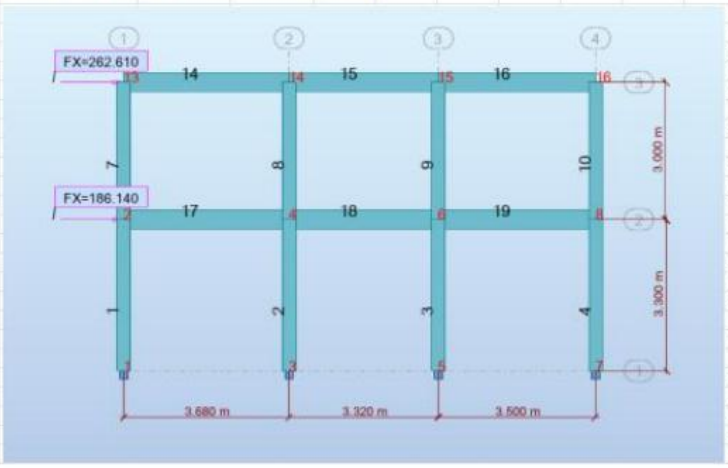
Vertical distribution of seismic forces

Story	Height (m)	Weight (kN)	F(kN)	M(kN*m)
Story 1	3.300	1704.16	20.823	0.000
Story 2	3.000	773.45	18.042	0.000

APPROXIMATE FRAME ANALYSIS USING PORTAL METHOD

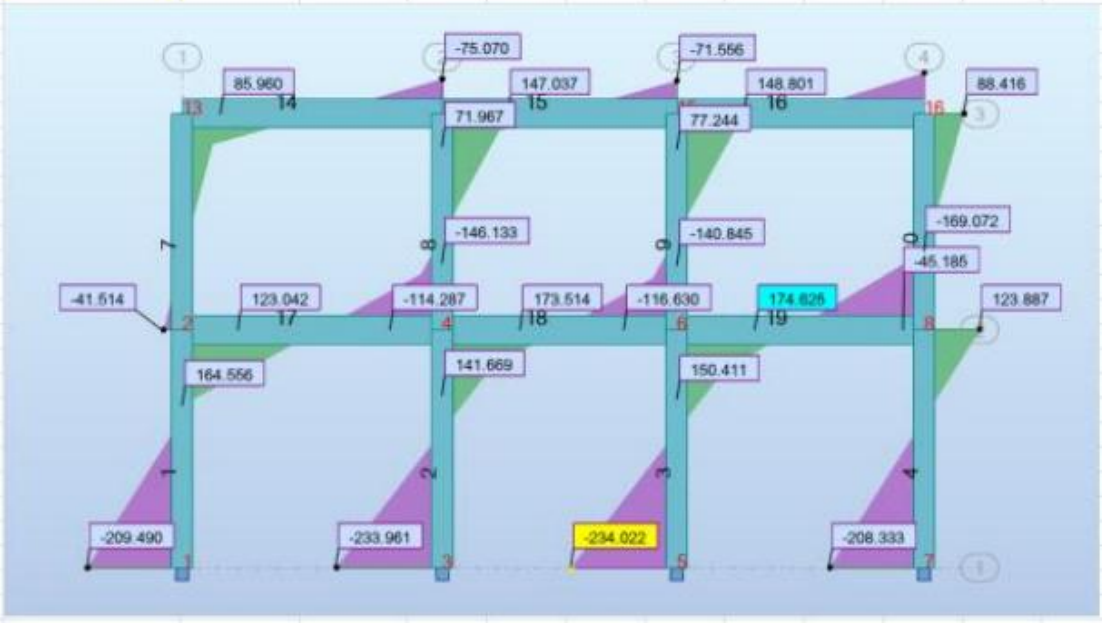
Legend:	
Black Number	Member
Red Number	Node

Frame Analysis in Transverse Direction

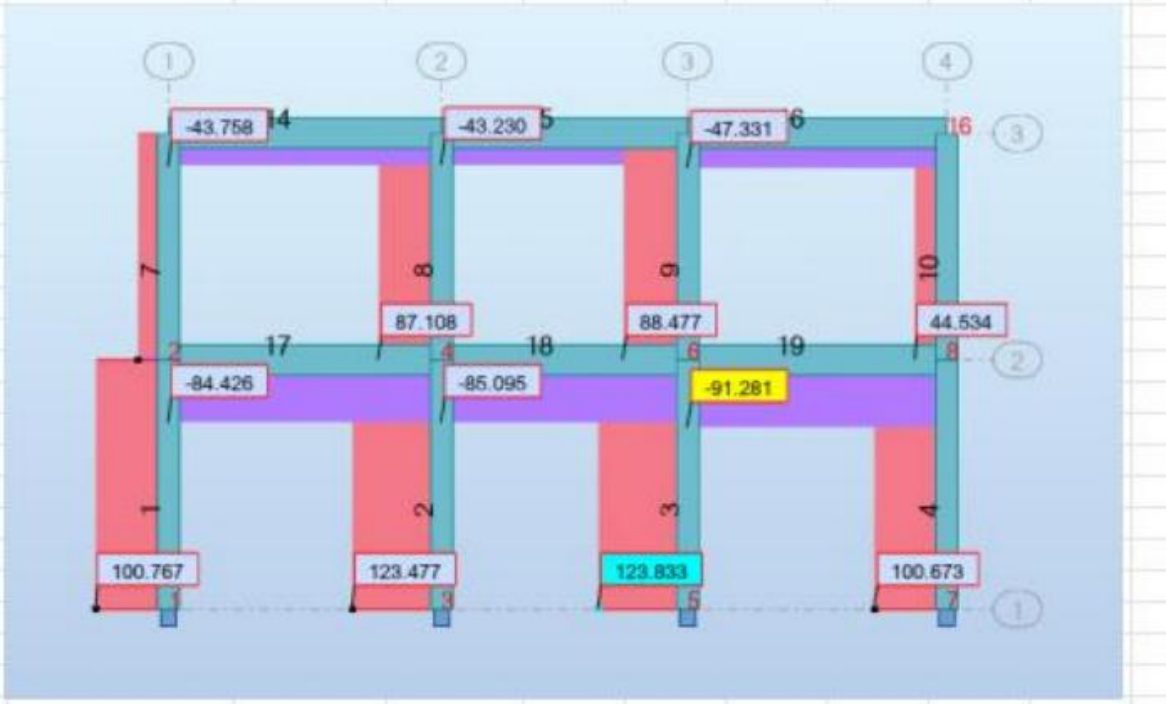


Member/Node/Case	FX (kN)	FZ (kN)	MY (kNm)
1/ 1/ 5	-128.184	100.767	-209.490
1/ 2/ 5	-128.184	100.767	123.042
2/ 3/ 5	-0.140	123.477	-233.961
2/ 4/ 5	-0.140	123.477	173.514
3/ 5/ 5	-10.288	123.833	-234.022
3/ 6/ 5	-10.288	123.833	174.626
4/ 7/ 5	138.612	100.673	-208.333
4/ 8/ 5	138.612	100.673	123.887
7/ 2/ 5	-43.758	42.491	-41.514
7/ 13/ 5	-43.758	42.491	85.960
8/ 4/ 5	0.528	87.108	-114.287
8/ 14/ 5	0.528	87.108	147.037
9/ 6/ 5	-4.101	88.477	-116.630
9/ 15/ 5	-4.101	88.477	148.801
10/ 8/ 5	47.331	44.534	-45.185
10/ 16/ 5	47.331	44.534	88.416
14/ 13/ 5	220.119	-43.758	85.960
14/ 14/ 5	220.119	-43.758	-75.070
15/ 14/ 5	133.011	-43.230	71.967
15/ 15/ 5	133.011	-43.230	-71.556
16/ 15/ 5	44.534	-47.331	77.244
16/ 16/ 5	44.534	-47.331	-88.416
17/ 2/ 5	127.864	-84.426	164.556
17/ 4/ 5	127.864	-84.426	-146.133
18/ 4/ 5	91.495	-85.095	141.669
18/ 6/ 5	91.495	-85.095	-140.845
19/ 6/ 5	56.139	-91.281	150.411
19/ 8/ 5	56.139	-91.281	-169.072

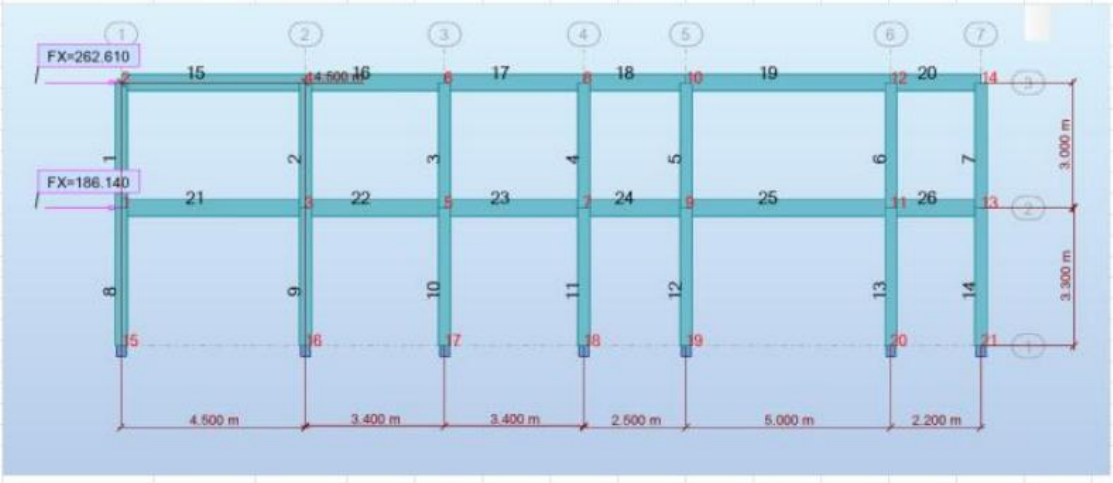
Moment Diagram



Shear Diagram

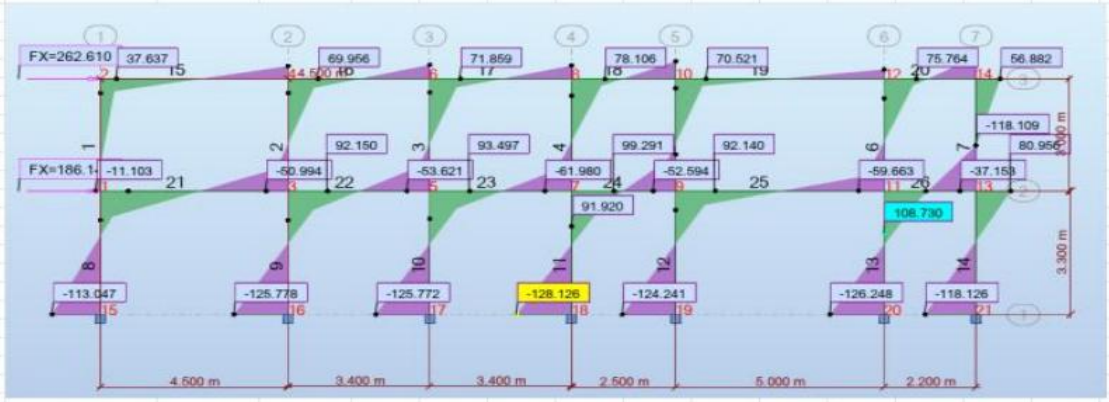


Frame Analysis in Longitudinal Direction

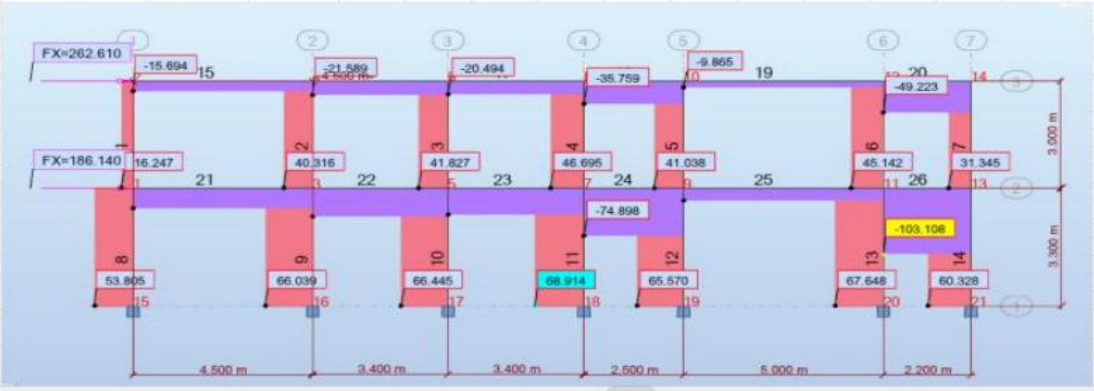


Member/Node/Case	FX (kN)	FZ (kN)	MY (kNm)
1/ 1/ 2	-15.694	16.247	-11.103
1/ 2/ 2	-15.694	16.247	37.637
2/ 3/ 2	-5.895	40.316	-50.994
2/ 4/ 2	-5.895	40.316	69.956
3/ 5/ 2	1.096	41.827	-53.621
3/ 6/ 2	1.096	41.827	71.859
4/ 7/ 2	-15.266	46.695	-61.980
4/ 8/ 2	-15.266	46.695	78.106
5/ 9/ 2	25.894	41.038	-52.594
5/ 10/ 2	25.894	41.038	70.521
6/ 11/ 2	-39.358	45.142	-59.663
6/ 12/ 2	-39.358	45.142	75.764
7/ 13/ 2	49.223	31.345	-37.153
7/ 14/ 2	49.223	31.345	56.882
8/ 15/ 2	-47.381	53.805	-113.047
8/ 1/ 2	-47.381	53.805	64.511
9/ 16/ 2	-18.708	66.039	-125.778
9/ 3/ 2	-18.708	66.039	92.150
10/ 17/ 2	4.024	66.445	-125.772
10/ 5/ 2	4.024	66.445	93.497
11/ 18/ 2	-48.593	68.914	-128.126
11/ 7/ 2	-48.593	68.914	99.291
12/ 19/ 2	81.326	65.570	-124.241
12/ 9/ 2	81.326	65.570	92.140
13/ 20/ 2	-123.000	67.648	-126.248
13/ 11/ 2	-123.000	67.648	96.991
14/ 21/ 2	152.332	60.328	-118.126
14/ 13/ 2	152.332	60.328	80.956
15/ 2/ 2	246.363	-15.694	37.637
15/ 4/ 2	246.363	-15.694	-32.987
16/ 4/ 2	206.047	-21.589	36.968
16/ 6/ 2	206.047	-21.589	-36.436
17/ 6/ 2	164.220	-20.494	35.423
17/ 8/ 2	164.220	-20.494	-34.256
18/ 8/ 2	117.525	-35.759	43.850
18/ 10/ 2	117.525	-35.759	-45.549
19/ 10/ 2	76.487	-9.865	24.972
19/ 12/ 2	76.487	-9.865	-24.354
20/ 12/ 2	31.345	-49.223	51.410
20/ 14/ 2	31.345	-49.223	-56.882
21/ 1/ 2	148.581	-31.687	75.614
21/ 3/ 2	148.581	-31.687	-66.976
22/ 3/ 2	122.859	-44.499	76.167
22/ 5/ 2	122.859	-44.499	-75.130
23/ 5/ 2	98.240	-41.570	71.989
23/ 7/ 2	98.240	-41.570	-69.351
24/ 7/ 2	76.021	-74.898	91.920
24/ 9/ 2	76.021	-74.898	-95.326
25/ 9/ 2	51.489	-19.466	49.408
25/ 11/ 2	51.489	-19.466	-47.924
26/ 11/ 2	28.983	-103.108	108.730
26/ 13/ 2	28.983	-103.108	-118.109

Moment Diagram



Shear Diagram

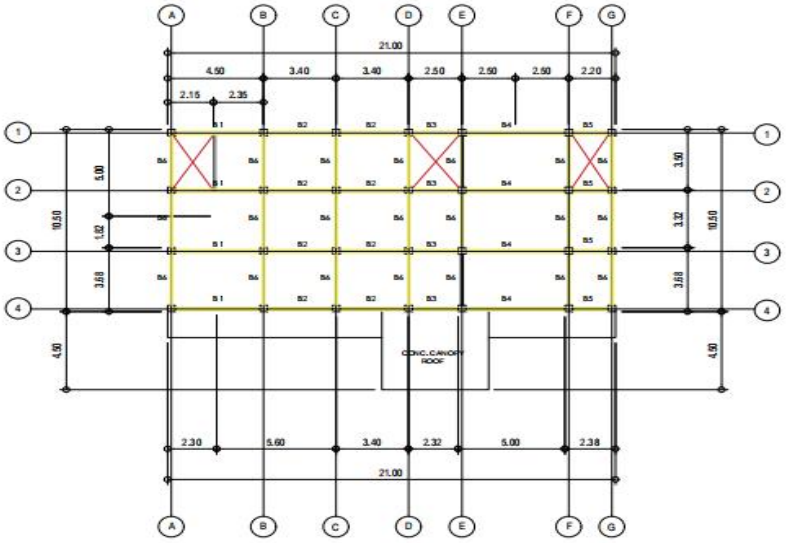


APPENDIX D

DESIGN AND ANALYSIS OF STRUCTURAL

DESIGN OF SINGLY REINFORCED RECTANGULAR BEAM FOR FLEXURE (RB4.A-B)

MATERIAL PROPERTIES:		BEAM DESCRIPTION AND LOADS:		
Concrete Compressive Strength (fc):	21 MPa	Simple Support		
Yield Strength of Steel (fy):	275 MPa	Simple Span (L):	5 m	
Unit Weight of Concrete:	23.6 kN/m^3	Service Dead Load (DL):	7.87 kN/m	*including self-weight*
		Truss Load (TL):	12.84 kN	



SECOND FLOOR FRAMING PLAN
SCALE : 1 : 100

SOLUTION

III. Step 3 — *Compute the Factored Load*

Total Dead Load (W_{DL}=DL+DL_S):	7.87 kN/m
Truss Load (TL):	12.84 kN/m
Total Factored Load (WU=1.2WDL+TL):	**22.28 kN/m**

IV. Step 4 — *Compute the Factored Moment to be resisted by the Beam*

For maximum positive moment: (WDL2)/24 +(TL/8)

Maximum Positive Ultimate/Design Moment (M_U):	**16.22 kN-m**
Maximum Positive Nominal Moment (M_N):	**14.60 kN-m**

For maximum negative moment: (WDL2)/12 +(TL/8)

Maximum Negative Ultimate/Design Moment (M_U):	**24.42 kN-m**
Maximum Negative Nominal Moment (M_N):	**21.98 kN-m**

(if fc is greater than 28 but less than 55, solve for the value of β_1 using the calculator provided on the side)

V. Step 5 — *Determine β1*

28MPa < f'c < 55MPa	
Calculator for β_1	
β1	-0.1716

Table 422.2.2.4.3
Values of β_1 for Equivalent Rectangular Concrete Stress Distribution

f'_c, MPa	β_1	
$17 \le f'_c \le 28$	0.85	(a)
$28 < f'_c < 55$	$0.85-\frac{0.05(f'_c-28)}{7}$	(b)
$f'_c \ge 55$	0.65	(c)

β1: 0.85

VI. Step 6 — *Solve for the Maximum Steel Ratio*

$$\rho_{max} = \frac{0.85 f'_c \beta_1}{f_y}\left(\frac{0.003}{0.008}\right)$$

Maximum Steel Ratio, ρ_{max} = 0.0206898

VII.	Step 7	*Solve for bd^2 and Design Beam Section*

FOR MAXIMUM POSITIVE MOMENT:

bd^2 = 3768251.988 mm^3

$$bd^2 = \frac{M_U}{\emptyset \rho f y (1 - \frac{1}{1.7} \cdot \frac{\rho f y}{f'c}}$$

Assumed beam width, b, and solve for d (d=1.5b to d=2b):

Assumed beam width, b =	200.00	mm
Computed Beam Effective depth, d =	137.26	mm
Assumed Beam Effective depth, d =	360.00	mm
Check b/d ratio (between 0.5 and 0.67 =	0.55556	
Assumed Concrete Cover =	40.00	mm
Total Beam Height, h =	400.00	mm

b/d ratio is Satisfied

FOR MAXIMUM POSITIVE MOMENT:

bd^2 = 5672221.077 mm^3

$$bd^2 = \frac{M_U}{\emptyset \rho f y (1 - \frac{1}{1.7} \cdot \frac{\rho f y}{f'c}}$$

Assumed beam width, b, and solve for d (d=1.5b to d=2b):

