PROPOSED DESIGN OF A THREE-STOREY MIXED-USE BUILDING AT CARTAGENA STREET, ILAUD POBLACION, BAROTAC NUEVO, ILOILO

A Project Study

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ABSTRACT

The economy is rising in every part of the world, including in big and small towns, like the town of Barotac Nuevo, Iloilo. Barotac Nuevo is known for a numerous of products and a home for sports, which is why it has established a reputation as the Football Capital of the Philippines.

Mixed-use building is one of the complex structures that can provide the basic needs of the emerging town of Barotac Nuevo, which can accommodate both the rising economy and government of the town. The proposed three-story mixed-use building located at Cartagena Street, Ilaud Poblacion is proposed to the municipality of Barotac Nuevo with the sole purpose of having government offices and business spaces. It was made primarily using the provisions of the National Structural Code of the Philippines 2015 (NSCP 2015). The proposed structure omit has a floor area of 1,145 m2 and has a proposed budget of P40,075,000.00 which will be funded by the municipality of Barotac Nuevo. In addition, structural, architectural, mechanical, plumbing, and electrical designs were included in the study. The study also consisted of BOQs, cost estimation, and work schedule construction specifications. Green building technology and special features were also added to the structure, such as the use of solar panels, LED or energy-saving lights, natural lighting, and ventilation.

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-The Research Team

Chapter I

Introduction

1.1 Background and Rationale

A mixed-use building is a type of property that blends multiple types of structures in one building. One of the advantages of a mixed-used building is its ability to efficiently use a piece of land which is crucial as of the time, when nearly 55% of the world's population lived within an urbanized area. This meant that most of the crowded urban cities had limited lots left. This is where mixed-use buildings could help because one lot could house commercial space, residential spaces, and industrial spaces in one area. In the study, the proposed mixed-use building would house a tourism hub, commercial space, and government agencies.

The proposed mixed-use structure would contain the tourism center as its first type of space. Among the supply market and the destination, there were connecting links known as tourism hubs. The primary access point to a location's resources and information services, including potential tourist attractions and activities, was through tourism hubs. These tourist destinations could draw visitors from other areas, which could potentially boost a community's economy. Commercial properties could aid in improving a community's economy in addition to tourism attractions.

According to the Certified Commercial Property Inspectors Association, commercial property is a structure that was intended to generate a profit. Furthermore, they classified the different types of commercial buildings to: industrial, retail, office, multi-dwelling unit, luxury home or estate, hotel and lodging, and restaurants.

Commercial buildings affected the economy of a municipality because they provided a venue for businesses to generate profit which impacted the overall economy of the community. It also opened job opportunities for the locals, which could improve the employment rate of the

place. The statement could be supported by the research made by Altus Group Economic Consulting, where they proved that commercial real estate had a large contribution to Canada's GDP and employment, where “the contribution of the commercial real estate sector of Canada’s economy was roughly equivalent to the country’s oil and gas sector.” and the same sector created and supported high-paying and high-skilled jobs.

Furthermore, commercial establishments could indirectly improve other sectors, such as health and tourism, because generating larger income resulted in an increase in the budget which could be used to improve the other sectors of the community. These improvements could help the Municipality of Barotac Nuevo improve its economy further.

The Old municipal hall of Barotac Nuevo opened in the year 1853. It housed different government offices and agencies in one place. However, the local government opened its new municipal hall, and as of the year 2022, the transition of the offices is still ongoing. Once the transition period was over, the old municipal hall would be abandoned and would be left unused. Due to the transfer, the different government agencies were displaced into separate places as well. With this being considered, the local government of Barotac Nuevo proposed to build a commercial building on the site to avoid luring criminal activities as well as improve their economy further and provide a venue for government agencies to be placed on one building.

Barotac Nuevo has a total land area of 10,000 hectares and twenty-nine (29) barangays and is twenty-eight (28) kilometers away from the city of Iloilo. As of 2020 the census by the Philippine Statistics Authority, the municipality was a second-class municipality with a projected population of fifty-eight thousand one hundred seventy-six (58,176) and an annual income of one hundred ninety-two million sixty-eight thousand seven hundred sixty-four and four pesos (P192,068,764). The poverty incidence of the municipality as of 2018 was 15.66%. As of 2022, Barotac Nuevo’s economy and employment rate has been increasing and is considered a second-class municipality. Figure 1 shows that the population of Barotac Nuevo was increasing.

This proved that the manpower of the locality was increasing, which could increase their capability to open new jobs for their locals. Figure 2 presents the economy of Barotac Nuevo omit; their economy has been increasing, and providing a venue for business would help boost their economy further.

Table 1

Population Census of Barotac Nuevo

Year	Population	+%
1939	20,572	+2.10%
1948	21,860	+0.68%
1960	23,164	+0.48%
1970	30,131	+2.66%
1980	34,276	+0.49%
1995	40,968	+0.56%
2007	49,515	+1.08%
2015	54,146	+0.82%
2020	58,176	+1.42%

Table 2

Economy of Barotac Nuevo

Fiscal Year	Annual Regular Income	Change
2009	69,483,686.50	-
2011	80,990,211.74	10.26%
2013	88,533,793.86	11.67%
2015	112,021,459.95	9.04%
2016	127.638,307.70	13.94%

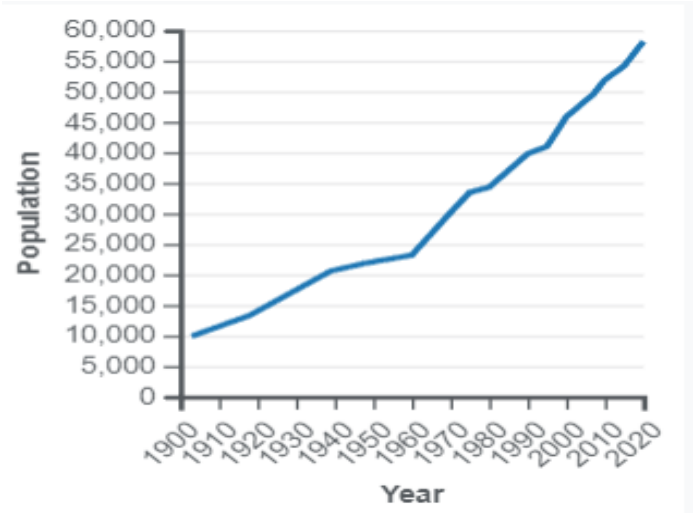


Figure 1

Population Growth of Barotac Nuevo, Iloilo

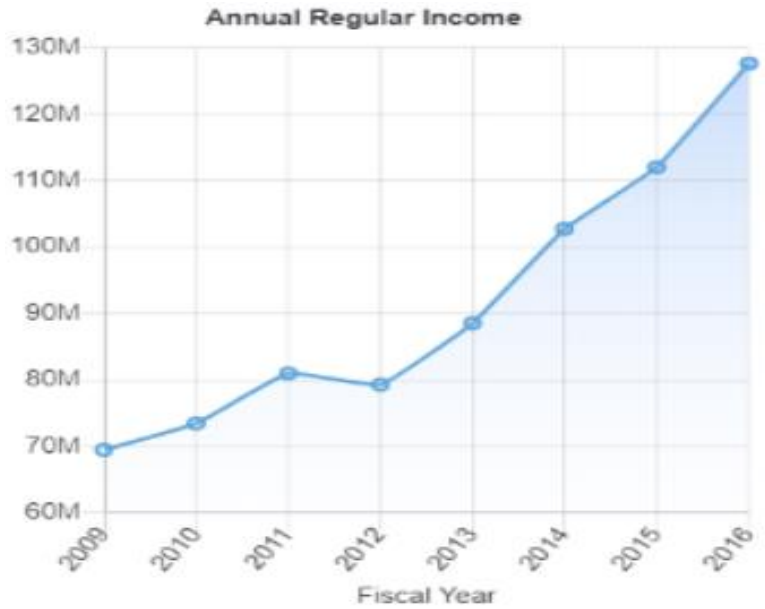


Figure 2

Annual Regular Revenue of Barotac Nuevo

These numbers showed that the economy and population of Barotac Nuevo had been increasing. Given these data, more people would have been using their government agencies in the municipality. The old municipal hall of Barotac Nuevo had housed government agencies since the year 1853. But as of the year 2022, the local government had opened its new municipal hall, leaving these government agencies in the old municipal hall where facilities had been left unimproved since its last renovation in the year 2014. With this, it was suggested that

a new building would be erected on the same lot in order to improve the work environment and facilities to be used by the government agencies, specifically the Post Office, Municipal Trial Court, and COMELEC.

These government agencies will be placed in one space to ease the travel time of Barotacnons in processing their papers. The tourism hub and commercial space will be located on the first floor, while the government agencies will be located on the second and third floors. The need to design a three-story mixed-use building at the lot of the old municipal hall of Barotac Nuevo is to further develop the economy and employment rate of the municipality. It will also provide the local government with a venue where government agencies could be in one place. By creating a design, the local government had a choice to lessen their unused lots and convert it into something that would improve their community. The design is being prepared for construction once the local government decided to it through.

1.2 Problem Identification

In the omit year 2014, the major thrust of the municipality was to develop an effective, efficient, and fast delivery of public services and provide economic opportunities which would provide income for the residents and its constituents. The problems that needed to be addressed concerning the proposed three-storey mixed-use building were provided.

1.2.1 No single venue for various governments

The government agencies in Barotac Nuevo are located in both the old and new municipal halls. The people of Barotac Nuevo are struggling to comply with government documents if other omit offices are far from each other, as shown in Figure 3. To ease the struggle the locals are facing, the designed mixed-use building provided spaces for these government agencies so that they could be condensed into one venue.

1.2.2 Tourism

One of the goals of the Tourism Department of Barotac Nuevo is to boost tourism because it was not receiving the recognition it deserved. Barotac has been the source of seafood for adjacent localities. They also have marine attractions that had not been receiving recognition due to lack of venues to be advertised and exposure. By constructing the proposed design mixed-use building, the tourism office will have a venue to feature their products to tourists as well as feature their locality as the football capital of the Philippines.

1.2.3 Employment Opportunity

In reference to Figure 1 of this study, the population of Barotac Nuevo had been increasing. In connection, the number of employment opportunities should have increased together with the increasing number of populations in order to avoid sudden increase in inflation rates.

Designing a three-story mixed-use building that houses a tourism hub, government agency, and commercial space will open job opportunities to locals of the municipality if the local government decided to erect the proposed building. This will help balance the employment-to-population ratio and prevented locals from becoming unemployed or being forced to migrate.

Figure 3

Government Agencies located at the Old Municipal Building

Figure 4

Old Municipal Building (Interior) of Barotac Nuevo

1.3 Objectives of the Study

1.3.1 General Objective

The objective of the study was to design a three-storey mixed-use building at the old municipal hall of Barotac Nuevo at Cartagena St, Barotac Nuevo, Iloilo, Philippines.

1.3.2 Specific Objectives

To achieve the general objective, the following specific objectives were provided:

a.) Gather necessary information regarding the location, including the geotechnical report and surveying of the location.

b.) Analyze the acquired data and design the structural, architectural, electrical, and plumbing systems.

c.) Provide cost estimates of the project as well as its project scheduling.

1.4 Significance of the Study

1.4.1 Government of Barotac Nuevo

After the completion of the proposed design of the three-storey mixed-use building, the local government of Barotac Nuevo will be able to visualize and implement the said proposed design and plan accordingly to the capabilities of the municipality. Adjustments could be made such as additional features and designs as the proposed design included the specifications, plans, materials, cost, and scheduling.

1.4.2 Locals

The locals now have one venue for government agency concerns because the three-storey mixed-used building housed the government agency in one place. Qualified locals also have job opportunities since the proposed building has been constructed.

1.4.3 Tourism Office

Tourism officers now have a venue where they can feature the products and tourist spots located in the municipality of Barotac Nuevo since they had no tourism hub located in their municipality as of January 2023.

1.4.4 Government Agencies

Government agencies were previously located at the old municipal hall of Barotac Nuevo where facilities were not well maintained since the last renovation as shown in Figures 3 and 4. Upon completion, they have access to new facilities and offices where the working conditions are suited for their designated assignments.

1.4.5 Business Owners

Since the proposed three-storey building houses a commercial space, business owners have a venue where they can place their respective businesses. The lot is also advantageous because it is located at a corner lot where buses coming in and out of Barotac Nuevo pass, and it is directly across Barotac Nuevo's Plaza Field, where some of the Football exhibitions of popular Philippine teams such as the Philippine Azkals are playing.

1.4.6 Researcher

This study served as a way to explore different patterns and techniques; applied learning; developed and honed skills useful in the field of engineering. In addition omit, knowledge gained from this study will help to have better and have more creative ideas and understanding in implementing different kinds of techniques that can serve as a basis for understanding the field of civil engineering.

1.4.7 Future Researchers

After the completion of this study, future researchers, agencies, and even institutions may use this study as a reference guide or study, which may have the same conditions as this study. This study can also benefit future researchers through different insights for the improvement of their research paper.

1.5 Scope and Limitations of the Study

The main purpose of this study was to design a three-storey mixed-use building at the old municipal hall of Barotac Nuevo at Cartagena St, Barotac Nuevo, Iloilo, Philippines. The design included the architectural, electrical, plumbing, and structural plans. Finally, technical specifications, construction work schedules, and cost estimates were provided in the design.

This study did not cover the financing, provision of the area to be allocated, and construction of this project if the Local Government Unit (LGU) of Barotac Nuevo decides to push through with this project. Furthermore, maintenance, repair, and landscape design were not covered in this study and it will be the responsibility of the LGU.

Chapter II

Review of Related Literature

2.1 Introduction

A property that combines numerous types of structures into one structure is called a mixed-use building. One benefit of a mixed-use structure is that it made efficient use of available land, which was important given that almost 55% of the world's population lived in metropolitan areas. This meant that the majority of densely populated urban cities had a limited number of available lots. Mixed-use buildings were helpful in these situations because they could accommodate commercial, residential, and industrial spaces on the same site. The proposed mixed-use structure in this research held a tourism hub, retail space, and administrative offices.

The tourism center was the first type of space included in the proposed mixed-use complex. The tourism hub was the link that joined the source market with the destination. The primary access point to a location's resources and information services, including potential tourist attractions and activities, was through tourism hubs. These tourist destinations could draw visitors from other locations, boosting the local economy. Commercial spaces, in addition to tourist attractions, could support a community's economy.

A building designed to make money is referred to as a commercial property. In addition, the various kinds of commercial structures are divided up into the following categories: restaurants, hotels, motels, retail stores, offices, multi-family homes, luxury homes, and estates. For both owners and renters, commercial structures played a crucial role in business operations. Retail stores, eateries, offices, manufacturing, and other companies could be housed in a commercial structure.

Twenty-nine (29) barangays comprise the 10,000 hectares land in Barotac Nuevo, is located 28 kilometers from Iloilo City. According to the Philippine Statistics Authority's 2020 census, the municipality had a projected population of 58,176 and an annual income of

102,060,688,764,4 pesos. It was classified as a second-class municipality (P192,068,764). As of 2018, the municipality's poverty rate was 15.66%. The economy and employment rate of Barotac Nuevo had been declining as of 2022, and it was regarded as a second-class municipality.

These figures demonstrated that Barotac Nuevo's economy and population have been growing. More people have used municipal government services as a result of these statistics. The government organizations omit called Barotac Nuevo's historic municipal hall home since 1853. However, the local government erected a new municipal building in 2022, leaving these government organizations in the existing municipal building, where facilities had not been upgraded since its previous renovation in the year 2016. In connection, it was proposed that a new structure be built on the same parcel of land to enhance the working environment and facilities used by government organizations, particularly the Post Office, Municipal Trial Court, and COMELEC. To reduce the distance that Barotacnons had to travel when completing their paperwork, these governmental entities would be gathered in one location.

The need to design a three-storey commercial building at the lot of the old municipal hall of Barotac Nuevo is to further develop the economy and employment rate of the municipality. It will also provide the local government with a venue where government agencies could be in one place. By creating a design, the local government will have a choice to lessen their unused lots and convert them into something that would improve their community.

This section of the paper discusses commercial buildings and their types, requirements, design standards, and traffic flow of the building. To further improve the design, the section also discusses different features of other commercial buildings that could be incorporated into the design of the two-storey commercial building.

2.2 Design Standards and Codes

The proposed project's design and other design guidelines accepted in the Philippines were based on the National Building Code of the Philippines (NBCP) and the National Structural Code of the Philippines 2015 (NSCP). The design was required to follow the codes for secure design.

2.3 Related Literature

2.3.1 Cluster Development Strategy in the Philippines

According to the research done by Laura L. Ignacio, cluster-based techniques have been common in national and local government development programs as well as in international organizations and donor agencies' competitive initiatives. It supports "the symbiotic interaction among these businesses and other companies, government agencies, as well as institutions" and stimulates business collaboration.

In general, clusters may receive funding from private businesses (commercial financial institutions), the public industry (government expenditures or through specific government finance like development banks), external sources (overseas direct expenditures or donor institutions), or internal sources (equity funding or voluntary donations). To cut expenses, government organizations congregate on commercial premises.

2.3.2 Commercial Buildings

A building is considered to be commercial if it has a minimum of 50% of its floor area dedicated to commercial uses (restaurants and the like), such as retail, service offering, or food service. It would not be considered a commercial structure if a building had 10 stories, 6 of which were apartments or other residential areas while the other 4 were business spaces.

A place having the potential to produce money may also be used to describe a corporate structure (or a piece of land). a place where companies may conduct their daily operations and cater to their clients or customers. As such, a commercial facility need not always be a store or a restaurant; it may also be a location where clients can pay for goods or services, such as a lawyer's or doctor's office, to generate revenue.

Workplace buildings vary from single-tenant spaces to skyscrapers and include everything in between. Class A, Class B, and Class C buildings are further categories.

Office assets include all types of commercial buildings, including single-tenant spaces, skyscrapers, and everything in between. There are more classes as buildings are given a Class A, B, or C designation.

Class A. Structures that are regarded as the best of the best. They frequently have greater facilities and infrastructure because they are new buildings. A Class A building, however, can be an older structure that underwent extensive refurbishment. They are often expertly run and situated in a desirable neighborhood with easy accessibility to nearby areas of interest.

Class B. Properties that are typically the most sought-after by investors because, although having a tendency to be a little older, they may still provide a sizeable return on investment with minor modifications and restorations. A Class B building typically has good management and reasonable upkeep.

Class C. Buildings in the Class C category are often more than 20 years old, situated in unattractive neighborhoods, and not closely as properly managed or preserved. These structures often require more upgrades; therefore, to make up for the lack of upkeep, they offer lower rents. Due to the lower grade of the property, these spaces frequently go unoccupied longer than Class A or Class B commercial properties, making them excellent candidates for rehabilitation.

2.3.3 Things to consider when building a commercial building.

Construction of a business building cannot start unless a thorough design has been made. The project needs to be completed regardless of how it will be utilized as an office, shop, or storage. Everything about a business space must run well from the minute it is conceived until the opening day. The resources and time invested in the endeavor are an investment.

Type. Every building project is unique. Whether it is a project for homes, shops, businesses, hotels, or offices. Each business structure has its own specific material requirements. It is crucial to establish this component early since it will dictate all the requirements that need to satisfy.

Location. It's critical to conduct market research on both possible rival businesses and the ideal places for drawing clients. The surrounding infrastructure might have a beneficial or negative impact on the investment. It is important to choose a place that is very accessible. Additionally, picking an area in an urban hub that is growing rapidly is recommended. Every day, everyone will travel to this location.

Budget. A common error made by business owners is to ignore financial considerations. The construction process will suffer if this is neglected. Construction projects require a lot of money, so setting a budget in advance is a good idea. The specific costs should be kept in mind, from the larger ones, like renting property, cement, and employee wages, to the little expenses, like drinking water and office supplies. The better the project is managed, the more exacting the budgeting must be.

Building permits. Owners of building projects must get several government permissions. Even environmental permissions are necessary today. Every nation and locality have a different set of construction licenses. The regulations will be subjected to a more thorough examination. Local officials may stop over to inspect the location. If this crucial paperwork is not available, construction may be delayed significantly or, worse still, shut down

entirely. It is advisable to get the necessary building permits in advance. This will guarantee a seamless building procedure.

Contingency plans. The project may be affected by several unanticipated risk factors. This could involve pandemics, lawsuits, poor weather that ruins the site conditions, and labor shortages. Make sure that the contingency plans can adapt to all of these circumstances. Don't forget to factor in any potential overhead expenses as well.

Selecting a contractor. Since the construction administration team is underperforming nonperforming, some owners are unable to succeed. Unprofessional teams, late material delivery, and mistakes in execution are a few of the things that might derail a construction project's progress. Employ a construction management group with extensive knowledge of the sector.

2.3.4 Functions and Types of Commercial Building

Office buildings. Common forms of business buildings that can be located throughout any large city or even a small town. Depending on its location and the owner's business goals, a corporate building could be a skyscraper or a single-story structure. The proprietor of a commercial building can either occupy the entire structure or rent it out. Tenants of an office building may include a single business or multiple on the same level.

Restaurants. Another common type of commercial structure with a single restaurant as its only tenant may be owned by the restaurant's managers or leased to business owners by the building owner. This holds true regardless of the restaurant's franchise system, network, or independence. A restaurant facility may be designed for a specific occupant based on trademark specifications, or it could be designed to meet the needs of any restaurant client. Restaurant facilities may be subject to stricter standards compared to other business structures due to their facilities.

Retail. Refers to any type of store or business, including small retailers that share a facility with other business owners or big warehouse stores that occupy a whole building designed to resemble a warehouse. Consequently, a retail structure may contain a single store or multiple stores, analogous to a strip mall. In some cases, such as shopping centers, it may be possible to access the building from the interior.

Hotels. Various types of commercial buildings, regardless of the fact that they might initially seem to be residential rather than commercial buildings. Hotels are generally seen as commercial entities since they operate more like businesses than just rental properties and because their turnover is frequently faster. Some hotels are small, one-story wayside motels; others are tall buildings with restaurants and retail spaces. The structure may be the property of the hotel owner or rented by business owners, depending on a variety of factors.

Warehouses. The common style of a commercial building. A merchant may store goods in a warehouse until they are needed at a store, or a logistics and shipping business may utilize one to hold products while processing and transferring the said goods. For many different sorts of enterprises, warehouses serve as central centers for storage. Warehouses can act as long-term storage spaces or temporary resting places for their products. Certain warehouses demand strict temperature control due to the items they hold.

Industrial. The term "industrial buildings" encompasses a wide variety of structures, including manufacturing facilities, workshop buildings, and even specific types of warehouses. An industrial building may contain hazardous chemicals, vast machinery, or it may even offer services to customers, such as a vehicle repair shop. Even though industrial facilities can house a variety of business types, they often stay congregated together due to potential pollution and safety issues. This prevents these types of buildings from extending far close to residential locations, although the precise distance will differ by city or community.

Healthcare. Many medical facilities, especially those in the healthcare industry, provide patients as their consumers in order to generate revenue. Thus, healthcare facilities are

regarded as a specific class of commercial buildings. Everything from large hospital campuses to small clinics may fall under this category. In contrast to larger hospital buildings, which are frequently owned by hospital owners and were designed specifically for their requirements, modest clinics are typically situated in their tiny structures or a multi-use facility that might rent space in.

Multi-use. A multi-tenant commercial building is commonly referred to as being multi-used. These tenants might include restaurants, stores, offices, and even healthcare facilities. It can still be considered commercial even though there are residential rents present if there are 51% commercial renters as opposed to residential tenants. Multi-use structures may be an intelligent investment for entrepreneurs and a source of security because they don't rely on just one type of business.

2.3.6 Types of mixed-use developments

Main Street. In towns and cities alike across North America, the "Main Street" paradigm has weathered urban decay to reappear and re-energize urban communities. In contrast, services, lodging, and entertainment venues have mostly taken the place of mom-and-pop stores in the modern version, but there are still residences above or behind the storefronts. For a modern take on the Main Street idea, take a look at the Princeton Junction Transit Village in Princeton, New Jersey.

Shopping Mall/Department Store Conversion. Numerous brick-and-mortar retail stores failed as a result of being unable to compete as electronic commerce swept the nation. Large department stores and abandoned shopping malls found a new use as mixed-use centers with apartments and businesses better suited to compete with e-commerce stores. Take a look at what has happened to the former Sears building in Santa Monica to see examples of the

types of redevelopments that have popped up all over the continent, giving new life to valuable but abandoned real estate.

Vertical Mixed-Use Developments. A vertically mixed-use structure, which falls under the broader class of mixed-use projects, can contain a wide variety of enterprises. However, typically, public access like eating establishments, cafes, government offices, as well as even travel facilities are centered on the lower floors, while private uses like condominiums or accommodations are found higher up. The Metropolis in Downtown Los Angeles is an effective example of this kind of construction.

Horizontal Mixed-Use Developments. These incorporate different single-use structures onto a single, mixed-use lot. With such a setup, the mix of establishments and homes can develop into a neighborhood or even a walkable community. Abandoned buildings are frequently renovated as part of horizontal mixed-use developments in urban areas. Consider Liberty Village in Toronto, a railroad-enclosed area that was first used for institutional and industrial purposes in the 19th century. While its factories and prisons closed during the 20th century, the abandoned neighborhood experienced a resurgence in the early 2000s. The old, empty factories were quickly filled with a plethora of stores, restaurants, banks, and offices, turning the area into one of the most vibrant and sought-after neighborhoods in the city. Mixed-use developments present an attractive investment opportunity today.

2.3.7 Types and Uses of the tourism hub

A tourism hub acts as an intermediary or link between the source market and the location of interest for both local and international travelers. The 4 distinct tourist flows are listed as follows: (1) local travelers travel to local locations via tourism hubs; (2) local tourists travel to foreign places via tourism hubs; (3) foreign tourists travel to local locations via tourism hubs; and (4) foreign tourists travel to foreign locations via tourism hubs. From the perspective of the

relationship between the tourist hub and nearby travel-spoke cities depending on the "hub-and-spoke" system, which characterizes the tourism hub. This definition states that a tourist hub is both the principal gateway or entry to the final destination and the main departure to the point of origin. The spoke cities' extra tourist events and attractions assist the tourism hub and the municipality's capacity at its busiest times in exchange for the assets and information services it provides to the spoke cities.

2.4 Related Studies

2.4.1 Construction of Mixed-use Building

According to Ababa (2013), Many elements influence the desire for standardized mixed-use buildings. The two that will have the biggest impact are the rate of population expansion and the level of income.

The office and commercial building sectors have undergone a significant transformation recently. This may be due to the country's quick economic development and expanding public infrastructure. The rapid expansion of domestic and foreign businesses, particularly those in the services sector, is another aspect that is pertinent in the specific instance of commercial buildings. Government offices previously operated in small quarters throughout the city focus on leasing new and contemporary structures. Instead of turning residences into offices as they historically used to do, global institutions and NGOs are regularly leasing full floors or even several levels in modern city center commercial buildings.

Because businesses lease space as a component of manufacturing the products or services they offer to consumers and businesses in the local, regional, or national economy, the need for workspace is derived.

2.4.2 Green House Gas (GHG) Mitigation for Commercial Building

There are several ways where environmentally friendly growth and GHG reduction may work together, including energy efficiency and the use of clean energy in buildings. The best of these for less developing nations are secure, effective stoves for cooking that, while lowering GHG emissions, also considerably reduce morbidity and mortality by lowering indoor air pollution. The amount of work for women and children is also lessened by such technologies, and less strain is placed on the planet's limited natural resources. Energy-efficiency improvements and the use of building-level sources of clean energy lower energy costs, which boost social welfare and increases access to energy-related services.

There are several approaches to reducing GHG emissions from buildings using both readily available and affordable technology and unique characteristics that are not yet commonly used. The use of solar design, energy-efficient lighting, and appliances, effective ventilation and cooling systems, etc., are only a few of these methods. Implementing carbon mitigation strategies in buildings has many additional benefits, including enhancing welfare assistance for low-income households, improving indoor and outdoor air quality, ventilation, and comfort, and, specifically, reducing costs associated with the construction of the building.

2.4.3 Exploring Decision-Making Methods for Sustainable Design in Commercial Buildings

Numerous choices are made at various stages of the construction design process. In order to do this, alternative parts, supplies, assemblages, networks, and architectural shapes must be chosen. The group of designers has to tackle a number of challenges to decide which approach is more economical. The approaches used to make these conclusions must take the intricate nature of the proposed procedure into reason and help the project team understand the compromises that have to be completed.

This must be accomplished in a situation-sensitive, open, and collaborative manner. The design group might profit from maintaining the decision's purpose for as much time as is practical during the process of decision-making in order to reduce useless discussion and disappointing results. The method used to make such decisions will have an impact on the final building design (Arroyo, 2014).

From the four different types of methods, the researcher learned:

1. Problems requiring an order of an immense or indefinite number of possibilities are particularly well suited to aim programming and optimization with multiple objectives approaches.

2. Value-based techniques are extensively used in structure design practice and works. These means might not, however, be effective in encouraging transparency, reaching consensus, and continual learning for group decision-making.

3. Ranking alternatives and comparing "value" to "cost" using outranking algorithms is challenging since they lack an aggregating function.

CBA helps the planning team to comprehend "value" vs. cost more effectively than the other methodologies mentioned since it focuses more on discriminating between options.

2.4.4 The Future of Commercial Buildings: The Major Trends, Influences, and Factors Driving Change in the Commercial Buildings Market

To satisfy the requirements of their consumers, commercial structures are constantly adapting and developing. Buildings have evolved over time in terms of their aspect, function, and use. Commercial structures will continue to change in the next decades to meet these changing needs. The study identified six socioeconomic variables that are believed to alter the essence of buildings: information technology, fuel, transport system/logistics, bioengineering/nanotechnology, production, and resources.

Since three dimensions would be used instead of two, and the facade would be the starting point, the method of developing structures would also be significantly altered. Designing in three dimensions rather than two is quicker, more precise, and of greater quality. Computer-aided software for engineering and extremely versatile computer-aided equipment for production will be linked to the usage of computer-aided design. More importantly, this propensity could result in better-built, more sustainable structures.

2.4.5 Full Structural Analysis and Design of Commercial Building Project

This project is a structural plan for a commercial center. It has a total area of about 15,000 square meters that is divided among fourteen floors, with the first five floors serving as parking levels underground, the following four serving as commercial floors, and the remaining floors serving as office levels, as shown in Figure 3.

To evaluate the structural layout of various kinds of slabs via both methods (one way and two way) along with additional structural components (columns, beams, and footings), considering strength and functionality specifications, to carry out a financial analysis to select the most cost-effective type of slabs, and to determine the center of mass and center of the rig.

The challenges include building irregularity, which affects the design of buildings to resist lateral earthquake loading, large spans, which affect slab framework, category, and dimensions, as well as beam thicknesses, and cantilever slabs for business. and workplace floors, and openings on certain business-related floors, such as escalators.

Several interior columns have been removed from the cellar floors to make parking easier and provide more space for vehicles. This change has no effect on other floors, but adjacent columns have a larger tributary area, resulting in larger column dimensions.

The materials utilized were concrete of normal density, with compressive strengths of 25 MPa for slabs and beams and 35 MPa for columns and footings. For the structural steel used as reinforcement steel, high yield strength steel is used, which has a yield strength of 420 MPa, and 200000 MPa for modulus of elasticity. Utilized in ribbed slabs are hollow blocks measuring 30x40x20 and 25x40x20 centimeters.

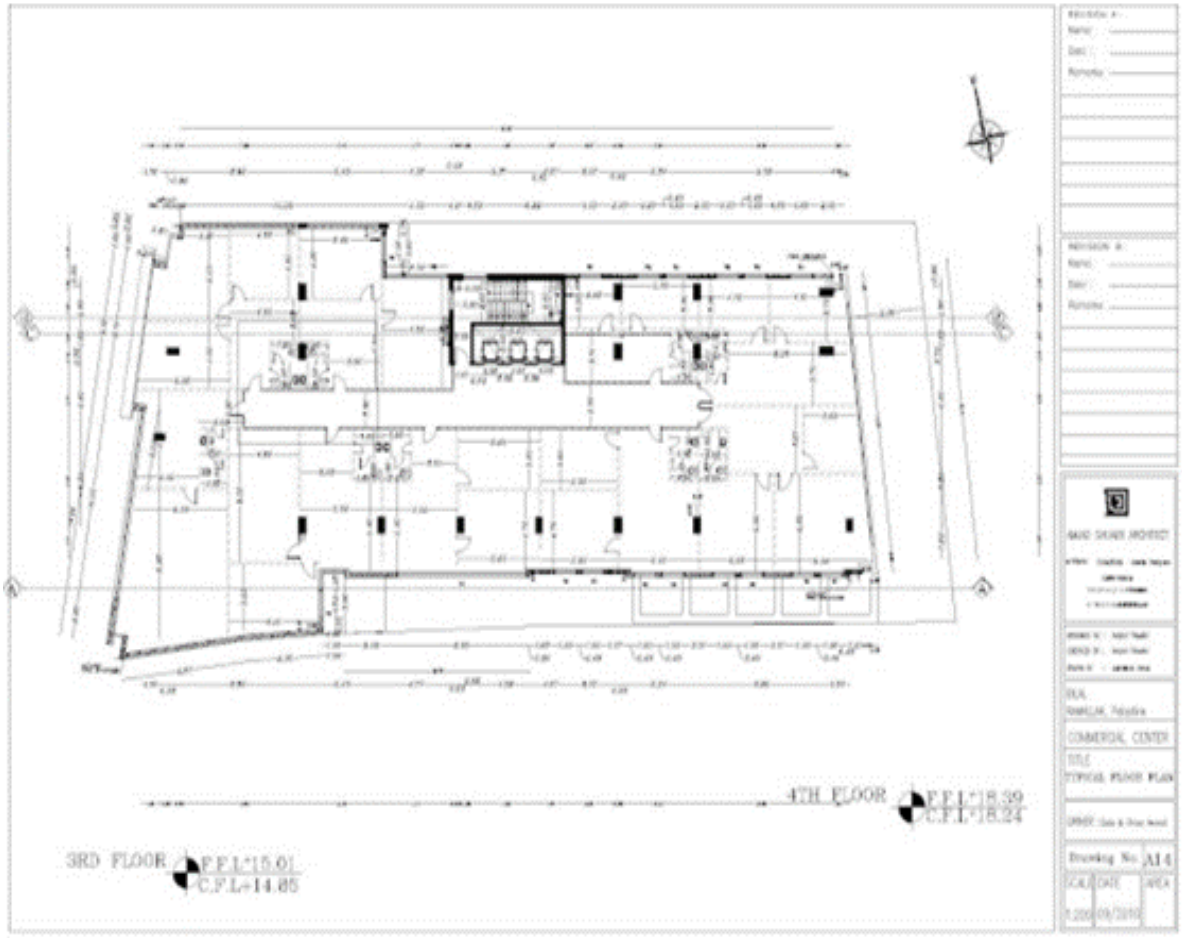


Figure 5

Architectural Plan of Typical Floor

2.5 Synthesis

The adaptability of the structure to different uses played a big part in the sustainable development of the barangays. As the modernity of the designs and resources became more updated, structures should also be adaptable to change. An adaptable structure would not only have its benefits on the financial aspect but also its social welfare and economic quality. From low to high income households, they could benefit from an adapting structure depending on its uses or planned purpose for a certain time. Also, the social welfare of both inside and outside citizens of the barangay or town might have increased so to say that it would have benefited the community and the local government of the town.

The most prominent factor addressed to the building was its efficiency in every aspect. Given that the location of the structure was in an area where it could be marketed and displayed well to the citizens/tourists, its advantages on the economic side would have risen. Given that the economy of the town might have risen, still the efficiency of the structure must have been put into account. Efficiency would not only have been an impact on the financial aspect but also on its physical aspect.

The development of this structure would have led to an increase in population and improvement in the town. Due to the wide range of boundaries of the town, this structure would have surely been a success. Developing towns or barangays now also have multi-purpose structures which gained their economic status in relation to their population and location. So as to this barangay, Barotac Nuevo, it would have left a good impression on the town as this structure welcomed (welcomes) everyone first as they entered in this town.

And lastly, the construction of the commercial building must have abided within the codes, standards, and design for the specifications of the structure.

Chapter III

Methodology

3.0 Introduction

The third chapter contained the methodology which was used for the data collection, design and data analysis, project cost estimation, project scheduling and resources and facilities which were utilized. In addition to that, design constraints and contemporary issues are also discussed in this chapter. The design codes were all based on the National Structural Code of the Philippines 2015.

3.1 Design Constraints

3.1.1 Green Building Technology

In achieving green building technology, location, accessibility, usage of resources, and economical designs were considered.

Water supply. Rainwater harvesting was one of the economical ways of storing water since it stores water from the rain. Though it needs to be maintained from time to time, it was very cost-effective, conserved water, and a very simple method of conserving water yet was very effective.

Another way was to have a water tank and water pump that store water for daily usage such as comfort rooms, washing room, etc. Though it could cost a bit, which ranges up to 50,000 PHP, its effect and convenience greatly benefit the owner of the structure, tenants, and customers.

Energy-Saving Lights. Glass or transparent roof is unique nowadays but is one of the simple and effective ways of illuminating the whole structure with natural light. In addition, more windows installed could also be a good help and factor in illuminating the interior. Another way

was to also use energy-saving bulbs such as LED's and halogen bulbs because it only consumes about 10 watts unlike those of fluorescent or incandescent bulbs which goes from 13 to 15 watts. They only consume less energy and are more efficient than ordinary bulbs. And lastly, the usage of solar panels. The average energy produced by solar panels ranged from 250 to 400 watts. It was also found in research that the average usage of energy of commercial buildings ranged up to 22.5 kWh. A mass of solar panels would help, economically, in the long run.

Ventilation and Air Flow. The first option was passive cooling or passive window ventilation openings using doors, windows, vents, and inlets to let natural air refresh the structure with no or less energy consumption. Cross-ventilation was also like PWVO to let the air travel all throughout the structure and control the airflow, heat transfer, and temperature distribution. Openings such as exhaust fans, small air inlets, etc. were also utilized. Given that the structure was along the road, natural wind pressure could be beneficial. Another way was to have cooling systems, though it demanded high usage of energy and may range up to 50,000 PHP, its effects were helpful. Thermal cooling devices such as air-conditioning, room thermometer, forced ventilation, fans, etc. were utilized.

3.1.2 Organizational Constraints

The Old Municipal Hall of Barotac Nuevo had some government agencies that were not transferred to the New Municipal Hall due to the lack of space. The government agencies that were still in the Old Municipal were SSS, Post office, Comelec and Veterans office, and they did not have a good working environment due to the lack of space and maintenance of their building as shown in Figure 6. The researchers considered two options for space planning. One option was to design an equal partition for all the government agencies that would use the area. The advantage of this design was that each office would have the same area to use, while the

disadvantage was that government agencies that catered to more people than others had a limited area, or they could not hold enough employees, equipment, and people to have transactions run smoothly. The second option was to design the partition with regard to the number of people who transacted with a specific government agency. The more people catered to on a daily basis, the larger the area of partition. The advantage of this design is the area would be used efficiently based on the needs of the specific agency, but the disadvantage is the possibility that government agencies would fight for the larger area. The criteria for choosing the design were the number of daily transactions from different government agencies, equipment used, and the number of employees working.

Figure 6

Government Agencies located at the Old Municipal Building

3.1.3 Technical Constraint

Selection of a proper roofing system is important because designers could use roof compositions to determine the ideal roofing material for the property depending on its requirements and style. Two options for the roofing system of the proposed building were considered by the researchers. These options are roof decks and steel truss systems. In the

following paragraphs, the advantages and disadvantages of the two types of roofing systems are discussed.

Roof Decks. Roof decks are outdoor spaces located at the top of a structure. They could be utilized for entertainment, gardening, assembly, or alike. The advantages of this roofing system are it could provide a rooftop view, ideal for entertaining guests, and had high-quality thermal performance. Designing a roof deck was also relatively simpler compared to a steel truss system. However, it needs more load considerations, as it could cause ponding water, and is more expensive than the steel truss system.

Steel Truss Systems. A steel truss system is a triangle-shaped configuration of straight, vertically linked structural elements. Welding is utilized at the nodes to join the various parts. External forces are frequently applied to the system at the nodes, resulting in responses at the supports. The advantage of this system is it is lightweight, eco-friendly, extremely durable, and less expensive compared to the roof decks. However, it requires great maintenance, was not energy efficient, susceptible to corrosion and rust, and more prone to damage when storms are present.

The criteria in choosing a roofing system were based on the feasibility of the study, allotted funds of the local government, and the practicability of the system.

3.1.4 Social Constraint

Modernized structures are designed and are applicable to every building that is to be constructed. As for this three-storey mixed-use building, it will be located at the corner street of the main road in the plaza of Barotac Nuevo, has the surrounding structure of unmodernized design. To answer this constraint about the design and modernity limitations due to the surrounding structures, the design of the structure was planned well by the researchers and

matched the surrounding designs of the structures but adopted modernity of the designs and also considered the clients' suggestion as well as their satisfaction.

3.2 Contemporary Issues

3.2.1 Employment/Business Opportunities

In the past, Barotac Nuevo was a significant municipality and was recognized for being the football capital of the Philippines. It offered numerous business opportunities, and businesses were built in various locations across Barotac Nuevo, which may have altered one of the goals of the planned design for the commercial structure. However, because the commercial building was able to house a variety of firms for commercial reasons, it increased the building's economic potential. A structure that could offer a variety of resources had will have a significant impact on the growing municipality of Barotac Nuevo.

3.2.2 Economic Recovery

The world's economy, including Barotac Nuevo, changed and decreased due to the pandemic. The instability of goods and resources affected every aspect of life, especially in a developing town. As the structure was planned and designed, one of its sole purposes was to build the economy through the production and distribution of goods and resources in Barotac Nuevo. Given that Barotac Nuevo produces a variety of goods, this structure would aid in and profit from the distribution and marketing of these regional products, as well as the development of a community that would meet the needs of residents and visitors while also providing for their basic needs through new employment opportunities, resources, etc.

3.2.3 Developing Innovative Infrastructure

Barotac Nuevo is a well-known location for tourists and locals for its fast-growing economy and modernized design in Iloilo. Innovation and infrastructure spending are important catalysts for economic expansion. Poor utilization of the building will lead to a higher risk of severe property damage that can pose a dangerous threat, not just to the occupants, but also to the structures near the property. The design of the building is intended to provide excellent quality, trustworthy, ecologically sound, and flexible building, incorporating local and international organizations, with a priority on accessibility for all that is both inexpensive and reasonable. One of the purposes of the structure is to support economic growth and human well-being. Renovating facilities and adapting industries to make the buildings more sustainable, with greater resource efficiency, increased use of clean, environment-friendly innovations, and economic operations for a high quality of life and easier access to both local and foreign citizens.

3.3 Design Framework

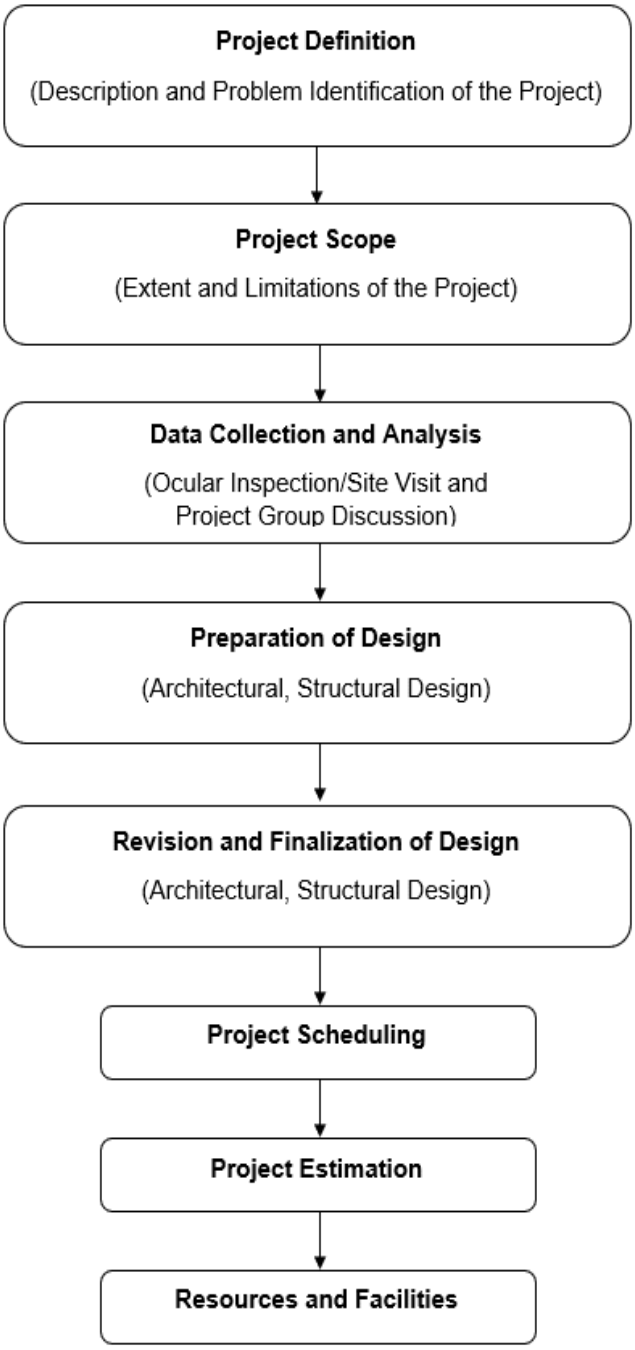


Figure 7

Design Framework of the Proposed Design for the Three-Storey Mixed-use Building

3.4 Project Definition

The researchers had sent a request for a list of the municipality's priority projects, which will be constructed after two years. The current problem in Barotac Nuevo was the plan, design, and erection of a mixed-use building to regain the lost economy and potential source/outlet of resources and products.

The project is a proposed three-storey mixed-use building in Barotac Nuevo, Iloilo. The location of the proposed project is on the old municipal hall of the Barotac Nuevo, which had been recommended by the municipality government. The facilities of the structure were subjective to the preferences of the municipal government while the design was subjective to the ideas and creativity of the researchers.

3.5 Project Scope

This study aimed to design the proposed three-storey mixed-use building in Barotac Nuevo, Iloilo. The design included detailed architectural and structural plans, construction specifications, construction work schedule, and project cost estimates. Additionally, the decision of whether the structure would be erected will depend on the municipality.

3.6 Data Collection and Analysis

3.6.1 Site Inspection

A site visit was conducted by the researchers to gather necessary data and information. The location, where the old municipal building in the town of Barotac Nuevo was situated, was investigated to access the current situation in order to address other concerns that may arise. To create the designs, the researchers examined and used the data acquired during the site inspection and study. These were one of the key factors taken into account while designing the suggested structure in order to efficiently plan any potential movement inside it.

3.6.2 Geotechnical Investigation

To determine the profile and characteristics of the soil, the researchers carried out a geotechnical examination. The collected soil samples underwent testing that met the minimal testing standards. The bearing capacity of the soil and its categorization for the foundation of the planned commercial building was determined using the test findings from geotechnical research.

3.7 Preparation of Design

3.7.1 Architectural Design

The architectural design was based on the criteria identified for a mixed-use building whose standards were provided by the Department of Public Works and Highways (DPWH). The architectural design was also created under the supervision of architects, and their suggestions were considered when designing the proposed structure's floor plans and aesthetic features. Special components with sustainability components were also included. The design of the proposed project increased the structure's efficiency and utility.

3.7.2 Structural Design

The design of slabs, beams, columns, footings, and other structural members was based on the National Structural Code of the Philippines (NSCP) 2015 and other applicable codes and requirements mandated by law. These were also utilized to establish loads, occupants, and other essential provisions. To confirm structural integrity and take further precautions against earthquake loads, seismic analysis, a vital step in structural analysis when constructing a project, was also carried out.

For the plumbing and electrical plan, the criteria and regulations for the designs were based on the National Plumbing Code of the Philippines as well as other regulatory codes. A licensed plumber and electrical engineer, among other professionals, were consulted regarding the plans

or architectural layouts of the plumbing and electrical systems of the planned structure. The plans were reviewed to see if they satisfied the needs of the clients as well as other pertinent stakeholders.

3.8 Revisions of Design

As the investigation advanced, the plans were modified in accordance with the technical modifications offered by the college of civil engineering. Professionals such as an architect, a master plumber, an electrical engineer, and advisors were consulted.

3.9 Finalization of Design

The design modifications and other adjustments were integrated into the study before it could be finished to allow for more effective procedures and to maximize plan effectiveness.

3.10 Project Scheduling

The project work schedule kept track of and projected the length of time required to implement and develop the suggested structure. The Program Evaluator and Review Technique and Critical Path Method were used to track the project's activities and related durations (PERT-CPM). The crucial path was also identified using this strategy and method of the planned building work in order to avoid project delays.

3.11 Cost Estimation

Estimates were established for supplies and equipment using the current market's demand, availability, and price of the necessary raw materials. It depended on the wage rate that was mandated by law in terms of labor costs. The various results were either chosen and

accepted by the persons concerned or mandated by the law. Subjectively, the parties concerned decided and concurred on the probable outcomes or the laws that enforced them. The objectives of the standards were to offer a consistent set of metrics that the employer and all other parties participating in a construction project could comprehend and to facilitate coordination of communications between the project team and other parties who may be affected. The project cost estimate for the planned project included materials, labor, equipment, and liabilities.

3.12 Resources and Facilities

For data collection, planning, analysis, and presentation, the researchers made use of the following facilities and resources:

Data recording and presentation applications

Microsoft Office applications such as Microsoft Word, Microsoft Excel, and Microsoft PowerPoint were utilized in recording the data gathered by the researchers. The applications were used for computations and encoding of graphs.

AutoDesk's AutoCAD software and CSI SAP2000

These computer-aided design software were utilized for the design and analysis of the structure as well as designing the project's architectural, structural, electrical, and plumbing designs.

Department of Civil Engineering, CPU

The research was improved by using references, internet articles, and previous project studies from the CPU Civil Engineering Department. Instruments from the said department were also used for the test conducted.

Codes and Provisions

The researchers utilized the National Structural Code of the Philippines (2015) in designing the different components of the structure. The said code was the basis for the design in order to meet the standard requirements. The National Plumbing Code of the Philippines and the Electrical Code of the Philippines were also used as a guide for designing the plumbing and electrical systems, respectively.

Project Management

According to the rules and guidelines for managing construction projects, the project schedule and budget had to coincide. To ensure this, estimation of the budget and the project schedule had to be met with significance.

Municipal Engineering Office (MEO) of Barotac Nuevo, Iloilo

The municipal engineering office was the source of pertinent data and records (such as the old municipal plans) that may be valuable for developing the mixed-use building. The proposed mixed-use building's location map, lot plan, various views of the designed structure, site development plan, and ground floor plan were used to gather background data on the project area. For information on the history of the potential location, the MEO was contacted.

Internet

The web was utilized to gather reference materials, online journals, online books, and past research papers. The data gathered was taken from legitimate sources and websites.

Data gathering and designing tools

Cameras, notebooks, and other forms of recording devices were utilized in collecting data such as numbers and pictures that were used for the designing of the project. Laptops were utilized in using the said applications above such as AutoCAD, SAP2000, and Microsoft Office.

Chapter IV

Project Area

4.1 Background and General Features of Barotac Nuevo

4.1.1 Historical background

Barotac Nuevo, a coastal municipality of the province of Iloilo, is located 31 kilometers from Iloilo City, the capital of the province. It is bordered by 4 municipalities. West: Pototan; north: Dingle; east: Anilao; and south: Dumangas. Barotac Nuevo is classified as a 2nd class municipality. 29 barangays built up Barotac Nuevo having a total population of 58,176 as of the year 2020 census.

Barotac Nuevo is Spanish term for New Barotac. The name Barotac derived from the word “baro”, which meant mud, and the last syllable of the word “lutac”. The Nuevo was added because of the already existing town, also called Barotac Viejo. Barotac Nuevo was a tiny town with agriculture and fishing as its primary industries. Spanish Roman Catholic priests built the neighborhood church in the sixteenth century.

Barotac Nuevo became the new Barotac because of a horse named “Tamasak”, a pristine white horse then with a reputation for strength according to the elders. The horse was owned by a man named Don Simon. The governor general at that time was Manuel Gonzales de Aguilar, who had offered to buy the stallion. Don Simon agreed to sell it but not in exchange of money, but for the title of the land. The barrio that was once called “Mulatac” is now known as Barotac Nuevo.

4.1.2 Climate

As seen in Figure 9, Barotac Nuevo had brief, humid, misty summers and short, warm, windy winters. The average yearly temperature was between 74 and 93 degrees Fahrenheit, seldom dropping below 72 or rising above 96. The hot season lasted (lasts) for 2 months, from

April to May, with a mean daily peak temperature of further than 92°F. The warmest period in Barotac Nuevo was May, with a mean maximum temperature of 92°F and minimum temperature of 78°F.

