PROPOSED DESIGN OF A SEAFOOD MARKET AT BARANGAY CABALAGNAN FISH PORT, NUEVA VALENCIA, GUIMARAS

A Project Study

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ABSTRACT

A seafood market facilitates the transaction of products and services between individuals or entities that purchase or sell seafood. The Municipality of Nueva Valencia, being the major fishing center of the Province of Guimaras recognizes the need to further develop the fishery sector in order to boost the economy of the province and to provide a stable source of livelihood to the community. At present, the Cabalagnan Fish Port which is the only established fish landing center of the municipality, lacks an exclusive selling area for seafood vendors, a cold storage and a fixed drying area which are necessary amenities of a seafood market. In line with this, a two-storey seafood market is proposed to be constructed at Brgy. Cabalagnan Fish Port, Nueva Valencia, Guimaras. The first floor of the structure will include the stalls, offices, cold storage and comfort rooms while the open roof deck is intended as a fixed drying area, venue for the solar panels and will constitute in the rainwater harvesting system. The project study consists of specifications, cost estimates, project schedules and plans for the architectural, structural, plumbing and electrical designs of the proposed structure wherein the structural design was based on the provisions of the National Structural Code of the Philippines (NSCP 2015). The construction of the 600 sq. m. structure has an estimated cost of Php 24,525,407.54 and is expected to last for 156 days. The source of funds shall be finalized after the proposed House Bill No. 3343 - The Cabalagnan Fish Port Act is resolved. Installation of security measures such as walls/perimeter fence and surveillance cameras are recommended once the structure is completely operational.

Chapter 1

Introduction

1.1 Background and Rationale

Fisheries encompass the activity of fish harvesting, which can include capturing wild fish or raising fish through aquaculture. The Fisheries and Aquaculture Organization (FAO) provides a definition of fisheries by taking into account aspects such as the individuals involved, type of fish, fishing area and method, type of vessel, and purpose of the fishing activities. The Organization for Economic Cooperation and Development (OECD) has corroborated that fisheries and aquaculture are a crucial source of sustenance for millions of people worldwide on a daily basis. In addition, these industries employ more than 10% of the global population, and majority of them being women. The growth of aquaculture, particularly in Asia, has contributed significantly to the increase in global seafood consumption, which has been twice the rate of the population since the early 1960s.

Among the countries in Asia, the Philippines, being an archipelago, is one of the major producers and consumers of fish and seafood. Despite of the declining fish production in the country, an article published by the National Economic and Development Authority (NEDA) dated May 17, 2021 revealed that the Agriculture, Fishery and Forestry (AFF) sector of Region VI Western Visayas, accelerated by 4.7% from 2019 to 2020 – the fastest growth rate among all regions in the country. The AFF was estimated to have a gross value added (GVA) of 163,899,173,000. This is important in light of the limitations imposed by the community quarantine. Despite the pandemic's varied effects on fisheries, which saw municipal fisheries decline by 11.36 percent and commercial fisheries drop by 3.96 percent, the agriculture sector's overall

strong performance allowed it to contribute 1.1 percent to the GRDP growth. The growth in aquaculture of 4.22 percent has greatly helped to support this development.

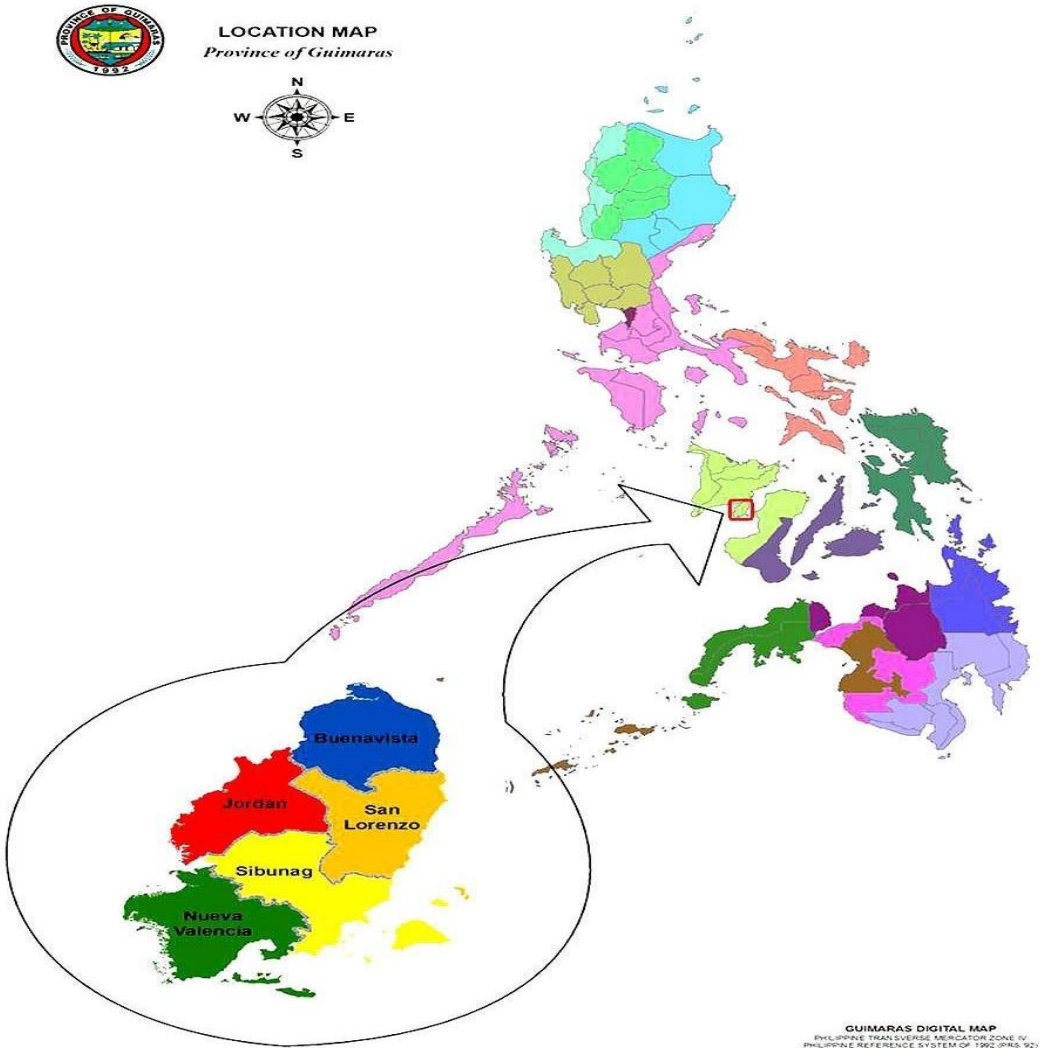


Figure 1

Map and Location of the Province of Guimaras

The Region VI Western Visayas is made up of Panay, the western part of Negros, Guimaras Island, and some other smaller islands, as illustrated in Figure 1. Panay has a land area of approximately 11,809.64 square kilometers or 4,559.70 square miles and a coastline that spans approximately 884.01 kilometers or 549.30 miles. Negros Island, on the other hand, has an approximate land area of 13,057.68

square kilometers or 5,041.57 square miles and a coastline that spans approximately 913.86 kilometers or 567.85 miles. Finally, Guimaras Island has a land area of approximately 592.85 square kilometers or 228.90 square miles, and a coastline that spans approximately 192.06 kilometers or 119.34 miles. In total, the coastline length of Western Visayas is approximately 1989.93 kilometers. Thus, one of the major sources of income and livelihood for the residents of Western Visayas relies on fisheries and seafood.

Guimaras is an island province situated in the Southeast of Panay and Northwest of Negros Island. This is the only island province among the six provinces in the region. Prior to being a province, it acted as a sub-province of Iloilo. The province encompasses five coastal municipalities, namely Jordan, Buenavista, Nueva Valencia, San Lorenzo, and Sibunag along with ninety-eight barangays. The diverse qualities of each of the five coastal municipalities make them unique. Jordan serves as the capital of the province and is situated in the middle of the island. Jordan is the island's second-oldest town, and it serves as the primary growth and commercial center as well as the primary entry point to Guimaras. The oldest of the five municipalities, Buenavista, is the hub for higher education and is regarded as the secondary growth center, and serves as a secondary entryway to Guimaras. The municipality of Nueva Valencia is recognized as the major fishing hub and tourism capital of its province. San Lorenzo serves as the primary agri-fishery producer and entry point for commuters to Negros Island, while Sibunag is the key port for freight linking Guimaras and Negros. Guimaras Island, including Inampulugan, Guiwanon (or Guiuanon), Panobolon, Natunga, Nadulao, and several surrounding islets, constitute the entirety of the province, which is a member of the Metro Iloilo-Guimaras, one of the twelve metropolitan areas of the Philippines.

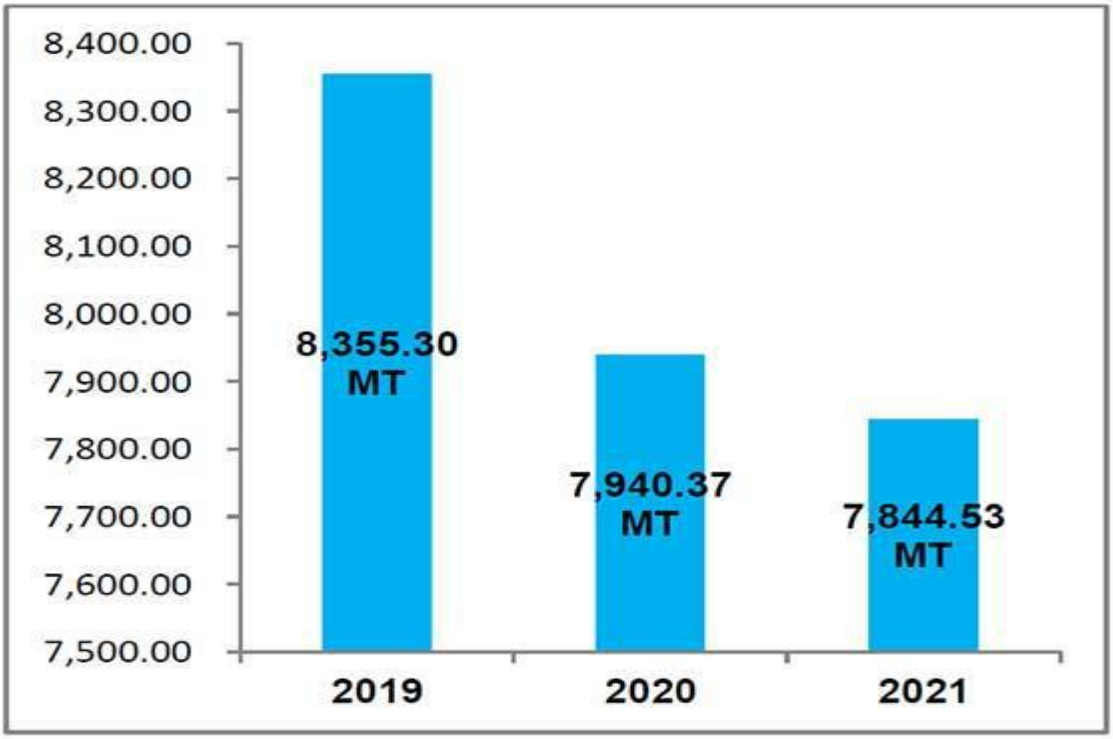


Figure 2

Fisheries Production in Guimaras, 2019-2021

Based on the information provided by the Philippine Statistics Authority (PSA), the Daily Guardian reported on March 30, 2022 that there was a decline in fisheries production in Guimaras for two consecutive years, 2020-2021, with production dropping from 8,355.30 metric tons (MT) in 2019 to 7,844.53 MT in 2021. This information is significant and relevant to the academic community.

According to Nelida B. Losare, the Provincial Statistics Officer of the Province of Guimaras, the fish production in the year 2021 decreased by 1.21% from the output of 7,940.37 metric tons the previous year, due to a fall in production in both municipal and aquaculture sub-sectors of the fishery industry with a total of 7,844.53 metric tons recorded. This decrease in fisheries production may have been directly or indirectly caused by the restrictions brought about by the community quarantine due to the

coronavirus pandemic. However, now that restrictions have been lifted, it is expected that the fisheries production in the province would return back to its normal range of around 8000-9000 metric tons per year.

Nueva Valencia, out of all the municipalities in the Province of Guimaras, is recognized as the tourism capital and major fishing hub for the province. It is considered as a fourth class municipality, and holds 22 barangays, out of those, 14 are coastal barangays, 6 are inland, and 2 are island barangays. Positioned in the southeast region of Panay, it is located roughly six (6) nautical miles from the shore. This municipality is enclosed by the Municipality of Sibunag on its northern side, Iloilo Strait on the south and east sides, and Guimaras Strait on the west, as demonstrated in Figure 3.

Figure 3

Location of the Municipality of Nueva Valencia in Guimaras

Figure 4

Infographic Map of the Municipality of Nueva Valencia (LGU – Nueva Valencia)

In the coastal zones of the municipality, it appears that fisheries and related industries have taken over as the primary source of livelihood, surpassing traditional agriculture. As indicated in the municipal profile of the year 2005, a total of 7,565 individuals rely on fishing as their primary livelihood. They utilize 510 motorized and 578 non-motorized fishing crafts. On average, the catch per day when using motorized crafts is 5 kilograms, while only 1.5 kilograms of catch are obtained per day with non-motorized boats. The territorial waters of the municipality cover a stretch of 15 kilometers from the Sibunag River and Punta Ganga shorelines in Poblacion. The collective annual production of the fisheries amounted to 1,984.668 metric tons.

As seen in Figure 4, there is a concentration of fishing grounds, marked by a fish icon, around the locality of Barangay Cabalagnan. The barangay is the gateway to the island barangays of Panobolon and Guiwanon, which hold some of the major fishing grounds of the province. It also accommodates the fish and seafood products coming from its neighboring coastal barangays namely Barangay La Paz, Canhawan, and Igdarapdap which are home to fish pens and freshwater farms.

Barangay Cabalagnan is additionally the site where the Bureau of Fisheries and Aquatic Resources (BFAR), National Anti-Poverty Commission (NAPC), Philippine Fisheries Development Authority (PFDA), and Local Government Units (LGUs) have implemented the municipal fish landing facility meant for the welfare of the town's fishing community.

The Community Fish Landing Center (CFLC) Program, which is defined by the National Anti-Poverty Commission (NAPC), aims to decrease poverty within poor fishing communities and encourage inclusive growth within the fishery sector. It presents a thorough structure to tackle poverty by providing suitable livelihoods and endorsing ecologically sustainable, economically feasible, and socially fair interventions.

Fishing is a subsistence source of income in the local region and many individuals have opted for this livelihood from a young age. The peak season for fishing spans from November to May but is still significant throughout the year.

Figure 5

Existing Renovated Fish Landing Center, Brgy. Cabalagnan

As seen in Figure 5, the existing and newly renovated community fish landing center consists of a 2-storey building. The first floor of the building consists of the BFAR office and an open space intended for buying and selling fish and other seafood products. However, due to its limited space and proposed conversion into a specific

selling area for bulk buyers, auctioneers and mobile retailers locally known as “manugpanting”, a designated area or building for retailers is necessary.

Despite the damages brought by the Guimaras Oil Spill which occurred 16 years ago, the fisheries and aquaculture sector of the Province of Guimaras have slowly recovered from its devastating effects and thus, this sector is still one of the main industries in the province, providing employment and income to the locals.

For this reason, the Municipal Planning and Development Office (MPDO) of the Municipality of Nueva Valencia and the Municipal Planning and Development Coordinator, Ms. Zurinie G. Zaldivar had identified the need for further improvements to the existing fish landing center. In order to accommodate more potential seafood sellers and to provide convenience to the buyers, there is a need to construct a new 2-storey building that will serve as a seafood market.

Also, after an investigation on the Environment and Natural Resources Section of the Municipality of Nueva Valencia headed by the Municipal Environment and Natural Resources Office (MENRO) Focal Person, Mr. Aljun B. Margallo, it was discovered that most of the local fishermen opt to deliver their catch to the nearby Province of Negros Occidental, specifically in the municipality of Valladolid since there is an established large seafood market in the said municipality and the selling price is significantly higher as compared to the selling price in the local fish landing center.

Furthermore, Mr. Aljun B. Margallo revealed that the Province of Guimaras is currently implementing a development of Barangay Cabalagnan Fish Port and its conversion into a Fish Port Complex with complete equipment and amenities to reinforce and further develop the fishing potential of the said locality. As of December 2022, the first phase of the development of the fish port had already commenced.

Also, the Provincial Government of Guimaras had expressed concerns on the issue of the fish supplies being delivered to nearby provinces. Mr. Aljun B. Margallo had revealed that the provincial government have plans to ban the unsupervised movement of fish supply outside of the province which would be implemented in order to encourage the growth of the local seafood market and also to provide abundant supplies to the locals, as well as invite buyers and business owners from outside the province to personally obtain the supply from the local fish landing center at Barangay Cabalagnan.

Figure 6

Satellite View of Barangay Cabalagnan Fish Port (Google Maps)

The researchers had inquired, inspected, and further investigated on the current situation of the existing fish landing center. As seen in Figure 6, the site is located on Barangay Cabalagnan Fish Port, completed more or less 15 years ago and was

constructed by reclaiming the bay across the public market. It has a size of approximately 60 meters in length and 30 meters in width. The existing fish landing center was constructed at the tip of the port. On the left side of the port, there is a research building managed by the Bureau of Fisheries and Aquatic Resources (BFAR) and on the right side are temporary stalls that vendors use for selling their products.

Figure 7

Possible Site of the Proposed New 2-Storey Seafood Market

The proposed 2-storey seafood market building will be constructed on the Cabalagnan Fish Port. Due to space constraints, the temporary stalls will be relocated to a new location. This proposed building will solve the problem of insufficient space for buying and selling seafood products.

The main goal of this proposed building is to serve as an avenue for further development of the fisheries and aquaculture industry of the municipality of Nueva Valencia as a whole while also providing sufficient and comfortable space for every market-goers. Furthermore, the establishment of this new building has the potential to invite investors, business owners, and even tourists which will ultimately propel the local

economy, provide more jobs and source of income, and improve the overall quality of life of the locals of the municipality of Nueva Valencia.

1.2 Problem Identification

No exclusive selling area for seafood retailers. The Province of Guimaras is currently implementing a development of Barangay Cabalagnan Fish port and converting it into a Fish Port Complex with complete equipment and amenities to reinforce and further develop the fishing potential of the said locality. As of December 2022, the first phase of the project which includes the construction of flood mitigation structure for the nearby Cabalagnan River and the reclamation of the existing fish port has already commenced. The proposed open space, as seen in Figure 8 will be intended for the construction of the structures which will comprise the fish port complex in the future.

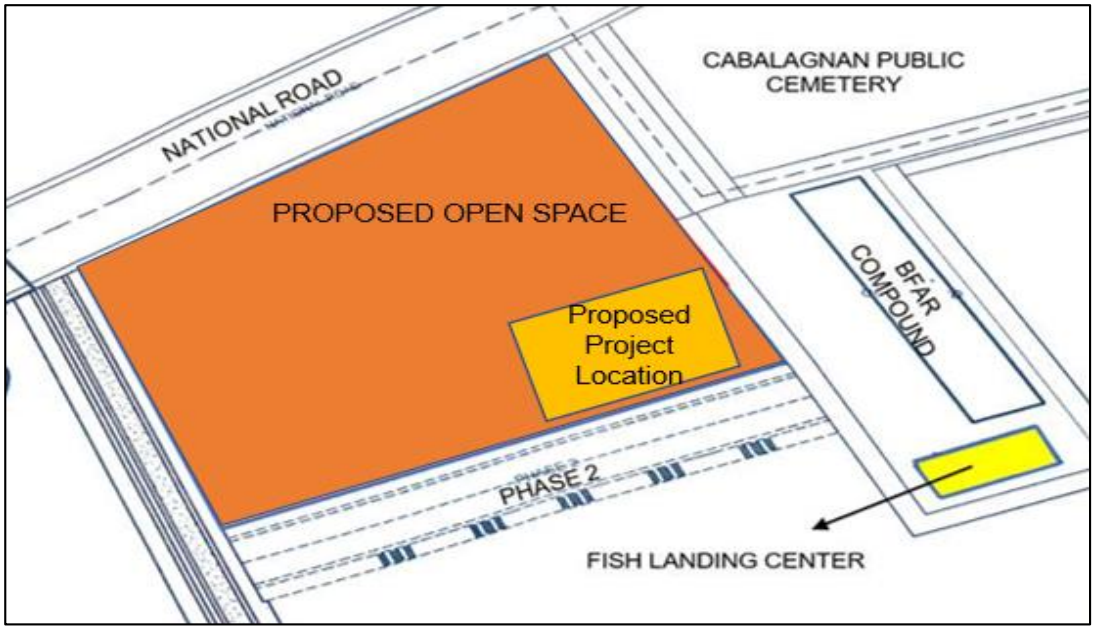


Figure 8

Proposed Project Location

In connection to this, the existing fish landing center was proposed to be converted into an area exclusive for bulk buyers, auctioneers and mobile/ambulant fish reseller, locally known as *"manugpanting".* This is done in order to control the supply that is being bought by bulk buyers, so as to leave a sufficient supply for normal household consumption. Therefore, there will be no selling area for retail seafood vendors once the conversion will be implemented.

Limited Area in the Existing Fish Landing Center. Although the existing fish landing center had finished renovation last December 2022, there is still an insufficiency of space for selling. The existing fish landing center has a dimension of approximately 7.5 meters by 15 meters with the BFAR office, stairs and comfort room occupying 4 meters by 5 meters in dimension as shown in Figure 10.

Figure 9

Front View of the Existing Fish Landing Center

Figure 10

Floor Plan of the First Floor of the Existing Fish Landing Center

According to the data provided by the Office of the Municipal Agricultural Services (OMAS), there are 4 registered bulk buyers, locally known as “komprador” and an estimated 100-150 mobile/ambulant fish reseller, locally known as “manugpanting” from different parts of the province. Figure 11 shows a mobile/ambulant fish reseller. With this, the Local Government Unit of Nueva Valencia had determined that the existing selling area is not sufficient and thus, a new building is necessary in order to accommodate the volume of buyers and sellers that utilize the fish landing center on a daily basis.

Figure 11

Mobile/Ambulant Fish Reseller (Manugpanting)

No Cold Storage and Fixed Drying Area. According to the Food and Agricultural Organization (FAO), the decay of fish meat caused by enzymes and bacteria can be delayed through the reduction of temperature. Freezing fresh raw material and storing it under low temperatures can halt the spoilage effectively.

The local fishermen and seafood vendors often store their seafood products on ice boxes and use ice for preservation as shown in Figure 12. There is no ice plant in the area and the ice supply is only available at sari-sari stores. This causes an inconvenience for the fishermen and also adds up to their expenses.

Figure 12

Seafood Products Stored in Ice Boxes, 2020

Another way of preservation that is used by the locals is by drying the fish. The fishermen and fish vendors use bamboo tables located at the Fish Port for drying fish as shown in Figure 13 below. This covers a significant portion of the boat landing and docking area which results in a difficulty in the movement of fish products from the motorboats. This process or way of fish drying also produces foul odor occasionally.

Distinct types of fish and seafood have varying peak seasons. During peak months, spoilage of fish and seafood supply is a common occurrence in the existing fish landing center.

Detailed summary of fish catch and shell/mollusks gathering season in the Municipality of Nueva Valencia can be seen in Appendix D.

Figure 13

Fish Drying Area

1.3 Objectives of the Study

1.3.1 General Objective

The objective of this study was to design a Seafood Market at Barangay Cabalagnan Fish Port at Municipality of Nueva Valencia, Province of Guimaras.

1.3.2 Specific Objectives

a.) Conducted an initial and final site visit on the proposed project location to familiarize the premises' condition;

b.) Acquired a copy of necessary documents such as vicinity map, boundary map, etc., to determine the usage and boundaries of the proposed project location;

c.) Conducted a geotechnical investigation to identify the soil profile and determine the geotechnical properties of the soil for the design of the

proposed structure's foundation based on the provisions of the NSCP 2015;

d.) Made the architectural design for the proposed structure which includes the perspectives, elevations, floor plans, etc. based on the NBCP;

e.) Designed and analyzed the structural members which includes the computation of wind, seismic, and service loads and the design of columns, beams, slabs, etc., in accordance with the provisions of the NSCP 2015;

f.) Made the electrical plans in accordance with the Philippine Electrical Code;

g.) Made the plumbing plans in accordance with the National Plumbing Code of the Philippines;

h.) Provided a detailed cost estimates and generate a bill of quantities;

i.) Developed a project schedule by utilizing the Program Evaluator and Review Techniques and Critical Path Method (PERT-CPM).

1.4 Significance of the Study

Local Government Unit. The proposed design of a seafood market building is of great assistance to the Local Government Unit (LGU) of Nueva Valencia, Guimaras in the visualization, execution and fulfillment of the said project. This study provided a definite set of plans and new designs including sustainable features for the structure.

Researchers and Future Researchers. This study made the researchers put their knowledge from their course into practice, through creating a secure and reliable structure that is also affordable and environmentally sustainable. The knowledge gathered in developing this study substantially aid the researchers in their chosen field

and practice through experience and real-life application of their learned abilities in college. This study also serves as a useful reference for the future researchers who would plan to conduct a similar study related to the proposed design of a seafood market. Moreover, this study will likewise serve as a guide to gather more information and a great assistance for future improvement of the seafood market.

The Community. Upon implementation, the proposed structure will provide more opportunity to the local individuals as it additionally aims to become an avenue for livelihood to grow while promoting and advancing inclusive development in the fishery sector and the tourism of the community.

1.5 Scope and Limitations of the Study

This study was focused on designing a Seafood Market at Barangay Cabalagnan Fish Port at Municipality of Nueva Valencia, Province of Guimaras. The design included the site development, architectural, structural, electrical, and plumbing plans. It also included the schematic diagram for the waste treatment, drainage system and water system as one of the major concerns in a seafood market. Moreover, this study covered the technical specifications, cost estimates, and construction work schedules. The construction will last for 156 days with an estimated cost of Php 24,525,407.54 in which the source of funds shall be finalized after House Bill No. 3343 to be known as “The Cabalagnan Fish Port Act” is resolved.

Furthermore, the designs and plans for the reclamation of the site were not included and the proposed project’s construction, operation, and maintenance were not directly covered in this study. The jurisdiction for the implementation of the project lies with the local government unit of Nueva Valencia.

Chapter 2

Review of Related Literature

2.1 Introduction

FAO defines fisheries as the activities associated with the gathering of fish, which can involve either fishing or aquaculture. This encompasses a range of characteristics, including the individuals involved, the type of fish or species, the location or environment, the methods employed, the types of vessels, the objectives of the operations, or a combination of these factors.

For many years, fishing has served as a significant means of livelihood for Filipinos, as fish is considered the country's second most essential food after rice. On the average, every Filipino consumes approximately 98.6 grams of fish and fish products daily (FNRI, 1994).

The Philippine fishery sector plays a significant role in the country's economy by employing around one million Filipinos, which accounts for approximately 3% in 1998. The municipal fishing sector has contributed 68% to the total employment, followed by aquaculture with 26% and commercial fishing with 6%, as it's a labor-intensive industry. From 1985 to 1998, the fishery sector has annually contributed 3.6% to the country's GDP on a current price basis.

In 1998, the industry's gross value added (GVA) was reported at P74.1 billion, which contributed 2.7% and 2.8% to the country's gross domestic product (GDP) and gross national product (GNP), respectively. It accounted for 17.6% of the agriculture, fishery, and forestry sector's share.

A vital element of the fishing industry is a seafood market, which serves as a physical location for selling seafood and its related products. Such establishments can

be exclusively dedicated to the wholesale trade of marine products between fishermen and merchants, the retail sale of seafood to individual customers, or they can engage in both forms of trade. Retail fish markets, classified as wet markets, typically offer an array of street food, as well as fruits and vegetables, essential for cooking seafood and fish. The magnitude of fish markets varies greatly based on the level of demand, ranging from diminutive fish stalls to sizable establishments. This fluctuation in size is dependent upon the demand for seafood products in a given area.

Figure 14

Seafood Market of Seaside Dampa Macapagal, Manila, Philippines

A well-structured and designed seafood market has the ability to play a significant role in the economic development of Nueva Valencia. It increases the likelihood of fishermen obtaining the optimum value for their fish products in a well-

organized environment stocked with numerous buyers and fellow fishermen possessing comprehensive knowledge of current market prices.

The primary objective of this research project is to present a detailed plan for the proposed development of a seafood market at Brgy. Cabalagnan Fish Port in Nueva Valencia, Guimaras.

Efficient seafood markets can offer a convenient, safe, and comfortable experience for both buyers and sellers. To facilitate an effective, cost-conscious, and innovative design of the proposed project, conducting research on related literature and studies is crucial.

This chapter discusses the literature and studies related to the development of the proposed seafood market in Brgy. Cabalagnan, Nueva Valencia, Guimaras.

2.2 Seafood Market in Context

A seafood market is a commercial location where various types of fish and seafood are sold, either wholesale or retail. This type of trading can involve disputes between fishermen or fishmongers, or between merchants and individual consumers. Traditionally, fishermen would deliver their catches directly to customers at a storefront within the retail market, but vendors may also use vehicles to deliver products directly to consumers.

Moreover, a seafood market shares similar functionalities with any other market, and it facilitates the provision of services and products. The consumers benefit from purchasing fresh, frozen, cured seafood, and retail and wholesale services, specifically salmon and tuna. The fishing industry is a significant global industry, and its relevance transcends being a source of food to the people. It has a direct impact on a country’s economy by selling fish products worldwide, making it one of the primary sectors that

generates a significant portion of a country's profits, and ultimately contributing to its national income. (sisinternational.com)

The seafood industry has undergone significant transformations in recent years. While wild fish landings, the traditional source for seafood, remained stagnant in the mid-1980s, aquaculture emerged as a vital production technology and led to a continued increase in total production. Seafood trade has significantly grown by more than 350% in terms of both quantity and real value since the mid-1970s, resulting in it becoming the most traded major food in the world (FA0, 2017). The combined trade with seafood is higher than that of all other animal proteins like beef, chicken, pork, and mutton combined (Asche et al., 2015). Consequently, this rapid growth has led to the emergence of global markets replacing regional markets, and has enabled the use of commodity markets for an increasing number of seafood products.

As the global sourcing of seafood has increased, the market has become more commoditized, resulting in decreased importance of individual species as a product attribute in many markets. Species groups are gaining more significance in today's world due to the growing interchangeable nature within these groups. This has helped in making the seafood trade more commoditized and facilitated the applications of technologies in various aspects of seafood production, transportation, and marketing (Asche, 2008, Kvaloy and Tveteras, 2008, Anderson et al., 2010, Larsen & Asche, 2011, Kumar and Engle, 2016, Ankamah-Yeboah et al., 2017).

2.3 Attributes of a Good Seafood Market

2.3.1 Accessible and Central Location

Accessing seafood markets is convenient, as they are readily reachable via car or bus transportation. Moreover, the majority of these markets are

situated within the urban areas or neighborhoods, making it easier for buyers and sellers to transport merchandise.

When making decisions about the location of landing and marketing facilities for fish within a fishing area, the distance between the proposed landing sites and the fishing grounds is a crucial factor to consider. Additionally, the chosen site must provide a secure docking area for fishing boats regardless of weather conditions or tide stages. It should also be easily accessible from the fishing grounds and market outlets.

2.3.2 Protection from the Elements

Most markets offer shelter from weather conditions, either by being housed under sturdy roofing or existing within buildings. When situated outdoors, vendors typically erected fabric or canvas canopies above the aisles, enabling visitors to enjoy the market regardless of the climate and remain dry on rainy days.

2.3.3 Navigable Aisles

Seafood markets vary in terms of their ease of navigation, and the markets with clearly marked and spacious aisles are most favorable for visitors. Such aisles provide ample space for customers to purchase items without obstructing the movement of others. Appropriate lighting, air circulation and proper signage also play a crucial role in making the market more navigable for customers. Although there is no universal formula for ensuring the ease of navigation in seafood markets, it is essential to consider this aspect both for customer comfort and vendor success.

2.3.4 Broad Selection of Goods

Excluding specialty markets focused on a single item, such as fish, the researched markets displayed exceptional diversity within each category of

goods and a vast number of such categories. In order to remain competitive in a market filled with options for consumers, it is essential that markets offer a varied and comprehensive selection of seafood goods categories.

2.3.5 Affordability

Majority of the markets offer goods at more affordable prices than what can be found in supermarkets. The availability of reasonably-priced seafood markets make it a significant location for both commercial and social activities. Although there are a few exceptions, the general perception is that these markets are public spaces that are accessible to everyone. Interestingly, this notion differs from the commonly held belief in the United States, where farmers' markets are often regarded as high-quality and therefore expensive.

2.3.6 Safety

Seafood markets attract a diverse range of people and can be noisy and chaotic, with money constantly changing hands. Despite feeling mostly safe, some safety issues remain unresolved in these markets. Due to less regulation than supermarkets, there are concerns about fraudulent business practices. To mitigate this, the markets often provide public scales for customers to ensure that they receive the correct weight for their purchases.

2.3.7 Integration of Public Space and/or Pedestrian Streets

The majority of the markets examined in this report occupy either a pedestrian street or a small plaza nearby, with some having both. Such markets are surrounded by pedestrian streets and open public spaces that not only facilitate walking, but they also provide places for people to socialize and engage in "street appropriation." This refers to the utilization of public spaces for activities other than permanent commerce, such as eating outdoors and street vending. Such areas serve as a gathering place for the community around the market,

thereby encouraging customers to stick around longer. The significance of this goal extends beyond any specific city or situation. (Flynn, 2014).

2.4 Related Studies

2.4.1 Fisheries Terminal Complex, Oistins, Barbados

The landing jetty is 145 meters in length and 4 meters in width. It is designed to accommodate five vessels for unloading and two vessels for bunkering simultaneously. With this capacity, unload operations for 70 boats can be carried out in 4-5 hours, provided that two 12-meter-long vessels and three shorter length vessels are concurrently unloaded. The jetty is equipped with two landing platforms that are 1.2 meters above the mean sea level, and rubber fenders are installed to reduce the impact when vessels make contact with the jetty.