Assumed beam width, b =	200.00	mm
Computed Beam Effective depth, d =	168.41	mm
Assumed Beam Effective depth, d =	360.00	mm
Check b/d ratio (between 0.5 and 0.67 =	0.55556	
Assumed Concrete Cover =	40.00	mm
Total Beam Height, h =	400.00	mm

b/d ratio is Satisfied

VIII.	Step 8	*Compute the weight of the beam and compare it to the assumption made in Step 2*

Computed Beam Weight = 1.8880 kN/m

IX.	Step 9	*Check beam thickness from the table*

Simple Supported Span, L =	5000.00	mm
Minimum height, h_{min} =	270.27	mm
Adjusted Minimum height, adjusted h_{min} =	270.00	mm
Supplied Beam Height, h =	400.00	mm

Beam height is okay

Table 409-1 - Minimum Thickness of Nonprestressed Beams or One-Way Slabs Unless Deflections are Computed

Member	Minimum Thickness, *h*			
	Simply Supported	One end continuous	Both ends continuous	Cantilever
	Members not supporting or attached to partitions or other construction likely to be damaged by large deflections			
Solid one-way slabs	$\frac{\ell}{20}$	$\frac{\ell}{24}$	$\frac{\ell}{28}$	$\frac{\ell}{10}$
Beams or ribbed one way slabs	$\frac{\ell}{16}$	$\frac{\ell}{18.5}$	$\frac{\ell}{21}$	$\frac{\ell}{8}$

Therefore use, 200.00 mm X 400.00 mm Beam Section

X. Step 10 *Solve for the steel requirements*

FOR MAXIMUM POSITIVE MOMENT			FOR MAXIMUM NEGATIVE MOMENT		
As1:	1489.663636		As1:	1489.663636	
Mu1:	111.575341		Mu1:	111.575341	
Mn1:	123.972601		Mn1:	123.972601	
analysis:	Singly Reinforced		analysis:	Singly Reinforced	
Rn:	0.69533751		Rn:	1.04666781	
ρ :	0.00257977		ρ :	0.00392472	
ρ min:	0.00509091		ρ min:	0.00509091	
ρ mccormac:	0.01374545		ρ mccormac:	0.01374545	
ρ bal:	0.03783273		ρ bal:	0.03783273	
ρ max:	0.02837455		ρ max:	0.02837455	
ρ sup:	0.00509091		ρ sup:	0.00509091	
As:	366.55	mm^2	As:	366.55	mm^2
db:	16	mm	db:	16	mm
Ab:	201.062	mm^2	Ab:	201.062	mm^2
Compression bars, n:	0		Compression bars, n:	0	
n supplied:	2	pcs.	n supplied:	2	pcs.
Tension bars, n:	1.823		Tension bars, n:	1.823	
n supplied:	**2**	**pcs.**	**n supplied:**	**2**	**pcs.**
Supplied Steel Area, As:	402.124	mm2	Supplied Steel Area, As:	402.124	mm2

XI. Step 11 *Solve for the Design Moment Capacity*

FOR MAXIMUM POSITIVE MOMENT			FOR MAXIMUM NEGATIVE MOMENT		
T=C			T=C		
AsFy = 0.85fcβcb			AsFy = 0.85fcβcb		
c:	36.442	mm	c:	36.442	mm
Depth of Compression Block, a:	30.976	mm	Depth of Compression Block, a:	30.976	mm
Section Design Moment Capacity:	34.288	kN-m	Section Design Moment Capacity:	34.288	kN-m

$$M_{Umax} = \emptyset T\left[d - \frac{a}{2}\right] = \emptyset A_s fy[d - \frac{a}{2}]$$

Verify the value of Ø

$$\varepsilon_t = \left[\frac{d-c}{c}\right](0.003) > 0.005$$

Et:	0.02664		Et:	0.02664	
Therefore the section is in Tension Controlled - Ductile Failure			Therefore the section is in Tension Controlled - Ductile Failure		
use			use		
Ø:	0.90		Ø:	0.90	

XI. Step 12 *Compare Actual Design Moment (MU) and Section Design Moment Capacity (Mumax)*

FOR MAXIMUM POSITIVE MOMENT			FOR MAXIMUM NEGATIVE MOMENT		
Section Design Moment Capacity:	34.288	kN-m	Section Design Moment Capacity:	34.288	kN-m
Actual Design Moment (MU):	16.22	kN-m	Actual Design Moment (MU):	24.42	kN-m
THEREFORE, SECTION IS SAFE			THEREFORE, SECTION IS SAFE		

SUMMARY:

beam height:	400.00 mm		
effective depth:	360.00 mm		
beam width:	200.00 mm		
db:	16 mm		
tb:	16 mm		
no. of bars:			
at midspan		at support	
compression bars:	3 pcs.	compression bars:	3 pcs.
tension bars:	3 pcs.	tension bars:	3 pcs.

DESIGN FOR SHEAR STRENGTH

MATERIAL PROPERTIES:

Concrete Compressive Strength (fc):	21 MPa
Yield Strength of Steel (fy):	275 MPa

BEAM DIMENSIONS:

Simple Support

Simple Span (L):	5 m	
Beam Width (b):	200.00 mm	
Effective Depth (d):	360.00 mm	
SERVICE LOADS:		
Service Dead Load (DL):	7.87 kN/m	including beam weight
Truss Load (TL):	12.84 kN	

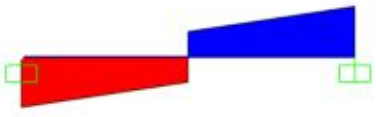
SOLUTION

I. Step 1 *Determine the Factored Load W_U*

Wu = 1.2DL

Total Factored Load, W_U = 9.4416 kN/m

II. Step 2 *Determine V_U at distance d*



Maximum Shear at Support

Vumax = WuL/2 + P/2

V umax = 30.02 kN

Shear at Distance d

$$V_{Ud} = R_A - W_U d$$

V_{ud} = 26.63 kN

411.2.3.1 For nonprestressed members, sections located less than a distance *d* from face of support shall be permitted to be designed for the same shear V_u as that computed at a distance *d*.

III. Step 3 — Determine V_c

Nominal shear strength provided by concrete V_c

$$V_c = 0.17\lambda\sqrt{f'c}\,b_w d$$

V_c = 56.09 kN
$\emptyset V_c$ = 42.07 kN
$1/2\emptyset V_c$ = 21.03 kN

411.4.1.1 For members subject to shear and flexure only:

$$V_c = 0.17\lambda\sqrt{f'_c}\,b_w d \qquad (411\text{-}3)$$

IV. Step 4 — Determine V_s at distance d

Nominal shear strenght provided by shear reinforcement

$$V_s = \frac{V_u}{\phi} - V_C$$

V_s = -20.59 kN

Check V_s

-If $0.66\sqrt{f'_c}b_w d \geq V_s$ (No need to redesign)
-If $0.66\sqrt{f'_c}b_w d < V_s$ (Need to redesign)

$0.66\sqrt{f'c}\,b_w d$ = 217.76 kN

THEREFORE, No need to redesign

411.2 Shear Strength

411.2.1 Except for members designed in accordance with Section 427, design of cross sections subject to shear shall be based on

$$\phi V_n \geq V_u \qquad (411\text{-}1)$$

where V_u is factored shear force at section considered and V_n is nominal shear strength computed by

$$V_n = V_c + V_s \qquad (411\text{-}2)$$

409.4.2 Strength-Reduction Factor

Strength-reduction factor ϕ shall be given in Sections 409.4.2.1 through 409.4.2.7:

409.4.2.3 Shear and torsion (See also Section 409.4.4 for shear walls and frames in Seismic Zone 4) 0.75

411.6.7.9 Shear strength V_s shall not be taken greater than $0.66\sqrt{f'_c}\,b_w d$.

V. Step 5 — Solve for A_v

Bar Diameter for Shear Reinforcement, d_b = 10 mm
Number of Legs = 2
A_v = 157.08 mm^2

A_v = area of shear reinforcement within a distance s, mm^2

VI. Step 6 — Solve for Theoretical Spacing, S at distance d

Theoretical Spacing

$$S = \frac{A_V f_{yt} d}{V_s x 10^3}$$

Theoretical Spacing, s = -755.24 mm

411.6.7 Design of Shear Reinforcement

411.6.7.1 Where factored shear force V_u exceeds shear strength ϕV_n, shear reinforcement shall be provided to satisfy Equations (411-1) and (411-2), where shear strength V_s shall be computed in accordance with Sections 411.6.7.2 through 411.6.7.9.

411.6.7.2 Where shear reinforcement perpendicular to axis of member is used,

$$V_s = \frac{A_v f_{yt} d}{s} \qquad (411\text{-}15)$$

VII. Step 7 — Check S_{max}

$$A_{vmin} = 0.062\sqrt{f'c}\frac{b_w S_1}{f_{yt}}$$

S_1 = 760.19 mm

$$A_{vmin} = 0.062\sqrt{f'c}\frac{b_w S_1}{f_{yt}}$$

S_2 = 617.10

Use the smaller value for spacing

Spacing, s = 617.10

411.6.6 Minimum Shear Reinforcement

411.6.6.1 A minimum area of shear reinforcement, $A_{v,min}$, shall be provided in all reinforced concrete flexural members (prestressed and nonprestressed) where V_u exceeds $0.5\phi V_c$, except in members satisfying one or more of (1) through (6):

411.6.6.3 Where shear reinforcement is required by Section 411.6.6.1 or for strength and where Section 411.7.1 allows torsion to be neglected, the minimum area of shear reinforcement for prestressed (except as provided in Section 411.6.6.4) and nonprestressed members shall be computed by:

$$A_{v,min} = 0.062\sqrt{f'_c}\,\frac{b_w s}{f_{yt}} \qquad (411\text{-}13)$$

but shall not be less than $(0.35b_w s)/f_{yt}$, where b_w and s are in millimeters.

VIII. Step 8 *Check S_3*

V_s = -20.59 kN
108.882 kN

For: $V_s \le 0.33\sqrt{f'c}\,b_w d$

$S = \frac{d}{2}$ or 600

For: $V_s > 0.33\sqrt{f'c}\,b_w d$

$S = \frac{d}{4}$ or 300

S_3 = 180 mm
S_3 = 600 mm

Use the smaller value for spacing

S_3 = **180** mm

411.6.5 Spacing Limits for Shear Reinforcement

411.6.5.1 Spacing of shear reinforcement placed perpendicular to axis of member shall not exceed $d/2$ in nonprestressed members and $0.75h$ in prestressed members, nor 600 mm.

411.6.5.3 Where V_s exceeds $0.33\sqrt{f'_c}\,b_w\,d$, maximum spacing given in Sections 411.6.5.1 and 411.6.5.2 shall be reduced by one half.

IX. Step 9 *Tabulate*

Distance from the support (m)	*Factored Shear Force at section* V_u (kN)	*Nominal Shear Strength provided by shear reinforcement* $V_s = \frac{V_u}{\phi} - V_c$, $\phi = 0.75$ (kN)	*Theoretical Spacing* $s = \frac{A_v f_{yt} d}{V_s \times 10^3}$ (mm)	*Check* S_{max}: $A_{v\,min} = 0.062\sqrt{f'_c}\frac{b_w S_2}{f_{yt}}$, $A_{v\,min} = 0.35\frac{b_w S_2}{f_{yt}}$ (mm)	*Check* S_3: *For:* $V_s \le 0.33\sqrt{f'_c}\,b_w d$, $S = \frac{d}{2}$ or 600; *For:* $V_s > 0.33\sqrt{f'_c}\,b_w d$, $S = \frac{d}{4}$ or 300 (mm)
0.36	26.63	-20.59	-755.24	S1: 760 S2: 617	S3: 180 S3: 600
0.72	23.23	-25.12	-619.00	S1: 760 S2: 617	S3: 180 S3: 600
1.08	19.83	-29.65	-524.40	S1: 760 S2: 617	S3: 180 S3: 600
1.44	16.43	-34.19	-454.88	S1: 760 S2: 617	S3: 180 S3: 600
1.8	13.03	-38.72	-401.64	S1: 760 S2: 617	S3: 180 S3: 600
2.16	9.63	-43.25	-359.55	S1: 760 S2: 617	S3: 180 S3: 600
2.52	6.23	-47.78	-325.45	S1: 760 S2: 617	S3: 180 S3: 600
2.88	2.83	-52.31	-297.26	S1: 760 S2: 617	S3: 180 S3: 600
3.24	-0.57	-56.85	-273.56	S1: 760 S2: 617	S3: 180 S3: 600

CHECK FOR SEISMIC

2h: 800 mm

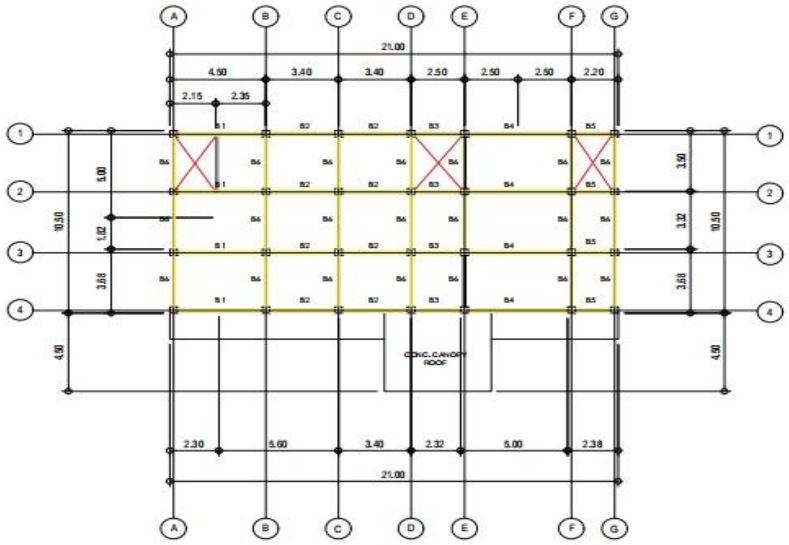
d/4: 90 mm
8db: 128 mm
24tb: 384 mm
300 300 mm

use: 90 mm

STIRRUPS: 1 @ 50MM, 10 @ 70mm, rest 150mm

DESIGN OF SINGLY REINFORCED RECTANGULAR BEAM FOR FLEXURE (RB4.A-B)

MATERIAL PROPERTIES:		BEAM DESCRIPTION AND LOADS:		
Concrete Compressive Strength (f'c):	21 MPa	Simple Support		
Yield Strength of Steel (fy):	275 MPa	Simple Span (L):	5 m	
Unit Weight of Concrete:	23.6 kN/m^3	Service Dead Load (DL):	15.82 kN/m	*including self-weight*
		Truss Load (TL):	10.94 kN	



SECOND FLOOR FRAMING PLAN
SCALE : 1 : 100

SOLUTION

III. Step 3 — *Compute the Factored Load*

Total Dead Load (W_{DL}=DL+DL_S):	15.82 kN/m
Truss Load (TL):	10.94 kN/m
Total Factored Load (WU=1.2WDL+TL):	**29.92 kN/m**

IV. Step 4 — *Compute the Factored Moment to be resisted by the Beam*

For maximum positive moment: (WDL2)/24 +(TL/8)

Maximum Positive Ultimate/Design Moment (M_U):	**23.32 kN-m**
Maximum Positive Nominal Moment (M_N):	**20.99 kN-m**

For maximum negative moment: (WDL2)/12 +(TL/8)

Maximum Negative Ultimate/Design Moment (M_U):	**39.80 kN-m**
Maximum Negative Nominal Moment (M_N):	**35.82 kN-m**

(if fc is greater than 28 but less than 55, solve for the value of β_1 using the calculator provided on the side)

V. Step 5 — *Determine β1*

28MPa < f'c < 55MPa	
Calculator for β_1	
β1	-0.1716

Table 422.2.2.4.3
Values of β_1 for Equivalent Rectangular Concrete Stress Distribution

f'_c, MPa	β_1	
$17 \le f'_c \le 28$	0.85	(a)
$28 < f'_c < 55$	$0.85-\frac{0.05(f'_c-28)}{7}$	(b)
$f'_c \ge 55$	0.65	(c)

β1: 0.85

VI. Step 6 — *Solve for the Maximum Steel Ratio*

$$\rho_{max} = \frac{0.85 f'_c \beta_1}{f_y}\left(\frac{0.003}{0.008}\right)$$

Maximum Steel Ratio, ρ_{max} = 0.0206898

VII.	Step 7	*Solve for bd^2 and Design Beam Section*

FOR MAXIMUM POSITIVE MOMENT:

bd^2 = 5416680.742 mm^3

$$bd^2 = \frac{M_U}{\varnothing \rho f y (1 - \frac{1}{1.7} \cdot \frac{\rho f y}{f'c}}$$

Assumed beam width, b, and solve for d (d=1.5b to d=2b):

Assumed beam width, b =	250.00	mm
Computed Beam Effective depth, d =	147.20	mm
Assumed Beam Effective depth, d =	410.00	mm
Check b/d ratio (between 0.5 and 0.67 =	0.60976	
Assumed Concrete Cover =	40.00	mm
Total Beam Height, h =	450.00	mm

b/d ratio is Satisfied

FOR MAXIMUM POSITIVE MOMENT:

bd^2 = 9244945.991 mm^3

$$bd^2 = \frac{M_U}{\varnothing \rho f y (1 - \frac{1}{1.7} \cdot \frac{\rho f y}{f'c}}$$

Assumed beam width, b, and solve for d (d=1.5b to d=2b):

Assumed beam width, b =	250.00	mm
Computed Beam Effective depth, d =	192.30	mm
Assumed Beam Effective depth, d =	410.00	mm
Check b/d ratio (between 0.5 and 0.67 =	0.60976	
Assumed Concrete Cover =	40.00	mm
Total Beam Height, h =	450.00	mm

b/d ratio is Satisfied

VIII.	Step 8	*Compute the weight of the beam and compare it to the assumption made in Step 2*

Computed Beam Weight = 2.6550 kN/m

IX.	Step 9	*Check beam thickness from the table*

Simple Supported Span, L =	5000.00	mm
Minimum height, h_{min} =	270.27	mm
Adjusted Minimum height, adjusted h_{min} =	270.00	mm
Supplied Beam Height, h =	450.00	mm

Beam height is okay

Table 409-1 - Minimum Thickness of Nonprestressed Beams or One-Way Slabs Unless Deflections are Computed

Member	Minimum Thickness, *h*			
	Simply Supported	One end continuous	Both ends continuous	Cantilever
	Members not supporting or attached to partitions or other construction likely to be damaged by large deflections			
Solid one-way slabs	$\frac{\ell}{20}$	$\frac{\ell}{24}$	$\frac{\ell}{28}$	$\frac{\ell}{10}$
Beams or ribbed one way slabs	$\frac{\ell}{16}$	$\frac{\ell}{18.5}$	$\frac{\ell}{21}$	$\frac{\ell}{8}$

Therefore use, 250.00 mm X 450.00 mm Beam Section

X. Step 10 *Solve for the steel requirements*

FOR MAXIMUM POSITIVE MOMENT			FOR MAXIMUM NEGATIVE MOMENT		
As1:	2120.701705		As1:	2120.701705	
Mu1:	180.900991		Mu1:	180.900991	
Mn1:	201.001102		Mn1:	201.001102	
analysis:	**Singly Reinforced**		**analysis:**	**Singly Reinforced**	
Rn:	0.61647608		Rn:	1.05217353	
ρ :	0.00228184		ρ :	0.00394603	
ρ min:	0.00509091		ρ min:	0.00509091	
ρ mccormac:	0.01374545		ρ mccormac:	0.01374545	
ρ bal:	0.03783273		ρ bal:	0.03783273	
ρ max:	0.02837455		ρ max:	0.02837455	
ρ sup:	0.00509091		ρ sup:	0.00509091	
As:	521.82	mm^2	As:	521.82	mm^2
db:	16	mm	db:	16	mm
Ab:	201.062	mm^2	Ab:	201.062	mm^2
Compression bars, n:	0		Compression bars, n:	0	
n supplied:	2	pcs.	n supplied:	2	pcs.
Tension bars, n:	2.595		Tension bars, n:	2.595	
n supplied:	**3**	**pcs.**	**n supplied:**	**3**	**pcs.**
Supplied Steel Area, As:	603.186	mm2	Supplied Steel Area, As:	603.186	mm2

XI. Step 11 *Solve for the Design Moment Capacity*

FOR MAXIMUM POSITIVE MOMENT			FOR MAXIMUM NEGATIVE MOMENT		
T=C			T=C		
AsFy = 0.85fcβcb			AsFy = 0.85fcβcb		
c:	43.731	mm	c:	43.731	mm
Depth of Compression Block, a:	37.171	mm	Depth of Compression Block, a:	37.171	mm
Section Design Moment Capacity:	58.434	kN-m	Section Design Moment Capacity:	58.434	kN-m

$$M_{Umax} = \emptyset T\left[d-\frac{a}{2}\right] = \emptyset A_s fy[d-\frac{a}{2}]$$

Verify the value of Ø

$$\varepsilon_t = \left[\frac{d-c}{c}\right](0.003) > 0.005$$

Et:	0.02513		Et:	0.02513	
Therefore the section is in Tension Controlled - Ductile Failure			Therefore the section is in Tension Controlled - Ductile Failure		
use			use		
Ø:	0.90		Ø:	0.90	

XI. Step 12 *Compare Actual Design Moment (MU) and Section Design Moment Capacity (Mumax)*

FOR MAXIMUM POSITIVE MOMENT			FOR MAXIMUM NEGATIVE MOMENT		
Section Design Moment Capacity:	58.434	kN-m	Section Design Moment Capacity:	58.434	kN-m
Actual Design Moment (MU):	23.32	kN-m	Actual Design Moment (MU):	39.80	kN-m
THEREFORE, SECTION IS SAFE			THEREFORE, SECTION IS SAFE		

SUMMARY:

beam height:	450.00	mm			
effective depth:	410.00	mm			
beam width:	250.00	mm			
db:	16	mm			
tb:	16	mm			
no. of bars:					
	at midspan			at support	
compression bars:	3	pcs.	compression bars:	3	pcs.
tension bars:	4	pcs.	tension bars:	4	pcs.