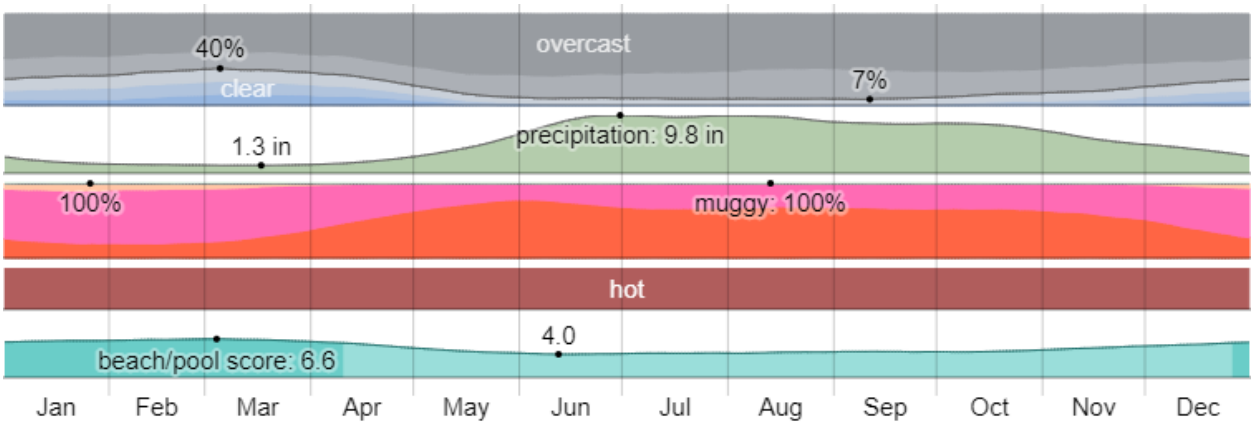


Figure 9

Climate in Barotac Nuevo

4.1.3 Land Area

Barotac Nuevo has a total land area of 10,000 hectares and twenty-nine (29) barangays and is twenty-eight (28) kilometers from the city of Iloilo. It lies at 1220 42'34" longitude and 100 49'22" latitude. The density of people in Barotac Nuevo was 620 inhabitants per square kilometer, according to the 2020 census. Department of Trade and Industry had ranked Barotac Nuevo 115th in Infrastructure, having a score of 6.0686, with high scores in Distance to ports and Availability of Basic Utilities. Figure 10 shows the Urban Land Use plan of Barotac Nuevo from the year 2017 to 2026. 73.10% of the land area of the municipality was (is) an agricultural area where 58.73% are rice fields, 41.96% are sugarcane fields, with the remaining 6.01% for other crops such as corn, bananas, vegetables, and like. 0.09% are industrial areas, 2.85% are built-up areas, 20.40% are fishpond areas, .78% are forest areas, and 1.07% are parks. Rivers, creeks, and swamps have occupied 1.68% of the area.

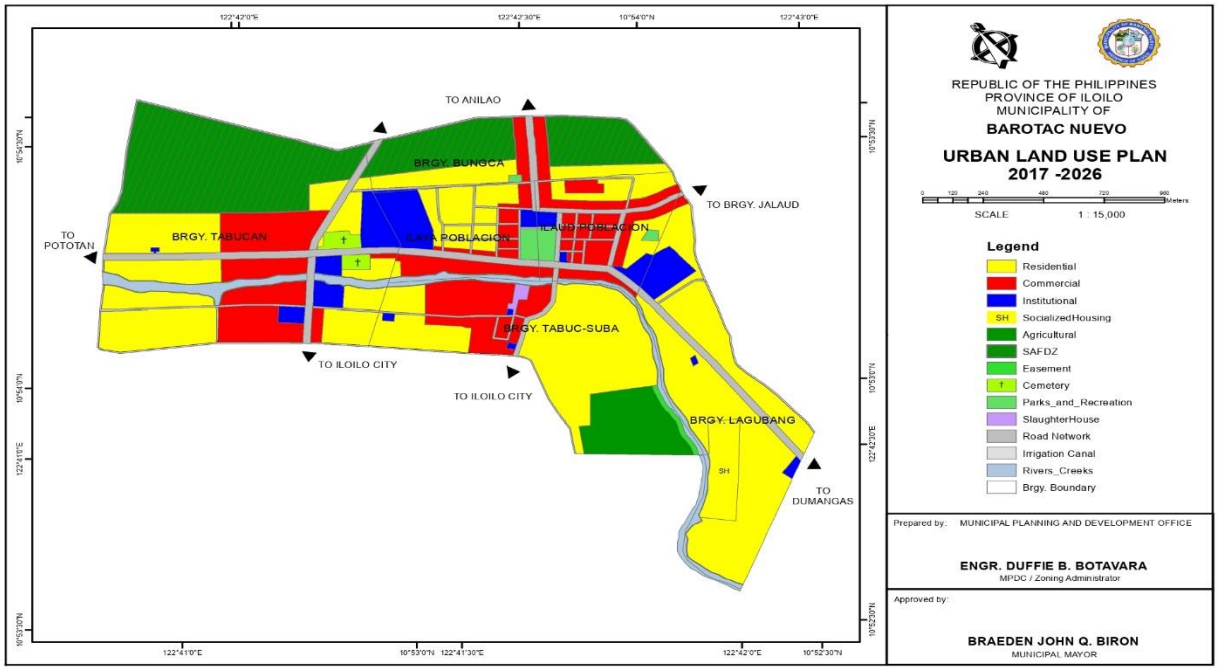


Figure 10

Urban Land Use Plan of the Municipality of Barotac Nuevo

4.1.4 Topography, Slopes, and Elevations

The majority of Barotac Nuevo consisted of plains. Mt. Salihid, its highest peak is 132 meters above sea level. The Andagao Mountain is next at 87 meters above sea level. The land lay at 122 degrees, 42 minutes longitude, and 10 degrees, 53 minutes latitude, with an elevation range of 0 to 123 meters above sea level. The main mountainous water drainage system was is the Jalaur River. This is supported by the Tinori-an River and the Jalaur River, of which water flow out to the sea. Figure 11 presents the Slope Map of Barotac Nuevo, while Figure 12 shows the Topography Map of Barotac Nuevo.

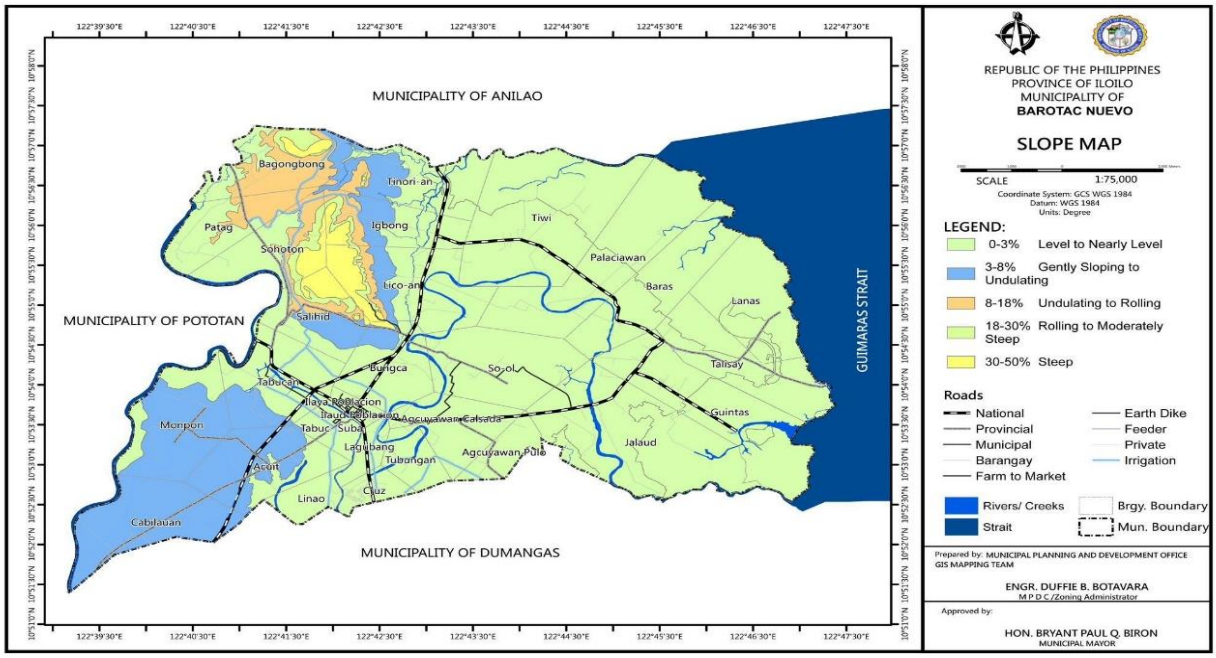


Figure 11

Slope Map of the Municipality of Barotac Nuevo

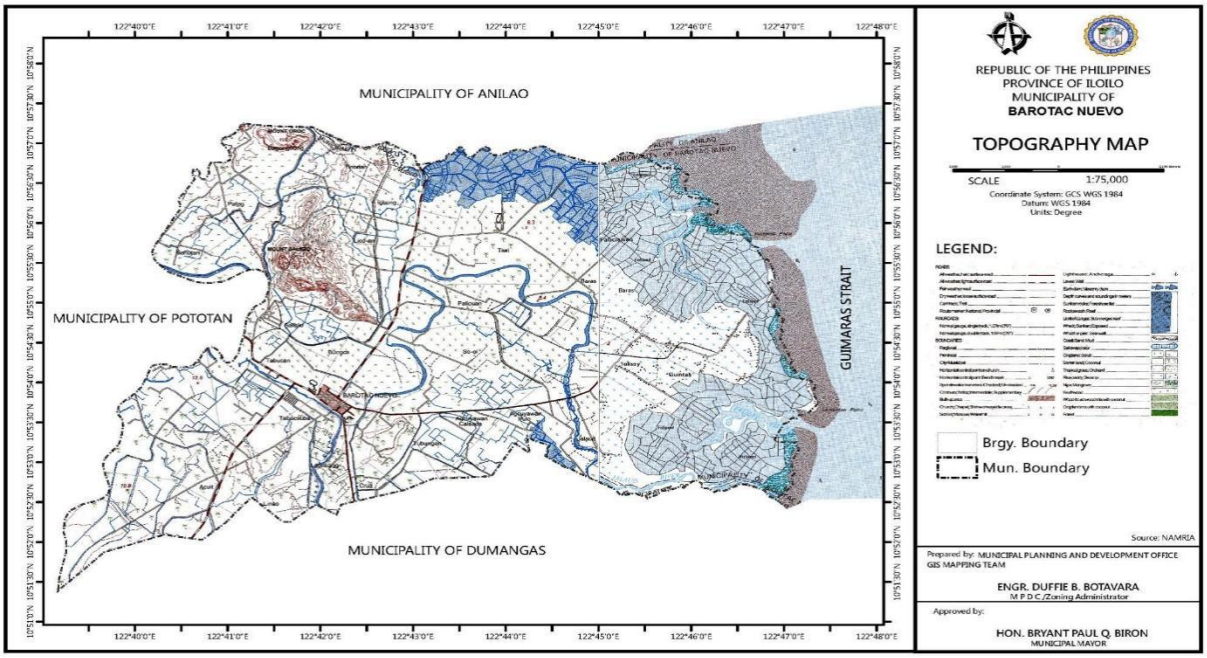


Figure 12

Topography Map of the Municipality of Barotac Nuevo

4.1.5 Geology

Barotac's soil is home to 11 types of soils based on genetic and morphological characteristics. The municipality's soil is fertile, which was suitable for farming crops. There is a predominance of loam soil in the area, which was good for planting agricultural crops. Figure 13 shows the different soils located in the town and its location as well as the road networks in the said place.

The soil series occupies the terraced to hilly areas and belonged to the loamy, moderately deep soils. These soils are residual, originating from basaltic rock. Drainage conditions are excessive externally and fair to poor internally. Surface soils range in thickness from 10 to 15 cm, were mostly brown to darker brown in color, and had a sandy loam to loam texture. The majority of subsoils are brown, ranging in color from yellow to reddish brown, and their textures range from sandy clay to loam to clay.

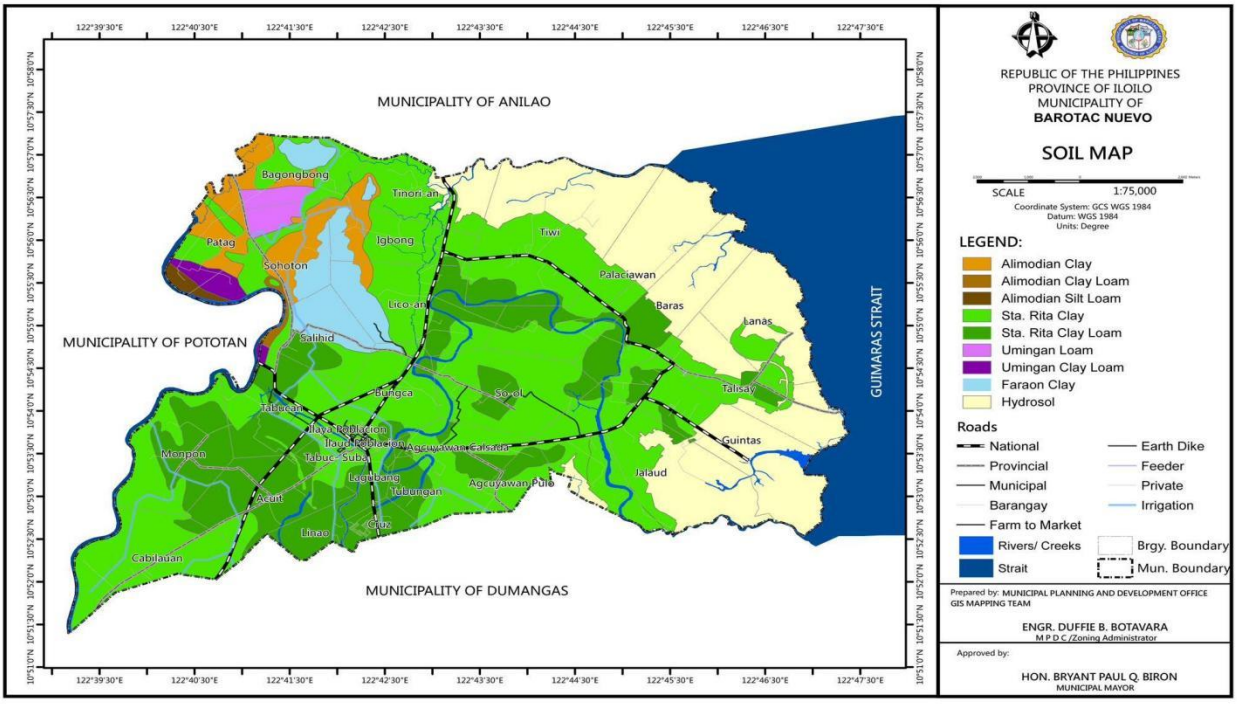


Figure 13

Soil Map of the Municipality of Barotac Nuevo

4.1.6 Fault and Earthquake Zones

According to the Philippine Institute of Volcanology and Seismology (PHILVOLCS), the Municipality of Barotac Nuevo could experience earthquakes generated along the fault lines on Panay Island. The nearest active fault is approximately 39.8 kilometers away from the municipality, as shown in Figure 14, and is known as the West Panay Fault. Recent quakes above magnitude 1 in or near Barotac Nuevo as of March 1, 2023. For the past 24 hours, quakes were felt, having a magnitude of 2 to 3. For the past 7 days, 6 quakes were felt, having a magnitude of 2 to 4. For the past 30 days, 63 quakes were felt, 51 quakes having a magnitude of 2 to 4, and 5 quakes having a magnitude of 4 to 7. For the past 90 days, 118 quakes were felt, 94 quakes having a magnitude of 2 to 4, and 5 quakes having a magnitude of 4 to 7. For the past 356 days, 530 quakes were felt, 434 quakes having a magnitude of 2 to 4, and 18 quakes having a magnitude of 4 to 7.

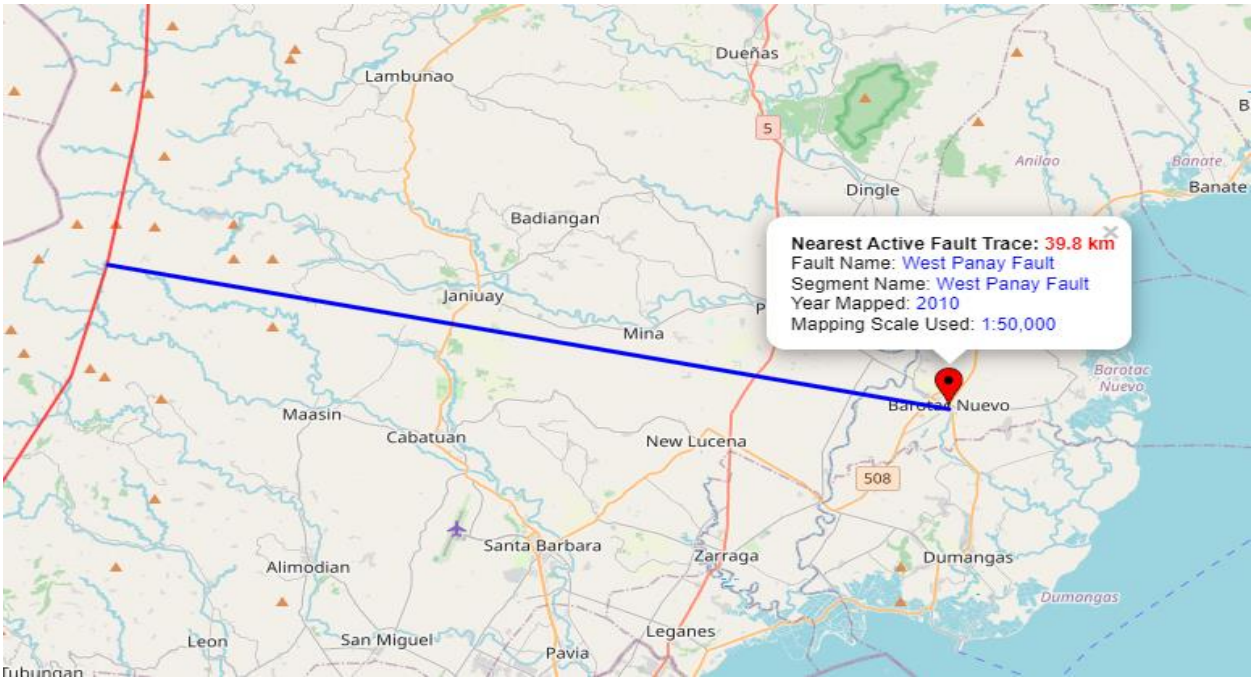


Figure 14

Nearest Active Fault from Barotac Nuevo

4.1.7 Location and Accessibility

The Barotac Center municipal building is situated on the island of Panay, approximately 10° 54' North and 122° 42' East. The elevation at the given coordinates is approximately 13.0 meters (42.7 feet) above mean sea elevation. Iloilo City, the provincial capital, was 31 kilometers from Barotac Nuevo. It had four municipalities on its borders: west: Pototan; north: Dingle; east: Anilao; and south: Dumangas.

The town is accessible via public bus and private cars. From Tagbak Terminal, buses that went to Estancia, Concepcion, Carles, Calinog, Aklan, and Barotac Viejo all passed by the town of Barotac Nuevo. Figure 15 shows the Vicinity Map of Barotac Nuevo and the location of the old municipal building, whereas in Figure 16 shows the route from Iloilo City to the center of Barotac Nuevo.

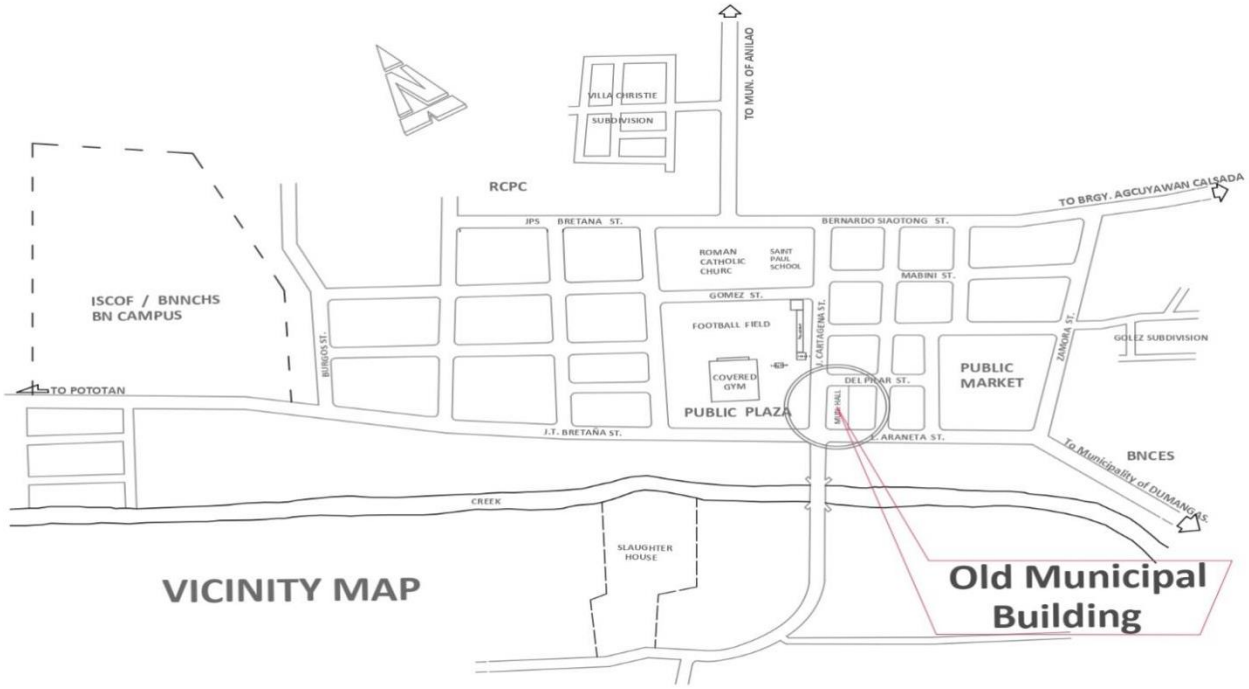


Figure 15

Vicinity Map of the Municipality of Barotac Nuevo

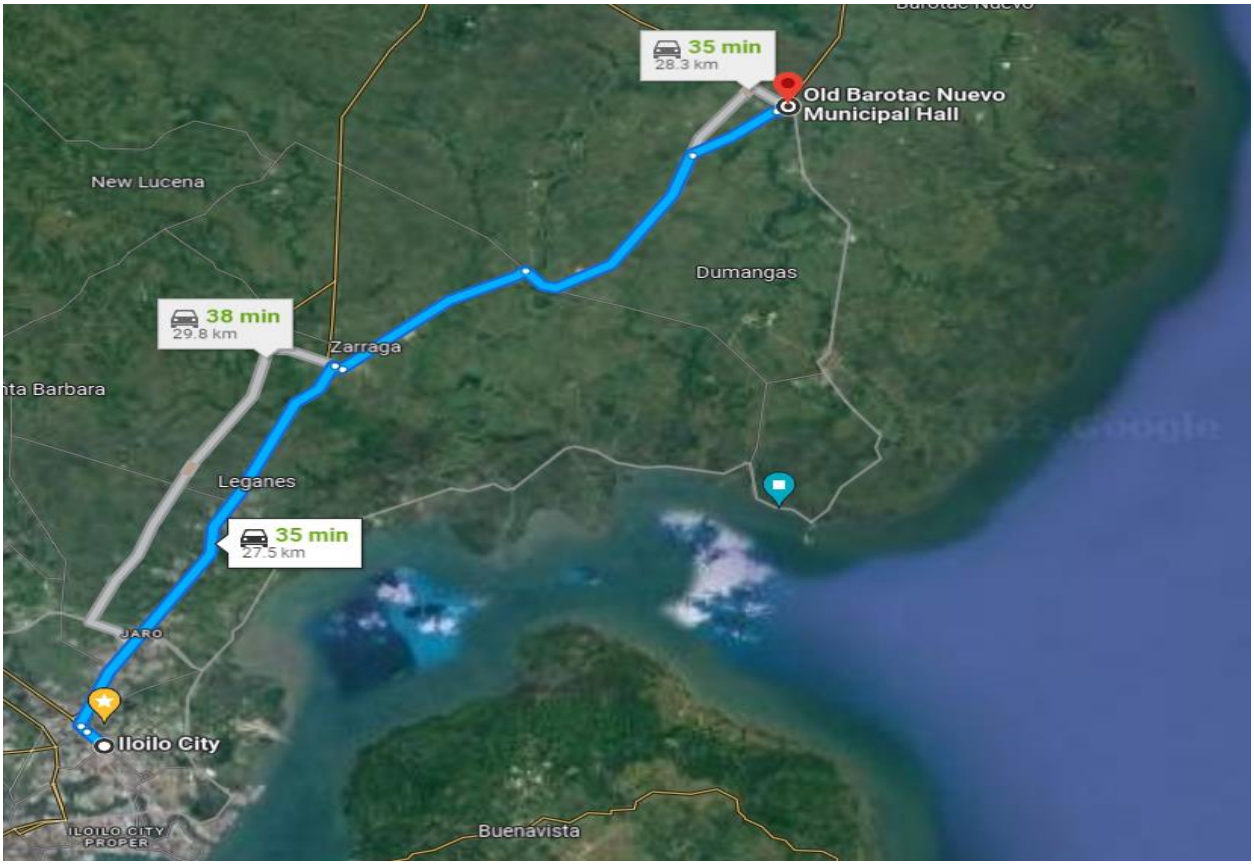


Figure 16

Routes from Iloilo City to the Municipality of Barotac Nuevo

4.2 Background and General Features of the Project Site

4.2.1 Historical background

The proposed three-storey mixed-use commercial building will be located at the corner street of the plaza in Barotac Nuevo. The old Municipal Hall exists since the year 1853. During the daytime, the plaza in Barotac Nuevo is filled with people strolling at the park and watching football games, vendors, and commuters who are going in and out of the municipality of Barotac Nuevo.

4.2.2 Location and Accessibility

The location of the proposed mixed-use building is at Cartagena St, Brgy. Ilaud Poblacion Barotac Nuevo, Iloilo. Barotac Nuevo is comprised of 29 barangays, covering 10,000 hectares of land, and is situated 28 kilometers away from Iloilo City. According to the 2020 census conducted by the Philippine Statistics Authority, the municipality is classified as a second-class municipality with a projected population of 58,176. The project site is located at the center of Barotac Nuevo near the public plaza and the public market. The proposed mixed-use building is easily accessible due to the National Highway between the old Municipal Hall and the Barotac Nuevo Plaza. The location of the project site could also be accessed via Brgy. Tabuc-Suba and Dumangas road, as shown in Figure 17.

Figure 17

Location of the Project Site

4.2.3 Geology

The soil investigation was conducted in the project site, which showed that the first or top layer, one to two feet, was rocky soil. From that point, two feet up to four feet, was a mixture of sandy and clayey soil. And for the last layer, which was from four to six feet, was made up of clayey soil. As for the location of the structure, it is located near a river, which resulted in a mixture of sand and clayey soil. The findings of the soil investigation were consistent with what was found in the data of the soil profile of Barotac Nuevo, where the general soil classification was Sta. Rita Clay. Figure 18 shows the soil profile of the project site in Barotac Nuevo with the actual images of the layers, and Figure 19 shows the actual image of the soil profile in the borehole.

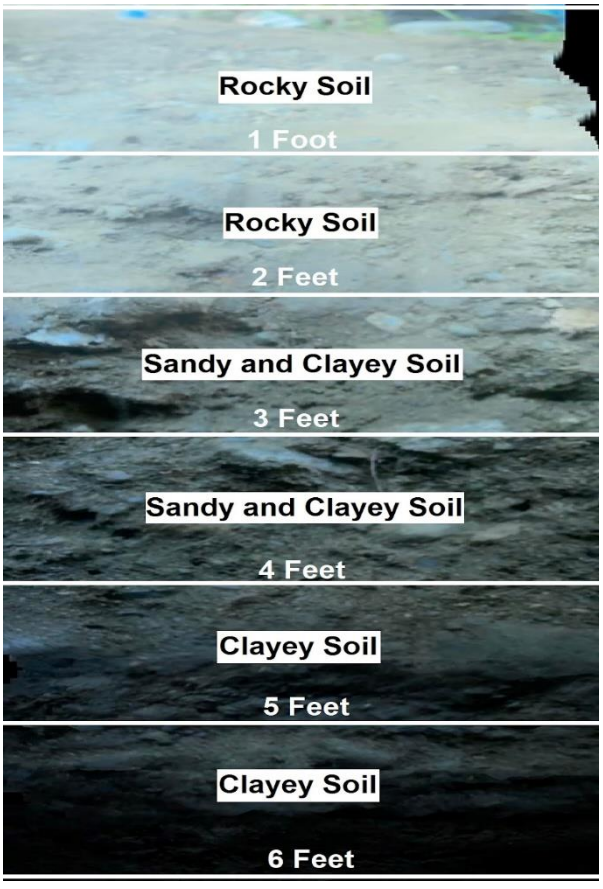


Figure 18

Diagram of Soil Profile beneath the Project Site

Figure 19

Actual image of the Soil Profile

4.2.5 Land Area

According to the lot plan of the project site, the area of the site included two government-owned lots which were Lot 87 and Lot 83, as shown in Figure 20. The area of Lot 87 is 375 square meters with 4 boundaries of Lot 83 in the north, L. Araneta Street in the south, Lot 85 in the east, and Cartagena Street in the west. The area of Lot 83 is 977 square meters with 4 boundaries of: M.H. Del Pilar in the north, Lot 87 in the south, Lot 84-A in the east, and Harrison Street in the west.

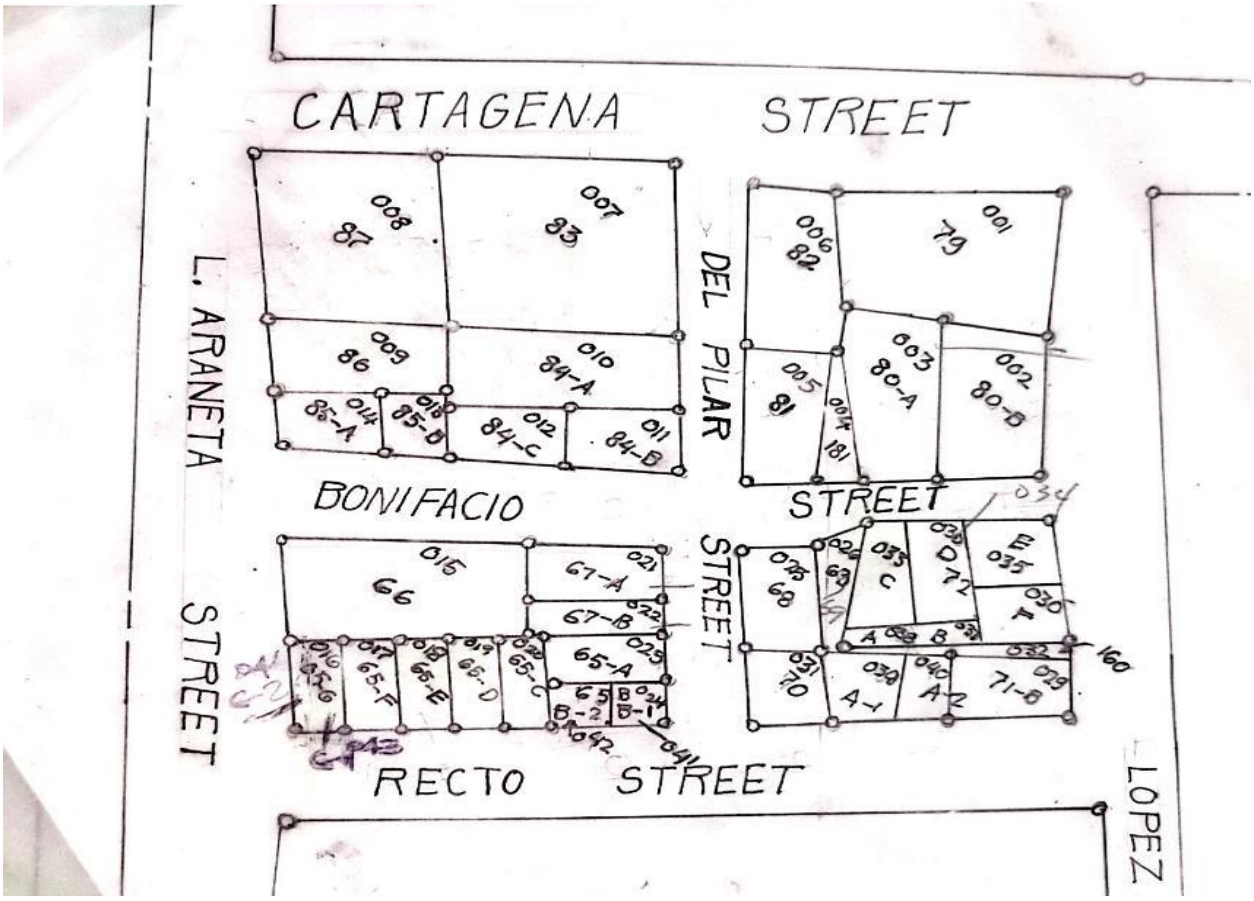


Figure 20

Property Map in the Area of the project site

Chapter V

The Proposed Project

5.1 Technical Plans

5.1.1 Architectural Design

The architectural design of the proposed three-storey mixed used building was in fulfillment with the National Building Code of the Philippines. The design included the following: floor plans, elevations, sections, material specifications, and details of doors and windows. The design was based on the required specifications set by the National Building Code of the Philippines (NBCP). The structure housed a tourism hub, commercial space, and government offices.

Located on the ground floor are 11 commercial spaces, 10 rentable spaces, lavatories, and an elevator slot that extended up to the last floor. The second floor has 4 retail shops, 4 souvenir shops, 5 rentable spaces, 2 lounge areas, an information desk, a gallery, a museum, a library, and an administrative office. The third floor is dedicated to office spaces. The architectural plan was done by a licensed architect and was checked and approved by Barotac Nuevo's Municipal architect and engineer.

5.1.2 Structural Design

All load-bearing structural members, such as concrete slabs, beams, columns, footings, tie beams, and stairs, were designed and included in the structural design of the three-storey mixed-use building. The sizes of the structural members were computed based on the minimum requirements as stated in the National Structural Code of the Philippines (NSCP) 2015.

Material Properties. The values for the material properties used in the design project are shown in Table 3.

Table 3

Material Properties Used in the Design

Description	Values
Concrete Compressive Strength, f'c	20.7 MPa
Yield Strength of Steel, fy	248 MPa
Unit Weight of Concrete	23.60 kN/m^3
Allowable Soil Bearing Capacity (q_a)	

Design Load Specifications. The values of loads, which were based on NSCP 2015, were shown in Table 4.

Table 4

Design Loads Used for the Design of Structural Members

Description	Loads
Dead Load:	
Roof dead loads	
Roof frame	0.41 kPa
Roofing Sheet	0.10 kPa
Gypsum Sheet	0.02 kPa
MEP	0.10 kPa
Total	**0.63 kPa**
2nd and 3rd floor dead loads	
Floor finish (ceramic)	1.10 kPa
Gypsum board	0.02 kPa

MEP	0.10 kPa
Mechanical Duct Allowance	0.20 kPa
Suspended Steel Channel System	0.10 kPa
Interior partition	1.00 kPa
Total	**2.52 kPa**
Live Load:	
Stores (2nd floor)	4.80 kPa
Office (3rd floor)	2.90 kPa
Total	**7.7 kPa**
Roof Live load	1.00 kPa
Total	**1.00 kPa**

Geotechnical Investigation. The laboratory conducted tests on the soil samples that were acquired from the project site. The findings of the grain size analysis, moisture content, unit weight analysis, and specific gravity tests were shown in Appendix F. The allowed soil carrying capacity taken into account for the design was determined using the soil's unit weight of 18.59 kN/m3. The overview of the soil sample's geotechnical characteristics was shown in Table 5.

Table 5

Geotechnical Properties

Description	Loads
Soil Type	S_D
Specific Gravity	2.52

Moisture Content, %	26.45
Ultimate Soil Bearing Capacity, q_u (kPa)	350.43
Allowable Soil Bearing Capacity, q_a (kPa)	116.81

Seismic Analysis. Using NSCP 2015, the values which were important for seismic analysis were determined and shown in Table 6.

Table 6

Seismic Properties

Description	Loads
Seismic Importance Factor, I	1
Numerical Coefficient, R (Special Moment Frame)	8.5
Seismic Source Type	A
Soil Profile Type	S_D
Seismic Zone Factor, Na	1
Seismic Zone Factor, Nv	1.2
Seismic Response Coefficient, Cav	0.44
Seismic Response Coefficient, Cv	0.768
Period, T	0.5431795096 s

5.1.3 Electrical Design

The Iloilo Electric Cooperatives II ILECO II will provide the primary electricity supply for the building. Proper lighting was installed on the ground, second, and third floors, along with electrical outlets for appliances, ventilation, and other purposes. All electrical installations

complied with the specifications of the Philippine Electrical Code (PEC) and any relevant municipal ordinances.

5.1.4 Mechanical Design

The mechanical design included the placement and routing of HVAC (Heating, ventilation, and Air Conditioning) in accordance with the mechanical requirements and the NBCP.

5.1.5 Plumbing Design

The plumbing layout of the proposed system was included in the design and was based on the National Plumbing Code of the Philippines. Detailed specifications were found on the plumbing plans.

5.2 Project Cost and Scheduling

The project's overall cost is Php 40,000,121.33. The labor, equipment, supplies, and other expenses required for specialized works were included. Appendix H contains the detailed breakdown of project cost estimation and material quantity. A summary of the cost estimates for the project is shown in Table 7.

Table 7

Cost Estimates for the Project

Description	Cost (PHP)
General Requirements	361,022.64
Earth works	1,307,250.00
Concrete Works	19,225,613.40
Carpentry	580,469.40

Glass and Steel Works	7,859,535.60
Tile works	2,330,955.00
Roofing works	2,250,048.13
Electrical works	732,857.96
Plumbing works	470,125.60
Painting works	413,026.60
Electronics	1,260,000.00
Mechanical	2,276,835.00
Total labor and material cost	40,000,121.33

5.3 General Construction Specifications

5.3.1 Site Preparation

Labor, materials, equipment, and other resources in the facility were provided by the management until the structure will successfully and satisfactorily be erected. Procurement of the materials and equipment had to be acquired before the construction and had to follow the work schedule to avoid delays and should be in excellent quality and condition.

5.3.2 Clearing of the Site

To prevent the project from being delayed, the entire lot inside the project area have to be removed of all obstructions and debris and collected and disposed of. Objects necessary to keep were permitted to remain.

5.3.3 Excavation

The excavation will have to follow the indicated dimensions and elevation specified in the design plan. The depth of the soilhave to meet the level where soil carrying capacity was safe. The excavation will be done with the knowledge and agreement of the engineer in charge to ensure the right procedures and depth were done. Errors in excavation have to be corrected by filling additional depth.

5.3.4 Materials

The cement have to adhere to ASTM C-150, the standard requirements for Portland cement. It is required to keep cement in bags in an appropriate weatherproof construction that was as airtight as possible. Clean, potable water have to be used for mixing. Natural sand have to be used for fine aggregate, and it had to be devoid of harmful amounts of clay, loam, and vegetation matter. Crushed stone or river gravel will be used as coarse aggregates. The size should not be smaller than 38mm or larger than 50mm. It should be clean gravel that was devoid of foreign objects.

5.3.5 Concrete and Masonry Works

Mixture class A will be used for all concrete works unless details were indicated in the drawings. It should have a concrete proportion of 1:2:4 cement, sand, and gravel respectively. The strength of concrete will be tested after curing. Mixture class A will be used for footings, columns, beams, stairs, and walls with thickness less than 10 cm. Mixture class B concrete proportion will be 1:2.5:5 cement, sand, and gravel respectively, and was used for walls with thickness more than 10 cm. Mixture class C concrete proportion will be 1:3:6 cement, sand, and gravel respectively, and will be used for concrete fillers. For plaster works, cement mortar mix will be used. Plastering includes coating walls, ceilings, partitions, beams, and columns.

5.3.6 Forms

Forms have to be strong enough to bear the stress and vibration caused by the placing and positioning of concrete, and they had to be kept firmly in the right position. In order to preserve the concrete from deterioration, forms could only be removed when the concrete has reached its optimum capacity.

5.3.7 Curing

The curing phase has to start as soon as the surface-free water evaporated. The concrete mixture has to be fully covered with straws, jute sacks, or other suitable material for at least seven days after the concrete was placed.

5.3.8 Finishing

All exposed concrete walls have to be finished and smoothed with the specified materials on the design. The mixture for cement plaster, which was used for finishing, has to be a mixture of cement and fine sand.

5.3.9 Steel Works

Steel materials utilized for the proposed project must meet or exceed the standard specifications for steel reinforcements. Steel bars used for the proposed project should be circular so that the concrete could further strengthen the compactness of the connections through the bond of steel and concrete in the said project.

5.3.10 Plumbing Works

The Philippine National Plumbing Code and Philippine Code of Sanitation will be followed during the installation of plumbing works. All the materials will be inspected for quality and defects before installation. The piping system will be placed under the walls and was not projected more than necessary. The materials must be of high quality to avoid clogging and

contamination. The septic tank has to be located at a distance from the water supply to avoid leakage.

5.3.11 Electrical Works

The Philippine Electrical Code will strictly be followed during the electrical installation. The installation will be arranged neatly according to the plan. The defective or damaged materials will be replaced with high-quality materials.

5.3.12 Painting Works

To ensure that the surface is free from dust and other particles, the paint will be attached to the surface. The primer or undercoat will be applied to the surface and continued with a top coating. The remaining unused paint will be stored in the storage room to avoid pollution and the risk of fire. The specifications and plans will be followed during the operation. The engineer should be present for concerns that were not addressed in the plan.

5.3.13 Green Building Technology

The proposed project also has green building technology features which can mitigate costs and reduce the consumption of electricity while increasing natural ventilation and lighting inside the structure.

Daylighting is a way in which the structure is illuminated through natural light and will also cut the total cost of energy usage. As per the design, the structure is composed of windows and glass on the outside to help distribute the light throughout the structure. In addition, energy-saving bulbs such as LEDs were utilized because of their efficiency. Low-cost and consumes only about 10 watts unlike other bulbs which consume 13 to 15 watts.

Passive ventilation, also known as natural ventilation, which can be incorporated in the daylighting, can be as simple as opening a window or openings of the structure to allow external air to ventilate the structure and reduce heat inside the structure. This can be achieved passively through the design of the structure which is mostly made of glass and openings. Air conditioning and other fixtures are (were) also incorporated which may take up to 4000 watts of electricity.

Another special feature that is (was) incorporated into the structure to help withstand the changing environment and help mitigate the total cost of the structure is the installation of solar panels. Solar panels are a source of renewable energy that can enhance the efficiency of usage of energy, protect the roof and lessen the cost of power supply. Solar panels were also utilized which can produce 250 up to 400 wattages with 3 feet x 6.5 feet of size. Also, according to research, the average energy usage of commercial buildings ranged up to 22.5 kWh. A square meter or 3 x 6.5 feet of solar panel can produce 250 watts of energy in ideal conditions and can produce 120 kW/day.

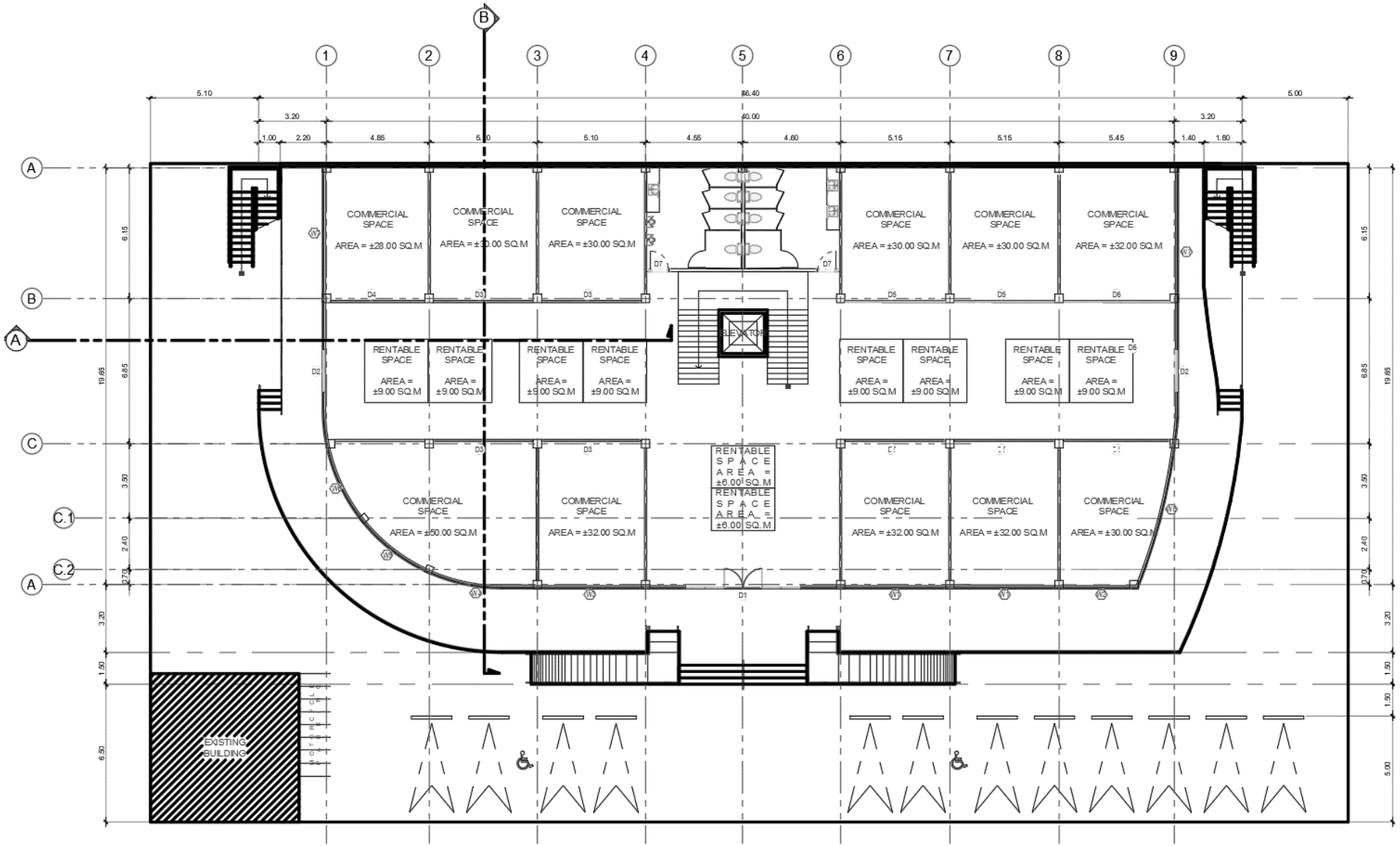
$$15kW\,(8hours) = 120\ kWp$$

The rainwater harvesting system installed in the proposed project is very economical and can help minimize the cost of the usage of water used in sanitation, comfort rooms, etc. The amount to be collected per day which will be used for the flushing, sanitation, etc., can be computed with the following formula:

$$\frac{Rainwater\ collected}{1day} = (\frac{Ave.monthly\ precipitation(mm)}{Ave.rainfall\ days})(\frac{1L}{m^2})(Roof\ Area)$$

ARCHITECTURAL PLAN

P E R S P E C T I V E



GROUND FLOOR PLAN

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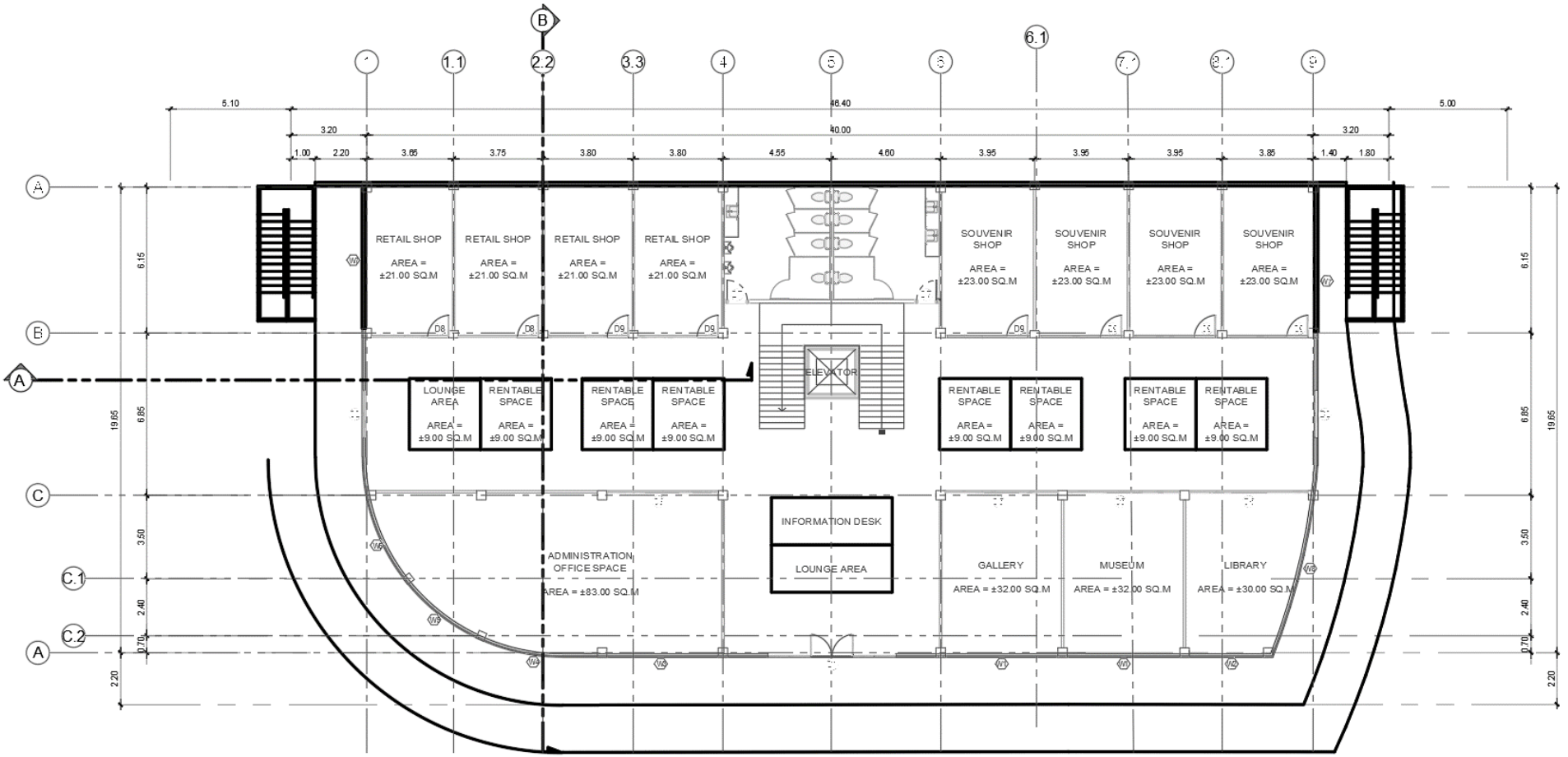

SECOND FLOOR PLAN
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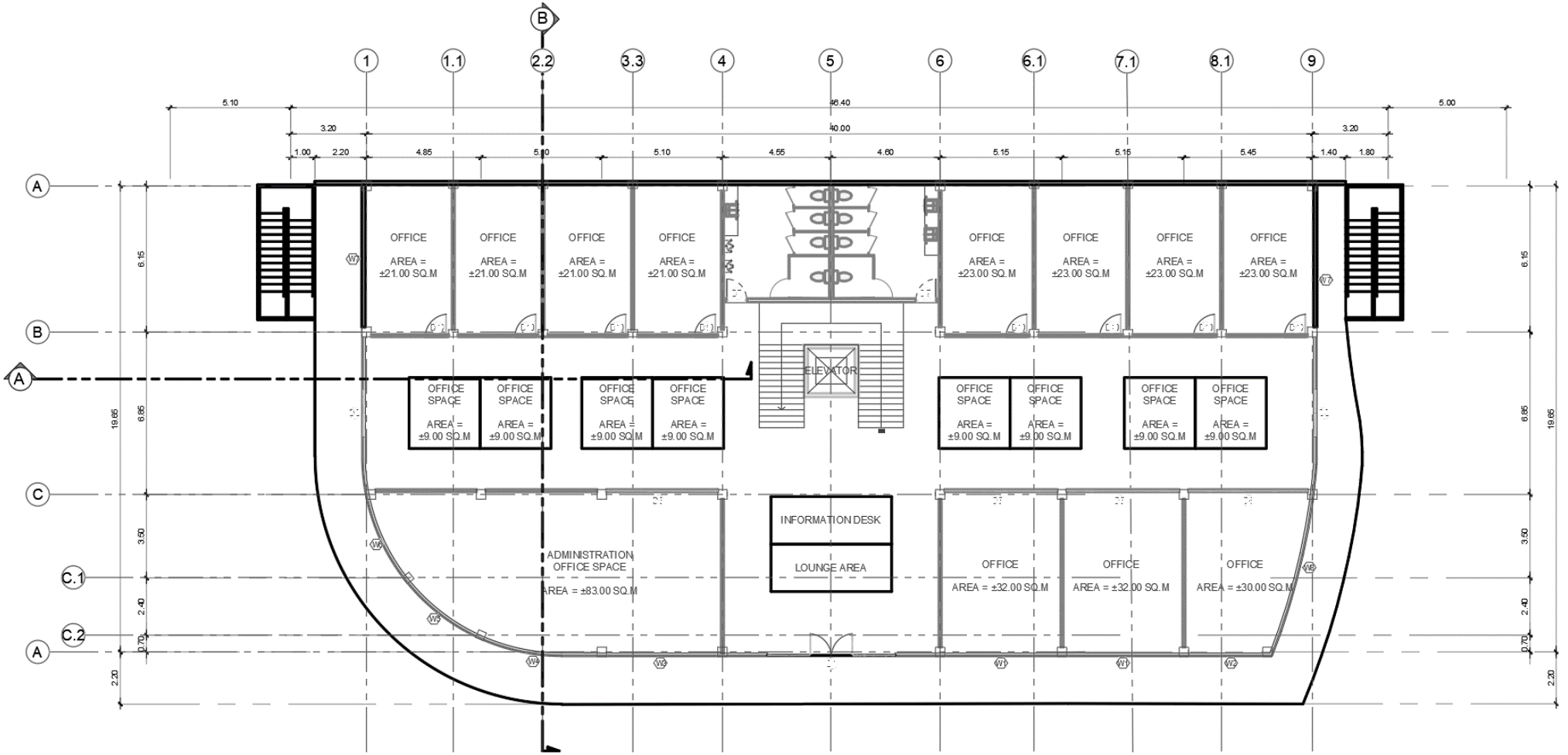