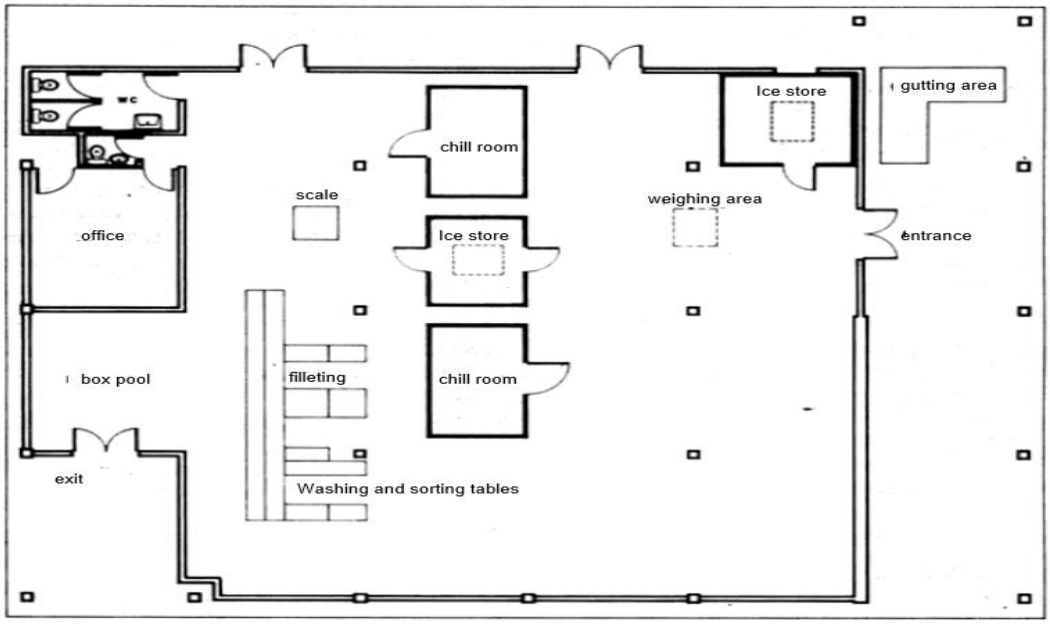


Figure 15

Oistins Fisheries Terminal Complex

The fish terminal, which spans an area of 490 square meters, is a location where fish caught from the sea is received, weighed, and auctioned. In this location, the fish is washed, sorted, filleted if necessary, packaged, iced, and stored for sale in chill rooms that have the capacity to store 5 tons of boxed iced fish. Furthermore, two flake ice makers with a 2 t/24 h capacity each are also installed. Above the ice storage rooms are two chill rooms, which have a total capacity of 13 t. For vessels outside the terminal, a 12 t/24 h capacity flake ice plant and two 24 t capacity reefer-type containers are available. The purpose of this fish port is to handle and manage a daily supply of 6,400 kilograms of fish.

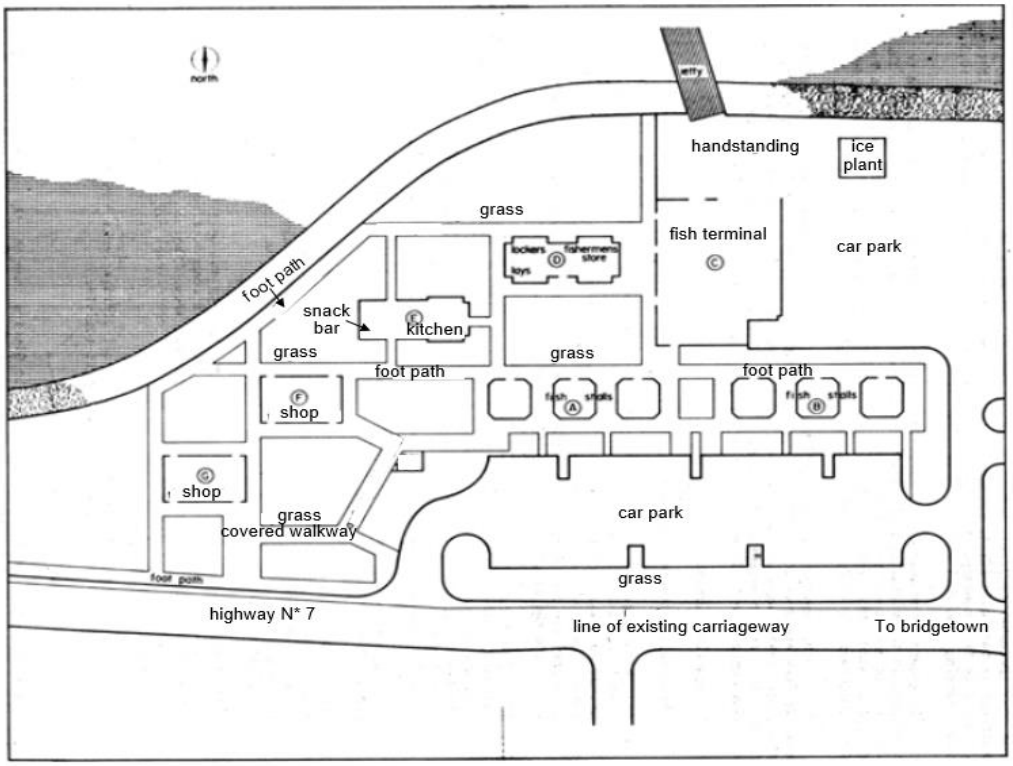


Figure 16

Layout of Fisheries Terminal at Oistins

The complex at the terminal is furnished with six stalls specialized for fish retail, and it provides ample space for the purpose of processing and cleaning

fishes, catering to as many as 36 fish merchants. The stalls comprise of reinforced concrete with tiled working surfaces. Moreover, the area encompasses kiosks dedicated to vegetable retail, along with two stalls bringing together a bar and a grocery store, in addition to a canteen designed for fishermen. Figure 17 illustrates the design of the fish retail stalls.

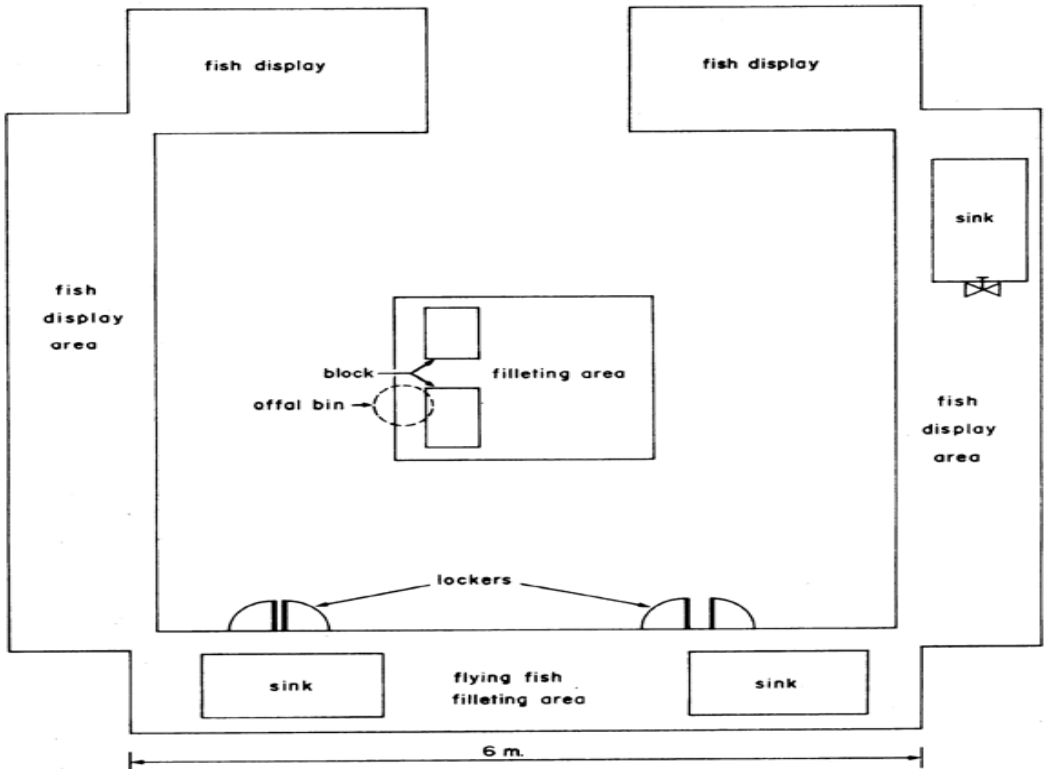


Figure 17

Layout of Fish Retail Stalls at Oistins

The boat repair yard is equipped with a vast area for hauling and maintaining fishing boats, including a 5 m wide haul-out slipway, and a winch, mechanical workshop, vessel servicing area, fishing equipment shop, and chandlery. Due to a lack of suitable boat haul-out equipment, this boat repair facility is not yet completely operational.

The fundamental supplementary facilities comprise of a storage tank structure for fuel, provisions of electricity, a reserve of pure water for vessels, along with lavatories easily accessible to the public.

2.4.2 San Fernando Wholesale/Retail Fish Market (Trinidad)

The San Fernando fish market, which operates as both a wholesale and retail vendor, can be found approximately 45 minutes south of Port of Spain. The market consists of several key components, including a concrete platform for fish landing that spans 3, 12 meters. In addition, there is a small wholesale auction hall of about 40 square meters, a flake ice machine that can produce 300 kg of ice per day, a chilled room with a capacity of 6.8 tons that is kept at 0-2°C, and a cold storage area whose capacity is 2.2 tons of fish and is maintained at a temperature of -3.5 to -5°C.

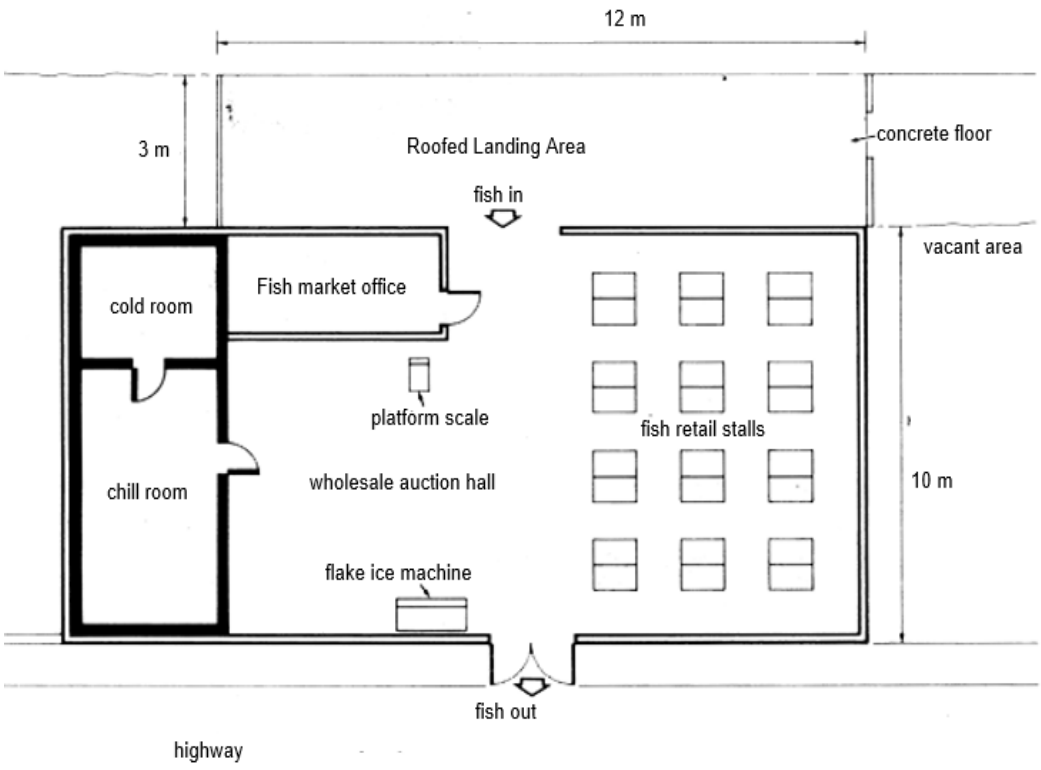


Figure 18

Layout of San Fernando Wholesale/Retail Fish Market

The San Fernando fish market is considered as the second largest wholesale fish market in Trinidad which handles more than one thousand tons of fish annually. On a daily basis during the fishing season, around 3 tons of fish are auctioned off. In the auction hall, the fish are sorted, weighed on a platform scale and then taken to the fish retail area which is situated on the right side of the building. The fishmongers have their stalls which are made up of concrete and coated with white tiles in the shopping district. These stalls are equipped with work tools, drainage, and water supply. The market has the capacity for around twenty-four fishmongers as shown in Figure 18.

2.4.3 Otaheite Fish Landing Facilities (Trinidad)

A rudimentary structure designated as a fish landing hut is utilized to receive the catch of shrimp and fish from the small-scale fishermen of Otaheite village. There are around 27 fishing boats, known as pirogues, equipped with primarily small trawl nets, that are powered by either outboard motors (in the case of 7 boats) or inboard diesel engines (in the case of 20 boats), are currently unloading their catch at this site. It is worth mentioning that onboard the fishing boats, the handling of fish is limited to preserving the catch by keeping it moist and away from direct sunlight; ice is not employed for this purpose.

Small-scale fishers have access to a maintenance and storage shed for fishing nets and a boat yard in the town of Otaheite. A paved road also connects the community of Otaheite to nearby coastal communities such as San Fernando, Orange Valley, and Port of Spain as shown in figures 19, 20, and 21. The town receives a regular supply of electricity and potable water from the main public supply.

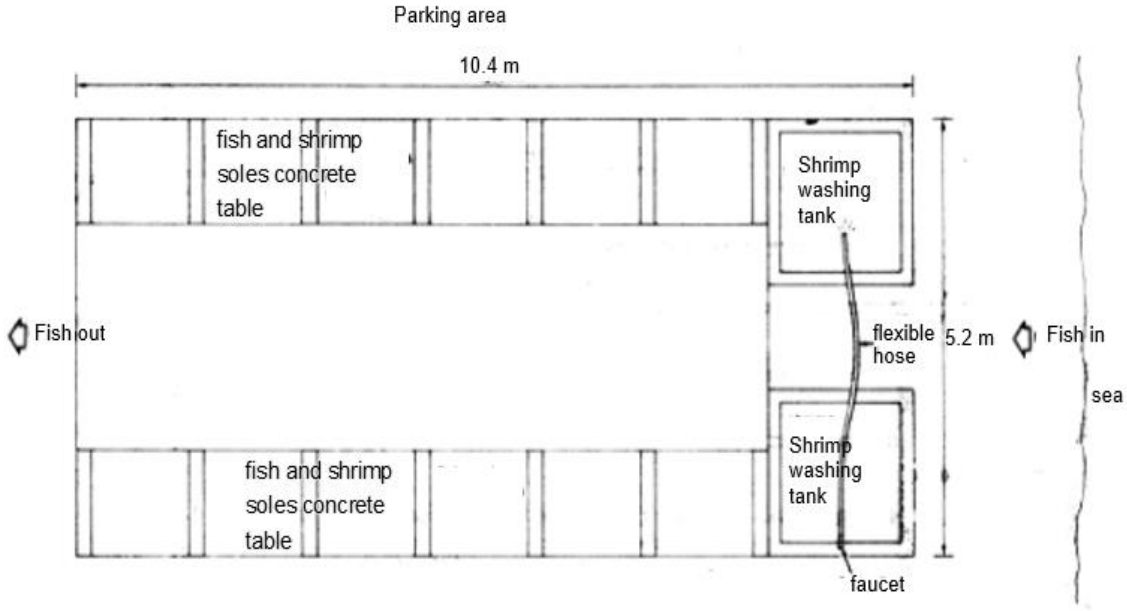


Figure 19

Layout of Otaheite Fish Landing Shed

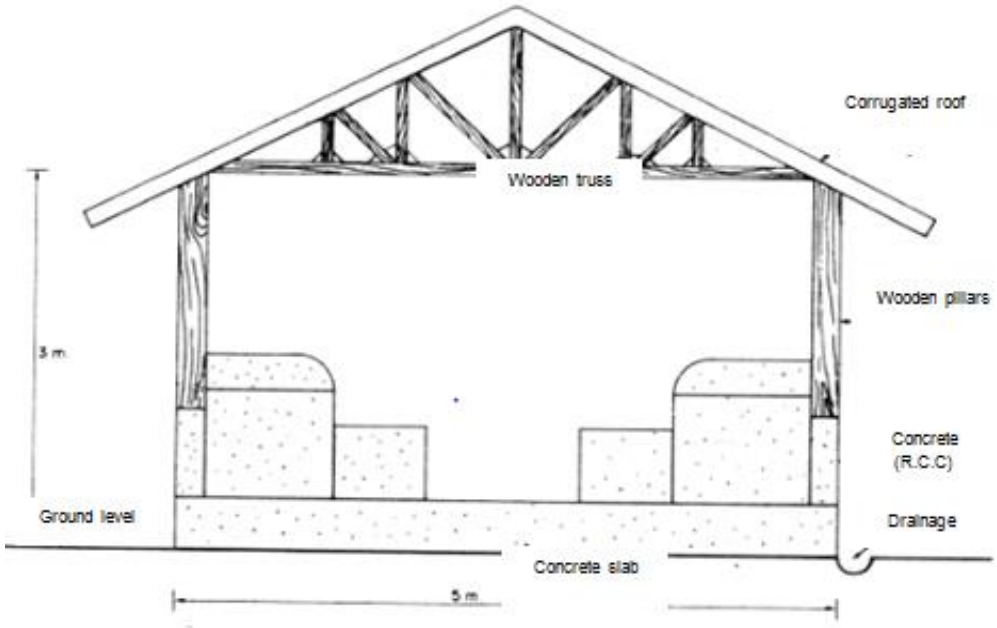


Figure 20

Front view of Fish Landing Shed at Otaheite

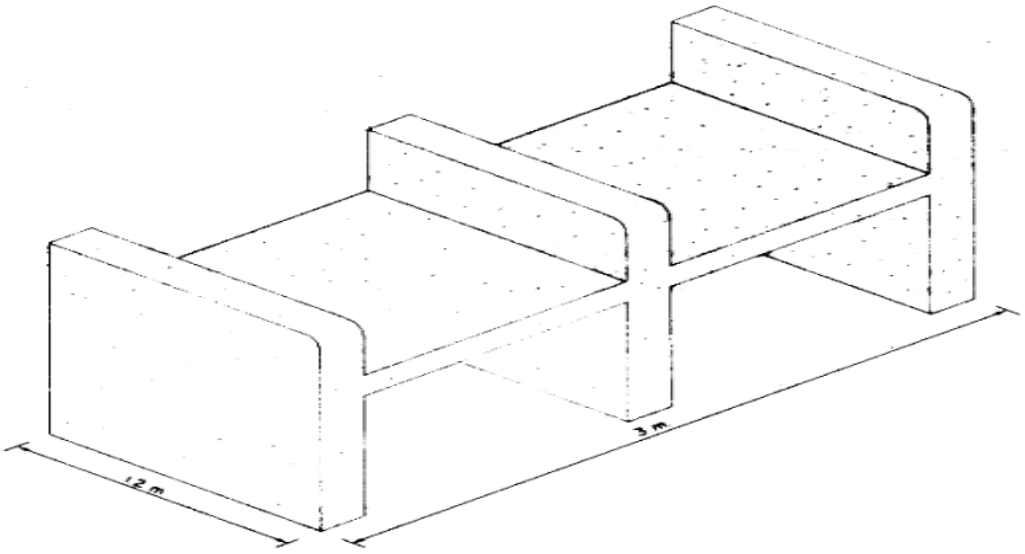


Figure 21

Concrete Fish Wholesale/ Retail Sales Table at Otaheite

2.4.4 Besiktas Fish Market

The Besiktas Fish Market, located in one of Istanbul's most populated and diverse neighborhoods, is a well-known place where both locals and tourists buy fresh fish daily. Due to its dilapidated state, the market's original structure required replacement. GAD's design solution aimed to preserve the market's iconic presence in the neighborhood while also maintaining its welcoming atmosphere by constructing a concrete shell with a triangular shape that covers the entire site and features large openings at street level.

Figure 22

Besiktas Fishmarket

Figure 23

Besiktas Fish Market Interior

The concrete shell has been intelligently crafted to maximize the available interior space without the need for columns, thus optimizing the project's

programmatic requirements. Additionally, the design has taken into consideration the historical significance of the fish market and has injected a contemporary and pragmatic solution that complements the location's past while satisfying the needs of the present. (www.archdaily.com).

2.4.5 The New Sydney Fish Market

Figure 24

The New Sydney Fish Market

As the leading seafood hub in Australia, the Sydney Fish Market is of immense importance to the national fishermen, aqua culturists, and cooperatives. The renovation of the Market not only rejuvenates it into a modern facility but also invests $750 million into the country's fish industry. The restored Market's grandeur complements it with other iconic waterfront attractions such as the Sydney Opera House.

The recent redesign is set to establish more than 4,700 square meters of fresh public open space, while simultaneously laying foundations for a forthcoming joint cycle and pedestrian path, bridging access to Sydney Fish Market to Woolloomooloo. The new facility is also expected to house a prominent auction zone, which is more visible and easier to access. This will provide an opportunity for educational exploration for the public as well as facilitating a more extensive display of the seafood supply chain.

The new site's facilities will result in substantial technological advancements. The operative floor will be outfitted with cutting-edge machinery to speed product movement and material handling, while enhancing quality assurance. In addition, the new site will bring chances for scientific projects – extending existing connections with UTS Food Agility and Australia's Nuclear Science and Technology Organization – that are fundamental to supply chain traceability.

The upcoming Sydney Fish Market is poised to enhance Australia's seafood industry and raise awareness among consumers, while also encouraging them to support fishing communities.

2.4.6 Small-Scale Fisheries Development Project, Bayawan, in Negros Oriental, Philippines

Two seafood processing facilities, situated in Bayawan and Dumaguete respectively, have been established. Specifically located near the municipal fishing port, the Bayawan Fish Handling Complex (BFHC) has been designed with the capacity to handle approximately 600 tons of fresh fish on an annual basis. The various components of the BFHC include:

A dock designed like a seawall is available by the Bayawan River to assist the fishing fleet in docking, unloading, and obtaining necessary supplies

such as fuel, freshwater, and ice. The covered receiving space measures 28 m^2. Additionally, a foyer that spans 405 square meters provides enough area for activities such as fish washing, sorting, and ice-packing, and it also serves as a space for bidding sales. The BFHC boasts a flake ice plant with a capacity of 2.5 tons, an ice storage area that can hold up to 6.4 tons, and a chill room measuring 25 m^3 that can house 6.25 tons of iced fish in boxes.

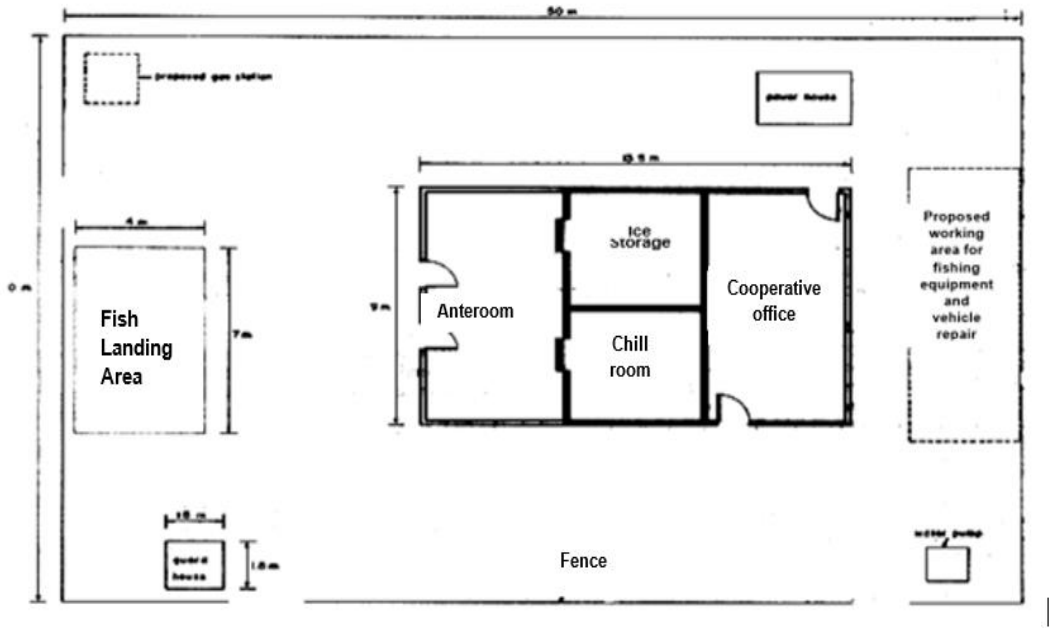


Figure 25

Layout of Bayawan Fisheries Complex

2.4.7 Dumaguete Fish Handling Facilities (DFCS)

This establishment is designed to complement those found in Bayawan, and it comprises a 2.5-ton ice-making facility, a 6.4-ton ice storage area, and a 25 cubic meters refrigeration space. A 40.5 square meter adjacent room is available for sorting, accepting, and packaging fish for transportation, in conjunction with other marketing activities such as ice sales and bidding, as illustrated in Figure 26.

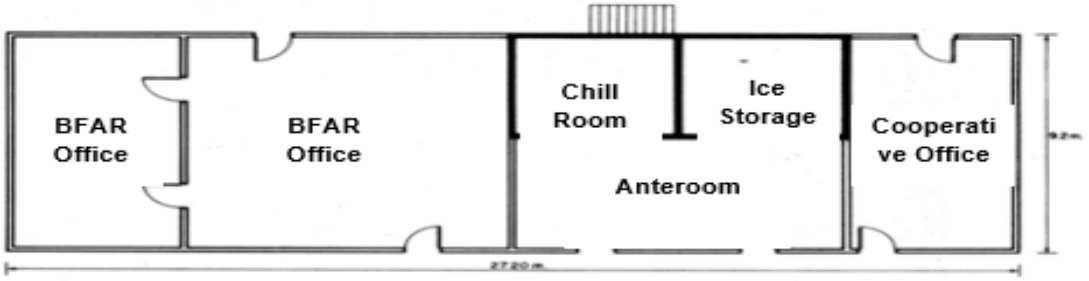


Figure 26

Layout of Dumaguete Fish Handling Facilities

2.5 Synthesis

A market refers to an assembly of people on a regular basis for buying and selling of food, livestock, and other goods. Furthermore, it is a process by which buyers and sellers come into contact with one another and exchange products and services, either directly or through intermediary agents or institutions. A seafood market in particular, is a place where fish and other seafood are sold. It focuses on selling seafood to individual customers or on wholesale trading between fish merchants and fishermen.

Seafood markets are traditionally seen in seaside locations because seafood spoils quickly. Some were also developed in inland areas with good trade routes to the coast once chilling and preservation methods became available. In the municipality of Nueva Valencia, there is an existing fish landing center located at Brgy. Cabalagnan, a coastal barangay in the said municipality. However, this building has very limited capacity and does not have facilities to store and preserve fish and seafood products. Therefore, there is a need to improve the said facility in order to provide more services and usability, as well as to provide more space for merchants and buyers.

The New Sydney Fish Market and the Besiktas Fish Market was used as a basis in the design of the proposed seafood market. It was designed as a two-storey

reinforced concrete building with an open covered space at the front. The open design will highlight the seafood supply chain in greater detail.

In connection to the Otaheite Fish Landing Facilities (Trinidad), the proposed seafood market was designed to have sufficient roofing to provide shelter against rain and direct sunlight, as well as provide a large open space for wholesaling, sorting, storage and loading/unloading of the products. To avoid accidents due to slippery or muddy soil conditions and to enable the proper handling and storage of products, the ground around the building will be paved.

Moreover, the organized layout of the San Fernando Wholesale/Retail Fish Market was adapted so that a smooth flow of products can be maintained. A separate entrance and exit will facilitate an orderly and safe movement of supply. Fish tables/stalls made out of concrete outfitted with an individual water supply and drainage system to accommodate retail sellers were also adapted.

Facilities such as storage rooms, office rooms, processing rooms, and public toilets were also provided. The second floor will be accessed via stairs and was designed to be an open roof deck and will be used as a drying area. Open air-drying using sun and wind has been practiced since ancient times to preserve food. This will ensure that no fish supply will be spoiled and wasted. Also, ramps were provided so that elderly and disabled persons can access the building easily. Enough apertures were provided in the market building in order to provide excellent air circulation and natural lighting.

The market is constantly a hub for community interaction. When buyers, sellers, and other market goers come into contact, there occurs interaction that might range from inquiring for items to the bargaining process. Most traditional markets are dirty, muddy and humid. However, this proposed seafood market is a well-designed market that will facilitate easy access to shopping and promote increased social interaction.

Chapter 3

Methodology

3.1 Design Constraints

3.1.1 Choice of Materials

Corrosion refers to a combination of chemical and physical processes that negatively impact the environment's quality and impair the durability of materials and structures. Coastal infrastructure is especially vulnerable to seawater corrosion, which occurs at a faster rate compared to freshwater due to a higher presence of dissolved ions.

When evaluating materials for applications that require a high degree of corrosion resistance, it is important to consider several factors. For instance, the application of protective coatings, such as paints, epoxy coatings, and powder coatings, can provide an extra layer of defense against the corrosive environment and guard the structure against degradation.

It is vital to consider that materials that are resistant to corrosion often require more financial investment than non-resistant materials. As a result, before incorporating corrosion-resistant materials, it is crucial to perform an assessment of their economic viability, taking into account their particular application.

3.1.2 Roof Type

Coastal regions are infamous for their consistent occurrence of strong gusts of wind, particularly during inclement weather conditions. This phenomenon can result in a plethora of issues. Various types of structures may be vulnerable to the detrimental effects of high wind pressure. Of note is that roof

overhangs, which have the propensity to confine air below them and produce considerable uplift forces, tend to be particularly susceptible.

In the context of roof decks, it is paramount to ensure proper installation and maintenance to achieve water tightness. The lack of incline can pose significant drainage challenges, which may exacerbate the risk of water leakage or ponding if the design and maintenance are subpar. Additionally, roof decks can offer a contemporary and streamlined look that can complement specific architectural styles. Nonetheless, some may consider them aesthetically unappealing in contrast to slanted roofs.

Conversely, pitched rooftops are specifically engineered to efficiently divert water, ultimately decreasing the risk of water collection and leakage. The overlaid slope architecture allows for effective drainage, thereby reducing the likelihood of water-related problems. Additionally, pitched rooftops are renowned for their traditional and ageless aesthetic. They provide a pleasing visual quality by generating a well-proportioned and symmetrical appearance with their slopes.

3.1.3 Sanitation Systems

Proper hygiene and sanitation are essential for maintaining good health, promoting survival, and ensuring development. Numerous countries encounter challenges in offering sufficient sanitation infrastructure for their entire populations, thus exposing individuals to the dangers of water, sanitation, and hygiene-related illnesses.

Having an adequate water supply is crucial in ensuring cleanliness and hygiene in a public market, especially when it comes to cleaning stalls, hand washing, and maintaining the overall cleanliness of the market area. By upholding hygiene standards, vendors, customers, and market authorities can effectively prevent the spread of diseases and guarantee a safe environment.

3.1.4 Green Building Technology

Green building technology refers to the design, construction, and operation of buildings that are environmentally responsible and resource-efficient throughout their lifecycle. It encompasses a wide range of practices, materials, and technologies aimed at minimizing the negative environmental impacts associated with traditional building methods while maximizing energy efficiency, sustainability, and occupant well-being.

The concept of green building technology emerged as a response to the growing concern over climate change, depletion of natural resources, and the need for sustainable development. By adopting green building principles, architects, engineers, and construction professionals aim to create structures that minimize energy consumption, reduce greenhouse gas emissions, conserve water, and promote a healthy indoor environment.

3.1.4.1 Water Resources

In the context of a market environment, the supply of water is of utmost importance for effective and seamless operations. Markets are renowned for offering a vast and diverse range of fresh, high-quality produce, such as fruits, vegetables, and seafood. These products necessitate adequate hydration to preserve their freshness and quality. The provision of water is pivotal in safeguarding perishable goods, averting wilting or decay, and delivering a broad selection of superior items to customers.

Moreover, markets produce a considerable quantity of waste, encompassing leftover food, wrapping elements, as well as other remains. Water plays a crucial role in getting rid of waste and keeping the market premises clean and hygienic. This is done through various

cleaning activities such as washing surfaces, garbage bins, and ensuring proper sanitary conditions. An adequate water supply is key to support and maintain effective waste management techniques.

Lastly, public markets generally have amenities such as restrooms, drinking fountains, and other facilities that necessitate a reliable water supply. Essential to maintaining hygiene standards in these areas and ensuring the convenience and satisfaction of market-goers, accessible and clean water is of utmost importance.

3.1.4.2 Energy Resources

The provision of energy is indispensable for the public sector, as it furnishes the required power for a wide range of activities and services.

In an academic context where the audience is knowledgeable and a formal tone is required, it is crucial to understand the significance of having proper lighting in a public market. Vendors and customers require a safe and welcoming environment, and this can be achieved by ensuring that the market has access to an adequate energy supply that powers a range of lighting systems, including overhead, stall, and outdoor lights. Proper illumination helps improve visibility, enhances security, and promotes commerce during daytime and nighttime hours.

Furthermore, the provision of energy is of utmost importance for the proper functioning of infrastructure and utilities in a public market. These utilities encompass elevators, escalators, public address systems, water pumps, security systems and other essential components that elevate the market's efficiency, accessibility and safety.

A consistent and dependable source of energy is essential to maintaining lighting, refrigeration, food preparation, electrical equipment,

and climate control in public markets. This is particularly true in academic settings, where it is necessary to ensure that the market's infrastructure and utilities operate smoothly. By creating an environment that is favorable to vendors and customers, a reliable energy supply contributes to the market’s overall functionality and success.

3.2 Contemporary Issues

3.2.1 Combating Corrosion: Researchers Fight Underwater Deformation with Enhanced Metals

It is essential for engineers to ensure that offshore and floating structures are constructed with materials that can endure the ocean's dangerous environment, as employees' lives and a company’s finances are at stake. Nonetheless, there are other considerations to bear in mind beyond the relentless pounding of the waves. An example of this is corrosion, which weakens materials and causes them to deteriorate over time, eventually warping or collapsing. Corrosion is particularly problematic in the high-salinity environment of the sea and is a significant concern for engineers who design such structures.