DESIGN FOR SHEAR STRENGTH

MATERIAL PROPERTIES:

Concrete Compressive Strength (fc):	21 MPa
Yield Strength of Steel (fy):	275 MPa

BEAM DIMENSIONS:

Simple Support

Simple Span (L):	5	m
Beam Width (b):	250.00	mm
Effective Depth (d):	410.00	mm

SERVICE LOADS:

Service Dead Load (DL):	15.82	kN/m	including beam weight
Truss Load (TL):	10.94	kN	

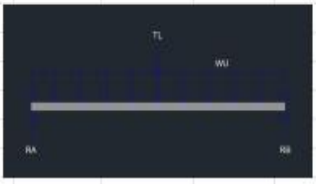
SOLUTION

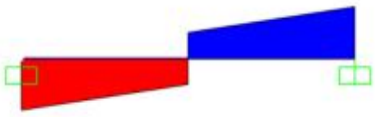
I. Step 1 *Determine the Factored Load W_U*

Wu = 1.2DL

Total Factored Load, W_U = 18.984 kN/m

II. Step 2 *Determine V_U at distance d*





Maximum Shear at Support

Vumax = WuL/2 + P/2

V umax = 52.93 kN

Shear at Distance d

$$V_{Ud} = R_A - W_U d$$

V_{ud} = 45.15 kN

411.2.3.1 For nonprestressed members, sections located less than a distance *d* from face of support shall be permitted to be designed for the same shear V_u as that computed at a distance *d*.

III. Step 3 — Determine V_c

Nominal shear strength provided by concrete V_c

$$V_c = 0.17\lambda\sqrt{f'c}\,b_w d$$

V_c = 79.85 kN
$\emptyset V_c$ = 59.89 kN
$1/2\emptyset V_c$ = 29.94 kN

411.4.1.1 For members subject to shear and flexure only:

$$V_c = 0.17\lambda\sqrt{f'_c}\,b_w d \qquad (411\text{-}3)$$

IV. Step 4 — Determine V_s at distance d

Nominal shear strenght provided by shear reinforcement

$$V_s = \frac{V_U}{\phi} - V_C$$

V_s = -19.66 kN

Check V_s

-If $0.66\sqrt{f'_c}b_w d \geq V_s$ (No need to redesign)

-If $0.66\sqrt{f'_c}b_w d < V_s$ (Need to redesign)

$0.66\sqrt{f'c}\,b_w d$ = 310.01 kN

THEREFORE, No need to redesign

411.2 Shear Strength

411.2.1 Except for members designed in accordance with Section 427, design of cross sections subject to shear shall be based on

$$\phi V_n \geq V_u \qquad (411\text{-}1)$$

where V_u is factored shear force at section considered and V_n is nominal shear strength computed by

$$V_n = V_c + V_s \qquad (411\text{-}2)$$

409.4.2 Strength-Reduction Factor

Strength-reduction factor ϕ shall be given in Sections 409.4.2.1 through 409.4.2.7:

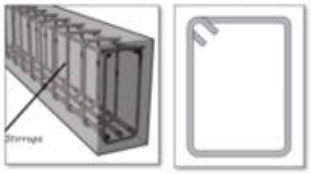
409.4.2.3 Shear and torsion (See also Section 409.4.4 for shear walls and frames in Seismic Zone 4) 0.75

411.6.7.9 Shear strength V_s shall not be taken greater than $0.66\sqrt{f'_c}\,b_w d$.

V. Step 5 — Solve for A_v

Bar Diameter for Shear Reinforcement, d_t = 10 mm
Number of Legs = 2
A_v = 157.08 mm^2

A_v = area of shear reinforcement within a distance s, mm^2



VI. Step 6 — Solve for Theoretical Spacing, S at distance d

Theoretical Spacing

$$S = \frac{A_v f_{yt} d}{V_s x 10^3}$$

Theoretical Spacing, s = -901.04 mm

411.6.7 Design of Shear Reinforcement

411.6.7.1 Where factored shear force V_u exceeds shear strength ϕV_n, shear reinforcement shall be provided to satisfy Equations (411-1) and (411-2), where shear strength V_n shall be computed in accordance with Sections 411.6.7.2 through 411.6.7.9.

411.6.7.2 Where shear reinforcement perpendicular to axis of member is used,

$$V_s = \frac{A_v f_y d}{s} \qquad (411\text{-}15)$$

VII. Step 7 *Check S_{max}*

$$A_{vmin} = 0.062\sqrt{f'c}\frac{b_w S_1}{f_{yt}}$$

S_1 = 608.15 mm

$$A_{vmin} = 0.062\sqrt{f'c}\frac{b_w S_1}{f_{yt}}$$

S_2 = 493.68

Use the smaller value for spacing

Spacing, s = 493.68

411.6.6 Minimum Shear Reinforcement

411.6.6.1 A minimum area of shear reinforcement, $A_{v,min}$, shall be provided in all reinforced concrete flexural members (prestressed and nonprestressed) where V_u exceeds $0.5\phi V_c$, except in members satisfying one or more of (1) through (6):

411.6.6.3 Where shear reinforcement is required by Section 411.6.6.1 or for strength and where Section 411.7.1 allows torsion to be neglected, the minimum area of shear reinforcement for prestressed (except as provided in Section 411.6.6.4) and nonprestressed members shall be computed by:

$$A_{v,min} = 0.062\sqrt{f'_c}\frac{b_w s}{f_{yt}} \qquad (411\text{-}13)$$

but shall not be less than $(0.35b_w s)/f_{yt}$, where b_w and s are in millimeters.

VIII. Step 8 *Check S_3*

V_S = -19.66 kN

155.00562 kN

For: $V_s \le 0.33\sqrt{f'c}\,b_w d$

$S = \frac{d}{2}$ or 600

For: $V_s > 0.33\sqrt{f'c}\,b_w d$

$S = \frac{d}{4}$ or 300

S_3 = 205 mm

S_3 = 600 mm

Use the smaller value for spacing

S_3 = 205 mm

411.6.5 Spacing Limits for Shear Reinforcement

411.6.5.1 Spacing of shear reinforcement placed perpendicular to axis of member shall not exceed $d/2$ in nonprestressed members and $0.75h$ in prestressed members, nor 600 mm.

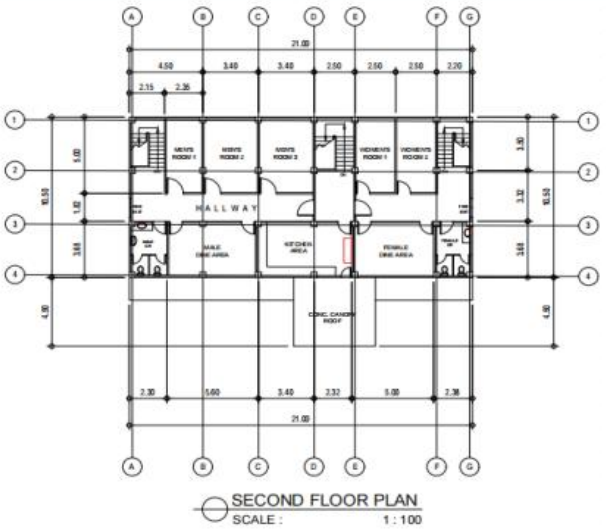
411.6.5.3 Where V_s exceeds $0.33\sqrt{f'_c}\,b_w d$, maximum spacing given in Sections 411.6.5.1 and 411.6.5.2 shall be reduced by one half.

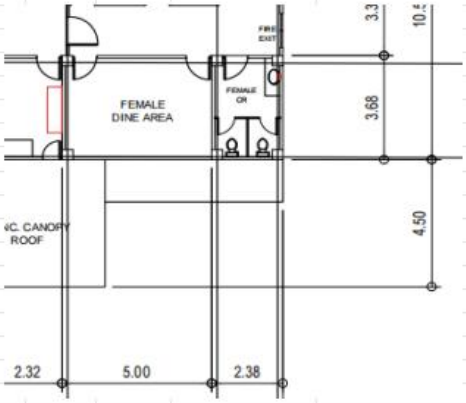
IX. Step 9 *Tabulate*

Distance from the support (m)	Factored Shear Force at section V_u (kN)	Nominal Shear Strength provided by shear reinforcement $V_s = \frac{V_u}{\phi} - V_c$, $\phi = 0.75$ (kN)	Theoretical Spacing $s = \frac{A_v f_{yt} d}{V_s \times 10^3}$ (mm)	Check S_{max}: $A_{v\,min} = 0.062\sqrt{f'_c}\frac{b_w S_1}{f_{yt}}$, $A_{v\,min} = 0.35\frac{b_w S_2}{f_{yt}}$ (mm)	Check S_3: For: $V_s \le 0.33\sqrt{f'_c}b_w d$, $S = \frac{d}{2}$ or 600; For: $V_s > 0.33\sqrt{f'_c}b_w d$, $S = \frac{d}{4}$ or 300 (mm)
0.41	45.15	-19.66	-901.04	S1: 608 S2: 494	S3: 205 S3: 600
0.82	37.36	-30.03	-589.69	S1: 608 S2: 494	S3: 205 S3: 600
1.23	29.58	-40.41	-438.26	S1: 608 S2: 494	S3: 205 S3: 600
1.64	21.80	-50.79	-348.71	S1: 608 S2: 494	S3: 205 S3: 600
2.05	14.01	-61.17	-289.54	S1: 608 S2: 494	S3: 205 S3: 600
2.46	6.23	-71.55	-247.54	S1: 608 S2: 494	S3: 205 S3: 600
2.87	-1.55	-81.92	-216.19	S1: 608 S2: 494	S3: 205 S3: 600
3.28	-9.34	-92.30	-191.88	S1: 608 S2: 494	S3: 205 S3: 600
3.69	-17.12	-102.68	-172.49	S1: 608 S2: 494	S3: 205 S3: 600

CHECK FOR SEISMIC			
	2h:	900	mm
	d/4:	102.5	mm
	8db:	128	mm
	24tb:	384	mm
	300	300	mm
	use:	102.5	mm
STIRRUPS:	1 @ 50MM, 10 @ 70mm, rest 150mm		

ANALYSIS AND DESIGN OF SLAB





TWO-WAY ANALYSIS: **COEFFICIENT METHOD**

Minimum Thickness of Slab

Assumed Size of Beam			h	400	mm
			w	200	mm
L	5000	mm	S	3680	
lnL	4800	mm	lnS	3480	
β	1.38				
Afm > 2.0					
hmin1	98.79	mm	ADOPT		
hmin	110	mm	125	mm	

Table 408.3.1.2 Minimum Thickness of Non-Prestressed Two-Way Slabs with Beams Spanning between Supports on All Sides

α_{fm} [1]	Minimum h, mm		
$\alpha_{fm} \le 0.2$	Section 408.3.1.1 applies		(a)
$0.2 < \alpha_{fm} \le 2.0$	Greater of:	$\frac{\ell_n\left(0.8+\frac{f_y}{1400}\right)}{36+5\beta(\alpha_{fm}-0.2)}$	(b)[2][3]
		125	(c)
$\alpha_{fm} > 2.0$	Greater of:	$\frac{\ell_n\left(0.8+\frac{f_y}{1400}\right)}{36+9\beta}$	(d)[2][3]
		90	(e)

[1] α_{fm} is the average value of α_f for all beams on edges of a panel and α_f shall be calculated in accordance with Section 408.10.2.7.
[2] ℓ_n is the clear span in the long direction, measured face-to-face of beams (mm.).
[3] β is the ratio of clear spans in long to short directions of slab.

PROPERTIES OF MATERIALS:

Description		Value	Units
Concrete compressive strength	fc'	21	Mpa
Reinforcing steel bar yield strength	fy	275	Mpa
Span	Long Span	5000	mm
	Short Span	3680	mm
Min. thickness (t=P/180)	tmin	98.79	mm
Considered thickness	t	125	mm
Clear Concrete cover	d'	70	mm
Diameter of bar	db	12	mm
Effective depth	d	324	mm
Factor depending of Fc'	β	0.85	
Balanced steel ratio=(.85Fc'B600)/fy(600+fy)	ρb	0.037832727	
Min. steel ratio (1.4/fy)	ρmin	0.0050909091	
Max. steel ratio (.75ρb)	ρmax	0.028374545	
Strength reduction factor	Ø	0.9	
Diameter of main bar	Dm	12	mm
Area of one bar (main)	Ao	113.0973355	mm^2
Diameter of temperature bar	Dt	10	mm
Area of one bar (temp.)	At	78.53981634	mm^2
Slab coefficient	S/L	0.736	

LOADINGS:

Description		Value	Unit
Live Loads			
Applied live load	LL	4.8	Kpa
Total Live Loads	LLt	4.8	Kpa
Dead Loads			
Weight of slab	Ws	2.95	Kpa
Weight of floor finishing and ceiling	Wf	1	kpa
Weight of Partition	Wp	3.531	kpa
Total Dead Loads	DLt	7.481	Kpa
Consider 1m strip		1000	mm
Total Load	W	12.281	KN/m
Ultimate Uniform Load	Wu	16.6572	KN/m

CASE 2

NEGATIVE MOMENT AT CONTINUOUS EDGE @MIDDLE STRIP (BENT BARS)

Interpolation:		
Cs	0.0724	
Cl	0.0204	
(-) Ms = (Cs)(Wu)(S^2)	16.3319	kN-m
(-) Ml = (Cl)(Wu)(L^2)	8.4952	kN-m

DESIGN OF REINFORCEMENT AT CONTINUOUS EDGE @MIDDLE STRIP (BENT BARS)

Description		Value	Unit		
Ultimate bending moment	Mu	16.3319	KN.m	(take q = 0.001)	
Actual steel Ratio (qf'c/fy)	ρ act.	0.003810		Mu/0.9 = 0.85 b d^2 f'c q (1-0.59 q)	
Min. steel ratio (1.4/fy)	ρmin.	0.005091		q	0.04989
Max. steel ratio (.75ρb)	ρmax	0.028375		p	0.00381
Area of req. reinforcemnt (As = **ρbd**)	Areq.	1649.454545	mm^2		
Number of Main Bars	n	14.58	pcs	15	pcs
Spacing of main bars (S < 3h < 450	S	66.66666667	mm		
Max. spacing (450 mm and 3h)	Smax1	375	mm		
	Smax2	450	mm		
Adopt spacing		60	mm		

NEGATIVE MOMENT AT CONTINUOUS EDGE	@SUPPORT	
Interpolation:		
Cs	0.0724	
Cl	0.0204	
(-) Ms = (Cs)(Wu)(S^2)	5.4440	kN-m
(-) Ml = (Cl)(Wu)(L^2)	2.8317	kN-m

DESIGN OF REINFORCEMENT AT CONTINUOUS EDGE	@SUPPORT					
Description		**Value**	**Unit**		(take q = 0.001)	
Ultimate bending moment	Mu	5.4440	KN.m		Mu/0.9 = 0.85 b d^2 f'c q (1-0.59 q)	
Actual steel Ratio (qf'c/fy)	ρ act.	0.001245				
Min. steel ratio (1.4/fy)	ρmin.	0.005091			q	0.01630
Max. steel ratio (.75pb)	ρmax	0.028375			p	0.00124
Area of req. reinforcemnt (As = **ρbd**)	Areq.	1649.454545	mm^2			
Number of Main Bars	n	14.58	pcs	15		
Spacing of main bars (S < 3h < 450 mm)	S	66.66666667	mm			
Max. spacing (450 mm and 3h)	Smax1	375	mm			
	Smax2	450	mm			
Adopt spacing		60	mm			

POSITIVE MOMENT ALONG SHORT DIRECTION (DISCONTINUOUS)	@MIDDLE STRIP (BENT BARS)				
Interpolation:				WuDL (1.2DL)	8.9772 kN/m
Cs(LL)	0.0473			WuLL (1.6LL)	7.68 kN/m
Cs(DL)	0.0293				
(+) Ms = (CsDL)(WuDL)(S^2)	3.5621	kN-m			
(+) Ml = (CsLL)(WuLL)(S^2)	4.9195	kN-m			
(+) Mt = Ms + Ml	8.4816	kN-m			

DESIGN OF REINFORCEMENT ALONG SHORT DIRECTION (DISCONTINUOUS)	@MIDDLE STRIP (BENT BARS)					
Description		**Value**	**Unit**		(take q = 0.001)	
Ultimate bending moment	Mu	8.4816	KN.m		Mu/0.9 = 0.85 b d^2 f'c q (1-0.59 q)	
Actual steel Ratio (qf'c/fy)	ρ act.	0.001950				
Min. steel ratio (1.4/fy)	ρmin.	0.005091			q	0.02553
Max. steel ratio (.75pb)	ρmax	0.028375			p	0.00195
Area of req. reinforcemnt (As = **ρbd**)	Areq.	1649.454545	mm^2			
Number of Main Bars	n	14.58	pcs	15 pcs		
Spacing of main bars (S < 3h < 450	S	66.66666667	mm			
Max. spacing (450 mm and 3h)	Smax1	375	mm			
	Smax2	450	mm			
Adopt spacing		60	mm			

POSITIVE MOMENT ALONG SHORT DIRECTION (DISCONTINUOUS)	@SUPPORT	
Interpolation:		
Cs(LL)	0.0473	
Cs(DL)	0.0293	
(+) Ms = (CsDL)(WuDL)(S^2)	1.1874	kN-m
(+) Ml = (CsLL)(WuLL)(S^2)	1.6398	kN-m
(+) Mt = Ms + Ml	2.8272	kN-m

DESIGN OF REINFORCEMENT ALONG SHORT DIRECTION (DISCONTINUOUS)	@SUPPORT					
Description		Value	Unit		(take q = 0.001)	
Ultimate bending moment	Mu	2.8272	KN.m		Mu/0.9 = 0.85 b d^2 f'c q (1-0.59 q)	
Actual steel Ratio (qf'c/fy)	ρ act.	0.000643				
Min. steel ratio (1.4/fy)	ρmin.	0.005091			q	0.008424
Max. steel ratio (.75pb)	ρmax	0.028375			p	0.000643
Area of req. reinforcemnt (As = **ρbd**)	Areq.	1649.454545	mm^2			
Number of Main Bars	n	14.58	pcs	15		
Spacing of main bars (S < 3h < 450 mm)	S	66.66666667	mm			
Max. spacing (450 mm and 3h)	Smax1	375	mm			
	Smax2	450	mm			
Adopt spacing		60	mm			

POSITIVE MOMENT ALONG LONG DIRECTION (DISCONTINUOUS)	@MIDDLE STRIP (BENT BARS)	
Interpolation:		
Cl(LL)	0.0134	
Cl(DL)	0.0083	
(+) Ms = (ClDL)(WuDL)(L^2)	1.8628	kN-m
(+) Ml = (ClLL)(WuLL)(L^2)	2.5728	kN-m
(+) Mt = Ms + Ml	4.4356	kN-m

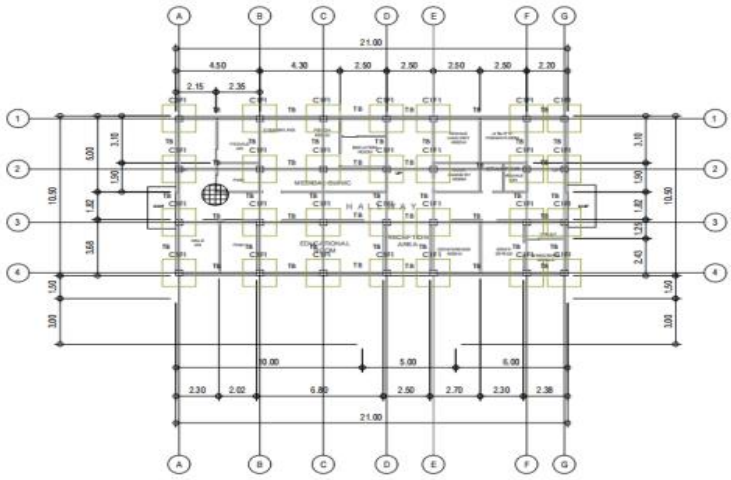
DESIGN OF REINFORCEMENT ALONG LONG DIRECTION (DISCONTINUOUS)	@MIDDLE STRIP (BENT BARS)					
Description		Value	Unit		(take q = 0.001)	
Ultimate bending moment	Mu	4.4356	KN.m		Mu/0.9 = 0.85 b d^2 f'c q (1-0.59 q)	
Actual steel Ratio (qf'c/fy)	ρ act.	0.001013				
Min. steel ratio (1.4/fy)	ρmin.	0.005091			q	0.01327
Max. steel ratio (.75pb)	ρmax	0.028375			p	0.00101
Area of req. reinforcemnt (As = **ρbd**)	Areq.	0.000000	mm^2			
Number of Main Bars	n	0.000	pcs	15 pcs		
Spacing of main bars (S < 3h < 450	S	66.66666667	mm			
Max. spacing (450 mm and 3h)	Smax1	375	mm			
	Smax2	450	mm			
Adopt spacing		60	mm			