THIRD FLOOR PLAN

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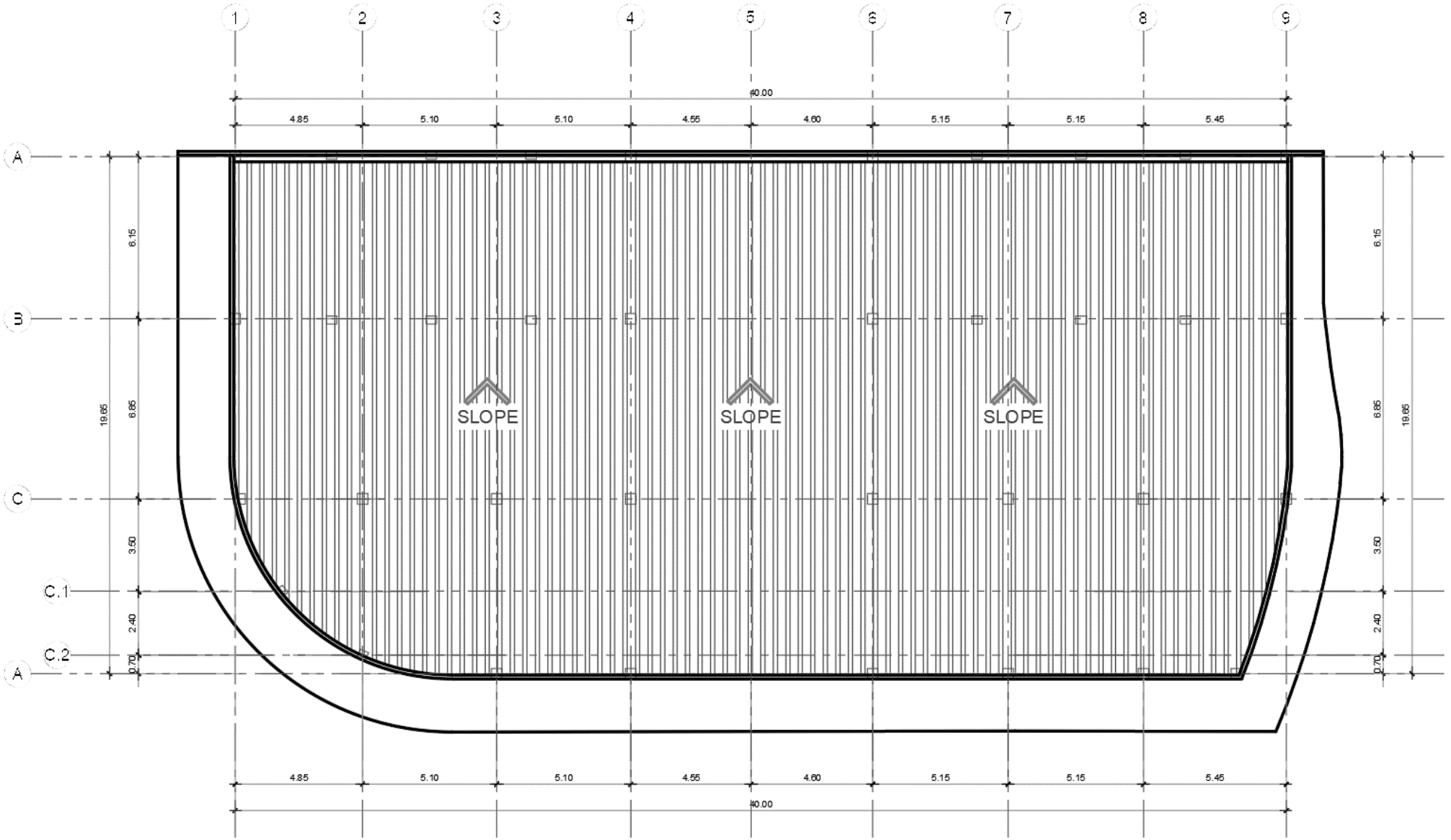

R O O F P L A N

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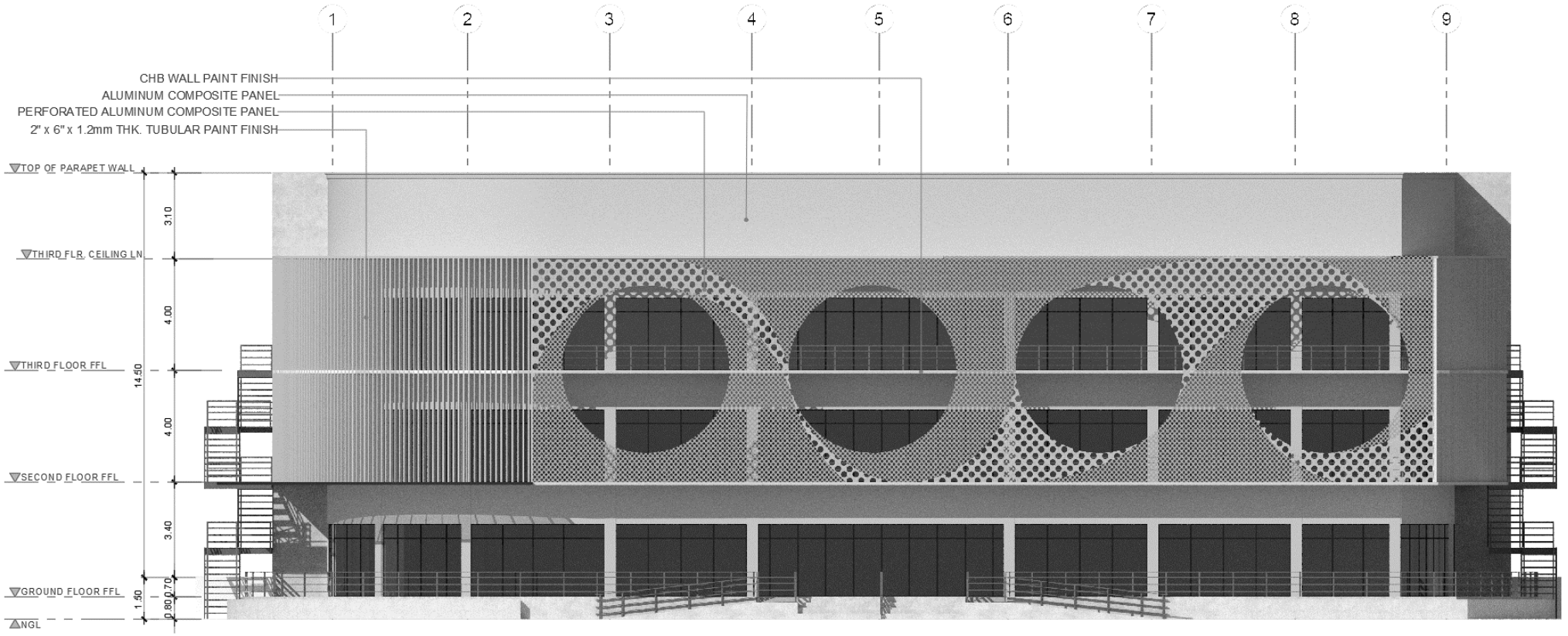

FRONT ELEVATION

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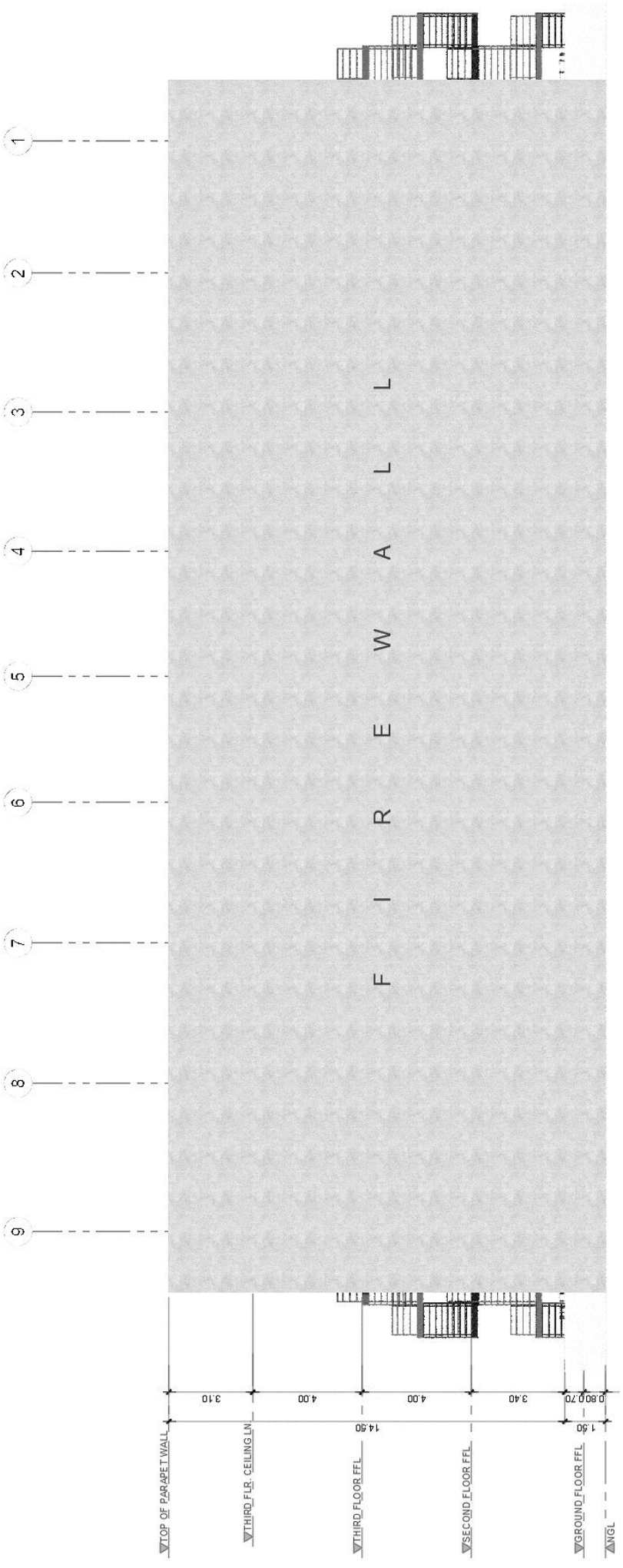
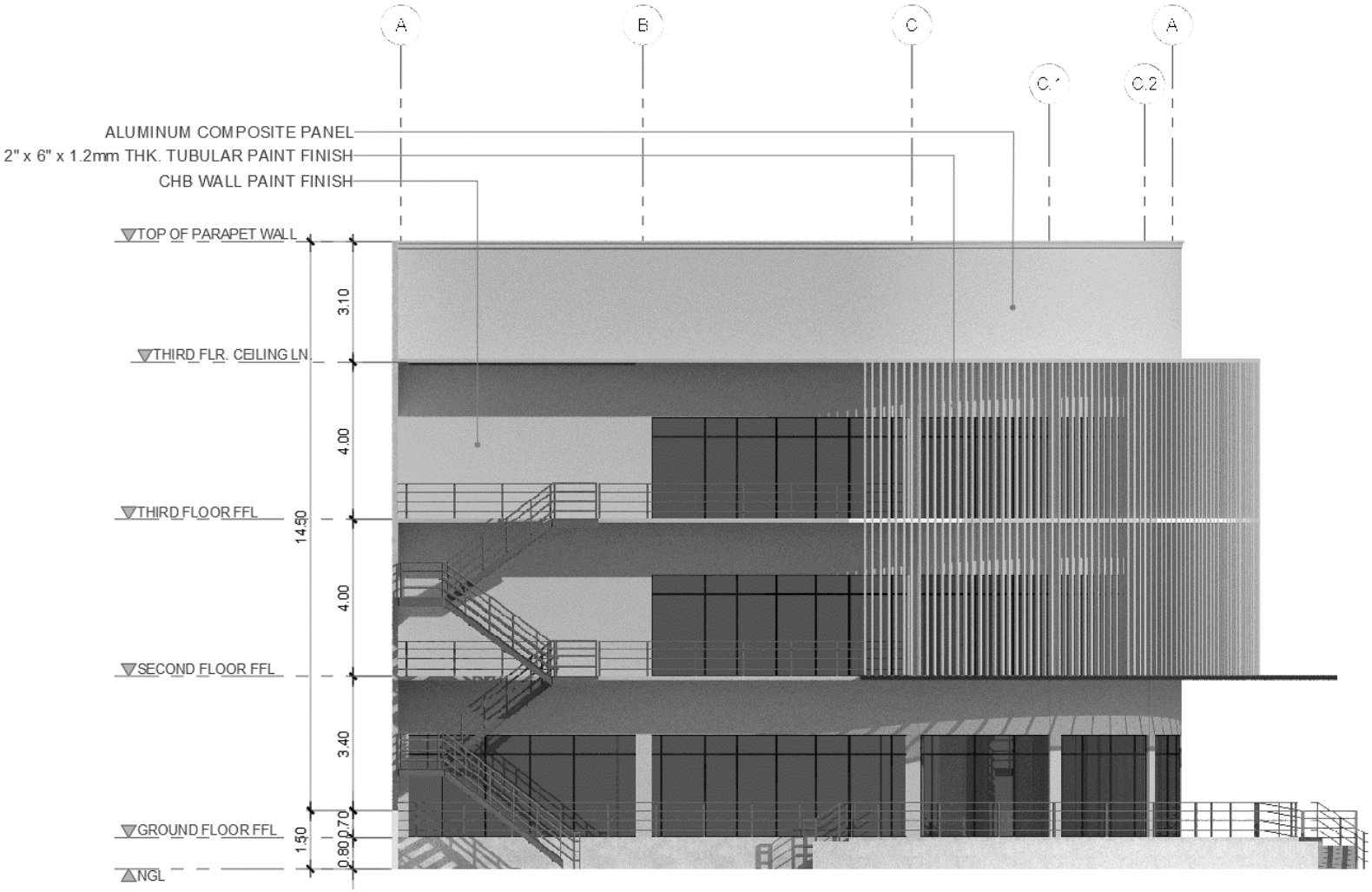
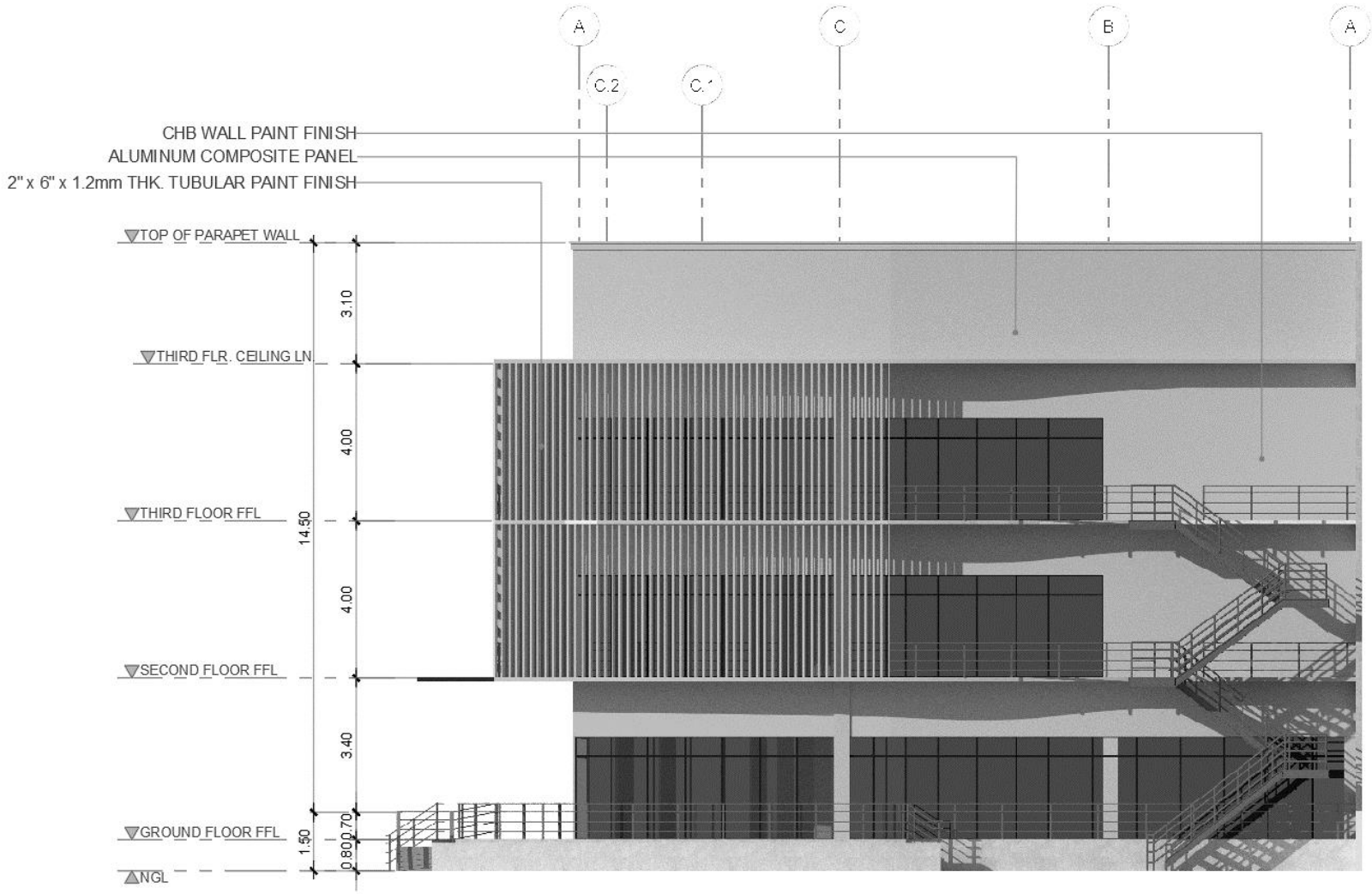


REAR ELEVATION
SCALE 1:1000



LEFT SIDE ELEVATION

SCALE 1:1000



RIGHT SIDE ELEVATION

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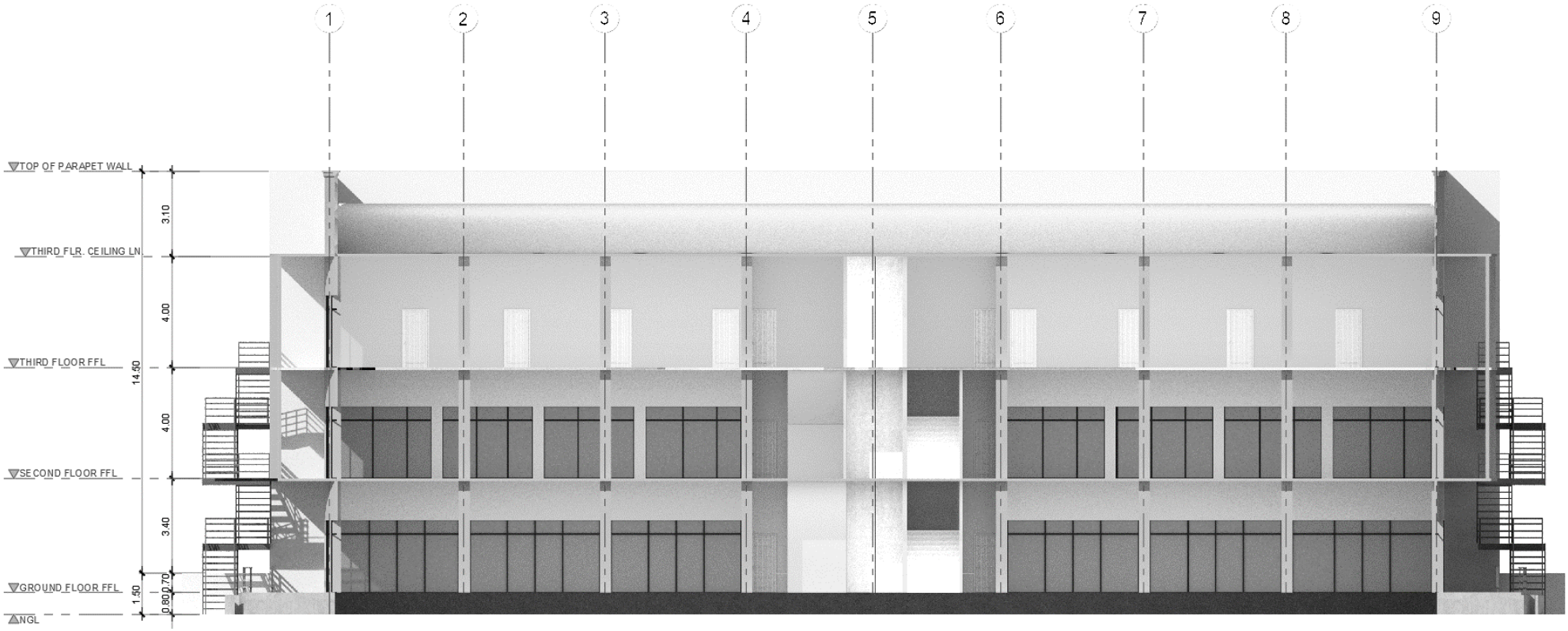

SECTION THRU A

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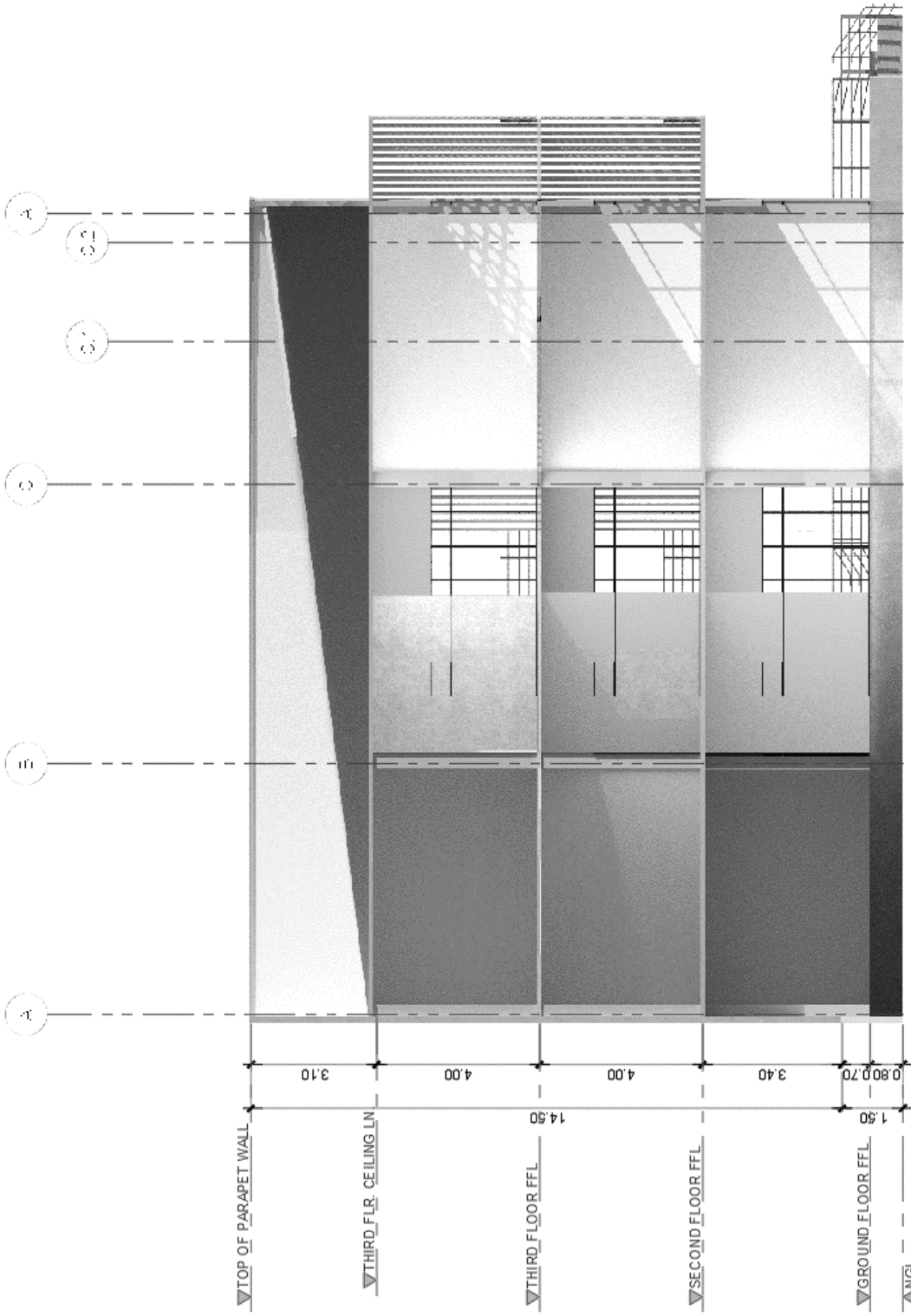
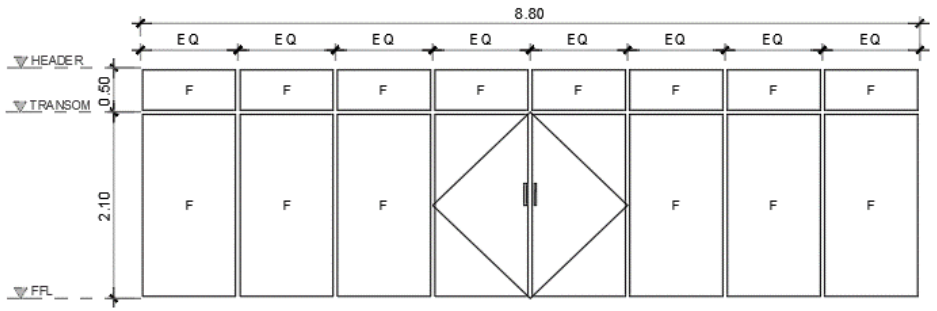


SECTION THRU B

SCALE 1:1000

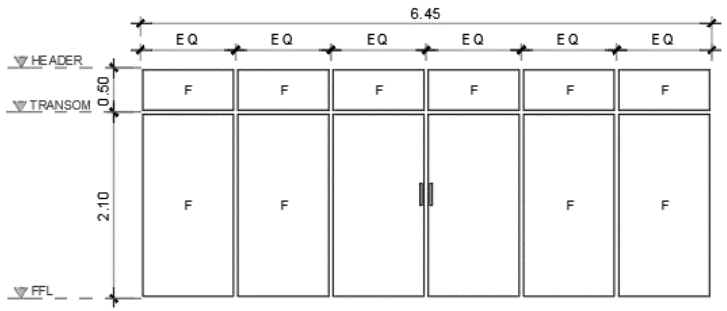
SCHEDULE OF DOORS AND WINDOWS

SCHEDULE OF DOOR



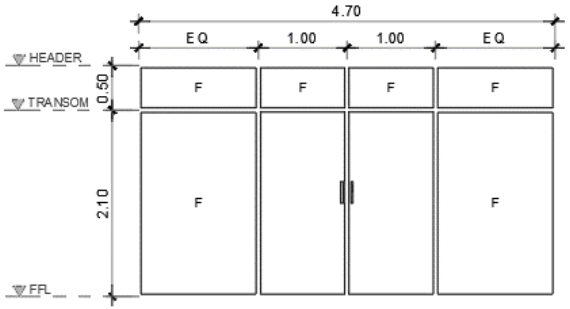
¼" THK. CLEAR GLASS ON ANALOK FRAME

D1 | UNIT/S : 3
LOCATION : AS SHOWN



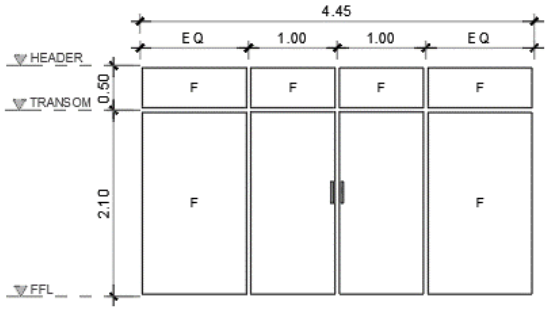
¼" THK. CLEAR GLASS ON ANALOK FRAME

D2 | UNIT/S : 6
LOCATION : AS SHOWN



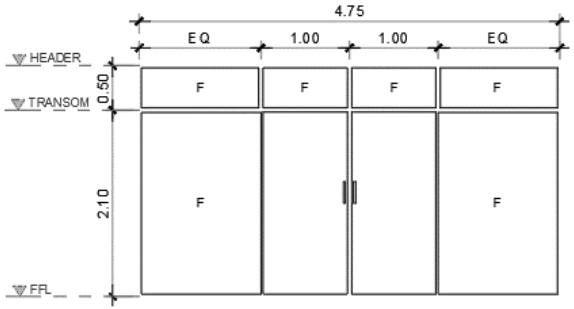
¼" THK. CLEAR GLASS ON ANALOK FRAME

D3 | UNIT/S : 4
LOCATION : AS SHOWN



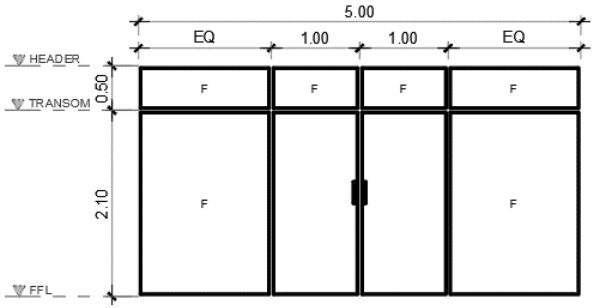
¼" THK. CLEAR GLASS ON ANALOK FRAME

D4 | UNIT/S : 1
LOCATION : AS SHOWN

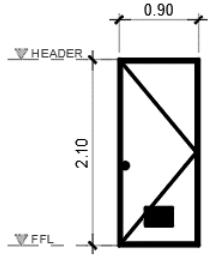


¼" THK. CLEAR GLASS ON ANALOK FRAME

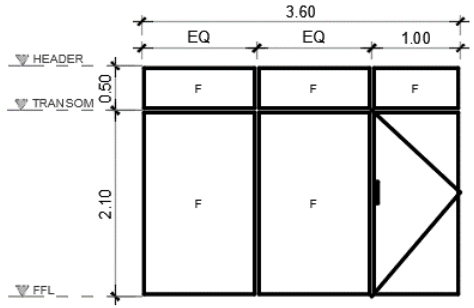
D5 | UNIT/S : 8
LOCATION : AS SHOWN



¼" THK. CLEAR GLASS ON ANALOK FRAME	D6	UNIT/S : 4 LOCATION : AS SHOWN



PVC DOOR W LOUVER	D7	UNIT/S : 6 LOCATION: AS SHOWN



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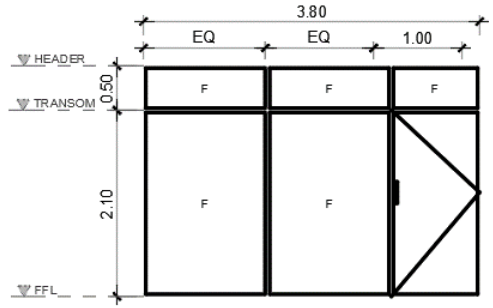
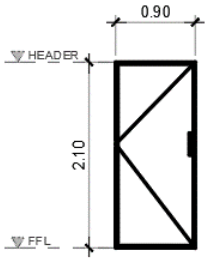
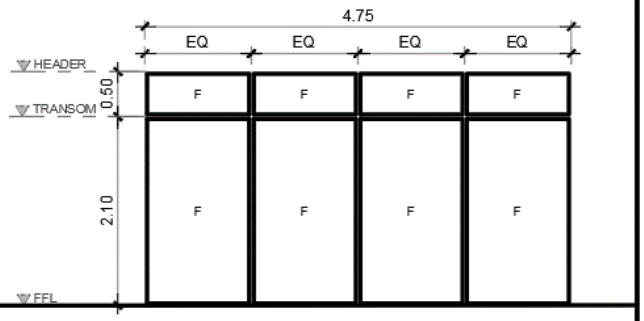


¼" THK. CLEAR GLASS SLIDING WINDOW ON ANALOK FRAME	D9	UNIT/S : 6 LOCATION : AS SHOWN



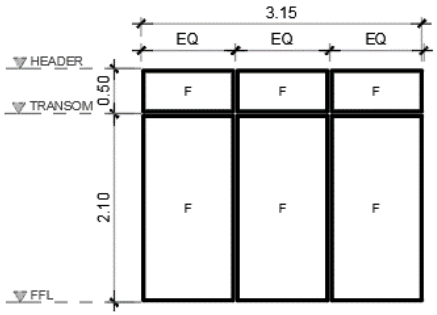
¼" THK. CLEAR GLASS ON ANALOK FRAME	D10	UNIT/S : 8 LOCATION : AS SHOWN

SCHEDULE OF WINDOW



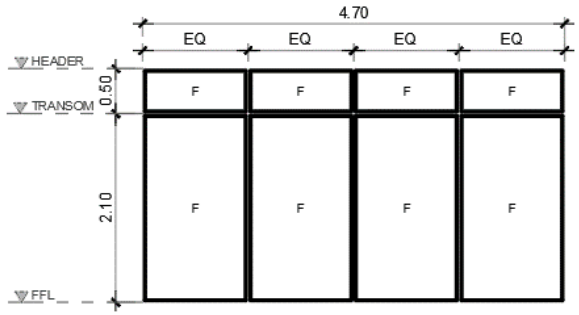
1/4" THK. CLEAR GLASS ON ANALOK FRAME

W1 UNIT/S : 6
LOCATION : AS SHOWN



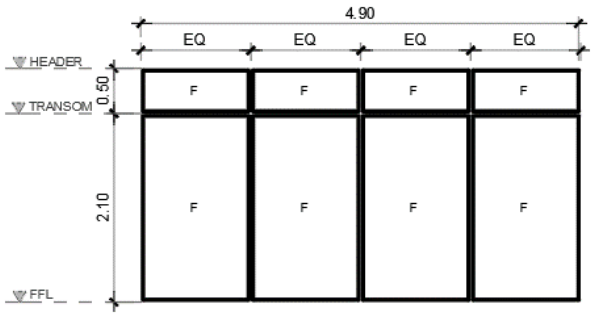
1/4" THK. CLEAR GLASS ON ANALOK FRAME

W2 UNIT/S : 3
LOCATION : AS SHOWN



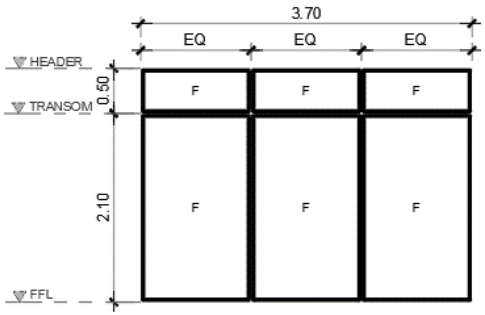
1/4" THK. CLEAR GLASS ON ANALOK FRAME

W3 UNIT/S : 3
LOCATION : AS SHOWN



1/4" THK. CLEAR GLASS ON ANALOK FRAME

W4 UNIT/S : 3
LOCATION : AS SHOWN



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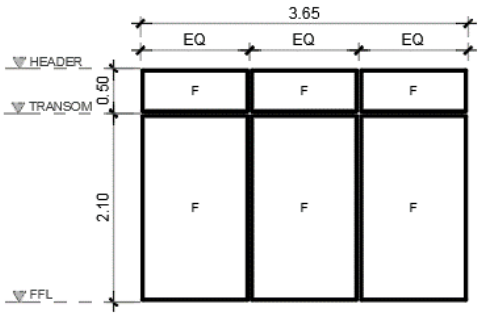
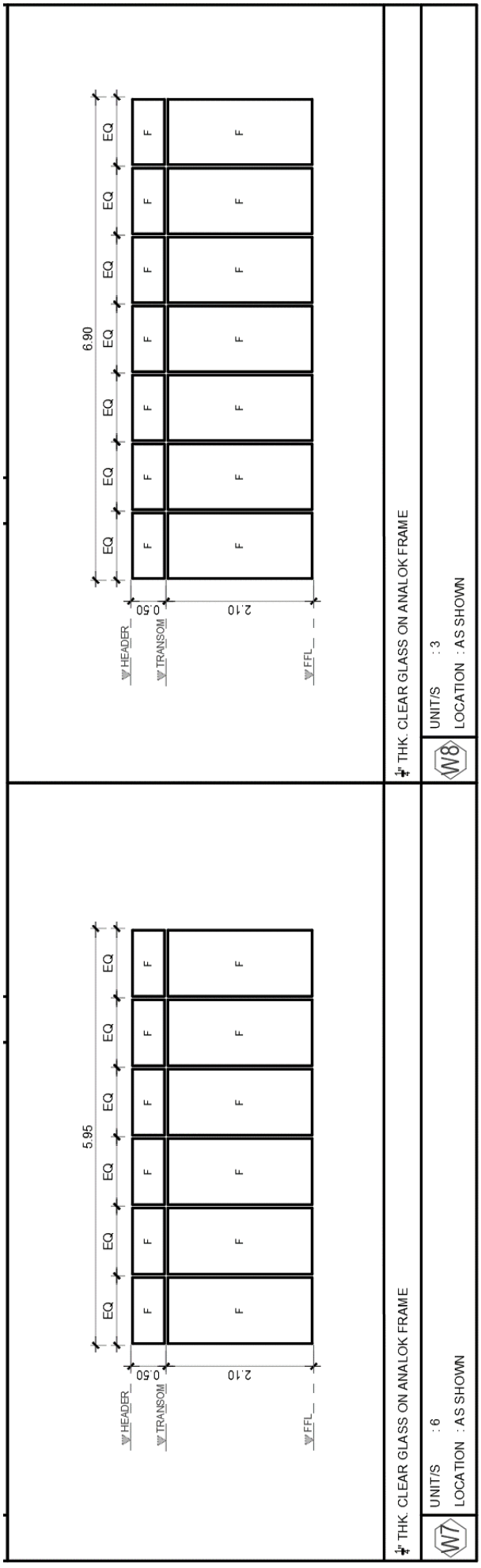
W5 UNIT/S : 3
LOCATION : AS SHOWN



1/4" THK. CLEAR GLASS ON ANALOK FRAME

W6 UNIT/S : 3
LOCATION : AS SHOWN


6.90
EQ
F
0.50
2.10
HEADER
TRANSOM
FFL
1/4" THK. CLEAR GLASS ON ANALOK FRAME
W8
UNIT/S : 3
LOCATION : AS SHOWN
5.95
EQ
F
0.50
2.10
HEADER
TRANSOM
FFL
1/4" THK. CLEAR GLASS ON ANALOK FRAME
W7
UNIT/S : 6
LOCATION : AS SHOWN

STRUCTURAL PLAN

CONSTRUCTION NOTES

A. GENERAL NOTES

1. CONSTRUCTION NOTES AND TYPICAL DETAILS APPLY TO ALL DRAWINGS UNLESS OTHERWISE SHOWN OR NOTED MODIFY TYPICAL DETAILS AS DIRECTED TO MEET SPECIAL CONDITIONS.
2. THE CONTRACTOR SHALL EXAMINE THE DRAWINGS AND SHALL NOTIFY THE ENGINEER/ARCHITECT OF ANY DISCREPANCIES HE MAY FIND BEFORE PROCEEDING WITH THE WORK, OR DURING CONSTRUCTION.
3. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE ADEQUATE SHORING & BRACINGS OF THE STRUCTURE FOR ALL LOADS THAT MAY BE IMPOSED DURING CONSTRUCTION.
4. SHOP DRAWINGS WITH ERECTION AND PLACING DIAGRAMS OF ALL STRUCTURAL STEELS, MISCELLANEOUS IRON, PRE-CAST CONCRETE ETC. SHALL BE SUBMITTED FOR ENGINEERS APPROVAL BEFORE FABRICATION.
5. CONTRACTOR SHALL VERIFY ALL DIMENSIONS BEFORE ALL WORK IS TO BEGIN CHECK WITH MECHANICAL AND ELECTRICAL CONTRACTORS FOR CONDUITS PIPE SLEEVES, ETC., TO BE EMBEDDED IN CONCRETE.
6. INSPECTION - ALL CONSTRUCTION AND WORKMANSHIP SHALL BE SUBJECT TO INSPECTION, EXAMINATION AND TESTING BY THE ENGINEER. THE ENGINEER SHALL HAVE THE RIGHT REJECT DEFECTIVE MATERIALS AND WORKMANSHIP OR REQUIRE ITS CORRECTION.
7. ALL SLABS, BEAMS, GIRDERS AND OTHER STRUCTURAL ELEMENTS WHICH ARE NOT INDICATED, DETAILED, DESIGNATED OR INADVERTENTLY OMITTED BUT ARE NECESSARY TO BE COORDINATED WITH THE ARCHITECTURAL AND OTHER ENGINEERING PLANS AS WELL AS TO COMPLETE THE STRUCTURAL WORK IN ACCORDANCE WITH THE INTENT OF THE PLANS AND SPECIFICATIONS SHALL BE BROUGHT UP DURING PRE-BIDS/MEETINGS/NEGOTIATIONS. IT IS UNDERSTOOD THAT THE CONTRACTOR HAS PROVIDED AND INCLUDED ALL THESE ITEMS IN THEIR BID.

B. FOUNDATION NOTES

1. SAFE BEARING CAPACITY IS 90 kPa (Assumed).
   a. PILE CAPACITY 1.10 TONS.
   b. BOTTOM OF FOOTINGS SHOULD BE SOLID GROUND. ACTUAL DEPTH TO BE APPROVED BY THE ENGINEER.
   c. SOIL BEARING CAPACITY SHALL BE INCREASED BY 33% WHEN COMBINATION WITH SEISMIC OR WIND LOAD.
2. ALL COLUMN FOOTINGS SHALL REST ON 0.10m THICK WELL COMPACTED GRAVEL BASE COURSE.
3. BACKFILL SHALL BE PACED IN 0.20m LAYERS AND EACH LAYER SHALL BE COMPACTED TO 95%MAXIMUM DRY DENSITY.
4. WHERE LOOSE/SOFT MATERIAL IS ENCOUNTERED AT DEPTH OF EMBEDMENT EXCAVAVATE TO FIRM LAYER OR TO MAXIMUM OF 0.10m AND REPLACE LOOSE/SOFT MATERIALS UNDERNEATH THE FOOTING WITHIN THE FOOTING AREA PLUS 1/2 OF THE DEPTH OF EXCAVATED SOFT MATERIAL ON ALL SIDES WITH SELECTED SAND/GRAVEL BACKFILL MATERIALS COMPACTED AS DESIRED BY THE ENGINEER.
5. THE STRUCTURAL ENGINEER-OF-RECORD, UPON NOTIFICATION, SHALL CONDUCT THOROUGH INSPECTION OF FOUNDATION WORKS AFTER EXCAVATION BEFORE FOOTINGS ARE COMPLETED. NO REINFORCING STEEL OR FORMWORKS SHALL BE PLACED PRIOR TO INSPECTION. CONCRETE POURING OF THE FOUNDATION SYSTEM SHALL NOT BE ALLOWED WITHOUT FIRST OBTAINING WRITTEN APPROVAL FROM THE STRUCTURAL ENGINEER-OF-RECORD.

C. SLAB-ON-GRADE NOTES

1. THE SOIL, SUBGRADE AND FILL LAYERS BELOW ALL SLABS-ON-GRADE, PAVING AND RT SLABS SHALL BE MECHANICALLY COMPACTED IN 200MM THICK LAYERS TO A MINIMUM OF 95 PERCENT MDD.
2. ALL SLAB-ON-GRADE SHALL BE PROVIDED WITH A MINIMUM OF 100MM THICK COMPACTED CLEAN COARSE GRAVEL BED, EXCEPT AS OTHERWISE DETAILED IN THE PLANS.
3. ALL SLAB-ON-GRADE ARE NOT DESIGNED AS PRESSURE SLAB UNLESS OTHERWISE INDICATED ON PLAN.
4. SLAB-ON-GRADE SHALL BE 100MM THICK WITH 10MM DIA. BARS SPACED AT 0.60M O.C.

D. CONCRETE NOTES

ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE MINIMUM REQUIREMENTS OF THE NATIONAL STRUCTURAL CODE OF THE PHILIPPINES (NSCP) 2010 OR THE AMERICAN CONCRETE INSTITUTE BUILDING CODE FOR REINFORCED CONCRETE ACI 318 - EXCEPT AS MODIFIED HEREIN.

1. CONSTRUCTION OR COLD JOINTS SHALL BE LOCATED WITHIN THE MIDDLE THIRD OF SPANS OF SLABS, BEAMS, AND GIRDERS FOR CASE UNAVOIDABLE, PROPOSED LOCATION MUST BE APPROVED FIRST BY THE STRUCTURAL ENGINEER.
2. PIPES OR DUCTS EXCEEDING ONE THIRD THE SLAB OR WALL THICKNESS SHALL NOT BE PLACED IN STRUCTURAL CONCRETE UNLESS SPECIFICALLY DETAILED.
3. REINFORCING BARS, ANCHOR BOLTS, AND OTHER INSERTS SHALL BE SECURED IN PLACE BEFORE POURING CONCRETE. BAR PLACEMENT AND SUPPORTS SHALL BE IN ACCORDANCE WITH THE RECOMMENDED ACI PRACTICE.
4. ALL INSERTS, ANCHOR BOLTS, ETC TO BE EMBEDDED IN THE CONCRETE SHALL BE HOT DIP GALVANIZED UNLESS NOTED OTHERWISE.
5. IN GENERAL, THE LATEST EDITION OF THE MANUAL OF STANDARD PRACTICE FOR DETAILING CONCRETE STRUCTURES, ACI 315, SHALL BE ADHERED TO, UNLESS SHOWN OTHERWISE.
6. USE OF ADMIXTURES IS PERMITTED TO PRODUCE PROPER SLUMP AND WORKABILITY BUT SUBJECT TO THE ENGINEERS APPROVAL. ADDITION OF WATER TO CONCRETE AT JOB SITE IS NOT ALLOWED.
7. PREPARE AND SUBMIT CONCRETE MIX DESIGN INCLUDING AGGREGATES GRADATION, WATER AND CEMENT CONTENTS, AND CYLINDER STRENGTH TEST RESULT FOR REVIEW.

SCHEDULE OF STRUCTURAL CONCRETE AT 28 DAYS COMPRESSIVE STRENGTH

LOCATION	STRUCTURAL ELEMENTS	28-DAY COMPRESSIVE STRENGTH MPa (psi)	MAX. SLUMP mm (in.)
FOUNDATION	FOOTING	24.1 (3500)	100 (4")
GROUND LEVEL	SLAB ON GRADE	24.1 (3500)	100 (4")
ALL LEVELS	SLAB	24.1 (3500)	100 (4")
ALL LEVELS	BEAMS	24.1 (3500)	100 (4")
ALL LEVELS	COLUMNS	24.1 (3500)	100 (4")

SCHEDULE OF CONCRETE AGGREGATES

ITEMS	MAXIMUM AGGREGATE SIZE
FOOTINGS	19 mm (3/4")
SLABS	13 mm (1/2")
WALLS	19 mm (3/4")
BEAMS	19 mm (3/4")
COLUMNS	19 mm (3/4")

E. REINFORCING STEEL NOTES

ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE MINIMUM REQUIREMENTS OF THE NATIONAL STRUCTURAL CODE OF THE PHILIPPINES (NSCP) 2010 OR THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION FOR REINFORCING STEEL AND REINFORCING BARS EXCEPT AS MODIFIED HEREIN.

SCHEDULE OF REINFORCING STEEL AND REINFORCING BARS

DIAMETER OF BARS	ASTM	GRADE
WELDED WIRE MESH	----	Fy = 228 MPa (33)
12MM AND SMALLER	A615 / A615M (DEFORMED)	Fy = 276 MPa (40)
16MM AND LARGER	A615 / A615M (DEFORMED)	Fy = 414 MPa (60)

1. BARS SHALL BE CLEAN OF RUST, GREASE OR OTHER MATERIALS LIKELY TO IMPAIR BOND. ALL REINFORCING BAR BEND SHALL BE MADE COLD.
2. IN GENERAL, BAR SPLICES SHALL BE MADE AT POINTS OF MINIMUM STRESS. SPLICES SHALL BE SECURELY WIRED TOGETHER STAGGER SPLICES AT LEAST 600mm. WHENEVER POSSIBLE IN BEAMS AND SLABS, SPLICE TOP BAR AT MID SPAN AND BOTTOM BARS NEAR SUPPORT. SPLICE OF REINFORCEMENT SHALL BE MADE ONLY AS REQUIRED OR PERMITTED ON DESIGN DRAWINGS OR AS ALLOWED BY THE ACI CODE OR AS AUTHORIZED BY THE ENGINEERS.
3. BARS NOTED AS CONTINUOUS SHALL HAVE A MINIMUM SPLICE LENGTH OF 40 BAR DIAMETER BUT NOT LESS THAN 300mm UNLESS OTHERWISE NOTED.
4. REINFORCEMENT SHALL BE SPLICED ONLY AS INDICATED IN THE DRAWINGS.
5. MINIMUM CONCRETE COVER FOR REINFORCING BARS SHALL BE:

F. MASONRY WORKS

1. ALL NON-LOAD BEARING TYPE CONCRETE BLOCKS SHALL HAVE A UNIT WEIGHT NOT TO EXCEED 80 PCF. FOR LOAD BEARING TYPE, TYPE CONCRETE BLOCKS, A MINIMUM COMPRESSIVE STRENGTH OF 6.90 MPA SHALL BE DEVELOPED.
2. PROVIDE 1-#16 VERTICAL BARS AT CORNERS, INTERSECTIONS, END OF WALLS AND EACH SIDE OF OPENINGS.
3. L INTEL BEAMS SHALL BEAR AT LEAST 8 INCHES (200 MM) ON EACH SIDE OF MASONRY WALL OPENING.
4. WALL REINFORCEMENTS SHALL BE AS FOLLOWS.

WALL THICKNESS	VERTICAL REINFORCEMENT	HORIZONTAL REINFORCEMENT
8 IN. (200 MM)	#12 @ 600 MM	# 10 @ 600 MM
6 IN. (150 MM)	#12 @ 600 MM	# 10 @ 600 MM
4 IN. (100 MM)	#10 @ 600 MM	# 10 @ 600 MM

5. REINFORCING BARS SHALL BE LAPPED A MINIMUM OF 40 BAR DIAMETERS WHERE SPLICE DOWELS FROM FOOTING OR SLABS SHALL EXTEND INTO THE BLOCK WALL A MINIMUM OF 40 BAR DIAMETERS, AND DOWELS TO MATCH.
6. ALL CELLS CONTAINING REINFORCING BARS OR INSERTS SHALL BE SOLIDLY FILLED WITH CONCRETE GROUT (REFER TO SPECIFICATIONS).

ITEMS	COVER
CONCRETE CAST AGAINST EARTH	75mm
EXPOSED TO EXTERIOR OR WEATHER	50mm
FORMED SURFACE BELOW GRADE	50mm
SLAB ON GRADE	50mm
COLUMNS/SHEARWALLS AND BEAMS	40mm
STRUCTURAL SLABS TOP AND BOTTOM (INTERIOR)	25mm
R.C. WALLS	20mm

6. WELDING OF REINFORCING STEEL IS NOT PERMITTED UNLESS MATERIAL TEST RESULT PROVES THAT THE BAR IS WELDABLE.
7. SHOP DRAWINGS: THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR REINFORCING STEEL PREPARED IN ACCORDANCE WITH ACI 315. INDICATE BENDING DIAGRAM, ASSEMBLY DIAGRAM, SPLICING AND LAPS OF RODS AND SHAPES DIMENSIONS AND DETAILS FOR REINFORCING BARS.
8. ANCHOR BOLTS, DOWELS, AND OTHER EMBEDDED ITEMS ARE TO BE SECURELY TIED IN PLACE BEFORE CONCRETE IS POURED.