Dr. Marcelo Paredes, an assistant professor at Texas A&M University at Galveston's Department of Ocean Engineering, has been conducting research to combat corrosion in high entropy alloys (HEAs) widely used in the automotive, offshore, and nuclear industries by developing materials modeling.

HEAs or alloys composed of five or more elements in equal or substantial proportions provide considerable potential for engineering applications due to their superior qualities, as explained by Paredes.

The primary driving force behind these advances is the necessity to discover new materials that exhibit enhanced strength, resilience, and mechanical and chemical properties for energy generation and off-shore installations, as well as low-density and affordable alloys for transportation.

Paredes expressed his opinion that collaboration to address the complex issue of material design could be a highly beneficial endeavor. Such cooperation presents an opportunity to investigate the potential of HEA as advanced materials for engineering purposes in an aggressive environment.

3.2.2 Sustainable Development Goals (SDG)

All UN Member States in 2015, offer a cooperative road map to long-term security and prosperity for humanity and the planet. It centers on 17 Sustainable Development Goals (SDGs) that represent an urgent call to action by all countries, developed and developing, in a global partnership. They understand that combating climate change and protecting the world's oceans and forests are inextricably linked to efforts to enhance health and education, decrease inequality, and stimulate economic growth.

Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation. Industries and infrastructure will need to be modernized in order to face the challenges of the future. All people should have free and unfettered access to the world's information and monetary systems, thus we must support and spread new, sustainable technology. This will lead to increased wealth, the creation of new jobs, and the establishment of more secure and wealthy societies all across the world.

Goal 11: Sustainable cities and communities. It is one of the 17 Sustainable Development Goals established by the United Nations General

Assembly in 2015. The official mission of SDG 11 is to "Make cities inclusive, safe, resilient, and sustainable," and it includes Proportion of municipal solid waste collected and managed in controlled facilities as a percentage of total municipal waste generated by cities. The 17 SDGs take into account that actions in one area will affect outcomes in other areas as well, and that development must balance social, economic, and environmental sustainability.

3.3 Design Framework

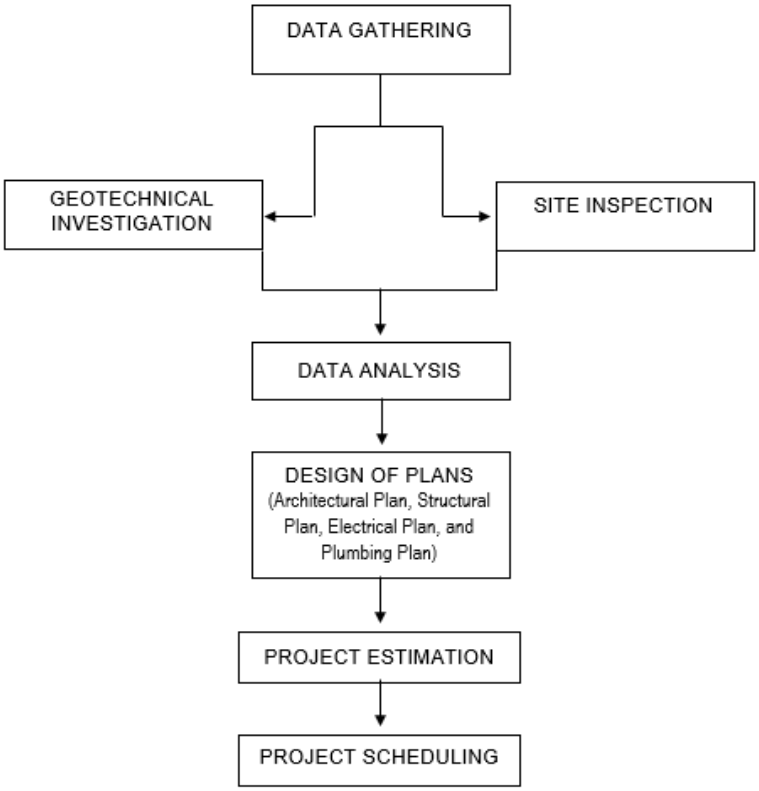


Figure 27

The Design Framework

The design framework for the proposed design of a seafood market building at Barangay Cabalagnan Fish Port can be seen in Figure 27. The initial aspect of the framework pertains to data gathering, which necessitates not only that researchers visit the site and carry out an inquiry, but also gather soil samples to verify the soil's capacity to support the proposed structure. Subsequently, the data collected was analyzed and evaluated which were considered in the designs for the seafood market's architectural, structural, plumbing, and electrical plans. Upon completion, the researchers produced an estimated cost as well as the project schedule.

3.4 Project Scope

This study developed a definite set of plans and provided a sustainable design to the proposed seafood market in Barangay Cabalagnan, Nueva Valencia, Guimaras.

The project scope was focused on generating a detailed architectural, structural, electrical, and plumbing plan and provide a schematic diagram of the drainage system, water system and waste treatment. Moreover, this study likewise incorporated construction specifications, cost estimates, and construction work schedules of the proposed seafood market. The execution of the said project will be handled by the Local Government Unit of Nueva Valencia in the event that they want to proceed with it.

3.5 Data Collection and Analysis

3.5.1. Site Visit

To gather quality information, obtain better understanding and familiarize the premises' condition, an initial site visit was conducted by the researchers last December 7, 2022 and the final site visit was conducted last February 15, 2023.

The proposed site which is currently under construction, as well as the adjacent buildings were visually inspected.

Moreover, other important papers that include zoning and land use, lot area, vicinity maps, etc. were also obtained to be utilized as a reference in making the plans and designs of the seafood market. Surveys and interviews with the locals were also conducted.

Figure 28

The Proposed Site as of May 3, 2023

The collected data during the site investigation was thoroughly analyzed and utilized as reference to generate a practical design that will provide safety and convenience to the people when accessing good quality seafood products and establish sufficient space for the fishers to unload their catch.

3.5.2 Survey of Land

A copy of the cadastral survey of the proposed site as shown in Figure 29, was obtained from the Local Government Unit of Nueva Valencia. This map was used to determine the boundaries of the proposed site.

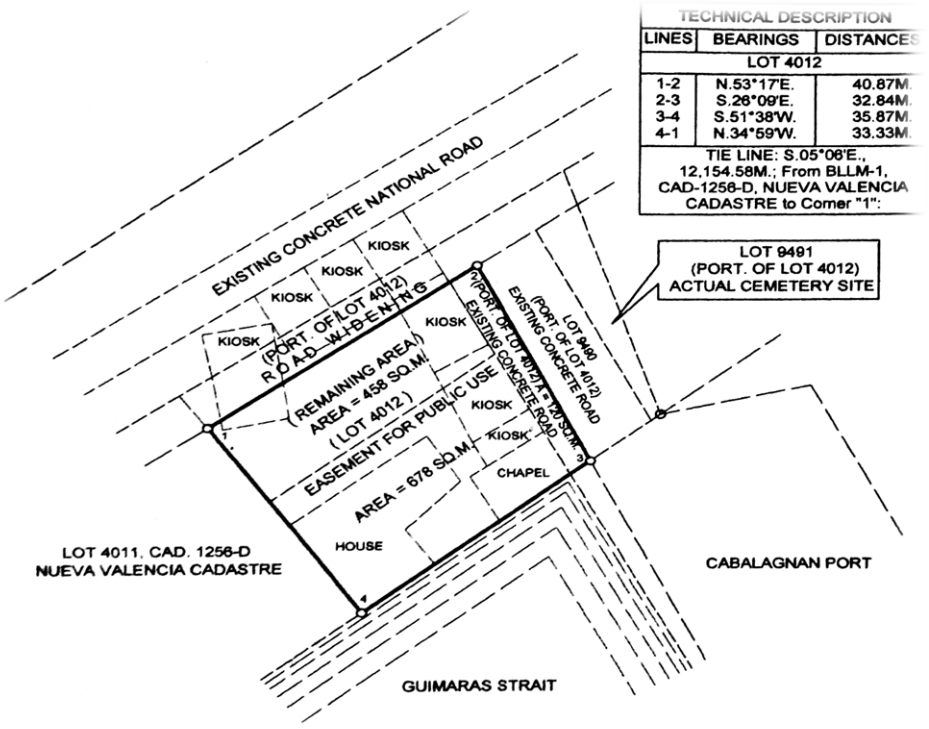


Figure 29

Boundary Map of the Proposed Site (MO-ENRS, Nueva Valencia)

3.5.3 Geotechnical Investigation

The researchers conducted a geotechnical investigation on where the proposed seafood market will be constructed in order to identify the profile and properties of its soil. The soil sampling was conducted last February 15, 2023 in sunny weather starting at around 10 AM to 12 AM.

The natural soil samples were collected with the use of an excavator. The digging process was stopped on the onset of groundwater which was recorded at

approximately 5-6 feet and after which, the soil samples were obtained at this depth.

Since a portion of the proposed site is to be reclaimed, a soil sample was also obtained from a stockpile of soil which will be used as an embankment material.

The soil samples were then stored in a ziplocked container and then transported to the CPU Soil Laboratory. Soil samples were utilized on several laboratory tests such as Specific Gravity, Moisture Content, Unit Weight Analysis and Sieve Analysis which started at February 16, 2023 and ended at February 20, 2023.

The test results were analyzed to determine the ultimate bearing capacity, properties and classification of the soil which are crucial in evaluating the stability and strength of the ground and to identify the type of foundation to be used for the proposed seafood market.

Figure 30

Soil Sampling of the Proposed Site's Natural Soil Profile

3.6 Preparation of Designs

3.6.1 Architectural Design

The National Building Code of the Philippines (NBCP) was used in developing the architectural design including the general site location plan, perspectives, elevations, floor plans, sections, and schedules of windows and doors of the proposed structure.

The architectural design was checked by a licensed architect to make sure that the final structure meets the people's specific needs. The architectural plan was based on the determined characteristics and features of a seafood market which can provide the most convenient, efficient and sustainable market area for both the customers and sellers.

The final architectural plans were checked and approved by licensed architect, Ar. Leelix Ann J. Molina last April 6 2023.

3.6.2 Structural Design

The structural design was in compliance with the National Structural Code of the Philippines (NSCP) 2015 and other design codes mandated by law in order to have a safe and economical structural design that would pass the standard specifications.

This plan included the structural layout and the design of the elements of the structure. In addition, this study incorporated material properties and data specifications, design loads, and other design considerations deemed necessary.

The final structural plans were checked and approved by licensed civil engineer, Engr. Madrigal O. Mandalawi last April 29, 2023.

3.6.3 Electrical Plan

This plan included the electrical layout of the structure and was designed in accordance with the Philippine Electrical Code. Energy efficient lighting options were used in the plans.

3.6.4 Plumbing Plan

This plan included the plumbing layout of the structure and was designed in accordance with the Plumbing Code of the Philippines. The designs of storm water drainage layout were also included in the plans.

3.7 Revisions and Finalization of Plans

To ensure efficient techniques were utilized, necessary adjustments were made throughout the duration of the study with the assistance of the designated Thesis Adviser, Civil Engineering professors, and other consultants and specialists. The plans were finalized after the revisions.

3.8 Project Scheduling

Project scheduling aligns the project tasks to fit a deadline. Since tasks may overlap or require completion before starting on another, it's essential to schedule tasks in an optimal order to complete them in a timely manner. The Program Evaluator and Review Technique and Critical Path Method (PERT-CPM) were utilized to create a task flow and an estimated timeline. The Gantt chart was also used to simplify planning and scheduling through a bar graph. It makes it easier to visualize the progress of a project and see how different tasks interact with one another.

3.9 Cost Estimation

Cost estimation is the process that takes direct costs, indirect costs and other factors into account, and calculates a budget that meets the financial commitment necessary for a successful project. Since the proposed project will be implemented by the Municipality of Nueva Valencia, the LGU will have two options. First, the LGU can invite contractors and conduct a bidding wherein the proposed project will be awarded to the most competitive bidder. The winning firm will then finalize their cost estimates and commence the construction process as agreed on the contract. For the second option, the LGU can assign the project to the Municipal Engineering Office which will then be responsible for finalizing the plans, estimates, and the actual construction of the proposed project.

Materials and equipment will be provided by the firm that will construct the project. However, these materials will be subject to thorough materials testing as supervised by the LGU, represented by the Municipal Engineering Office. All costs for the materials testing and quality control will be covered by the construction firm as stated in the contract.

Labor costs will be dependent on the skill level of the needed workers. The proposed project will need at least one (1) construction foreman, one (1) materials engineer/specialist, and an uncertain number of heavy equipment operators, skilled laborers, and unskilled laborers depending on the work demand. The wages for each type of worker will comply with the hourly rate as mandated by the law.

Indirect costs such as Overhead, Contingencies and Miscellaneous (OCM) costs, as well as the Contractor’s Profit (CP) will follow a standard percentage of the direct costs (labor and materials cost) as agreed in the contract.

3.10 Resources and Facilities

The researchers utilized the following tools and resources in data collection, data analysis, designing, and presentation of outputs and results:

Microsoft Word. A word processing software that was used by the researchers to make the necessary documents, letters and reports.

Microsoft PowerPoint. A slide show presentation program that was used to generate slide shows for data presentations and project defense.

Microsoft Excel. A spreadsheet program that was used by the researchers to organize, format and calculate data as well as perform simple calculations.

PTC Mathcad. A data calculation program that was used for more complex mathematical calculations and presented these calculations and designs in one comprehensive document.

AutoCAD. A computer-aided design software that was used by the researchers in generating engineering drawings and plans including architectural, structural, electrical, plumbing, etc. and allowed for quicker and easier drawing and editing of digital 2D and 3D designs.

Sketchup. A computer-aided design software for making drawings and plans as well as rendering designs and generating realistic elevations of the proposed project.

Internet. The researchers utilized the internet as a quick source of necessary information. Previous studies that were published on the internet was used as a basis in making the designs and proposals. However, only the most credible sources were considered as the references.

Books/ Past Studies. Books and/or previous studies published on paper are very reliable sources of information. Significant findings and results from past studies of similar nature and type were a crucial basis in making the designs. The researchers utilized the Henry Luce Library of Central Philippine University.

National Structural Code of the Philippines (NSCP 2015 Edition). The NSCP 2015 is the country's main design standard. This was the ultimate guide for the researchers in designing the different structural elements included in the proposed project.

National Building Code of the Philippines. Another crucial reference used in formulating policies, plans, standards and guidelines on building design, construction, use, occupancy and maintenance. The proposed project conformed to the guidelines as stated on the National Building Code.

National Plumbing Code of the Philippines. A reference used in designing the plumbing and drainage systems for the proposed project.

Philippine Electrical Code. A reference used in designing the electrical plans and layout for the proposed project.

Documents from the Municipality of Nueva Valencia (MO, MPDO, ENRS, MEO, OMAS, AO). Important documents including existing plans, zoning and land use, lot area, vicinity maps, etc. were used as a reference in making the plans and designs as well as in determining the necessary considerations beforehand.

CPU Testing Laboratories*.* The testing facilities and equipment present in the university were used by the researchers in determining certain properties of materials and soil since it is important to determine these properties before designing a particular project. Hidden problems and flaws that were discovered during the testing phase served as a guide on how the researchers designed the proposed project in consideration to the results.

Miscellaneous Technologies. Smartphones, calculators, cameras, computers, laptops etc. were used in performing calculations, gathering data, generating designs and presenting result.

Chapter 4

Project Area

4.1 Background and General Features of the Municipality of Nueva Valencia, Guimaras

4.1.1 Historical Background

Nueva Valencia is a fourth-class municipality in the Province of Guimaras, which is composed of five (5) municipalities. It is considered to be the tourism capital and the primary fishing ground of the province. The municipality consists of twenty-two (22) barangays, with the majority of them being coastal (14 barangays), followed by 6 inland and 2 island barangays. Nueva Valencia can be found southeast of Panay, with a distance of roughly six (6) nautical miles.

The said municipality is bounded on the northern side by the Municipality of Sibunag, while it is situated between two straits, namely Iloilo Strait and Guimaras Strait on the southern and eastern side respectively. Its geographical location corresponds to 10 31’ 40.63” North latitude and 122 32’ 18.52” East longitudes.

During the reign of the Spanish government, Valencia was established as an independent municipality with the late Don Manuel Segovia serving as Alkalde Mayor. The Christianization process of Nueva Valencia's residents began simultaneously with the other regions of the Philippines. The area's original name was "Valencia" and it was under the jurisdiction of the Alkalde Mayor. The royal house, known as the casa real, used to reside in the small village of Santa Ana, which is currently called Poblacion and serves as the municipal government center. Following a mysterious fire that destroyed the casa real, the name

Valencia was altered to Nueva Valencia, which was previously a constituent of the Jordan municipality.

On the 1st of January, 1942, Hon. Florentino Gallopa was appointed as the first municipal mayor of Nueva Valencia, marking the official inauguration of the municipality. Initially, the municipal government headquarters were situated at Igbantog in Santa Ana. However, due to the lack of necessary facilities like a municipal building, the office was temporarily housed at the Barrio Igang police station. This arrangement continued until World War II disrupted normalcy.

In the year 1949, during the term of the late mayor Ricardo Ortiz, political leaders raised the issue of finding a final permanent site for the municipal government seat. A plebiscite was held, and the majority of people decided to permanently move the municipal government seat to Sitio Igbantog, Santa Ana, which continues to be the municipality's permanent seat of government to date.

4.1.2. Climate

The weather in Nueva Valencia is similar to that of the entire island of Guimaras, although it is cooler than other provinces in Western Visayas. Nueva Valencia experiences two well-defined seasons, namely the wet and dry seasons. During the months of November to April, the northeast monsoon brings in rain clouds intercepted by the mountains of Negros Island, causing the dry season. Meanwhile, the southeast monsoon brings rainfall during the rest of the year, giving rise to the wet season. In the year 2003, the average rainfall was 6.73 millimeters, while the average temperature was 27.6 degrees Celsius.

Most likely, rainfall in the northeast monsoon season is caused by conventional thunderstorms, which are the result of intense heating causing rapid evaporation. Alternatively, typhoons may also bring rainfall during October-November in the region, but luckily the probability of a typhoon hitting Guimaras

is low. The island experiences a rare frequency of typhoon passage, comprising only 0%-10% of the annual average of 19.8 typhoons.

The southwest monsoon, known as the *hanging habagat*, marks the beginning of the wet season and lasts from June to September. It is identified by moisture-laden maritime tropical winds prevailing from a southwesterly direction, caused by a high-pressure system over the Australian Continent. These winds move towards a low-pressure system over South and Southeast Asia, which includes Mainland China.

Nueva Valencia's climate can be described as hot, oppressive, windy, and overcast. Throughout the year, the temperature usually fluctuates between 75 °F to 91 °F, with rare occasions where it drops below 73°F or exceeds 94°F, as depicted in Figure 31.

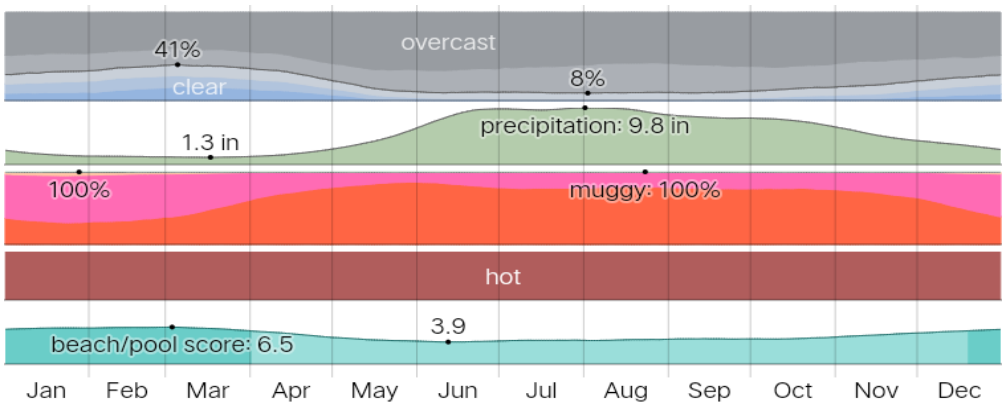


Figure 31

Climate in Nueva Valencia, Guimaras (weatherspark.com)

Climate fluctuations in Guimaras have been noted wherein certain areas experience rainfall while others remain dry. As such, diverse micro-climatic conditions across the island necessitate more comprehensive climatological measurements and sophisticated meteorological observation infrastructure. This

holds significant relevance given that the key drivers of the economy are agriculture, fisheries, and tourism.

4.1.3. Land Area

The municipality of Nueva Valencia has a total land area of 13712.13 hectares, and its coast stretches 102 kilometers. In terms of land area, Barangay Calaya holds the largest area while Barangay Magamay is the smallest. Table 1 presents the land area by Barangay for the Municipality of Nueva Valencia.

Table 1

Land Area per Barangay in the Municipality of Nueva Valencia

Barangay	Land Area (Hectares)
Cabalagnan	458.91
Calaya	1509.7
Canhawan	323.59
Concordia Sur	689.06
Dolores	421.76
Guiwanon	298.49
Igang	608.48
Igdarapdap	467.76
La Paz	704.59
Lanipe	1002.8
Lucmayan	737.22
Magamay	218.67
Napandong	407.28
Oracon	525.18
Pandaraonan	283.55
Panobolon	310.5
Poblacion	579.76
Salvacion	803.94
San Antonio	1056.01
San Roque	524.52
Sto. Domingo	727.42
Tando	287.37
Total:	**13712.13**

(Source: MPDO)

4.1.4 Topography, Slopes and Elevations

The terrain of Nueva Valencia municipality exhibits a range of topographic features across its different barangays. The North-eastern part of the municipality, which faces Panay Island, is characterized by hilly terrain that rises to about 150 meters above sea level. In contrast, the coastal areas are flat and lowland. As shown in Table 2, the land elevation in Nueva Valencia spans from 0-300 meters above sea level, with the highest peak being Mount Adan.

Table 2

Land Area by Evaluating Ranges

Elevation Range (m)	Area Coverage (ha)	Share to Total (%)
Below – 100	4950	36.10
101 – 150	2832	20.65
151 – 200	3444	25.12
201 – 250	1163	8.48
251 – 300	1323	9.65
TOTAL	13,712	100

(Source: MPDO)

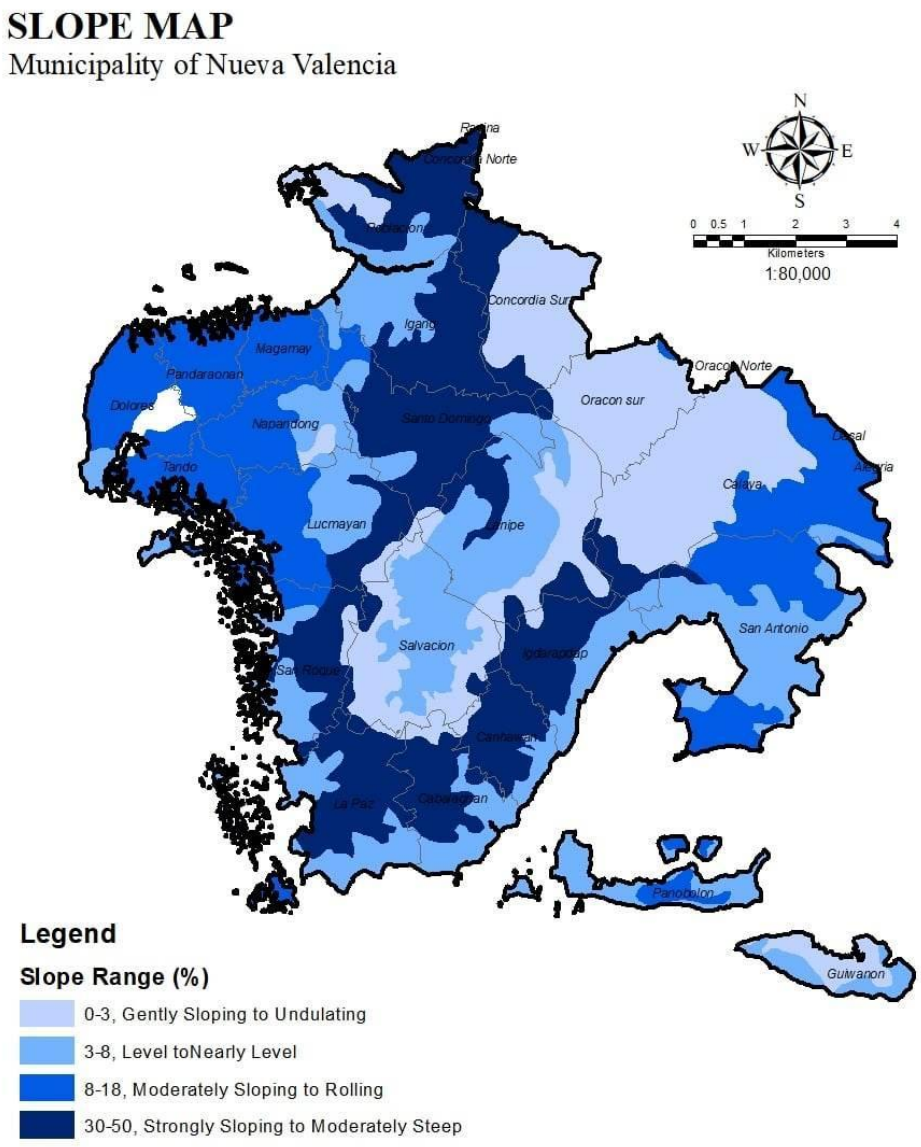


Figure 32

Slope Map, Municipality of Nueva Valencia (MPDO-Nueva Valencia)

4.1.5. Geology

The area of Nueva Valencia is comprised of different categories or types of soils. Figure 33 shows the most common types of soil and area coverage of Nueva Valencia which are Guimaras Gravelly Loam, which covers the majority of

the land area, followed by Faraon Clay and lastly Hydrosol which can only be found in the vicinity of Barangay Igang. Moreover, Table 3 discusses an in-depth soil classification on the major soil types in the municipality, namely Oysteric Nitrosol (62.82% of the total land area), Orthic Herosol (10.03% of the total land area), Orthic Luvisol (12.14%), Hydrosol (1.12%) and Beach Sand (13.89%).

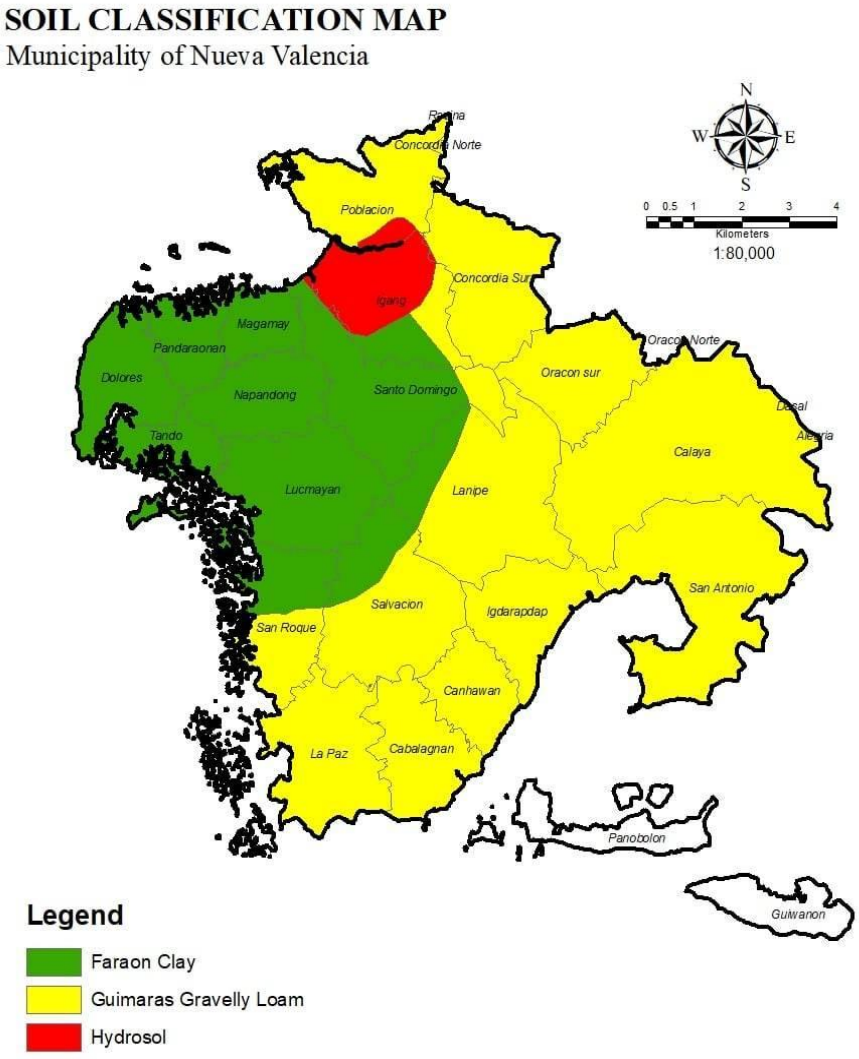


Figure 33

Soil Classification Map, Municipality of Nueva Valencia (MPDO-Nueva Valencia)

Table 3

Types of Soil and Area Coverage of Nueva Valencia

Types of Soils	Area (ha)	% to Total
Oysteric Nitrosol	8,613.88	62.82
Orthic Herosol	1,375.31	10.03
Orthic Luvisol	1,664.63	12.14
Hydrosol	153.58	1.12
Beach Sand	1,904.60	13.89
Total	**13, 712.00**	**100**

(Source: Bureau of Soils & Water Management, 2000)

Oysteric Nitrosol. It is a soil type that covers a large area in Nueva Valencia. It is suitable for different kinds of crops and fruit trees that are grown in uplands. The soil is known for its stability, resistance to soil erosion, and good infiltration capacity and drainage.

Orthic Herosol. This type of soil covers approximately 1,375.31 hectares, which accounts for 10.03% of the total land area. It is generally characterized by a high level of acidity, resulting in low fertility. This type of soil can be found in the upland areas of Nueva Valencia.

Orthic Luvisol. This type of soil is formed from limestone and volcanic rocks, comprising 12.19% of the total land area in hectares, which makes it suitable for coconut, upland rice and other rain-fed annual crop production. However, sustaining productivity over a long period can be challenging, as this type of soil usually contains low levels of organic matter.

Hydrosols. This are a type of soil that covers around 1563.58 hectares (1.12% of the entire land area), predominantly consisting of water and organic materials.

Beach Sand. This type of soils is typically situated in the coastal regions and encompasses approximately 19,004.60 hectares, making up 13.89% of the total land area within the municipality.

4.1.6. Location and Accessibility

Nueva Valencia is located southeast of Panay Island, northwest of Negros Occidental. Iloilo Strait separates Guimaras from Panay with a distance of approximately six (6) nautical miles. The Municipality of Nueva Valencia is bounded on the north by the Municipality of Sibunag, on the South and East by Iloilo Strait and on the West by Guimaras Strait. It is within the geographical coordinates of 10° 31′ 40.63″ N latitude and 122° 32′ 18.62” E longitude. Figure 34 shows the location of the Province of Guimaras within the Philippines, and that of Nueva Valencia with respect to Guimaras.

It is situated 31.9 kilometers away from Iloilo City and 494 kilometers away from Manila and is readily accessible through various modes of transportation. It can be reached via land travel and passenger plane service. Iloilo International Airport in Cabatuan, Iloilo offers direct flights to Iloilo Province which only takes 45 minutes from Manila. Those who wish to travel by land from Manila can take an 18 to 20-hour bus ride from Cubao to Jordan Terminal Market.

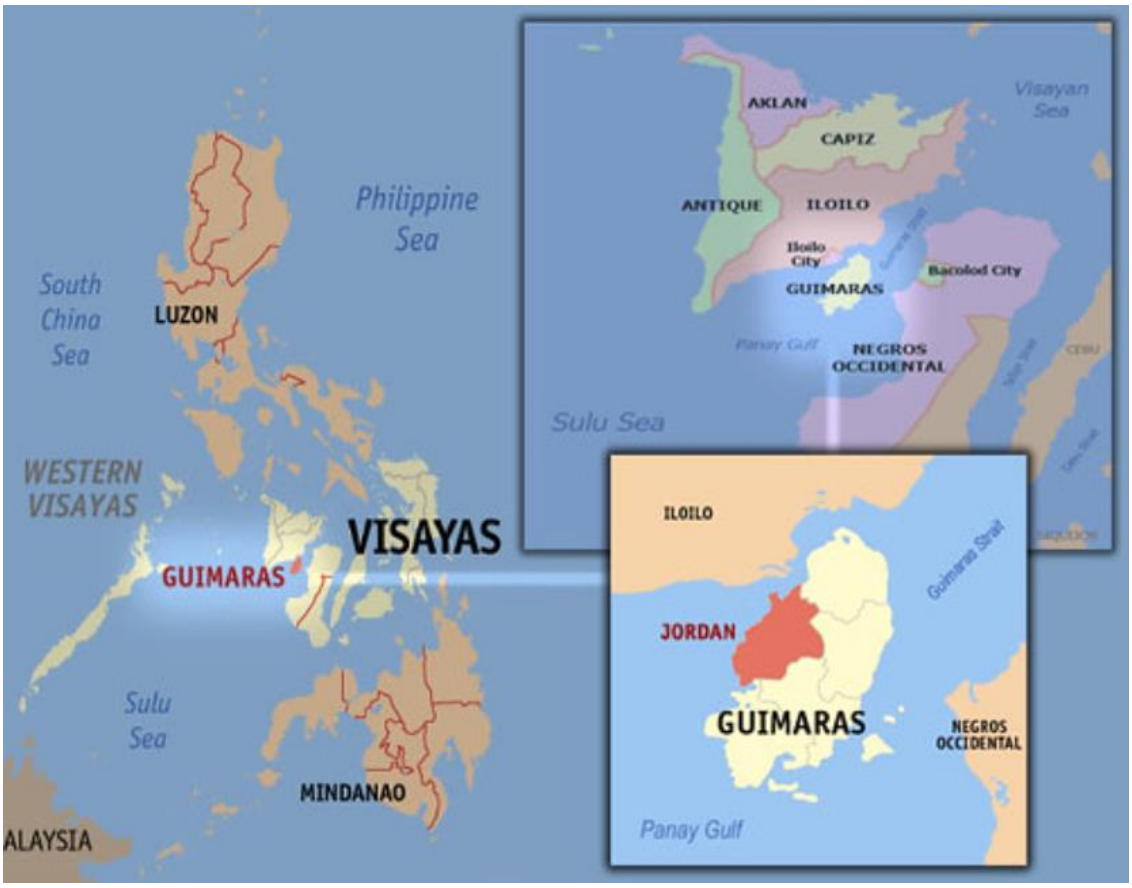


Figure 34

Location of Nueva Valencia, Guimaras in the Philippines

To get to Guimaras from Iloilo City, one can take a taxi or PUJ to Parola Wharf, which takes about 10 to 15 minutes. Upon reaching the wharf, a ferry ride can be taken for 15 to 25 minutes to reach Jordan Wharf in Guimaras. From there, taking a public utility jeepney or van for hire for 45 minutes to 1 hour will lead to Nueva Valencia.