POSITIVE MOMENT ALONG LONG DIRECTION (DISCONTINUOUS)	@SUPPORT	
Interpolation:		
Cl(LL)	0.0134	
Cl(DL)	0.0083	
(+) Ms = (ClDL)(WuDL)(L^2)	0.6209	kN-m
(+) Ml = (ClLL)(WuLL)(L^2)	0.8576	kN-m
(+) Mt = Ms + Ml	1.4785	kN-m

DESIGN OF REINFORCEMENT ALONG LONG DIRECTION (DISCONTINUOUS)	@SUPPORT				
Description		Value	Unit		(take q = 0.001)
Ultimate bending moment	Mu	1.4785	KN.m		Mu/0.9 = 0.85 b d^2 f'c q (1-0.59 q)
Actual steel Ratio (ρf'c/fy)	ρ act.	0.000336			
Min. steel ratio (1.4/fy)	ρmin.	0.005091		q	0.00440
Max. steel ratio (.75ρb)	ρmax	0.028375		p	0.00034
Area of req. reinforcemnt (As = **ρbd**)	Areq.	1649.454545	mm^2		
Number of Main Bars	n	14.584	pcs	15	
Spacing of main bars (S < 3h < 450 mm)	S	66.66666667	mm		
Max. spacing (450 mm and 3h)	Smax1	375	mm		
	Smax2	450	mm		
Adopt spacing		60	mm		

DESIGN OF TEMPERATURE BAR	@MIDDLE STRIP (BENT BARS)		
Description		Value	Unit
Area of required temp. bars	At req.	1145.455	mm^2
Spacing of temp. bar	S	68.567	mm
Max. allowed spacing	Stmax	450	mm
	Smax1	375	mm
Adopt spacing		60	mm

ANALYSIS AND DESIGN OF FOOTING



ISOLATED FOOTING 10		
Number of Stories	2	
Floor Height (1st)	3.3	m
Floor Height (2nd)	3	m

Live Load:		
2nd Floor LL	4.8	kPa
Roof LL	0.75	kPa
Slab (tributary):		
1st Floor total area	12.125	m2
2nd Floor total area	12.125	m2
thickness of slab	0.125	m
Total Wt of Slab	71.5375	kN
Beam:		
h	0.4	m
bw	0.2	m
Total length of tributary beams	7.25	m
Wt of beam @ 2nd floor	13.688	kN
Wt of beam @ Roof	13.688	kN
Columns:		
Square column size (c)	0.3	m
Wt of Columns (including the neck column)	18.2664	kN
Walls:		
Total Wt. of Walls directed to the footing	61.20896	kN
Earthquake Load:	0	kN
Total Tributary Weight in Isolated Footing	178.38886	kN

Properties:					
Concrete Compressive Strength (f'c):	21	MPa			
Yield Strength of Steel (fy):	275	MPa			
Unit Weight of Concrete:	23.6	kN/m^3			
Square Column Dimension:	300	mm			
diameter of bar, db:	12	mm			
Concrete cover, Cc:	50	mm			
PD:	178.38886	kN			
PL:	16.8234375	kN			
Assume Weight of Footing:	10%				
qall:	108.73	kPa			

Solution:					
Weight of Footing:	19.52122975	kN			
Pn:	214.7335273	kN			
Required Area:	1.974924375	m^2	say	1.974924375	m^2
Length of Footing:	1.405320026	m	say	**1.5**	m
Actual Area:	2.25	m^2			
Pu:	264.4096077	kN			
Actual qu:	117.5153812	kPa			
Allowable qu:	133.883409	kPa			
Is allowable qu greater than qall?	SAFE				

Check for Wide Beam Shear:

Computing "d" for Beam Shear:

$$Vc = \frac{1}{6}\sqrt{f'c}$$

$$Vn = \frac{Vu}{\emptyset bd} = \frac{quLx}{\emptyset bd}$$

$$x = \frac{L-c}{2} - d$$

Vc:	0.763762616	MPa	
d:	304.6674	mm	
say	**305**	mm	

Check for Punching Shear Depth:

Computing "d" for Punching Shear:

Allowable Punching Shear:

$$Allowable\ Vcp = \frac{1}{3}\sqrt{f'c}$$

Allowable Vcp:	1.527525232	MPa	

Actual Punching Shear:

$$Actual\ Vcp = (1 + \frac{2}{\beta})(\frac{\sqrt{f'c}}{6})$$

β:	1			
Actual Vcp:	2.291287847			
Is actual Vcp greater than allowable Vcp?	TRUE	use Allowable Vcp	1.527525232	MPa

Actual Punching Shear:

Equate Allowable Vcp & Vnp:

$$Vn = \frac{Vup}{\emptyset bod} = \frac{qu(L^2 - (c+d)^2)}{\emptyset(c+d)(4d)}$$

d:	125.3546	mm	say	126	mm
use bigger value of d:	305	mm			

Total depth (D):

D:	373	mm	say	380	mm

Solve for Actual Ultimate Moment:

$$Lm = \frac{L - c}{2}$$

Lm: 600 mm

$$Mu = \frac{quL(Lm)^2}{2}$$

Mu: 36.14852042 kN-m

Solve for steel ratio (ρ) to be used:

$$Mu = \emptyset f'cbd^2w(1 - 0.59w)$$

w: 0.02872709

$$\rho = \frac{wf'c}{fy}$$

ρ: 0.002193705

$$\rho min1 = \frac{1.4}{fy}$$

ρmin1: 0.005090909

$$\rho min2 = \frac{\sqrt{f'c}}{4fy}$$

ρmin2: 0.004165978

$$\rho max = \frac{0.375(0.85)\beta f'c}{fy}$$

ρmax: 0.020689773

use ρ: 0.005090909

Compute for the Area of Steel:						
	As:	962.1818182	mm^2			
Solve for number of 20 mm bars needed:						
	Ab:	113.0973355				
	n:	8.50755514	pcs	say	9	pcs
Spacing:	s:	117.5425823	mm	say	100	mm
Solve for the development length:						
	Ldreq:	432.0714227	mm			
	Ldfurnished:	550	mm			
	hook at bar end is not required					

DESIGN OF TIE BEAMS

MATERIAL PROPERTIES

Concrete Compressive Strength (f'c):	21	MPa
Yield Strength of Steel (fy):	275	MPa
Unit Weight of Concrete:	23.6	kN/m^3

BEAM DESCRIPTION AND LOADS

Beam Number:	G17	
Simple Support		
Simple Span (L):	5	m
Service Dead Load (DL):	15.222	kN/m
Service Live Load (LL):	0	kN/m

I. Step 1 — *Determine the values of loads, Service Dead Load and Live load.*

Service Dead Load (DL):	15.222	kN/m
Service Live Load (LL):	0	kN/m
Total Service Uniform Load:	15.222	kN/m

II. Step 2 — *Approximate the weight of the Beam between 20% to 25% of (DL+LL).*

Assumed % weight of the Beam:	25	%
Approximated weight of the Beam:	3.8055	kN/m

III. Step 3 — *Compute the Factored Load.*

Total Dead Load:	19.0275	kN/m
Total Live Load:	0	kN/m
Total Factored Load:	22.833	kN/m

IV. Step 4 — *Compute the Factored Moment to be resisted by the Beam.*

Maximum Ultimate/Design Moment: 71.353125 kN-m

V. Step 5 — *Determine β_1.*

If $17MPa \leq f'c \leq 28MPa$, then $\beta_1 = 0.85$

If $f'c > 28MPa$, then $\beta_1 = 0.85 - \frac{0.05}{7}(f'c - 28)$ but $\beta_1 \geq 0.65$

β_1 0.85

VI. Step 6 — *Solve for ρbal , ρmax, ρMcCormac, ρmin.*

Assumed Steel Ratio Between ρmin and 0.5 ρbal or 0.6 ρbal

Balance Steel Ratio, ρbal:	0.0378327
0.5ρbal:	0.0189164
0.6ρbal:	0.0226996
Maximum Steel Ratio, ρmax:	0.0206898
McCormac Steel Ratio, ρMcCormac:	0.0137455
Minimum Steel Ratio, ρmin:	0.0050909
[1]	0.004166
[2]	0.0050909
Assumed Steel Ratio:	**0.0137455**

VII. Step 7 — *Solve for bd^2 and Design Beam Section.*

bd^2:	23457624	mm^3	
Assume beam width, b, and solve for d (1.5b to 2b)			
Assumed beam width, b:	250	mm	
d:	375	mm	380 mm
b/d ratio (between 0.5 and 0.67):	0.6666667		SATISFIED
Assumed Concrete Cover:	60	mm	
Total Beam Height, h:	440	mm	

VIII. Step 8 — *Compute the beam weight and compare it to the assumption.*

Computed Beam Weight:	2.596	kN/m
Assumed Beam Weight:	3.8055	kN/m

VIII. Step 8 — *Compute the beam weight and compare it to the assumption.*

Simply Supported Span, L:	5.00	m	
Minimum Height, hmin:	312.5	mm	
Supplied Beam Height:	440	mm	SATISFIED

Table 409-1 - Minimum Thickness of Nonprestressed Beams or One-Way Slabs Unless Deflections are Computed

Member	Minimum Thickness, *h*			
	Simply Supported	One end continuous	Both ends continuous	Cantilever
	Members not supporting or attached to partitions or other construction likely to be damaged by large deflections			
Solid one-way slabs	$\frac{\ell}{20}$	$\frac{\ell}{24}$	$\frac{\ell}{28}$	$\frac{\ell}{10}$
Beams or ribbed one way slabs	$\frac{\ell}{16}$	$\frac{\ell}{18.5}$	$\frac{\ell}{21}$	$\frac{\ell}{8}$

Values given shall be used directly for members with normal weight concrete (w_c = 2,400 kg/m³) and Grade 415 reinforcement. For other conditions, the values shall be modified as follows:

a) For structural lightweight concrete having unit weight in the range 1,500-2,000 kg.m³, the values shall be multiplied by (1.65 - 0.0003w_c) but not less than 1.09, where w_c is the unit weight in kg/m³.

b) For f_y other than 415 MPa, the values shall be multiplied by (0.4 + f_y/700)

Therefore, use the Beam Section 250 mm x 440 mm

X. Step 10 — *Solve for the required steel area and number of bars.*

Required Steel Area, As:	1288.6364	mm^2	
Main Reinforcing Steel Diameter, d_b:	20	mm	
A_b:	314.15927	mm^2	
Number of Bars Required, n:	4.1018569	pcs	
Use Number of Bars, n:	5	pcs	
Supplied Steel Area, As:	1570.7963	mm^2	
ρmin:	0.0050909		
ρsupplied:	0.0167552		
ρmax:	0.0206898		

ρmin ≤ ρsupplied ≤ ρmax **Therefore, the section is Singly Reinforced.**

XI.	Step 11	*Solve for the Design Moment Capacity.*			
		C=T			
		C:	$0.85f'_c ab$		
		T:	Asfy	431968.99	
		Depth of Compression Block, a:	96.799774	mm	
		c:	113.88209	mm	
		assume Ø:	0.9		
		Section Design Moment Capacity, M_{umax}:	126.97301	kN-m	
		Verify Ø value:			
		ε_t:	0.0068786		tension-controlled
		Ø:	0.90		

XII.	Step 12	*Compare Actual Design Moment (Mu) and Section Design Moment Capacity (Mumax).*		
		Section Design Moment Capacity, Mumax:	126.97301	kN-m
		Maximum Ultimate/Design Moment, Mu:	71.353125	kN-m
			SECTION IS SAFE	

SUMMARY:

STEEL REINFORCEMENT:

Actual Tension Steel:		
$A_{sactual}$:	1570.7963	mm^2
Bar Diameter:	20	mm
Area of one bar, A_b:	314.15927	mm^2
Use Number of Bars, n:	5	pcs

BEAM DIMENSION:

Overall height, h:	440	mm
Beam Width, b:	250	mm
Tension Side Concrete Cover:	60	mm
Effective Depth (d):	380	mm

DESIGN:

Use	250	mm	by	440	mm
Beam Secti	5	-	20	mm	Tension Bars

DESIGN FOR SHEAR STRENGTH

Maximum Shear at Support

R_A: 57.0825 kN

Shear at Distance d

Vu 48.40596 kN

Determine Vc

$V_c = 0.17\lambda\sqrt{f'c}b_w d$

Vc: 74.008597 kN
ØVc: 55.506448 kN
1/2ØVc: 27.753224 kN

Determine Vs at distance d

Check V_s
-If $0.66\sqrt{f'c}b_w d \geq V_s$ (No need to redesign)
-If $0.66\sqrt{f'c}b_w d < V_s$ (Need to redesign)

Vs: -9.467317 kN

$V_s = \frac{V_U}{\phi} - V_C$

Check Vs

$0.66\sqrt{f'c}b_w d$: 287.3275 kN

THEREFORE, SAFE

Determine the area of shear reinforcements with distances, Av

Bar Diameter for Shear Reinforcement, dt: 10 mm
Number of Legs: 2
Av: 157.07963 mm^2

Theoretical Spacing, S at distance d

Theoretical Spacing, s: -1733.841 mm

Check Smax

$A_{vmin} = 0.062\sqrt{f'c}\frac{b_w S_1}{f_{yt}}$

$A_{vmin} = \frac{0.35 bw S_2}{f_{yt}}$

s1: 608.15072 mm
s2: 493.67885 mm

smax: 493.67885 mm

Check s3:

Vs: -9.467317 kN

$0.33\sqrt{f'c}b_w d$: 143.66375 kN

$For: V_s \leq 0.33\sqrt{f'c}b_w d$ $\quad S = \frac{d}{2}$ or 600

$For: V_s > 0.33\sqrt{f'c}b_w d$ $\quad S = \frac{d}{4}$ or 300

s: 190 mm

s: 600 mm

s3: 190 mm

Tabulate:

Distance from the support (m)	Factored Shear Force at Section (kN)	Nominal Shear Strength provided by shear reinforcement (kN)	Theoretical Spacing (mm)	Smax (mm)	s3 (mm)
0.525	45.095175	-13.88169747	-1633.68868	s1: 608.1507201	s3: 190
				s2: 493.6788456	s3: 600
1.05	33.10785	-29.86479747	-1518.73603	s1: 608.1507201	s3: 190
				s2: 493.6788456	s3: 600
1.575	21.120525	-45.84789747	-1483.93099	s1: 608.1507201	s3: 190
				s2: 493.6788456	s3: 600
2.1	9.1332	-61.83099747	-1467.11992	s1: 608.1507201	s3: 190
				s2: 493.6788456	s3: 600
2.625	-2.854125	-77.81409747	-1457.21487	s1: 608.1507201	s3: 190
				s2: 493.6788456	s3: 600
3.15	-14.84145	-93.79719747	-1450.68547	s1: 608.1507201	s3: 190
				s2: 493.6788456	s3: 600

COLUMN DESIGN FOR B3

Red — Given values/assumed values/input

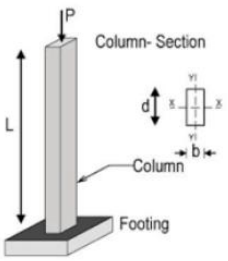
MATERIAL PROPERTIES :

Concrete Compressive Strength (f'c):	21 MPa
Yield Strength of Steel (fy):	275 MPa

LOADS :

Dead Load (DL):	173.60 kN
Live Load (LL):	123.11 kN
Truss Load (TL):	0.00 kN
Factored Load (PU):	405.30 kN

Phi value (ø) =	0.65
Alpha value (α) =	0.8
As =	0.02 Ag



12

Selecting Column Dimensions:

Pn =	623.53 kN
Area of section, Ag =	33897.94 mm2
b=	184.11 mm
use:	190.00 mm

Therefore, use:

300 mm x 300 mm Column Section

Chpt.7 (708.2.3.9) NSCP 2015

3. **Columns**

3.1 The nominal width of a column shall not be less than 300 mm.

3.2 The distance between lateral supports of a column shall not exceed 30 times the nominal width of the column.

3.3 The nominal length of a column shall not be less than 300 mm and not greater than three times the nominal width of the column.

Selecting Longitudinal Bars:

Area of steel, Ast =	722.00 mm2
Diameter of ties =	10 mm
Set Main Reinforcing Steel Diameter, db =	16 mm
Ab=	201.06 mm2
Number of Bars Required, n =	3.59 pcs
Use Number of Bars, n =	8.00 pcs

Therefore use, 8.00 pcs - 16 mm dia. bars

Design Tie Spacing:

16(db) =	256 mm
48 tie =	480 mm
least column dimension =	300 mm

*use the smallest value

Therefore use, # 10 ties @ 250 mm tie spacing

DESIGN:

Use	300	mm	by	300	mm
Column Section with	8.00	-	16	mm	Ø Tension Bars
	# 10	ties @	250	mm	Tie Spacing

DESIGN FOR SQUARE TIED COLUMN		
Dead Load	173.60	kN
Live Load	123.11	kN
Truss Load	0.00	kN
Column Short Dimesnion,ts	300	mm
Column Long Distance,tl	300	mm
Concrete Strength, f'c	21	MPa
Yielding Strength, fy	275	MPa
Diameter of Main Bar	16	mm
No. of Bars	8.00	pcs
Diameter of Tie Bar	10	mm
Phi Value	0.65	
Alpha Value	0.8	

Capacity Check		
Total Factored Load, Pu	405.30	kN
Gross Area,Ag	90000	mm^2
Area of Steel, Ast	1608.5	mm^2
Ultimate Axial Capacity	1050.47	kN
Maximum Column Load	405.296	kN
SAFE		

Properties			Loads	
fy	275 MPa		Live load	1.9 kPa
f'c	21 MPa		Miscellaneous live load	0.5 kPa
cc	20 mm		Floor finish and toppings	1.1 kPa
Main Bar		12 mm ø	Miscellaneous dead load	0.5 kPa
Temperature Bar		10 mm ø		
Hook Bar		10 mm ø		

STAIR DETAIL :

Tread	0.3	m
Riser	0.2	m
Lc	2.5	m

Solution

I. HEIGHT OF STAIRS

Hmin = L/20 = 125 mm

II. DEAD LOADS (self weight)

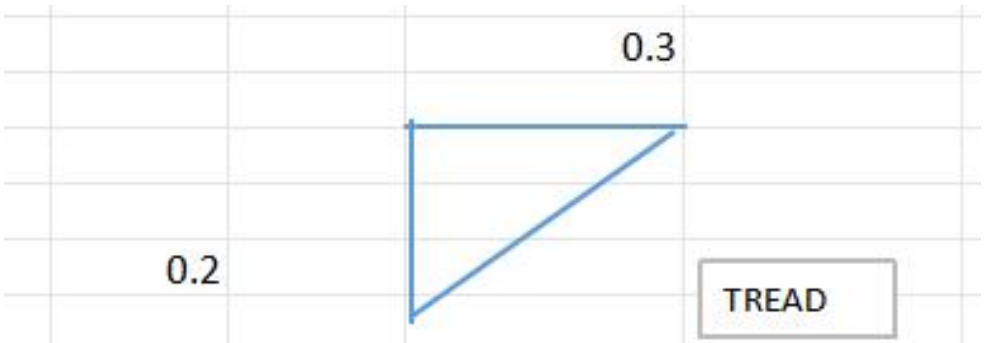
weight of step 2.36 kPa

WEIGHT OF SLAB $=H\omega\left(\frac{\sqrt{R^2+T^2}}{T}\right)$

WEIGHT OF SLAB

= 4.254550505 kPa

DLself	6.614550505 kPa		
SDL	1.6 kPa	LL	2.4 kPa
Wu	13.69746061 kN/m		



III. EFFECTIVE DEPTH

d 99 mm

IV. MOMENT (simply supported)

Mu	10.7011411	kN-m
Rn	1.213157512	Mpa
p req	0.004572539	
p min	0.005090909	
p max	0.037832727	
Use p	0.005090909	

$$\rho_{reqd} = \frac{0.85f_c'}{f_y}\left(1 - \sqrt{1 - \frac{2R_n}{0.85f_c'}}\right)$$