SCHEDULE OF DEVELOPMENT LENGTH

BAR SIZE (GR. 60)	DEVELOPMENT LENGTH (Ld)						
	f'c = 21 MPa (3000 psi)	f'c = 28 MPa (4000 psi)	f'c = 34 MPa (5000 psi)	f'c = 42 MPa (6000 psi)	f'c = 48 MPa (7000 psi)	f'c = 55 MPa (8000 psi)	f'c = 69 MPa (10000 psi)
10mm (#3)	450	400	350	325	300	275	250
12mm (#4)	525	475	425	375	350	325	300
16mm (#5)	700	625	550	500	475	425	400
20mm (#6)	875	775	675	625	575	550	475
22mm (#7)	975	850	750	675	625	600	525
25mm (#8)	1350	1175	1050	950	900	825	750
28mm (#9)	1500	1300	1175	1075	1000	925	825
32mm (#10)	1725	1500	1350	1225	1125	1050	950
36mm (#11)	1950	1675	1500	1375	1275	1200	1075

SCHEDULE OF LAP SPLICE

BAR SIZE (GR. 60)	LAP SPLICE (Ld)						
	f'c = 21 MPa (3000 psi)	f'c = 28 MPa (4000 psi)	f'c = 34 MPa (5000 psi)	f'c = 42 MPa (6000 psi)	f'c = 48 MPa (7000 psi)	f'c = 55 MPa (8000 psi)	f'c = 69 MPa (10000 psi)
10mm (#3)	600	525	475	425	400	375	325
12mm (#4)	700	625	575	500	475	425	400
16mm (#5)	925	825	725	650	625	575	525
20mm (#6)	1150	1025	900	825	750	725	625
22mm (#7)	1275	1125	975	900	825	800	700
25mm (#8)	1775	1550	1375	1250	1175	1075	975
28mm (#9)	1950	1700	1550	1450	1350	1225	1075
32mm (#10)	2250	1950	1775	1650	1475	1375	1250
36mm (#11)	2550	2200	2000	1850	1675	1575	1400

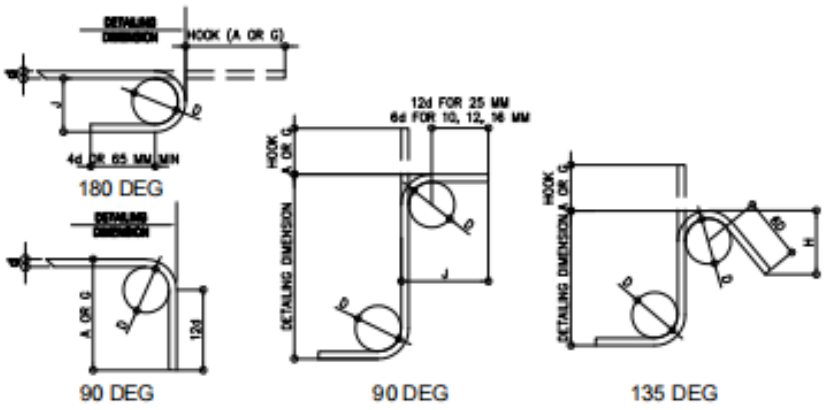
SCHEDULE OF DEVELOPMENT LENGTH OF STANDARD HOOKS

BAR SIZE (GR. 60)	DEVELOPMENT LENGTH OF STANDARD HOOKS (Ldh)						
	f'c = 21 MPa (3000 psi)	f'c = 28 MPa (4000 psi)	f'c = 34 MPa (5000 psi)	f'c = 42 MPa (6000 psi)	f'c = 48 MPa (7000 psi)	f'c = 55 MPa (8000 psi)	f'c = 69 MPa (10000 psi)
10mm (#3)	220	190	170	155	150	150	150
12mm (#4)	265	230	205	190	175	165	150
16mm (#5)	350	305	275	250	230	215	195
20mm (#6)	440	380	340	310	290	270	240
22mm (#7)	485	420	375	340	315	295	265
25mm (#8)	550	475	425	390	360	335	300
28mm (#9)	615	530	475	435	405	375	340
32mm (#10)	700	610	545	495	460	430	385
36mm (#11)	790	685	610	560	515	485	435

BAR SIZE (GR. 40)	DEVELOPMENT LENGTH OF STANDARD HOOKS (Ldh)						
	f'c = 21 MPa (3000 psi)	f'c = 28 MPa (4000 psi)	f'c = 34 MPa (5000 psi)	f'c = 42 MPa (6000 psi)	f'c = 48 MPa (7000 psi)	f'c = 55 MPa (8000 psi)	f'c = 69 MPa (10000 psi)
10mm (#3)	150	150	150	150	150	150	150
12mm (#4)	175	155	150	150	150	150	150

STANDARD HOOKS, ALL GRADES

BAR SIZE (GR. 60)	FINISHED BEND DIAMETER, D (MM)	STANDARD HOOKS	
		90°	180°
		X (MM)	Y (MM)
10mmØ (#3)	60	180	100
12mmØ (#4)	72	216	120
16mmØ (#5)	96	288	160
20mmØ (#6)	120	360	200
22mmØ (#7)	132	396	220
25mmØ (#8)	150	450	250
28mmØ (#9)	224	560	336
32mmØ (#10)	256	640	384
36mmØ (#11)	288	720	432



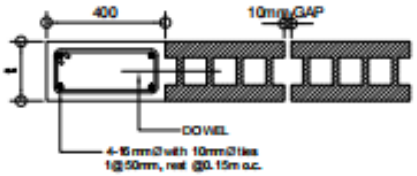
STANDARD HOOKS STIRRUPS AND TIE-HOOKS

CONCRETE HOLLOWBLOCKS REINFORCEMENT			
THICKNESS	REINFORCEMENT		NOTES
	HORIZONTAL	VERTICAL	
0.07m	10Ø @ 0.60m O.C.	10Ø @ 0.60m O.C.	A. MIN. LAP SPLICE = 0.25M
0.10m	10Ø @ 0.60m O.C.	10Ø @ 0.60m O.C.	B. PROVIDE RIGHT ANGLE REINFORCEMENT AT CORNER 0.90M LONG.
0.15m	10Ø @ 0.60m O.C.	10Ø @ 0.60m O.C.	C. WHERE CHB WALLS ADJOINING COLUMN, R.C. BEAM, WALL DOWEL W/ SAME SIZE AS VERTICAL OR HORIZONTAL REINFORCEMENT SHALL BE PROVIDED.
0.20m	10Ø @ 0.60m O.C.	10Ø @ 0.60m O.C.	

CHB STIFFENER DETAILS

NOTE:
PROVIDE VERTICAL STIFFENERS EVERY 3.00mm O.C. MAXIMUM
PROVIDE HORIZONTAL STIFFENERS EVERY 3.00mm O.C. MAXIMUM

VERTICAL STIFFENER

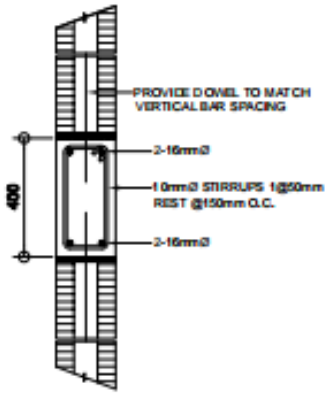


CONCRETE WALLS:

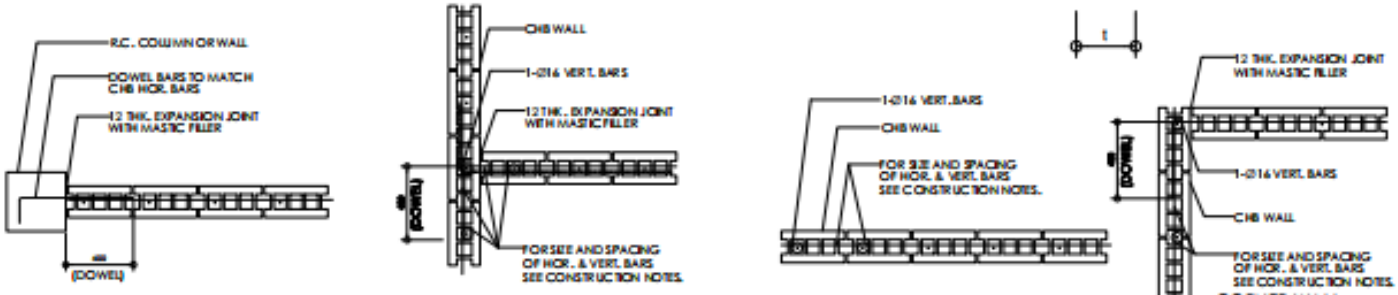
UNLESS OTHERWISED INDICATED IN THE PLANS, WALL REINFORCEMENT SHALL BE FOLLOWED ACCORDING TO THE FOLLOWING SCHEDULE

WALL THK.	REINFORCEMENT		REMARKS	VERTICAL SECTION
	HORIZONTAL	VERTICAL		
0.10m	10Ø @ 0.30m O.C.	10Ø @ 0.30m O.C.	HOR. & CORNER VERT. BARS STAGGERED OUTSIDE	
0.125m	10Ø @ 0.30m O.C.	10Ø @ 0.30m O.C.	-DO-	
0.15m	12Ø @ 0.30m O.C.	12Ø @ 0.30m O.C.	BOTH FACES HOR. SHALL BE INSIDE	
0.175m	12Ø @ 0.25m O.C.	12Ø @ 0.25m O.C.	-DO-	
0.20m	12Ø @ 0.20m O.C.	12Ø @ 0.30m E.F.	BOTH FACES HOR. SHALL BE OUTSIDE	
0.225m	12Ø @ 0.20m O.C.	12Ø @ 0.30m O.C. E.F.	-DO-	
0.25m	12Ø @ 0.25m O.C. E.F.	12Ø @ 0.30m O.C. E.F.	-DO-	
0.275m	12Ø @ 0.25m O.C. E.F.	12Ø @ 0.30m O.C. E.F.	-DO-	
0.30m	12Ø @ 0.25m O.C. E.F.	12Ø @ 0.30m O.C. E.F.	-DO-	
0.35m	12Ø @ 0.25m O.C. E.F.	12Ø @ 0.30m O.C. E.F.	-DO-	
0.40m	12Ø @ 0.25m O.C. E.F.	12Ø @ 0.30m O.C. E.F.	-DO-	

HORIZONTAL STIFFENER



TYPICAL CONNECTION DETAIL OF MASONRY WALL



INTERSECTING R.C. COL. OR WALL

INTERSECTION WALL

OPENING OR END WALL

CORNER WALL

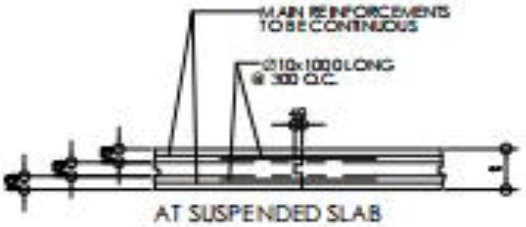
G. STRUCTURAL STEEL NOTES

1. STEEL TO BE USED FOR FABRICATION AND ERECTION OF THIS STRUCTURE SHALL COMPLY WITH ALL THE PERTINENT PROVISIONS OF AISC SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS 1989 - 9TH EDITION.

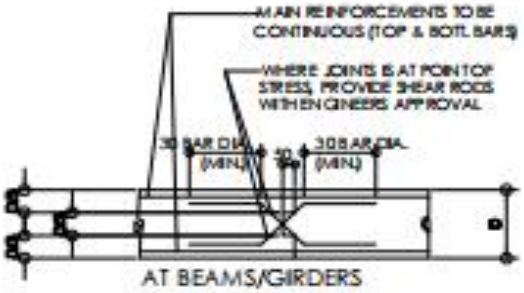
STRUCTURAL STEEL MEMBERS	ASTM A-36, GR 36 OR A992 Fy = 248 MPa (36 ksi)
LC PURLIN	Fy = 248 MPa (36 ksi)
STEEL PLATES	Fy = 248 MPa (36 ksi)

2. ALL BOLTS, NUTS AND WASHERS SHALL CONFORM TO A325 UNLESS OTHERWISE INDICATED. ANCHOR BOLTS SHALL LIKEWISE BE OF EQUAL STRENGTH AS A325 BOLTS OF THE SAME.
3. ALL WELDS SHALL BE IN ACCORDANCE WITH AWS STRUCTURAL WELD CODE D1-1 LATEST REVISION FOR SHIELDING METAL ARC WELDING PROCESS, ELECTRODES E-70 SHALL CONFORM TO AWS A5-1 OR LATEST EDITION. SUBMERGED ARC WELDING PROCESS MAY BE USED AT THE OPTION OF FABRICATOR UPON THE APPROVAL OF ENGINEER.
4. ALL WELDED CONNECTIONS MUST DEVELOP THE FULL STRENGTH OF THE MEMBERS.
5. FABRICATION AND WELDING SHALL BE GOVERNED BY APPLICABLE PROVISIONS OF THE LATEST AISC OR AWS STANDARDS.
6. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO CHECK ACTUAL FIELD CONDITIONS PRIOR TO PREPARATION OF FABRICATION (SHOP) DRAWINGS.
7. THE CONTRACTOR SHALL PREPARE FABRICATION (SHOP) DRAWINGS OF ALL STRUCTURAL STEEL MEMBERS BASED ON THE DESIGNS FOR APPROVAL OF THE ENGINEER PRIOR TO FABRICATION.
8. ALL DOUBLE-ANGLE STRUCTURAL MEMBERS SHALL BE PROVIDED WITH GUSSET PLATES AS SHOWN IN THE DRAWINGS.
9. ALL EXPOSED STRUCTURAL STEEL MEMBERS SHALL RECEIVE AT LEAST ONE COAT OF RED LEAD PAINT.

CONSTRUCTION JOINT DETAIL

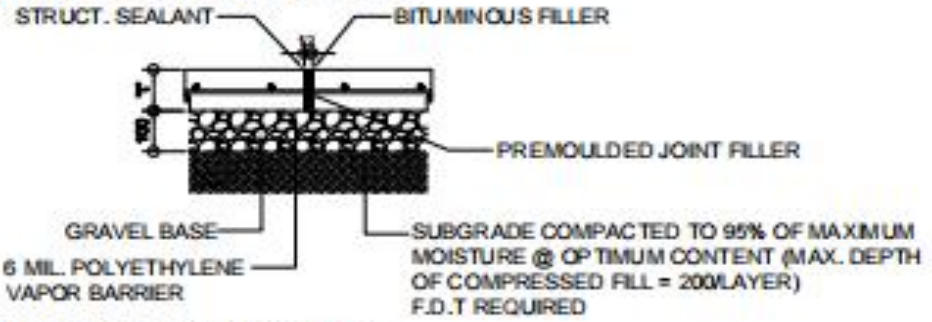


AT SUSPENDED SLAB

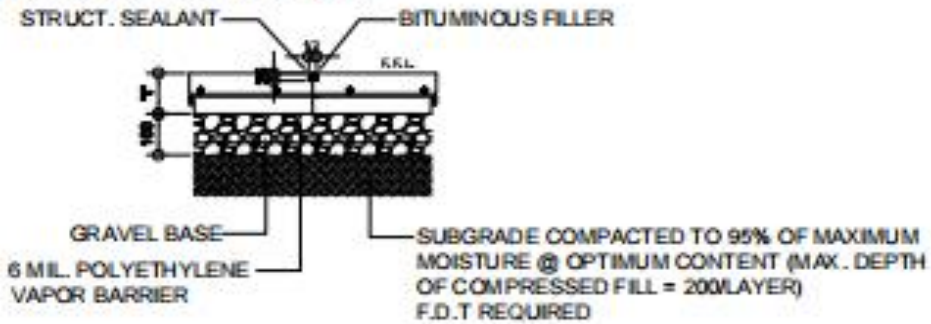


AT BEAMS/GIRDERS

SLAB ON GRADE CONSTRUCTION JOINT

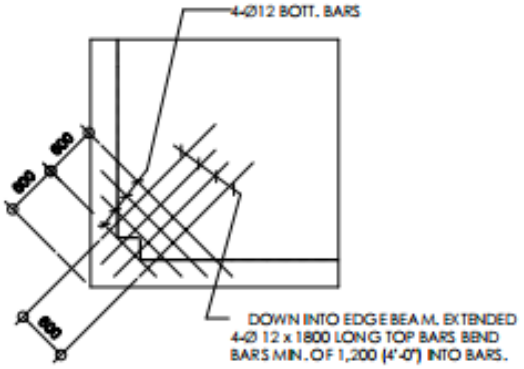


SLAB ON GRADE EXPANSION JOINT

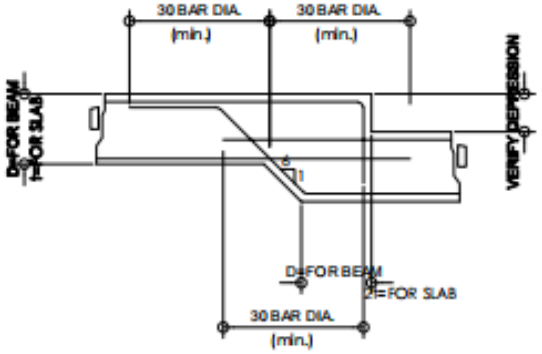


NOTE:

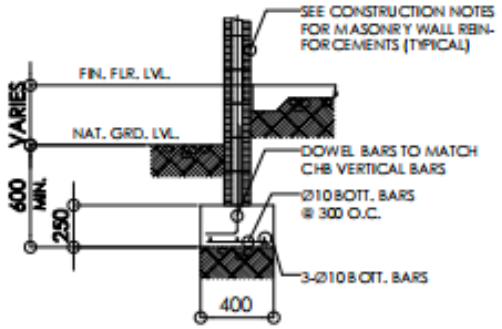
1. ALL SURFACES OF CONSTRUCTION JOINTS SHALL BE ROUGHENED TO 6 MM. AMPLITUDE
2. ALL CONSTRUCTION JOINTS SHALL BE CLEANED TO REMOVE DUST, CHIPS, OR OTHER FOREIGN MATTERS PRIOR TO PLACING OF ADJACENT CONCRETE.
3. THE CONTRACTOR SHALL SUBMIT THE PROPOSED LOCATIONS OF CONSTRUCTION JOINTS FOR THE APPROVAL OF STRUCTURAL ENGINEER BEFORE STARTING CONSTRUCTION.

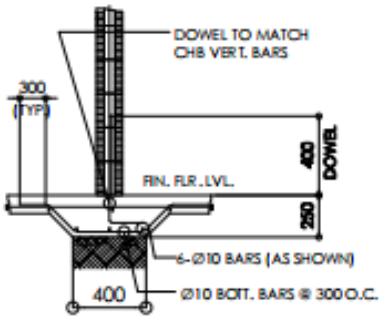


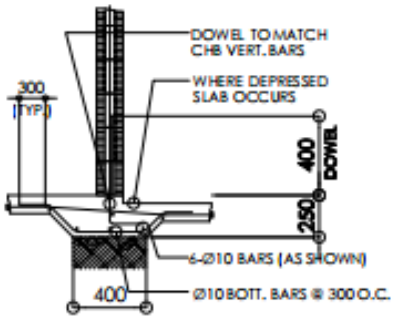
TYPICAL CORNER SLAB DETAIL



TYPICAL DETAIL FOR BEAM
OR SLAB CHANGE SOFFIT

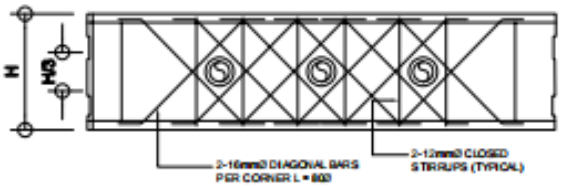


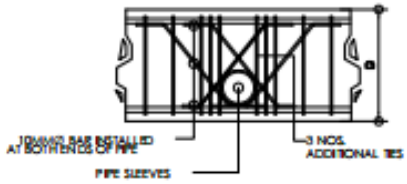




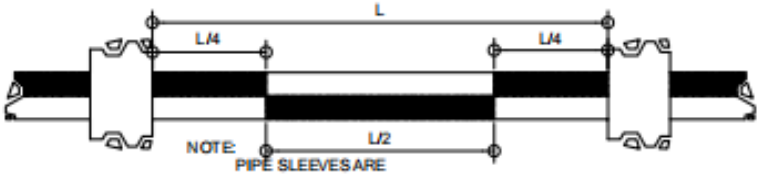
TYPICAL CHB FOOTING DETAILS (WHERE APPLICABLE)

PIPE SLEEVE DETAIL





PIPE SLEEVES REINFORCEMENT

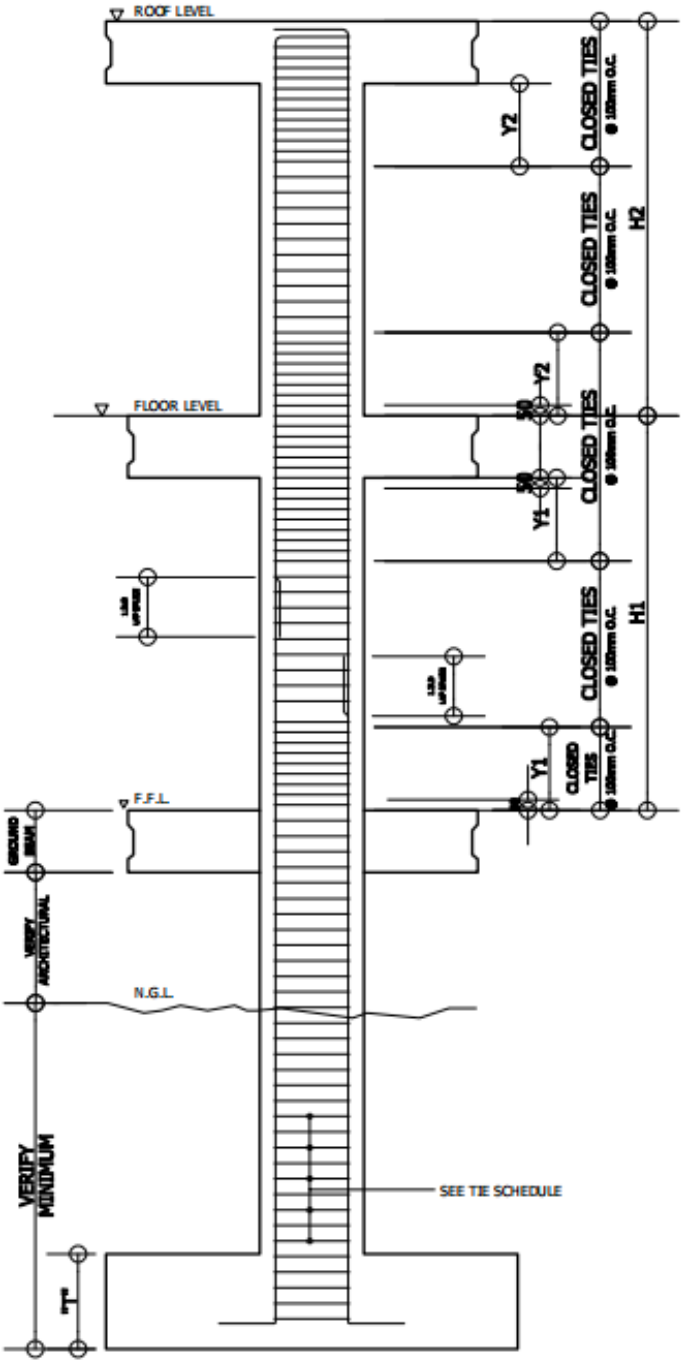


PIPE SLEEVES LOCATION

NOTE:
1. CENTER TO CENTER SPACING OF PIPE SLEEVES "S" SHALL IN NO CASE BE LESS THAN 3 TIMES THE SLEEVE DIAMETER.
2. PIPE SLEEVES OF ALUMINUM SHALL NOT BE EMBEDDED IN STRUCTURAL CONCRETE.
3. PIPE SLEEVES SHALL NOT BE LARGER IN OUTSIDE DIMENSION THAN 1/3 THE OVERALL DEPTH OF THE BEAM.
4. PIPE SLEEVES SHALL BE LOCATED WITHIN THE MIDDLE THIRD OF THE BEAM DEPTH.
5. AVOID LOCATION OF MAXIMUM STRESSES.
6. CONTRACTOR SHALL SUBMIT PIPE SLEEVE LOCATION LAYOUT FOR APPROVAL OF THE STRUCTURAL ENGINEER OF RECORD, PLACE SLEEVE AT LEAST 2H FROM THE FACE OF THE SUPPORT.
7. NO CONCRETE POURING SHALL BE MADE WITHOUT OUR APPROVAL OF THE STRUCTURAL ENGINEER OF RECORD.

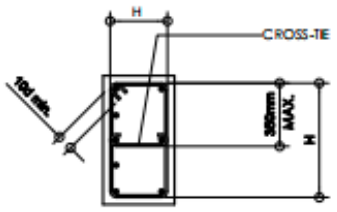
H. CURING NOTES

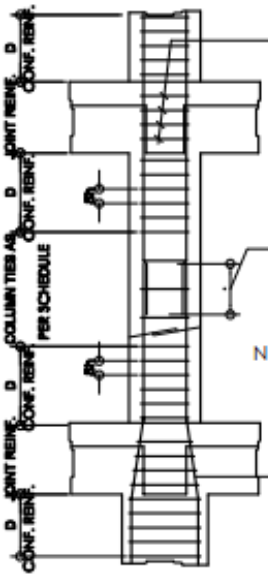
1. CONCRETE (OTHER THAN HIGH EARLY STRENGTH) SHALL BEKEPT IN A MOIST CONDITION FOR AT LEAST FIRST SEVEN (7) DAYS AFTER PLACEMENT.
2. HIGH EARLY STRENGTH CONCRETE SHALL BE KEPT IN A MOIST CONDITION FOR AT LEAST FIRST THREE (3) DAYS AFTER PLACEMENT.
3. USED OF WET BURLAP, FOG SPRAYING AND CURING COMPOUNDS ARE APPROVED CURING METHODS.



NOTES:
1. Y = MAX OF F.F.
   A. H/6
   B. 450mm
   C. MAX COLUMN DIMENSION
2. SPLICES ARE PERMITTED ONLY WITHIN THE CENTER HALF OF COLUMN HEIGHT (H)
3. STAGGER BAR SPLICES BY 600mm OR MORE
4. PROVIDE TIES @ 100mm O.C. (MAX.) OVER THE FULL LAP SPLICE LENGTH
5. SPECIAL TIES @ THE BEAM COL. JOINT TO CONFORM TO THE SAME CONFIGURATION OF TIES AS INDICATED IN THE SCHEDULE OF COLUMNS
6. NO OF SPLICES BARS AT ONE LEVEL SHALL NOT EXCEED ONE-THIRD (1/3) OF THE TOTAL NO. OF COLUMN VERTICAL BARS

NOTES:
1. YIELD STRESS OF HOOPS = 40 KSI
2. D = USE MAXIMUM COLUMN DIMENSION, 1/6 CLEAR HEIGHT OR 18" (450mm) WHICHEVER IS GREATER.
3. NUMBER OF HOOP TIES SAME AS PER COLUMN TIES SCHEDULE.
4. ALL CONCRETE REINFORCEMENT DETAIL SHOULD BE DONE IN ACCORDANCE WITH ACI DETAILING MANUAL 1980 PUB. SP-66





JOINT HOOP SPACE @ "2/3h" WHEN THERE ARE BEAMS HAVING WIDTH OF AT LEAST ONE-HALF THE COLUMN WIDTH & DEPTHS NOT LESS THAN THREE QUARTERS OF THE DEEPEST BEAM THAT FRAME INTO FOUR SIDES OF THE COLUMN. ALL OTHER CONDITIONS USE HOOPS @ "3/4" CENTERS.

FOR COL. BAR SPLICES SEE TABLE OF MIN. LAP SPLICE LENGTH OF COLUMN REINFORCEMENT

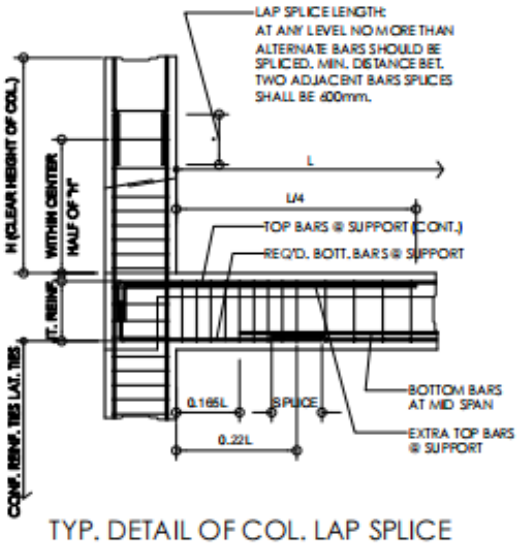
NOTE:

ALL CONCRETE REINF. DETAIL SHOULD BE DONE IN ACCORDANCE WITH ACI DETAILING MANUAL 1980 PUB-66.

MAX SLOPE 1:6 FOR CRACKING OF REINFORCEMENT FOR COLUMN AND BEAM

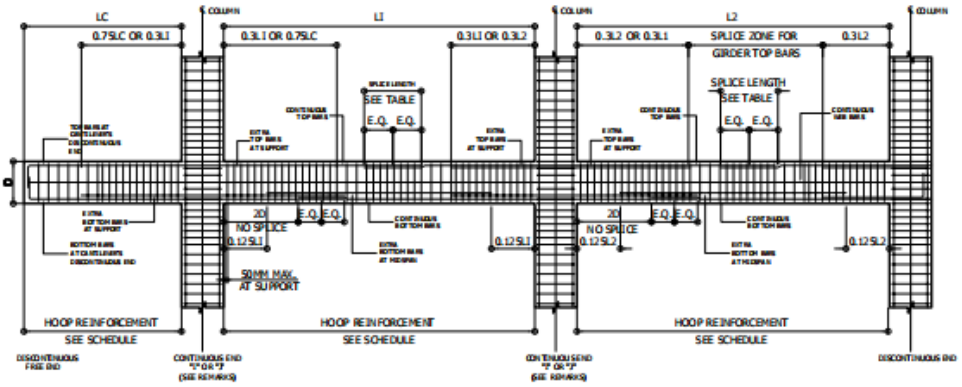
SLOPE WILL DEPEND ON HOW MUCH THE COLUMN IS REDUCED.

TYPICAL COLUMN ELEV. SHOWING DOWELS AND TIES SPACING



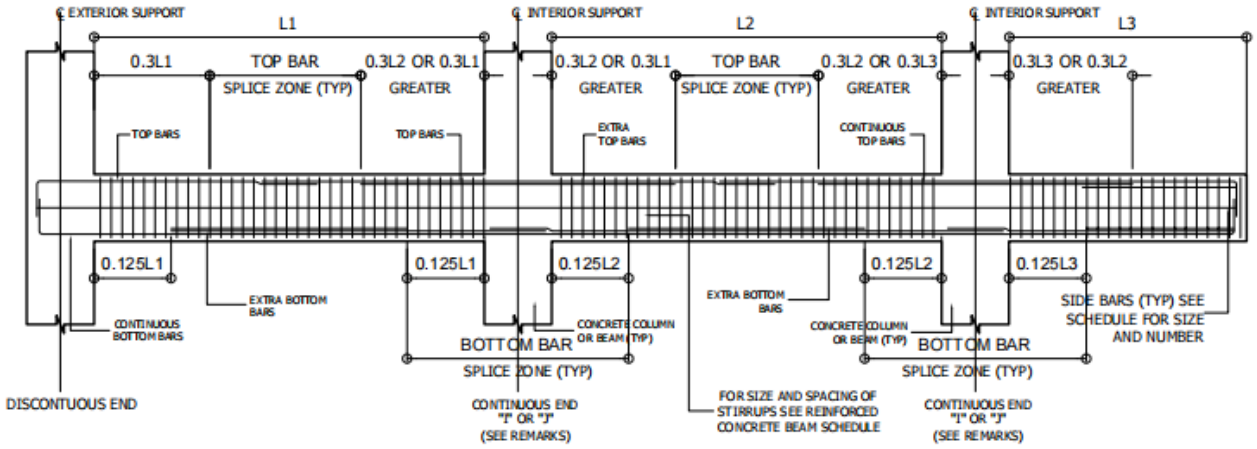
TYP. DETAIL OF COL. LAP SPLICE & EXT. GIRDER TO COL. CONNECT.

TYPICAL GIRDER DETAILS



STRUCTURAL NOTES:
1. SEE TABLE OF LAP SPLICE & ANCHORAGE LENGTHS SHOWN ON SHEET.
2. LAP SPLICE SHALL BE LOCATED ONLY WITHIN THE LAP SPLICE ZONE.
3. TOP & BOTTOM BARS MAY BE LAP SPLICED ONLY ON ONE LOCATION FOR EACH STRING OF BEAMS
4. CLOSED HOOPS WITH A 135 BEND SHALL BE SPACED AT 100 O.C. MAXIMUM AT A DISTANCE 2D FROM THE FACE OF THE SUPPORT, FIRST STIRRUP SHALL 5D FROM THE FACE OF THE SUPPORT.
5. SPACING OF STIRRUPS ON LAP SPLICE SHALL BE SPACED @ 100MM O.C. MAXIMUM.
6. AT INTERIOR SUPPORT (CONTINUOUS END) PROVIDE LARGER SIZE AND NUMBER OF TOP AND BOTTOM BARS FROM ADJACENT SPANS.
7. NO SPLICE SHALL BE ALLOWED 2D FROM THE FACE OF THE SUPPORT.

TYPICAL GRAVITY BEAM DETAILS



I. STRIPPING OF FORMS

NOTE:
1. FORMS SHALL RESULT IN FINAL STRUCTURE THAT CONFORMS TO SHAPES, LINES AND DIMENSIONS OF THE MEMBERS AS REQUIRED BY THE DESIGN DRAWINGS AND SPECIFICATIONS.
2. FORMS SHALL BE REMOVED IN SUCH A MANNER AS NOT TO IMPAIR SAFETY AND SERVICEABILITY OF THE STRUCTURE.

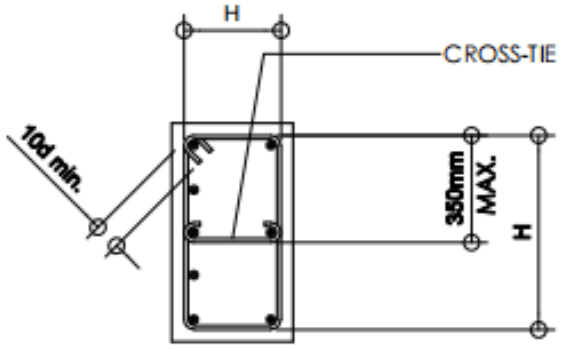
STRUCTURAL ELEMENT	PERIOD
1. BEAM/GIRDER	14 DAYS
2. SUSPENDED SLAB	8 DAYS
3. COLUMN/SHEARWALL	2 DAYS
4. RETAINING WALL	18 HOURS
5. FOUNDATION	24 HOURS

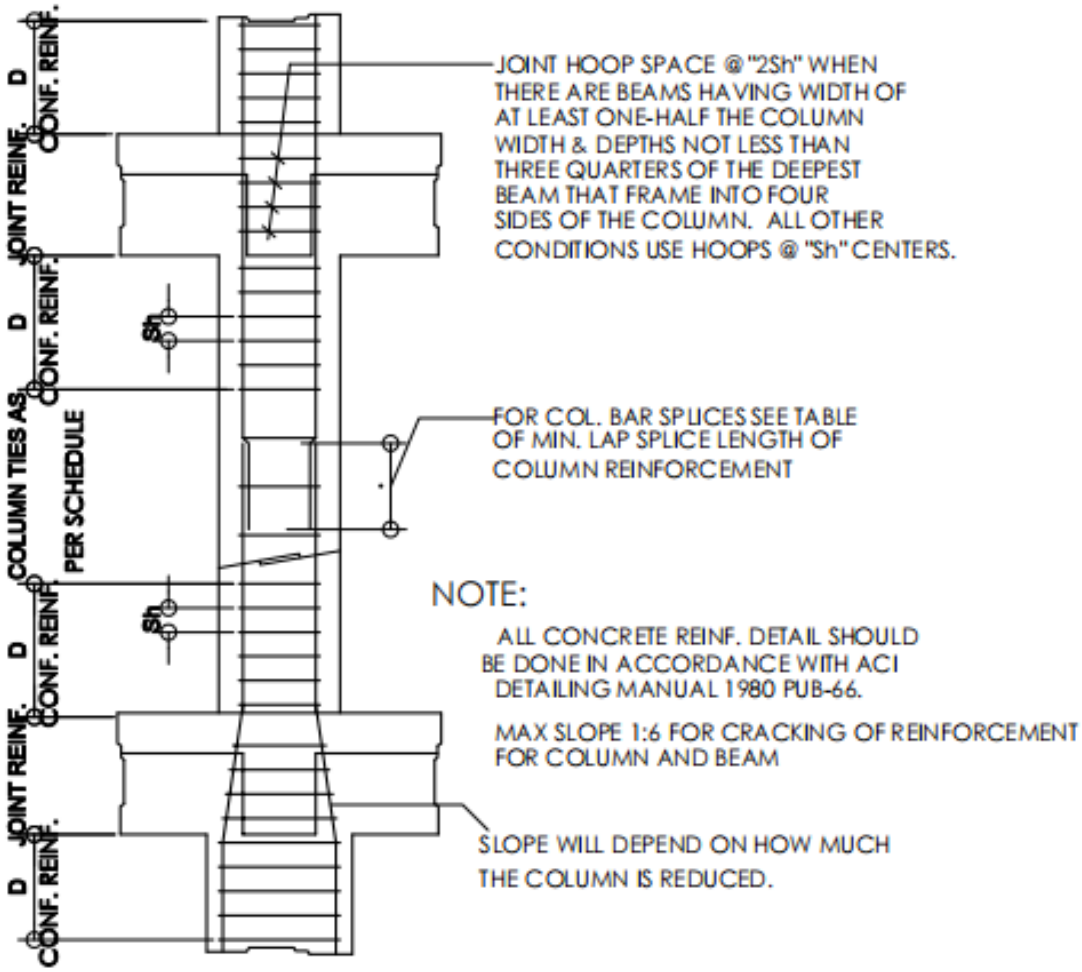
J. REMOVAL OF SHORES AND SHORING

1. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE ADEQUATE SHORING AND BRACING OF THE STRUCTURE FOR ALL LOADS THAT MAYBE IMPOSED UNDER CONSTRUCTION.
2. STRUCTURAL ELEMENT MUST ATTAINED SUFFICIENT STRENGTH OR DEVELOPED DESIGN PROPERTIES REQUIRED TO SUPPORT ALL LOADS, LIMIT DEFLECTIONS AND CRACKING BEFORE REMOVAL OF SHORES.
3. REMOVAL OF SHORES ARE NOT ALLOWED WITHIN THE GIVEN CURING PERIOD WHEN ADDITIONAL LOADS ARE IMPOSED, UNLESS ANAYSIS INDICATES ADEQUATE STRENGTH TO SUPPORT SUCH ADDITIONAL LOADS.
4. INSTALLATION OF RESHORES IS NECESSARY FROM ANY PART OF STRUCTURE UNDER CONSTRUCTION.

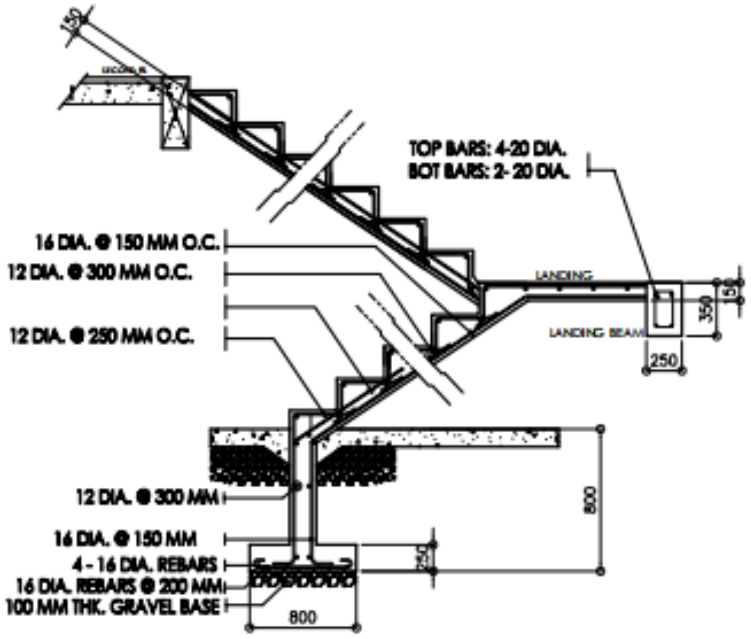
NOTES:

1. YIELD STRESS OF HOOPS = 40 KSI
2. D = USE MAXIMUM COLUMN DIMENSION, 1/6 CLEAR HEIGHT OR 18" (450mm) WHICHEVER IS GREATER.
3. NUMBER OF HOOP TIES SAME AS PER COLUMN TIES SCHEDULE.
4. ALL CONCRETE REINFORCEMENT DETAIL SHOULD BE DONE IN ACCORDANCE WITH ACI DETAILING MANUAL 1980 PUB SP-66



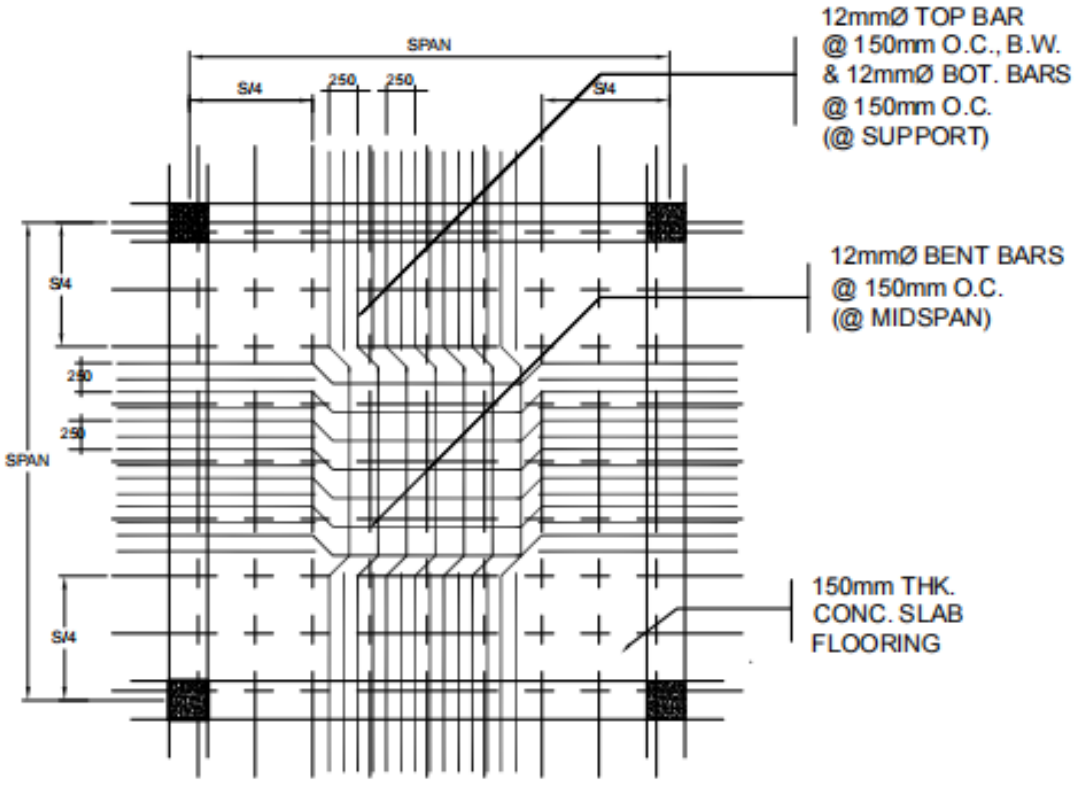


TYPICAL COLUMN ELEV. SHOWING DOWELS AND TIES SPACING



TYPICAL STAIR DETAIL

SCALE NTS

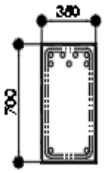
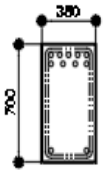
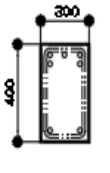
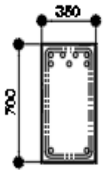
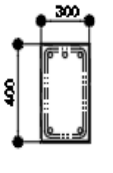
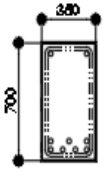
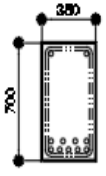
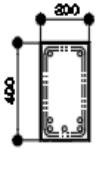
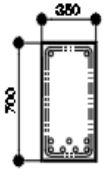
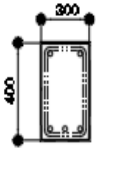


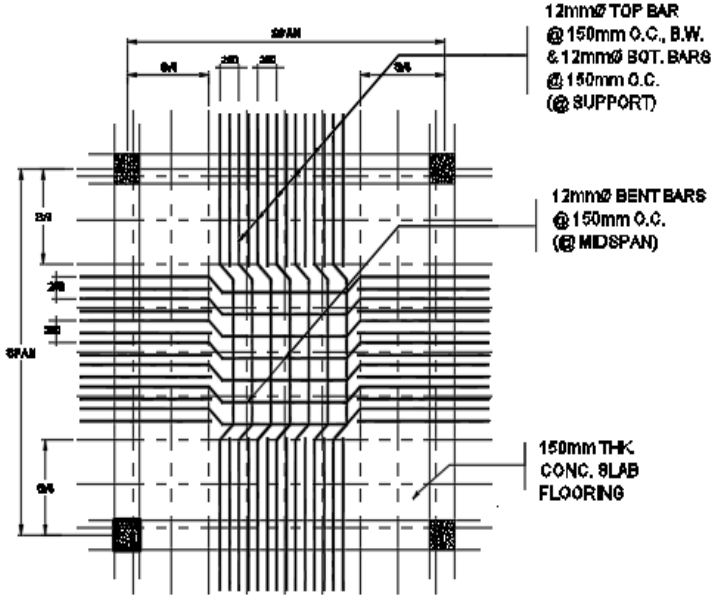
2S-1

2ND FLOOR SLAB TYPICAL DETAIL

SCALE NTS

BEAM DETAIL

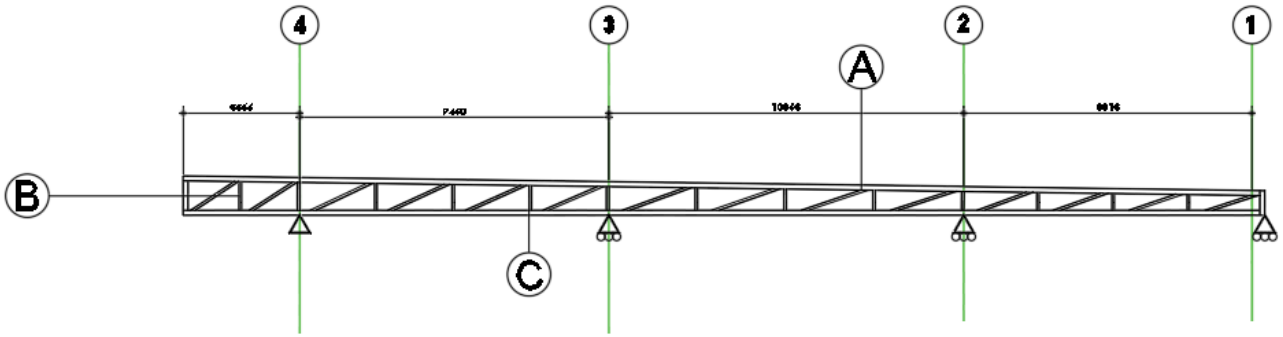
LEVEL	FTB-1	G-1	B-1	G-2	RB-1
SECTION @ SUPPORT					
	TB 7 - 16mm ø BB 2 - 16mm ø	TB 9 - 25mm ø BB 2 - 16mm ø	TB 5 - 16mm ø BB 2 - 16mm ø	TB 7 - 25mm ø BB 2 - 16mm ø	TB 3 - 16mm ø BB 2 - 16mm ø
SECTION @ MIDSPAN					
	TB 2 - 16mm ø BB 7 - 16mm ø	TB 2 - 16mm ø BB 9 - 25mm ø	TB 2 - 16mm ø BB 5 - 16mm ø	TB 2 - 16mm ø BB 7 - 25mm ø	TB 2 - 16mm ø BB 3 - 16mm ø
STIRRUPS	5 @ 50mm, 10 @ 75mm, REST @ 150 mm O.C.				