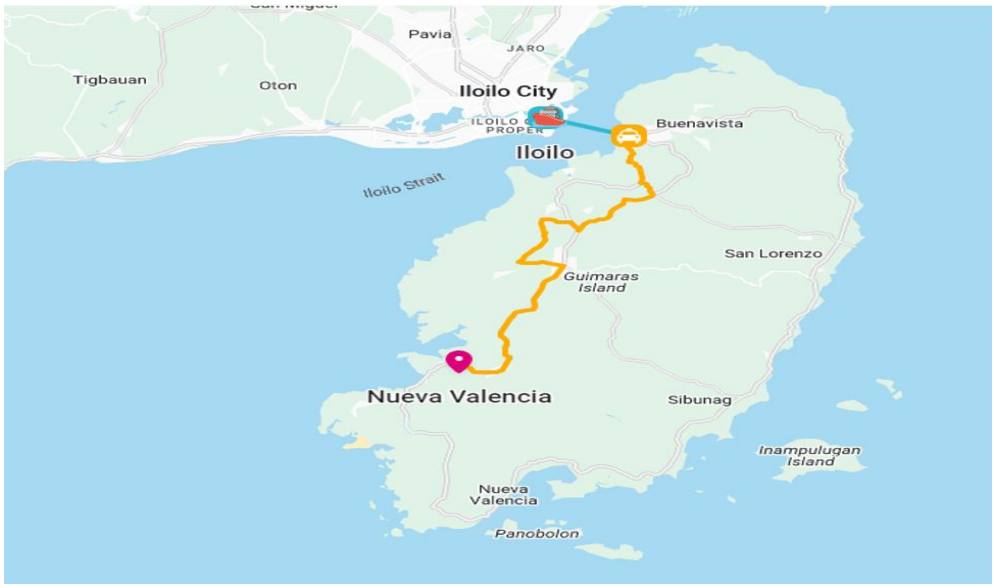


Figure 35

Route from Iloilo City to Nueva Valencia, Guimaras

4.1.7. Faults and Earthquake Zone

The Philippine Institute of Volcanology and Seismology (PHIVOLCS), showed that the nearest active fault is the West Panay Fault located approximately 42.9 kilometers from the municipality as seen in Figure 36.

Since 1900, there was 106 considerably strong earthquakes recorded in the municipality of Nueva Valencia, 3 earthquakes are above magnitude 7, 16 earthquakes are between magnitude 6 and 7, while 87 earthquakes between magnitude 5 and 6. The strongest earthquake felt in the municipality was a Magnitude 7.8 earthquake originating 10.5 km W of Leon, Iloilo during the year 1948 while the latest earthquake was a Magnitude 5.1 earthquake originating at Sulu Sea, approximately 93 km SW of Iloilo City last August 13, 2022. Figure 37 shows the location of epicenters of past earthquakes that affected the municipality of Nueva Valencia.

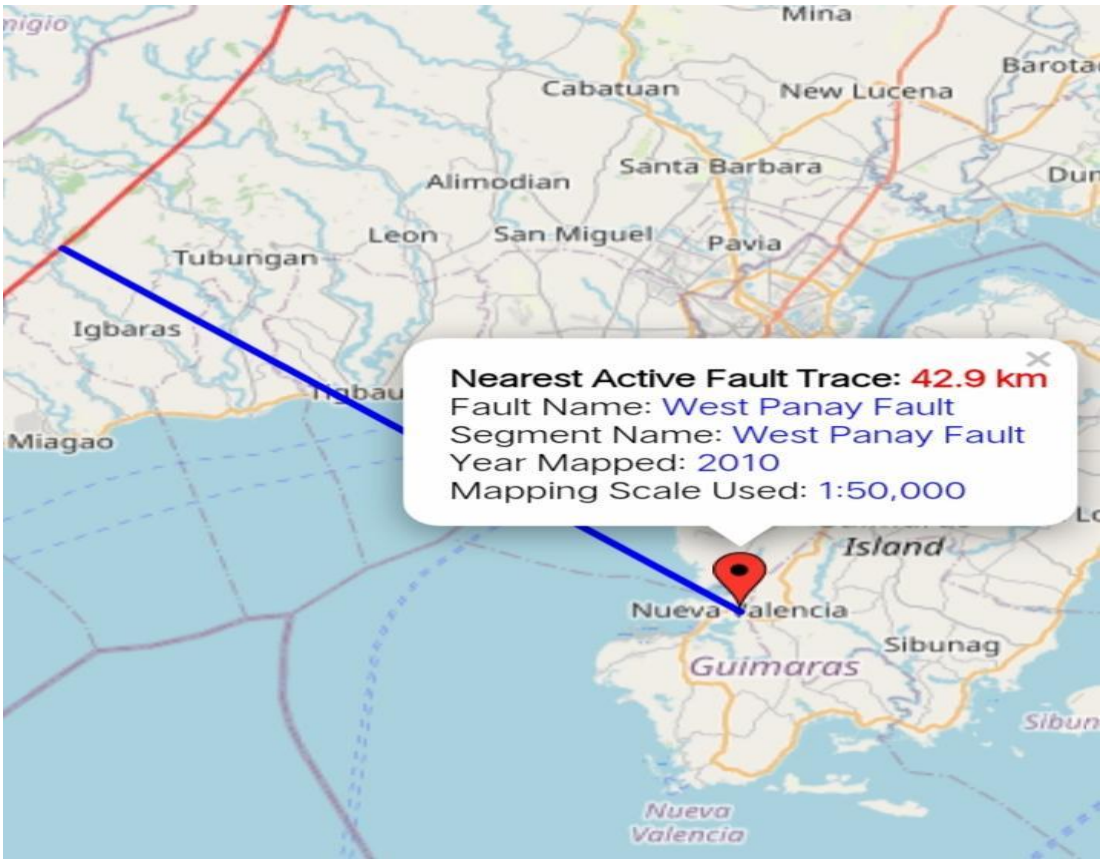


Figure 36

Nearest Active Fault from Nueva Valencia, Guimaras (PHIVOLCS FaultFinder)

Figure 37

Past Earthquake Epicenters around Nueva Valencia, Guimaras

4.2 Background and General Features of the Project Site

4.2.1 Brief Historical Background

The location of the proposed two-storey seafood market is at Barangay Cabalagnan Fish Port, Nueva Valencia, Guimaras which is within a government-owned lot. The fish port was completed approximately 15 years ago and was constructed by reclaiming the bay across the public market. It has a size of approximately 60 meters in length and 30 meters in width. The existing fish landing center was constructed at the tip of the port. On the left side of the port, there is a research building managed by the Bureau of Fisheries and Aquatic Resources (BFAR) and on the right side are temporary stalls that vendors use for selling their products.

Ever since its completion, the fish port had served several purposes. Mainly, it is used as a docking area by local fishermen and merchants coming from different barangays around the locality. Moreover, due to its proximity to the local public market, it is also used as an extra space for temporary market stalls during the local market day. Lastly, it is used as docking area for boat travellers coming from the island barangays of Panobolon and Guiwanon, as well as waiting area for utility vans that travel to Jordan Wharf.

4.2.2 Location and Accessibility

The proposed seafood market will be located at Barangay Cabalagnan, one of the 22 barangays of Nueva Valencia, Guimaras. It has a total land area of 458.91 hectares. The 2020 Census shows that its population was 1,972. This accounted for 4.61% of the total population of Nueva Valencia.

The proposed project site located at Barangay Cabalagnan is along the Guimaras Circumferential Road and the available modes of transportation from Jordan Wharf are Public Utility Jeepneys and Utility Vans. However, the number

of public transportation vehicles is very limited. These vehicles operate daily but due to the limited number, the trips from Cabalagnan to Jordan Wharf are only during 6:00-8:00 AM and trips from Jordan Wharf back to Cabalagnan are only from 11:00-4:00 PM. Figure 38 shows the available routes from Jordan Wharf to the proposed project site at Barangay Cabalagnan.

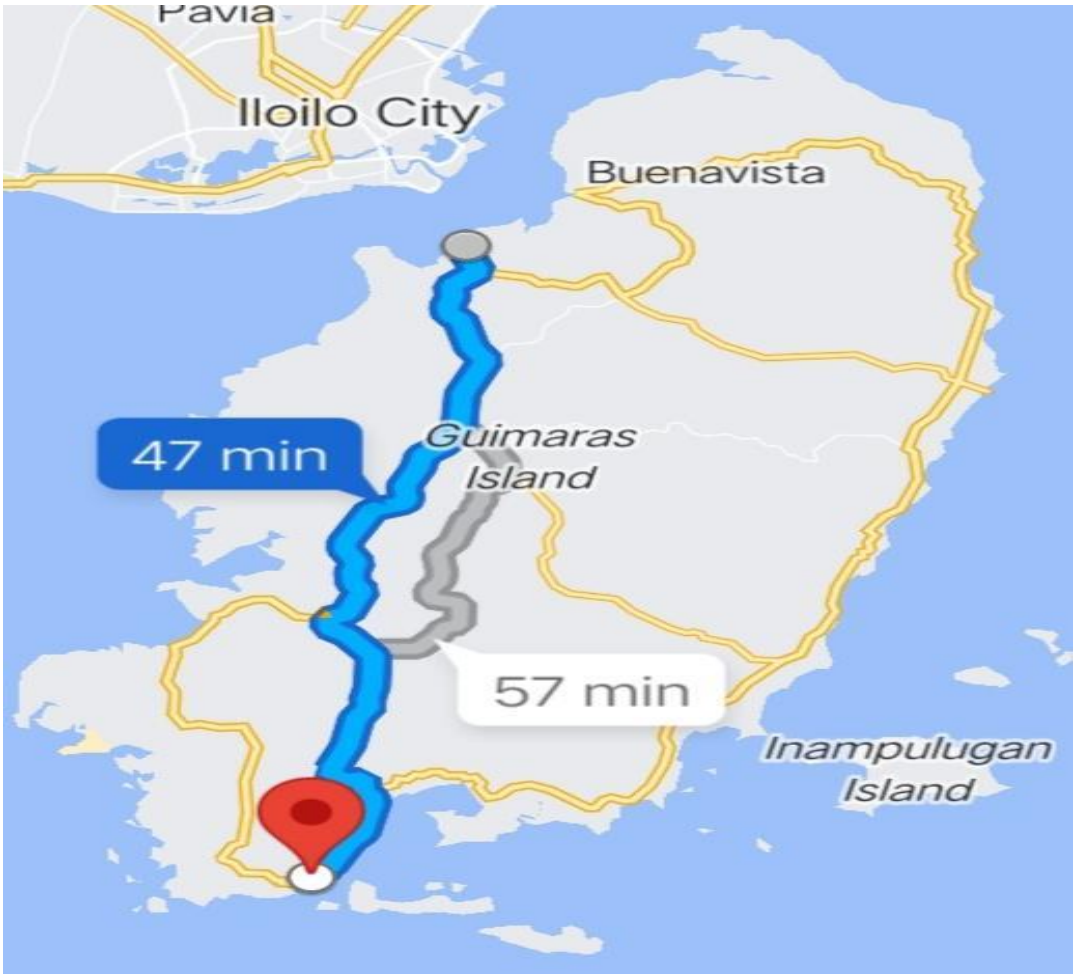


Figure 38

Routes from Jordan Wharf to Barangay Cabalagnan

4.2.3 Geology

The project site's soil investigation revealed that the topmost to the bottom layer of the natural soil is composed entirely of gravelly beach sand for the first five (5) feet. A considerable number of rocks, gravel and some organic matter are present in the soil sample. Moreover, groundwater was discovered about 4.5 to 5 feet from the natural ground level.

The diagram of soil profile is presented on Figure 39, while the actual image of the borehole can be seen in Figure 40.

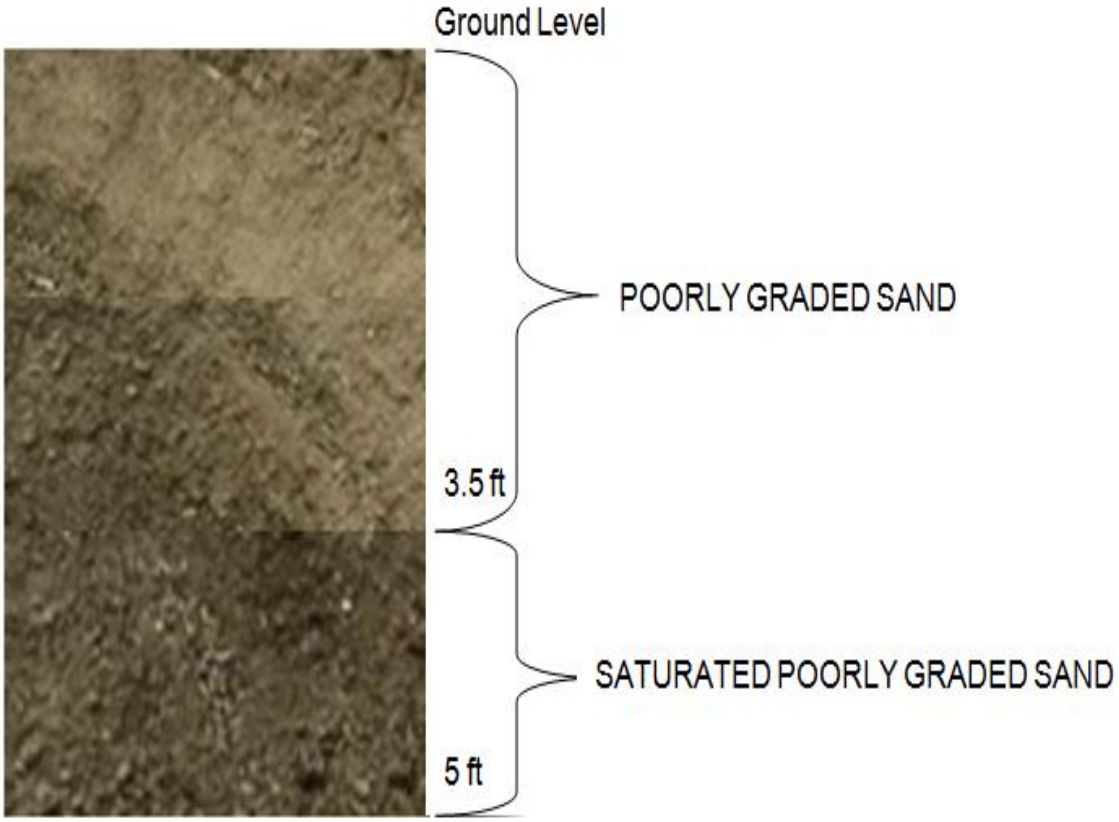


Figure 39

Diagram of Soil Profile beneath the Proposed Project Site

Figure 40

Actual Image of the Borehole

4.2.4 Land Area

The project site is located in a government-owned lot adjacent to a privately owned lot. As shown in Figure 41, the Phase 2 construction of a flood mitigation structure which starts from Barangay Cabalagnan Fish Port up to the riverbanks of the nearby Cabalagnan River is currently ongoing.

It has been confirmed that the local government plans to acquire the adjacent private-owned lot in the future. In the meantime, the area of the proposed project site is only within the boundaries of the government-owned lot which is 2903.00 square meters in size.

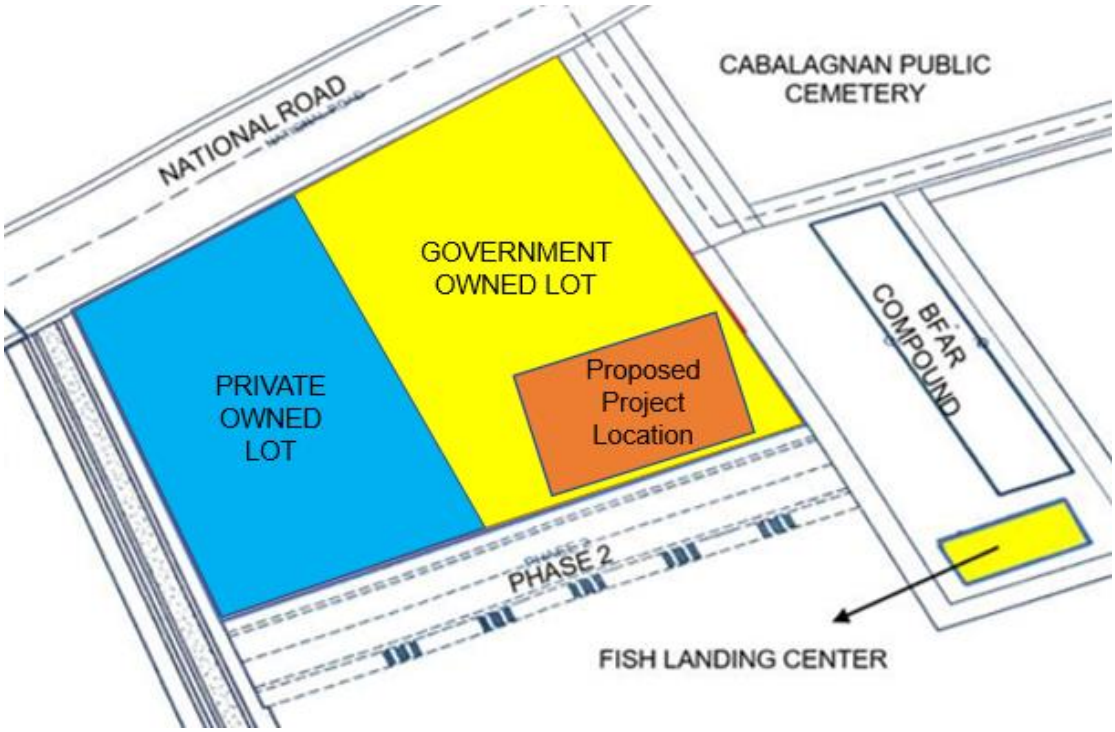


Figure 41

Proposed Project Site

Chapter 5

The Proposed Project

5.1 Consideration of Constraints

The details of the solutions considering the design constraints as defined in the methodology are as follows:

5.1.1 Choice of Materials

To combat the effects of corrosion due to seawater, reinforced concrete and carbon steel will be used for the construction of the substructure. Components that are exposed to open air such as railings, window frames, etc. will be constructed with the use of corrosion resistant metals such as stainless steel, aluminum metal and galvanized steel. Table 4 shows a comparative consideration of constraints due to the proposed structure's close proximity to seawater.

Table 4

Comparative table considering corrosion of steel due to seawater

Option	Resistance against Corrosion	Strength	Cost	Aesthetic Appearance
Regular Metals/Alloys (Carbon Steel, etc.)	no resistance	greater strength	cheaper	less attractive
Corrosion Resistant Metals/Alloys (Stainless Steel, Aluminum, etc.)	very high resistance	less strength	more expensive	aesthetically pleasing

5.1.2 Roof Type

To mitigate the effects of strong winds, the proposed seafood market building was designed to have an open roof deck in order to eliminate the risk of the roofing material getting destroyed due to strong winds especially during typhoons. This choice of roofing provided an open usable space which will be designated mainly as a fixed drying area for fish and seafood. Table 5 shows a comparison of the two roofing options namely hip & gable roofing and open roof deck and discusses the potential utilities of each option.

Table 5

Comparative table considering strong winds

Option	Resistance against strong winds	Cost	Maintenance	Installation	Potential Utility/ Functionality
Hip & Gable Roofing	high resistance	more expensive	low	requires more time and labor	Can support solar panels as well as roof turbine vents for additional ventilation
Open Roof Deck	impervious against strong winds	cheaper	moderate	easier to design and install	Can support solar panels, water distribution tanks, rainwater harvesting systems, air conditioning units, etc., while most parts will serve as a fish drying area

5.1.3 Sanitation Systems

The layout of the proposed seafood market was designed to prevent cross-contamination, provide adequate drainage, and allow easy access to all equipment for effective cleaning and maintenance.

To ensure the safety and cleanliness of the products, the fish tables/stalls made out of concrete is outfitted with an individual water supply and drainage

system. Table 6 shows the advantages and disadvantages of providing a dedicated water supply and drainage system for each fish table/stall.

Table 6

Comparative table of consideration of constraints for sanitation systems

Option	Pros	Cons
Individual water supply for each fish table/stall	Minimizes risk of contamination, convenient and allows easier and faster cleaning of products	Much expensive to install and maintain, requires more complex plumbing plans and designs
Common/Shared washing area	Less expensive to install and maintain, easy to design	Higher risk of cross-contamination, might be insufficient especially when many vendors need to use it at the same time

Additionally, the sewage system which was deemed appropriate for the seafood market is the septic tank, mainly due to its relatively cheaper costs compared to other alternatives such as the sewage treatment plant.

Table 7 shows a comparison of the septic tank and sewage treatment plant.

Table 7

Comparative table considering sewage systems

Option	Installation Cost	Operating Cost	Maintenance Cost	Energy Cost
Septic Tank (3 chambers)	cheaper (Php 40,000 – Php 50,000)	Php 20,000 (per septic tank pumping)	Php 5,000/year	none
Sewage Treatment Plant	expensive (Php 350,000 – Php 750,000)	Php 50,000 (every 5-10 years)	Php 10,000/year	Php 10,000 – Php 15,000/year

5.1.4 Green Building Technology

The proposed project's inclusion of green technologies, such as solar panels and a rainwater collection system allows the proposed structure to save energy and water while also lowering total costs and mitigating negative environmental effects.

In connection to the goals of green building, an open design is adapted so as to ensure that fresh air can circulate thoroughly, thus minimizing the foul odor caused by fish guts and other wastes. This will minimize or even eliminate the need for ventilators, thus reducing the electricity consumption. The open design will reduce energy consumption since there will be enough apertures in the market building that provides excellent air circulation and natural lighting.

Because of the nature of the proposed structure, this is expected to consume a significant volume of freshwater on a daily basis. In order to ensure sustainability, a rainwater harvesting system was incorporated in the structure. This rainwater harvesting system can aid in minimizing energy and tap water consumption.

Moreover, solar panels were installed for an additional and more sustainable source of energy.

5.1.4.1 Water Resources

The municipality has its own water distribution system which is managed by the Local Government Unit. The main water pipeline had already been installed at Barangay Cabalagnan which is the location of the proposed project site and it is expected to be operational within this year. This water system, along with the possibility of a deep well and rainwater harvesting system will be the main sources of water supply for the proposed seafood market.

To reduce or possibly completely eliminate the use of commercial water for toilet flushing, a rainwater collection system is installed on the planned structure. This green technology's viability is calculated as follows:

$$\frac{Rainwater\ collected}{1\ day} = (\frac{Ave.\ Monthly\ precipitation(mm)}{Ave.\ Rainfall\ Days})(\frac{1\ L}{m})(Area\ of\ Roof)$$

The peak rainfall months for the Municipality of Nueva Valencia is during July and August which is around 9.8 inches of rainfall or 245 millimeters. The number of rainy days during these months can be estimated at an average of 15-18 days. Therefore, around 245 liters of rainwater per square meter of roof can potentially be harvested. The gross area of the roof deck is 600 square meters which means that around 8170 liters or about 8.17 cubic meters of rainwater can be collected per day during peak rainy season. This means that the use of 600 square meter rainwater harvesting area can lower the water consumption costs by up to Php 200.17 on a daily basis.

Table 8 expounds the properties of each water source option namely municipal water line, deep well, and rainwater harvesting system.

Table 8

Comparative table considering water resources

Option	Installation Cost	Availability	Reliability	Maintenance	Savings per Day
Municipal water line	Low	Readily available	Very reliable	Low	-na-
Deep well	High	Currently not available	Reliable	Moderate	-na-
Rainwater Harvesting System	Moderate	Currently not available	Moderately reliable	Moderate	Php 200.17

5.1.4.2 Energy Resources

GUIMELCO is the dominant provider of electricity distribution services in the Province of Guimaras. This cooperative is controlled by its members and follows the regulations of the National Electrification Administration (NEA), an official body responsible for advancing rural electrification in the nation.

Another feature of this proposed structure is the inclusion of solar panels which would be installed on the open roof deck. This will not only lessen electricity expenses but it will also provide an alternative energy source whenever power interruptions occur, ensuring that essential equipment such as preservation fridges are powered all the time. Solar energy is a free and renewable energy source; thus, it reduces carbon emissions.

The proposed site is located on a generally open area and it is estimated that it can receive 6-8 hours of sunlight on a daily basis, in which around 5 hours can be considered peak sun hours. A single 400 W solar panel can produce a minimum of 2 kWh of electricity per day and around 60 kWh of electricity per month in ideal conditions. Approximately, the designated area for solar panels in the proposed structure can accommodate up to 20 solar panels considering the area of a single solar panel is 2.11 square meters. The commercial electricity rate provided by Guimaras Electric Cooperative is currently priced at Php 11.79 per kWh. Each day, 20 solar panels can produce about 40 kWh of electricity under ideal conditions. This means that the use of 20 solar panels can lower the electricity consumption costs by up to Php 471.60 on a daily basis.

GUIMELCO is the primary source of power for the proposed building, but with the aim of enhancing sustainability and reducing electricity consumption, the utilization of solar panels has been considered. Table 9 shows a comparison of these two energy sources.

Table 9

Comparative table considering energy resources

Option	Installation Cost	Availability	Reliability	Maintenance	Savings per Day
Solar Panels	High	Currently not available	Moderately reliable	Low	Php 471.60
Commercial Electricity (GUIMELCO)	Low	Readily available	Very reliable	Low	-na-

5.2 Technical Plans and Specifications

5.2.1 Architectural Design

The architectural plans of the proposed two-storey seafood market included the perspectives, floor plans, elevations, and sections. Also, the schedule of doors and windows in accordance with the standards and requirements set by the National Building Code of the Philippines (NBCP) are included.

The architectural design and layout were inspired by several fish markets around the world as discussed in Chapter 2 of this project study. The entrance and exit doors were separated so that the flow of goods and customers is safe and orderly. Also, a canopy for service vehicles was included on both openings so as to provide a convenient loading and unloading of products. Ramps were

also incorporated in order to make the structure more accessible for Persons with Disabilities (PWDs) and elderly people. Due to the nature of the structure, all the windows were made of Pre-painted Welded Tubular G.I. Window Grills in order to provide excellent natural air flow into the building which will lessen the need for ventilation. The exterior of the building is composed of painted plain cement wall finish which provides an aesthetically pleasing appearance with minimal costs.

Additionally, an 18.00 square meter cold storage room was included in order to cater the preservation needs of the users. A 17.10 square meter office building can also be found on the first floor of the building which will serve as the headquarters of the market manager and other market officials. Separate comfort rooms for male and female were also included which measures 11.75 square meters each.

The designs and layout were rendered with the help of a licensed architect. The architectural plans were then checked and approved by the Local Government Unit of Nueva Valencia represented by the Municipal Planning and Development Coordinator, Mrs. Zurinie G. Zaldivar.

5.2.2 Structural Design

The structural design of the proposed two-storey seafood market includes the design of all the load bearing structural members such as concrete slabs, girders, beams, columns, foundation and other structural elements which are in compliance with the National Structural Code of the Philippines (NSCP) 2015 and other design codes.

The ground floor is a slab on grade with a thickness of 200 mm reinforced with 10 mm RSB spaced at 0.30 m both ways. Moreover, the backfill shall be compacted every 0.20 m per layer up to 95% maximum dry density to ensure stability of the slab on grade.

5.2.2.1 Material Properties

The following table shows the material properties that were utilized for the structural design of the proposed project.

Table 10

Properties of Materials used in Structural Design

Description	Values
Concrete Compressive Strength, f'c	28 MPa
Yield Strength of Steel for slabs and footings, fy	230 MPa
Yield Strength of Steel for beams and columns, fy	420 MPa
Unit Weight of Concrete	23.6 kN/m^3
Allowable Soil Bearing Capacity, qa	75 KPa

5.2.2.2 Design Load Specifications

The references used for determining the design loads is the National Structural Code of the Philippines (NSCP) 2015 Table 204-2 and Table 205-1. The following table shows the design loads used for the structural design of the proposed project.

Table 11

Design Loads used in Structural Design

Description	Values
Roof Deck Dead Loads	
Floor Finish (20 mm) on 25 mm mortar bed	1.2 KPa
Ceiling Finish (Plaster on Concrete)	0.24 KPa
Mechanical Duct Allowance	0.20 KPa
Electrical Loads	0.15 KPa
Total	**1.79 KPa**
Roof Deck Live Load	4.8 KPa

5.2.2.3 Geotechnical Investigation

The soil samples obtained from the proposed site were tested in Central Philippine University Soil Laboratory. Several tests were performed namely Moisture Content, Grain Size Analysis Test, Specific Gravity Test, and Unit Weight Test. The detailed results of the tests performed can be seen on Appendix D. Both the natural soil and embankment soil samples were tested and it was determined that the unit weight of the natural soil is 13.93 kN/m^3 while the embankment soil has a unit weight of 15.89 kN/m^3. However, since the proposed structure is to be constructed on the embankment which is still under construction, it was recommended by licensed geotechnical engineer, Engr. Erwin Rizardo that the unit weight of the embankment shall be used to determine the allowable soil bearing capacity for the design, which can be seen on Table 304-1 of the National Structural Code of the Philippines (NSCP) 2015, and under the assumption that the embankment is well compacted at every 0.5 meter

depth. The summary of results of the soil tests for both natural and embankment soil can be seen in Table 12.

Table 12

Geotechnical Properties of the Natural Soil and Embankment

Description	Natural Soil	Embankment
Soil Type (USCS)	Poorly Graded Sand	Poorly Graded Sand
Specific Gravity	2.49	2.29
Moisture Content	14.22%	24.86%
Unit Weight	13.93 kN/m^3	15.89 kN/m^3
Density	1.42	1.62
Allowable Soil Bearing Capacity (NSCP 2015)	-na-	75 kPa

5.2.2.4 Seismic Analysis

The reference used in determining the seismic properties of the proposed site is the National Structural Code of the Philippines (NSCP) 2015. The seismic properties of the soil used in the structural design are summarized on Table 12.

Table 13

Seismic Properties used in Structural Design

Description	Values
Seismic Importance Factor, I	1
Numerical Coefficient, R (Concrete SMRF)	8.5
Seismic Source Type	A
Soil Profile Type	SD
Seismic Zone Factor, Na	1.0
Seismic Zone Factor, Nv	1.0
Seismic Response Coefficient, Ca	0.44
Seismic Response Coefficient, Cv	0.64
Period, T	0.0731 s

5.2.3 Electrical Design

The electrical design of the proposed two-storey seafood market included the electrical layout of the structure based on the provision of the Philippine Electrical Code (PEC). Detailed specifications can be seen on Electrical Plans. Also, designs of electrical outlets are set up with power appliances and electrical fixtures. The power distributor for the proposed structure shall be the Guimaras Electric Cooperative (GUIMELCO).

5.2.4 Plumbing Design and Water Supply

The plumbing design included the plumbing layout for the proposed project based on the provisions of the National Plumbing Code of the Philippines. Detailed specifications are found in Plumbing Plans.

For a seafood market, the water system plays an integral part. A water detention tank is located below the ground which will hold the water supply which will then be pumped to the individual outlets. The primary water supply of the proposed project would come from the municipal water system while rainwater harvesting can also be an additional water source. A deep well can also be another potential source of water supply.

5.2.5 Project Cost and Estimation

The total cost of the project was estimated to be Php 24,525,407.54, which consists of Labor and Materials, Earth Works, Civil Works, Architectural Works, Plumbing Works, Septic Vault, Detention Tank, Catch Basin, Electrical Works, and Solar Panels as well as the Overhead, Contingencies and Miscellaneous (OCM), Contractor’s Profit and Tax Costs. A detailed bill of quantities and cost estimates can be found on Appendix E. The following table shows the summary of the cost estimates for the proposed project.

Table 14

Cost Estimates for the Proposed Project

Description	Cost, Php
Labor and Materials	
General Requirements	574,389.00
Facility for Engineers	226,800.00
Earth Works	704,459.40
Civil Works	15,159,082.32
Masonry works	962,668.00
Architectural Works	3,052,315.61
Roofing and Ceiling Works	353,686.62
Plumbing Works	1,385,630.03
Electrical Works	1,387,992.56
Total Project Cost	24,525,407.54

5.2.6 Construction Work Schedule

The project duration of the proposed seafood market is estimated around 156 calendar days. The detailed and chronological succession of activities and the S-Curve are provided and compiled on Appendix B.

5.3 General Construction Specifications

The management and execution of the tasks outlined in the overall building guidelines requires the supervision of experts in related fields such as Civil Engineering, Architecture, Contraction, and Mechanical Engineering. These tasks primarily involve labor, materials, equipment, and specialized undertakings.

5.3.1 Site Preparation

The contractor will be responsible for the procurement of all necessary resources, including but not limited to labor, materials, equipment, and facilities, to complete the site work to a satisfactory standard. They are required to ensure that all construction equipment and materials meet the standards specified by the manufacturer and are of excellent condition and quality.

5.3.2 Clearing of the Site

It is imperative to ensure that the project site's surroundings are free from any obstruction or impediments that may hinder the seamless execution of the project. However, it is admissible to keep any essential objects that are required for the project.

5.3.3 Excavation

The dimensions and elevation specified on the designs must be strictly followed during excavation. The excavation must be carried out with the approval and oversight of the responsible engineer to ensure that adequate soil depth is utilized. It is imperative to excavate to a safe depth, where the soil carrying capacity is secure, and any errors occurring during excavation must be remedied by filling up additional depth.

5.3.4 Materials

All tangible elements employed must adhere to the precise standards stipulated in the ACI Building Code and represent the highest quality available in the market.