V. SPACING

Main Bars

As	504	sq. mm	Ab main	113.09724 sq. mm
Spacing 1	200	mm		
Spacing 2	375	mm		
Spacing	200	mm		

Temperature Bars

As	178.2			78.53975 sq. mm
Spacing 1	425	mm		
Spacing 2	375	mm		
Spacing	375	mm		

APPENDIX E

COST ESTIMATES

BILL OF QUANTITIES

SPL Item No.	Description	Unit	Quantity	Unit Price (Php)	Amount (Php)	Total Amount (Php)
1	GENERAL REQUIREMENTS					1,326,597.27
1.1	Permitting Works	1	l.s	65,625.00	65,625.00	
1.2	Layouting and Staking	441	sq.m	55.77	24,596.02	
1.3	Billboadrs/SignBoards	2	each	20,416.56	40,833.12	
1.4	Occupational Safety and Health	11.33	mos	57,595.93	652,561.88	
1.5	Mobilization/Demobilization	1	l.s	276,543.75	276,543.75	
1.6	Clearing and Grubbing	1000	sq.m	276.54	276,543.75	
2	TEMPORARY FACILITIES FOR THE ENGINEER					230,514.89
2.1	Provision of the Office for the Engineer	30	sq.m	2,630.70	78,921.14	
2.2	Operation and Maintenance of the Engineer's Office	11.33	mos	13,379.85	151,593.75	
3	EARTHWORKS					2,069,050.40
3.1	Excavation	654.28	cu.m	2,007.50	1,313,466.00	
3.2	Embankment from Excavation	176.17	cu.m	2,030.18	357,656.25	
3.3	Gravel Fill	75.80	cu.m	5,249.71	397,928.15	
4	FORM WORKS AND SCAFFOLDINGS					1,137,392.09
4.1	Footing	58.88	sq. m	385.27	22,684.85	
4.2	Column	313.36	sq. m	497.73	155,969.38	
4.3	Beams	324.18	sq. m	540.36	175,173.50	
4.4	Slabs	283.75	sq. m	489.24	138,820.94	
4.5	Stairs	61.85	sq. m	558.33	34,532.54	
4.6	Scaffoldings	921.6	sq. m	662.12	610,210.88	
5	CONCRETE WORKS					2,652,446.17
5.1	Footing	32.78	cu.m	12,439.45	407,737.12	
5.2	Tie Beam	17.31	cu.m	11,335.19	196,174.60	
5.3	Column	33.87	cu.m	12,617.94	427,389.62	
5.4	Slab	83.13	cu.m	11,335.19	942,251.17	
5.5	Beam	29.26	cu.m	12,617.94	369,158.77	
5.6	Stairs	38.73	cu.m	6,492.16	251,417.49	
5.7	Ramp	7.59	cu.m	7,680.21	58,317.41	
6	MASONRY WORKS					1,794,653.75
6.1	CHB Walls	2132.47	sq.m	841.58	1,794,653.75	
7	STEEL WORKS					2,479,176.47
7.1	Footing	4590.11	kgs	62.60	287,332.85	
7.2	Tie Beams	5102.65	kgs	65.13	332,315.93	
7.3	Beams	12647.3	kgs	53.20	672,876.95	
7.4	Slabs	16156.96	kgs	39.24	634,017.60	
7.5	Column	6829.09	kgs	58.54	399,789.24	
7.6	Stairs/Ramps	2456.19	kgs	62.23	152,843.90	
8	TILE WORKS					775,787.75
8.1	Tiling Works	2721	sq.m	285.11	775,787.75	
9	PAINTING WORKS					830,817.94
9.1	Painting Works	1532.23	sq.m	542.23	830,817.94	
10	OPENINGS					1,461,133.86
10.1	Windows	192	sq.m	9,237.49	1,461,133.86	
10.2	Doors	72.13	sq.m	7,403.84	706,169.86	
11	ROOFING WORKS					1,208,101.20
11.1	Roofing and Roof Framing	504	sq.m	2,397.03	1,208,101.20	
12	ELECTRICAL WORKS					1,215,411.22
12.1	Luminaire and Lighting	1	lot	321,523.75	321,523.75	
12.2	Conduits/Fittings	1	lot	1,737,562.09	1,737,562.09	
12.3	Wiring Device and Fixtures	1	lot	- 843,674.62	- 843,674.62	
13	PLUMBING WORKS					1,346,206.32
13.1	Cold Water Line	1	lot	1,280,206.32	1,280,206.32	
13.2	Sanitary Line	1	lot	11,000.00	11,000.00	
13.3	Plumbing Fixtures, Complete with Fittings & Accessories	1	lot	55,000.00	55,000.00	
				TOTAL PROJECT COST		18,527,289.32

PROJECT NAME: PROPOSED TWO-STOREY BALAY SILANGAN
LOCATION Brgy. Caraudan, Janiuay, Iloilo

SPL.ITEM		Description	Quantity	Unit	Unit Cost (PhP)	Amount (PhP)	Sub-Total (PhP)	Total (PhP)
1	GENERAL REQUIREMENTS							
	1.1	Permitting Works	1	l.s	50,000.00	50,000.00	50,000.00	**50,000.00**
						TOTAL DIRECT COST		50,000.00
						OCM (PhP)	*15% of DC*	7,500.00
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	5,000.00
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	3,125.00
						TOTAL INDIRECT COST		15,625.00
						TOTAL PROJECT COST (PhP)		**65,625.00**
	1.2	Layouting and Staking	441	sq.m				
	A. MATERIALS							
		Nylon String	5	roll	120.00		600.00	
		2"x2"x10' Coco Lumber	35	pc	325.00		11,375.00	
		4" CW Nails	4	kg	100.00		400.00	
		2 1/2" CW Nails	2	kg	80.00		160.00	
							12,535.00	
	B. LABOR (45% MATERIALS COST)						**5,640.75**	
	C. EQUIPMENT							
	Minor Tools (10% LABOR COST)						**564.08**	
						TOTAL DIRECT COST		18,739.83
						OCM (PhP)	*15% of DC*	2,810.97
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	1,873.98
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	1,171.24
						TOTAL INDIRECT COST		5,856.20
						TOTAL PROJECT COST (PhP)		**24,596.02**
	1.3	Billboadrs/SignBoards						
	A. MATERIALS							
		Tarpaulin with text 8x8 (COA)	1	pc.	4,000.00		4,000.00	
		Tarpaulin with text 4x8 (project)	2	pcs.	4,000.00		8,000.00	
		Marine Plywood (3/4" thk)	4	pcs.	1,250.00		5,000.00	
		Rough Lumber 2x2x8	25	pcs.	135.00		3,375.00	
		C.W.N. Asst.	3	kilos	145.00		435.00	
							20,810.00	
	B. LABOR (45% MATERIALS COST)						**9,364.50**	
	C. EQUIPMENT							
	MINOR TOOLS (10% LABOR COST)						**936.45**	
						TOTAL DIRECT COST		31,110.95
						OCM (PhP)	*15% of DC*	4,666.64
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	3,111.10
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	1,944.43
						TOTAL INDIRECT COST		9,722.17
						TOTAL PROJECT COST (PhP)		**40,833.12**
	1.4	Occupational Safety and Health						
	A. MATERIALS							

		PPE	11.33	mo.	15,000.00		169,950.00	
		Signages	1.00	l.s	10,000.00		10,000.00	
							179,950.00	
	B. LABOR							
		Safety Officer	11.33	mo.	28,000.00		**317,240.00**	
						TOTAL DIRECT COST		497,190.00
						OCM (PhP)	*15% of DC*	74,578.50
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	49,719.00
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	31,074.38
						TOTAL INDIRECT COST		155,371.88
						TOTAL PROJECT COST (PhP)		**652,561.88**
	1.5	Mobilization/Demobilization						
	A. LABOR							
		Laborers	6.00	persons	3,500.00		**21,000.00**	
	B. EQUIPMENT							
		Backhoe (0.80 cu.m)	7	days	14,400.00		100,800.00	
		Dump Truck (12 cu.yd)	7	days	12,400.00		86,800.00	
	Minor Tools (10% Labor Cost)						2,100.00	
							189,700.00	
						TOTAL DIRECT COST		210,700.00
						OCM (PhP)	*15% of DC*	31,605.00
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	21,070.00
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	13,168.75
						TOTAL INDIRECT COST		65,843.75
						TOTAL PROJECT COST (PhP)		**276,543.75**
	1.6	Clearing and Grubbing	1000	sq.m				
	A. LABOR							
		Laborers	4.00	persons	3,500.00		**14,000.00**	
	B. EQUIPMENT							
		Backhoe (0.80 cu.m)	7	days	14,400.00		100,800.00	
		Dump Truck (12 cu.yd)	7	days	12,400.00		86,800.00	
							187,600.00	
	MINOR TOOLS (10% LABOR COST)						**1,400.00**	
						TOTAL DIRECT COST		203,000.00
						OCM (PhP)	*15% of DC*	30,450.00
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	20,300.00
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	12,687.50
						TOTAL INDIRECT COST		63,437.50
						TOTAL PROJECT COST (PhP)		**266,437.50**
SPL.ITEM		Description	Quantity	Unit	Unit Cost (PhP)	Amount (PhP)	Sub-Total (PhP)	Total (PhP)
2	**TEMPORARY FACILITIES FOR THE ENGINEER**							
	2.1	Provision of the Office for the Engineer	40	sq.m				
	A. MATERIALS	Lumber	75	bd.ft.	70.00	5,250.00	5,250.00	
		Plywood 4ftx8ftx1/2	28	pcs	900.00	25,200.00	25,200.00	
		Roofing Sheets (3m long)	15	pcs	587.00	8,805.00	8,805.00	
		Assorted Nails	14	kg	69.00	966.00	966.00	
							40,221.00	
	B. LABOR (45% Material Cost)						**18,099.45**	
	C. EQUIPMENT							
	Minor Tools (10% Labor Cost)						**1,809.95**	

						DIRECT COST		60,130.40
						OCM (PhP)	*15% of DC*	9,019.56
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	6,013.04
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	3,758.15
						TOTAL PROJECT COST (PhP)		**78,921.14**
								-
	2.2	Operation and Maintenance of the Engineer's Office						
		Water Bill	11	mos	3,000.00		33,000.00	
		Electric Bill	11	mos	7,500.00		82,500.00	
							115,500.00	
						DIRECT COST		115,500.00
						OCM (PhP)	*15% of DC*	17,325.00
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	11,550.00
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	7,218.75
						TOTAL PROJECT COST (PhP)		**151,593.75**
SPL.ITEM		Description	Quantity	Unit	Unit Cost (PhP)	Amount (PhP)	Sub-Total (PhP)	Total (PhP)
3	**EARTHWORKS**		**906.25**	**cu.m**				
	3.1	Excavation	654.28	cu.m				
	A. LABOR							
		Laborers	8.00	persons	24,500.00		**196,000.00**	
	B. EQUIPMENT							
		Backhoe (0.80 cu.m)	654.28	cu.m	1,200.00		785,136.00	
	Minor Tools (10% Labor Cost)						19,600.00	
							804,736.00	
						TOTAL DIRECT COST		1,000,736.00
						OCM (PhP)	*15% of DC*	150,110.40
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	100,073.60
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	62,546.00
						TOTAL INDIRECT COST		312,730.00
						TOTAL PROJECT COST (PhP)		**1,313,466.00**
	3.2	Embankment from Excavation	176.17	cu.m				
	A. LABOR							
		Laborers	6.00	persons	3,500.00		**21,000.00**	
	B. EQUIPMENT							
		Plate Compactor	7.00	days	5,000.00		35,000.00	
		Backhoe (0.80 cu.m)	8	days	14,400.00		115,200.00	
		Dump Truck (12 cu.yd)	8	days	12,400.00		99,200.00	
	Minor Tools (10% Labor Cost)						2,100.00	
							251,500.00	
						TOTAL DIRECT COST		272,500.00
						OCM (PhP)	*15% of DC*	40,875.00
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	27,250.00
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	17,031.25
						TOTAL INDIRECT COST		85,156.25
						TOTAL PROJECT COST (PhP)		**357,656.25**
	3.3	Gravel Fill	75.80	cu.m				
	A. MATERIALS							
		Screened Gravel	75.80	cu.m	1,350.00		**102,330.00**	
	B. LABOR (45% Material Cost)						**46,048.50**	
	C. EQUIPMENT							
		Plate Compactor	7.00	days	5,000.00		35,000.00	
		Backhoe (0.80 cu.m)	8	days	14,400.00		115,200.00	
	Minor Tools (10% Labor Cost)						4,604.85	
							154,804.85	

						TOTAL DIRECT COST		303,183.35
						OCM (PhP)	*15% of DC*	45,477.50
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	30,318.34
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	18,948.96
						TOTAL INDIRECT COST		94,744.80
						TOTAL PROJECT COST (PhP)		**397,928.15**
SPL.ITEM		Description	Quantity	Unit	Unit Cost (PhP)	Amount (PhP)	Sub-Total (PhP)	Total (PhP)
4	**FORM WORKS AND SCAFFOLDINGS**		**1994.8**	**sq.m**				
	4.1 FOOTING							
	A. MATERIALS							
		Cocolumber 2x4x10	145.60	bd.ft	35.00	5,096.00	5,096.00	
		1/2" Thk Phenolic Board	14.00	pcs	450.00	6,300.00	6,300.00	
		Nails	1.00	kgs	55.00	55.00	55.00	
		Tie Wire	1.00	kgs	110.00	110.00	110.00	
							11,561.00	
	B. LABOR (45% MATERIAL COST)						**5,202.45**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					520.25	**520.25**	
						TOTAL DIRECT COST		17,283.70
						OCM (PhP)	*15% of DC*	2,592.55
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	1,728.37
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	1,080.23
						TOTAL INDIRECT COST		5,401.15
						TOTAL PROJECT COST (PhP)		**22,684.85**
	4.2 COLUMN							
	A. MATERIALS							
		Cocolumber 2x4x10	1326.50	bd.ft	35.00	46,427.50	46,427.50	
		1/2" Thk Phenolic Board	72.00	pcs	450.00	32,400.00	32,400.00	
		Nails	6.00	kgs	55.00	330.00	330.00	
		Tie Wire	3.00	kgs	110.00	330.00	330.00	
							79,487.50	
	B. LABOR (45% MATERIAL COST)						**35,769.38**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					3,576.94	**3,576.94**	
						TOTAL DIRECT COST		118,833.81
						OCM (PhP)	*15% of DC*	17,825.07
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	11,883.38
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	7,427.11
						TOTAL INDIRECT COST		37,135.57
						TOTAL PROJECT COST (PhP)		**155,969.38**
	4.3 BEAMS							
	A. MATERIALS							
		Cocolumber 2x4x10	1424.56	bd.ft	35.00	49,859.60	49,859.60	
		1/2" Thk Phenolic Board	86.00	pcs	450.00	38,700.00	38,700.00	
		Nails	7.00	kgs	55.00	385.00	385.00	
		Tie Wire	3.00	kgs	110.00	330.00	330.00	
							89,274.60	
	B. LABOR (45% MATERIAL COST)						**40,173.57**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					4,017.36	**4,017.36**	
						TOTAL DIRECT COST		133,465.53
						OCM (PhP)	*15% of DC*	20,019.83
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	13,346.55
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	8,341.60
						TOTAL INDIRECT COST		41,707.98
						TOTAL PROJECT COST (PhP)		**175,173.50**
	4.4 SLABS							
	A. MATERIALS							
		Cocolumber 2x4x10	1287.23	bd.ft	35.00	45,053.05	45,053.05	
		1/2" Thk Phenolic Board	56.00	pcs	450.00	25,200.00	25,200.00	

		Nails	5.00	kgs	55.00	275.00	275.00	
		Tie Wire	2.00	kgs	110.00	220.00	220.00	
							70,748.05	
	B. LABOR (45% MATERIAL COST)						**31,836.62**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					3,183.66	**3,183.66**	
						TOTAL DIRECT COST		105,768.33
						OCM (PhP)	*15% of DC*	15,865.25
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	10,576.83
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	6,610.52
						TOTAL INDIRECT COST		33,052.60
						TOTAL PROJECT COST (PhP)		**138,820.94**
	4.5 STAIRS							
	A. MATERIALS							
		Cocolumber 2x4x10	186.40	bd.ft	35.00	6,524.00	6,524.00	
		1/2" Thk Phenolic Board	24.00	pcs	450.00	10,800.00	10,800.00	
		Nails	3.00	kgs	55.00	165.00	165.00	
		Tie Wire	1.00	kgs	110.00	110.00	110.00	
							17,599.00	
	B. LABOR (45% MATERIAL COST)						**7,919.55**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					791.96	**791.96**	
						TOTAL DIRECT COST		26,310.51
						OCM (PhP)	*15% of DC*	3,946.58
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	2,631.05
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	1,644.41
						TOTAL INDIRECT COST		8,222.03
						TOTAL PROJECT COST (PhP)		**34,532.54**
	SCAFFOLDINGS		**921.6**	**sq.m**				
	A. MATERIALS							
		Cocolumber 2x2	1926.00	bd.ft	95.00	182,970.00	182,970.00	
		Cocolumber 2x3	1182.00	bd.ft	105.00	124,110.00	124,110.00	
		Nails	35.00	kgs	55.00	1,925.00	1,925.00	
		Tie Wire	18.00	kgs	110.00	1,980.00	1,980.00	
							310,985.00	
	B. LABOR					139,943.25	**139,943.25**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					13,994.33	**13,994.33**	
						TOTAL DIRECT COST		464,922.58
						OCM (PhP)	*15% of DC*	69,738.39
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	46,492.26
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	29,057.66
						TOTAL INDIRECT COST		145,288.30
						TOTAL PROJECT COST (PhP)		**610,210.88**
SPL ITEM		Description	Quantity	Unit	Unit Cost (PhP)	Amount (PhP)	Sub-Total (PhP)	Total (PhP)
5	**CONCRETE WORKS**		**242.66**	**cu.m**				
	5.1 Footing		**32.78**	**cu.m**				
	A. MATERIALS							
		Cement	286.00	bags	269.00	76,934.00	76,934.00	
		Sand	17.88	cu.m.	1,700.00	30,396.00	30,396.00	
		Gravel	35.60	cu.m.	1,750.00	62,300.00	62,300.00	
							169,630.00	
	B. LABOR (45% MATERIAL COST)						**76,333.50**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					7,633.35	7,633.35	
		Transit Mixer	2	day	2800	5,600.00	5,600.00	
		Concrete Vibrator	2	day	25000	50,000.00	50,000.00	

		Pumpcrete	2	day	730	1,460.00	1,460.00	
							64,693.35	
						TOTAL DIRECT COST		310,656.85
						OCM (PhP)	*15% of DC*	46,598.53
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	31,065.69
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	19,416.05
						TOTAL INDIRECT COST		97,080.27
						TOTAL PROJECT COST (PhP)		**407,737.12**
	5.2 Tie Beam		**17.31**	**cu.m**				
	A. MATERIALS							
		Cement	145.00	bags	269.00	39,005.00	39,005.00	
		Sand	8.06	cu.m.	1,700.00	13,694.44	13,694.44	
		Gravel	16.11	cu.m.	1,750.00	28,194.44	28,194.44	
							80,893.89	
	B. LABOR (45% MATERIAL COST)						**36,402.25**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					3,640.23	3,640.23	
		Transit Mixer	1	day	2800	2,800.00	2,800.00	
		Concrete Vibrator	1	day	25000	25,000.00	25,000.00	
		Pumpcrete	1	day	730	730.00	730.00	
							32,170.23	
						TOTAL DIRECT COST		149,466.36
						OCM (PhP)	*15% of DC*	22,419.95
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	14,946.64
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	9,341.65
						TOTAL INDIRECT COST		46,708.24
						TOTAL PROJECT COST (PhP)		**196,174.60**
	5.3 Column		**33.87**	**cu.m**				
	A. MATERIALS							
		Cement	318	bags	269.00	85,542.00	85,542.00	
		Sand	15.1	cu.m	1,700.00	25,670.00	25,670.00	
		Gravel	28.2	cu.m	1,750.00	49,350.00	49,350.00	
							160,562.00	
	B. LABOR (45% MATERIAL COST)						**72,252.90**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					7,225.29	7,225.29	
		Transit Mixer	3	days	2800	8,400.00	8,400.00	
		Concrete Vibrator	3	days	25000	75,000.00	75,000.00	
		Pumpcrete	3	days	730	2,190.00	2,190.00	
							92,815.29	
						TOTAL DIRECT COST		325,630.19
						OCM (PhP)	*15% of DC*	48,844.53
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	32,563.02
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	20,351.89
						TOTAL INDIRECT COST		101,759.43
						TOTAL PROJECT COST (PhP)		**427,389.62**
	5.4 Slab		**83.13**	**cu.m**				
	A. MATERIALS							
		Cement	715.00	bags	269.00	192,335.00	192,335.00	
		Sand	47.00	cu.m.	1,700.00	79,900.00	79,900.00	
		Gravel	75.22	cu.m.	1,750.00	131,635.00	131,635.00	
							403,870.00	
	B. LABOR (45% MATERIAL COST)						**181,741.50**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					18,174.15	18,174.15	
		Transit Mixer	4	days	2800	11,200.00	11,200.00	