SS-1

2ND FLOOR SLAB TYPICAL DETAIL

SCALE NTS



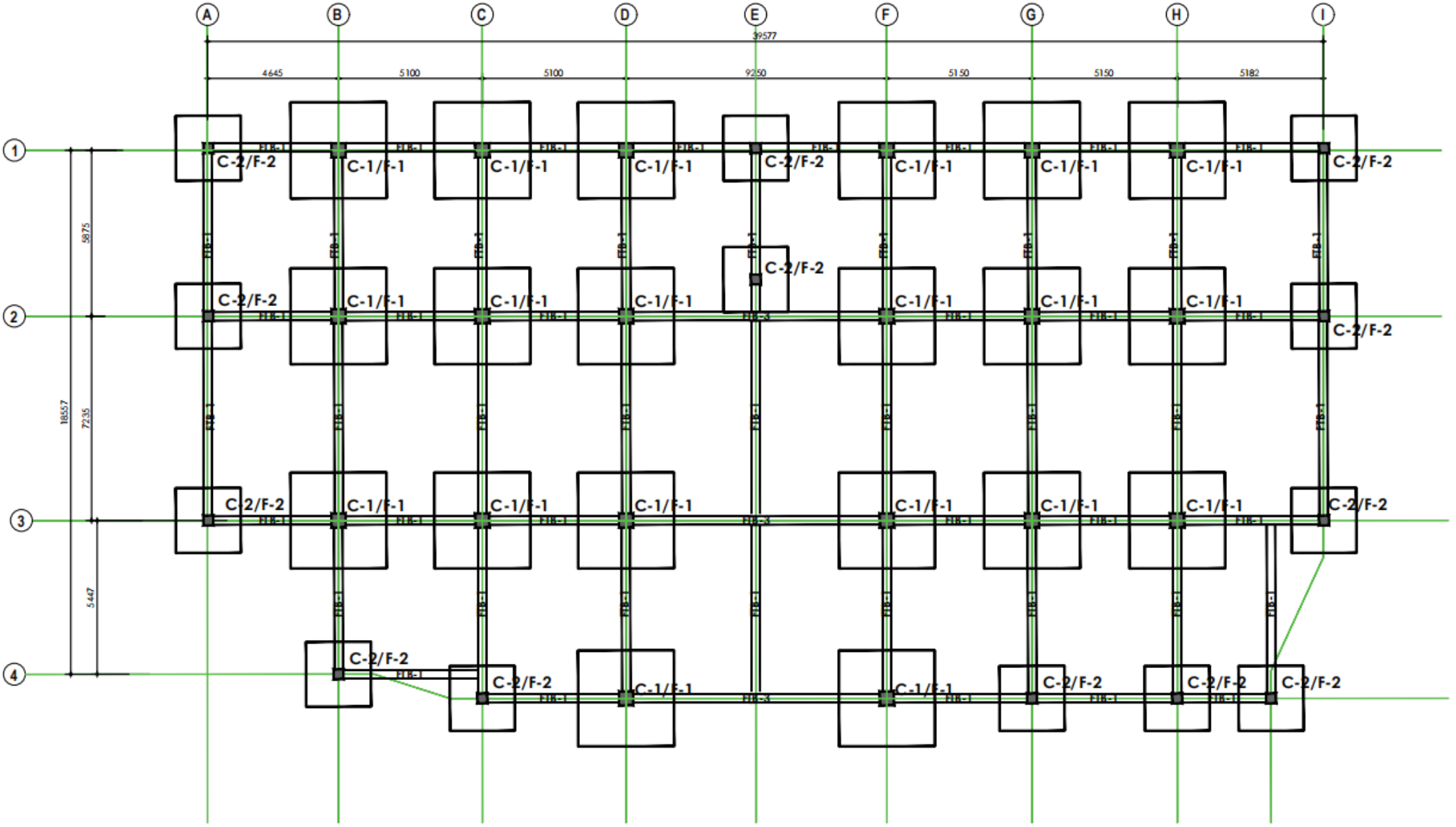
TYPICAL TRUSS DETAIL

SCALE 1:50

Ⓐ TOP CHORD : 1L X 100 x 100 x 12mm ANGLE BAR

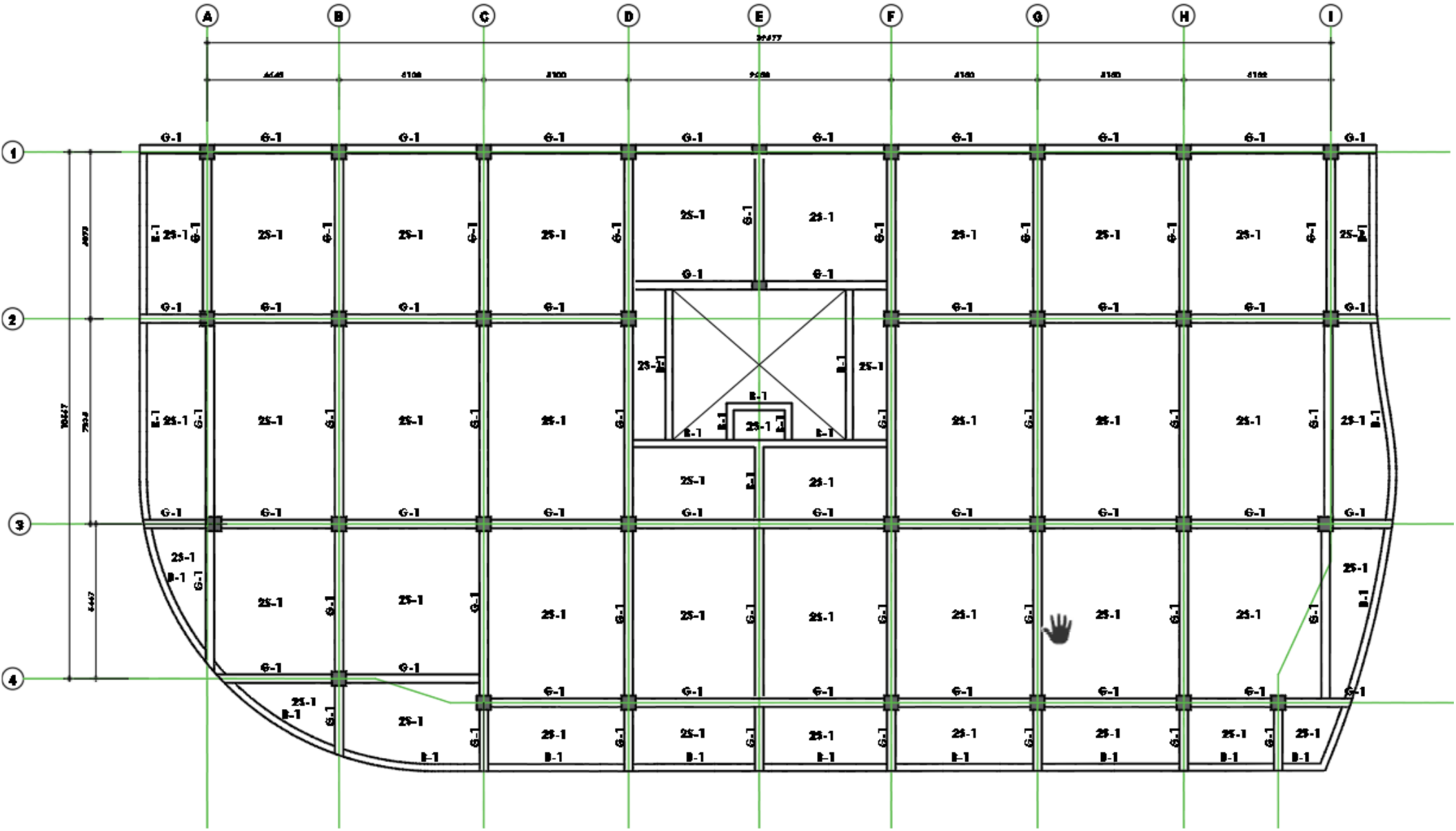
Ⓑ WEB MEMBERS : 1L X 50 x 30 x 4mm ANGLE BAR

Ⓒ BOTTOM CHORD :1L X 100 x 100 x 12mm ANGLE BAR



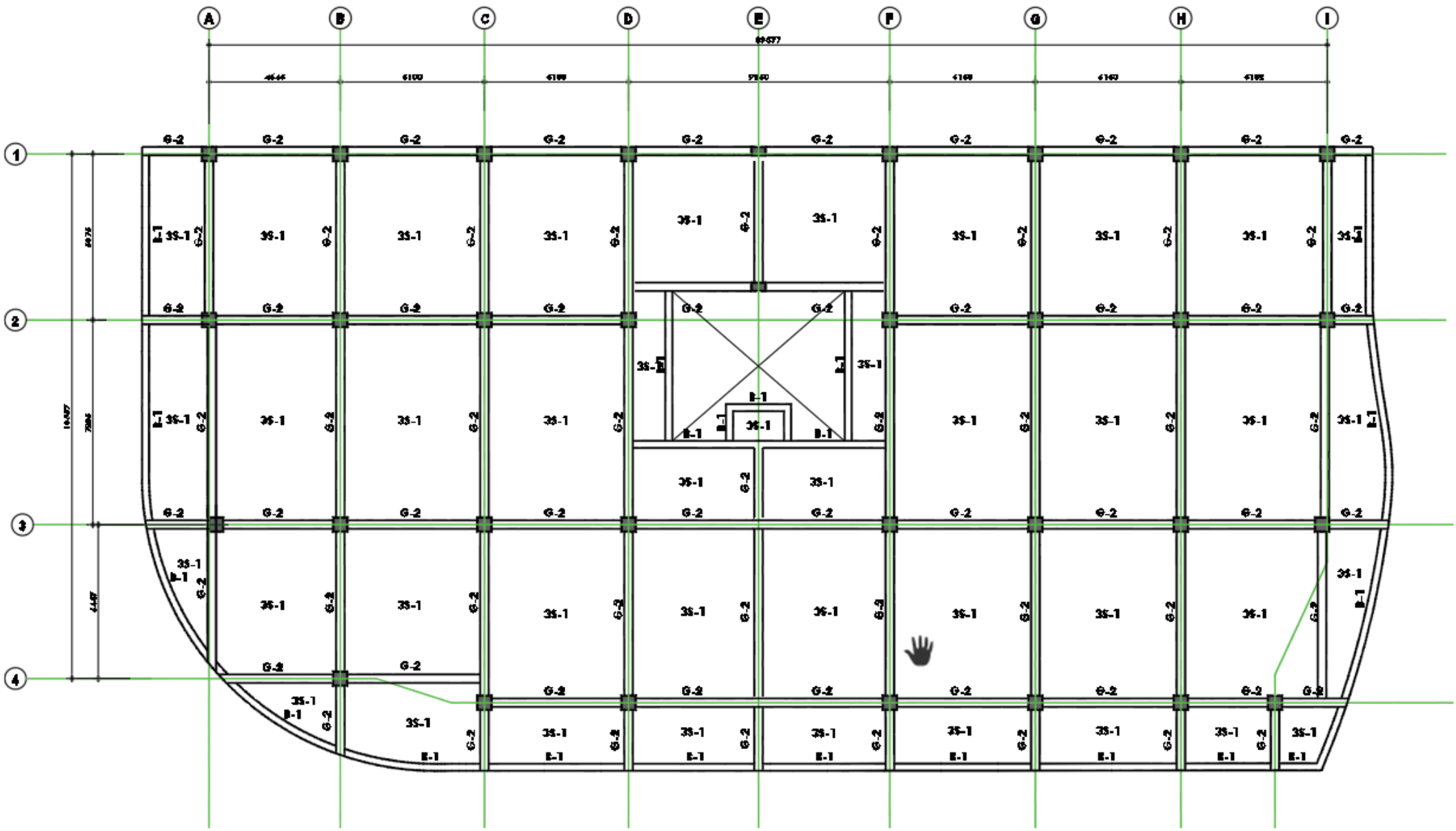
FOUNDATION PLAN

SCALE 1:100



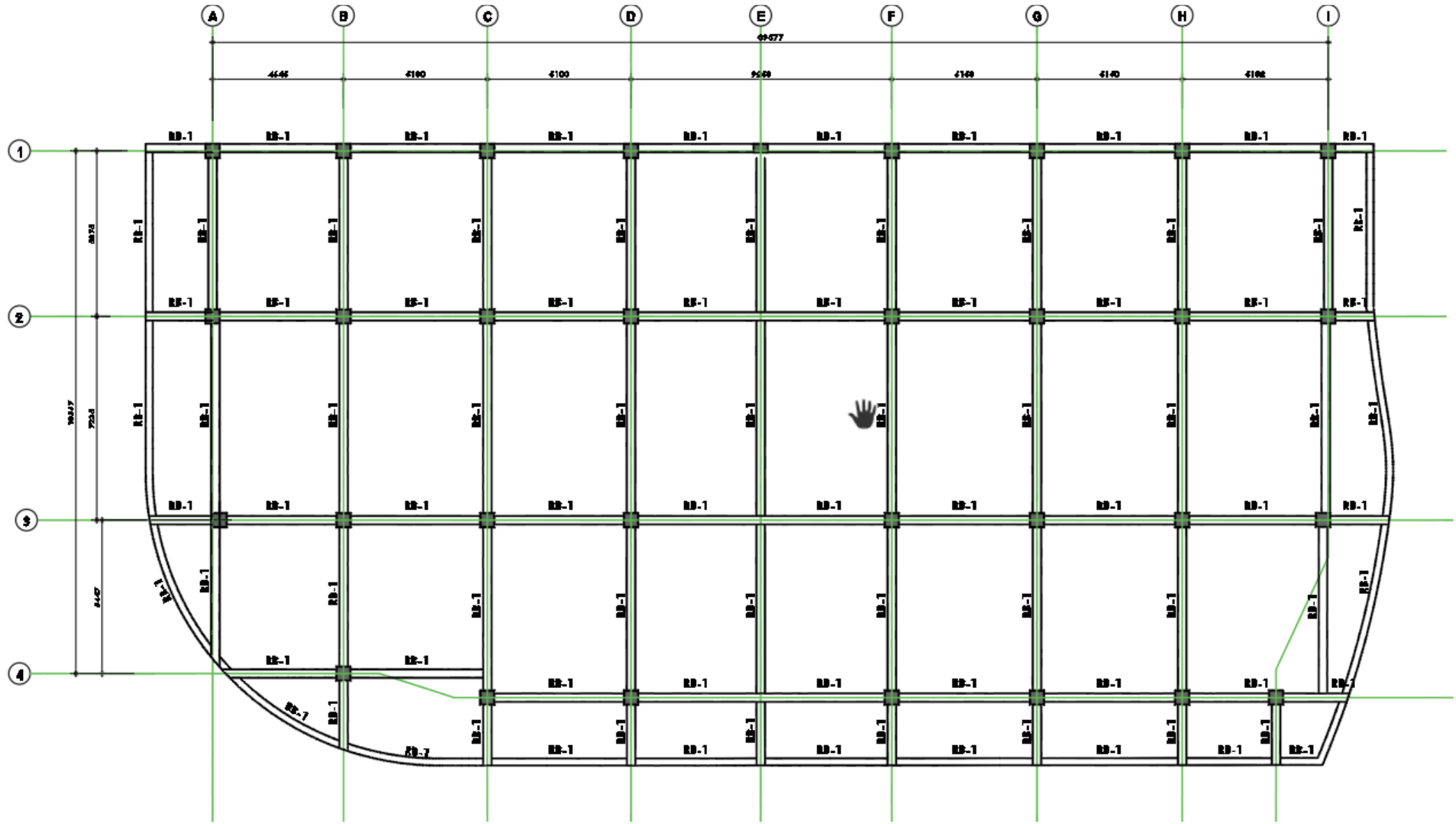
2ND FLOOR FRAMING PLAN

SCALE 1:100



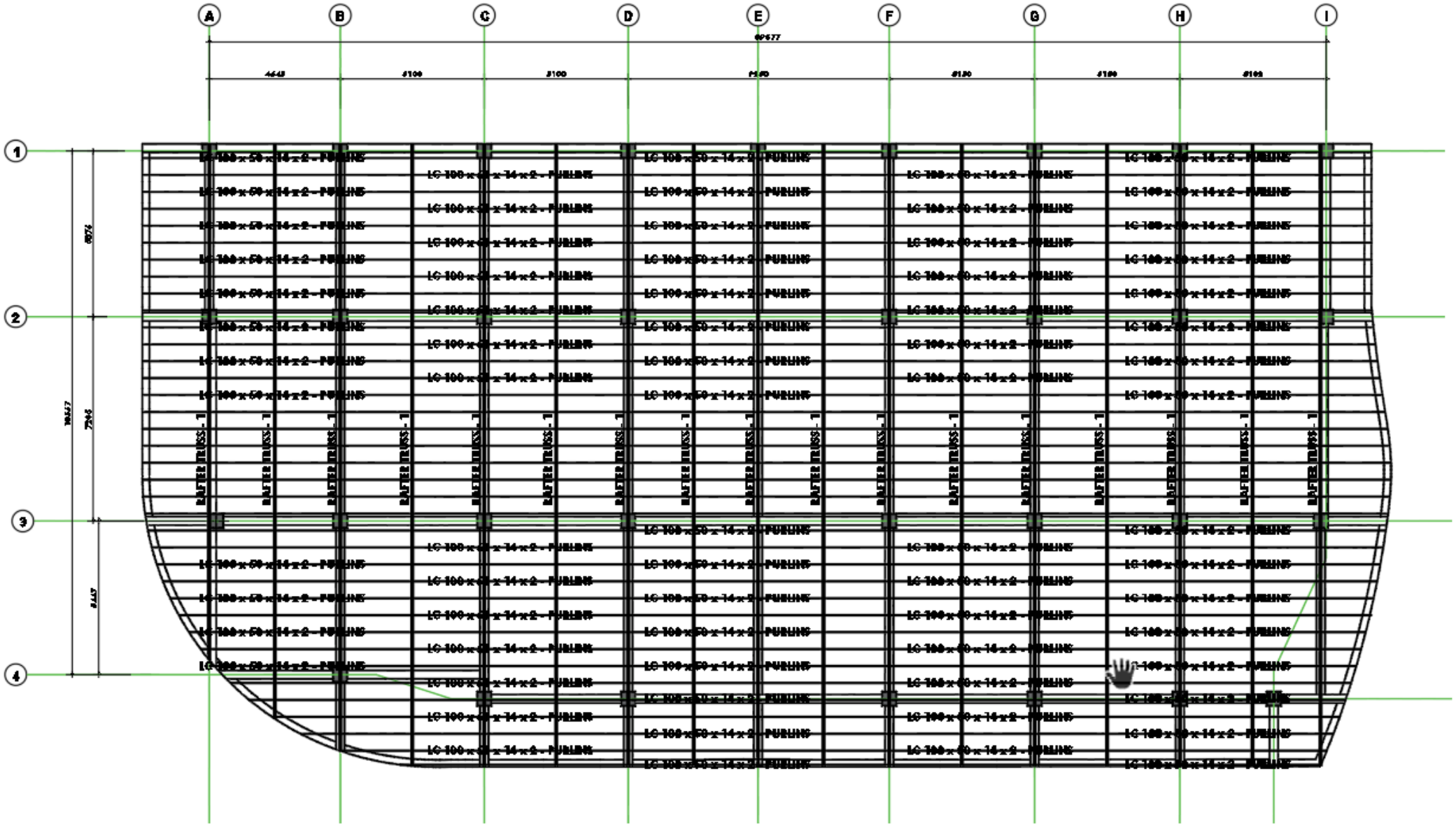
3RD FLOOR FRAMING PLAN

SCALE 1:100



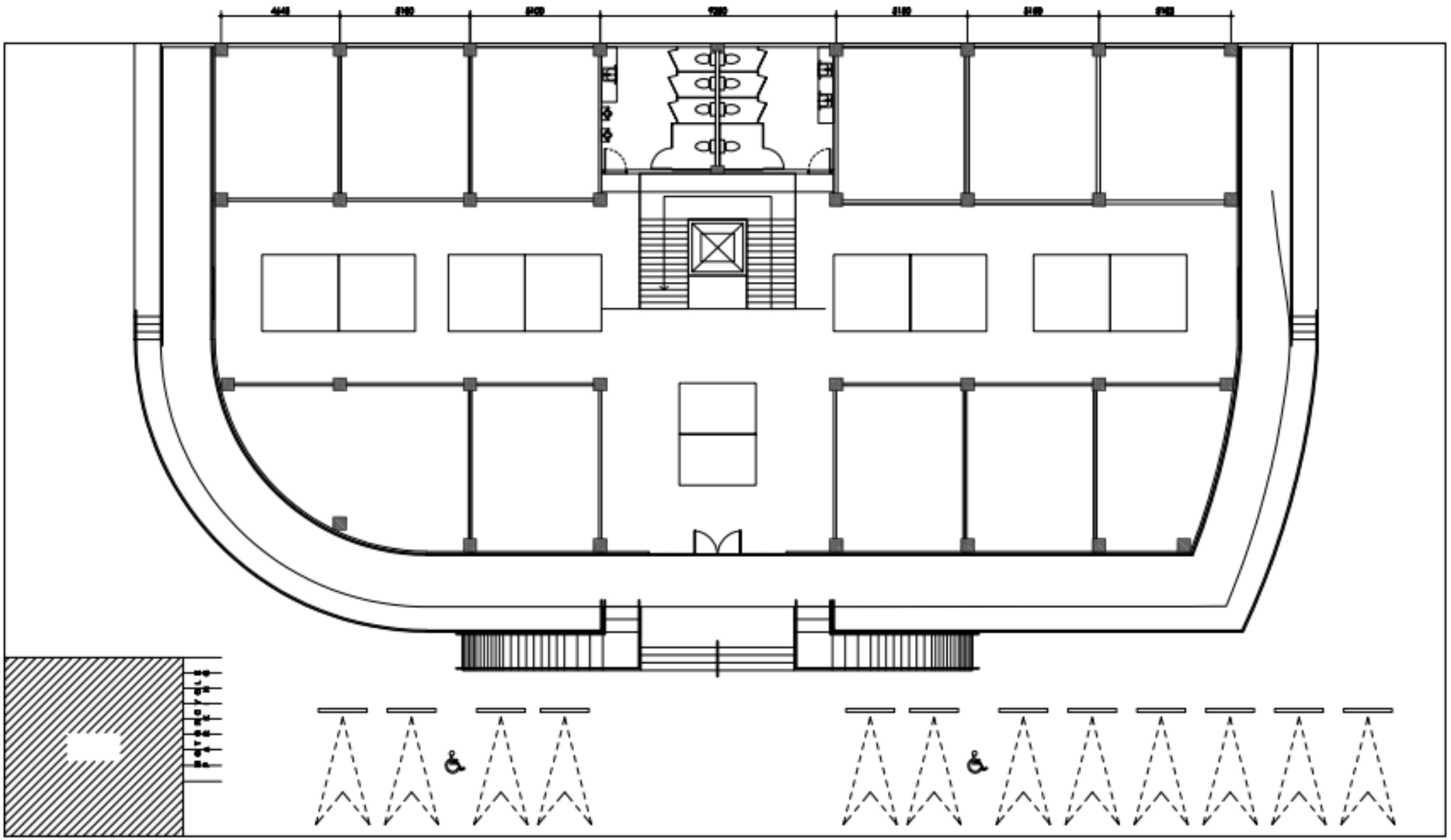
ROOF BEAM FRAMING PLAN

SCALE 1:100



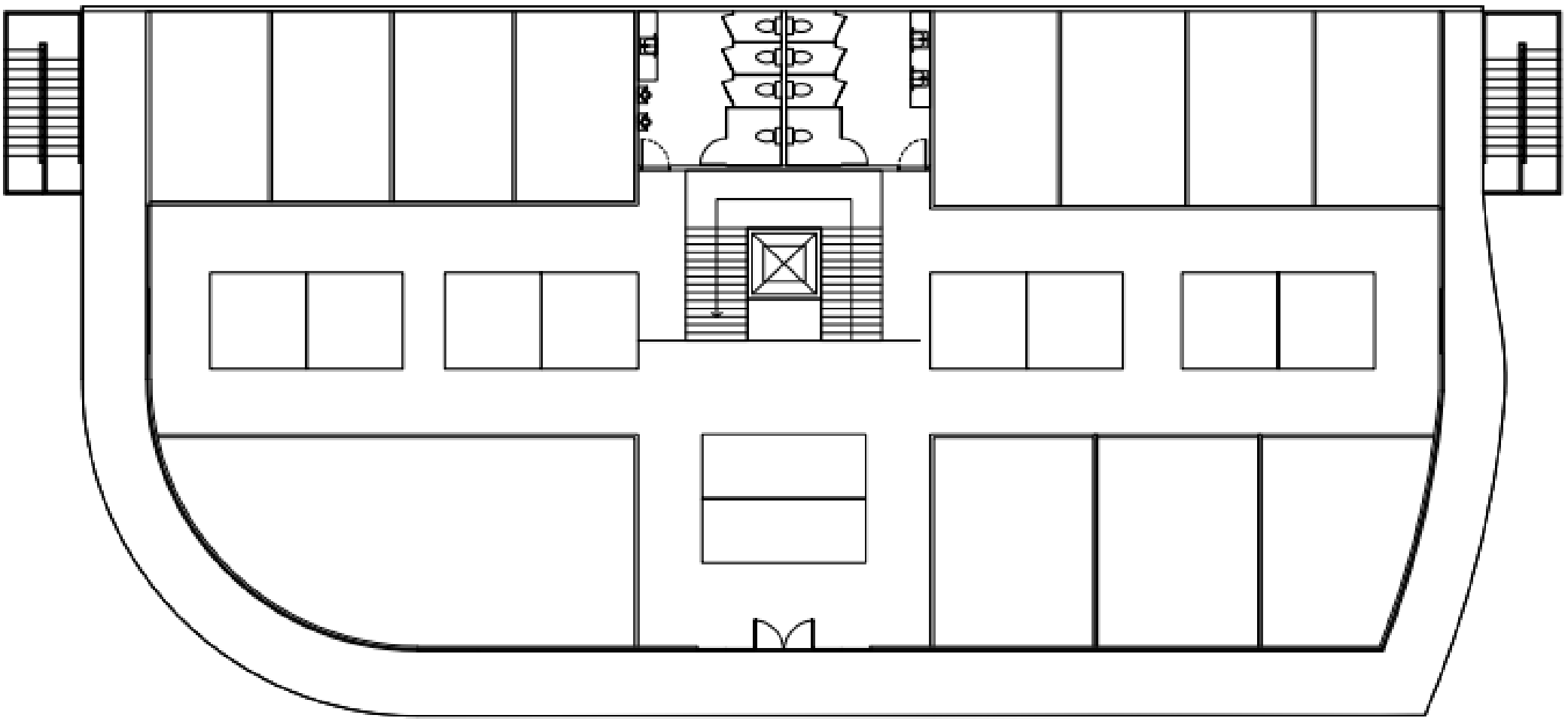
TRUSS FRAMING PLAN

SCALE 1:100



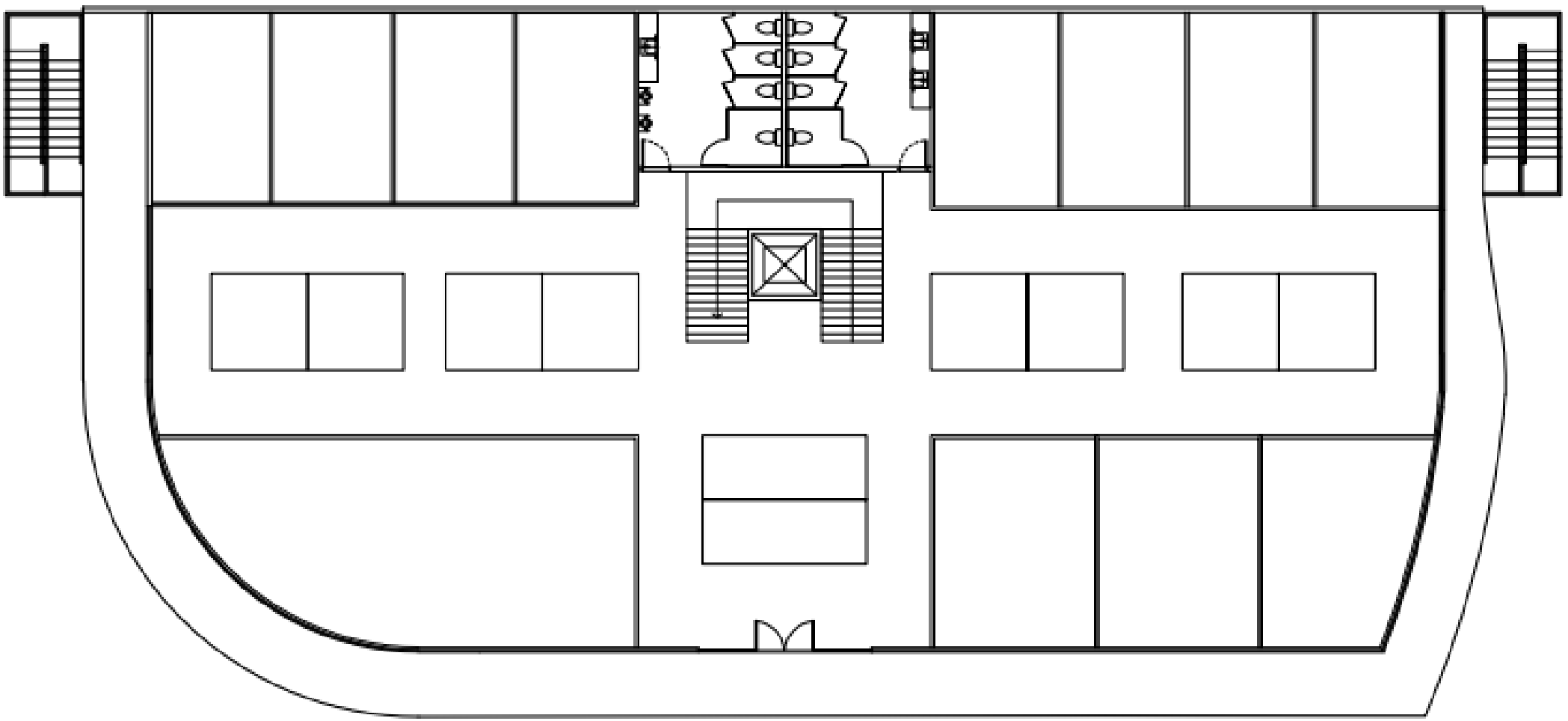
GROUND FLOOR PLAN

SCALE 1:100



SECOND FLOOR PLAN

SCALE 1:100



THIRD FLOOR PLAN

SCALE 1:100

ELECTRICAL PLAN

GENERAL NOTES:

ALL ELECTRICAL INSTALLATION WORKS HEREIN SHALL BE DONE IN ACCORDANCE WITH THESE PLANS AND SPECIFICATIONS, THE APPLICABLE PROVISIONS OF THE LATEST EDITION OF THE PHILIPPINES ELECTRICAL CODE, THE RULE AND THE REGULATIONS OF THE LOCAL POWER COMPANY

THE ELECTRICAL SERVICE VOLTAGE SHALL BE 230V, 1 PHASE, 60HZ.

ALL WIRES SHALL BE COPPER UNLESS OTHERWISE INDICATED. THE MINIMUM SIZE OF WIRES TO BE USED FOR LIGHTING AND POWER SHALL BE 3.5MM2 THHN CU.

ALL MATERIALS TO BE USED AND EQUIPMENT TO BE INSTALLED SHALL BE BRAND NEW AND MUST BE OF APPROVED TYPE FOR PARTICULAR LOCATION AND PURPOSE.

THE MOUNTING HEIGHT OF WIRING DEVICES SHALL BE AS FOLLOWS:

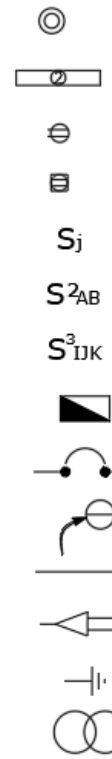
LIGHT SWITCHES	– 1.4M ABOVE FINISH FLOOR LINE	
CONVENIENCE OUTLET	– 0.3M ABOVE FINISH FLOOR LINE	
PANEL BOARD	– 1.5M ABOVE FINISH FLOOR LINE	

TO THE CENTER OF THE PANEL
AS REQUIRED.

FOR EACH SPARE BRANCH CIRCUIT IN PANEL BOARD PROVIDE 20MM DIAMETER EMPTY CONDUIT.

ALL WORKS SHALL BE DONE UNDER THE DIRECT SUPERVISION OF A DULY LICENCE ELECTRICAL ENGINEER OR MASTER ELECTRICIAN.

LEGEND & SYMBOLS:



16w LED Pinlight

2x20w Fluorescent Lamp, Box type

Duplex Convenience Outlet, Grounding Type

Floor–mounted Outlet, Grounding Type

S_j Single Pole Switch

S^2_{AB} Duplex Switch

S^3_{IJK} Triplex Switch

Distribution Panel

Circuit Breaker

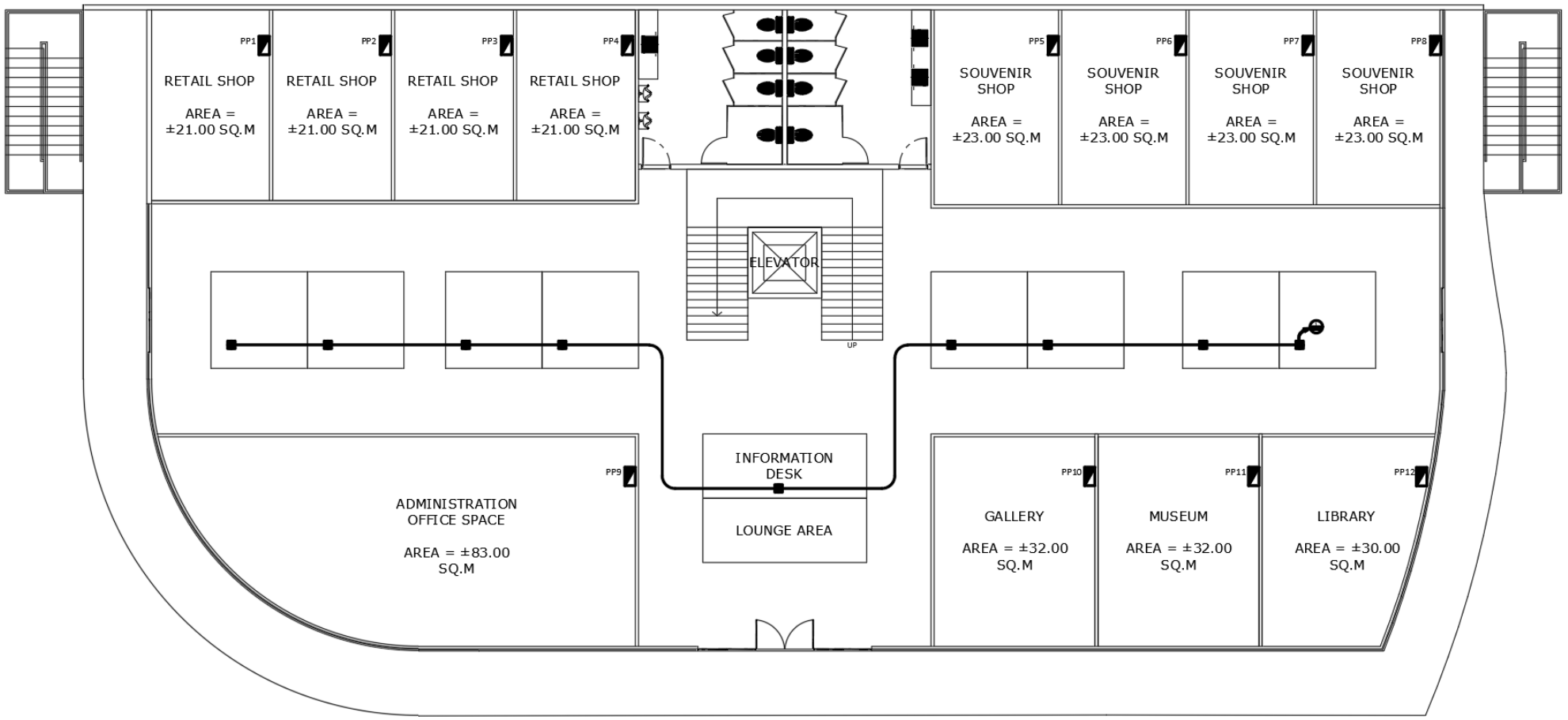
Circuit Homerun

Conduit

Service Entrance

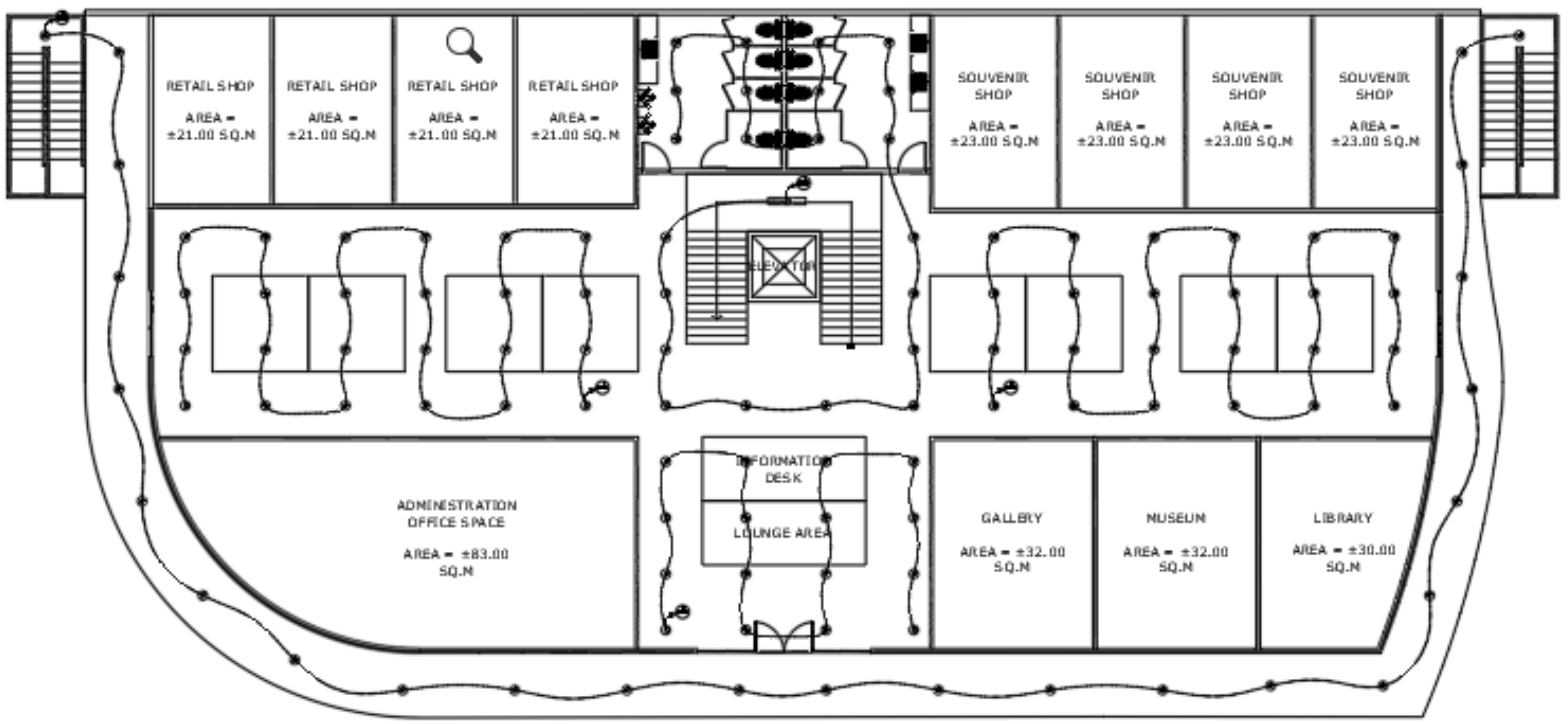
Grounding System

Transformer

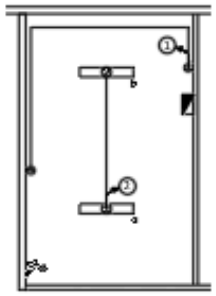


TYPICAL POWER LAYOUT

SCALE 1:100

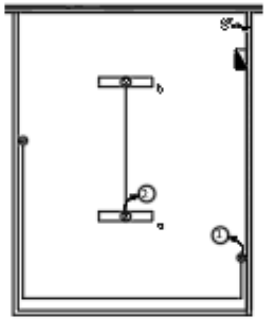


TYPICAL LIGHTING LAYOUT



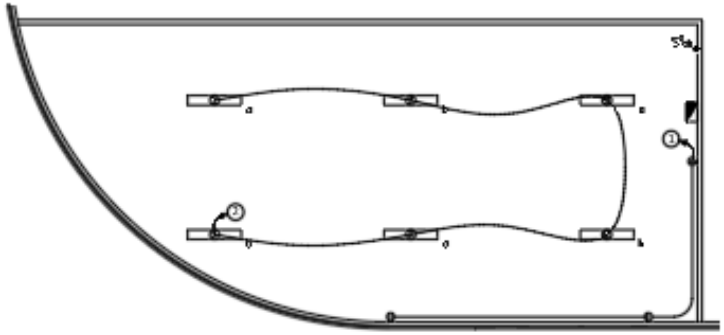
TYPICAL - RETAIL/SOUVENIR SHOP ELECTRICAL LAYOUT

SCALE 1:75



TYPICAL - GALLERY/MUSEUM/LIBRARY SHOP ELECTRICAL LAYOUT

SCALE 1:75



TYPICAL - ADMINISTRATION OFFICE ELECTRICAL LAYOUT

SCALE 1:75

SCHEDULE OF LOADS & COMPUTATION

PANEL NAME: "PP1" TO "PP8" **LOCATION: SOUVENIR/ RETAIL SHOP**

VOLTAGE: 230V
PHASE: 1
WIRES: 2+G
FREQ.: 60HZ

COMPUTATIONS:
It = (10.7 x 0.8) + (4.35 x 0.25) = 9.65 A
Ic = (10.7 x 0.8) + (4.35x 1.5) = 15.09 A

USE: 2-8.0mm² THHN cu. & 5.5mm²G, 25mmø uPVC
USE: 2P, 50AT, 50AF, 12KAIC

CKT NO.	L.O.	SW.	C.O.	LOAD DESCRIPTION	LOAD (KVA)	AMPERE (A)	CKT. BREAKER				WIRE (mm²)			CONDUIT (mmø)	
							P	AT	AF	KAIC	PHASE	GND	TYPE	SIZE	TYPE
1			2	Convenience Outlet	0.36	1.57	2	30	50	10	3.5	3.5	THHN	20	uPVC
2	2	1		Lighting Outlet	0.10	0.43	2	20	50	10	3.5	3.5	THHN	20	uPVC
3				Spare	1.00	4.35	2	30	50	10				20	uPVC
4				Spare	1.00	4.35	2	30	50	10				20	uPVC
	2	1	2	TOTAL	2.46	10.70									

PANEL NAME: "PP9" TO "PP12" **LOCATION: GALLERY/MUSEUM/LIBRARY**

VOLTAGE: 230V
PHASE: 1
WIRES: 2+G
FREQ.: 60HZ

COMPUTATIONS:
It = (10.7 x 0.8) + (4.35 x 0.25) = 9.65 A
Ic = (10.7 x 0.8) + (4.35x 1.5) = 15.09 A

USE: 2-8.0mm² THHN cu. & 5.5mm²G, 25mmø uPVC
USE: 2P, 50AT, 50AF, 12KAIC

CKT NO.	L.O.	SW.	C.O.	LOAD DESCRIPTION	LOAD (KVA)	AMPERE (A)	CKT. BREAKER				WIRE (mm²)			CONDUIT (mmø)	
							P	AT	AF	KAIC	PHASE	GND	TYPE	SIZE	TYPE
1			2	Convenience Outlet	0.36	1.57	2	30	50	10	3.5	3.5	THHN	20	uPVC
2	2	1		Lighting Outlet	0.10	0.43	2	20	50	10	3.5	3.5	THHN	20	uPVC
3				Spare	1.00	4.35	2	30	50	10				20	uPVC
4				Spare	1.00	4.35	2	30	50	10				20	uPVC
	2	1	2	TOTAL	2.46	10.70									

PANEL NAME: "PP9" **LOCATION: ADMINISTRATION OFFICE**

VOLTAGE: 230V
PHASE: 1
WIRES: 2+G
FREQ.: 60HZ

COMPUTATIONS:
It = (12.35 x 0.8) + (4.35 x 0.25) = 11.0 A
Ic = (12.4 x 0.8) + (4.35x 1.5) = 116.45 A

USE: 2-8.0mm² THHN cu. & 5.5mm²G, 25mmø uPVC
USE: 2P, 50AT, 50AF, 12KAIC

CKT NO.	L.O.	SW.	C.O.	LOAD DESCRIPTION	LOAD (KVA)	AMPERE (A)	CKT. BREAKER				WIRE (mm²)			CONDUIT (mmø)	
							P	AT	AF	KAIC	PHASE	GND	TYPE	SIZE	TYPE
1			3	Convenience Outlet	0.54	2.35	2	30	50	10	3.5	3.5	THHN	20	uPVC
2	6	1		Lighting Outlet	0.30	1.30	2	20	50	10	3.5	3.5	THHN	20	uPVC
3				Spare	1.00	4.35	2	30	50	10				20	uPVC
4				Spare	1.00	4.35	2	30	50	10				20	uPVC
	6	1	3	TOTAL	2.84	12.35									

PANEL NAME: "PPAd" **LOCATION: ADMINISTRATION OFFICE**

VOLTAGE: 230V
PHASE: 1
WIRES: 2+G
FREQ.: 60HZ

COMPUTATIONS:
It = (102.87 x 0.8) + (4.35 x 0.25) = 83.38 A
Ic = (102.87 x 0.8) + (4.35x 1.5) = 88.82 A

USE: 2-30mm² THHN cu. & 8.0mm²G, 40mmø uPVC
USE: 2P, 100AT, 100AF, 12KAIC

CKT NO.	L.O.	SW.	C.O.	LOAD DESCRIPTION	LOAD (KVA)	AMPERE (A)	CKT. BREAKER				WIRE (mm²)			CONDUIT (mmø)	
							P	AT	AF	KAIC	PHASE	GND	TYPE	SIZE	TYPE
1			9	Gnd flr. Convenience Outlet	1.62	7.04	2	30	50	10	3.5	3.5	THHN	20	uPVC
2	25	1		Gnd flr. Lighting Outlet	1.25	5.43	2	20	50	10	3.5		THHN	20	uPVC
3	24	1		Gnd flr. Lighting Outlet	1.20	5.22	2	20	50	10	3.5		THHN	20	uPVC
4	23	2		Gnd flr. Lighting Outlet	1.15	5.00	2	20	50	10	3.5		THHN	20	uPVC
5	24	1		Gnd flr. Lighting Outlet	1.20	5.22	2	20	50	10	3.5		THHN	20	uPVC
6	16	1		Gnd flr. Lighting Outlet	0.80	3.48	2	20	50	10	3.5		THHN	20	uPVC
7			9	2nd flr. Convenience Outlet	1.62	7.04	2	30	50	10	3.5	3.5	THHN	20	uPVC
8	25	1		2nd flr. Lighting Outlet	1.25	5.43	2	20	50	10	3.5		THHN	20	uPVC
9	24	1		2nd flr. Lighting Outlet	1.20	5.22	2	20	50	10	3.5		THHN	20	uPVC
10	23	2		2nd flr. Lighting Outlet	1.15	5.00	2	20	50	10	3.5		THHN	20	uPVC
11	24	1		2nd flr. Lighting Outlet	1.20	5.22	2	20	50	10	3.5		THHN	20	uPVC
12	16	1		2nd flr. Lighting Outlet	0.80	3.48	2	20	50	10	3.5		THHN	20	uPVC
13			9	3rd flr. Convenience Outlet	1.62	7.04	2	30	50	10	3.5	3.5	THHN	20	uPVC
14	25	1		3rd flr. Lighting Outlet	1.25	5.43	2	20	50	10	3.5		THHN	20	uPVC
15	24	1		3rd flr. Lighting Outlet	1.20	5.22	2	20	50	10	3.5		THHN	20	uPVC
16	23	2		3rd flr. Lighting Outlet	1.15	5.00	2	20	50	10	3.5		THHN	20	uPVC
17	24	1		3rd flr. Lighting Outlet	1.20	5.22	2	20	50	10	3.5		THHN	20	uPVC
18	16	1		3rd flr. Lighting Outlet	0.80	3.48	2	20	50	10	3.5		THHN	20	uPVC
18				Spare	1.00	4.35	2	30	50	10				20	uPVC
4				Spare	1.00	4.35	2	30	50	10				20	uPVC
	336	18	27	TOTAL	23.66	102.87									

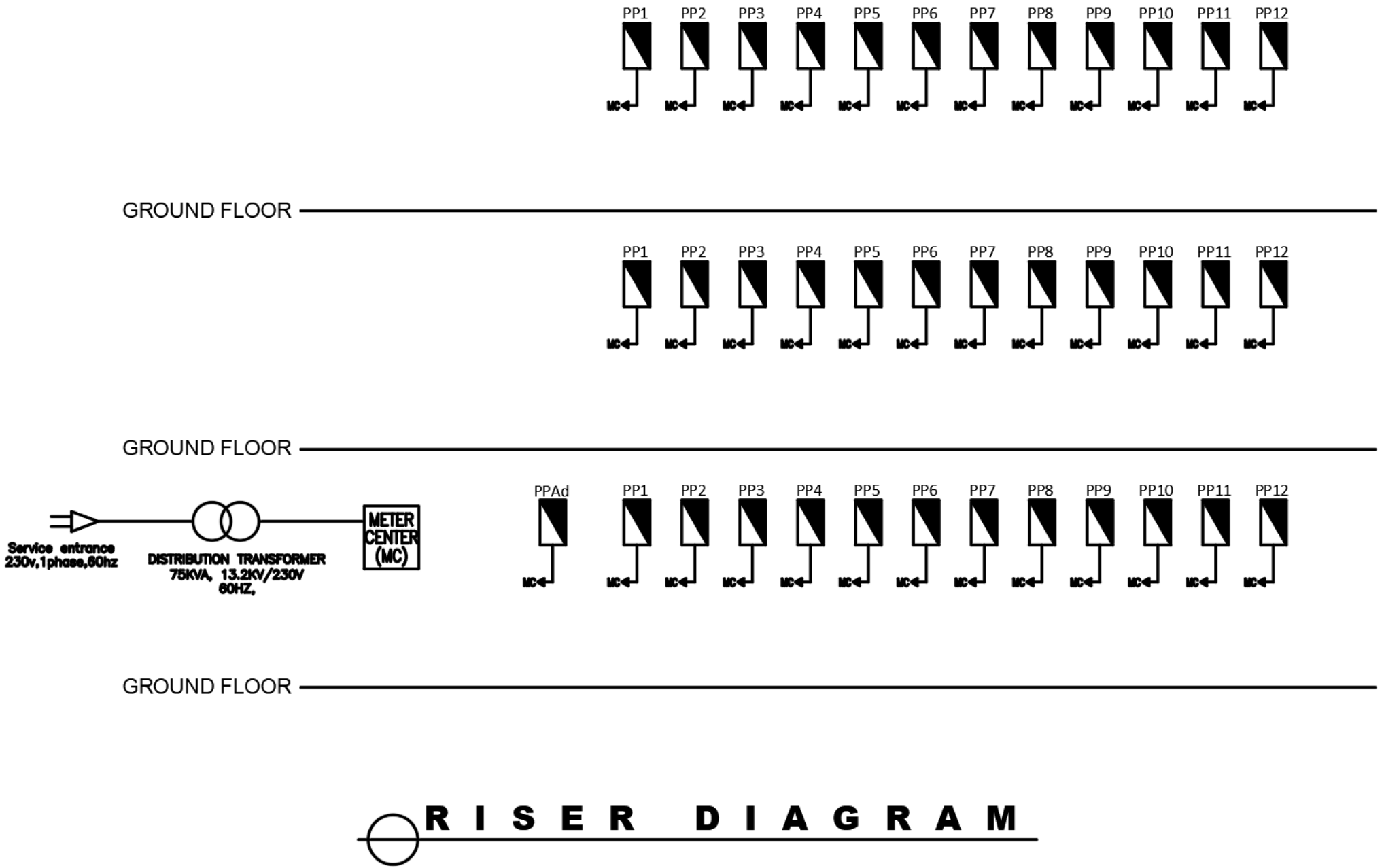
DESIGN ANALYSIS :

TOTAL COMPUTED LOAD = 96,840VA

MAIN SERVICE ENTRANCE CONDUCTORS:
- @80% DEMAND FACTOR
- TOTAL FULL LOAD CURRENT [PEC SECTIONS 4.30.2.4 AND 4.40.1.7]
  - I = (96840/230)(0.7) + (4.35 x 0.25)
  - = 295.82 A
- USE: 2–150MM² THHN CU. WIRE +30MM² G WIRE
  IN 50MMø RSC PIPE

MAIN SERVICE EQUIPMENT:
- @80% DEMAND FACTOR
- TOTAL FULL LOAD CURRENT [PEC SECTIONS 4.30.2.4 AND 4.40.1.7]
  - I = (96840/230)(0.7) + (4.35 x 1.5)
  - = 301.26 A
- USE: 350AT, 350AF, 2P, 35KAIC MAIN CIRCUIT BREAKER

TRANSFORMER SIZING: DIV. FACTOR= 1.3
- KVA = 96840 VA / (1000 x 1.3)
- = 74.49 KVA
- USE: 1x75KVA, 60HZ, 1PHASE, DISTRIBUTION TYPE TRANSFORMER
  13.2KV/240V, WYE–DELTA



RISER DIAGRAM

GENERAL NOTES:

1. ALL ELECTRICAL WORKS AND INSTALLATION HEREIN SHALL BE DONE IN ACCORDANCE W/ THE LASTEST APPROVED EDITOIN OF THE PHIL. ELECTRICAL CODE W/ THE RULES & REGULATION OF THE NATIONAL & LOCAL AUTHORITIES CONCERNED IN THE ENFORCEMENT OF ELECTRICAL LAWS AND ORDINACES & WITH THE POLICIES OF LOCAL UTILITY COMPANY.

2. ALL ELECTRICAL INSTALLATIONS SHALL BE ENCASED IN PVC CONDUIT PIPE EXCEPT FOR SERVICE ENTRANCE W/C SHALL BE IN RIGID STEEL CONDUIT PIPE, PEC CODE ON NON-METALLIC RACEWAYS SHALL BE COMPLIED WITH.

3. ALL MATERIALS TO BE USED SHALL BE NEW AND OF APPROVED TYPE BOTH LOCATION AND PURPOSE INTENED.

4. ALL SERVICE ENTRANCE EQUIPMENT SUCH AS DISTRIBUTION PANEL LIGHTING & POWER PANELS
ETC. SHALL BE PROPERLY GROUNDED IN ACCORDANCE W/ THE REQUIREMENTS OF PEC.

5. ALL OUTDOOR INSTALLATION SHALL BE WEATHER PROOF TYPE.

6. THE CONTRACTOR SHALL VERIFY THE EXACT LOCATION AND COORDINATES W/ PESPECT TO UTILITY COMPANY AND OTHERS,

7. ALL WORKS SHALL BE DONE UNDER DIRECT SUPERVISION OF A DULY LICENSED PROFESSIONAL ELECT'L ENGINEER.

TECHNICAL SPECIFICATIONS:

SOLAR PHOTOVOLTAIC MODULES:

1. FOR THE PV MODULES TO BE USED IN A HIGHLY CORROSIVE ATMOSPHERE THROUGHOUT THEIR LIFETIME THEY MUST QUALIFY TO IEC 61701.
2. THE TOTAL PV ARRAY CAPACITY SHOULD NOT BE LESS THAN THE ALLOCATED CAPACITY (kWp).
3. ADEQUATE PROTECTIVE DEVICES AGAINST SURGES AT THE PV MODULE SHALL BE PROVIDED. LOW VOLTAGE DROP BYPASS DIODES SHALL BE PROVIDED.
4. THE MODULE FRAME SHALL BE MADE OF CORROSION RESISTANT MATERIALS, PREFERABLY HAVING ANODIZED ALUMINUM.

ARRAY STRUCTURE:

1. HOT DIP GALVANIZEDMS MOUNTING STRUCTURES MAY BE USED FOR MOUNTING THE MODULES PANELS/ ARRAYS. MINIMUM THICKNESS OF GALVANIZATION SHOULD BE AT LEAST 120 MICRONS.
2. ALUMINUM STRUCTURES ALSO CAN BE USED WHICH CAN WITHSTAND THE WIND SPEED OF PERSPECTIVE WIND ZONE. NECESSARY PROTECTION TOWARDS RUSTING NEED TO BE PROVIDED EITHER BY COATING OR ANODIZATION. ALUMINUM FRAMES SHOULD BE AVOIDED FOR INSTALLATION IN COASTAL AREAS.
3. THE TOTAL LOAD OF STRUCTURE (WHEN INSTALLED WITH PV MODULES) TERRACE SHOULD BE LESS THAN 60kg/sq.m.
4. THE MINIMUM CLEARANCE OF THE STRUCTURE FROM THE ROOF LEVEL SHOULD BE 300mm.

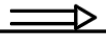
PROTECTIONS:

THE SYSTEM SHOULD BE PROVIDED WITH ALL NECESSARY PROTECTIONS LIKE EARTHING AND LIGHTNING AS FOLLOWS:

A. SURGE PROTECTION
INTERNAL SURGE PROTECTION SHALL CONSIST OF THREE MOV TYPE SURGE-ARRESTORS CONNECTED FROM +VC AND -VC TERMINALS TO EARTH VIA Y ARRANGEMENT.

B. EARTHING PROTECTION
EACH ARRAY STRUCTURE OF PV YARD SHOULD BE GROUNDED/ EARTHED PROPERLY. EARTH RESISTANCE SHALL NOT BE LESS THAN 5 OHMS. IS SHALL BE ENSURED THAT ALL THE EARTHING POINTS ARE BONDED TOGETHER TO MAKE THEM AT THE SAME POTENTIAL.