The Portland Cement (ASTM C-150) requirements must be met by the cement used, and it should be stored in a weatherproof facility that is tightly sealed. Only clean and drinkable water should be used for mixing the cement, and any substances in the water that could adversely affect the hydration

reactions, such as excessive alkaline, oils, acid, organic materials, and other compounds that could alter the properties of concrete and steel, should be avoided.

It is necessary to use fine aggregates that are clean and devoid of clay, loam, and vegetative matter. In compliance with set standards, coarse aggregates must be either river-run gravel or crushed stones, with a range of sizes between 38mm to 50mm, and should be free from any foreign matter.

5.3.5 Concrete and Masonry Works

For all concrete works, it is mandatory to use Class A blended concrete comprised of the mixture of cement, sand, and gravel in the ratio of 1:2:4. It is essential to conduct material strength testing after 28 days.

The prescribed ratios are mandatory for all concrete-related activities, except for instances specifically stipulated in the illustrations.

For footings, columns, beams, stairs, and walls that are less than 10 cm thick, it is required to use Class A concrete mix. This type of concrete is particularly suitable for such purposes due to its compressive strength and durability. A wall with a thickness exceeding 10 cm requires the utilization of Class B concrete mix. For the purpose of filling concrete, it is required to use Class C concrete mix as per the specification.

Cement mortar mix that shall be used for plaster works. General conditions shall be applied to all works and the entire construction. This includes the concrete hollow block partitions, concrete slabs, walls, foundations, and any other concrete and masonry works included in the plans.

5.3.6 Forms

In the field of concrete construction, it is imperative that the structures' forms possess robust durability to withstand the force and tremors created during

concrete placement. More specifically, these forms must be engineered to resist fluctuating pressures caused by vibration and maintain their original, rigid position. To prevent any damage to the concrete, it is critical to withdraw the forms only when the concrete has reached its peak strength.

5.3.7 Curing

Once the surface water in concrete evaporates, the curing process should begin promptly. To do this, the entire concrete surface should be covered with appropriate materials like jute sacks or straw for a minimum of seven days after its placement.

5.3.8 Finishing

It is imperative that the exterior surfaces of concrete hollow block walls are covered with the materials specifically designated on the elevation plan. To achieve the desired finishes for the said walls, a cement plaster mixture of one part cement and three parts sand should be utilized.

5.3.9 Steel Works

To satisfy the requirements of this proposed project, the steel applied must align with the established test criteria for steel reinforcements. The cylindrical shape of all steel reinforcing bars is mandatory, along with a distorted pattern that enhances the bond between the steel bars and concrete used.

Adequate precautions should be taken to ensure that steel bars are devoid of any impurities, including rust, scale, grease, oil, or any other substances that could undermine their adhesion with concrete and the integrity of the building.

The steel reinforcements that are used to strengthen structural components such as slabs, beams, walls, columns, and footings must conform to the predetermined specifications outlined in the steel reinforcement schedule. Furthermore, the Bill of Materials must clearly identify the dimensions and details

of the steel reinforcements utilized in the construction of the structure. This adherence to the specific sizes, number of pieces, and spacing requirements is essential for ensuring the structural integrity and safety of the building.

5.3.10 Plumbing Works

The plumbing activities will conform to the regulations outlined in the Philippine Code of Sanitation and the Philippine National Plumbing Code, with plans crafted under the guidance of a certified Master Plumber, as per the requirements of the academic domain.

Prior to installation, it is imperative to examine all plumbing fixtures, pipe fittings, and accessories for satisfactory quality. Furthermore, proper spacing of each plumbing fixture in accordance with its intended usage is essential. The piping system must not be projected beyond the walls or steel lines and must not be suspended below slabs beyond what is required.

In order to prevent clogging, solid deposit, and fouling, it is imperative that the equipment and materials used are durable, free of defects, and consistently maintained. Additionally, ample cleanouts should be present to facilitate easy cleaning. Furthermore, it is crucial that the septic tank be waterproof and situated at a safe distance from the current water source to prevent any leaks.

5.3.11 Electrical Works

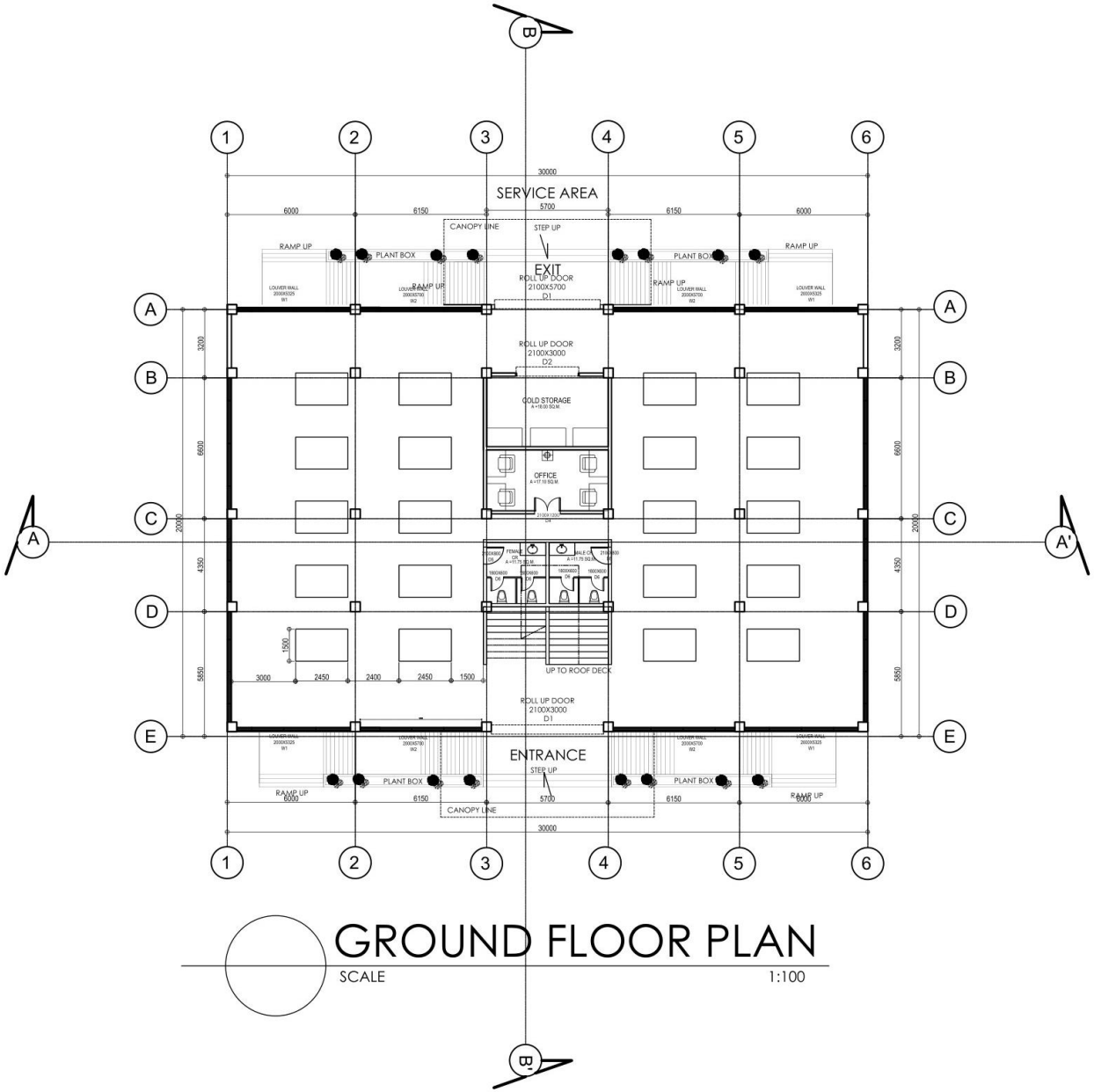
Electrical installation in the Philippines must comply with the Philippine Electrical Code and the regulations set by the electrical utility company. The installation process must be meticulously planned and executed to ensure a neat presentation. In case of any defects or damages caused during installation, the electrical works should be replaced promptly. The utilization of all equipment and materials must strictly adhere to the standards of good quality.

5.3.12 Painting Works

In order to guarantee optimal adhesion of the paint to the provided surface, it is necessary to ensure that the surface is free of any dirt or debris. The first step in the painting process entails applying lead primers to the surface, followed by the final top coat. For concrete surfaces, a neutralizer should first be applied before the concrete paint is put on. It is important to maintain a clean and contamination-free environment for paint storage to eliminate any risk of fire. All activities carried out should be in line with the plans and specifications, with any concerns not outlined in the plans being discussed with the responsible engineer.

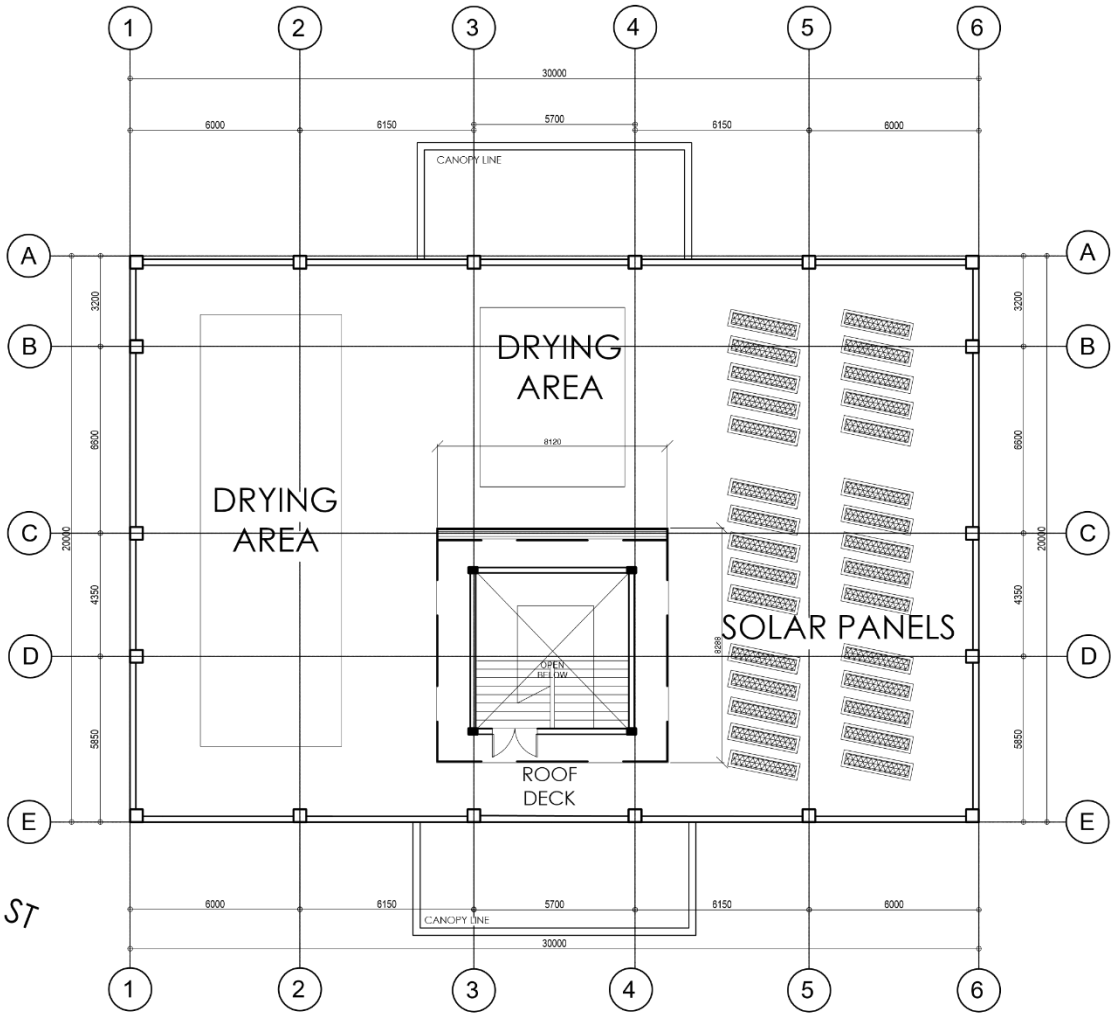
ARCHITECTURAL PLANS

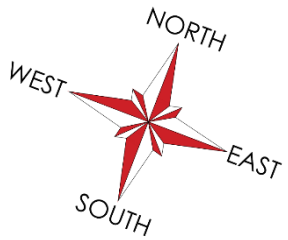
3-D PERSPECTIVE



GROUND FLOOR PLAN

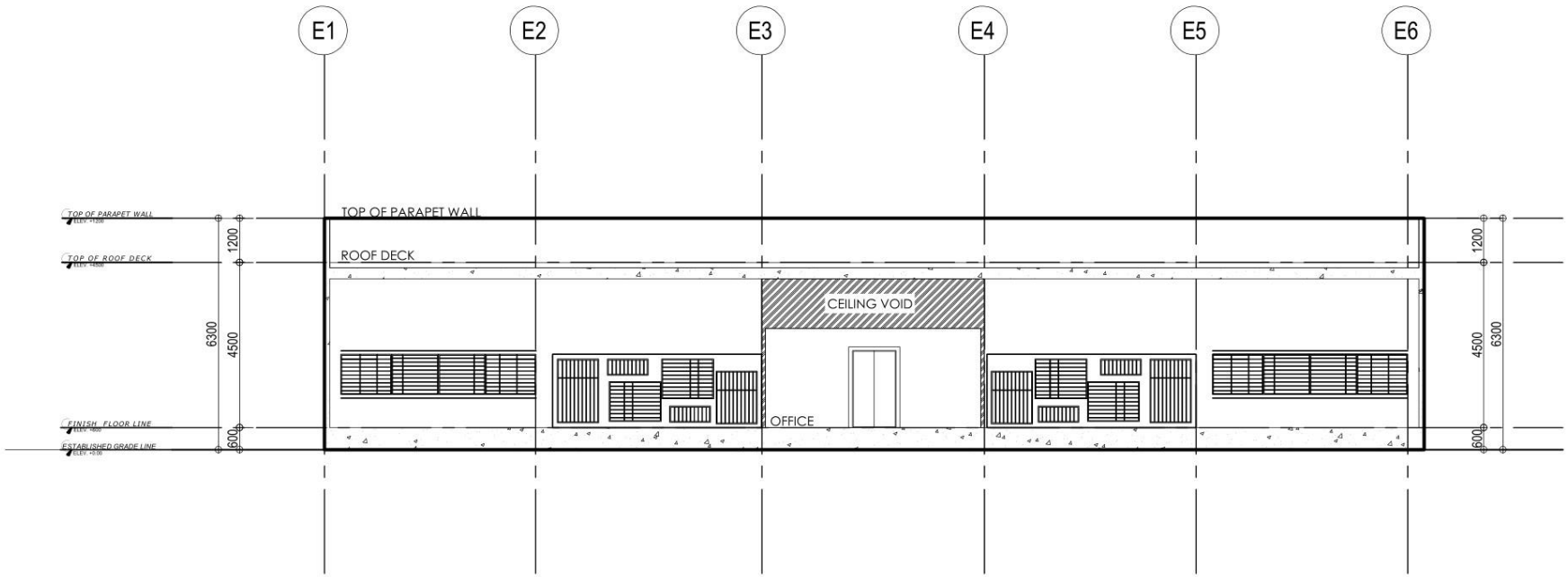
SCALE 1:100





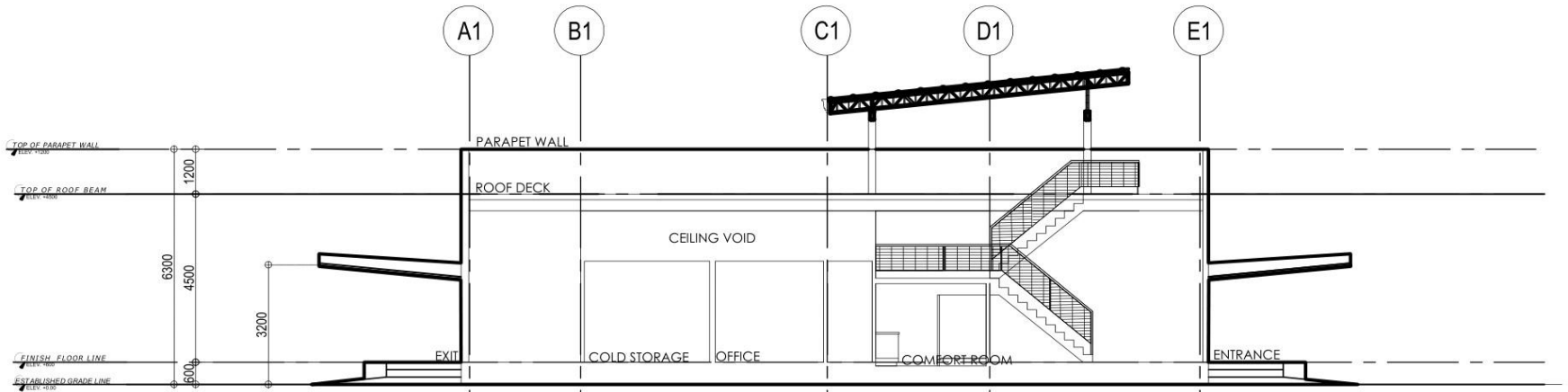
ROOF DECK PLAN

SCALE 1:100



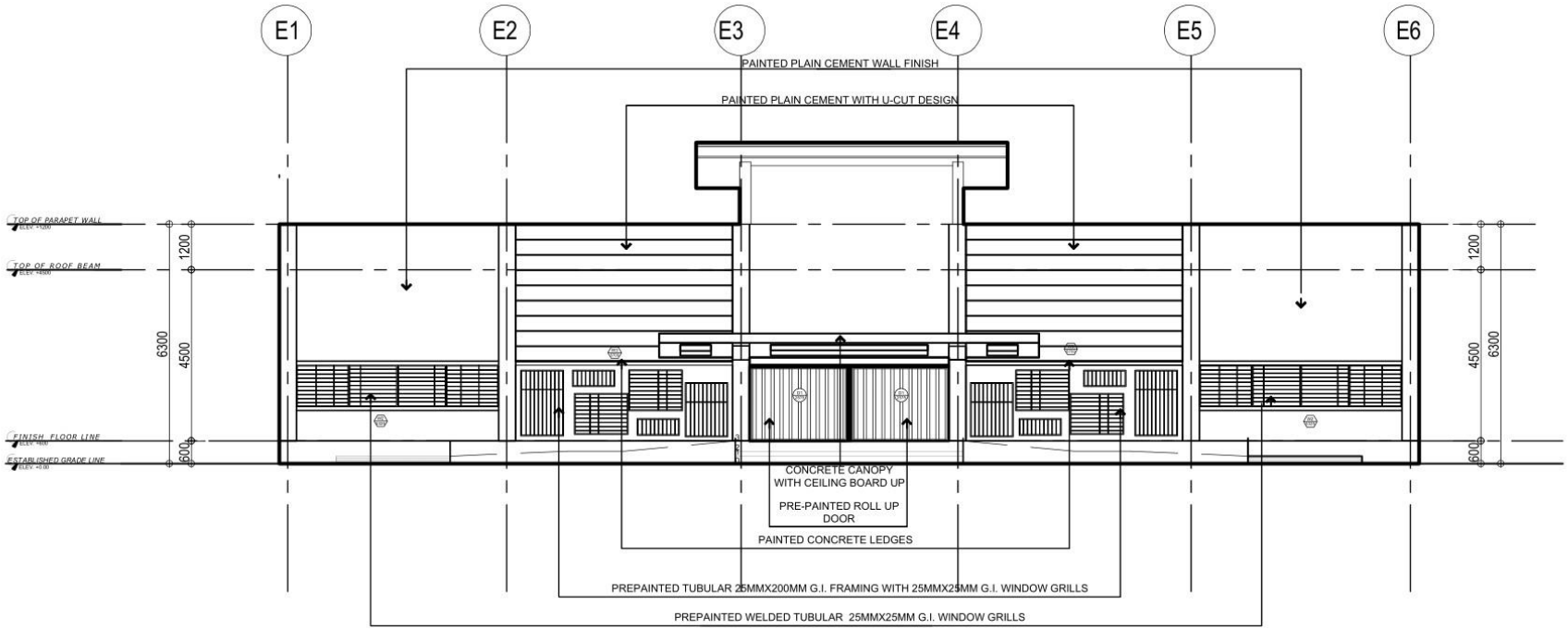
SECTION THRU A-A'

SCALE 1:100



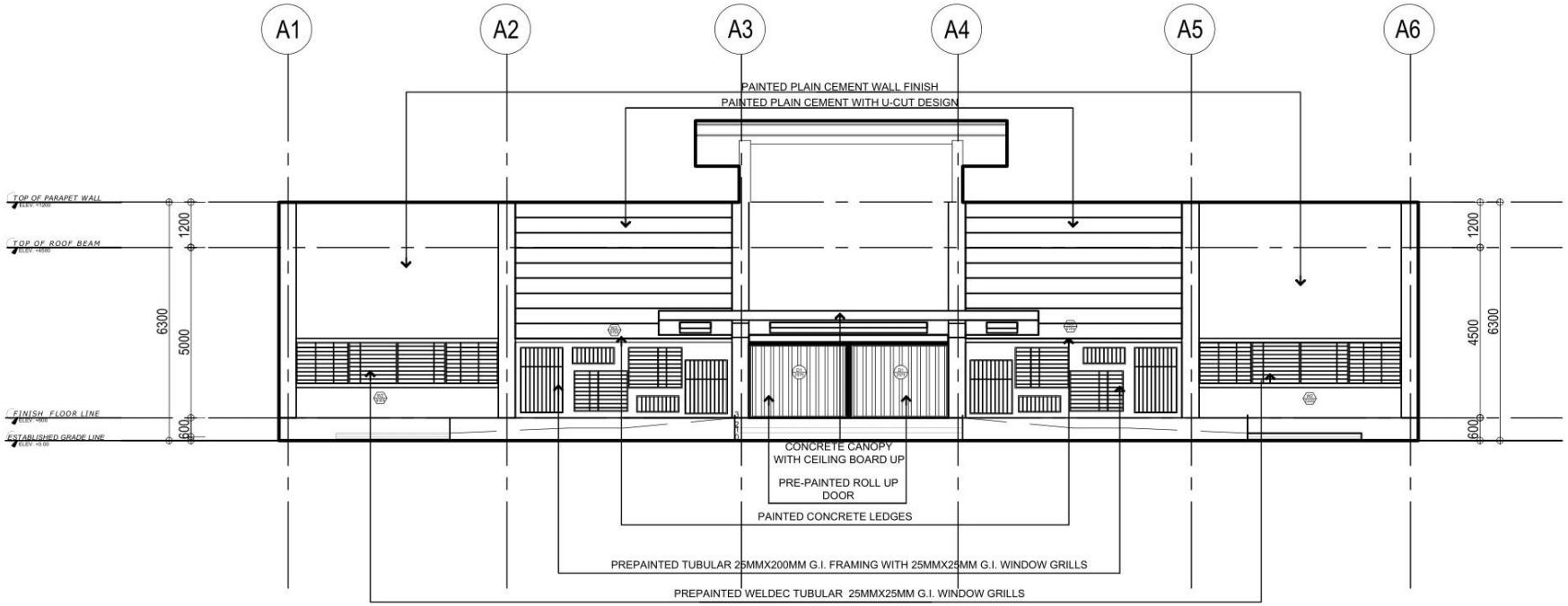
SECTION THRU B-B'

SCALE 1:100



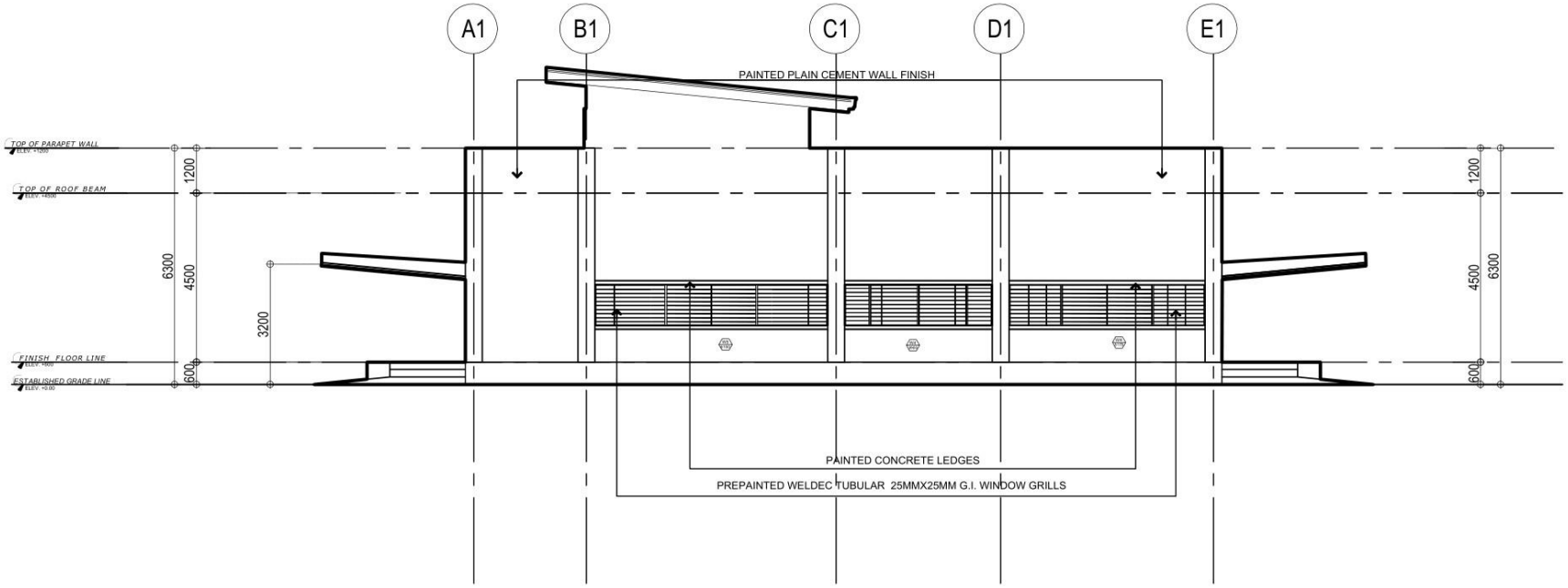
FRONT ELEVATION

SCALE 1:100



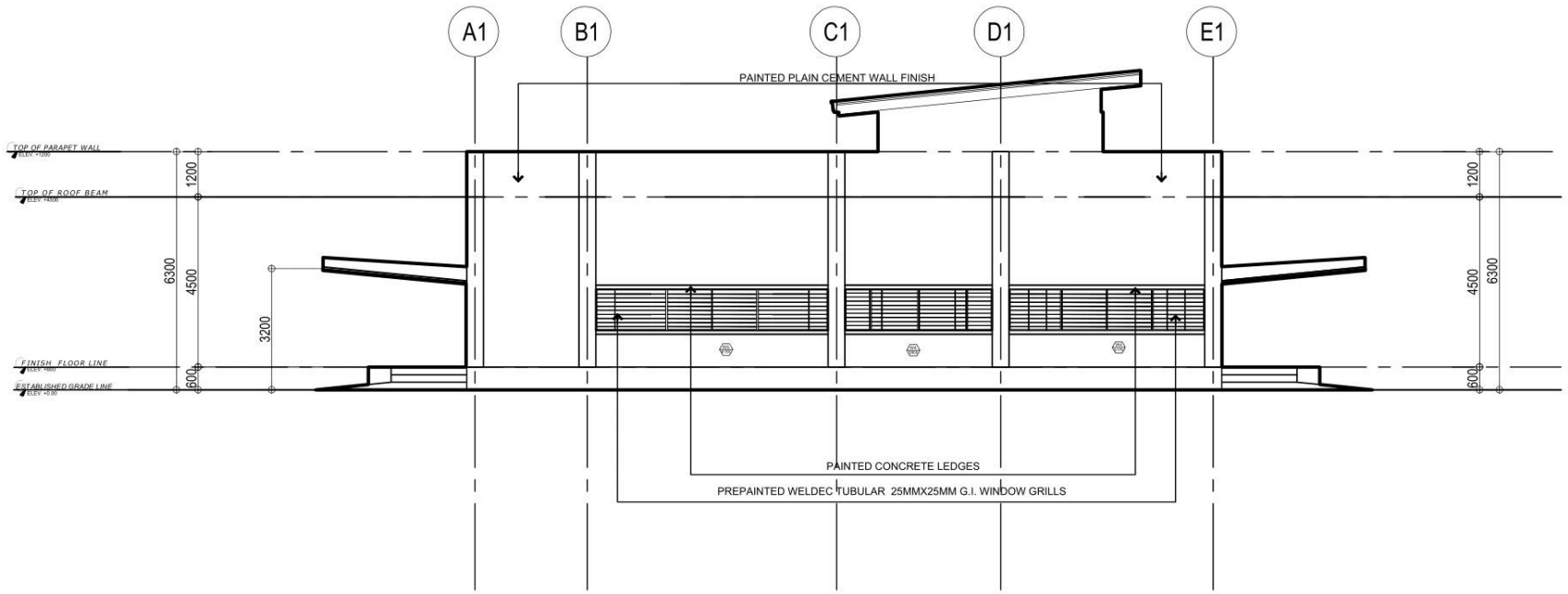
REAR ELEVATION

SCALE 1:100



LEFT SIDE ELEVATION

SCALE 1:100

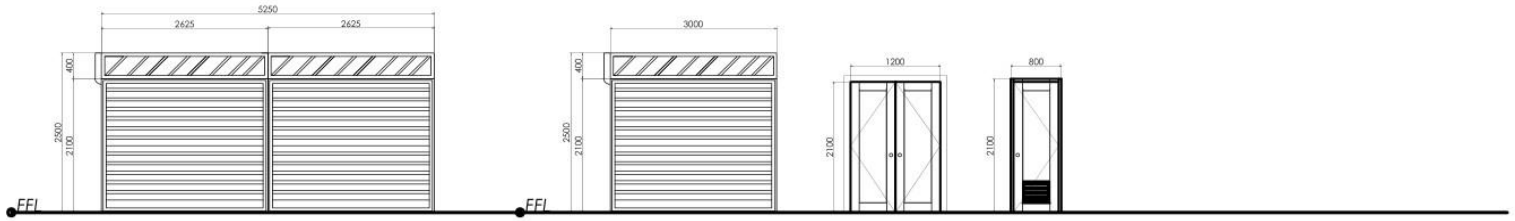


RIGHT SIDE ELEVATION

SCALE 1:100

SCHEDULE OF DOORS AND WINDOWS

SCALE 1:40M



D1 2625

SIZE: 2100mm x 2625mm
DESCRIPTION: ALUMINUM ROLL UP DOOR
2 UNITS
LOCATION: ENTRANCE AND EXIT
NO. OF SETS: 2 SETS

D2 3000

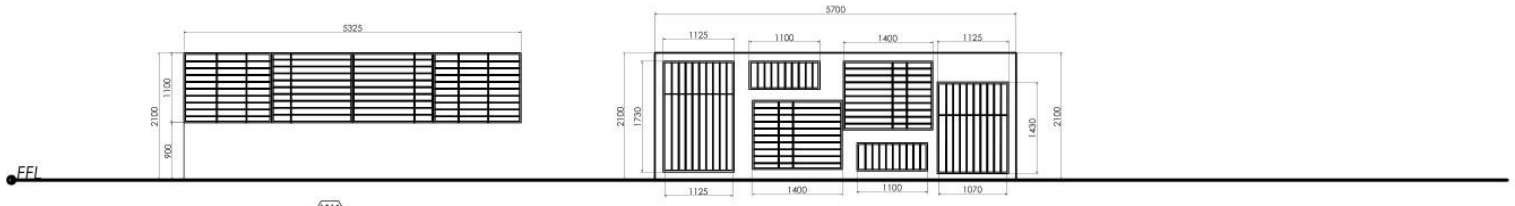
SIZE : 2100mm x 3000mm
DESCRIPTION: ALUMINUM ROLL UP DOOR
1 UNITS
LOCATION : COLD STORAGE
NO. OF SETS : 1 SET

D3 1200

SIZE: 2100mm x 1200mm
DESCRIPTION: WOODEN
PANEL DOOR
LOCATION: OFFICE
NO. OF SETS: 1

D4 800

SIZE: 2100mm x 800mm
DESCRIPTION: PVC PANEL DOOR WITH LOUVER
LOCATION: COMFORTROOM
NO. OF SETS: 2



W1 3525

SIZE: 1200mm x 5325mm
HT. FROM FFL: 900mm
DESCRIPTION: PREPAINTED TUBULAR 25MMX200MM G.I. FRAMING WITH 25MMX25MM G.I. WINDOW GRILLS
PREPAINTED WELDED TUBULAR 25MMX25MM G.I. WINDOW GRILLS
LOCATION: SELLING AREA

NO. OF SETS: 9

W1 5700

SIZE: 1200mm x 5700mm
HT. FROM FFL: 900mm
DESCRIPTION: PREPAINTED TUBULAR 25MMX200MM G.I. FRAMING WITH 25MMX25MM G.I. WINDOW GRILLS
PREPAINTED WELDED TUBULAR 25MMX25MM G.I. WINDOW GRILLS

LOCATION: SELLING AREA

NO. OF SETS: 4 SETS

STRUCTURAL PLANS

CONSTRUCTION NOTES

A. GENERAL

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. 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.
3. 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.
4. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE ADEQUATE SHORING & BRACINGS OF THE STRUCTURE FOR ALL LOADS THAT MAYBE IMPOSED DURING CONSTRUCTION.

B. CONCRETE & REINFORCEMENT

1. ALL MATERIALS AND WORKMANSHIP SHALL CONFORM WITH THE LATEST BUILDING CODE OF AMERICAN CONCRETE INSTITUTE (ACI-318).
2. ALL CONCRETE SHALL DEVELOP A MIN. COMPRESSIVE STRENGTH AT THE END OF TWENTY EIGHT (28) DAYS W/ CORRESPONDING MAXIMUM SIZE AGGREGATE & SLUMPS AS FOLLOWS.