		Concrete Vibrator	4	days	25000	100,000.00	100,000.00	
		Pumpcrete	4	days	730	2,920.00	2,920.00	
							132,294.15	
						TOTAL DIRECT COST		717,905.65
						OCM (PhP)	*15% of DC*	107,685.85
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	71,790.57
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	44,869.10
						TOTAL INDIRECT COST		224,345.52
						TOTAL PROJECT COST (PhP)		**942,251.17**
	5.5 Beam		**29.26**	**cu.m**				
	A. MATERIALS							
		Cement	256	bags	269.00	68,864.00	68,864.00	
		Sand	13.62	cu.m	1,700.00	23,154.00	23,154.00	
		Gravel	22.21	cu.m	1,750.00	38,867.50	38,867.50	
							130,885.50	
	B. LABOR (45% MATERIAL COST)						**58,898.48**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					5,889.85	5,889.85	
		Transit Mixer	3	days	2800	8,400.00	8,400.00	
		Concrete Vibrator	3	days	25000	75,000.00	75,000.00	
		Pumpcrete	3	days	730	2,190.00	2,190.00	
							91,479.85	
						TOTAL DIRECT COST		281,263.82
						OCM (PhP)	*15% of DC*	42,189.57
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	28,126.38
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	17,578.99
						TOTAL INDIRECT COST		87,894.94
						TOTAL PROJECT COST (PhP)		**369,158.77**
	5.6 Stairs		**38.73**	**cu.m**				
	A. MATERIALS							
		Cement	176.00	bags	269.00	47,344.00	47,344.00	
		Sand	8.60	cu.m.	1,700.00	14,620.00	14,620.00	
		Gravel	16.00	cu.m.	1,750.00	28,000.00	28,000.00	
							89,964.00	
	B. LABOR (45% MATERIAL COST)						**40,483.80**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					4,048.38	4,048.38	
		Transit Mixer	2	day	2800	5,600.00	5,600.00	
		Concrete Vibrator	2	day	25000	50,000.00	50,000.00	
		Pumpcrete	2	day	730	1,460.00	1,460.00	
							61,108.38	
						TOTAL DIRECT COST		191,556.18
						OCM (PhP)	*15% of DC*	28,733.43
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	19,155.62
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	11,972.26
						TOTAL INDIRECT COST		59,861.31
						TOTAL PROJECT COST (PhP)		**251,417.49**
	5.7 Ramp		**7.59**	**cu.m**				
	A. MATERIALS							
		Cement	10.50	bags	269.00	2,824.50	2,824.50	
		Sand	1.25	cu.m.	1,700.00	2,125.00	2,125.00	
		Gravel	3.25	cu.m.	1,750.00	5,687.50	5,687.50	
							10,637.00	
	B. LABOR (45% MATERIAL COST)						**4,786.65**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					478.67	478.67	

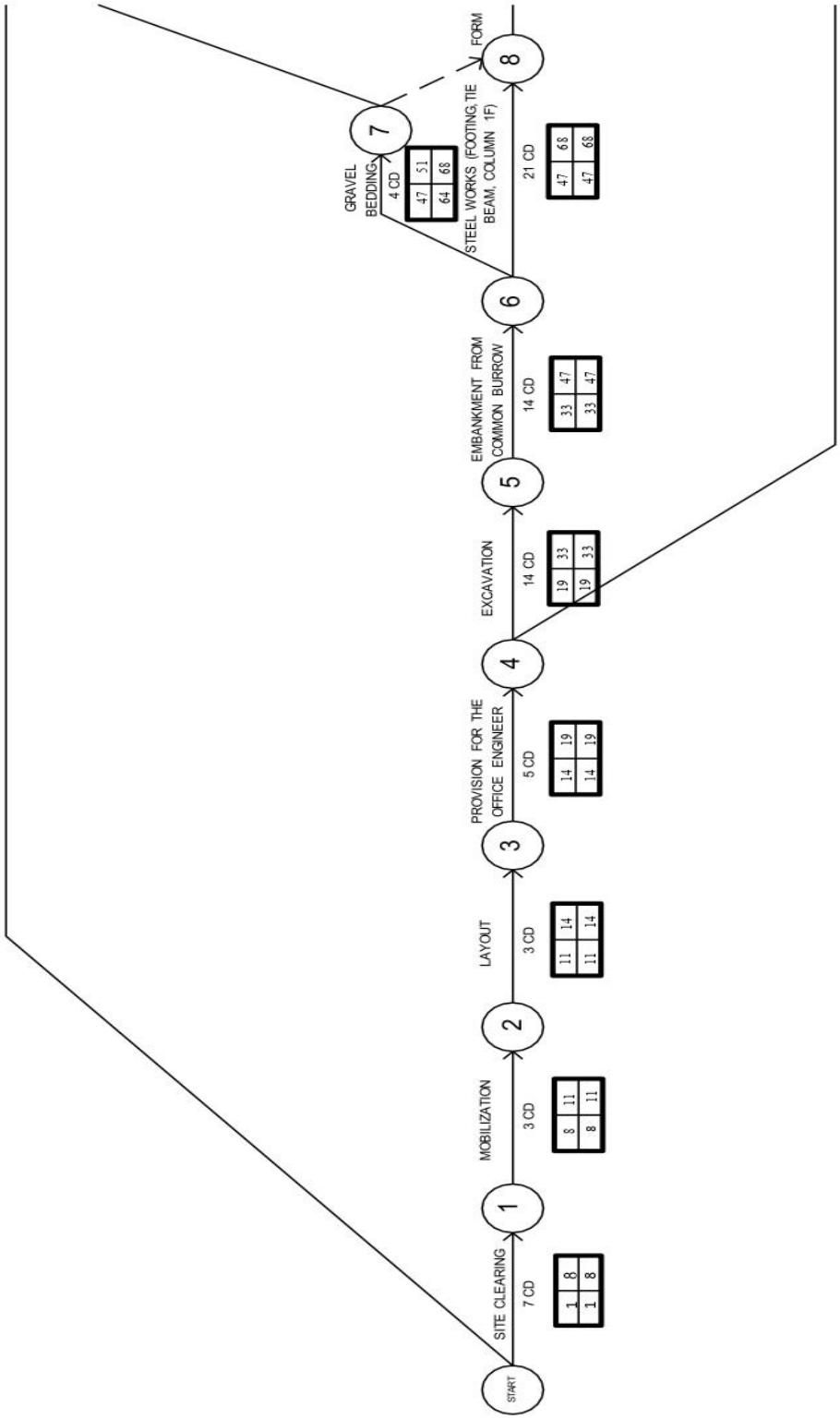
		Transit Mixer	1	day	2800	2,800.00	2,800.00	
		Concrete Vibrator	1	day	25000	25,000.00	25,000.00	
		Pumpcrete	1	day	730	730.00	730.00	
							29,008.67	
						TOTAL DIRECT COST		44,432.32
						OCM (PhP)	*15% of DC*	6,664.85
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	4,443.23
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	2,777.02
						TOTAL INDIRECT COST		13,885.10
						TOTAL PROJECT COST (PhP)		**58,317.41**
SPL.ITEM		Description	Quantity	Unit	Unit Cost (PhP)	Amount (PhP)	Sub-Total (PhP)	Total (PhP)
6	**MASONRY WORKS**		**2132.47**	**sq.m**				
	A. MATERIALS							
	6.1 Concrete Hollow Blocks							
		4"x8"x16" CHB	7434.00	pcs	12.50	92,925.00	92,925.00	
		6"x8"x16" CHB	8443	pcs	12.50	105,537.50	105,537.50	
	6.2 Mortar Filler							
		Cement	905	bags	269.00	243,445.00	243,445.00	
		Sand	89.41	cu.m	1,700.00	151,997.00	151,997.00	
	6.3 Plastering (Two Faces)							
		Cement	362	bags	269.00	97,378.00	97,378.00	
		Sand	20.07	cu.m	1,700.00	34,119.00	34,119.00	
		12 mm Grade 60 RSB	556	each	244.44	135,908.64	135,908.64	
		#16 Tie Wire	49	kgs	16.00	784.00	784.00	
							862,094.14	
	B. LABOR (45% MATERIAL COST)						**387,942.36**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					38,794.24	38,794.24	
		2 Bagger Mixer	316	hrs	172.00	54,352.00	54,352.00	
		Bar Cutter	110	hrs	219.75	24,172.50	24,172.50	
							117,318.74	
						TOTAL DIRECT COST		1,367,355.24
						OCM (PhP)	*15% of DC*	205,103.29
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	136,735.52
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	85,459.70
						TOTAL INDIRECT COST		427,298.51
						TOTAL PROJECT COST (PhP)		**1,794,653.75**
SPL.ITEM		Description	Quantity	Unit	Unit Cost (PhP)	Amount (PhP)	Sub-Total (PhP)	Total (PhP)
7	**STEEL WORKS**							
	7.1 Footing							
	A. MATERIALS							
		16 mm Grade 60 RSB	306.00	pcs	451.00	138,006.00	138,006.00	
		#16 Tire Wire	17.4	kgs	100.00	1,740.00	1,740.00	
							139,746.00	
	B. LABOR (45% MATERIAL COST)						**62,885.70**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					6,288.57	6,288.57	
		Bar Cutter	5	day	1200	6,000.00	6,000.00	
		Bar Bender	5	day	800	4,000.00	4,000.00	
							16,288.57	
						TOTAL DIRECT COST		218,920.27
						OCM (PhP)	*15% of DC*	32,838.04
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	21,892.03
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	13,682.52
						TOTAL INDIRECT COST		68,412.58
						TOTAL PROJECT COST (PhP)		**287,332.85**
	7.2 Tie Beams							

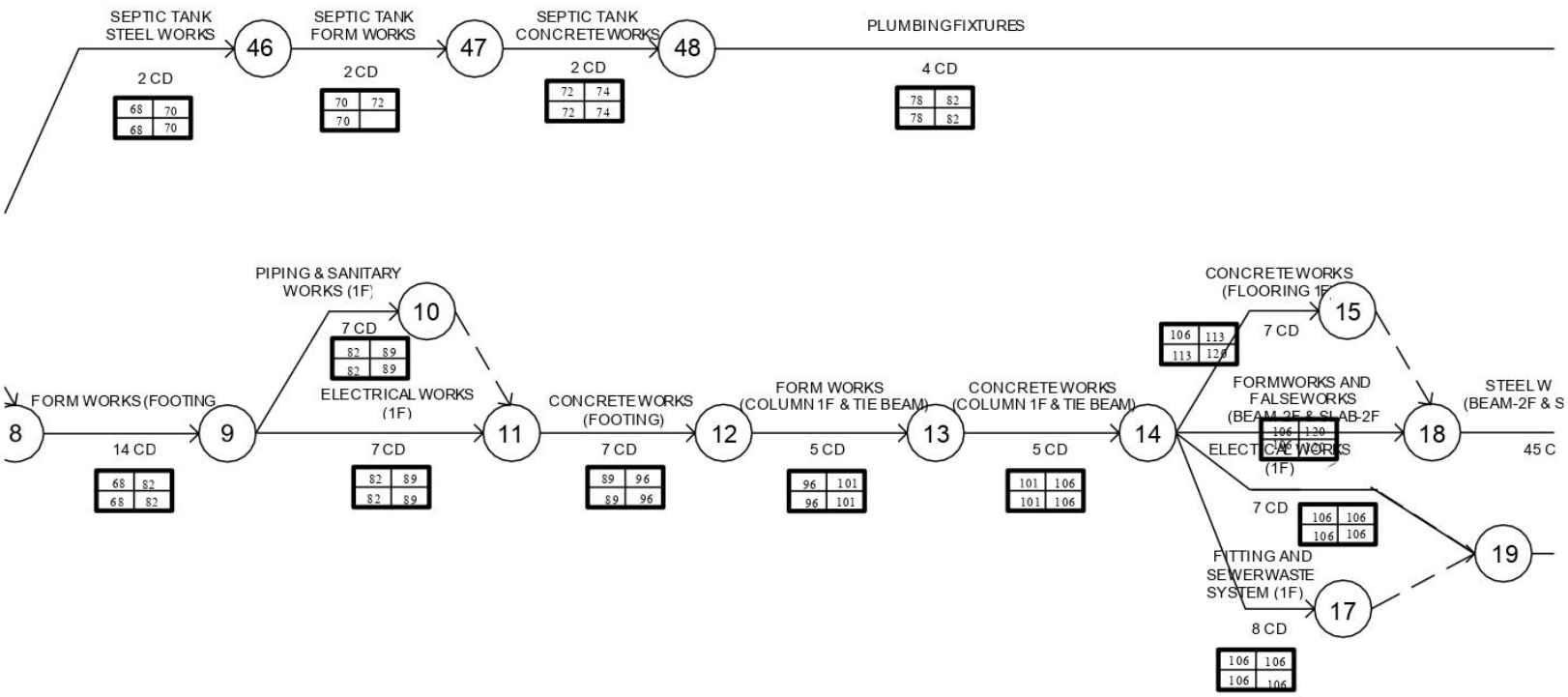
	A. MATERIALS							
		16 mm Grade 60 RSB	342.00	kgs	451.00	154,242.00	154,242.00	
		#16 Tire Wire	17.40	pcs	100.00	1,740.00	1,740.00	
							155,982.00	
	B. LABOR (45% MATERIAL COST)						**70,191.90**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					7,019.19	7,019.19	
		Bar Cutter	10	days	1200	12,000.00	12,000.00	
		Bar Bender	10	days	800	8,000.00	8,000.00	
							27,019.19	
						TOTAL DIRECT COST		253,193.09
						OCM (PhP)	*15% of DC*	37,978.96
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	25,319.31
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	15,824.57
						TOTAL INDIRECT COST		79,122.84
						TOTAL PROJECT COST (PhP)		**332,315.93**
	7.3 Beams							
	A. MATERIALS							
		16 mm Grade 60 RSB	448.00	pcs	451.00	202,048.00	202,048.00	
		10 mm Grade 60 RSB	374.00	pcs	183.00	68,442.00	68,442.00	
		#16 Tire Wire	68.80	kgs	100.00	6,880.00	6,880.00	
							277,370.00	
	B. LABOR (45% MATERIAL COST)						**124,816.50**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					12,481.65	12,481.65	
		Bar Cutter	49	days	1200	58,800.00	58,800.00	
		Bar Bender	49	days	800	39,200.00	39,200.00	
							110,481.65	
						TOTAL DIRECT COST		512,668.15
						OCM (PhP)	*15% of DC*	76,900.22
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	51,266.82
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	32,041.76
						TOTAL INDIRECT COST		160,208.80
						TOTAL PROJECT COST (PhP)		**672,876.95**
	7.4 Slabs							
	A. MATERIALS							
		12 mm Grade 40 RSB	1035.00	pcs	257.00	265,995.00	265,995.00	
		#16 Tire Wire	103.00	kgs	100.00	10,300.00	10,300.00	
							276,295.00	
	B. LABOR (45% MATERIAL COST)						**124,332.75**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					12,433.28	12,433.28	
		Bar Cutter	35	days	1200	42,000.00	42,000.00	
		Bar Bender	35	days	800	28,000.00	28,000.00	
							82,433.28	
						TOTAL DIRECT COST		483,061.03
						OCM (PhP)	*15% of DC*	72,459.15
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	48,306.10
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	30,191.31
						TOTAL INDIRECT COST		150,956.57
						TOTAL PROJECT COST (PhP)		**634,017.60**
	7.5 Column							
	A. MATERIALS							
		16 mm Grade 60 RSB	240.00	pcs	451.00	108,240.00	108,240.00	
		10 mm Grade 60 RSB	215.00	pcs	183.00	39,345.00	39,345.00	
		#16 Tire Wire	26.50	kgs	100.00	2,650.00	2,650.00	

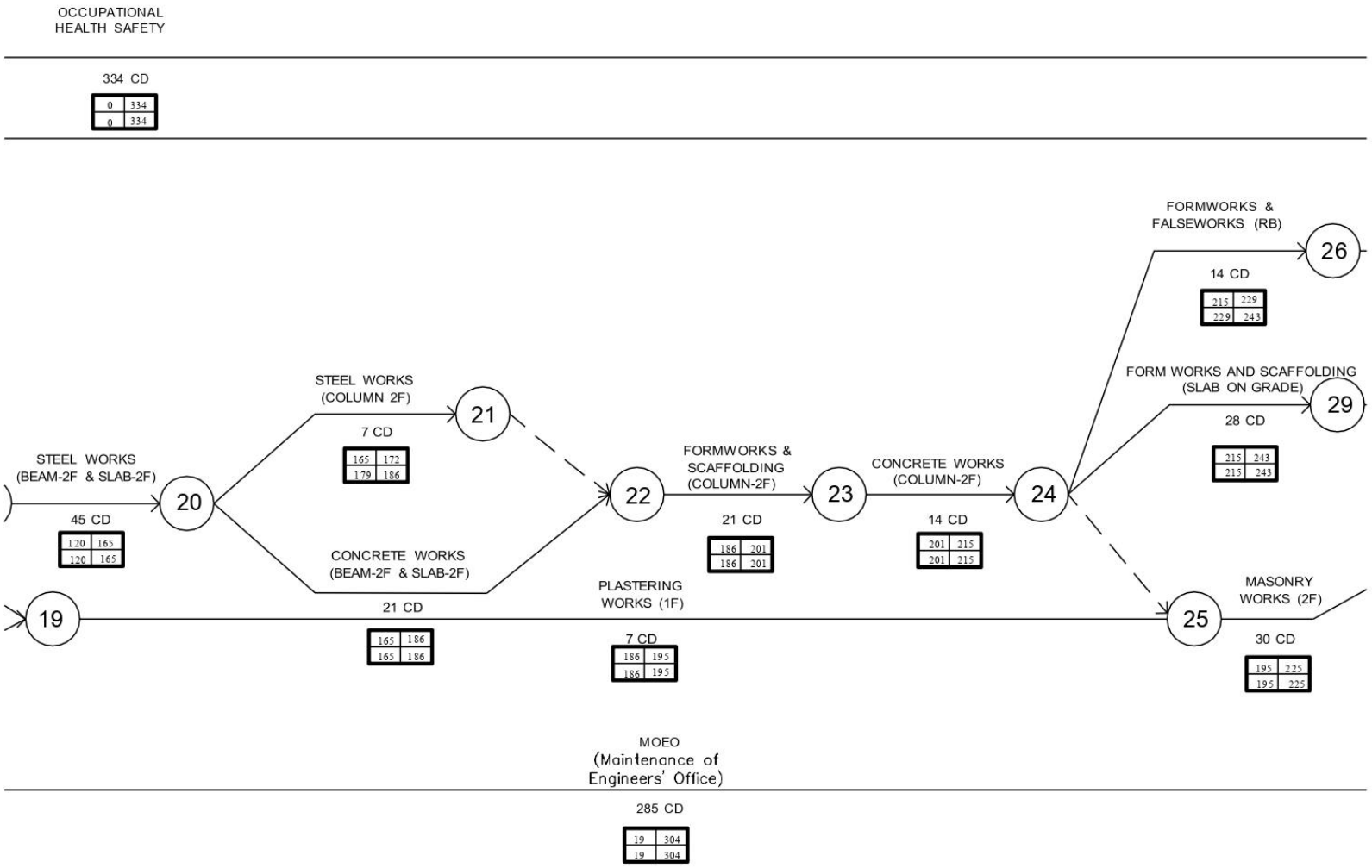
							150,235.00	
	B. LABOR (45% MATERIAL COST)						**67,605.75**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					6,760.58	6,760.58	
		Bar Cutter	40	days	1200	48,000.00	48,000.00	
		Bar Bender	40	days	800	32,000.00	32,000.00	
							86,760.58	
						TOTAL DIRECT COST		304,601.33
						OCM (PhP)	*15% of DC*	45,690.20
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	30,460.13
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	19,037.58
						TOTAL INDIRECT COST		95,187.91
						TOTAL PROJECT COST (PhP)		**399,789.24**
	7.6 Stairs & Ramps							
	A. MATERIALS							
		16 mm Grade 60 RSB	34.00	pcs	451.00	15,334.00	15,334.00	
		10 mm Grade 40 RSB	131.00	pcs	257.00	33,667.00	33,667.00	
		#16 Tire Wire	8.00	kgs	100.00	800.00	800.00	
							49,801.00	
	B. LABOR (45% MATERIAL COST)						**22,410.45**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					2,241.05	2,241.05	
		Bar Cutter	21	days	1200	25,200.00	25,200.00	
		Bar Bender	21	days	800	16,800.00	16,800.00	
							44,241.05	
						TOTAL DIRECT COST		116,452.50
						OCM (PhP)	*15% of DC*	17,467.87
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	11,645.25
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	7,278.28
						TOTAL INDIRECT COST		36,391.40
						TOTAL PROJECT COST (PhP)		**152,843.90**
SPL ITEM		Description	Quantity	Unit	Unit Cost (PhP)	Amount (PhP)	Sub-Total (PhP)	Total (PhP)
8	**TILE WORKS**		**2721**	**sq.m**				
	A. MATERIALS							
		Polished Ceramic Tiles (0.6m x 0.6m)	1590.00	each	125.00	198,750.00	198,750.00	
		Non-Slip Ceramic Tiles (0.2m x 0.2m)	976.00	each	75.00	73,200.00	73,200.00	
		Non-Slip Ceramic Tiles (0.3m x 0.6m)	140.00	each	80.00	11,200.00	11,200.00	
		Tile Grout, 2kg	80.14	bags	850.00	68,119.00	68,119.00	
		Tile Adhesive, 25kg	91.90	bags	418.00	38,414.20	38,414.20	
							389,683.20	
	B. LABOR (45% MATERIAL COST)						**175,357.44**	
	C. EQUIPMENT							
	Minor Tools (10% of Labor Cost)					17,535.74	17,535.74	
		Electric Tile Cutter	85	hrs	100.00	8,500.00	8,500.00	
							26,035.74	
						TOTAL DIRECT COST		591,076.38
						OCM (PhP)	*15% of DC*	88,661.46
						CONTRACTOR'S PROFIT (PhP)	*10% of DC*	59,107.64
						VAT (PhP)	*5% of sum (DC, OCM, CP)*	36,942.27
						TOTAL INDIRECT COST		184,711.37
						TOTAL PROJECT COST (PhP)		**775,787.75**
SPL ITEM		Description	Quantity	Unit	Unit Cost (PhP)	Amount (PhP)	Sub-Total (PhP)	Total (PhP)
9	**PAINTING WORKS**		**1532.23**	**sq.m**				
	A. MATERIALS							
		Paint Brush 4"	10.00	pcs	137.00	1,370.00	1,370.00	
		Paint Brush 2"	10.00	pcs	66.00	660.00	660.00	
		Concrete Neutralizer	106.94	gals	822.00	87,902.80	87,902.80	