LEGEND & SYMBOLS:

	Solar Panel
	Surge Protection Device
	Circuit Breaker
	Manual Transfer Switch
	Isolation Switch
	Battery
	Service Entrance
	Electric Meter
	Ground

LOAD COMPUTATION

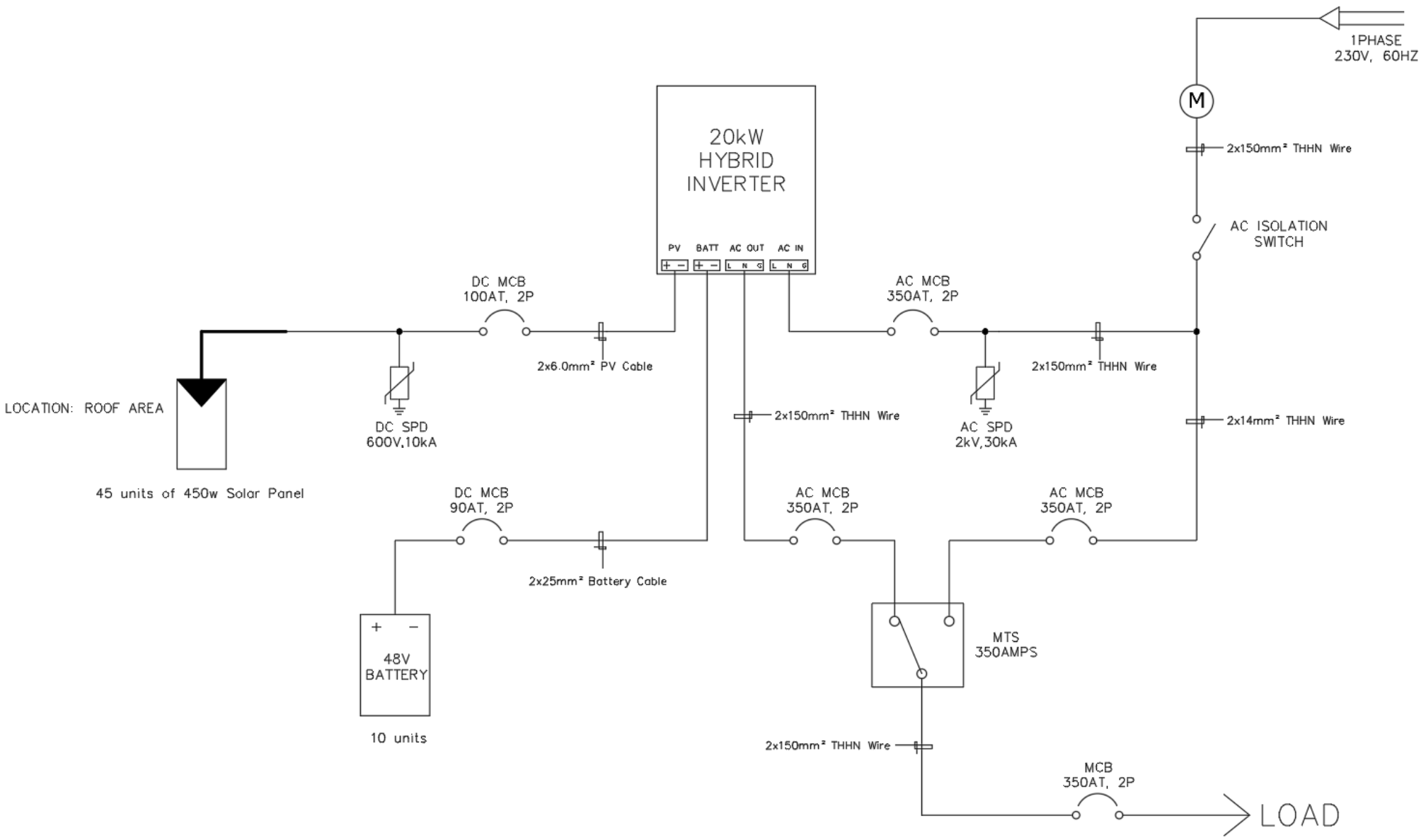
TOTAL CONNECTED LOAD:

Convenience outlet @180va	=6 x 180va	=1080va
Computer outlet @300va	=2 x 300va	=600va
1.5hp Aircon	=4.6A x 220v	=1012va
Lighting Outlet @50va	=14 x 50va	=700va
		3392va

It =(3392VA/220) + (4.6Ax0.25)
=16.57A

Ic =(3392VA/220) + (4.6Ax1.5)
=22.32A

USE: 2–14 SQ.MM THHN WIRE
USE: 63AT, 100AF, 2P CIRCUIT BREAKER



SINGLE LINE DIAGRAM

NOT TO SCALE

INVERTER SPECIFICATIONS 25 DEG. CELCIUS CELL TEMPERATURE (STC)	
Max. PV Array Power	5000W
Rated Output Power	5500W
Max. PV Array Open Circuit Voltage	500Vdc
MPPT Range @ Operating Voltage	120–450Vdc
GRID TIE OPERATION	
GRID OUTPUT (AC)	
Nom. Output Voltage	220/230/240Vac
Output Voltage Range	184–265Vac
Nom. Output Current	25A/23.9A/22.9A
Efficiency	Up to 93.5%
OFF–GRID, HYBRID OPERATION	
GRID INPUT	
Acceptable Input Voltage Range	120–280Vac
Frequency Range	50Hz/60Hz
BATTERY MODE OUTPUT (AC)	
Nom. Output Voltage	220/230/240Vac
Output Waveform	Pure sine wave
BATTERY & CHARGER	
Nom. DC Voltage	48Vdc
Max Solar Charge Current	90A
Max. AC Charge Current	60A
Max Charge Current	90A
EMERGENCY OUTPUT POWER	
Max. Output Power	5500W
Surge Power	11000W
Automatic Transfer Time	<8ms
GENERAL	
Operating Temperature	0 to 50°C
Net Weight	9kg
Dimension	115x300x400mm

SOLAR CABLE SPECIFICATIONS	
Name	Single core Solar Calbe
Type	PV–1 1x4mm²
Conductor Material	Tinned copper
Insulation Material	XLPE
Rated Voltage	1.0/1.8kV
Rated Current	42A
Bend Radius	12mm: 3xD>∅>12mm: 4xD
Temperature Range	–45 to 120°C
Test Voltage	6500Vac
Resistance	(20°C) < 5.09ohm/km

STRING SCHEDULE						
MODULE NUMBER	Voc (Volts)	Isc (Amps)	WATT–PEAK	Vmp (Volts)	Imp (Amps)	PV CONDUCTOR
1	40.1	9.72	300	32.6	9.21	
2	40.1	9.72	300	32.6	9.21	
3	40.1	9.72	300	32.6	9.21	
4	40.1	9.72	300	32.6	9.21	
5	40.1	9.72	300	32.6	9.21	
6	40.1	9.72	300	32.6	9.21	
7	40.1	9.72	300	32.6	9.21	
8	40.1	9.72	300	32.6	9.21	
9	40.1	9.72	300	32.6	9.21	
10	40.1	9.72	300	32.6	9.21	
TOTAL	401	9.72	3000	326	9.21	
Vmax of string =VocxNs = 40.1 x 10 = 401V		Ampacity of String Conductor: I(cond) =1.25x9.72A = 12.15A		@50°C Use: 2–4.0mm² PV Cable +1–5.5mm² THHN Wire Use: 13at,50af,2p, DC breaker		

BATTERY SPECIFICATIONS	
Type	Lithium Battery
Nom. Voltage	48V
Rated Capacity	200AH (0.2°C/25°C)
Operating Voltage	42V–58.4V
Charging Voltage	56V (+/–) 1V
Discharge cut–off voltage	42V (+/–) 2V
Charging Current	20A
Continuous Current	50A
Discharge Current (Max.)	100A (<3sec.)
Cycle Life	>2000 Cycles
Efficiency of Charge	100% @0.3C
Efficiency of Discharge	96–99% @1C

PV MODULE SPECIFICATIONS	
Max. Power (Pmax)	300Wp
Voltage @ Pmax (Vmp)	32.6V
Current @ Pmax (Imp)	9.21A
Open-Circuit Voltage (Voc)	40.1V
Short-Circuit Current (Isc)	9.72A
Maximum System Voltage	1000Vdc
Fuse Rating	15A
Operating Temperature	-40°C to +85°C
Nom. Operating Cell Temp (NOCT)	44.5 (+/-) 2°C
Cell Technology	Mono-si
Application Class	A
Dimension (mm)	1640x992x40

ARRAY LOAD SCHEDULE

MPPT	Voc (Volts)	Isc (Amps)	WATT-PEAK	Vmp (Volts)	Imp (Amps)	PV CONDUCTOR
1	401	9.72	3000	326	9.21	

DESIGN ANALYSIS

PV string conductor: (Solar PV panel to Inverter)

Temperature correction for Isc at 55°C, α =0.045%/°C

Imax @55°C=(Isc @25°C)[1+(αxΔt/100%)]

=9.85A

Minimum ampacity of conductor *Ref. PEC 6.90.2.2(B)*

Icond =1.25 x Imax

=1.25 x 9.85A

=12.32A

Ampacity Temp. Correction *Ref. PEC Table 6.90.4.1(A)*

Ambient temp. 50°C

Icond =42A x 0.76

=31.92A (Sufficient)

Use: 2-4.0mm^2 PV Cable + 1-5.5mm^2 THHN Wire

Use: 13AT, 2P, 600Vdc, DC Circuit Breaker

VOLTAGE DROP CALCULATION:

VD = 2 x 5.09ohm/km x 20m x 9.21A

= 2 x 5.09ohm/km x 0.02km x 9.21A

= 1.88Vdc

%VD = VD x 100% / Vmp

= 1.88Vdc x 100% / 326Vdc

%VD = 0.58%

INVERTER TO UTILITY

CKT. NO.	INVERTER	RATED POWER (W)	OUTPUT VOLTAGE (Vac)	MAX. OUTPUT CURRENT (A)	CB RATING		SIZE OF CONDUCTOR AND CONDUIT
					AT	P	
1	INVERTER-01	20,000	230	150	150	2	

Inverter to Grid: Use 2-30mm THHN Wire
PV Disconnect: 150at,2p,230v in
NEMA 3R enclosure

DESIGN ANALYSIS

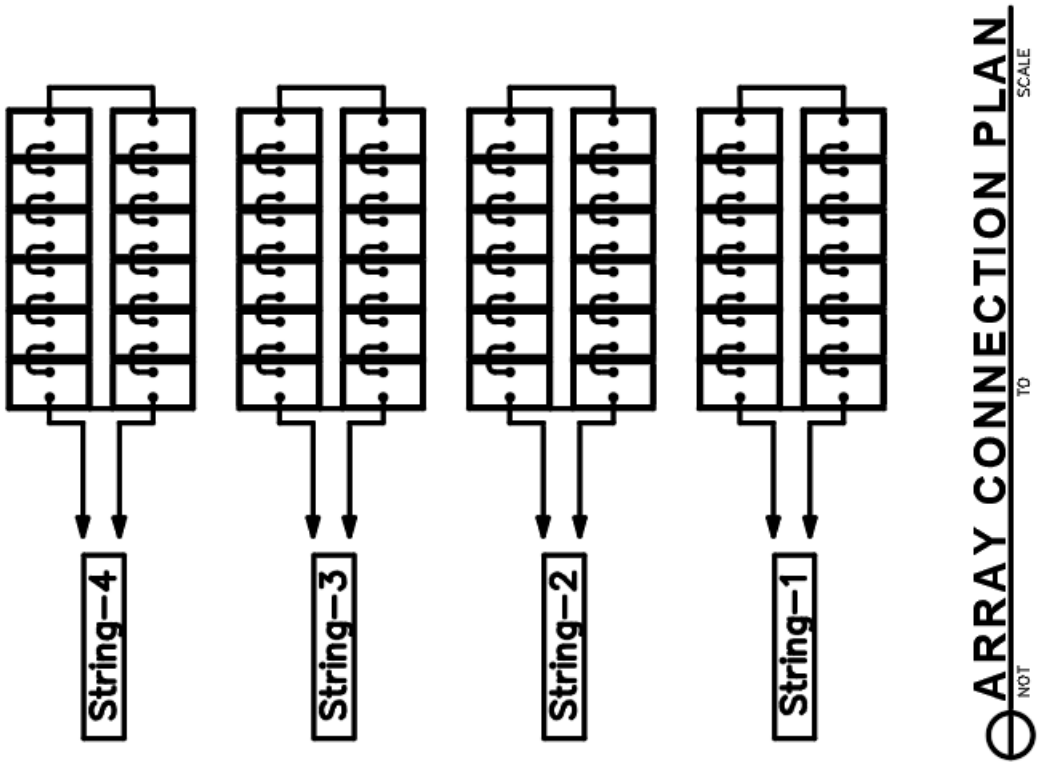
Inverter to Utility Conductor
Ic =1.25 x 25A
=31.25A

VOLTAGE DROP CALCULATION
VOLTAGE DROP (VD) = $2LI \times \sqrt{R^2+X^2} / 305$
I = LINE CURRENT, A
L = DISTANCE, m
R = AC RESISTANCE, Ω
X = REACTANCE @60HZ, Ω

FEEDER SIZE: 2-5.5mm² THHN wire
I = 25A
L = 10m
R = 1.2 Ω/305m [PEC TABLE 10.1.1.9]
X = 0.05 Ω/305m [PEC TABLE 10.1.1.9]

$VD = 2 \times 10 \times 25 \times \sqrt{1.2^2 + 0.05^2} / 305$
= 1.97 V

%VD = 1.97 x 100% / 230
= 0.96 %


String–4
String–3
String–2
String–1
ARRAY CONNECTION PLAN
NOT
TO
SCALE

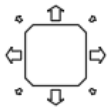
MECHANICAL PLAN

GENERAL NOTES:

1. CONTRACTOR IS ADVISED TO VISIT AND SURVEY THE PLACE OF INSTALLATION.
2. ALL AIR CONDITIONING UNITS AND VENTILATING UNITS TO BE SUPPLIED SHALL BE NEW AND APPROVED PRODUCTS OF REPUTABLE MANUFACTURERS.
3. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO COORDINATE CLOSELY HIS WORK WITH THE OTHER TRADES CONCERNED.
4. REFRIGERANT SUCTION LINES SHALL BE INSULATED WITH 25 mm THICK PREMOULDED ELASTOMERIC RUBBER INSULATION AS MANUFACTURED BY "ARMAFLEX",AEROFLEX OR APPROVED EQUAL.
5. INDIVIDUAL WEATHER PROOF TYPE CIRCUIT BREAKER SHALL BE PROVIDED PROVIDED FOR ALL CONDENSING UNITS.
6. ALL EXPOSED DRAIN LINES TO THE CEILING SHALL BE PROVIDED WITH INSULATION TYPICAL TO REFRIGERANT PIPING. (REFER TO PIPE INSULATION DETAIL.)
7. ALL EXPOSED DRAIN LINES TO THE CEILING SHALL BE PROVIDED WITH INSULATION TYPICAL TO REFRIGERANT PIPING.(REFER TO PIPE INSULATION DETAIL.)
8. ALL NECESSARY GOVERNMENT PERMITS SHALL BE SECURED AND FOR ACCOUNT OF THE CONTRACTOR.
9. AS-BUILT PLANS SHALL BE PROVIDED BY THIS CONTRACTOR AFTER COMPLETION OF WORKS.
10. ALL INSTALLATION WORKS SHALL BE DONE IN A NEAT AND WORK-MANLIKE MANNER.
11. ALL REFRIGERANT SUCTION LINES EXPOSED INDOORS AND/OR EXPOSED TO WEATHER SHOULD BE PROVIDED WITH GAUGE #24 ALUMINUM CLADDING. (SUBMIT SHOP DRAWING PRIOR TO INSTALLATION)
12. ALL ACCU's AND FCU's SHALL BE PROVIDED WITH ANGULAR BAR SUPPORTS. (SUBMIT SHOP DRAWING PRIOR TO INSTALLATION)

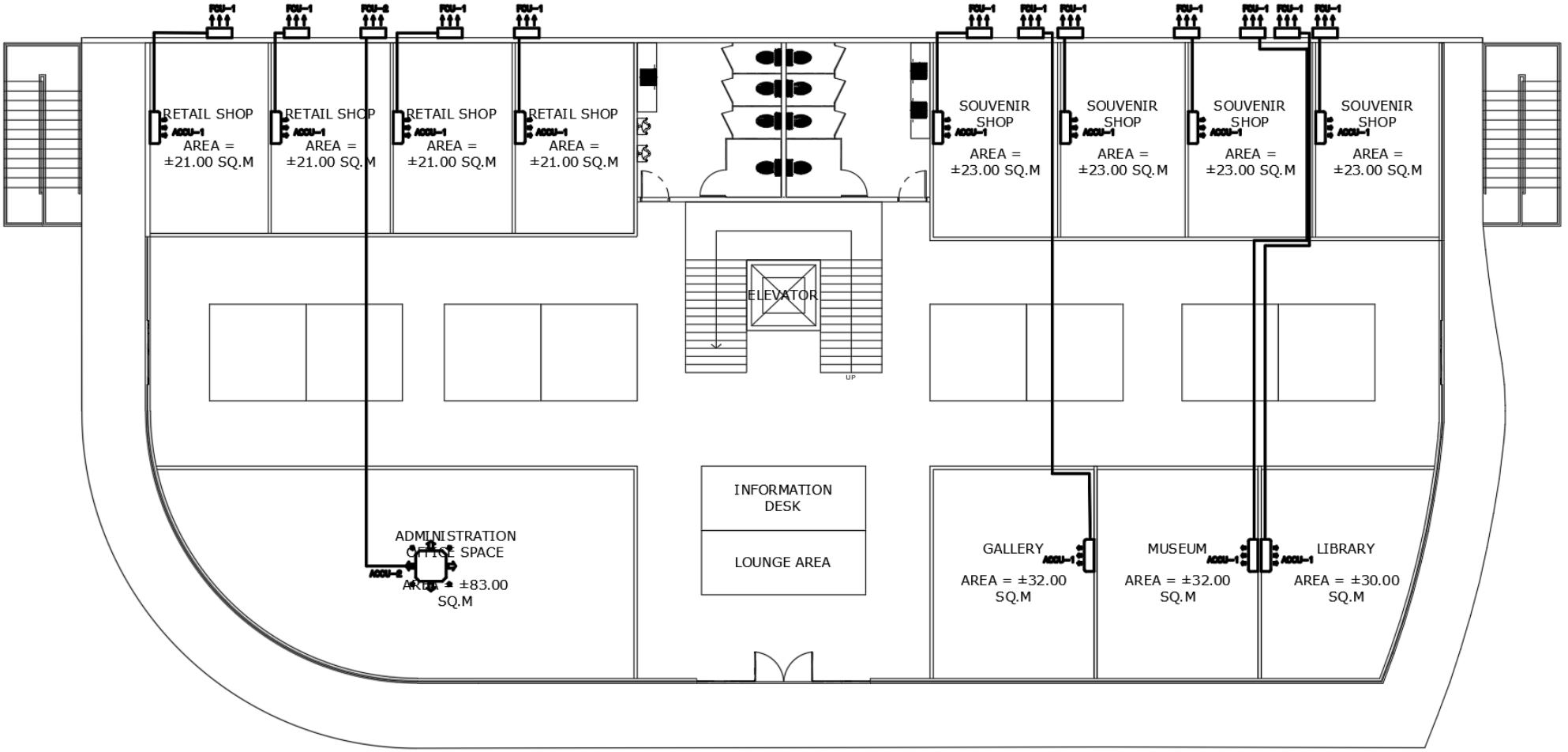
LEGEND AND SYMBOLS:

WALL MOUNTED TYPE FAN COIL UNIT



CEILING CASSETTE EXHAUST FAN

AIR COOLED CONDENSING UNIT



TYPICAL AIR CONDITIONING LAYOUT

SCALE 1:100

SCHEDULE OF EQUIPMENT

SCHEDULE OF SPLIT TYPE AIR CONDITIONER

INDOOR UNIT

DESIGNATION	QTY.	COOLING CAPACITY		DIMENSION WxDxH	AIR FLOW m^3 / hr	ELECTRICAL DATA							REMARKS
		BTU/hr	kJ/hr			POWER INPUT (kW)	EER	CURRENT (A) STARTING	CURRENT (A) RUNNING	VOLTS	PHASE	HERTZ	
ACCU-1	33	12,953	13,665	802 x 189 x 2975	566	0.91	14.2	-	4.6	230	SINGLE	60	ALL UNITS SHALL BE BRAND NEW & COMPLETE ELECTRONIC (REMOTE) CONTROL WITH STANDARD ACCESSORIES, READY FOR SERVICE.
ACCU-2	3	38,000	40,090	840 x 840 x245	2,000	3.10	12.3	-	16.7	230	SINGLE	60	NOTE : ALL FAN COIL UNITS (FCUS) SHALL BE PROVIDED WITH EVAPORATOR DRAIN PIPE.

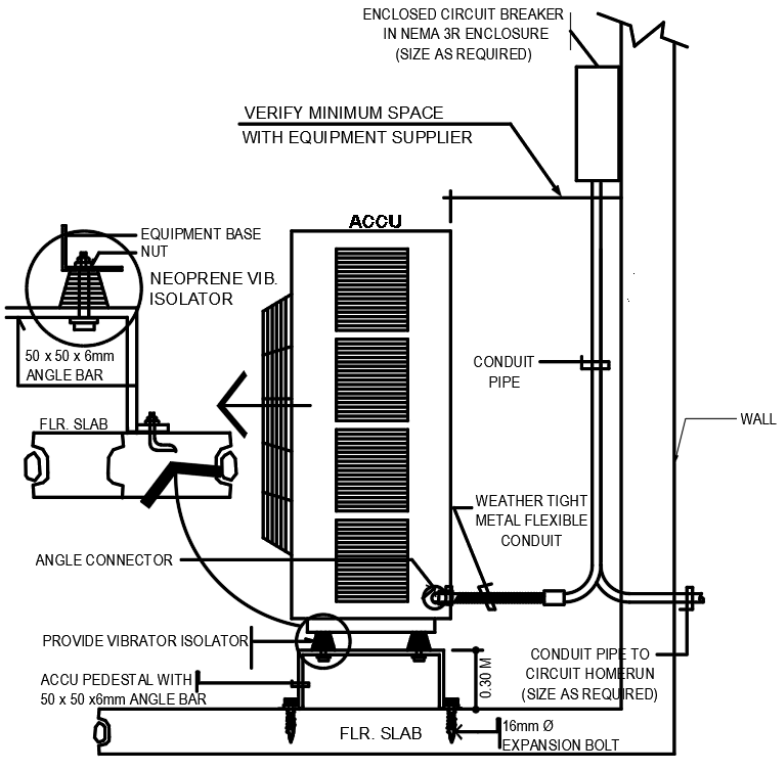
OUTDOOR UNIT

DESIGNATION	QTY.	COMPRESSOR		DIMENSION WxDxH	FAN MOTOR OUTPUT (W x Qty)	PIPING CONNECTIONS			REFRIGERANT	WEIGHT (kg)	REMARKS
		Type	QTY.			MAX LENGTH (m)	LIQUID (mm)	GAS (mm)			
FCU-1 (WM)	33			770 x 300 x 555		25	6.35Ø	12.7Ø	410 A	26.3	
FCU-2 (CS)				946 x 410 x810		30	9.52Ø	15.9Ø	410 A	69	

ELEVATOR SCHEDULE

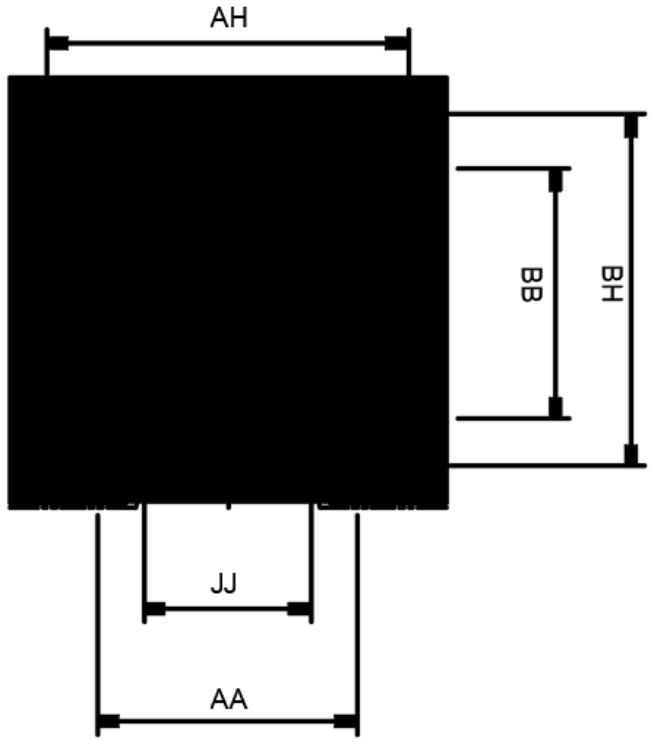
MAKE	MITSUBISHI STANDARD
CODE	P15
NO. OF PERSONS	15
RATEDSPEED	1.0 M/S
RATED CAPACITY	1000 KG
DOOR TYPE	2-PANEL CENTER OPENING
PHASE	3-PHASE
ENTRANCE WIDTH (JJ)	1000 MM
CAR DIMENSIONS	AA = 1800 MM BB = 300 MM 1
COUNTERWEIGHT POSITION	REAR
MINIMUM HOISTWAY DIMENSION	AH = 2200 MM BH = 1860 MM
MINIMUM MACHINE ROOM DIMENSION	AH = 2200 MM BH = 1900 MM
NO. OF STOPS	5
HP OF MOTOR	15 HP
POWER SUPPLY	3 220V 60 HZ

* THE CONTRACTOR SHALL VERIFY AND SUBMIT SHOP DRAWINGS FOR CONSULTANTS APPROVAL.
THE DIMENSIONS ARE BASED ON THE SPECIFIC APPROVED BRAND.



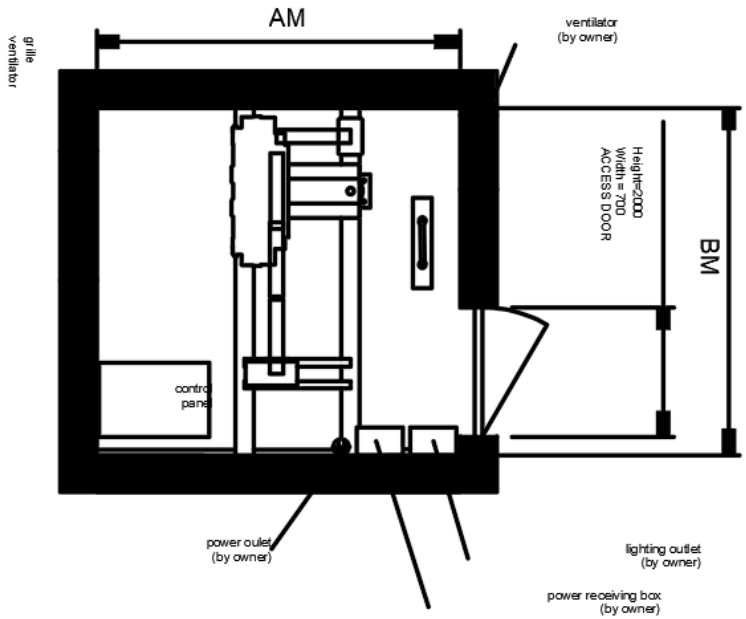
ACCU MOUNTING DETAIL

NOT TO SCALE



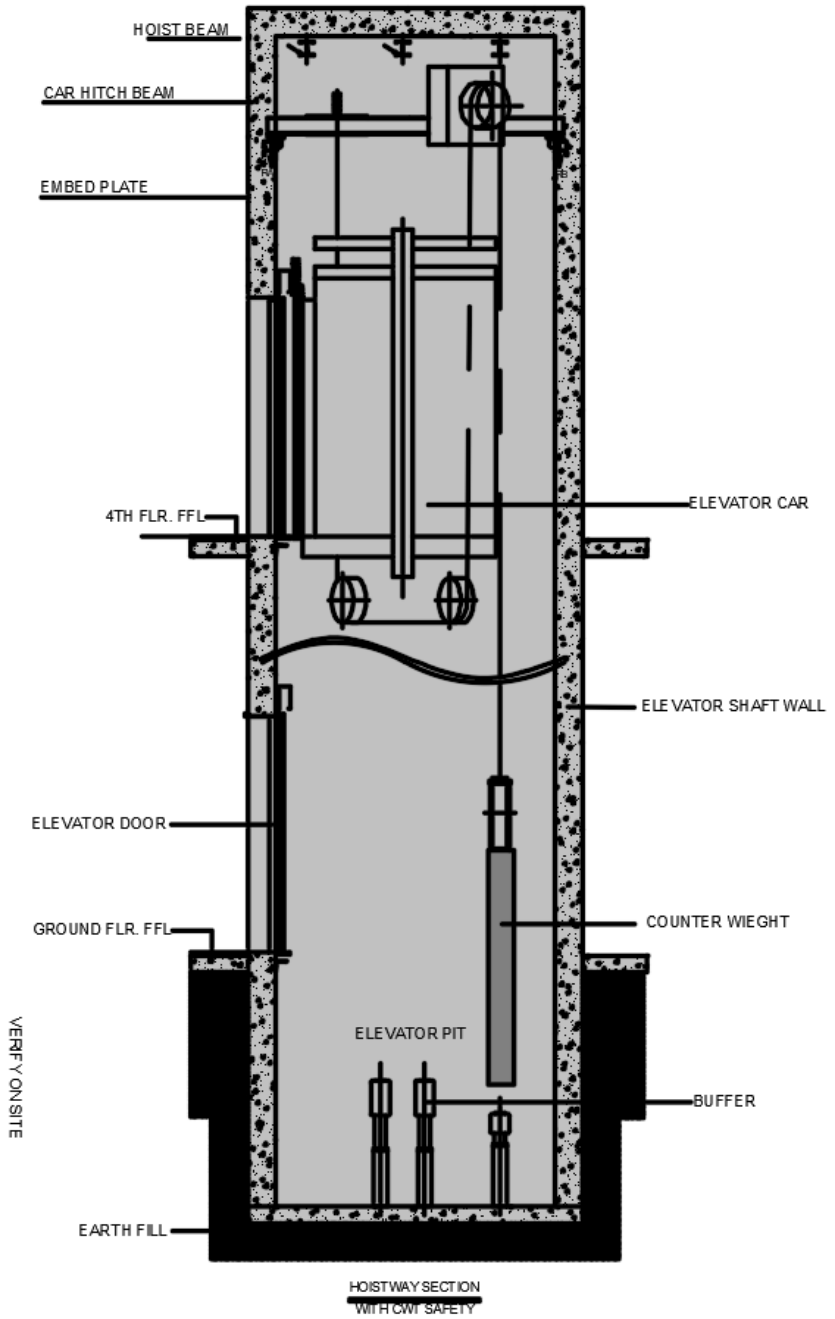
HOISTWAY PLAN

NOT TO SCALE



MACHINE ROOM PLAN

NOT TO SCALE



HOISETWAY VERTICAL LAYOUT

NOT TO SCALE

PLUMBING PLAN

GENERAL NOTES :

1. ALL PLUMBING WORKS HEREIN SHALL BE EXECUTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE NATIONAL PLUMBING CODE, AND THE RULES AND REGULATIONS OF THE CITY.

2. COORDINATE THE DRAWINGS WITH OTHER RELATED DRAWINGS AND SPECIFICATIONS. THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCY FOUND HEREIN.

3. PIPES SHALL BE INSTALLED AS INDICATED. ANY RELOCATION REQUIRED FOR PROPER EXECUTION OF OTHER TRADES SHALL BE WITH THE PRIOR APPROVAL OF THE ARCHITECT OR ENGINEER.

4. SANITARY AND DRAINAGE LINES SHALL HAVE A MINIMUM SLOPE OF 1 %.

5. ALL INDIVIDUAL BRANCHES SHALL BE VENTED UNLESS OTHERWISE NOTED.

6. DIMENSIONS ARE IN MILLIMETER (mm) UNLESS OTHERWISE INDICATED.

7. SIZES OF WATER SUPPLY PIPES TO FIXTURES SHALL BE IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

8. THE CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES AT SITE AND COORDINATE THE WORKS WITH SEWER EFFLUENT DISPOSAL AND WATERLINE SERVICES CONNECTING POINT.

9. THE WORK THROUGHOUT SHALL BE EXECUTED IN THE BEST AND MOST THOROUGH MANNER KNOWN TO SATISFACTION OF ARCHITECT OR ENGINEER.

10. PIPES FOR COLD WATER LINES SHALL BE POLYPROPYLENE Pn10 FUSION WELD PIPES, INCLUDE TRIMS AND FITTINGS. PIPES FOR HOT WATER LINES (OPTIONAL) SHALL BE POLYPROPYLENE Pn20 FUSION WELD PIPES, INCLUDE TRIMS AND FITTINGS.

11. PIPES FOR SANITARY LINES SHALL BE uPVC EXTRA SERIES 1000, INCLUDING TRIMS AND FITTINGS.

12. PIPES FOR VENT LINES SHALL BE uPVC EXTRA SERIES 1000, INCLUDING TRIMS AND FITTINGS.

13. CONCEAL ALL PIPES, WATER LINES AND VENTS SHALL BE SUPPLIED AND INSTALLED IN ACCORDANCE W/ THE APPROVED WORKMANSHIP. ALL MOTOR PUMPS TECHNICAL BROCHURE & PERFORMANCE, SAMPLE OF PLUMBING FIXTURES, FLOOR DRAINS, ROOF DRAINS, GUTTER DRAINS AND CLEAN OUTS MUST BE APPROVED BY THE ARCHITECT PRIOR TO PROCUREMENT AND INSTALLATION.

MATERIAL SPECIFICATION

COLD WATER LINE

SHALL BE POLYPROPYLENE RANDOM PIPE(PPR-PN16)

SEWER LINE

SHALL BE POLYVINYL CHLORIDE (PVC) PIPE SERIES 1000 HIGH IMPACT

SIMILAR TO NELTEX, EMERALD, CROWN BRAND OR APPROVED EQUAL.

VENT LINE

SHALL BE POLYVINYL CHLORIDE (PVC) PIPE SERIES 600

SIMILAR TO NELTEX, EMERALD, CROWN BRAND

DOWN SPOUT

SHALL BE POLYVINYL CHLORIDE (PVC) PIPE SERIES

1000 HIGH IMPACT SIMILAR TO NELTEX, EMERALD, CROWN BRAND

WATER METER

SIMILAR TO BADGER, ARAD ASAHI

GATE VALVE

SIMILAR TO KITZ, CRANE, NIBCO, OR APPROVED EQUAL.

SITE STORM DRAINAGE LINE

SHALL BE POLYVINY CHLORIDE, PVC (<250mm)

SHALL BE REINFORCED CONCRETE PIPE, RCP (>250mm)

P-TRAP

SHALL BE STAINLESS STEEL AND/OR DURABLE CHROME PLATED

WATER CLOSET

SHALL BE DUAL FLUSH TYPE AND HAS ANTIBACTERIAL SEAT

FAUCET

SHALL BE LEVER TYPE STAINLESS STEEL

NOTE: All Computations, Sizes and Dimensions are Based on the Revised National Plumbing Code of the Philippines (RNPCP). Only Water Closets shall be tapped to the Septic Vault. Bath Tub, Lavatory, Floor Drain & Kitchen Sink shall be tapped to the nearest Catch Basin.

A. FOR THE SIZE AND CAPACITY OF THE SEPTIC VAULT

1. DRAINAGE FIXTURE UNIT LOAD (dfu)
   - WC = 2 x 6 = 12 dfu
   - URI = 1 x 6 = 6 dfu
   - FD = 2 x 2 = 4 dfu
   - LAV = 2 x 2 = 4 dfu
   - TOTAL = 26 dfu
2. BASED ON THE TABLE B-2 OF RNPCP FOR 26 dfu TOTAL LOAD
   - The minimum SEPTIC TANK CAPACITY shall be:
   - 1,500 gallons = 5,678 liters = 5,678 cubic meter
3. BASED ON THE APPENDIX B.5.4 OF PRNCP
   - 3.a. DIGESTIVE CHAMBER = $\frac{2}{3}$ OF 5,678 = 3.8 cubic meter
   - W = 1.40m, L = 1.80m, D = 1.50m,
   - 3.b. LEACHING CHAMBER = $\frac{1}{3}$ OF 5.6783 = 1.9 cubic meter
   - W = 1.40m, L = 0.90m, D = 1.50m,

B. FOR THE SIZE OF SOIL AND WASTE PIPE, DRAIN AND SEWER PIPE

BASED ON THE TABLE 7-1 AND 7-2 OF RNPCP, THE SIZES OF FF. SHALL BE:
Bldg. Drain Pipe= 150mm dia ; Floor Drain Pipe= 50mm dia
Bldg. Sewer Pipe= 150mm dia ; Vent Thru Roof= 50mm dia
Water Closet= 100mm dia ; Kitchen Sink= 50mm dia
Lavatory Pipe= 50mm dia; Drainage Pipe= 150mm dia

C. FOR THE SIZE OF DOWNSPOUT AND ROORDRAIN

BASED ON THE TABLE 11-1 OF RNPCP, WHERE RAINFALL INTENSITY IS 102mm/hr AND ROOF AREA 60.0 sq. m.

ROOF DRAIN = 75mm dia: DOWNSPOUT = 75mm dia
USE: 8 pieces or more or 75mm dia. RD, DS

D. FOR THE SIZE OF WATER SUPPLY AND BRANCH PIPE

WATER SUPPLY FIXTURE UNIT LOAD
WC = 2 x 6 = 12 wsfu TOTAL wsfu = 35 wsfu
LAV = 2 x 2 = 4 wsfu
FAU = 2 x 4 = 8 wsfu
URI = 1 x 3 = 3 wsfu
SHO = 2 x 4 = 8 wsfu

FROM CHART A-4 TO A-7 OF RNPCP, THE 17 wsfu INCLUDING FRICTION LOSS, THE SUPPLY MAIN COLD WATER PIPE SHALL BE 25mm dia.

FROM WATER LINE TO FIXTURE PIPE, THE PIPE SIZE SHALL BE:
WC = 10mm dia. ; SH = 13mm dia.
LAV = 10mm dia. ; KS = 13mm dia.
BT = 13mm dia. ; HB = 25mm dia.

E. FOR WATER VOLUME DEMAND

ASSUME 8 gallons PER wsfu FOR COMMERCIAL USED,
WATER VOLUME = 8 x 33 = 264 gallons
FIRE RESERVE = 400 gallons
TOTAL GALLONS = 664 gallons x 3.79 = 2,516.56 liters
USE: 1-2,500 liters CAPACITY STAINLESS TANK

F. FOR HORSEPOWER RATING OF TRANSFER PUMP

2,500 liters STAINLESS TANK WATER SUPPLY SHALL BE PUMP 1.5 hp ELECTRIC MOTOR PUMP.

I, _____, DO HEREBY AGREE, THAT THE TOP SLAB OF THE SEPTIC VAULT SHALL NOT BE CONSTRUCTED OR PUT INTO PLACE, NOT UNTIL AFTER INSPECTION BY THE MASTER PLUMBER IN-CHARGE OF CONSTRUCTION AND AFTER APPROPRIATE INSPECTION REPORT FORMS HAVE BEEN SIGNED BY THIS MASTER PLUMBER, THAT INDEED, THE SEPTIC VAULT IS WATERTIGHT/WATERPROOFED.

THIS SIGNED REPORT FORM SHALL THEN ATTACHED BY ME WHEN APPLYING FOR THE CERTIFICATE OF OCCUPANCY.

THE UNDERSIGNED ALSO ACKNOWLEDGE TO ABIDE WITH THE PROVISION AS STATED ON TABLE B-1 OF THE REVISED NATIONAL PLUMBING CODE OF THE PHILIPPINES.

SIGNATURE OF THE OWNER

REFERENCE:

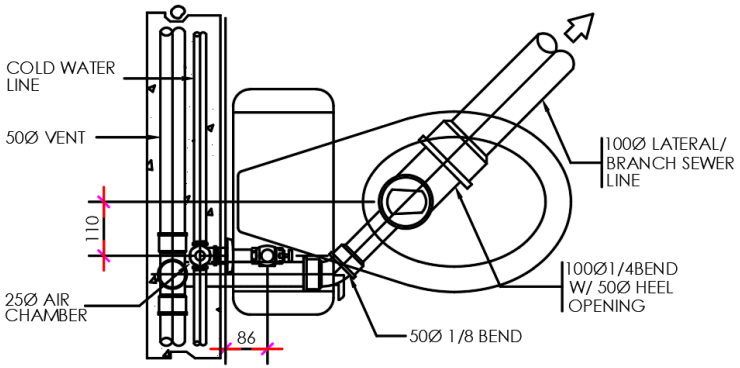
REVISED NATIONAL PLUMBING CODE OF THE PHILIPPINES 2020

DRAINAGE FLOW / WATER DEMAND

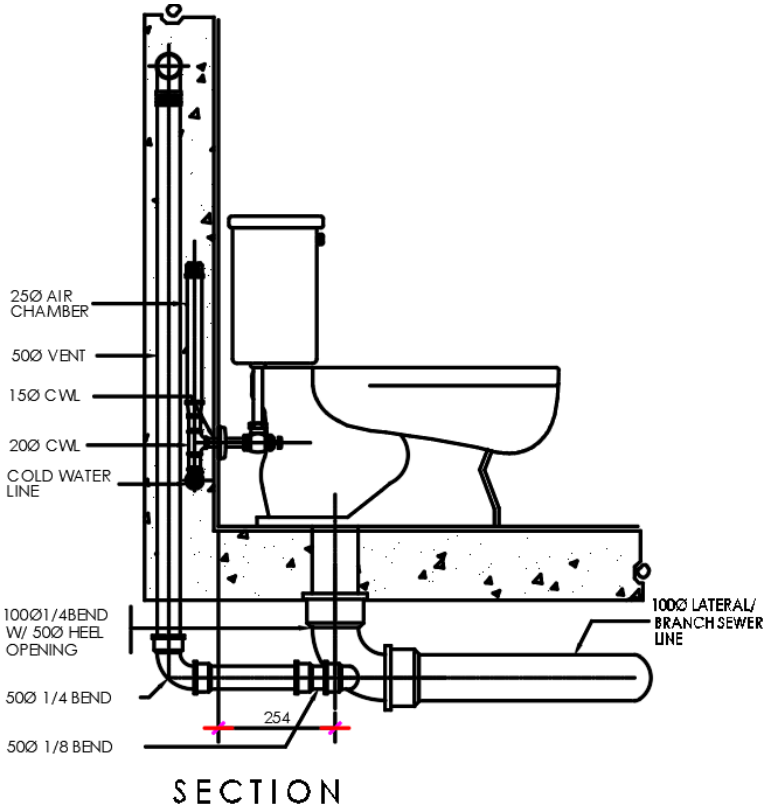
FIXTURE TYPE	UNIT	(DFU)	(WSFU)
WC	4	2	8
UR	2	2	4
SHO	0	0	8
LAV	2	2	4
FAU	2	2	4
SINK	0	0	0
BD	0	0	0
	TOTAL:	8	28

LEGEND

CB	CATCH BASIN
FD	FLOOR DRAIN
WC	WATER CLOSET
BD	BIDET WATER CLOSET
UR	URINAL
LAV	LAVATORY
FAU	FAUCET
SHO	SHOWER
SVTR	STACK VENT THRU ROOF
PVC	POLY VINYL CHLORIDE
CO	CLEANOUT
MH	MANHOLE
ST	SEPTIC TANK
	SEWAGE LINE
	WATER LINE
GV	GATE VALVE
M	WATER METER



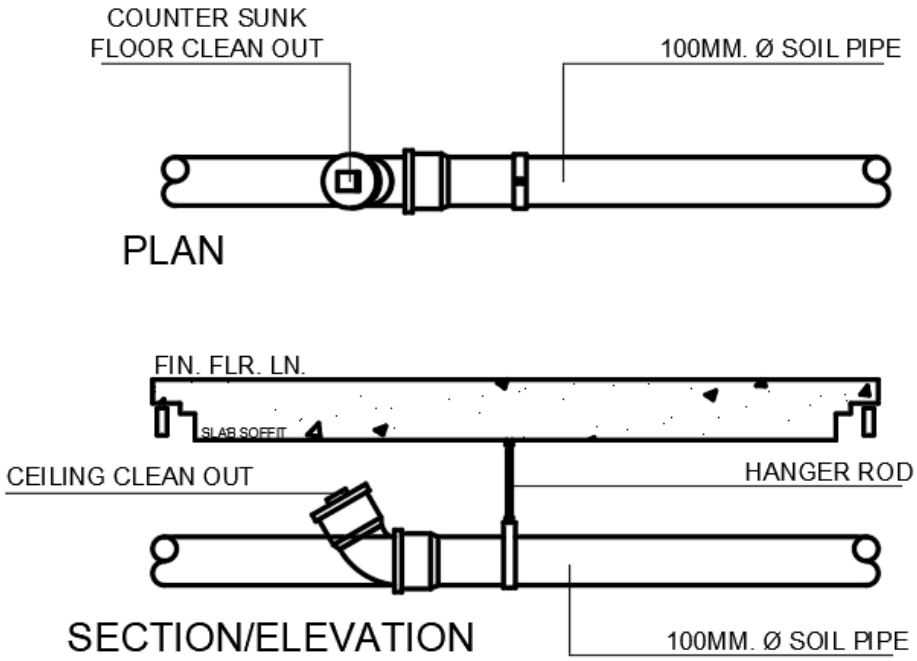
PLAN

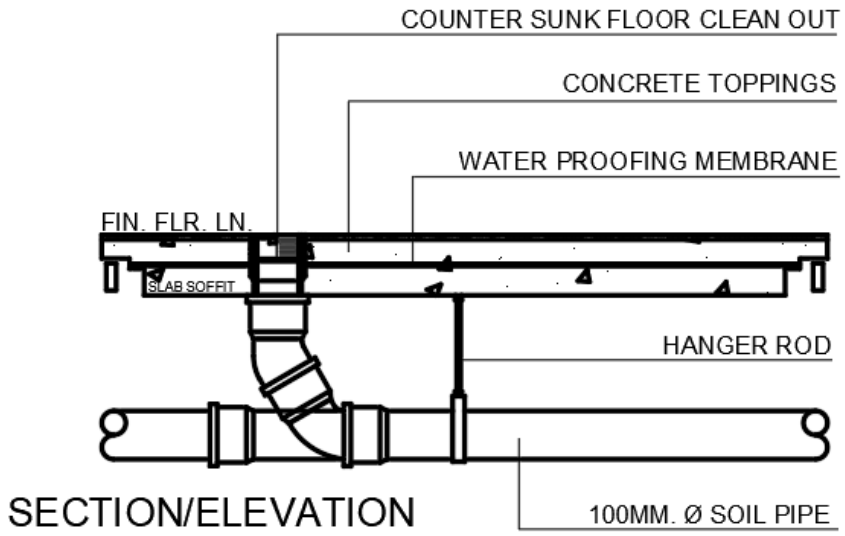


SECTION

DETAIL OF TANK TYPE WATER CLOSET MOUTING

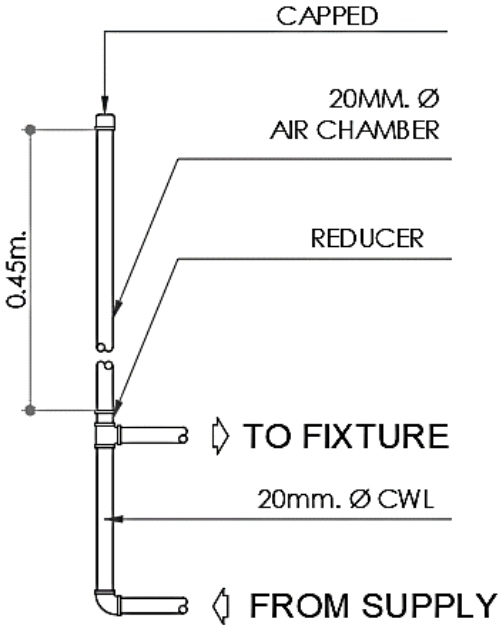
SCALE 1:20 M

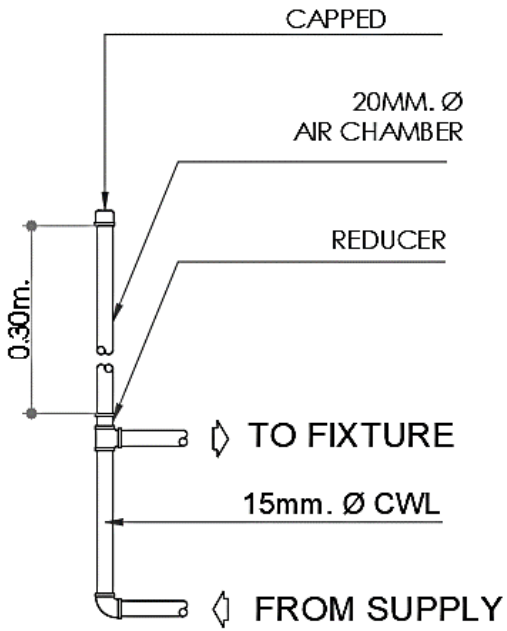




CLEAN OUT DETAIL

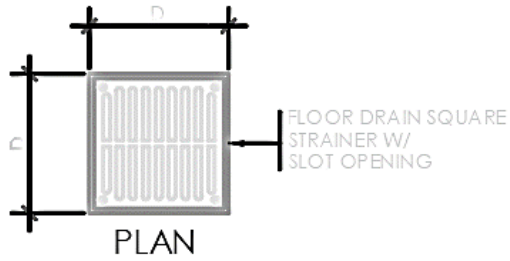
SCALE NTS



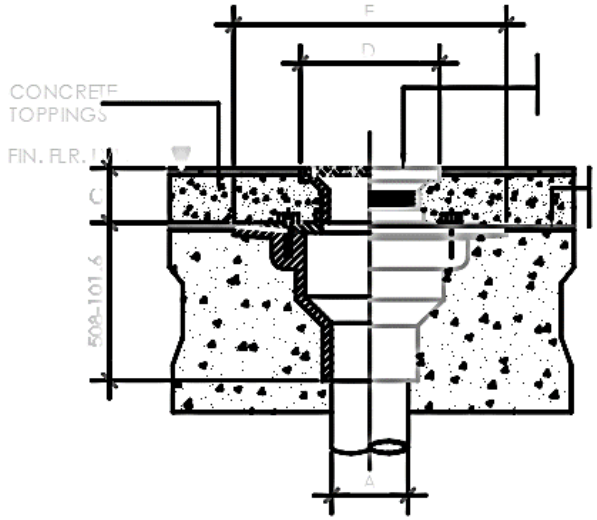


AIR CHAMBER DET.