LOCATION	28 DAYS STRENGTH	MAX. SIZE AGGREGATE	MAX. SLUMP
ALL OTHERS, INCLUDING SUSPENDED SLABS,	3000 PSI	3/4 IN. (19 MM)	4 IN. (100 MM)
COLUMNS, R.C. WALLS	3000 PSI	3/4 IN. (19 MM)	4 IN. (100 MM)
BEAMS, GIRDERS	3000 PSI	3/4 IN. (19 MM)	4 IN. (100 MM)
SLAB ON GRADE	2000 PSI	3/4 IN. (19 MM)	4 IN. (100 MM)

3. ALL REINFORCING BARS SHALL CONFORM TO ASTM A615 GRADE 33 FOR DIAMETER 12 & SMALLER BARS AND GRADE 40 FOR DIA. 16 AND LARGER BARS.
4. IN GENERAL THE LATEST EDITION OF ACI-315, MANUAL OF STANDARD PRACTICE DETAILING REINFORCED CONCRETE STRUCTURES SHALL BE ADHERED TO UNLESS OTHERWISE SHOWN OR NOTED.
5. MAINTAIN MINIMUM CONCRETE COVER FOR REINFORCING STEEL AS FOLLOWS.
   - SUSPENDED SLABS — 3/4 IN. (19 MM)
   - SLAB ON GRADE — 1 1/2 IN. (38 MM)
   - WALLS ABOVE GRADE — 1 IN. (25 MM)
   - BEAM STIRRUPS AND COLUMN TIES — 1 1/2 IN. (38 MM)
   - WHERE CONCRETE IS EXPOSED TO EARTH BUT POURED AGAINST FORMS — 2 IN. (50 MM)
   - WHERE CONCRETE IS DEPOSITED DIRECTLY AGAINST EARTH — 3 IN. (75 MM)
6. SPLICES SHALL BE SECURELY WIRED TOGETHER & SHALL LAP OR EXTEND IN ACCORDANCE W/ TABLE 1 (TABLE OF LAP SPLICE & ANCHORAGE LENGTH) UNLESS OTHERWISE SHOWN ON DRAWINGS, SPLICES SHALL BE STAGGERED WHENEVER POSSIBLE.
7. ALL ANCHOR BOLTS, DOWELS, AND OTHER INSERTS, SHALL BE PROPERLY POSITIONED & SECURED IN PLACE PRIOR TO PLACING OF CONCRETE.
8. CONTRACTOR SHALL NOTE AND PROVIDE ALL MISCELLANEOUS CURBS, SILLS, STOOLS, EQUIPMENT'S AND MECHANICAL BASES THAT ARE REQUIRED BY THE ARCHITECTURAL, ELECTRICAL, AND MECHANICAL DRAWINGS.
9. ALL CONCRETE SHALL BE KEPT MOIST FOR A MINIMUM OF SEVEN CONSECUTIVE DAYS IMMEDIATELY AFTER POURING BY THE USE OF WET BURLAP FOG SPRAYING, CURING COMPOUNDS OR OTHER APPROVED METHODS.
10. STRIPPING OF FORMS AND SHORES:
    - FOUNDATION — 24 HRS.
    - SUSPENDED SLAB EXCEPT WHEN ADDITIONAL LOADS ARE IMPOSED — 8 DAYS
    - 18 HRS.
    - 14 DAYS

C. MASONRY AND CONCRETE BLOCKS

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-Ø16 VERTICAL BARS AT CORNERS, INTERSECTIONS, END OF WALLS AND EACH SIDE OF OPENINGS.
3. LINTEL 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)	Ø12 @ 600 MM	Ø10 @ 600 MM
6 IN. (150 MM)	Ø12 @ 600 MM	Ø10 @ 600 MM
4 IN. (100 MM)	Ø10 @ 600 MM	Ø10 @ 600 MM

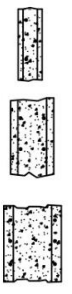
5. REINFORCING BARS SHALL BE LAPPED A MINIMUM OF 40 BAR DIAMETERS WHERE SPLICE DOWELS FROM FOOTING OR SLABS SHALL EXTEND INTO THE BLOCK WALL A MINIMUM OF 40 BAR DIAMETERS, AND DOWELS TO MATCH.
6. ALL CELLS CONTAINING REINFORCING BARS OR INSERTS SHALL BE SOLIDLY FILLED WITH CONCRETE GROUT (REFER TO SPECIFICATIONS).

D. FOUNDATION

1. SOIL BEARING CAPACITY DEPENDS ON THE SOIL TEST REPORT.
   a. PILE CAPACITY 110 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.

CONCRETE WALLS:

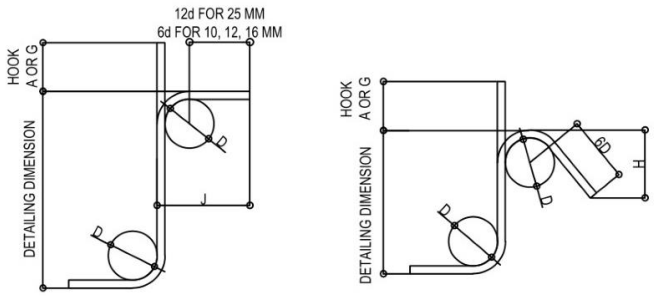
UNLESS OTHERWISED INDICATED IN THE PLANS, WALL REINFORCEMENT SHALL BE FOLLOWED ACCORDING TO THE FOLLOWING SCHEDULE

WALL THK.	REINFORCEMENT		REMARKS	VERTICAL SECTION
	HORIZONTAL	VERTICAL		
0.10m	10Ø @ 0.25m O.C.	10Ø @ 0.30m O.C.	HOR. & CENTER VERT. BARS STAGGERED OUTSIDE	
0.125m	10Ø @ 0.20m O.C.	10Ø @ 0.25m O.C.	- DO -	
0.15m	12Ø @ 0.25m O.C.	12Ø @ 0.30m O.C.	BOTH FACES HOR. SHALL BE INSIDE	
0.178m	12Ø @ 0.23m O.C.	12Ø @ 0.25m O.C.	- DO -	
0.20m	12Ø @ 0.30m O.C.	12Ø @ 0.30m E.F.	BOTH FACES HOR. SHALL BE OUTSIDE	
0.225m	12Ø @ 0.20m O.C.	12Ø @ 0.25m O.C. E.F.	- DO -	
0.25m	12Ø @ 0.30m 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 @ 0.23m O.C. E.F.	12Ø @ 0.27m O.C. E.F.	- DO -	
0.35m	12Ø @ 0.20m O.C. E.F.	12Ø @ 0.25m O.C. E.F.	- DO -	
0.40m	12Ø @ 0.25m O.C. E.F.	12Ø @ 0.30m O.C. E.F.	- DO -	

CONCRETE HOLLOW BLOCKS REINFORCEMENT			
THICKNESS	REINFORCEMENT		NOTES
	HORIZONTAL	VERTICAL	
0.076m	10Ø @ 0.60m O.C.	10Ø @ 0.60m O.C.	A. MIN. LAP SPLICE = 0.25M B. PROVIDE RIGHT ANGLE REINFORCEMENT AT CORNER 0.90M LONG. C. WHERE CHB WALLS ADJOINING COLUMN, R.C. BEAM, WALL DOWEL W/ SAME SIZE AS VERTICAL OR HORIZONTAL REINFORCEMENT SHALL BE PROVIDED.
0.102m	10Ø @ 0.60m O.C.	10Ø @ 0.60m O.C.	
0.152m	10Ø @ 0.60m O.C.	10Ø @ 0.60m O.C.	
0.208m	10Ø @ 0.60m O.C.	10Ø @ 0.60m O.C.	

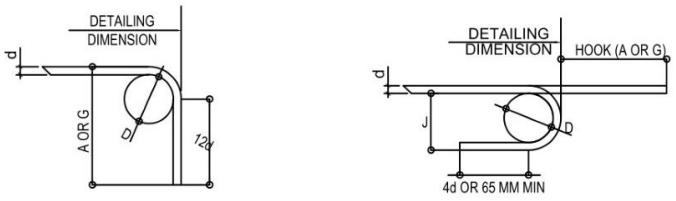
STRUCTURAL STEEL:

1. ALL STRUCTURAL STEEL SECTIONS SHOWN IN THE DRAWINGS SHALL CONFORM TO ASTM SPECIFICATIONS FOR A-36 STEEL (Fy= 36,000 psi),
2. ALL WELDED CONNECTIONS MUST DEVELOP THE FULL STRENGHT OF THE MEMBERS.
3. FABRICATION AND WELDING SHALL BE GOVERNED BY APPLICABLE PROVISIONS OF THE LATEST AISC OR AWS STANDARDS.
4. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO CHECK ACTUAL FIELD CONDITIONS PRIOR TO PREPARATION OF FABRICATION (SHOP) DRAWINGS.
5. THE CONTRACTOR SHALL PREPARE FABRICATION (SHOP) DRAWINGS OF ALL STRUCTURAL STEEL MEMBERS BASED ON THE DESIGNS FOR APPROVAL OF THE ENGINEER PRIOR TO FABRICATION.
6. ALL DOUBLE-ANGLE STRUCTURAL MEMBERS SHAL BE PROVIDED WITH GUSSET PLATES AS SHOWN IN THE DRAWINGS.
7. ALL EXPOSED STRUCTURAL STEEL MEMBERS SHALL RECEIVE AT LEAST ONE COAT OF RED LEAD PAINT.



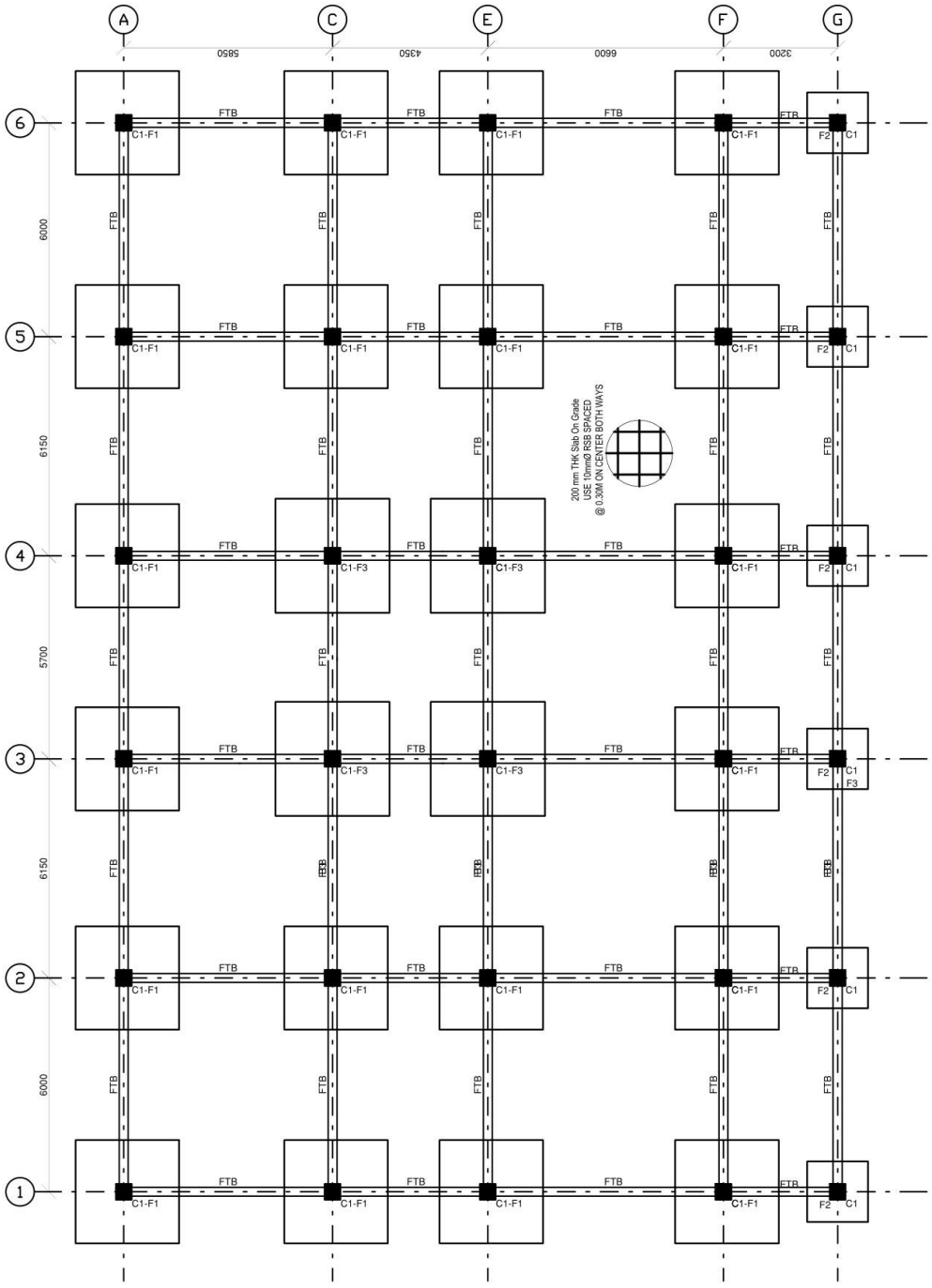
90 DEG 135 DEG

STIRRUPS AND TIE-HOOKS

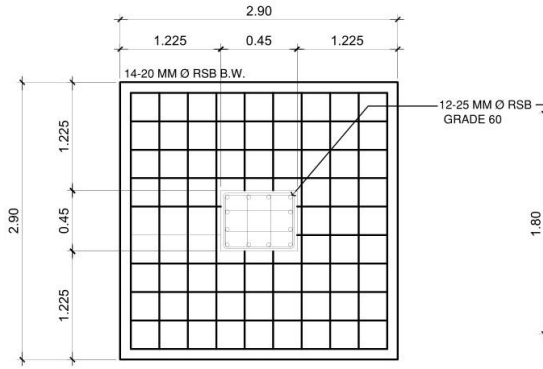


90 DEG 180 DEG

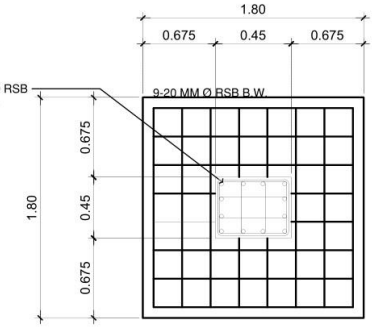
STANDARD HOOKS



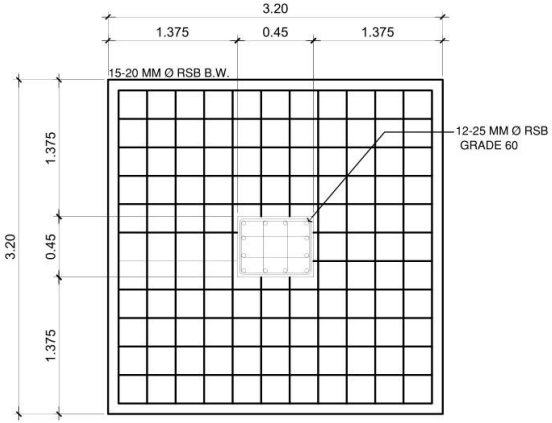
01 FOUNDATION PLAN
SCALE NTS



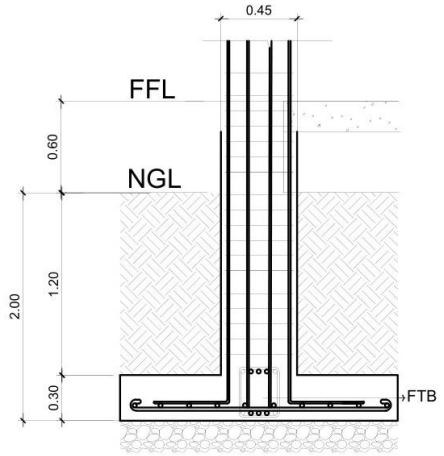
FOOTING 1 DETAIL



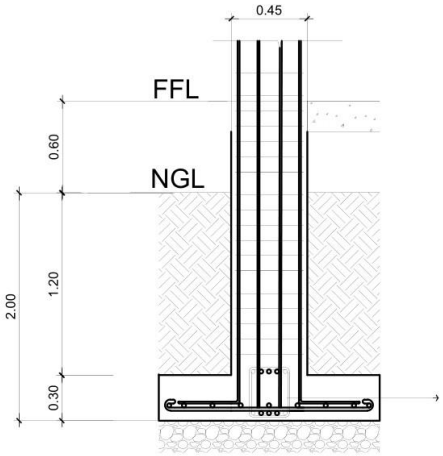
FOOTING 2 DETAIL



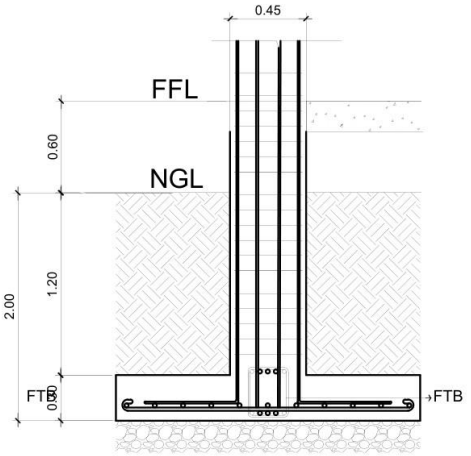
FOOTING 3 DETAIL



FOOTING 1 SECTION



FOOTING 2 SECTION



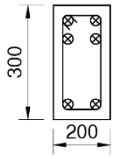
FOOTING 3 SECTION

03 FOOTING SECTION

SCALE NTS

CONCRETE COVER = 40mm
CONFINING ZONE = 745 MM

Z1 MAIN LINK	Z2 LINKS
Ø10 @ 100	Ø10 @ 100

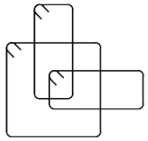


⊗ Ø 12MM

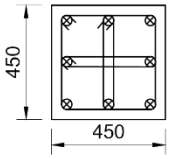
6 - Ø 12MM RSB (GRADE 60)

PC1

CONCRETE COVER = 40mm
CONFINING ZONE = 745 MM



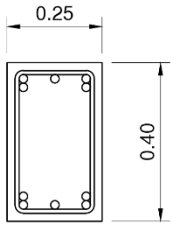
Z1 MAIN LINK	Z1 OTHERS	Z2 LINKS
Ø12 @ 100	Ø12 @ 100	Ø12 @ 225



⊗ Ø 20MM

8 - Ø 20MM RSB (GRADE 60)

C1

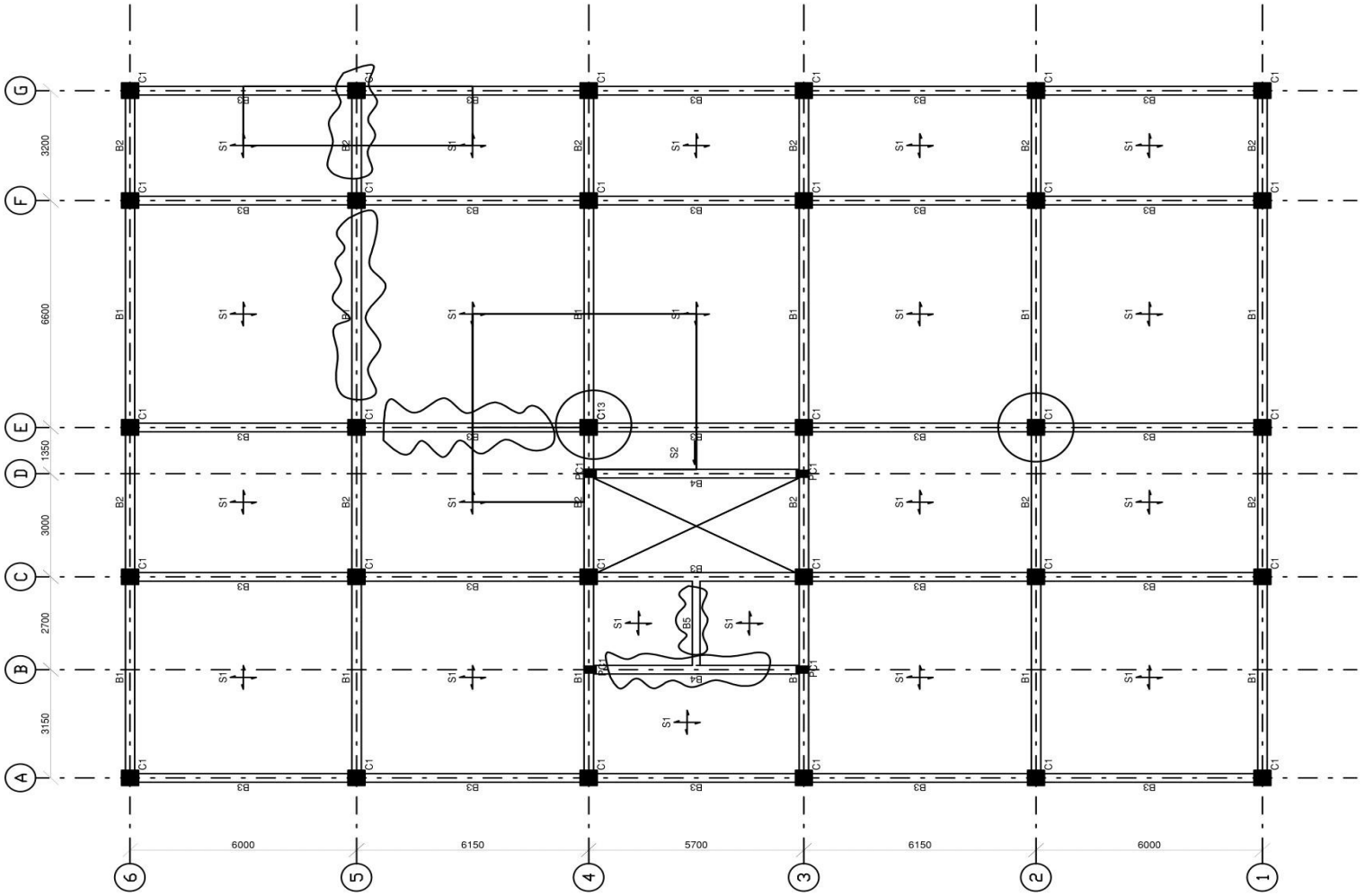


10MMØ RSB SPACE 5@0.05M , 5@0.10M ,
5@0.15M, REST @ 0.20M ON GRADE

FOOTING TIE BEAM

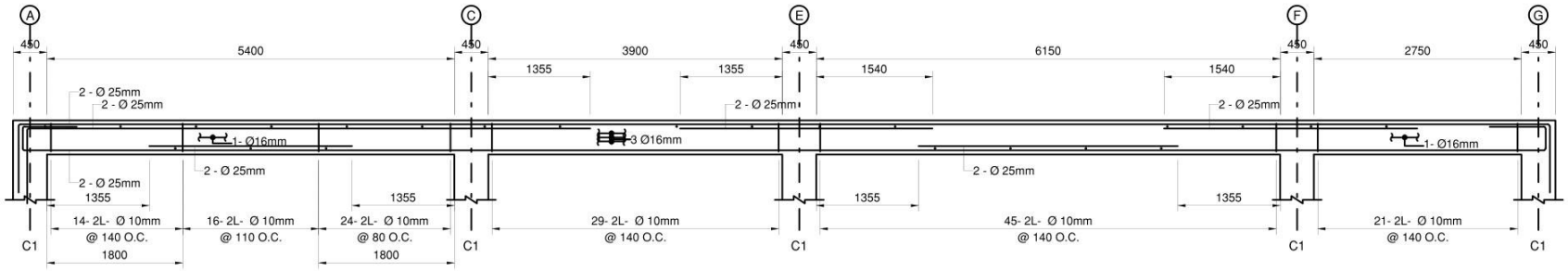
NOTES (AS PER NSCP 2015):
Z1 = SPECIAL CONFINING ZONE, Z2 = REMAINING ZONES

04 COLUMN & FTB PLAN
SCALE NTS



05 ROOFDECK FRAMING PLAN

SCALE NTS



07 BEAM DETAILING (GRID 1)
SCALE NTS

BEAM SCHEDULE

BEAM NUMBERS	SIZE		BOTTOM REINFORCEMENT			TOP REINFORCEMENT			SHEAR STIRRUPS			SFR	DIAGONAL	REMARKS
	B	D	LEFT	MID SPAN	RIGHT	LEFT	MID SPAN	RIGHT	LEFT	MID SPAN	RIGHT			
B1	250	400	2 - Ø 25mm	3 - Ø 25mm	2 - Ø 25mm	3 - Ø 25mm	2 - Ø 25mm	3 - Ø 25mm	14- 2L- Ø 10mm @ 140 O.C.	16- 2L- Ø 10mm @ 110 O.C.	24- 2L- Ø 10mm @ 80 O.C.	1 - Ø16mm	-	-
B2	250	400	2 - Ø 25mm	2 - Ø 25mm	2 - Ø 25mm	3 - Ø 25mm	2 - Ø 25mm	2 - Ø 25mm 2^{+}- Ø 25mm	11- 2L- Ø 10mm @ 140 O.C.	9- 2L- Ø 10mm @ 140 O.C.	11- 2L- Ø 10mm @ 140 O.C.	3 - Ø16mm	-	-
B3	250	400	3 - Ø 25mm	3 - Ø 25mm 2^{+}- Ø 25mm	3 - Ø 25mm	3 - Ø 25mm 3^{+}- Ø 25mm	3 - Ø 25mm	3 - Ø 25mm 3^{+}- Ø 25mm	15- 2L- Ø 10mm @ 140 O.C.	13- 2L- Ø 10mm @ 140 O.C.	15- 2L- Ø 10mm @ 140 O.C.	-	-	-
B4	250	400	2 - Ø 16mm	3 - Ø 16mm 2^{+}- Ø 16mm	2 - Ø 16mm	3 - Ø 16mm 2^{+}- Ø 16mm	2 - Ø 16mm	3 - Ø 16mm 2^{+}- Ø 16mm	16- 2L- Ø 10mm @ 125 O.C.	14- 2L- Ø 10mm @ 125 O.C.	16- 2L- Ø 10mm @ 125 O.C.	1 - Ø16mm	-	-
B5	200	300	2 - Ø 16mm	2 - Ø 16mm	2 - Ø 16mm	2 - Ø 16mm	2 - Ø 16mm	2 - Ø 16mm	11- 2L- Ø 10mm @ 90 O.C.	9- 2L- Ø 10mm @ 90 O.C.	11- 2L- Ø 10mm @ 90 O.C.	-	-	-

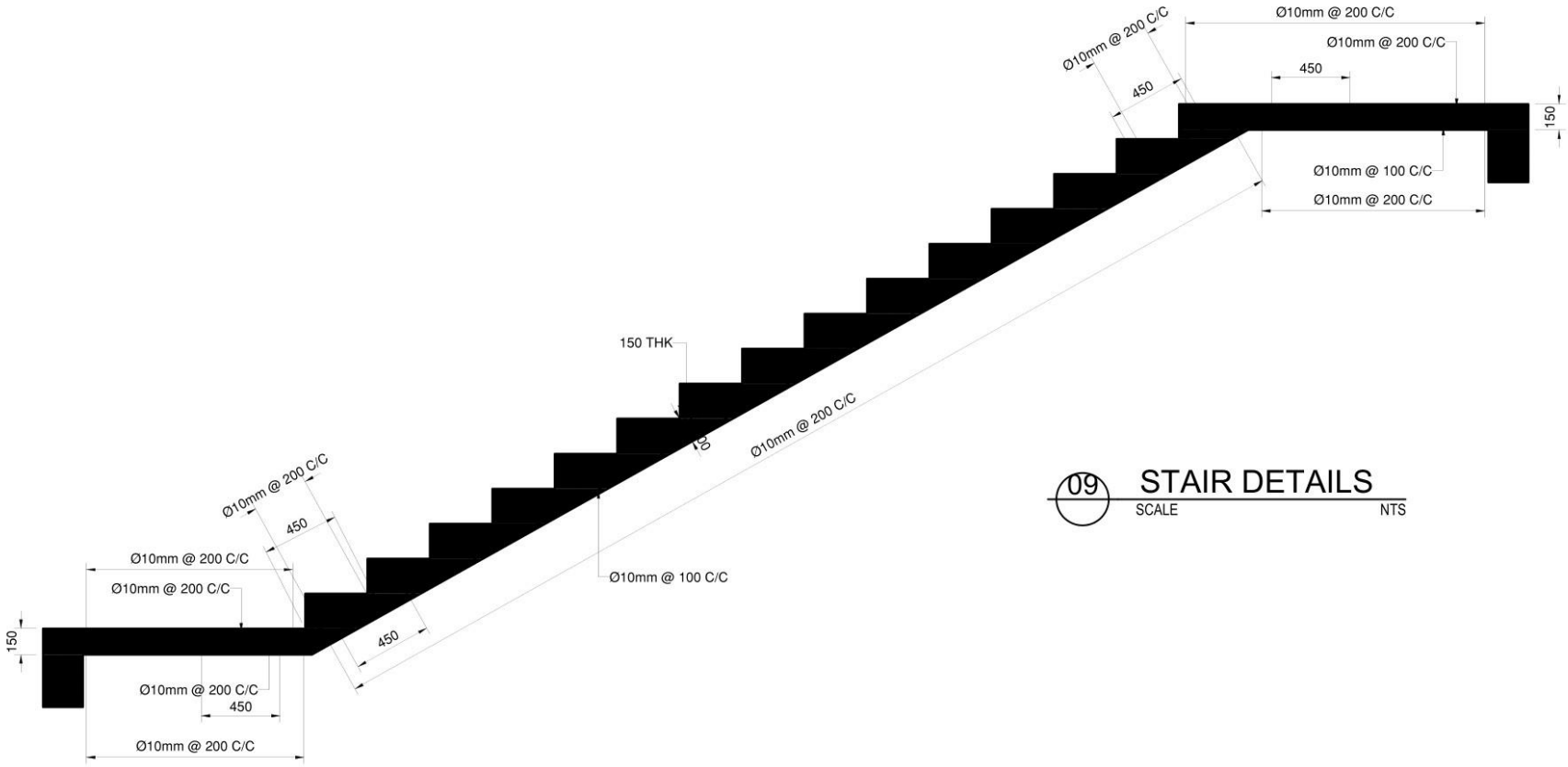
06 BEAM SCHEDULE
SCALE NTS

SLAB SCHEDULE

SLAB NUMBERS	THK	TYPE	BOTTOM REINFORCEMENT		TOP REINFORCEMENT		DISTRIBUTION
			SHORT SPAN (BENT UP)	LONG SPAN (BENT UP)	SS CONT.	LS CONT.	
S1	150	2-Way	Ø 12mm @ 100	Ø 12mm @ 100	Ø 12mm @ 100	Ø 12mm @ 100	Ø 12mm @ 200
S2	150	1-Way	Ø 10mm @ 100	--	Ø 10mm @ 100	--	Ø 10mm @ 200

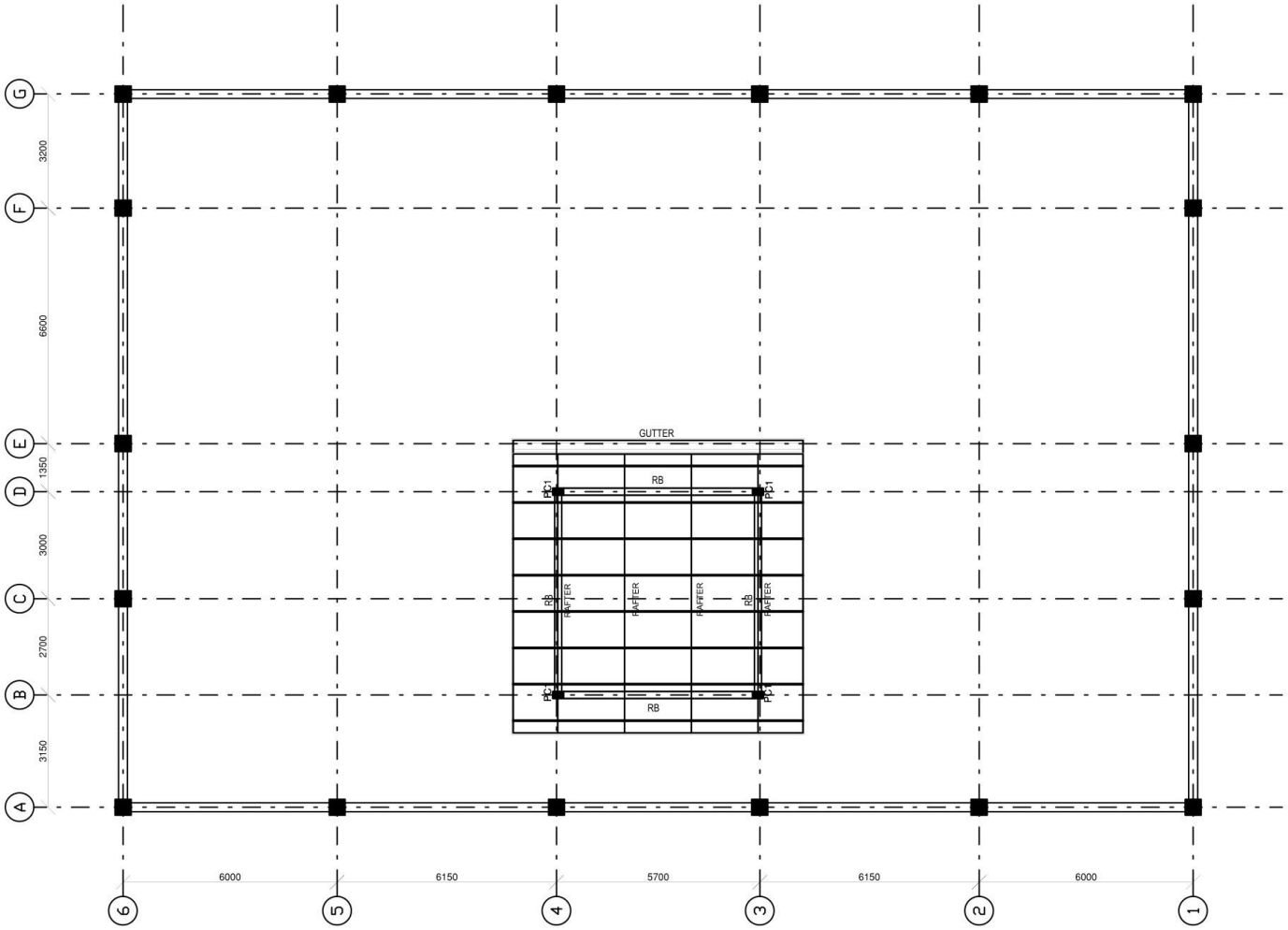
08 SLAB SCHEDULE

SCALE NTS



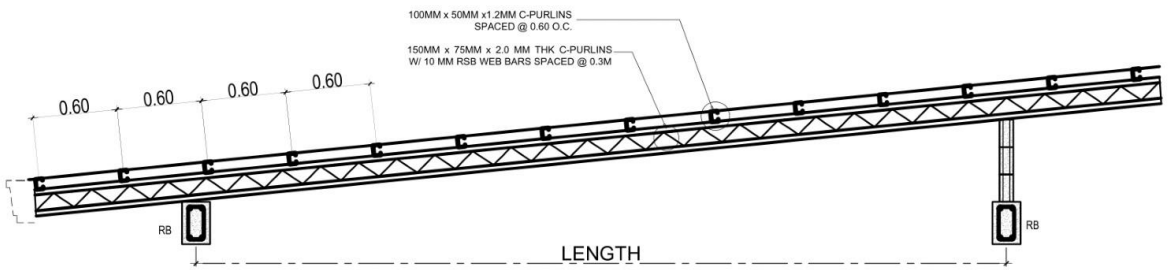
09 STAIR DETAILS

SCALE NTS

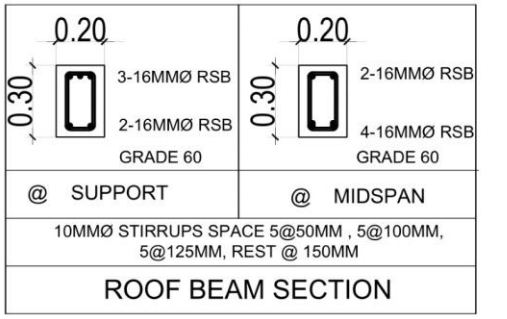


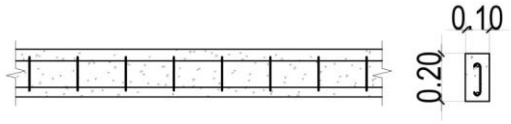
10 ROOF FRAMING PLAN

SCALE NTS



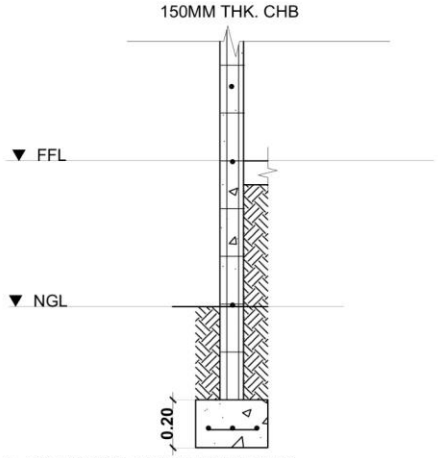
11 RAFTER DETAIL
SCALE NTS





USE : 2-12MMØ MAIN BARS W/ 10MMØ
C-STIRRUPS SPACE @ 0.20M O.C.