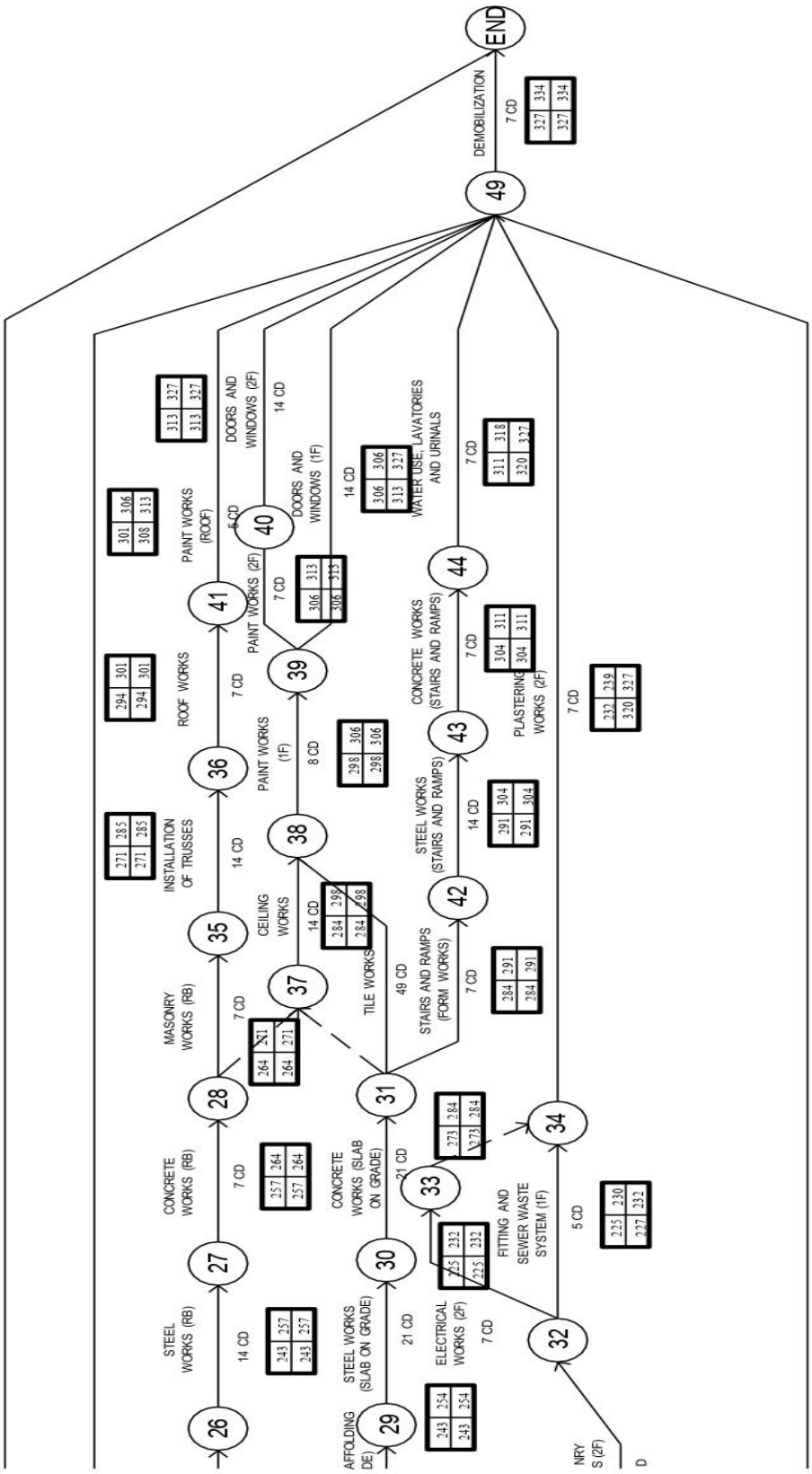
APPENDIX F

PERT-CPM


START
SITE CLEARING
7 CD
1 8
1 8
1
MOBILIZATION
3 CD
8 11
8 11
2
LAYOUT
3 CD
11 14
11 14
3
PROVISION FOR THE OFFICE ENGINEER
5 CD
14 19
14 19
4
EXCAVATION
14 CD
19 33
19 33
5
EMBANKMENT FROM COMMON BURROW
14 CD
33 47
33 47
6
STEEL WORKS (FOOTING, TIE BEAM, COLUMN 1F)
21 CD
47 68
47 68
8
FORM
GRAVEL BEDDING
4 CD
47 51
64 68
7


SEPTIC TANK STEEL WORKS
46
2 CD
68 70
68 70
SEPTIC TANK FORM WORKS
47
2 CD
70 72
70
SEPTIC TANK CONCRETE WORKS
48
2 CD
72 74
72 74
PLUMBING FIXTURES
4 CD
78 82
78 82
PIPING & SANITARY WORKS (1F)
10
7 CD
82 89
82 89
8
FORM WORKS (FOOTING
14 CD
68 82
68 82
9
ELECTRICAL WORKS (1F)
7 CD
82 89
82 89
11
CONCRETE WORKS (FOOTING)
7 CD
89 96
89 96
12
FORM WORKS (COLUMN 1F & TIE BEAM)
5 CD
96 101
96 101
13
CONCRETE WORKS (COLUMN 1F & TIE BEAM)
5 CD
101 106
101 106
14
CONCRETE WORKS (FLOORING 1F
15
7 CD
106 113
113 120
FORMWORKS AND FALSEWORKS (BEAM-2F & SLAB-2F
106 120
ELECTRICAL WORKS (1F)
7 CD
106 106
106 106
18
STEEL W (BEAM-2F & S
45 C
19
FITTING AND SEWERWASTE SYSTEM (1F)
17
8 CD
106 106
106 106


OCCUPATIONAL
HEALTH SAFETY
334 CD
0 334
0 334
FORMWORKS &
FALSEWORKS (RB)
26
14 CD
215 229
229 243
STEEL WORKS
(COLUMN 2F)
21
7 CD
165 172
179 186
FORM WORKS AND SCAFFOLDING
(SLAB ON GRADE)
29
28 CD
215 243
215 243
STEEL WORKS
(BEAM-2F & SLAB-2F)
20
45 CD
120 165
120 165
FORMWORKS &
SCAFFOLDING
(COLUMN-2F)
22
23
CONCRETE WORKS
(COLUMN-2F)
24
21 CD
186 201
186 201
14 CD
201 215
201 215
CONCRETE WORKS
(BEAM-2F & SLAB-2F)
PLASTERING
WORKS (1F)
MASONRY
WORKS (2F)
19
21 CD
165 186
165 186
7 CD
186 195
186 195
25
30 CD
195 225
195 225
MOEO
(Maintenance of
Engineers' Office)
285 CD
19 304
19 304


END
DEMOBILIZATION
7 CD
49
DOORS AND WINDOWS (2F)
14 CD
DOORS AND WINDOWS (1F)
14 CD
WATER USE, LAVATORIES AND URINALS
7 CD
CONCRETE WORKS (STAIRS AND RAMPS)
7 CD
PLASTERING WORKS (2F)
7 CD
PAINT WORKS (ROOF)
5 CD
PAINT WORKS (2F)
7 CD
ROOF WORKS
7 CD
PAINT WORKS (1F)
8 CD
STEEL WORKS (STAIRS AND RAMPS)
14 CD
STAIRS AND RAMPS (FORM WORKS)
7 CD
INSTALLATION OF TRUSSES
14 CD
CEILING WORKS
14 CD
TILE WORKS
49 CD
MASONRY WORKS (RB)
7 CD
CONCRETE WORKS (RB)
7 CD
CONCRETE WORKS (SLAB ON GRADE)
21 CD
FITTING AND SEWER WASTE SYSTEM (1F)
5 CD
ELECTRICAL WORKS (2F)
7 CD
STEEL WORKS (SLAB ON GRADE)
21 CD
STEEL WORKS (RB)
14 CD
AFFOLDING
DE)
NRY
S (2F)
D

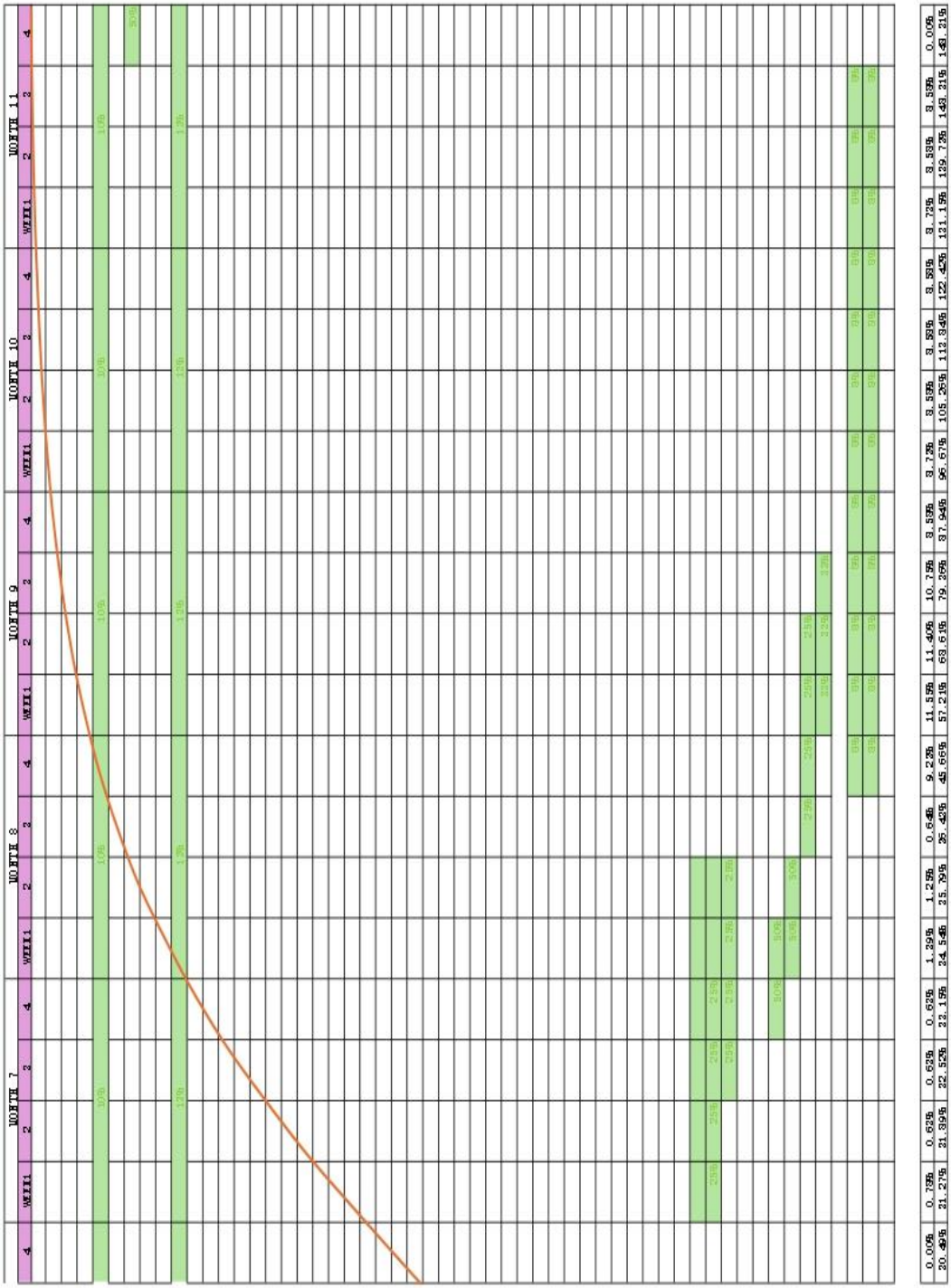
APPENDIX G

S-CURVE

Project Title: PROPOSED TWO-STOREY BALAY SILANGAN
Location: BRGY. CARAUDAN, JANIUAY, ILOILO
Total Duration: 220 DAYS
Total Project Cost:
SUBJECT:
S-CURVE

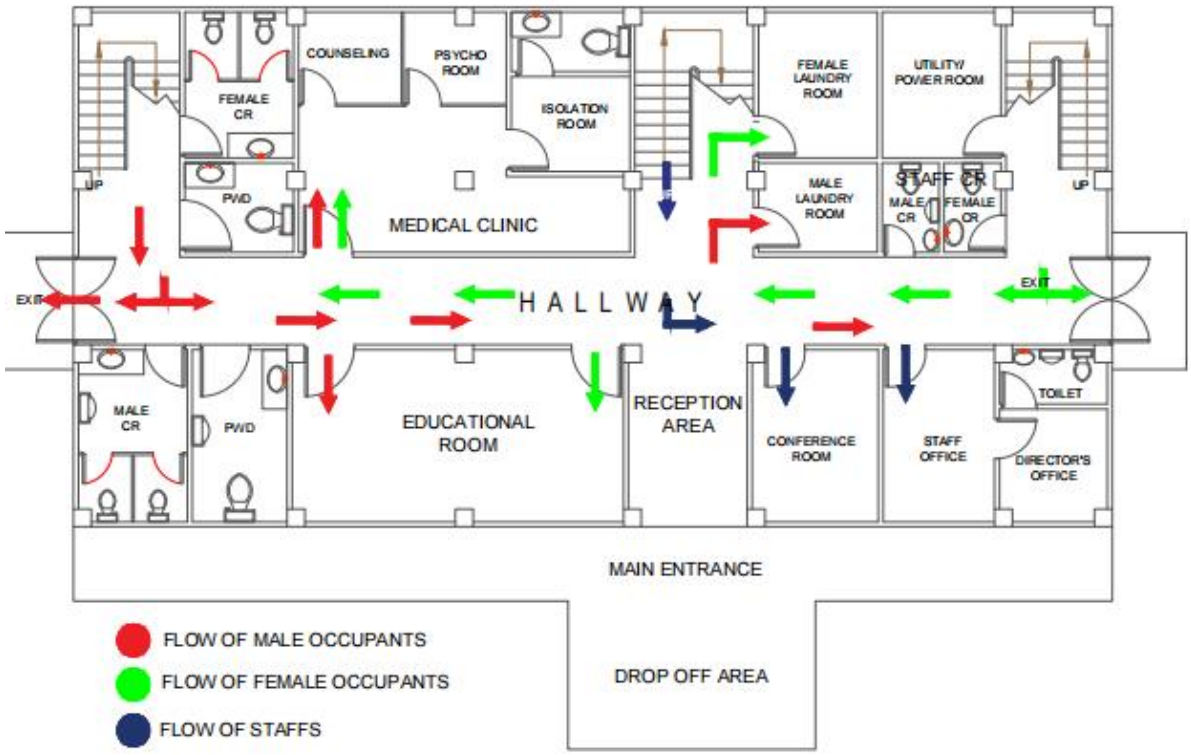
Item No.	Description	QTY	Unit	Amount	Wt%	Duration (Days)	MONTH 1 WEEK1	2	3	4	MONTH 2 WEEK1	2	3	4	MONTH 3 WEEK1	2	3	4	MONTH 4 WEEK1	2	3	4	MONTH WEEK1	2	3	4	MONTH 6 WEEK1	2	3
I.	GENERAL REQUIREMENTS																												
a.	Permitting Works	1	Ls.	₱ 65,625.00	0.35%	28	25%	25%	25%	25%																			
b.	Layouting and Staking	441	sq. m.	₱ 24,596.02	0.13%	7					100%																		
c.	Billboards/Signboads	3	e.a.	40833.12188	0.22%	7																							
d.	Occupational Safety and Health	11.33	mos.	₱ 652,561.88	3.52%	320					10%				10%				10%				10%				10%		
e.	Mobilization/Demobilization	1	Ls.	276543.75	1.49%	7					50%																		
f.	Clearing and Grubbing	1000	sq. m.	₱ 266,437.50	1.44%	7				50%																			
II.	TEMPORARY FACILITIES FOR THE ENGINEER																												
a.	Provision of the Office for the Engineer	40	sq. m.	₱ 78,921.14	0.43%	28					25%	25%	25%	25%															
b.	Maintenance & Operation of the Office for the Eng	11	mos.	₱ 151,593.75	0.82%	285									14%				14%				14%				14%		
III.	EARTHWORKS				0.00%																								
a.	Excavation	658.23	cu. m.	₱ 1,313,466.00	7.09%	14				50%	50%																		
b.	Embankment from Excavation	175.17	cu. m.	₱ 357,656.25	1.93%	7					100%																		
c.	Gravel fill	75.20	cu. m.	₱ 397,928.15	2.15%	7																							
IV.	FORMWORKS																												
a.	Footing	36	pcs.	₱ 22,684.85	0.12%	7								30%															
b.	Column	112	pcs.	₱ 155,969.38	0.84%	14									50%	50%													
c.	Beams	121	pcs.	₱ 175,173.50	0.95%	21													33%	33%	33%								
d.	Slabs	96	pcs.	₱ 138,820.94	0.75%	14													50%	50%		50%	50%						
e.	Stairs	22	pcs.	₱ 34,532.54	0.19%	7															100%								
V.	SCAFFOLDING	753	pcs.	₱ 610,210.88	3.29%	14										100%													
VI.	CONCRETING WORKS																												
a.	Ground Floor: Footings	112	sq. m.	₱ 158,880.00	0.86%	7								100%															
b.	Ground Floor: Tie Beam	22	sq. m.	₱ 80,893.89	0.44%	5									100%														
c.	Ground Floor: Columns	3	sq. m.	₱ 60,781.00	0.33%	5									100%														
d.	Ground Floor: Flooring	121	sq. m.	₱ 145,165.00	0.78%	10									50%	50%													
e.	Ground Floor: Septic Tank	14	sq. m.	₱ 74,337.00	0.40%	1											100%												
f.	Second Floor: Slab	121	sq. m.	₱ 80,710.50	0.44%	10											50%	50%											
g.	Second Floor: Columns	3	sq. m.	₱ 60,781.00	0.33%	8											100%												
h.	Second Floor: Beams	40	sq. m.	₱ 43,366.10	0.23%	8													100%										
i.	Stair and Ramp	6	sq. m.	₱ 10,637.00	0.06%	3														100%									
VII.	STEEL WORKS																												
a.	Footing	4590.11	kgs	₱ 287,332.85	1.55%	7							50%																
b.	Tie Beam	5102.65	kgs	₱ 332,315.93	1.79%	14							50%	50%															
c.	Column	6529.09	kgs	₱ 399,789.24	2.16%	35									20%	20%	20%				20%	20%							
d	Beams	12867.3	kgs	₱ 672,676.95	3.63%	42										33%	33%	33%											
e.	Slabs	10151.96	kgs	₱ 634,017.60	3.42%	35											33%	33%											
f.	Stairs	2455.19	kgs	₱ 152,843.90	0.82%	7																							
VIII.	MASONRY WORKS																												
a.	CHB Block Laying: Ground Floor	102	sq. m.	₱ 723,837.83	3.91%	25															25%	25%	25%	25%					
b.	CHB Block Laying: Second Floor	154	sq. m.	₱ 873,675.67	4.72%	25																	25%	25%	25%	25%			
IX.	DOORS AND WINDOWS	127	sq. m.	₱ 1,447,218.30	7.81%	35																			20%	20%	20%	20%	20%	
X.	PAINTING WORKS																												
a.	Painting Works: Ground Floor	360	pcs.	₱ 443,437.29	2.39%	14																							
b.	Painting Works: Second Floor	732	pcs.	₱ 464,746.50	2.51%	18																							
XI.	CEILING WORKS																												
a.	Installation of Ceiling Boards: Ground Floor	252	pcs.	₱ 201,619.03	1.09%	14																							
b.	Installation of Ceiling Boards: Second Floor	263	pcs.	₱ 168,809.00	0.91%	14																							
XII.	TILING WORKS																												
a.	Laying of Tiles: Ground Floor	285	sq. m.	₱ 461,580.52	2.49%	28																							
b.	Laying of Tiles: Second Floor	220	sq. m.	₱ 477,999.63	2.58%	21																							
XIII.	ROOFING WORKS	504	sq. m.	₱ 1,208,101.20	6.52%	35															10%	10%	10%	10%	10%	10%	10%	10%	
XIV.	ELECTRICAL WORKS	1	Ls.	₱ 1,215,411.22	6.56%	85														33%	33%								
XV.	PLUMBING WORKS	1	Ls.	₱ 1,346,206.32	7.27%	85															33%			50%					
	Total			₱ 18,527,289.32	100.00%	220																							