SCALE NTS



PLAN



SECTION

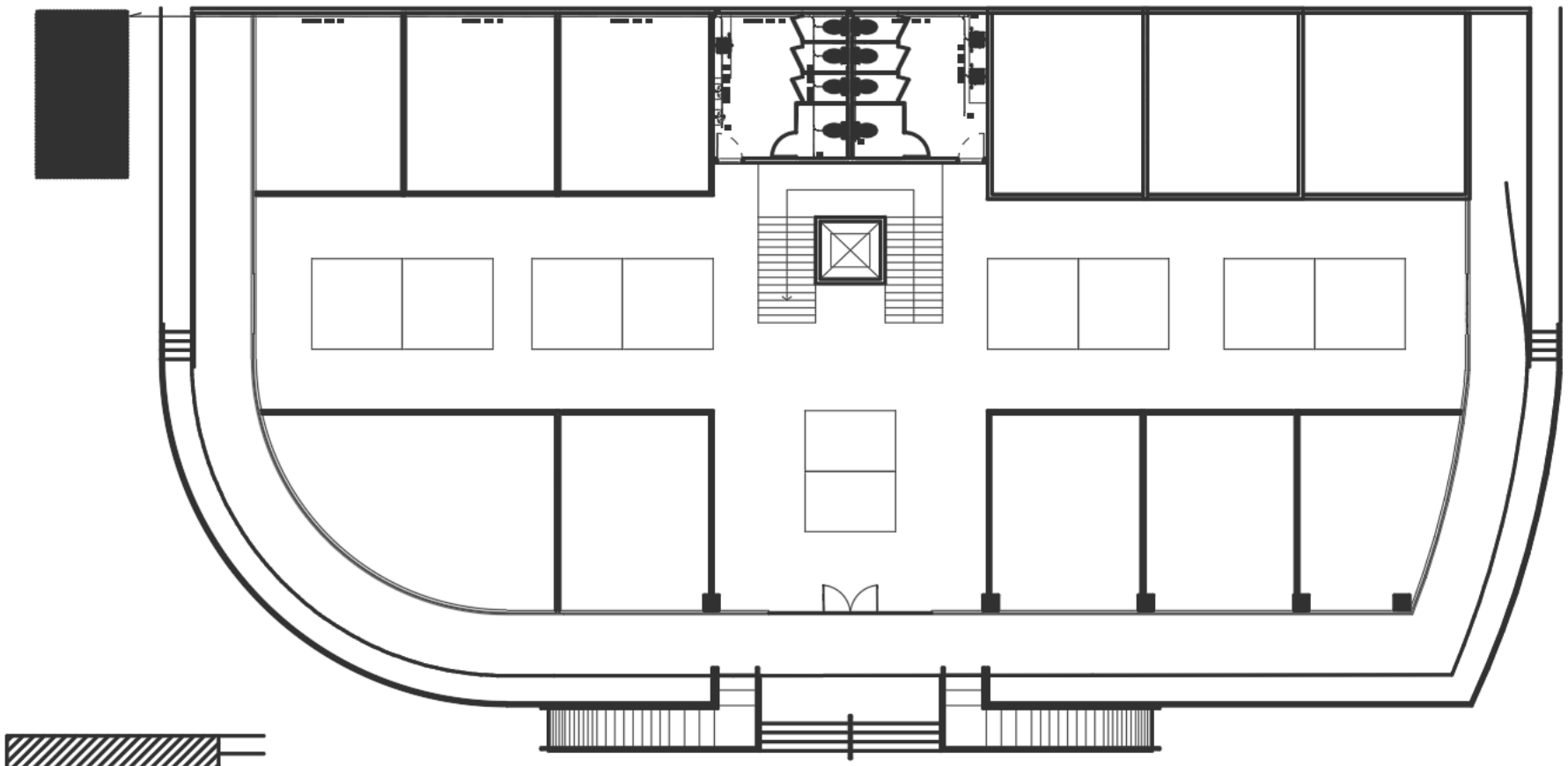
SCHEDULE OF DIMENSIONS

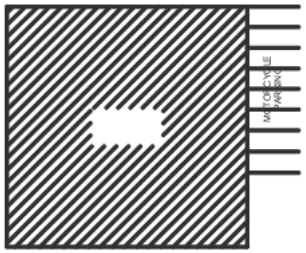
PIPE SIZE IN 'A'	DIMENSIONS IN MM.		
	C	D	F
100	40.00	150X150	225.42
150	50.80	200X200	282.57

FLOOR DRAIN DETAIL

SCALE NTS

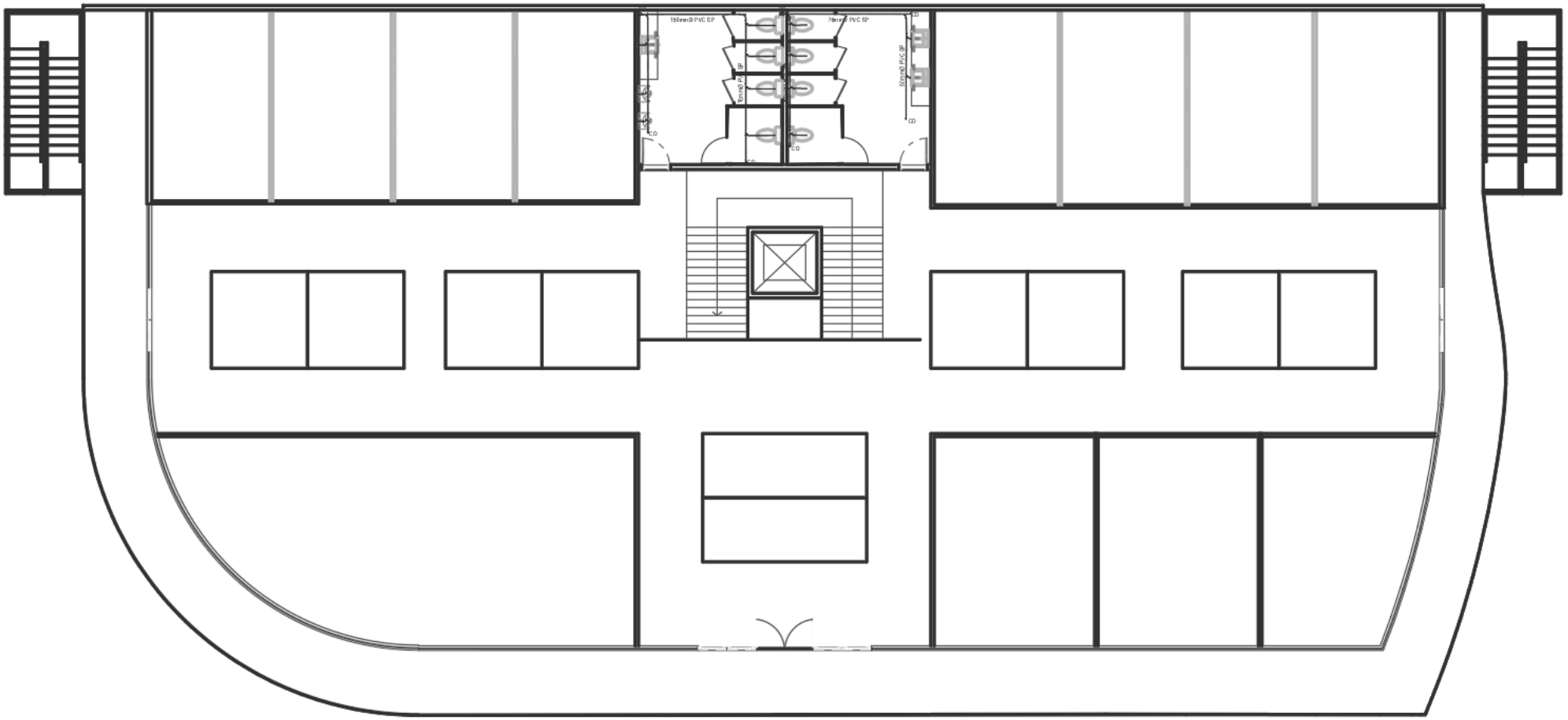
NOTE: PVC PIPE MUST EMBEDDED AND POURED BY CONCRETE TO AVOID THE PVC DAMAGED





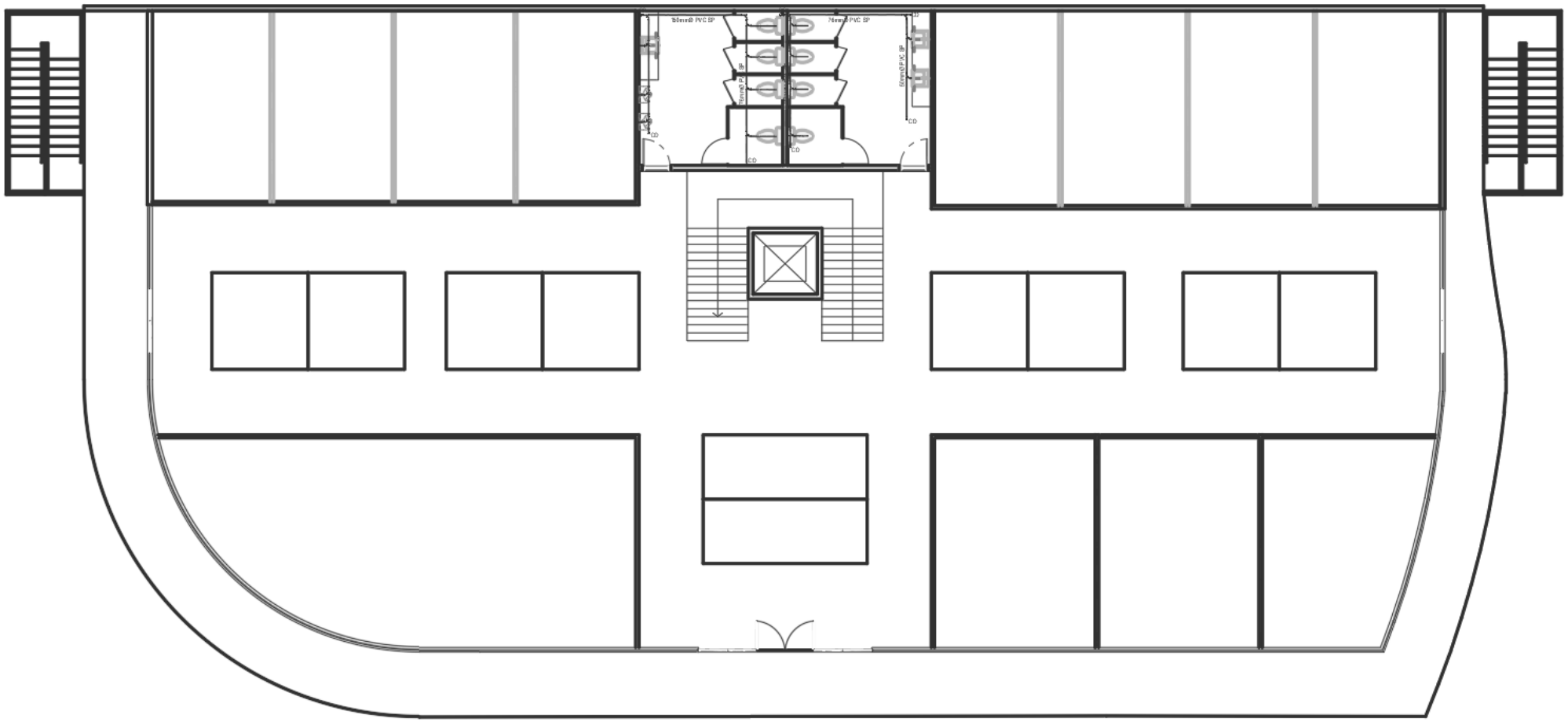
GROUND FLOOR SANITARY LINE

SCALE 1:100



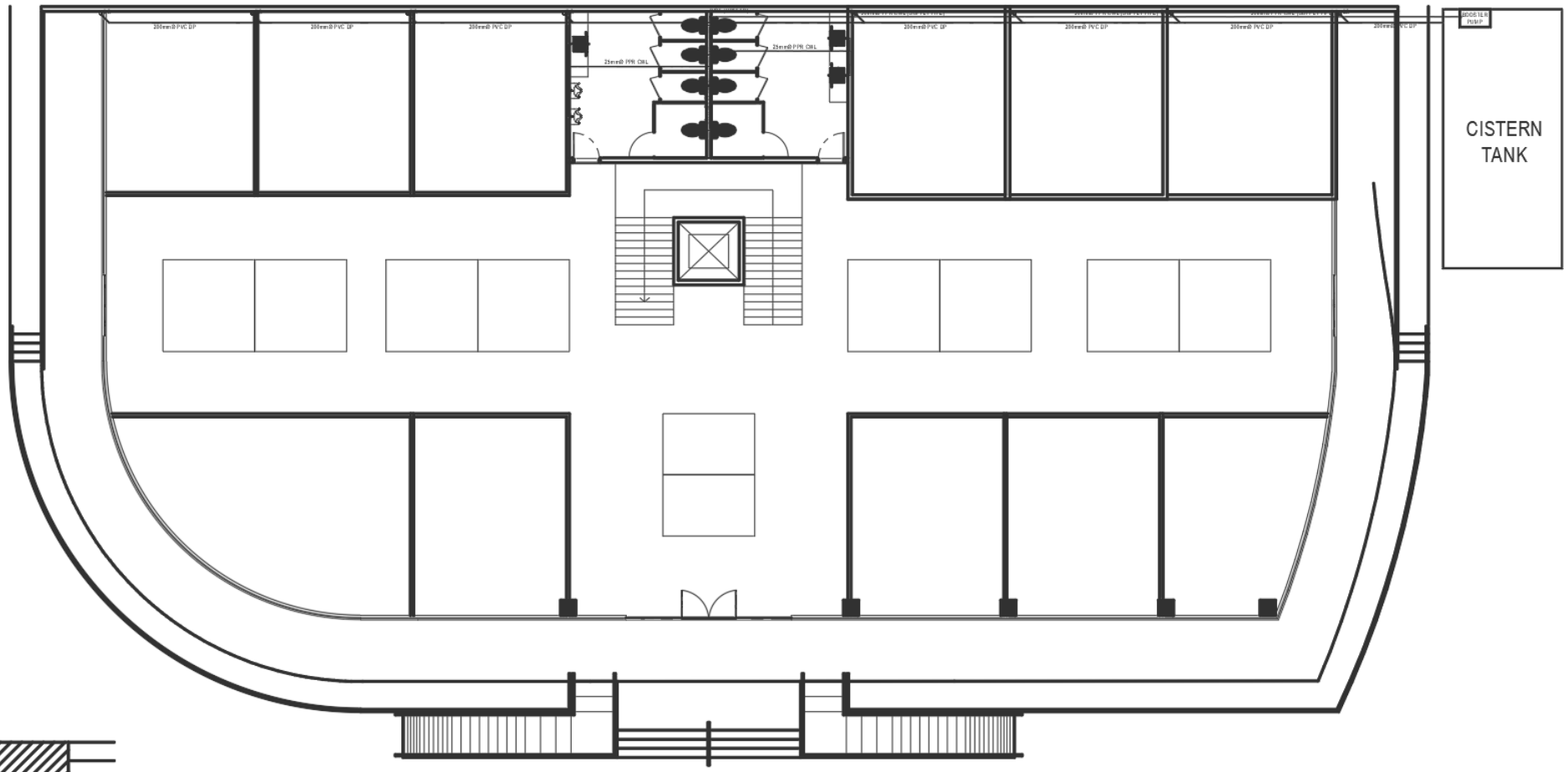
SECOND FLOOR SANITARY LINE

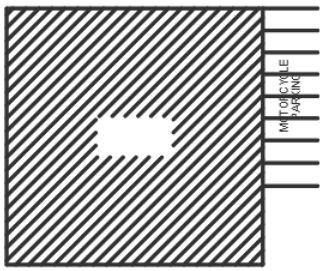
SCALE 1:100



THIRD FLOOR SANITARY LINE

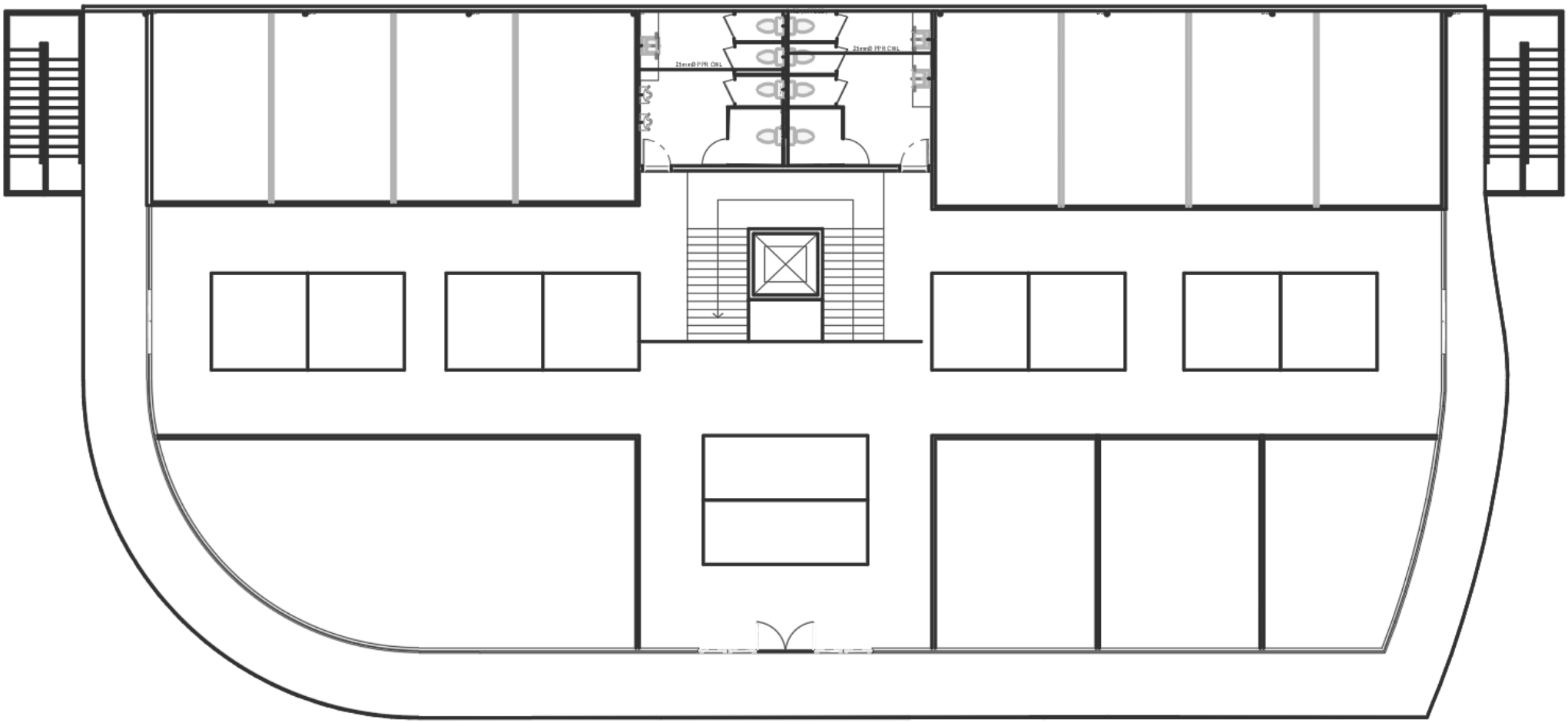
SCALE 1:100





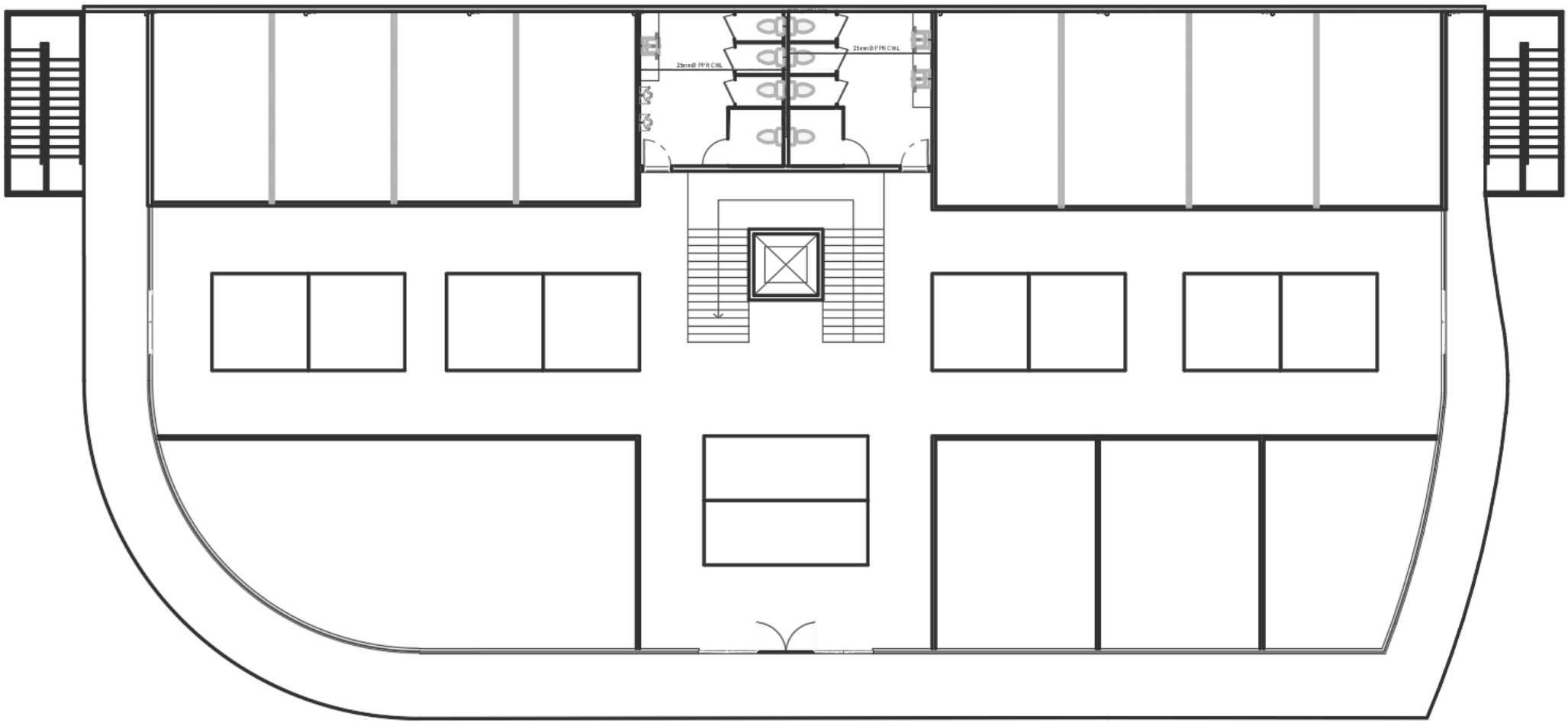
GROUND FLOOR WATER LINE

SCALE 1:100



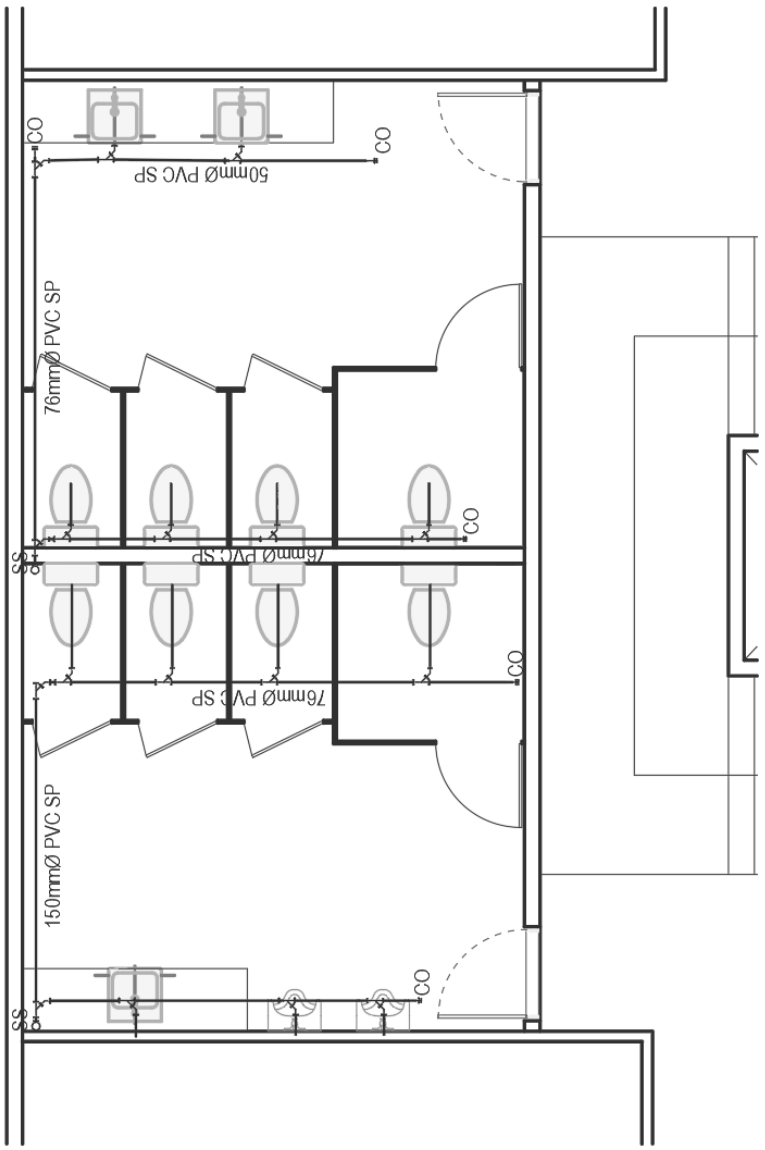
SECOND FLOOR WATER LINE

SCALE 1:100



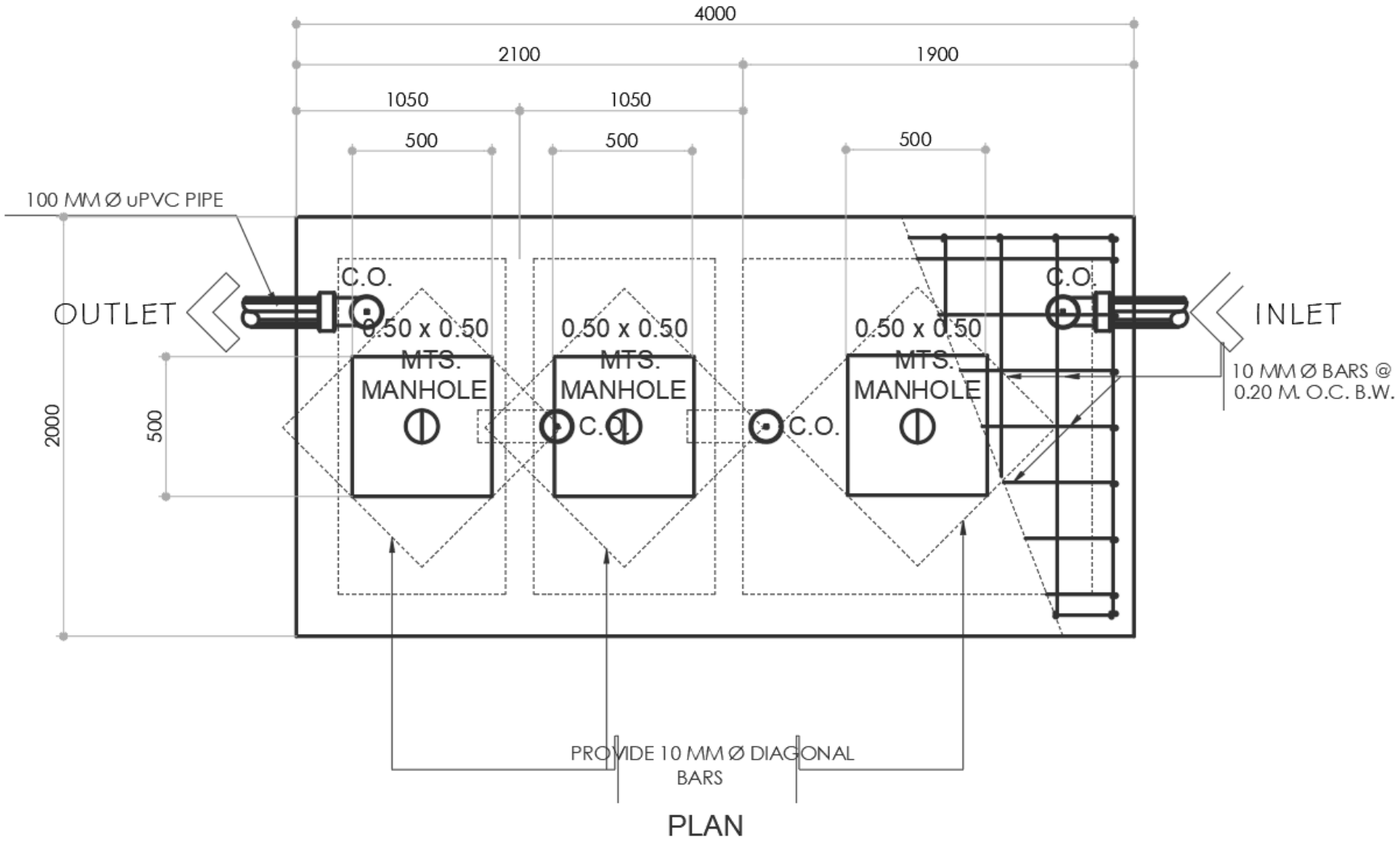
THIRD FLOOR WATER LINE

SCALE 1:100

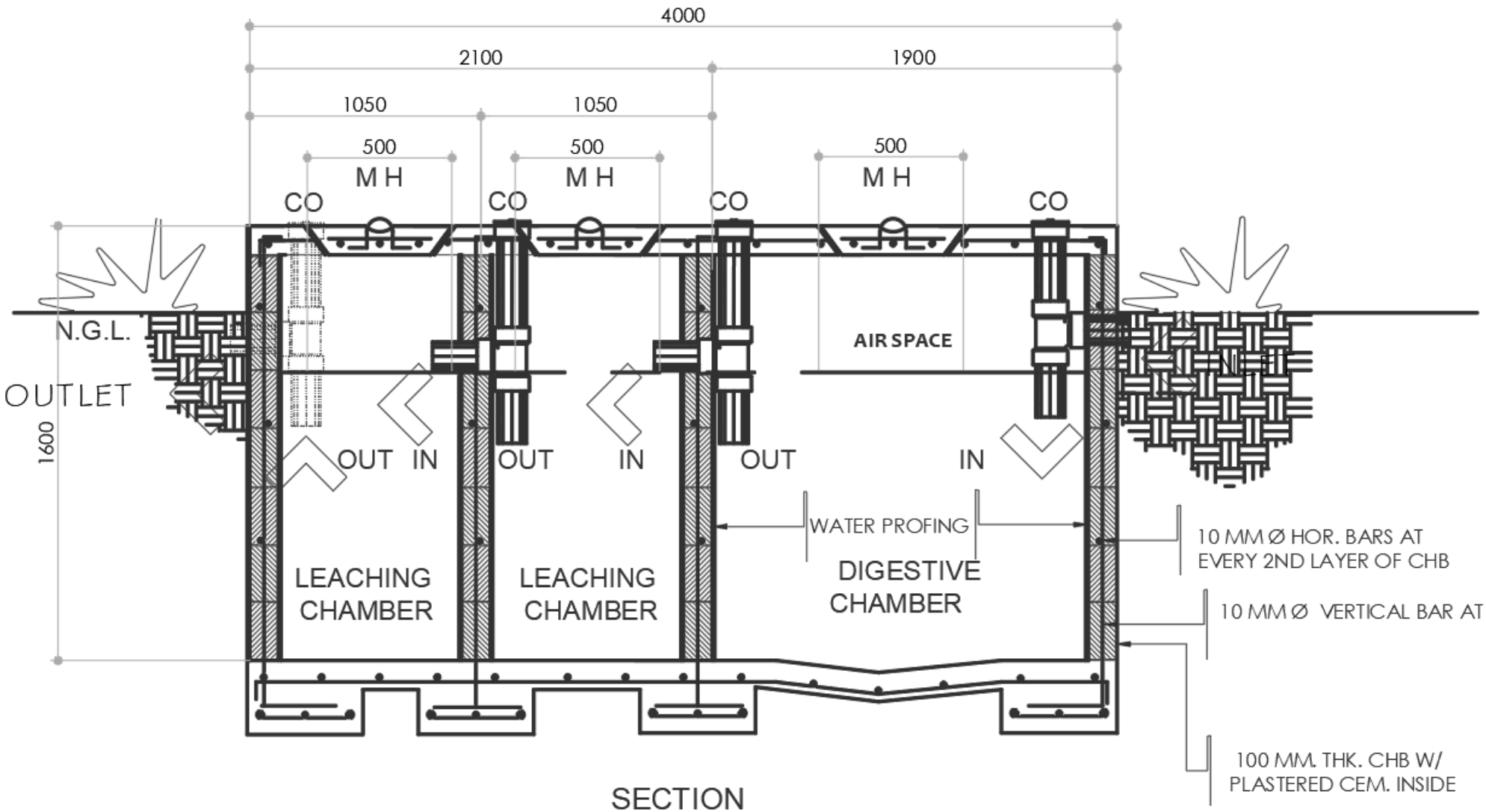


TYPICAL TOILET SANITARY LAYOUT

SCALE 1:50


4000
2100
1900
1050
1050
500
500
500
100 MM Ø uPVC PIPE
OUTLET
C.O.
0.50 x 0.50 MTS. MANHOLE
0.50 x 0.50 MTS. MANHOLE
0.50 x 0.50 MTS. MANHOLE
C.O.
C.O.
C.O.
INLET
10 MM Ø BARS @ 0.20 M. O.C. B.W.
2000
500
PROVIDE 10 MM Ø DIAGONAL BARS

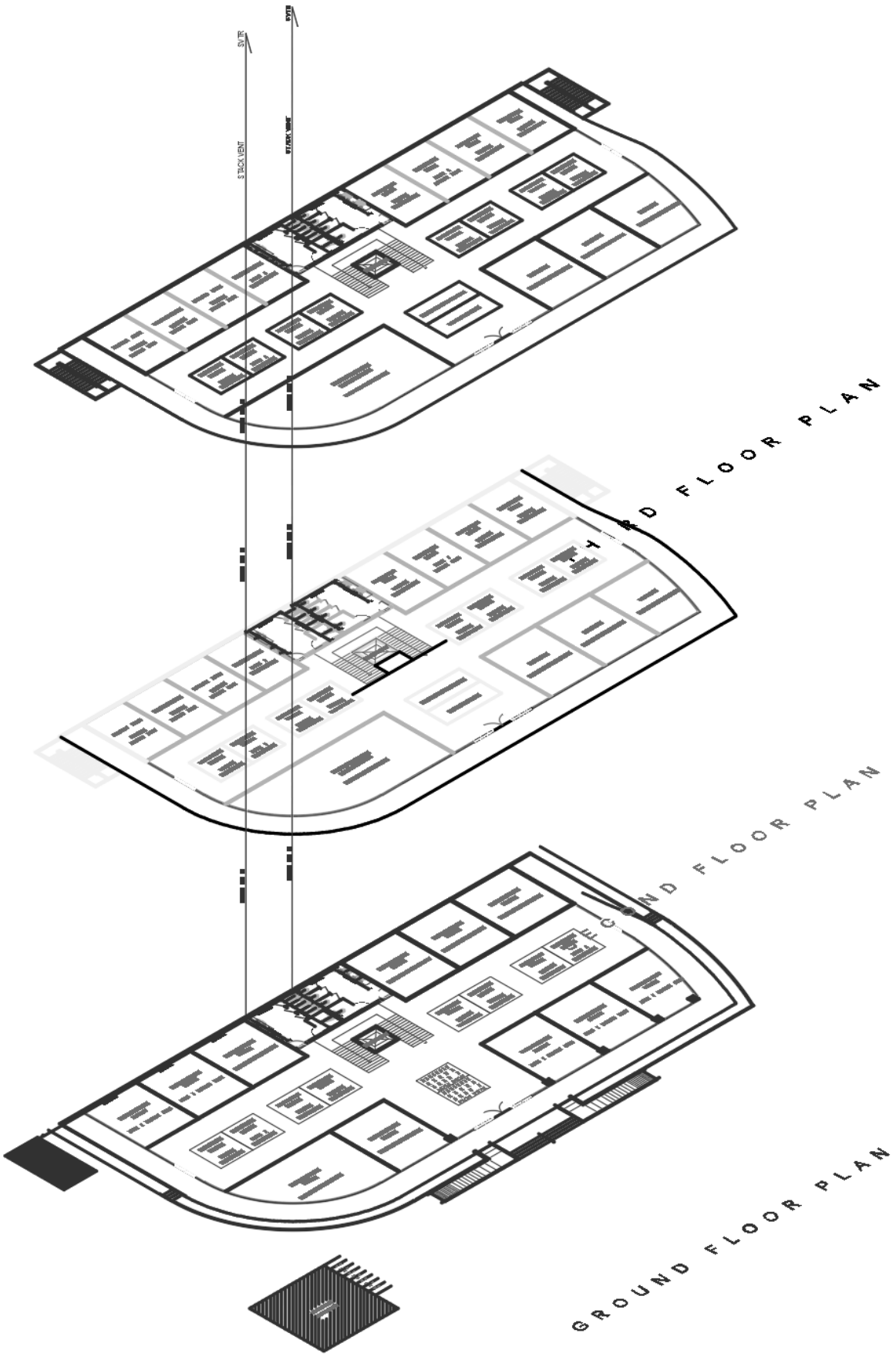
PLAN



SECTION

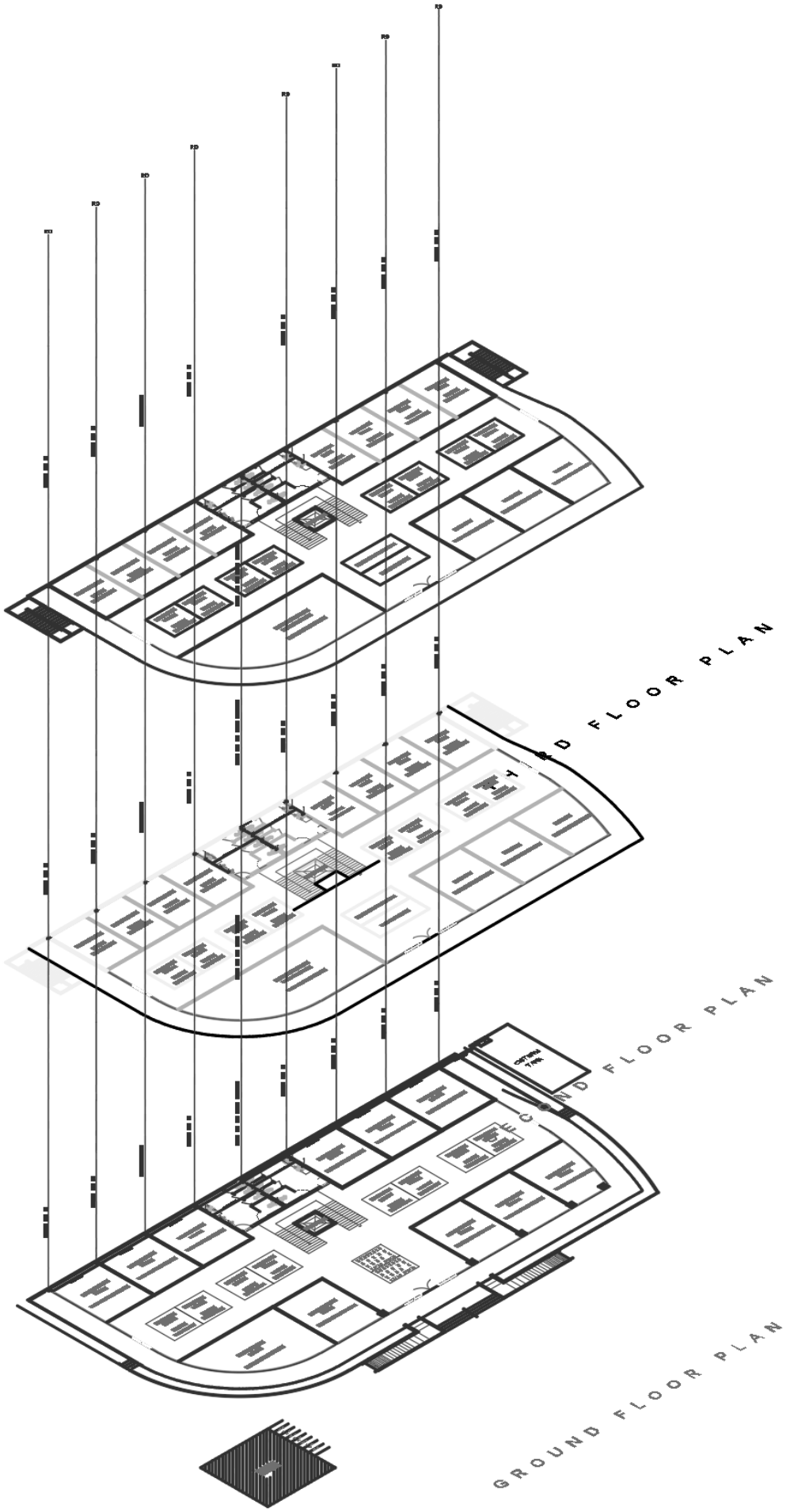
SEPTIC TANK DETAIL

SCALE 1:20 M



SANITARY LINE ISOMETRIC VIEW

SCALE 1:50



WATER LINE ISOMETRIC VIEW

SCALE 1:50

Chapter VI

Project Implementation

6.1 Implementation Scheme

The Barotac Nuevo Local Government Office will provide funding for the project. During the construction, the Municipal Engineer's Office will supervise correct budgeting. Either the Barotac Nuevo municipal administration or the business owners who rent spaces in the stated area provided funding for the commercial portion of the three-story building, which was the second floor. The design, specifics, and specifications of the project determined the entire cost of construction.

6.2 Construction Management

The Barotac Nuevo Local Government Office will provide funding for the project. While the project is being built, the Municipal Engineer's Office will oversee and manage correct budgeting. Either the Barotac Nuevo municipal administration or the business owners who are renting spaces in the stated area provided funding for the commercial portion of the three-story building, which was the second floor. The design, specifics, and specifications of the project determined the entire cost of construction.

6.3 Finance and Funding

The Barotac Nuevo Local Government Office will provide funding for the project. While the project was being built, the Municipal Engineer's Office will monitor correct budgeting. Either the Barotac Nuevo municipal administration or the business owners who rent spaces in the stated area provided funding for the commercial portion of the three-story building, which was the second floor. The design, specifics, and specifications of the project determined the entire cost of construction.

6.4 Organizational Structure

The Municipal Mayor, who will spearhead the Municipal government of Barotac Nuevo, will be the main governing body of the project. The departments that succeeded in the hierarchy of authority will be the inspection team, the municipal engineer's office, and the municipal treasurer. In addition to handling and supervising building progress, the municipal treasurer will oversee allocating funds based on work progress. The project will be subjected to evaluation, and any final suggestions or modifications could have been made by the municipal engineer's office. While for the contractor who will be under the municipal engineer's office, they are obligated to submit timely progress updates to the office, and the contractor will receive the subcontractors' status reports as well. The implementing project's organizational structure is shown in Figure 21.

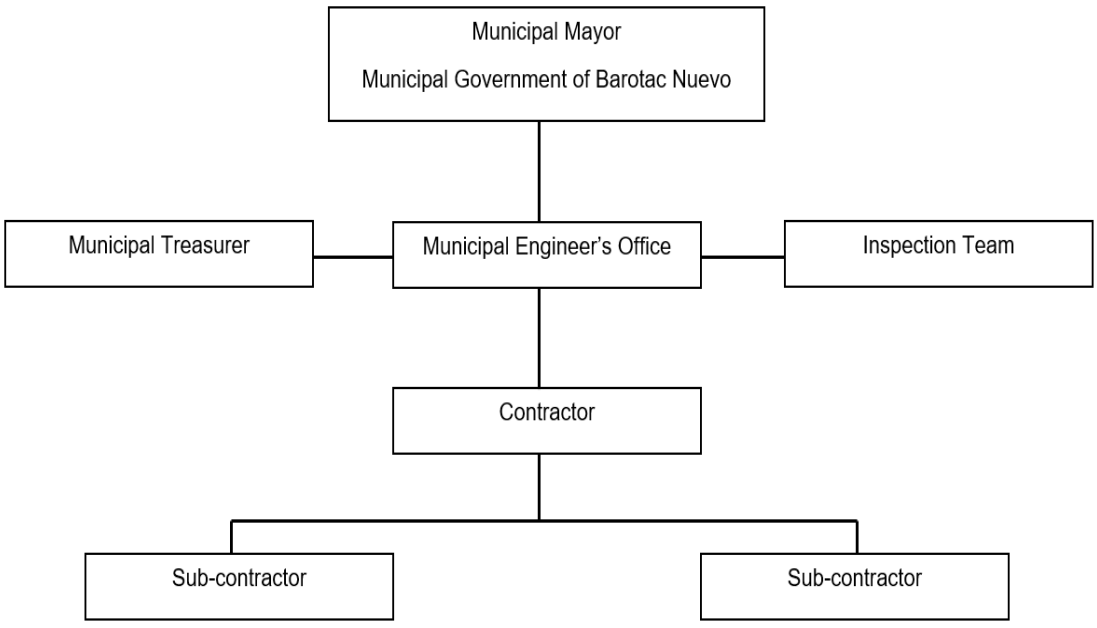


Figure 20

Organizational Structure of the Project

Chapter VII

Conclusion and Recommendations

7.1 Conclusion

As the municipality of Barotac Nuevo is expanding in terms of governmental and economic aspects, the need for another structure that could encapsulate the government and economic needs is vital to keep up with the socio-economic aspect of the municipality. In other words, the erection of the proposed three-storey mixed-use building would be beneficial for the municipality of Barotac Nuevo. Data were acquired and analyzed, which were significant for the use of government organizations, offices, tenants, and business spaces. Inspections of different facilities and the proposed project area, acquiring of information regarding the status and other project descriptions along with the additional services and facilities were gathered thoroughly and successfully. Soil tests, which were significant for the erection of the structure, were taken and conducted. Green building technologies such as solar panels, energy-saving lights, natural light, and air ventilation were also incorporated in the proposed mixed-use building. Additionally, architectural, structural, mechanical, electrical, and plumbing designs were also provided. Cost estimation and BOQ were also given.

7.2 Recommendation

Structural design is still the primary focus of this project, yet architectural design is also subjective to the owner as well as the architectural facilities and elements. The opinions and suggestions of the owner could be accommodated if they did not change or decrease the integrity of the structure for a mixed-use building. The placement of stores was based on the decision of the owner as well as the location of the offices in their respective places within the structure.

APPENDICES

APPENDIX A
LETTERS AND CERTIFICATIONS

MAYOR'S PERMIT

PERMIT is hereby granted to **NILO BEDURIA JR.** to conduct a research in the Municipality of Barotac Nuevo, to be used as a requirement for his degree in Bachelor of Science in Civil Engineering at Central Philippine University.

This **PERMIT** is subject to compliance with the Minimum Public Health Standards of the IATF, other pertinent laws and ordinances. The office reserves the right to revoke this permit once there is a violation.

Issued this 12th day of September, 2022 at Municipality of Barotac Nuevo, Iloilo, Philippines.

HON. BRYANT PAUL Q. BIRON
Municipal Mayor

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 2, 2022

Mayor Bryant Paul Q. Biron
Municipality of Barotac Nuevo
Iloilo, Province

Dear Mayor Biron,

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 five or six 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. Nilo L. Beduria Jr., The Team's Project Member, you may reach him through mobile phone number at: 09054078420 (Globe) or email at: nilo.beduriajr-17@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

ENGR. DANY C. MOLINA
Dean, College of Engineering

OFFICE OF THE MAYOR
MUNICIPALITY OF BAROTAC NUEVO
TIME: 4:25 PM
DATE RECEIVED: SEP. 07 2022
RECEIVED BY: MARY ANN L. FLORES
MAYOR'S OFFICE

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

CERTIFICATION OF APPROVED ARCHITECTURAL DESIGN

This is to certify that the DESIGN CONCEPT/ ARCHITECTURAL DESIGN of the following Civil Engineering students, namely:

Beduria Jr., Nilo
Bibanco, Jeric Ray
Carnaje, Juan Miiguel
Ciriaco, Freud Matthew
Eslabon, Sean Carlo

in their project study entitled "Proposed Design of a Three-Storey Mixed-Use Buildingat Cartagena Street, Ilaud Poblacion, Barotac Nuevo, Iloilo," was approved.

NOEL DULADA
Municipal Engineering Officer

5-2-23
Date

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 02, 2023

C E R T I F I C A T I O N

This is to certify that the project entitled **"PROPOSED DESIGN OF A THREE-STOREY MIXED-USE BUILDING AT CARTAGENA STREET, ILAUD POBLACION, BAROTAC NUEVO, ILOILO"** by **Nilo L. Beduria Jr., Jeric Ray Bibanco, Juan Miiguel H. Carnaje, Freud Matthew B. Ciriaco** and **Sean Carlo D. Eslabon** has undergone Turnitin Similarity Checking with a passing percentage of **3%** and have passed the requirements (Chapter 1-7).

Prepared by:

PINKY E. LUTERO-TONGOL
Staff -in-charged

Approved by:

LENNY ROSE P. MUCHO, EdD.
Director, RCECC

APPENDIX B
LOT DETAILS

TAX DECLARATION OF REAL PROPERTY

ARP No./TD No: 07-0001-00043 PIN: 041-07-0001-001-20

Owner: MUNICIPAL GOVERNMENT OF BAROTAC NUEVO Address: ILAUD POBLACION, BAROTAC NUEVO, ILOILO, PHILIPPINES

Administrator: MUNICIPAL MAYOR Address: BAROTAC NUEVO, ILOILO, PHILIPPINES

Beneficial User: Address:

Location of Property: CORNER CARTAGENA AND L. ARANETA ST (Number and Street) ILAUD POBLACION (Barangay) BAROTAC NUEVO (Municipality & Province/City)

OCT/TCT/CLOA NO: LOT NO.: 87 Block No.:

Dated: Survey No.: Assrs. Lot No.:

BOUNDARIES:

North: NE- LOT 83 South: L. ARANETA ST.

East: LOT 86 West: CARTAGENA ST.

KIND OF PROPERTY ASSESSED:

[X] **LAND**

[ ] **BUILDING** Description:

No. of Storeys: Total Floor Area: sqm.

[ ] **MACHINERY** Description: [ ] **OTHERS** Specify:

Classification	Area (ha)	Market Value	Actual Use	Assessment Level (%)	Assessed Value	
					Taxable	Exempt
COMMERCIAL	0.0375	2,268,750.00	COMMERCIAL	15.0	0.00	340,310.00
Totals	0.0375	2,268,750.00		Php	0.00	340,310.00

Taxable Assessed Value: PESOS

(Amount in Words)

CoOwners:

Effectivity of Assessment/ReAssessment: 2018

This declaration cancels TD No.: 0112 (R-9) Owner: MUN. GOV'T. OF BAROTAC NUEVO

Previous PIN: 041-07-001-02-008 Previous Assessed Value (Php) : 185,620.00

APPROVED BY: MAY KATHERINE S. SULLANO
Provincial/City/Municipal Assessor

01/12/2017
Date

Note: *This declaration is for real property taxation purposes only and the valuation indicated herein is based on the schedule of unit market values prepared for the purpose and duly enacted into an Ordinance by the Sangguniang Panlalawigan of Iloilo under Ordinance No. 2017-150 dated July 25, 2017. It does not and cannot by itself alone confer ownership or legal title to the property.*

TAX DECLARATION OF REAL PROPERTY

ARP No./TD No: 07-0001-00001 PIN: 041-07-0001-001-01

Owner: BUENSUCESO, JESUS Address: POBLACION, BAROTAC NUEVO, ILOILO, PHILIPPINES

Administrator: Address:

Beneficial User: Address:

Location of Property: (Number and Street) ILAUD POBLACION (Barangay) BAROTAC NUEVO (Municipality & Province/City)

OCT/TCT/CLOA NO: LOT NO.: 83 Block No.:

Dated: Survey No.: Assrs. Lot No.:

BOUNDARIES:

North: M.H. DEL PILAR South: LOT 87

East: LOT 84-A West: HARRISON ST.

KIND OF PROPERTY ASSESSED:

[X] **LAND**

[ ] **BUILDING** Description:

No. of Storeys: Total Floor Area: sqm.