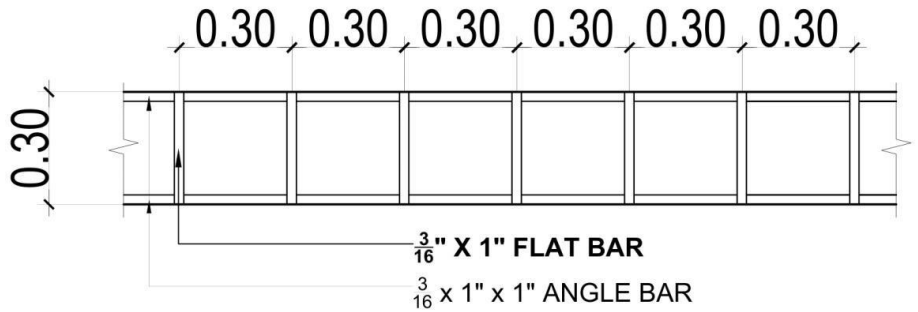
12 LB & RB DETAIL
SCALE NTS



3 - 12MMØ RSB CONTINUOUS BARS
12MMØ RSB CUT BARS SPACED @ 0.20M O.C.

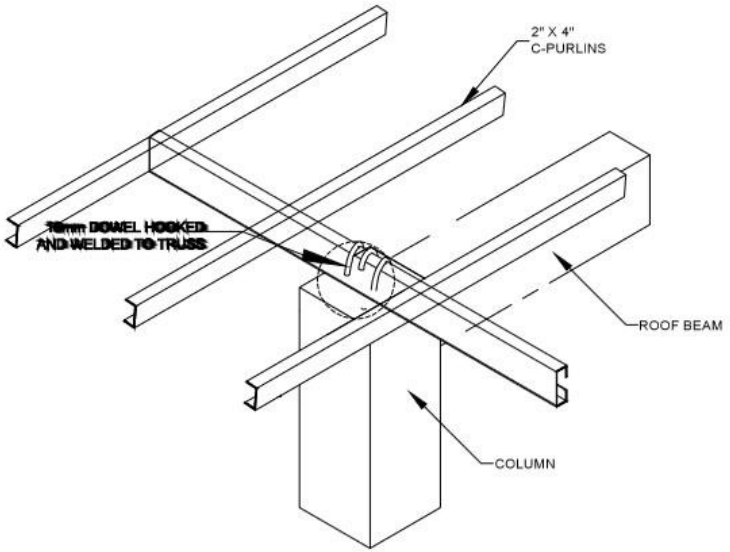
SECTION

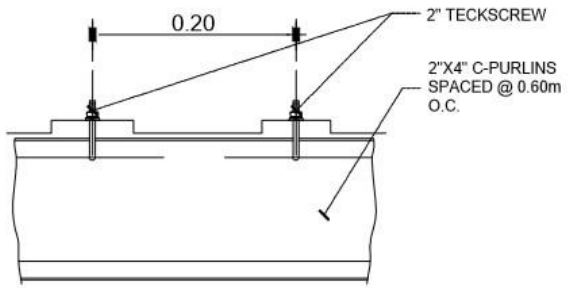
13 WALL FOOTING DETAIL
SCALE NTS



14 FASCIA FRAME DETAIL

SCALE NTS





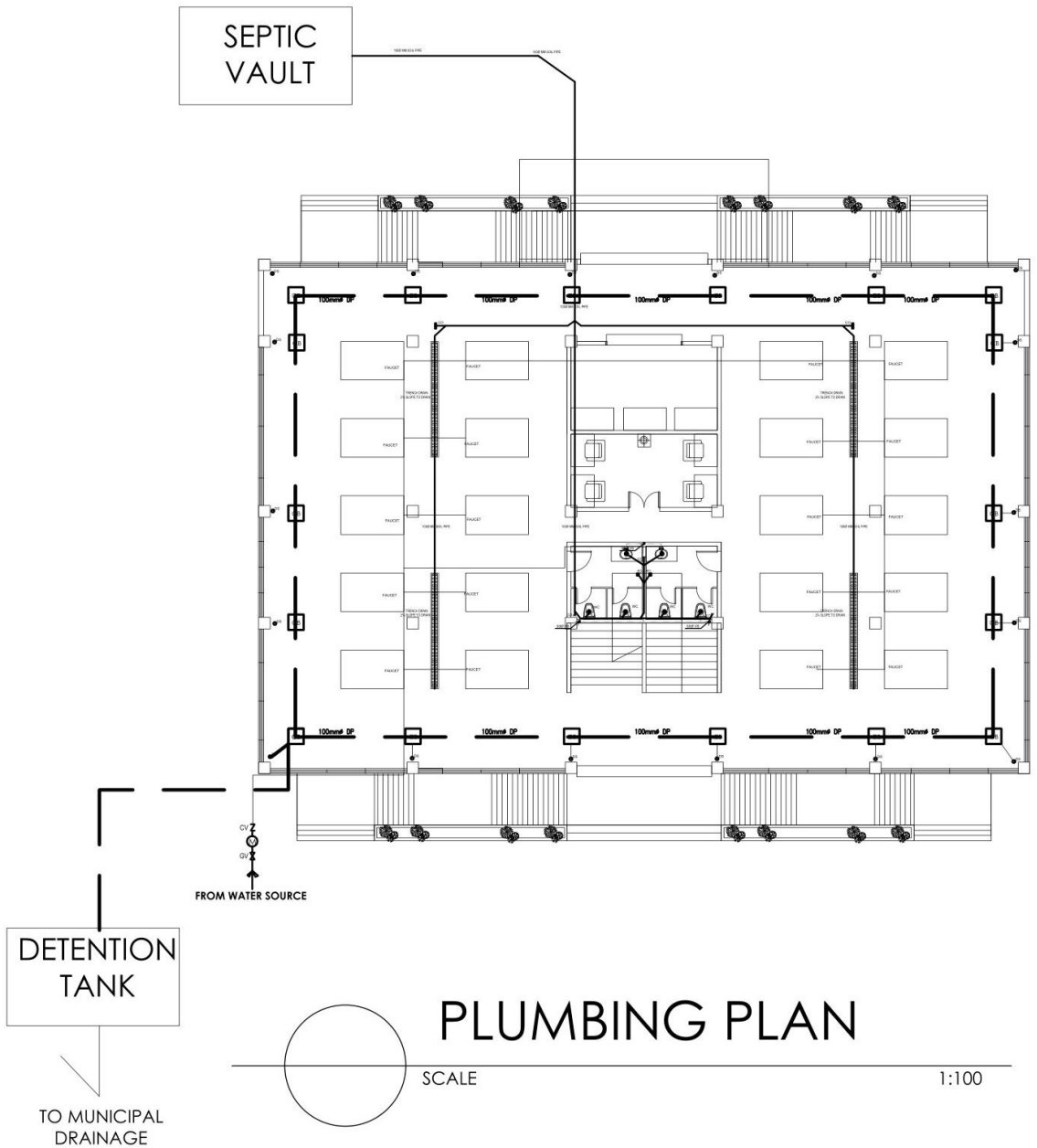
S-6 TECKSCREW SPACING

SCALE NTS

15 SPOT DETAILS

SCALE NTS

PLUMBING PLAN



PLUMBING PLAN

SCALE 1:100

GENERAL NOTES

1. ALL PLUMBING WORKS INCLUDED HEREIN SHALL BE EXECUTED ACCORDING TO THE REQUIREMENTS OF THE NATIONAL PLUMBING CODE OF THE PHILIPPINES AND THE RULES AND REGULATIONS OF THE LOCAL GOVERNMENT.
2. COORDINATE THE DRAWINGS WITH OTHER RELATED DRAWINGS AND SPECIFICATIONS. THE ARCHITECT OR MASTER PLUMBER SHALL BE NOTIFY IMMEDIATELY OF ANY DISCREPANCY FOUND THEREIN.
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 MASTER PLUMBER.
4. SANITARY AND DRAINAGE LINES SHALL HAVE A MINIMUM SLOPE OF 2% UNLESS OTHERWISE NOTED.
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.
9. ALL SEWER LINES SHALL BE UPVC PIPE AS MANUFACTURED BY ATLANTA OR OTHER APPROVED EQUAL BRANDS
10. ALL VENT STACKS SHALL BE UPVC PIPE SERIES 1.000
11. ALL DOWNSPOUT (D.S.) SHALL BE UPVC PIPE SERIES 1.000
12. ALL COLD WATER LINES 110MMØ & BELOW SHALL BE BELDEN POLYPROPYLENE (PP) PIPE. PN-20
13. ALL HOT WATER LINES SHALL BE XPLE (RED COLOR) BY UNILEX AND SHALL BE TESTED AT 150 PSI FOR THE PERIOD OF 2 HOURS BEFORE BACKFILLING OR COVERING.
14. ALL WASTE WATER, STORM DRAIN, & WATER SUPPLY PIPE PROVIDE PIPE HANGER EVERY 1.5 METERS.
15. ALL OTHER REQUIREMENTS WAS FOLLOWED WITHIN THE PROVISION OF THE NATIONAL PLUMBING CODE OF THE PHILIPPINES AND R.A. 1378.
16. PLUMBING WORKS SHALL BE DONE UNDER THE DIRECT SUPERVISION OF A DULY LICENSED MASTER PLUMBER.
17. THE WORK THROUGHOUT SHALL BE EXECUTED IN THE BEST AND MOST THOROUGH MANNER KNOWN TO SATISFACTION OF ARCHITECT AND/OR MASTER PLUMBER.

UNDERTAKING

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 THE 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 BE 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 NATIONAL PLUMBING CODE OF THE PHILIPPINES.

_____
SIGNATURE OF THE OWNER

PIPE SIZE CONVERSION TABLE:

PIPE MATERIAL	NOMINAL SIZE										
	INCH (DIAMETER)	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"	8"
POLYPROPYLENE (PPR)	MM (DIAMETER)	25	32	40	50	65	75	90	110		
GALVANIZED IRON (G.I.)	MM (DIAMETER)	20	25	32	40	50	65	80	100	150	200

SCHEDULE OF PIPE SLEEVE:

NOMINAL SIZE									
PIPE SIZE	25	32	40	50	65	80	100	150	200
SLEEVE SIZE	50	50	65	100	125	125	200	250	300

PLUMBING ANALYSIS

1. DESIGN OF SEPTIC TANK

FIXTURES	UNITS	DFU	LOAD
WATER CLOSET	4	4	8
LAVATORY	4	2	6
FLOOR DRAIN	4	2	6
TOTAL			20

FOR 24 DFU
USE: 4.542 LITERS CAPACITY SEPTIC TANK OR 4.542 CU.M
DEPTH = 1.20M
WIDTH = 1.70M
LENGTH = 2.30M

SIZE OF DIGESTION CHAMBER:
⅔(L)
⅔(2.30) = 1.53M SAY 1.50M

SIZE OF LEACHING CHAMBER:
⅓(L)
⅓(4.00) = 0.76 M SAY 0.80M

2. DESIGN OF SANITARY LINE

FIXTURES	UNITS	DFU	LOAD
WATER CLOSET	4	4	8
LAVATORY	4	2	6
FLOOR DRAIN	4	2	6
TOTAL			20

24 DFU

FROM TABLE 7-5:
MAIN SOIL PIPE:
USE 4" (100MMØ) (HOR.); 4" (100MMØ) (VERT.);
4"(100MM) FOR WC
2" (50MMØ) WASTE PIPE FOR FD, LAV, AND VENT PIPE

3. SIZING OF WATER LINE

FIXTURES	UNITS	DFU	LOAD
WATER CLOSET	4	3	7
LAVATORY	4	1	5
TOTAL			12

14 WSFU

FROM TABLE 6-6
USE 40MMØ PPR METER & STREET SERVICE
USE 40MMØ PPR BUILDING SUPPLY & BRANCHES

USE WATERLINE TO FIXTURES AS FOLLOWS:

WATER CLOSET = 20MMØ PPR
LAVATORY = 20MMØ PPR

4. WATER REQUIREMENTS

14 WSFU

AVERAGE DAILY DEMAND:
8 GALS/PERSON X 14 WSFU = 112 GALS/MIN
112 + 50% FIRE PRESERVE = 168 GALS / 0.70 CU.M

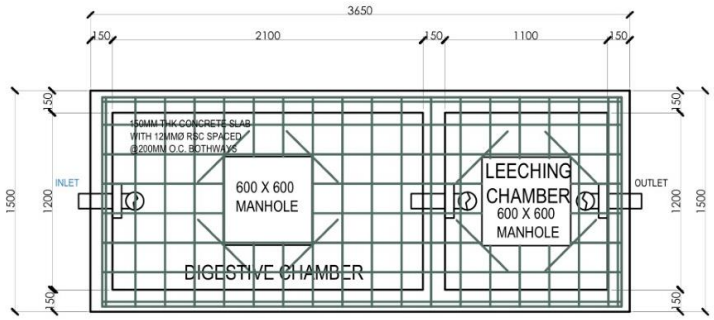
5. SIZING OF DOWNSPOUT AND ROOF DRAINS:

AREA OF ROOF: 79 SQ.M.
RAINFALL RATE: 102MM/HR
NPCP TABLE 11-4: USE 75MMØ uPVC DOWNSPOUT, ROOFDRAIN, AND VERTICAL RAINWATER PIPE
NPCP TABLE 11-2a: USE 75MMØ uPVC HORIZONTAL RAINWATER PIPE

SEPTIC TANK SPECIFICATIONS:

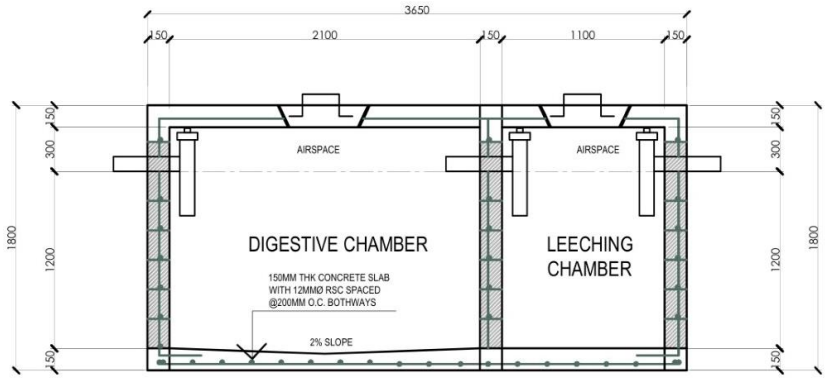
BASED ON THE PLUMBING DESIGN ANALYSIS

DIGESTION CHAMBER (DC) LENGTH	2100 MM	**DIGESTION CHAMBER (DC) WIDTH**	1200 MM
LEACHING CHAMBER (LC) LENGTH	1100 MM	**LEACHING CHAMBER (LC) WIDTH**	1200 MM
SEPTIC TANK (SV) TOTAL LENGTH	3650 MM	**SEPTIC TANK (SV) TOTAL WIDTH**	1500 MM
DIGESTION CHAMBER (DC) HEIGHT	1200 MM		
LEACHING CHAMBER (LC) HEIGHT	1200 MM		
SEPTIC TANK (SV) TOTAL HEIGHT	1800 MM		



PLAN

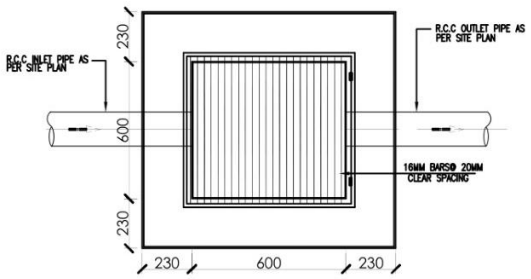
LEGEND	
	DRAIN PIPE LINE
	WATER LINE
	SOIL PIPE LINE
	VENT LINE
	GATE VALVE
	CHECK VALVE
M	WATER METER
	P-TRAP
FCO	FLOOR CLEANOUT
FAU	FAUCET
LAV	LAVATORY
WC	WATER CLOSET
UR	URINAL
FD	FLOOR DRAIN
DS	DOWNSPOUT
CB	CATCH BASIN
GT	GREASE TRAP
D	DRAIN
VSTR	VENT STACK THRU ROOF



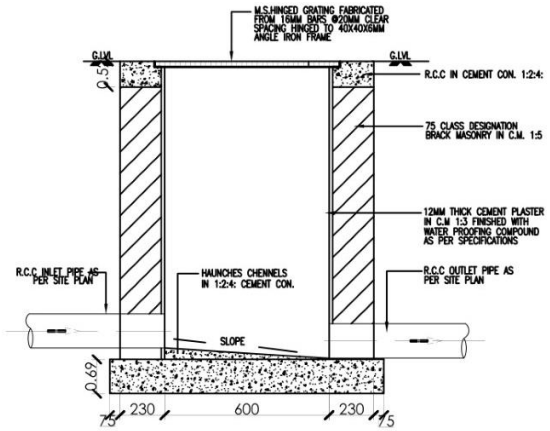
SECTION

SEPTIC VAULT DETAIL

SCALE 1:20 M



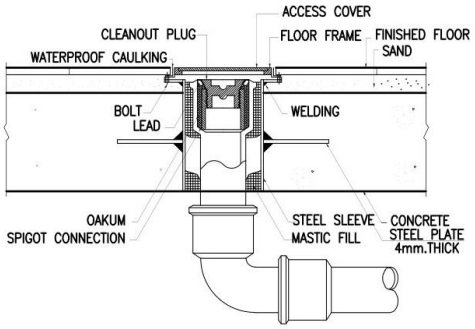
PLAN



SECTION

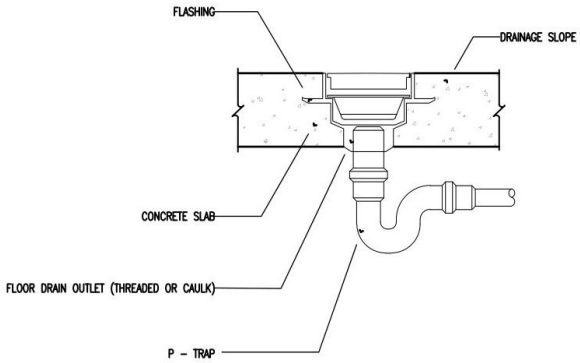
CATCH BASIN DETAIL

SCALE: 1:20M



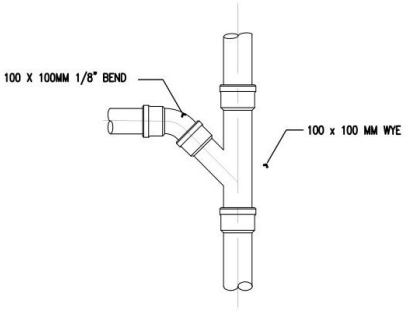
FLOOR CLEAN-OUT DETAIL

NOT TO SCALE



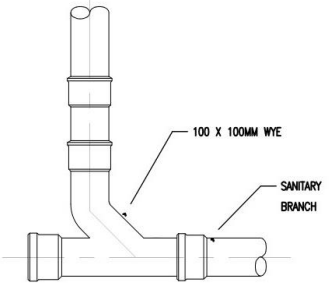
FLOOR DRAIN DETAIL

SCALE NOT TO SCALE



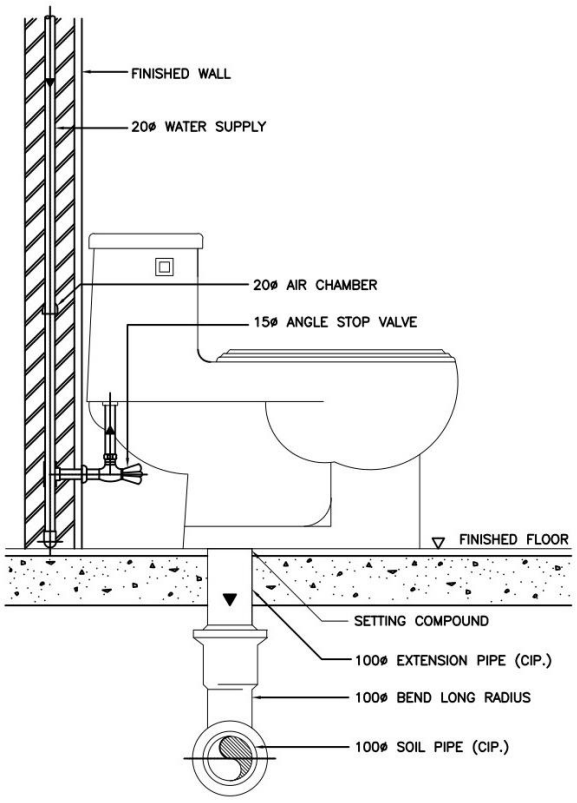
VERTICAL TO HORIZONTAL

SCALE NOT TO SCALE



HORIZONTAL TO VERTICAL

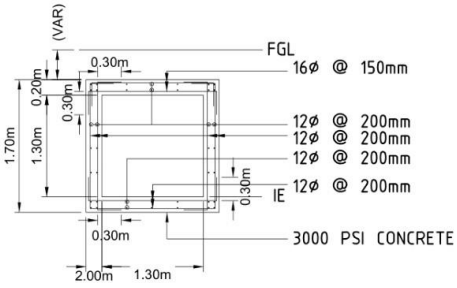
SCALE NOT TO SCALE



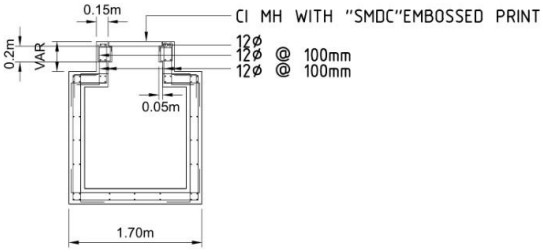
WATER CLOSET DETAIL

SCALE NOT TO SCALE

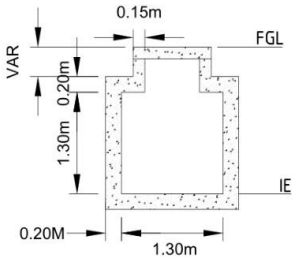
LEGEND	
———	DRAIN PIPE LINE
———	WATER LINE
———	SOIL PIPE LINE
———	VENT LINE
—⋈—	GATE VALVE
—N—	CHECK VALVE
Ⓜ	WATER METER
——U	P-TRAP
FCO	FLOOR CLEANOUT
FAU	FAUCET
LAV	LAVATORY
WC	WATER CLOSET
UR	URINAL
FD	FLOOR DRAIN
DS	DOWNSPOUT
CB	CATCH BASIN
GT	GREASE TRAP
D	DRAIN
VSTR	VENT STACK THRU ROOF