TOTAL PERCENTAGE (%)	0.02%	0.02%	0.02%	1.00%	2.04%	2.57%	0.44%	1.29%	2.17%	0.91%	1.07%	0.40%	0.44%	0.00%	1.32%	1.32%	3.94%	3.79%	2.61%	2.61%	0.81%	0.66%	0.00%					
CUMULATIVE PERCENTAGE (%)	0.02%	0.07%	0.10%	1.10%	3.14%	5.71%	6.15%	7.44%	9.61%	10.51%	11.58%	11.98%	12.42%	12.42%	14.25%	16.09%	20.02%	23.81%	26.42%	29.03%	29.83%	30.49%	30.49%					


MONTH 7
MONTH 8
MONTH 9
MONTH 10
MONTH 11
WEEK1
2
3
4

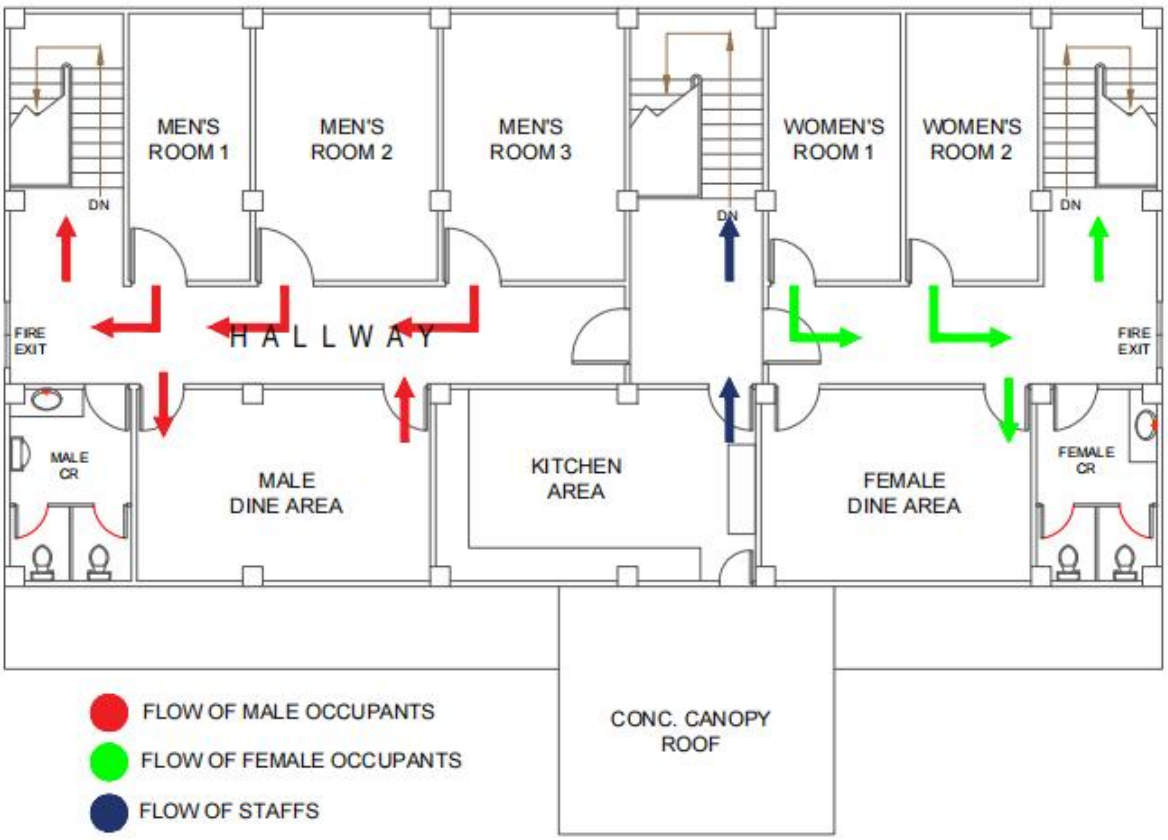
APPENDICES H

ACTION FLOW PLAN



ACTION FLOW PLAN GROUND FLOOR

SCALE : 1 : 100



ACTION FLOW PLAN 2ND FLOOR

SCALE : 1 : 100

APPENDICES I

PROPOSED BUDGET

COLLEGE of ENGINEERING
CENTRAL PHILIPPINE UNIVERSITY ILOILO
CITY, PHILIPPINES
Tel Nos (033) 329 1971 (to79) local 1082
Fax No (033) 320 3004
CIVIL ENGINEERING DEPARTMENT

BUDGET PLAN

A. Professional Fees

Fee	Amount (Php)
Architectural	5,000.00
Electrical	4,000.00
Drainage	3,000.00
Plumbing	4,000.00
Geotechnical Investigation	2,500.00
Subtotal	18**, 500.00**

B. Documentation

Fee	Amount (Php)
Papers	1,300.00
Printing	1000.00
Book Bind	1,200.00
Grammarian	1,500.00
Plagiarism Scan	500.00
Subtotal	**5,500.00**

C. Miscellaneous Fee

Fee	Amount (Php)
Food	1,000.00
Transportation	1000.00
Subtotal	2**,000.00**

TOTAL **26,000.00**

APPENDIX J

WORK SCHEDULE

COLLEGE of ENGINEERING
CENTRAL PHILIPPINE UNIVERSITY ILOILO
CITY, PHILIPPINES
Tel Nos (033) 329 1971 (to79) local 1082
Fax No (033) 320 3004
CIVIL ENGINEERING DEPARTMENT

PROJECT STUDY SCHEDULE OF ACTIVITIES

WEEK	TASK TO ACCOMPLISH
1 - 3 August 14 – September 1 , 2023	Class Orientation
3 August 28 – September 1, 2023	Finalization of Groups
4 September 4 – 8, 2023	Sending of Letters to Mayors
5 - 6 September 11 – 22, 2023	Approval of Requests and Visiting Municipalities
7 - 8 September 25 – October 6, 2023	Making of Concept Paper
9 October 9 – 13, 2023	Review and Approval of Concept Paper
10 - 12 October 16 – November 3, 2023	Approval of Final Concept Paper
12 - 13 October 30 – November 10, 2023	Municipality Visitation

12 - 15 October 30 – November 24, 2023	Data Gathering, Discussion and Submission of Chapter 1
16 - 17 November 27 – December 8, 2023	Discussion and Submission of Chapter 2
18 December 11 – December 15, 2023	Discussion and Submission of Chapter 3
19 December 18 - December 22, 2023	Site Visitation, Data Gathering, Discussion and Submission of the Final Proposal Document
20 - 21 December 25 2023 – January 5, 2024	Consultation of Chapters 1, 2, and 3 with assigned Advisers
22 - 23 January 8 – January 19, 2024	Data Gathering, Preparations, Revisions, and Submissions of Proposal and Proposal Presentation week
23 January 15 – January 19, 2024	Proposal Presentation Days
24 - 27 January 22– February 16, 2024	Revisions of Paper
28 February 19 – February 23, 2024	Submission of Edited Proposal Paper
28 – 29 February 19 – March 1, 2024	Topographic Survey and Preliminary Works For Architectural Plan
30 - 32 March 4 - March 22, 2024	Investigation of Soil Analysis And Finalization of Architectural Plan

30-32 March 4, 2024 – March 22, 2024	Structural Design And Analysis
31 March 11 – March 15, 2024	Discussion And Submission of Chapter Iv
32-- 33 March 18 – March 29, 2024	Electrical, Mechanical And Plumbing Plans
34 April 1 – May 5, 2024	Discussion And Submission of Chapter V
35 - 36 April 8 – May 19, 2024	Discussion And Submission of Chapter VI And VII
37 - 38 April 22 – May 3, 2024	Bill of Quantities and Schedule
37-- 38 April 22 – May 3, 2024	Checking and Revision of Project Study
38 April 29 – May 3, 2024	Making of Appendices/ Plagirarism Test
37-39 April 22 – May 3, 2024	Finalization of Final Project Study
40 May 13 – May 17, 2024	Preparations for Final Defense
40 May 13 – May 17, 2024	Distribution of Papers to the Panelist and Adviser
40 May 13- May 17, 2024	Final Defense

41- 42 May 20 – May 31, 2024	Revision of Final Paper Submission For the final document
42- 43 May 27 - June 7, 2024	Passing of the Hardbound

APPENDIX K

ARTICLES

ARTICLE

Section 2. Rationale:

In consideration of drug personalities who voluntarily surrendered as a result of the government's revitalized campaign against the Philippine Drug Problem, the PDEA shall lead the implementation of an LGU-led program designed to provide family-based in-house reformation for drug offenders based on the concept of BAHAY PAGBABAGO, a Reformation Center.

The BAHAY PAGBABAGO was conceptualized and implemented in the province of Bataan by the Bataan Police Provincial Office under the leadership PSSupt Rhodel Orden Sermonia.

Given the program's success in the province of Bataan, it was later expanded to the rest of Police Regional Office 3 (PRO-3) under the orders of PDEA DIRECTOR GENERAL AARON N AQUINO, who was then the Regional Director of PRO-3.

By allowing every institution in the community to be involved as part of the shared social and corporate responsibility in addressing the threat of illegal drug abuse, the Reformation Center or "BAHAY PAGBABAGO" operates on the spirit of volunteerism without expenses being incurred on the part of the patients as well as the government and its instrumentalities. It sustains its existence thru the support coming from the corporate community and civic spirited/ cause oriented groups.

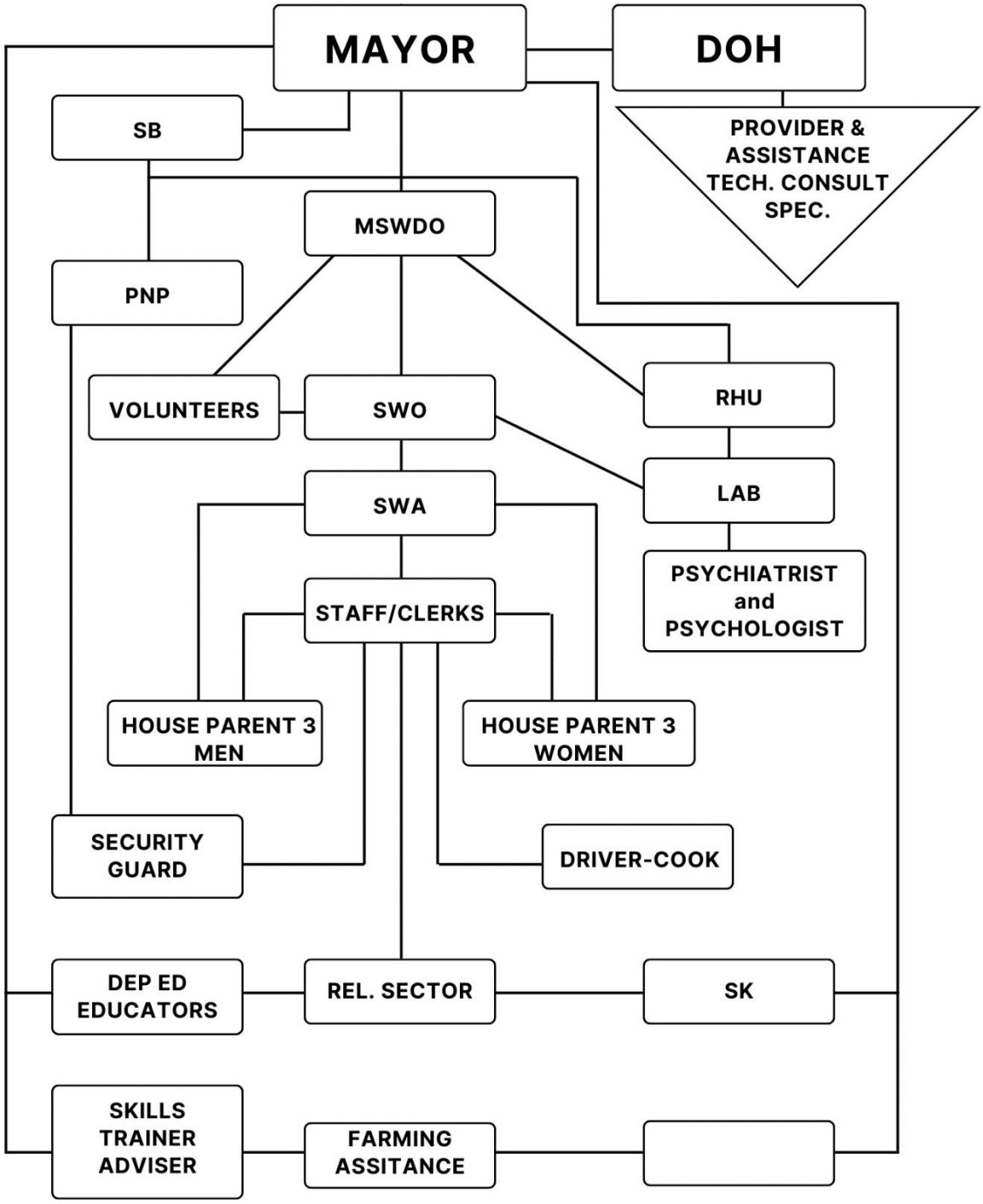
The BAHAY PAGBABAGO facility is specifically designed for surrendered drug personalities (who are not users/dependents) where they are given intervention, counseling, and livelihood with the end-in-view of helping them to become more productive and law abiding citizens once they are reintroduced/reintegrated to the society.

Relative to this model and idea, the BALAY SILANGAN was conceptualized. This program shall also serve as an instrument for the reformation of drug personalities who avail of plea bargaining in light of the decision of the Supreme Court in the case of Estipona v. Judge Frank Lobrigo (GR No. 226679, 15 August 2017). This serves as an alternative intervention for drug personalities who are not eligible to be admitted in Treatment and Rehabilitation facilities supervised by the Department of Health (DOH).

APPENDIX L

ORGANIZATIONAL CHART

ORGANIZATIONAL CHART



Number of Drug Offenders in every Municipality of Iloilo from year 2016- 2023

Municipality	Total Drug Offenders	Total Completed as of January 18, 2023	Remaining
Ajuy	331	290	41
Alimodian	43	43	0
Anilao	83	79	4
Badiangan	83	68	15
Balasan	181	144	37
Banate	171	171	0
Barotac Nuevo	229	83	146
Barotac Viejo	84	76	8
Batad	168	105	63
Bingawan	0	0	0
Cabatuan	157	157	0
Calinog	72	63	9
Carles	320	274	46
Concepcion	120	108	12
Dingle	155	151	4
Dueñas	61	52	9
Dumangas	417	349	68
Estancia	407	407	0
Guimbal	118	113	5
Igbaras	83	2	39
Janiuay	260	185	41

Lambunao	108	108	0
Leganes	87	65	13
Lemery	256	237	19
Leon	216	212	4
Maasin	63	62	1
Miag-ao	103	82	13
Mina	140	112	28
New Lucena	110	57	12
Oton	433	352	80
Passi City	234	193	41
Pavia	164	137	27
Pototan	648	647	1
San Dionisio	176	148	21
San Enrique	183	145	38
San Joaquin	98	98	0
San Miguel	104	81	23
San Rafael	1	1	0
Sara	297	261	36
Sta. Barbara	242	242	0
Tigbauan	256	255	1
Tubungan	52	52	0
Zarraga	228	228	0
Total	7742	6695	905

APPENDIX L

RESEARCHERS' VITAE

Nonito Barnizo Jr.

Nonito Barnizo, Jr., born on August 6, 2000, is a 24-year-old from Brgy. Sta. Barbara, Igbaras, Iloilo. He is the youngest son of Nonito Barnizo, Sr. and Memia Barnizo, and his upbringing instilled in him a deep curiosity and love for nature. Nonito enjoys exploring the outdoors, whether it's hiking through the scenic landscapes of his hometown or traveling to discover new places. These outdoor adventures fuel his sense of wonder and help him stay connected to the world around him.

In addition to his adventurous spirit, Nonito is also an artist. He is skilled at creating art pieces, using various mediums to express his thoughts and emotions. His artwork often reflects the beauty of nature, capturing the essence of the environments he loves to explore. For Nonito, art is not just a hobby but a way to balance his adventurous side with something more introspective.

Currently pursuing a Bachelor of Science in Civil Engineering, Nonito merges his creative and technical skills to solve real-world problems. Civil engineering allows him to design solutions that positively impact communities, and he finds purpose in creating structures that stand the test of time. Guided by the mantra, "Strive for progress, not perfection," Nonito believes in continuous improvement. This mindset helps him navigate challenges, both in his studies and personal life, always pushing him to grow and become better.

Pauline Grace S. Lerez

Pauline Grace S. Lerez is a 22-year-old aspiring engineer. She is the eldest child of Mrs. Ma. Concepcion S. Lerez and Mr. Rolly S. Lerez, residing in Brgy. Alibunan, Calinog, Iloilo. Born on November 12, 2001, she completed her primary education at Calinog Elementary School and graduated with honors from Central Philippine University's Senior High School. Currently, she is pursuing a Bachelor of Science in Civil Engineering, with a major in Structural Engineering, at Central Philippine University. Her commitment to becoming an engineer is driven by her desire to achieve her personal dreams, make her younger self proud, and support her family in reaching their aspirations.

Throughout her academic journey, she has excelled as a varsity athlete in lawn tennis from elementary through junior high school. In her spare time, Pauline enjoys spending time with her family and pets, reconnecting with friends, watching horror and mystery films, and hiking. Pauline lives by the mantra, "You can't fail if you try your hardest." To her, success is determined not solely by the end result but by the effort and dedication invested in the pursuit of one's goals. Even if a specific objective is not achieved, the growth and knowledge gained from striving to give her best are invaluable measures of success.

KC S. Salcedo

KC S. Salcedo is a 24-year-old aspiring engineer and the youngest of four sons of Mariano C. Salcedo and Myrna S. Salcedo. Born on October 19, 2000, he has always been supported by his family, fostering his competitive spirit and love for sports.

During holidays and vacations, KC enjoys a variety of activities, including playing basketball, mobile gaming, watching movies and anime, and biking. His passion for basketball led him to represent his school as a varsity player during his junior and senior years, where he developed teamwork and discipline.

Currently, KC is pursuing a Bachelor of Science in Civil Engineering, majoring in Structural Engineering, at Central Philippine University. His ambition to become an engineer is driven by a strong desire to support his family and make a positive impact in his community. He is dedicated to overcoming challenges and focused on achieving his academic and professional goals.

Desiree Anne C. Suelan

Desiree Anne C. Suelan, born on July 7, 2001, is the third daughter of the three children of Mr. Nonilo V. Suelan and Mrs. Mercedes C. Suelan. She lives with her family in Brgy. Jelicuon Montinola Cabatuan, Iloilo. She is a happy-go-lucky and outgoing person. Her hobbies include playing volleyball, hanging out with friends and family, going on road trips, and eating. She was an athlete during her elementary and high school years. She has a bittersweet heart.

She graduated her primary education at Cabatuan Central Elementary School and her secondary at Cabatuan National Comprehensive High School with honors. Currently taking up a Bachelor of Science in Civil Engineering at Central Philippine University. Dedicated to getting that ENGR before her name and becoming the woman of her dreams.