[ ] **MACHINERY** Description: [ ] **OTHERS** Specify:

Classification	Area (ha)	Market Value	Actual Use	Assessment Level (%)	Assessed Value	
					Taxable	Exempt
COMMERCIAL	0.0977	5,910,850.00	COMMERCIAL	15.0	0.00	886,630.00
Totals	0.0977	5,910,850.00		Php	0.00	886,630.00

Taxable Assessed Value: PESOS

(Amount in Words)

CoOwners:

Effectivity of Assessment/ReAssessment: 2018

This declaration cancels TD No.: 0111(R-9) Owner: BUENSUCESO, ESUS

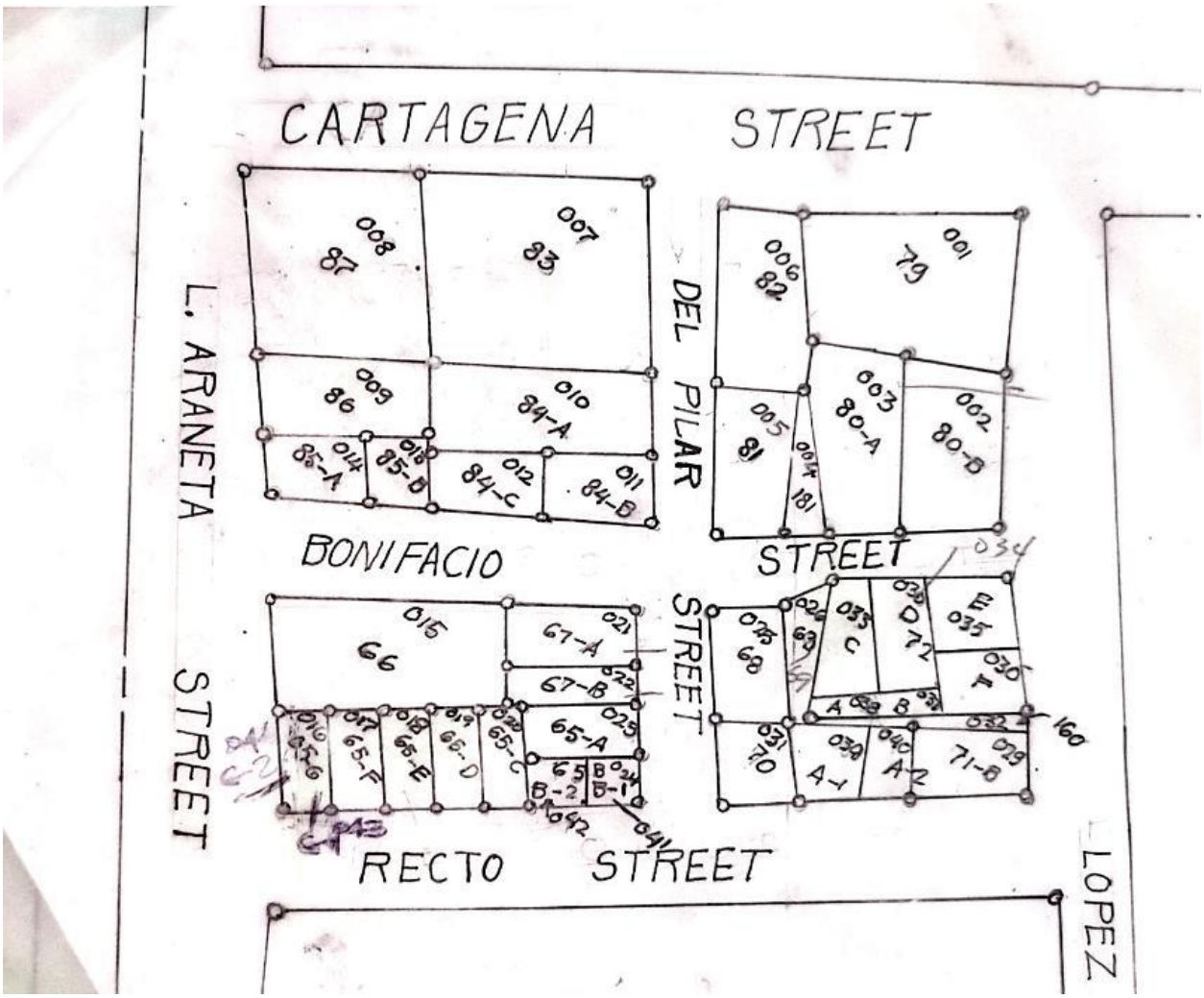
Previous PIN: 041-07-001-02-007 Previous Assessed Value (Php): 351,720.00

APPROVED BY: MAY KATHERINE S. SULLANO — Provincial/City/Municipal Assessor

01/12/2017 — Date

Note: *This declaration is for real property taxation purposes only and the valuation indicated herein is based on the schedule of unit market values prepared for the purpose and duly enacted into an Ordinance by the Sangguniang Panlalawigan of Iloilo under Ordinance No. 2017-150 dated July 25, 2017. It does not and cannot by itself alone confer ownership or legal title to the property.*

developed by iSDimalp


CARTAGENA STREET
DEL PILAR STREET
BONIFACIO STREET
L. ARANETA STREET
RECTO STREET
LOPEZ
STREET
001
002
003
005
006
007
008
009
010
011
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65-C
65-D
65-E
65-F
65-G
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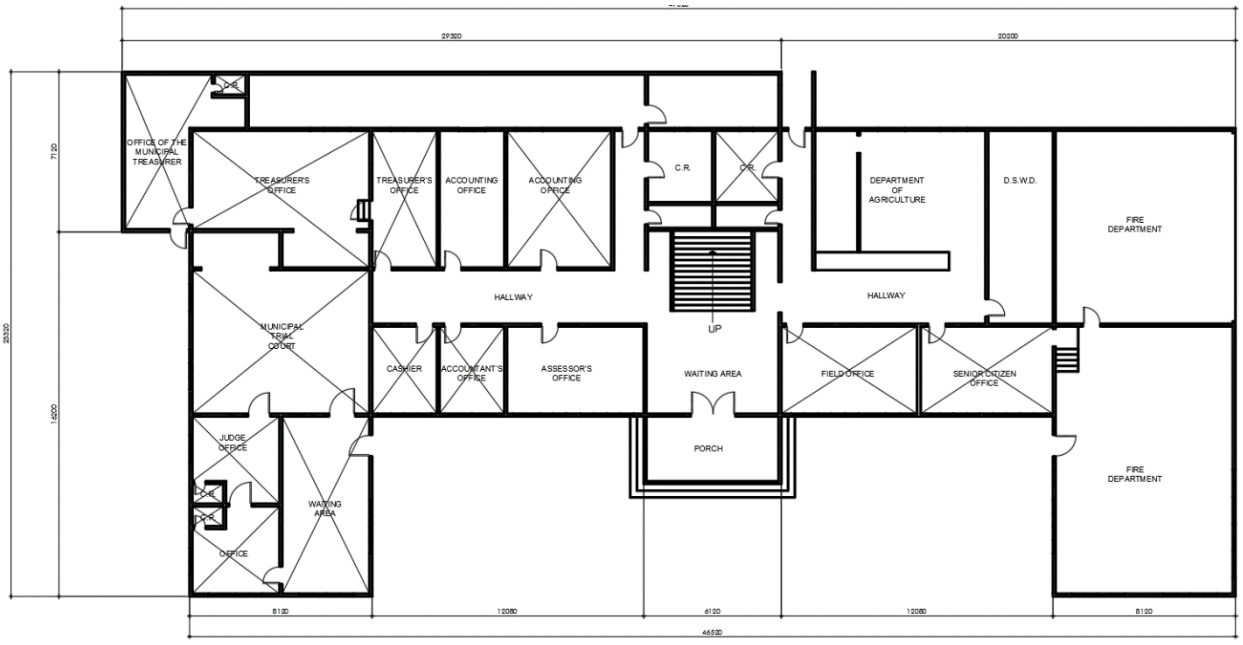
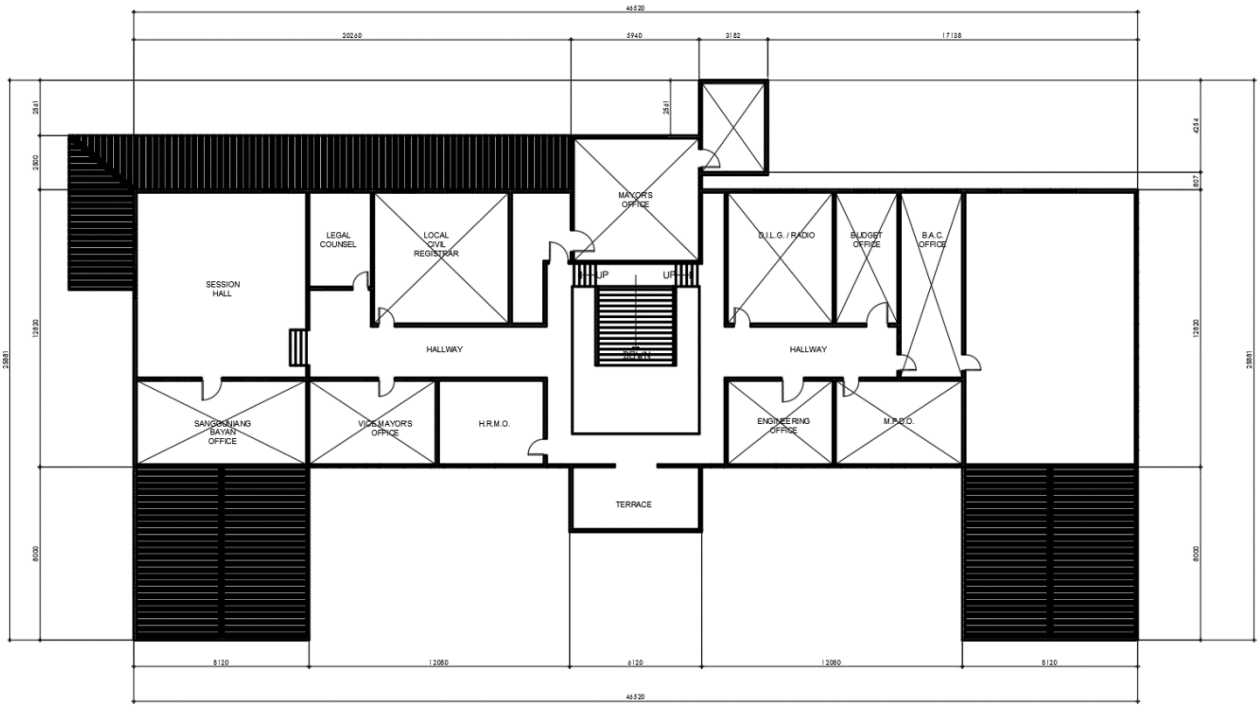
71
71-A
71-B
A-1
A-2
B-1
B-2
C
D
E
F
160

APPENDIX C
FLOOR PLANS OF OLD AND NEW MUNICIPAL BUILDING

Floor Plan of Existing Old Municipal Building

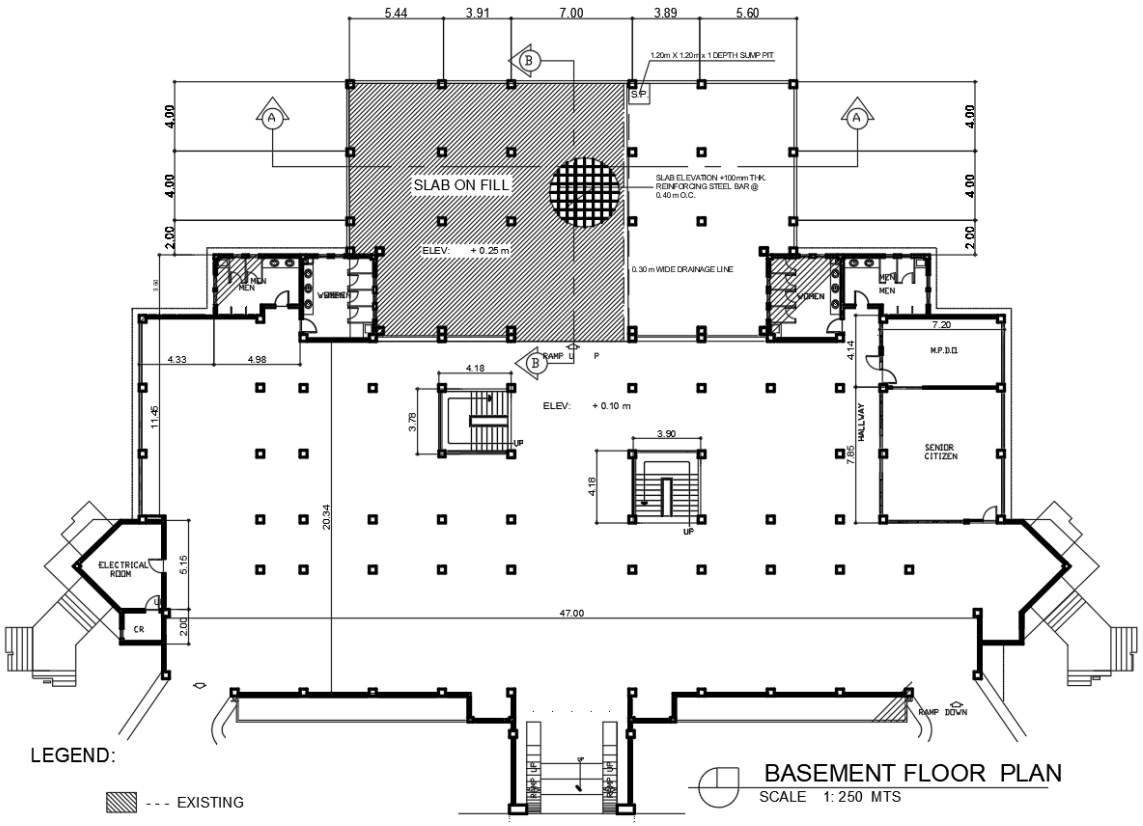


Ground Floor Plan

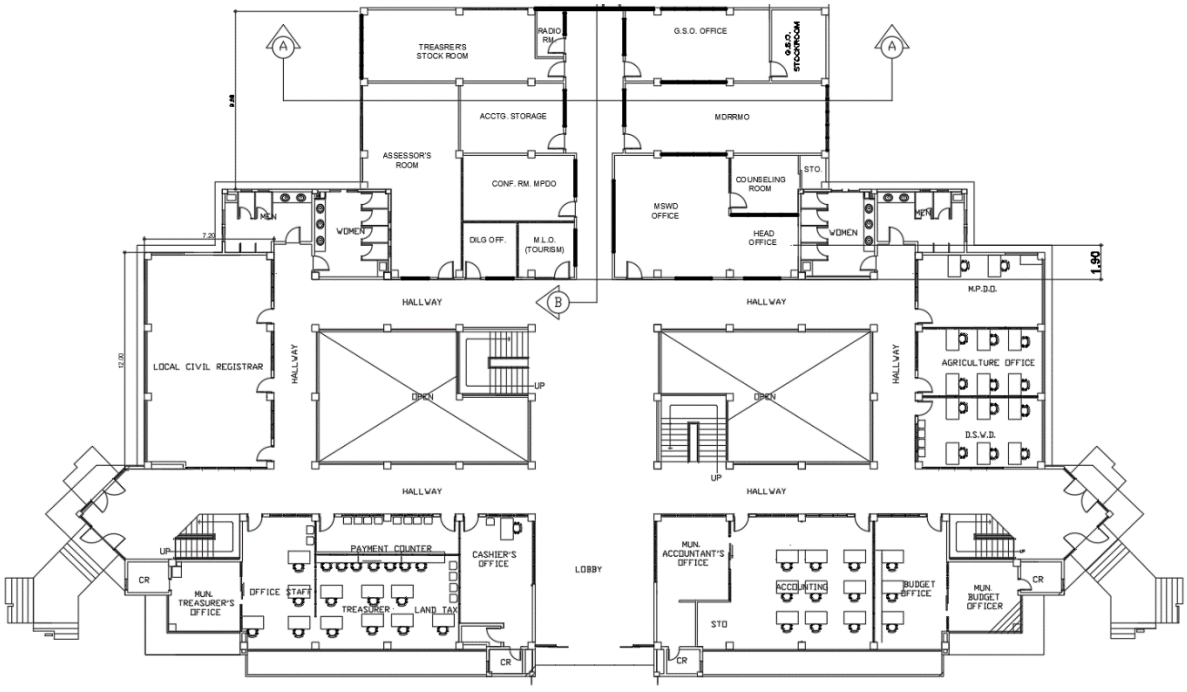


Second Floor Plan

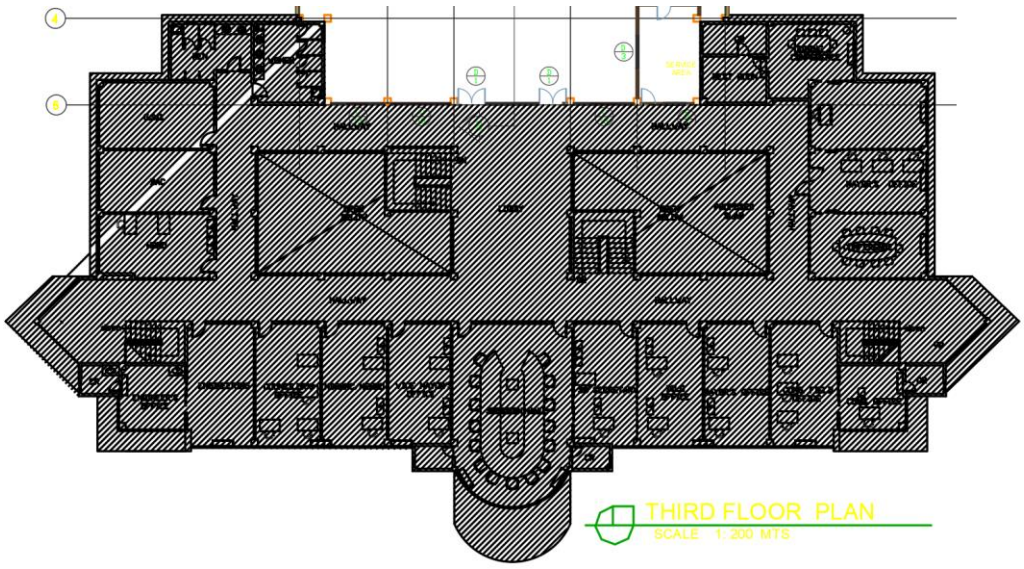
Floor Plan of New Municipal Building



Basement Floor Plan



Second Floor Plan



Third Floor Plan

Extension at New Municipal Building

APPENDIX D
WORK EXPENSES

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

SUMMARY OF EXPENSES

PARTICULAR	DESCRIPTION	AMOUNT
Documentation		
	Grammarian	₱ 1,000.00
	Paper Allowance	₱ 500.00
	Book Binding	₱ 2,500.00
	Printing	₱ 1,500.00
	Book Bind	₱ 3,000.00
	Sub Total:	₱ 8,500.00
Professional Fees		
	Soil Sampling Labour	₱ 500.00
	Architectural Plans	₱ 4,000.00
	Electrical Plans	₱ 2,000.00
	Plumbing Plans	₱ 2,000.00
	Mechanical Plans	₱ 2,000.00
	Sub Total:	₱ 10,500.00
Miscellaneous		
	Transportation	₱ 2,000.00
	Sub Total:	₱ 2,000.00
	TOTAL:	₱21,000.00

APPENDIX E
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

METHODS OF RESEARCH SCHEDULE OF ACTIVITIES

PROJECT STUDY / RESEARCH PROJECT

WEEK	TASK TO ACCOMPLISH
1 August 22 – 26, 2022	▪ Class Orientation
2 August 29 – September 2, 2022	▪ Sending of Letters to Mayors
3 August 5 – 9, 2022	▪ Approval of Requests and Visiting Municipalities
4 - 5 September 12 – 23, 2022	▪ Making of Concept Paper
6 - 7 September 26 – October 7, 2022	▪ Review and Approval of Concept Paper
7 - 9 October 3 – 21, 2022	▪ Approval of Final Concept Paper
8 - 9 October 10 – 21, 2022	▪ Site Visitation
9 October 17 – 21, 2022	▪ Discussion and Submission of Chapter 1
10 October 24 – 28, 2022	▪ Discussion and Submission of Chapter 2
11 October 31 – November 4, 2022	▪ Discussion and Submission of Chapter 3
12 - 14 November 7 – 25, 2022	▪ Discussion and Submission of the Final Proposal Document
15 - 17 November 28 – December 16, 2022	▪ Consultation of Chapters 1, 2, and 3 with assigned Advisers
18 - 20 December 19 – 23, 2022	▪ Preparations, Revisions, and Submissions of Proposal
21 - 22 January 9 – 20, 2023	▪ Proposal Presentation week
23 January 23 – 27, 2023	▪ Submission of Edited Proposal Paper
24 - 26 January 30 – February 17, 2023	▪ Architectural Plan

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

METHODS OF RESEARCH SCHEDULE OF ACTIVITIES

PROJECT STUDY / RESEARCH PROJECT

27 - 28 February 20 – March 3, 2023	Finalization of Architectural Plan
27 - 29 February 20 – March 10, 2023	Investigation of Soil Analysis
29 March 6 – 10, 2023	Structural Design and Analysis
30 March 13 – 17, 2023	Chapter IV Discussion and Submission
30 March 13 – 17, 2023	Plumbing and Electrical Plan
31 March 20 – 24, 2023	Chapter V Discussion and Submission
32 - 33 March 27 – April 7, 2023	Chapter VI Discussion and Submission
33 - 34 April 3 – 14, 2023	Chapter VII Discussion and Submission
35 April 17 – 21, 2023	Making of Appendices
35 April 17 – 21, 2023	Finalization of Final Chapters I to VII
35 - 36 April 17 – 28, 2023	Preparations for Final Defense
37 May 1 – 5, 2023	Distribution of Papers to the Panelist and Adviser
38 May 8 – 12, 2023	Final Defense
39 May 15 – 19, 2023	Revision of Final Paper Submission For the final document
40 May 22, 2023	Passing of the Hardbound

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

METHODS OF RESEARCH SCHEDULE OF ACTIVITIES (GANTT CHART)

PROJECT STUDY / RESEARCH PROJECT

LEGEND: PROJECTED DURATION
ACTUAL DURATION
DELAY

TASK ID	DESCRIPTION	WEEK 1 Aug. 22 - Aug. 26,	WEEK 2 Aug. 29 - Sep. 2,	WEEK 3 Sep. 5 - Sep. 9, 2022	WEEK 4 Sep. 12 - Sep. 16,	WEEK 5 Sep. 19 - Sep. 23,	WEEK 6 Sep. 26 - Sep. 30,	WEEK 7 Oct. 3 - Oct. 7, 2022	WEEK 8 Oct. 10 - Oct. 14,	WEEK 9 Oct. 17 - Oct. 21,	WEEK 10 Oct. 24 - Oct. 28,
1	Class Orientation										
2	Sending of Letters to Mayors										
3	Approval of Request and Visiting Municipalities										
4	Making of Concept Paper										
5	Review and Approval of Concept Paper										
6	Approval of Final Concept Paper										
7	Site Visitation										
8	Discussion and Submission of Chapter 1										
9	Discussion and Submission of Chapter 2										

TASK ID	DESCRIPTION	WEEK 11 Oct. 31 - Nov. 4,	WEEK 12 Nov. 7 - Nov. 11,	WEEK 13 Nov. 14 - Nov. 18,	WEEK 14 Nov. 21 - Nov. 25,	WEEK 15 Nov. 28 - Dec. 2,	WEEK 16 Dec. 5 - Dec. 9, 2022	WEEK 17 Dec. 12 - Dec. 16,	WEEK 18 Dec. 19 - Dec. 23,	WEEK 19 Dec. 26 - Dec. 30,	WEEK 20 Jan. 2- Jan. 6, 2023
10	Discussion and Submission of Chapter 3										
11	Discussion and Submission of Final Proposal Document										
12	Consultation of Chapter 1, 2 and 3 with assigned Advisers										
13	Preparations Revisions, and Submissions of Proposal										

COLLEGE of ENGINEERING
CENTRAL PHILIPPINE UNIVERSITY
ILOILO CITY, PHILIPPINES
Tel Nos (033) 329 1971 (to79) local 1082
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CIVIL ENGINEERING DEPARTMENT

METHODS OF RESEARCH SCHEDULE OF ACTIVITIES (GANTT CHART)

PROJECT STUDY / RESEARCH PROJECT

LEGEND: PROJECTED DURATION
ACTUAL DURATION
DELAY

TASK ID	DESCRIPTION	WEEK 21 Jan. 9 - Jan. 13, 2023	WEEK 22 Jan. 16 - Jan. 20,	WEEK 23 Jan. 23 - Jan. 27,	WEEK 24 Jan. 30 - Feb. 3,	WEEK 25 Feb. 6 - Feb. 10,	WEEK 26 Feb. 13 - Feb. 17,	WEEK 27 Feb. 20 - Feb. 24,	WEEK 28 Feb. 27 - Mar. 3,	WEEK 29 Mar. 6 - Mar. 10,	WEEK 30 Mar. 13 - Mar. 17,
14	Proposal Presentation week										
15	Submission of Edited Proposal Paper										
16	Architectural Plan										
17	Finalization of Architectural Plan										
18	Investigation of Soil Analysis										
19	Structural Design and Analysis										
20	Chapter IV Discussion and Submission										
21	Plumbing and Electrical Plan										

TASK ID	DESCRIPTION	WEEK 31 Mar. 20 - Mar. 24,	WEEK 32 Mar. 27 - Mar. 31,	WEEK 33 Apr. 3 - Apr. 7, 2023	WEEK 34 Apr. 10 - Apr. 14,	WEEK 35 Apr. 17 - Apr. 21,	WEEK 36 Apr. 24 - Apr. 28,	WEEK 37 May. 1 - May. 5,	WEEK 38 May. 8 - May. 12,	WEEK 39 May. 15 - May. 19,	WEEK 40 May. 22, 2023
22	Chapter V Discussion and Submission										
23	Chapter VI Discussion and Submission										
24	Chapter VII Discussion and Submission										
25	Making of Appendices										
26	Finalization of Final Chapter I to VII										
27	Preparations for Final Defense										
28	Distribution of Papers to the Panelist and Adviser										
29	Final Defense										
30	Revision of Final Paper Submission For the final document										
31	Passing of the Hardbound										

APPENDIX F
GEOTECHNICAL REPORT

GEOTECHNICAL REPORT

On the Soil Test Performed

In Partial Fulfillment of the Project Study Entitled

Proposed Design of a Three-Storey Mixed-Use Building at Cartagena Street, Ilaud Poblacion, Barotac Nuevo, Iloilo

For the Course

CE 4231 Civil Engineering Project II

By

Nilo L. Beduria Jr.

Jeric Ray Bibanco

Juan Miiguel H. Carnaje

Freud Matthew B. Ciriaco

Sean Carlo D. Eslabon

May 2023

Introduction

This report presented the results of the soil investigation works that were conducted at Brgy. Ilaud Poblacion, Barotac Nuevo, Iloilo, for the proposed construction of a Mixed-Use Commercial Building.

The range of the project was as follows:

Project Title: Proposed Mixed-Used Commercial Building in Barotac Nuevo, Iloilo

Location: Brgy. Ilaud Poblacion, Barotac Nuevo, Iloilo

Period of Work: Field Work (February 02, 2023)

Scope of Work: Open Test Pit

Sampling

Laboratory Testing

Report

The geotechnical investigation was conducted in Barotac Nuevo, Iloilo, on February 02, 2023, at a depth of 6ft of the Open Test Pit. The Standard Laboratory tests were conducted to gather data for the project study.

Scope of Work

The purpose of the geotechnical investigation was to:

a. Gather soil samples for laboratory tests.

b. Obtain information on the physical properties of the soil in the vicinity of the proposed project, which helped in the design of earthworks and foundation.

c. Acquire soil condition on the surface to recognize potential hazards in the vicinity of the proposed project.

Description of Method of Site Investigation

The field exploration was completed by excavating soil samples from open test pits.

Open Test Pit:

a. The location of the test pit was checked.

b. The open test pit was dug up to six (6) feet deep.

c. Data samples were secured by putting them in air-tight plastic bags.

d. The soil layering was identified.

e. Soil samples were kept for laboratory tests.

Laboratory Testing

In order to obtain results that were beneficial to the study, soil samples were put through various tests.

a. Grain Size Analysis

A granular substance having macroscopic granular sizes could have its particle size distribution determined using the analytical method known as sieve analysis. The smallest sieve was at the bottom of the stack, followed by layers of progressively larger sieves placed on top of each other.

b. Moisture Content

A measure of how much water is contained in soil was its moisture content, also known as water content. The quantity of water to the mass of solids in a sample, expressed as a percentage, was known as moisture content. This method covered the weight-based laboratory assessment of the soil's water content.

c. Liquid Limit Test

The water concentration, measured as a percentage of the soil's weight, that caused the soil to transition from a plastic to a liquid form was known as the liquid limit.

d. Plastic Limit and Plasticity Index Test

The term "plastic limit" referred to the moisture level at which soil transformed into a plastic substance. It could transition from a semi-solid to a plastic form as the moisture content rose or vice versa when the moisture content fell.

e. Soil Classification Test

This test described a comprehensive classification of soils based on distinctive qualities and standards that determined usage decisions.

Seismic Condition

Due to the proposed project's location in Barotac Nuevo, Iloilo, Philippines, a zone factor of 0.40 was applied in accordance with the 2015 edition of the National Structural Code of the Philippines. The building was a standard occupancy building, hence an importance factor of 1.00 was employed. The closest earthquake generator was the West Panay Fault, which was around 40 kilometers from the source. The seismic source type A and soil profile type varied from standard deviation (SD) by variables Na=1.0, Nv=1, Cv=0.44, and Ca=0.44.

Evaluation

According to the findings of the soil investigations, the layer extended from the surface down to a depth of 6 feet and was made up of well-graded sand with silt and gravel (SW-SM).

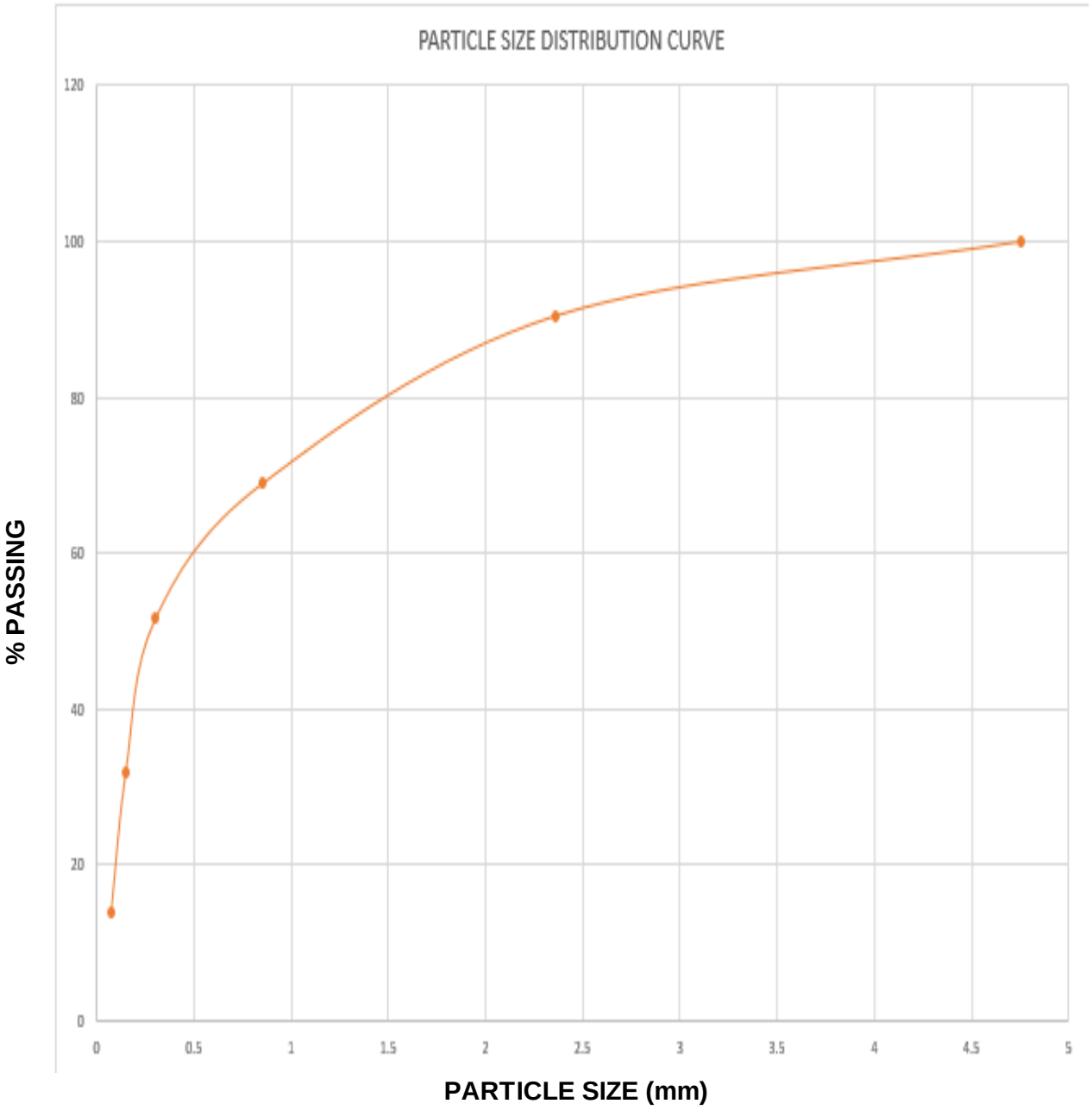
Results of Open Test Pit and Laboratory Testing

A variety of laboratory tests were performed on soil samples collected from an open test pit, which produced results specific to each layer of soil.

SIEVE ANALYSIS SUMMARY

Sieve No.	Diameter (mm)	Mass Retained (grams)	% Retained	% Cumulative	% Passing
4	4.75	0.1	0.010080645	0.01008	99.8992
10	2.36	94.4	9.516129032	9.52621	90.47379
20	0.85	213.16	21.53225806	31.058468	68.941532
50	0.3	172.3	17.36895161	48.427418	51.572582
100	0.15	193.8	19.53629032	67.963708	32.036292
200	0.075	178.1	17.95362903	85.917338	14.082662
pan		139.7	14.08266129	100	0.00
TOTAL		**991.56**	100		

RESULTS			
D60	0.57 mm	Cu	10.64
D30	0.14 mm	Cc	0.0019
D10	0.05 mm		


PARTICLE SIZE DISTRIBUTION CURVE
120
100
80
60
40
20
0
% PASSING
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
PARTICLE SIZE (mm)

LIQUID LIMIT

Soil Sample	Weight of Wet Soil (grams)	Weight of Dry Soil (grams)	Moisture Content (w %)	No. of blows
1	46	34.1	34.897	40
2	25.2	17.3	45.665	20
	LL	**40.281**		

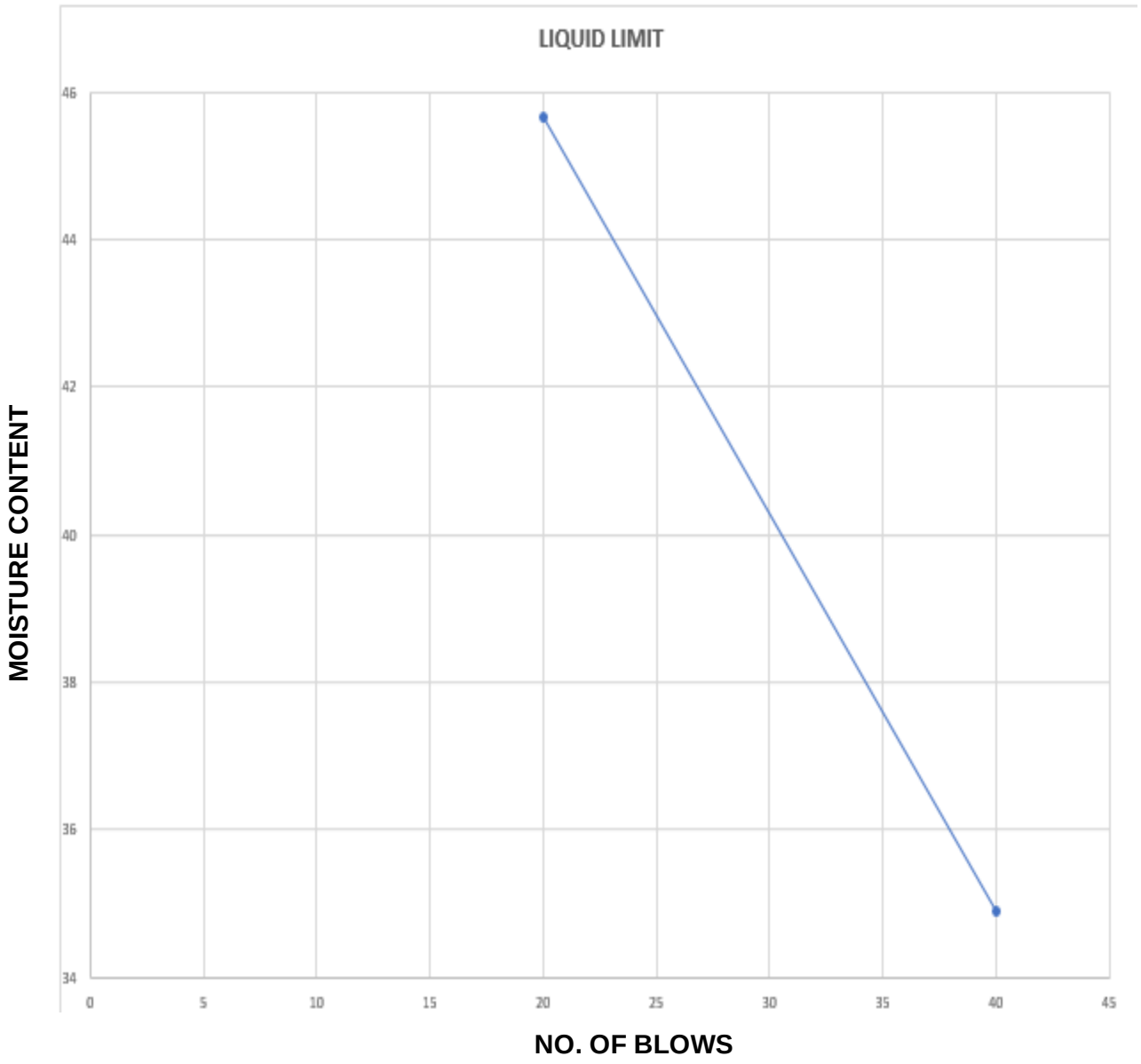
PLASTIC LIMIT

Trials	Wt. of Wet Soil (grams)	Wt. of Dry Soil (grams)	Moisture Content (%)
1	1.6	1.4	14.286
2	5	3.9	28.205
	Plastic Limit =	**21.2455**	

PLASTIC INDEX

PI = LL - PL

PI	24.4195


LIQUID LIMIT
MOISTURE CONTENT
46
44
42
40
38
36
34
0
5
10
15
20
25
30
35
40
45
NO. OF BLOWS

Specific Gravity

Description	Data
Weight of flask, (g)	96.1
Weight of Soil, (g)	60.3
Weight of flask, soil, and water, (g)	393.5
Weight of flask and water, (g)	333.2
Specific Gravity, G	2.51889

Soil classification

Classification System	Classification
AASTHO Soil Classification System	A-2-7
Unified Soil Classification System	SW-SC (Well graded sand with clay and gravel)

Soil Properties

Description	Data
Unit Weight	18.59
Moisture Content	0.2645
Soil Bearing Capacity	
Specific Gravity	2.51889
Liquid Limit	40.281
Plastic Limit	21.2455
Plastic Index	24.4195

Determination of Unit weight

Description	Data
Mass sample (g)	126.1
Height (cm)	6.61
Diameter (cm)	3.58
Volume of sample	66.536
Bulk density of soil	1.895
Unit weight of soil	18.59

Moisture Content

Sample Can no. 1		Sample Can no. 2	
Wt. of Wet Soil, g	96.61	Wt. of Wet Soil, g	97.5
Wt. of Dry Soil, g	76.31	Wt. of Dry Soil, g	77.2
Moisture Content, %	26.60	Moisture Content, %	26.29
Average Moisture Content, %		26.45	

Soil Bearing Capacity

Description	Data F1	Data F2
Soil Unit Weight, γ (kN/m^3)	18.59	18.59
Depth of Footing , Df (m)	1.8	1.8
Footing Width, B (m)	3.4	2
Φ, (deg)	20	20
Cohesion, c (kPa)	0	0
Factor of Safety, FS	2.0	2.0
N_C	14.83	14.83
N_q	6.40	6.40
$N\gamma$	5.39	5.39
Bearing Capacity, q_u (kPa)	350.43	294.32
Allowable Bearing Capacity, q_a (kPa)	175.21	147.16

APPENDIX G

DESIGN AND ANALYSIS OF STRUCTURAL MEMBERS

APPENDIX H
COST ESTIMATES

Project name: **Proposed Design of a Three-Storey Mixed-Use Building at Cartagena Street, Ilaud Poblacion, Barotac Nuevo, Iloilo**

I. General Requirements

Item Description	Quantity	Unit	Price	Cost
1.1 Mobilization and Demobilization	1	lot	₱361,022.64	₱361,022.64
Total Cost:				**₱361,022.64**

II. Earthworks

Item Description	Quantity	Unit	Price	Cost
2.1 Excavation and Backfilling	675	cu.m	₱550.00	₱371,250.00
2.2 Equipment Rental: Backhoe	225	hours	₱2,500.00	₱562,500.00
Sub-total:				₱933,750.00
Labor:				₱373,500.00
EARTHWORKS				
Total Cost:				**₱1,307,250.00**

III. Concrete Works

Item Description	Quantity	Unit	Price	Cost
3.1 Cement	13200	bags	₱260.00	₱3,432,000.00
3.2 Sand	2250	cu.m	₱1,080.00	₱2,430,000.00
3.3 Gravel	3000	cu.m	₱1,524.00	₱4,572,000.00
3.4 Steel Bars (25 mm)	5010	kgs.	₱50.00	₱250,500.00
3.5 Steel Bars (20 mm)	3003	kgs.	₱50.00	₱150,150.00
3.6 Steel Bars (16 mm)	11700	kgs.	₱50.00	₱585,000.00
3.7 Steel Bars (12 mm)	4532	kgs.	₱50.00	₱226,600.00
3.8 Steel Bars (10 mm)	10995	kgs.	₱50.00	₱549,750.00
3.9 G.I. Tie Wire #16	1218	kgs.	₱67.00	₱81,606.00

3.10 Plywood Ordinary (1.2mx2.44m)	468	Sheets	₱345.00	₱161,460.00
3.11 Assorted C.W.N	173	kgs.	₱55.00	₱9,515.00
3.12 Coco Lumber 2"x2"	4350	bd.ft.	₱20.00	₱87,000.00
3.13 CHB Ordinary (101 mm)	12600	pcs.	₱15.00	₱189,000.00
3.14 Equipment Rental: One-bagger mixer	1440	hours	₱500.00	₱720,000.00
3.15 Equipment Rental: Concrete Vibrator	1440	hours	₱200.00	₱288,000.00
Sub-Total:				₱13,732,581.00
Labor:				₱5,493,032.40
CONCRETE WORKS				
Total Cost:				**₱19,225,613.40**

IV. Carpentry

Item Description	Quantity	Unit	Price	Cost
4.1 Hardiflex	413	pcs.	₱480.00	₱198,240.00
4.2 Assorted C.W.N	53	kgs.	₱55.00	₱2,915.00
4.3 Plywood Ordinary	251	pcs.	₱595.00	₱149,345.00
4.4 Coco Lumber 2"x2"	525	bd.ft.	₱20.00	₱10,500.00
4.5 Coco Lumber 2"x6" rafter	300	bd.ft.	₱20.00	₱6,000.00
4.6 G.I. Tie Wire #16	263	kgs.	₱67.00	₱17,621.00
4.7 Flush Type Solid Core Door	15	sqm.	₱2,000.00	₱30,000.00
Sub-Total:				₱414,621.00
Labor:				₱165,848.40
CARPENTRY				
Total Cost:				**₱580,469.40**

V. Steel and Glass Works

Item Description	Quantity	Unit	Price	Cost
5.1 GI Pipe 38mm diameter	300	pcs.	₱1,197.00	₱359,100.00
5.2 GI Pipe 19mm diameter	353	pcs.	₱510.00	₱180,030.00
5.3 Bolts with nuts and washers	75	kgs.	₱150.00	₱11,250.00
5.4 Metal Furring Frame	338	pcs.	₱95.00	₱32,110.00
5.5 Glass Jalousie Window	33	sqm.	₱683.00	₱22,539.00
5.6 Awning Type Steel Casement Windows	2	sqm.	₱1,800.00	₱3,600.00
5.7 Sliding Aluminum Window	375	sqm.	₱5,500.00	₱2,062,500.00
5.8 Aluminum Frame Fixed Glass Window	173	sqm.	₱4,800.00	₱830,400.00
5.9 Aluminum Glass Door	25	sqm.	₱6,500.00	₱162,500.00
5.10 Aluminum Glass Sliding Door	15	sqm.	₱15,000.00	₱225,000.00
5.11 Structural Steel Angular Bar	1680	kgs.	₱50.00	₱84,000.00
5.12 Flat Bar	1575	kgs.	₱51.00	₱80,325.00
5.13 Stainless pipe 2" diameter	750	pcs.	₱1,950.00	₱1,462,500.00
5.14 Blind Rivets	9	box	₱320.00	₱2,880.00
5.15 Structural Steel Square Hollow Bar	1845	kgs.	₱50.00	₱92,250.00
5.16 Welding Rods	30	kgs.	₱99.00	₱2,970.00
Sub-total:				₱5,613,954.00
Labor:				₱2,245,581.60
STEEL AND GLASS WORKS				
Total Cost:				**₱7,859,535.60**

VI. Tile Works

Item Description	Quantity	Unit	Price	Cost
6.1 Floor Tiles 0.60mx0.60m	6450	pcs.	₱248.00	₱1,599,600.00
6.2 Cr Tiles	375	pcs.	₱65.00	₱24,375.00
6.3 Tile Adhesive	225	bag	₱230.00	₱51,750.00

6.4 Tile Grout	173	kg	₱80.00	₱13,840.00
6.5 Brick Wall	225	sqm.	₱580.00	₱130,500.00
6.6 Cement	1200	bag	₱260.00	₱312,000.00
6.7 Sand	60	cu.m	₱1,080.00	₱64,800.00
6.8 Brick Wall	230	sqm.	₱583.00	₱134,090.00
Sub-total:				₱2,330,955.00
Labor:				₱932,382.00
TILE WORKS				
Total Cost:				**₱3,263,337.00**

VII. Roofing Works

Item Description	Quantity	Unit	Price	Cost
7.1 Angle Bar	4194	kgs	₱110.32	₱462,686.27
7.2 C-purlins	10333	kgs	₱74.12	₱765,913.99
7.3 Corrugated Roof	416	sq.m	₱800.00	₱332,800.00
7.4 Sag Rod	177	kg	₱55.59	₱9,839.43
7.5 Miscellaneous	1	lot	₱35,937.54	₱35,937.54
Sub-total:				₱1,607,177.24
Labor:				₱642,870.89
Roofing Works				
Total Cost:				**₱2,250,048.13**

VIII. Electrical Works

Item Description	Quantity	Unit	Price	Cost
8.1 20mm uPVC Conduit Pipe	394	pcs.	₱125.00	₱49,250.00
8.2 50mm uPVC Conduit Pipe	75	pcs.	₱170.00	₱12,750.00
8.3 32 mm uPVC Conduit Pipe	30	pcs.	₱108.00	₱3,240.00

8.4 25 mm uPVC Conduit Pipe	30	pcs.	₱165.00	₱4,950.00
8.5 40 mm uPVC Conduit Pipe	15	pcs.	₱130.00	₱1,950.00
8.6 5.50mm^2 THHN Copper Wire	23	roll	₱37.00	₱851.00
8.7 6mm^2 THHN Copper Wire	15	roll	₱43.00	₱645.00
8.8 3.50 mm^2 THHN Copper Wire	23	roll	₱25.00	₱575.00
8.9 14 mm^2 THHN Copper Wire	15	roll	₱126.00	₱1,890.00
8.10 50mm^2 THHN Copper Wire	15	roll	₱470.00	₱7,050.00
8.11 100mm^2 THHN Copper Wire	11	roll	₱883.00	₱9,713.00
8.12 20 Ampere 2-wire circuit conductor	15	roll	₱1,350.00	₱20,250.00
8.13 30 Ampere 2-wire circuit conductor	8	roll	₱3,030.00	₱24,240.00
8.14 15 Ampere 2-wire circuit conductor	15	roll	₱1,220.00	₱18,300.00
8.15 40 Ampere 2-wire circuit conductor	2	roll	₱3,160.00	₱6,320.00
8.16 60 ampere, 2pst, 250 volts molded circuit breaker	5	pcs.	₱260.00	₱1,300.00
8.17 150 ampere, 2pst, 250 volts molded circuit breaker	5	pcs.	₱390.00	₱1,950.00
8.18 225 ampere, 2pst, 250 volts molded circuit breaker	5	pcs.	₱420.00	₱2,100.00
8.19 CCTV installation	15	unit	₱1,500.00	₱22,500.00
8.20 LED lightbulb	225	pcs.	₱1,153.00	₱259,425.00
8.21 Round LED light casing	225	pcs.	₱55.00	₱12,375.00
8.22 3 Gang Switch	150	pcs.	₱132.00	₱19,800.00
8.23 Switch Box	113	pcs.	₱93.00	₱10,509.00
8.24 Utility Box	120	pcs.	₱18.00	₱2,160.00
8.25 Flexible Hose 1/2"	15	roll	₱450.00	₱6,750.00
8.26 PVC solvent cement	23	can	₱56.39	₱1,296.97
8.27 Convenience Outlet	135	pcs.	₱158.00	₱21,330.00
Sub-total:				₱523,469.97
Labor:				₱209,387.99
ELECTRICAL WORKS				
Total Cost:				**₱732,857.96**

IX. Plumbing Works

Item Description	Quantity	Unit	Price	Cost
9.1 PVC Pipe 4 x 10	75	pcs.	₱681.00	₱51,075.00
9.2 PVC Pipe 3 x 10	150	pcs.	₱520.00	₱78,000.00
9.3 PVC Pipe 2 x 10	45	pcs.	₱68.00	₱3,060.00
9.4 PVC wye 4"	12	pcs.	₱120.00	₱1,440.00
9.5 PVC wye 3"	9	pcs.	₱88.00	₱792.00
9.6 PVC wye 2"	9	pcs.	₱72.00	₱648.00
9.7 PVC elbow 2 x 45	36	pcs.	₱22.00	₱792.00
9.8 PVC elbow 2 x 90	12	pcs.	₱28.00	₱336.00
9.9 PVC elbow 3 x 45	36	pcs.	₱63.00	₱2,268.00
9.10 PVC elbow 3 x 90	24	pcs.	₱82.00	₱1,968.00
9.11 PVC elbow 4 x 90	27	pcs.	₱82.00	₱2,214.00
9.12 PVC tee 4 x4	12	pcs.	₱118.00	₱1,416.00
9.13 PVC clean out 4"	12	pcs.	₱90.00	₱1,080.00
9.14 PVP P Trap 2"	5	pcs.	₱85.00	₱425.00
9.15 Solvent Cement 400 cc	15	can	₱295.00	₱4,425.00
9.16 Water Closet	11	sets	₱7,500.00	₱82,500.00
9.17 Urinal	5	sets	₱1,800.00	₱9,000.00
9.18Faucet	8	sets	₱480.00	₱3,840.00
9.19 Teflon 3/4	15	rolls	₱35.00	₱525.00
9.20 Stainless Tank 1000 liters	5	sets	₱18,000.00	₱90,000.00
Sub-total:				₱335,804.00
Labor:				₱134,321.60
PLUMBING WORKS				
Total Cost:				**₱470,125.60**

X. Painting Works

Item Description	Quantity	Unit	Price	Cost
10.1 Paint Enamel	90	gal.	₱690.00	₱62,100.00
10.2 Paint Latex Gloss	45	gal.	₱721.00	₱32,445.00
10.3 Flat Latex	75	gal.	₱2,500.00	₱187,500.00
10.4 Roller paint 7"	8	pcs.	₱97.00	₱776.00
10.5 Brush Paint 3"	15	pcs.	₱45.00	₱675.00
10.6 Varnish Paint	23	ltr.	₱501.00	₱11,523.00
Sub-total:				₱295,019.00
Labor:				₱118,007.60
PAINTING WORKS				
Total Cost:				**₱413,026.60**

XI. Electronics

Item Description	Quantity	Unit	Price	Cost
11.1 Solar panels (15kWp) including installation	1	set	₱1,260,000.00	₱1,260,000.00
Total Cost:				**₱1,260,000.00**

XII. Mechanical

Item Description	Quantity	Unit	Price	Cost
12.1 2.5hp Split type inverter air conditioner including installation	33	set	₱68,995.00	₱2,276,835.00
Total Cost:				**₱2,276,835.00**

TOTAL PROJECT COST	**₱40,000,121.33**

APPENDIX I
PROJECT SCHEDULING

APPENDIX J
DESIGNER'S VITAE

Beduria Jr, Nilo L.

Nilo Lapastora Beduria Jr., 23, is the son of Mr Nilo B. Beduria and Mrs. Juliet L. Beduria. He was born on August 30, 1999, and is a resident of Barotac Nuevo, Iloilo. He loves to play musical instruments and also loves to travel.

He graduated from St. Paul School Barotac Nuevo for Elementary and St. Vincent Ferrer Seminary for Junior High school. He completed his Senior High school at Central Philippine University.

He is currently enrolled at Central Philippine University, taking up a Bachelor of Science in Civil Engineering. He was the President of the Junior High school Department for School Year (2016-2017). His goal is to become a Civil Engineer and to inspire others to reach their dreams to become successful in life.

Bibanco, Jeric Ray

Jeric Ray Bibanco, 22, was born on August 21, 2000, and is a resident of Brgy. San Roque, Estancia, Iloilo. He is the son of Mr. Jerry Ramos and Mrs. Verna B. Jordan and Jerry Ramos and the youngest (younger) among the two siblings.

He likes to watch movies and read books. He likes to listen to music in any genre depending on the moment's mood. He likes to go on an adventure occasionally, to the beach, mountains, or with friends. He hopes to travel around the world to try different kinds of cuisine and meet new people.

He completed his elementary education at Estancia Seventh-Day-Adventist Elementary School (ESDAES). He then completed his Junior High School at Northern Iloilo State University – West Campus and his Senior High School at Western Institute of Technology.

He is currently enrolled at Central Philippine University, taking up a Bachelor of Science in Civil Engineering.

Carnaje, Juan Miguel H.

Juan Miguel Hablo Carnaje, 22, is the son of Roland Adorador Carnaje and Jo-Ann Hablo Carnaje. He was born on May 11, 2000, and is a resident of Estancia, Iloilo. He loves to play sports and travel.

He graduated from Estancia Central School for Elementary and Northern Iloilo Polytechnic State College Laboratory High School for Junior Highschool. He completed his Senior Highschool at Northern Iloilo Polytechnic State College Main Campus.

He is currently enrolled at Central Philippine University, taking up a Bachelor of Science in Civil Engineering. His goal is to become a successful engineer in life.

Ciriaco, Freud Matthew B.

Freud Matthew B. Ciriaco, 22, was born on September 11, 2000, at Negros Occidental. Currently, he is residing in Dungon C – Mandurriao, Iloilo City. He is the youngest among the three siblings, namely Prince Descartes Jode B. Ciriaco and Princess Jolia Bless B. Ciriaco, the sons, and daughters of Delia B. Ciriaco and Mr. Joel A. Ciriaco and Mrs. Delia B. Ciriaco.

He likes to be with his friends but wants to be alone at times. Traveling, writing, playing games, listening to music, and sports are what keep him energized in life. He believes that he can achieve whatever he wants when he wants it eagerly.

He graduated from Central Philippines University in his Elementary Level, Junior High school, and Senior High school Levels. He is currently enrolled at the same school, taking up a Bachelor of Science in Civil Engineering. And his goal is to become a living testimony of how good God is in his life and to live life as a successful engineer in the future.

Eslabon, Sean Carlo D.

Sean Carlo D. Eslabon, 23, was born on May 8, 1999. He is the son of Mr. Rizty Stephen F. Eslabon and the younger brother of Stephen Clyde Eslabon.

He spends his free time playing video games and doing organizational work. He also dances and plays basketball.

He studied at Ateneo de Iloilo – Santa Maria Catholic School from Kinder 1 to Grade 12.

He is currently enrolled at Central Philippine University, taking up a Bachelor of Science in Civil Engineering, and was a Community Director of Golden Lion Esports for the School Year 2022-2023. He is the Most Exalted Brother of the Phi Beta Epsilon Fraternity Central Philippine University Chapter.