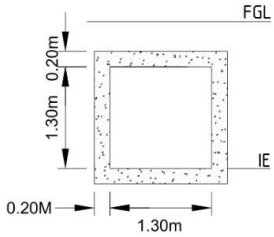


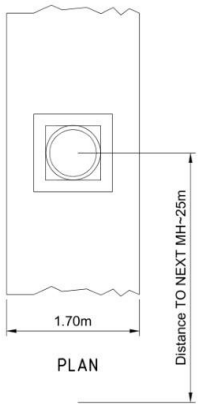
SECTION @ RCBC



SECTION @ MH

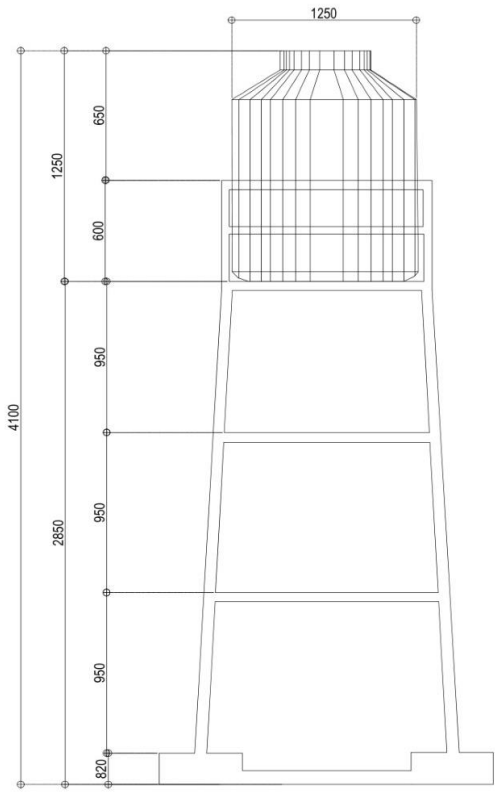


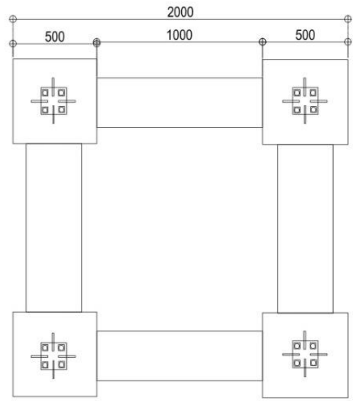


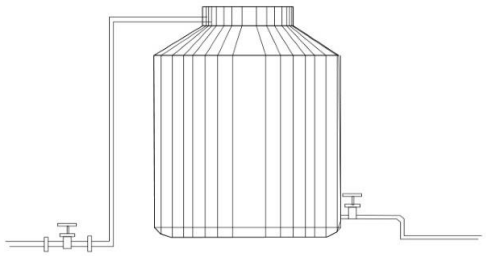


PLAN

DRAINAGE DETAILS



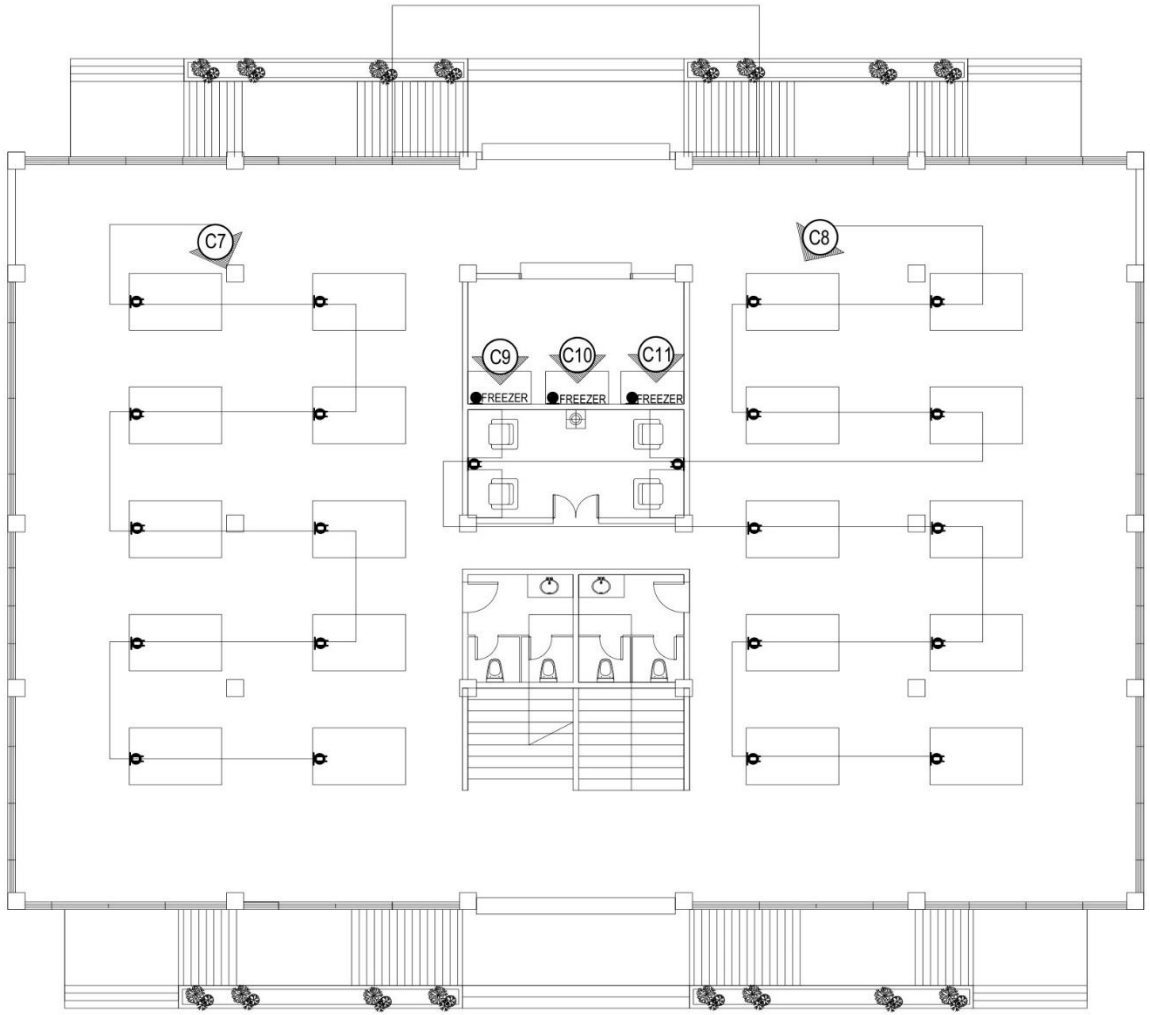




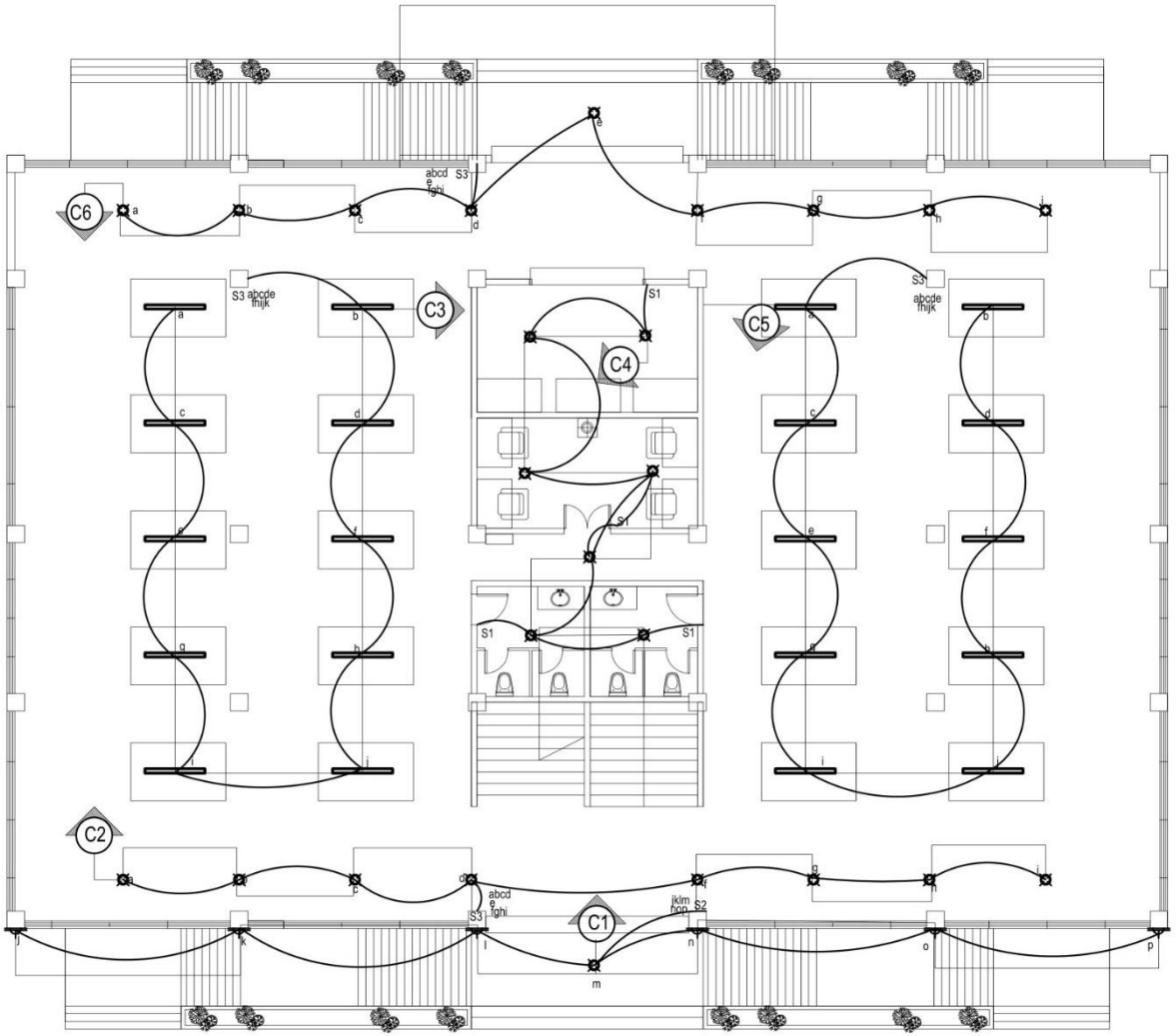
WATER TANK

SCALE NTS

ELECTRICAL PLANS



GROUND FLOOR PLAN
CONVENIENT OUTLET LAY-OUT



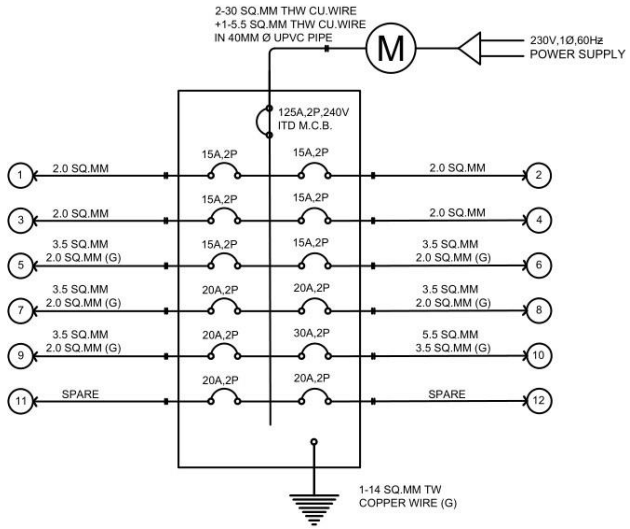
GROUND FLOOR PLAN

LIGHTING LAY-OUT

SCHEDULE OF LOADS

CKT. NO.	LOADS			SWITCHES				VOLT.	PHASE	FREQ.	LOAD CURRENT (A)	VOLT AMPERE (VA)	CIRCUIT PROTECTION	WIRE SIZE	CONDUIT SIZE (UPVC)
	L.O.	C.O.	OTHERS	S1	S2	S3	S3W								
1	10			4		4		230	1	60Hz	1.13	259.90	15A, 2P	2-3.5 SQ.MM	20 MMØ
2	9			4				230	1	60Hz	0.84	193.20	15A, 2P	2-3.5 SQ.MM	20 MMØ
3	5			1				230	1	60Hz	0.47	108.10	15A, 2P	2-3.5 SQ.MM	20 MMØ
4	8				2			230	1	60Hz	0.75	175.50	15A, 2P	2-3.5 SQ.MM	20 MMØ
5	6			1			2	230	1	60Hz	0.56	128.80	15A, 2P	2-3.5 SQ.MM	20 MMØ
6		9						230	1	60Hz	7.04	1,619.20	15A, 2P	2-3.5 SQ.MM	20 MMØ
7		8						230	1	60Hz	6.26	1,439.80	20A, 2P	2-3.5 SQ.MM 1-2.0 SQ.MM (G)	20 MMØ
8		7						230	1	60Hz	5.47	1,258.10	20A, 2P	2-3.5 SQ.MM 1-2.0 SQ.MM (G)	20 MMØ
9			1-1/6HP REFRIGERATOR					230	1	60Hz	13.04	2,992.30	20A, 2P	2-3.5 SQ.MM 1-2.0 SQ.MM (G)	**20 MMØ**
10			1-1/6HP REFRIGERATOR					230	1	60Hz	13.04	2,992.30	20A, 2P	2-3.5 SQ.MM 1-2.0 SQ.MM (G)	**20 MMØ**
11			1-1/6HP REFRIGERATOR					230	1	60Hz	13.04	2,992.30	20A, 2P	2-3.5 SQ.MM 1-2.0 SQ.MM (G)	**20 MMØ**
12			S P A R E					230	1	60Hz	5.00	1,150.00	20A, 2P		
16															
TOTAL	48	28		8	8	5		230	1	60Hz	60.60	11,167.20	125A, 2P	2-30.0 SQ.MM 1-5.5 SQ.MM (G)	40 MMØ

USE: 125 A,2P, 240 V ITD MAIN CIRCUIT BREAKER ; 2-30 SQ. MM THW COPPER WIRE & 1-5.5 SQ. MM TW COPPER WIRE (GROUND), IN 40 MM DIA. UPVC PIPE



LEGEND:


MAIN PANEL BOARD


18W PINLIGHT


DUPLEX CONVENIENCE OUTLET

REFRIGERATOR OUTLET

WASHING MACHINE OUTLET

AIRCON OUTLET

RANGE OUTLET

S1 1-GANG SWITCH

S2 2-GANG SWITCH

S3 3-GANG SWITCH

CIRCUIT LINE


CIRCUIT BREAKER

CIRCUIT HOMERUN

ELECTRICAL METER


GROUND

SPECIFICATIONS

1) ELECTRIC SERVICE SHALL BE OVERHEAD ; 230 VOLTS ; SINGLE-PHASE, TWO-WIRE, 60 CYCLES PER SECOND.

2) MAIN DISCONNECT SWITCH SHALL BE125 AMPERE - TRIP, 2 POLE, 240V MAIN CIRCUIT BREAKER.

3) MAIN FEEDER SHALL BE OF 2-30 SQUARE MM THW COPPER WIRE, 1-5.5 SQUARE MM TW COPPER WIRE(G) IN 40 MM DIA UPVC PIPE.

4) TYPE OF WIRING SHALL BE CONCEALED ON WALLS AND CEILING FOR LIGHTING AND POWER LOADS. SWITCHES AND CONVENIENCE OUTLETS SHALL BE INSTALLED 1380 MM AND 300 MM RESPECTIVELY ABOVE FINISHED FLOOR LINE UNLESS OTHERWISE SPECIFIED. SWITCHES AND CONVENIENCE OUTLETS SHALL BE RATED 10 AND 15 AMPERES RESPECTIVELY, 250 VOLTS, FLUSH TYPE AS MANUFACTURED BY NATIONAL.

5) ALL MATERIALS AND EQUIPMENTS TO BE USED SHALL BE NEW AND APPROVED FOR THAT PURPOSE.

6) PANEL BOARD SHALL BE INSTALLED 1200 MM ABOVE FINISHED FLOOR LINE.

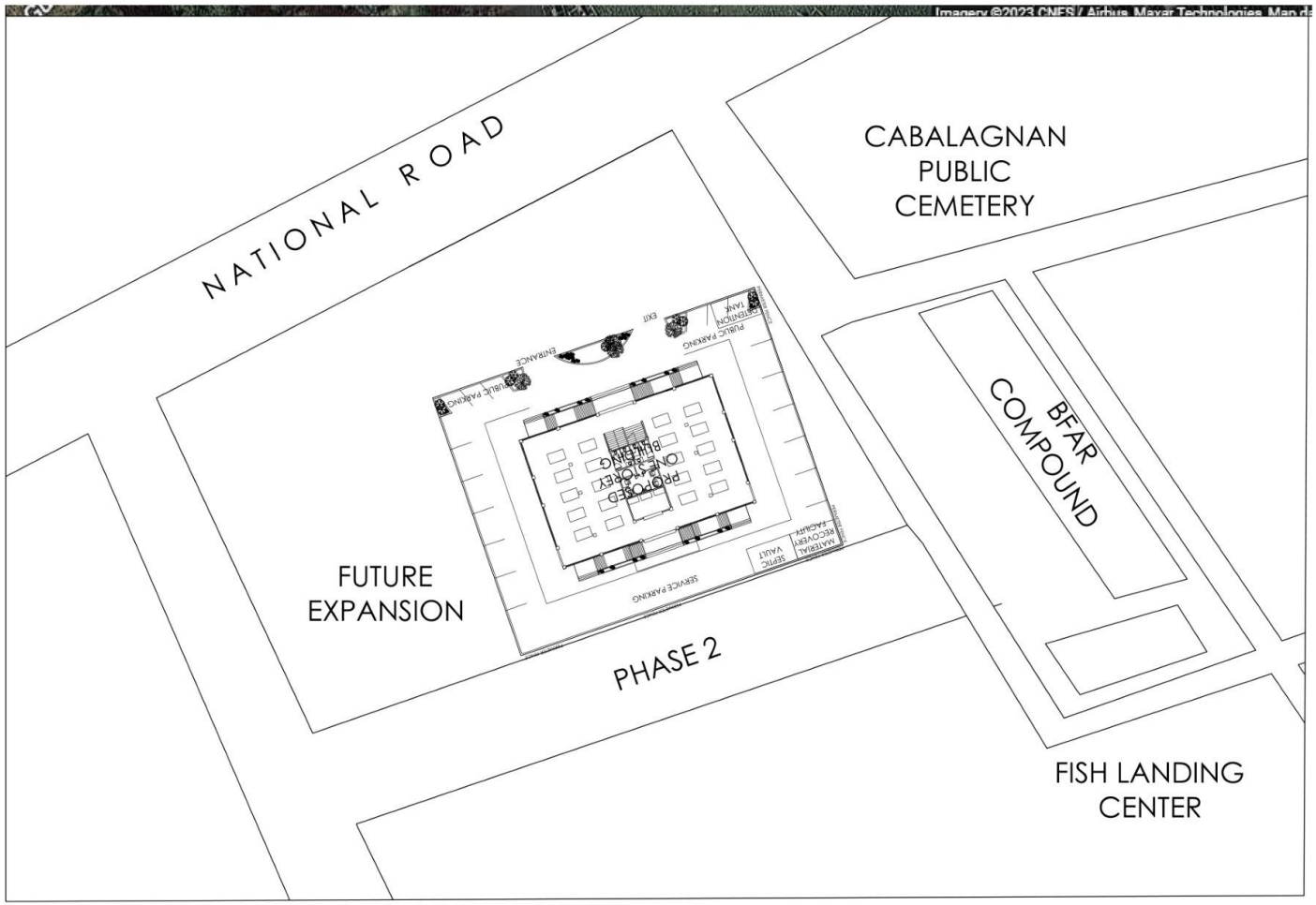
7) ALL WIRES AND CABLES TO BE USED SHALL BE STRANDED COPPER AS MANUFACTURED BY ANY APPROVED BRAND.

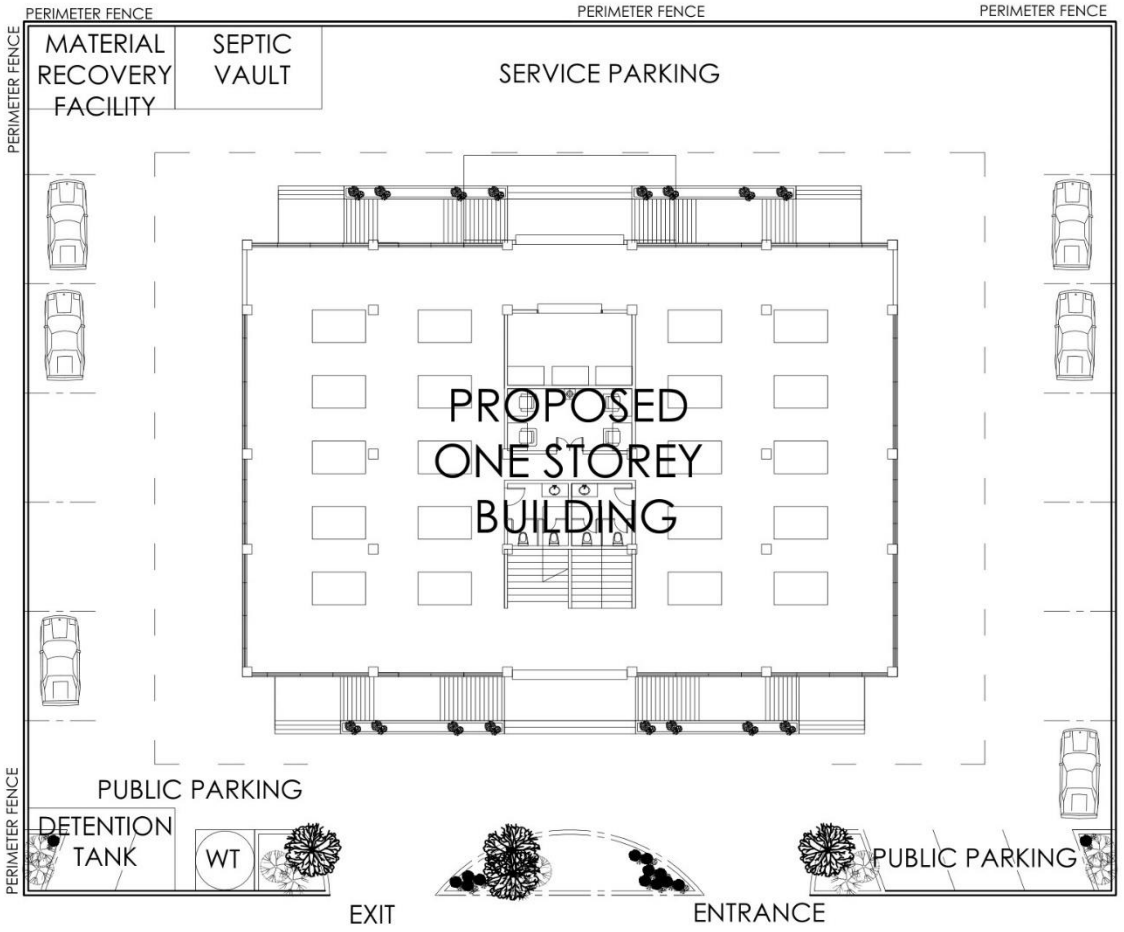
8) PROVIDE ADEQUATE AND EFFECTIVE GROUNDING SYSTEM.

9) ALL INSTALLATION WORKS HEREIN SHALL BE DONE UNDER DIRECT SUPERVISION OF A DULLY LICENSED ELECTRICAL ENGINEER OR MASTER ELECTRICIAN.

10) ALL WORKS SHALL BE DONE IN ACCORDANCE WITH THE LATEST EDITION OF THE PHILIPPINE ELECTRICAL CODE, ORDINANCES OF THE LOCAL ENFORCING AUTHORITY AND REQUIREMENTS OF LOCAL ELECTRIC UTILITY.

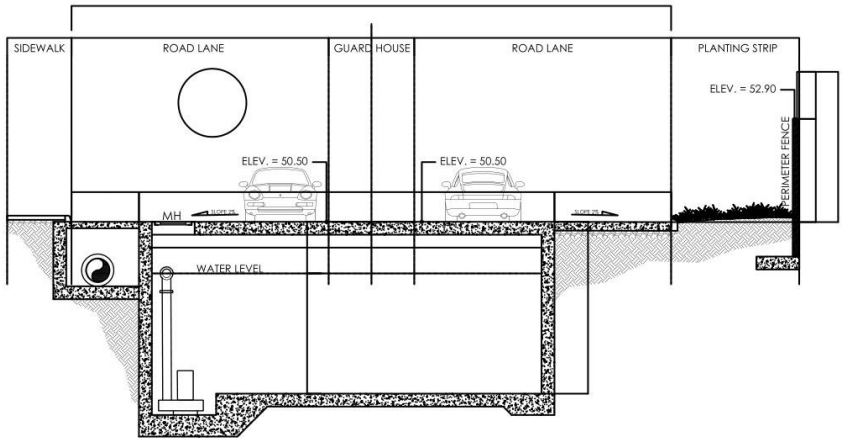
SITE DEVELOPMENT PLAN

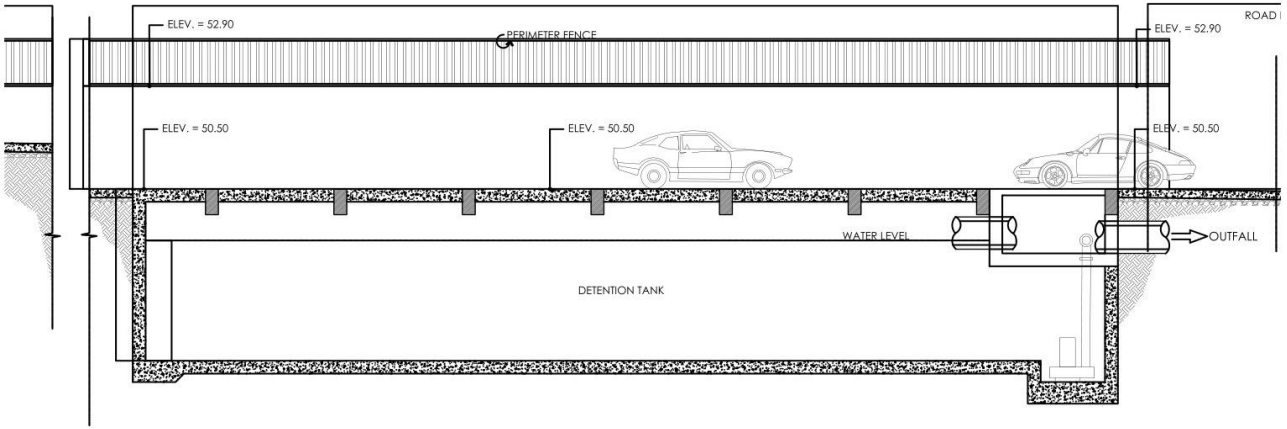

Imagery ©2023 CNES / Airbus, Maxar Technologies, Map d
NATIONAL ROAD
CABALAGNAN
PUBLIC
CEMETERY
BFAR
COMPOUND
FUTURE
EXPANSION
PHASE 2
FISH LANDING
CENTER
PROPOSED
ONE STOREY
BUILDING
PUBLIC PARKING
ENTRANCE
EXIT
SERVICE PARKING
SEPTIC
VAULT
MATERIAL
RECOVERY
FACILITY

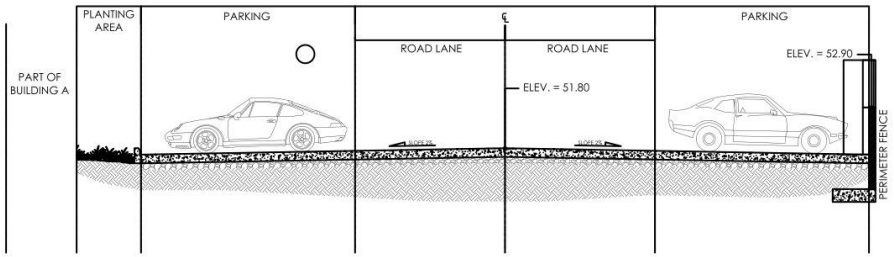


SITE DEVELOPMENT PLAN

SCALE 1:100


SIDEWALK
ROAD LANE
GUARD HOUSE
ROAD LANE
PLANTING STRIP
ELEV. = 52.90
PERIMETER FENCE
ELEV. = 50.50
ELEV. = 50.50
MH
WATER LEVEL


ELEV. = 52.90
PERIMETER FENCE
ELEV. = 52.90
ELEV. = 50.50
ELEV. = 50.50
ELEV. = 50.50
WATER LEVEL
OUTFALL
DETENTION TANK


PLANTING AREA
PARKING
ROAD LANE
ROAD LANE
PARKING
ELEV. = 52.90
ELEV. = 51.80
PART OF BUILDING A
PERIMETER FENCE

Chapter 6

Project Implementation

6.1 Implementing Scheme

Upon completion of the plans for this proposed project, it will be presented to the Municipal Planning and Development Office (MPDO) of the Municipality of Nueva Valencia wherein it would be thoroughly evaluated. After the evaluation, the MPDO will formally endorse the project for implementation to the Local Government Unit of Nueva Valencia and to the Provincial Government of Guimaras. After which, the source of funds will be determined and finalized. The Municipal Engineering Office (MEO) will then review the project which includes the plans, specifications, cost estimates, and scheduling as well as revise the plans accordingly, if necessary. These documents will be forwarded to the Mayor's Office for review and final approval prior to the project's implementation. The Bids and Awards Committee (BAC) will issue an invitation to bid and will also oversee construction bidding and awarding. The project will be awarded to the most competitive candidate who submitted the most comprehensive proposal at the lowest price.

6.2 Construction Management

During the implementation stage, the Municipal Engineering Office of Nueva Valencia will be responsible for overseeing the project's progress. The contractor will handle the construction of the project and will be required to submit timely progress reports to the Municipal Engineering Office via Statement of Work Accomplishment (SWA) after a specified time period. These progress reports ensure that the project is

well managed and follows the project schedule. To avoid project delays and other issues, the plans, specifications, and project timeline must be strictly followed.

6.3 Finance and Funding

The Local Government Unit of Nueva Valencia will fund the construction of this project with support from the Provincial Government of Guimaras. However, this is still subject to change because last March 22, 2023, Congresswoman Ma. Lucille L. Nava, MD sponsored House Bill No. 3343 entitled “An Act Establishing a Fish Port with Ice Plant and Cold Storage Facility in Barangay Cabalagnan, Municipality of Nueva Valencia, Province of Guimaras and Appropriating Funds Thereof” which shall be known as “The Cabalagnan Fish Port Act”. Therefore, it is possible that some funds may be provided by national government agencies such as the Department of Agriculture - Bureau of Fisheries and Aquatic Resources (DA-BFAR). The final estimated construction costs are dependent on several factors such as current labor costs, materials cost, project duration, etc. This will change depending on the revisions made in the final plans as presented in the project study.

6.4 Organizational Structure

The Municipal Mayor of the Municipality of Nueva Valencia shall be the governing body for this project. The Mayor’s Office shall have the highest authority, ensuring that the project is implemented effectively and efficiently. Under the Mayor’s Office are the relevant municipal offices which will serve its specific function during the implementation process. The Municipal Planning and Development Office (MPDO) shall be responsible for the evaluation of the final plans and designs as well as endorsing the proposed project for implementation. The Municipal Treasurer’s Office shall be

responsible for releasing the necessary funds needed for the implementation while the Municipal Accounting Office shall be responsible for properly recording all the financial transactions in connection to the project. The Municipal Engineering Office (MEO) will review and evaluate the final plans and designs and revise it accordingly, if necessary. Under the Municipal Engineering Office are the Contractor, which shall be required to submit progress reports to the MEO and the Inspection Team, which consists of engineers, architects and other specialists employed by the MEO to inspect and supervise the progress of the project, ensuring that the plans and specifications are being followed and the project schedule is strictly adhered to. A visual presentation of the organizational structure for project implementation is shown at Figure 42.

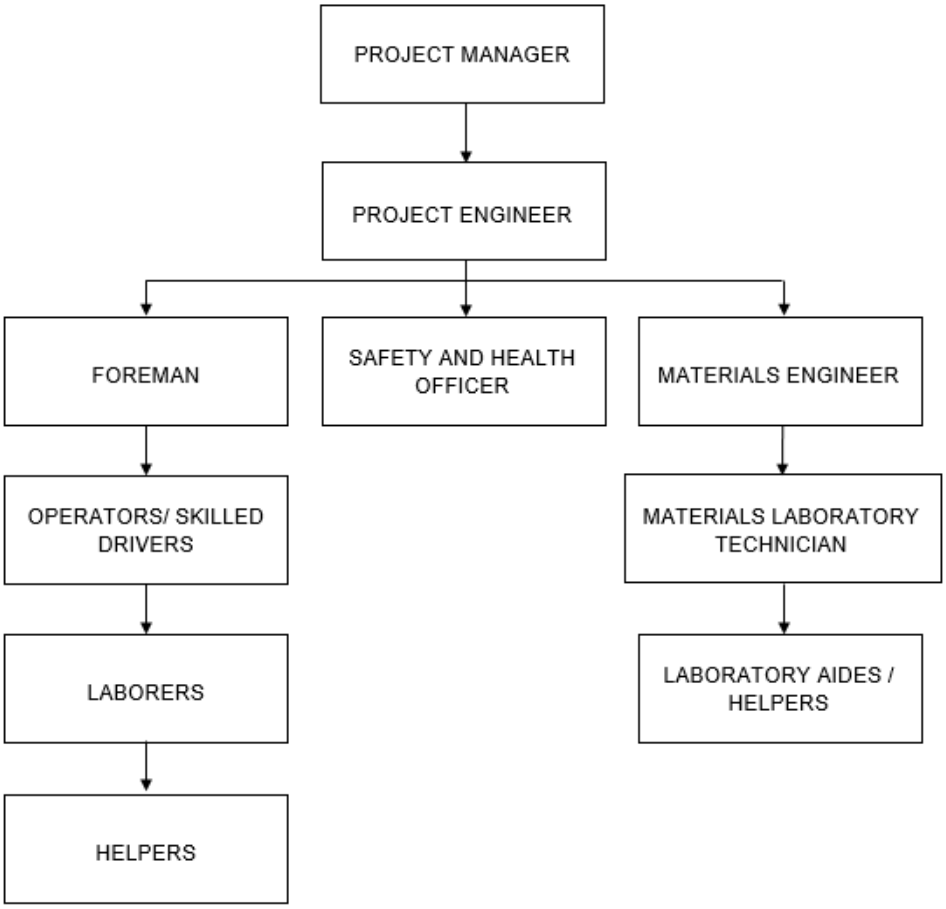


Figure 42

Organizational Structure for Project Implementation

6.5 Operation and Maintenance

The seafood market building will be operated, regulated, and maintained by the Local Government Unit of Nueva Valencia headed by the Office of the Mayor, along with its municipal offices that is relevant in the fisheries industry such as Office of the Municipal Agriculture Services (OMAS) and Municipal Environment and Natural Resources Office/Environment and Natural Resources Section (MENRO/ENRS).

Chapter 7

Summary, Conclusion, and Recommendation

7.1 Summary

The municipality of Nueva Valencia is known as the major fishing center of the province of Guimaras and the need for the development of Cabalagnan Fish Port is recognized in order to further develop the fishing industry of the municipality and the province itself. At present, the Cabalagnan Fish Port lacks the necessary facilities which include the exclusive selling area for retail fish vendors, cold storage and fixed drying area.

The proposed project is a two-storey structure located in Barangay Cabalagnan Fish Port, Nueva Valencia, Guimaras. The ground floor will be utilized as the seafood market with available stalls for seafood vendors, a cold storage, and room for offices. The second floor will be accessed via stairs and is designed to be an open roof deck and will be used as a drying area and will contain the solar panels.

The proposed seafood market will be an avenue to provide solutions for the aforementioned problems.

7.2 Conclusions

The proposed structure was designed to provide an exclusive selling area for fish vendors, a cold storage and a fixed drying area for the fish catch. It will also serve as an avenue for further development of the fisheries and aquaculture industry of the municipality of Nueva Valencia as a whole while also providing sufficient and comfortable space for every market-goers.

Additionally, the construction of this new structure may attract investors, business owners, and even tourists, all of which will boost the local economy, create more jobs and sources of income, and generally enhance the standard of living for residents of the municipality of Nueva Valencia.

Through this study, the problems identified in the first chapter are addressed by integrating the necessary solutions to the design of the proposed structure as shown in Table 15.

Table 15

Problems Identified and the Solutions Incorporated in the Design

Problem Definition	Provided Solution
Lack of exclusive selling area for fish vendors	Designed a seafood market which can accommodate 20 vendors
No cold storage	Incorporated a cold storage in the design of the proposed structure
No fixed drying area	The second floor of the building is intended to be the fixed drying area

The necessary geotechnical investigation was conducted at the Central Philippine University Soil Laboratory in order to determine the soil bearing capacity needed for the design of the footing. Investigations through interviews with the Municipal Planning and Development Office (MPDO) and Mayor's Office – Environment and Natural Resources Section (MO-ENRS) of Nueva Valencia were conducted in order to identify the problems to be addressed and the necessary amenities or facilities to be incorporated in the design of the structure. The architectural, structural, plumbing and electrical designs were presented and green building technologies such as rainwater

harvesting system and the use of solar panels are also incorporated in the design of the structure.

The proposed seafood market can accommodate a maximum of 20 seafood vendors, and also consists of an 18 m^2 cold storage and a 17.10 m^2 office space. Moreover, the second floor of the building which is 600 m^2 in floor area will serve as the fixed drying area and the area intended for the solar panels.

7.3 Recommendations

The project study provided the complete structural plans, architectural designs, cost estimates, and project schedule for the proposed seafood market. Since the market values for the construction materials changes in time, it is recommended to be implemented immediately for the cost estimates to be accurate. If actual material prices vary from the computed values in this study, necessary adjustments should be made.

The structural design has been completed with the help of a registered civil engineer and the guidance of the project advisers, subject coordinator and other faculty members of the Civil Engineering Department at Central Philippine University. To make sure the construction is reliable, resistant to damage, and long-lasting, it is advised to have it further examined against the necessary design criteria.

Since the proposed structure will be located on a reclaimed land which is currently being constructed, it is urgently recommended that the embankment in which the structure will be constructed is well compacted at every 0.5 meters to ensure the stability of the soil foundation and to validate the assumed value of the soil bearing capacity in this project study. The Municipal Government can conduct their own soil investigation to check results and achieve precise outcomes.

Materials to be used on several architectural elements like the type of fixtures, etc., which have no effect on the integrity, strength, design, and analysis of the structure can be subject to change during construction.

Because the Philippines is located in the Northern Hemisphere, the array orientation of solar panels should be orientated facing the "True South" to ensure optimal efficiency. Furthermore, the proposed structure's coordinates are 10.4166° N. Thus, in order to obtain optimal efficiency, it was calculated that the solar panels should be inclined at an angle of 8.46° from horizontal. Obstructions that can cast shadows on the solar panels should be eliminated, if possible.

Moreover, it is strongly advised that the traffic flow diagram depicted in the Site Development Plan be followed once the project has been completed in order to ensure a safe and orderly flow of traffic in the vicinity of the structure. When the proposed project is implemented, adequate traffic flow indicators and warning systems must be included.

Installation of a Material Recovery Facility (MRF) is required due to the importance of sanitary systems in a market setting. The Site Development Plan shows the proposed location of the MRF.

Lastly, security and safety devices such as CCTV cameras and a perimeter fence can be installed once the structure is completed and in full functionality.

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APPENDICES

APPENDIX A
WORK BUDGET

WORKING BUDGET

MISCELLANEOUS	BUDGET
Transportation	Php. 1,500.00
Others	Php. 1,500.00
Total	***Php. 3,000.00***

DOCUMENTATION	BUDGET
Grammarian	Php. 1,000.00
Paper Allowance	Php. 700.00
Plagiarism Scan	Php. 1,000.00
Printing	Php. 1,000.00
Book Bind	Php. 3,500.00
Total	***Php. 7,200.00***

PROFESSIONAL FEES	BUDGET
Architectural Plans	Php. 4,000.00
Plumbing Plans	Php. 2,000.00
Electrical Plans	Php. 2,000.00
Total	***Php. 8,000.00***

TOTAL BUDGET	Php.18,200.00

APPENDIX B
WORK SCHEDULE

COLLEGE OF ENGINEERING
CENTRAL PHILIPPINE UNIVERSITY
JARO, ILOILO CITY, PHILIPPINES
0063-33-3291971 TO 79 local 1084

METHODS OF RESEARCH SCHEDULE OF ACTIVITIES

PROJECT STUDY / RESEARCH PROJECT

WEEK	TASK TO ACCOMPLISH
1 August 17 - August 25, 2022	▪ CLASS ORIENTATION AND DISCUSSION
2 August 26 - 29, 2022	▪ BRAINSTORMING AND PROBLEM IDENTIFICATION
3 August 30 – September 9, 2022	▪ SEND OUT LETTERS TO MUNICIPALITIES TO GATHER INFORMATION ABOUT PRIORITY PROJECTS ▪ SELECTION OF TOP PRIORITY PROJECTS
4 September 12-18, 2022	▪ MAKING OF CONCEPT PAPERS
5 September 19-26, 2022	▪ CONCEPT PAPER REVIEWS
6-7 September 27 – October 8, 2022	▪ SUBMISSION OF FINAL CONCEPT PAPERS
8-10 October 10 – November 4, 2022	▪ CHAPTER 1 (Discussion and Submission)
11 November 5 - 11, 2022	▪ CHAPTER 2 (Discussion and Submission)
12-13 November 13 - 25, 2022	▪ CHAPTER 3 (Discussion andSubmission)
14-18 November 27 – December 23, 2022	▪ SITE VISIT ▪ REVISIONS OF CHAPTERS 1, 2, AND 3 ▪ CONSULTATION WITH ADVISER AND COURSE COORDINATOR ▪ FINALIZATION OF PROPOSAL

	DOCUMENT ▪ SUBMISSION OF FINAL CHAPTERS (1, 2, AND 3)
19-20 January 9 – 20, 2023	▪ SUBMISSION OF FINAL PROPOSAL DOCUMENT AND REQUIRED APPENDICES (WITH ENDORSEMENT FORM #1 FROM ADVISER) ▪ SUBMISSION OF PROPOSAL PRESENTATION VIDEO
21 January 23, 2023	▪ PROPOSAL PRESENTATION AND DEFENSE
22-23 January 24 – February 7, 2023	▪ EDITING OF DOCUMENT AND CONSULTATION WITH THE ADVISER AFTER THE PROPOSAL PRESENTATION ▪ SUBMISSION OF EDITED PROPOSAL PAPER (WITH ENDORSEMENT #2 FROM ADVISER)
24-26 February 8 – 24, 2023	▪ GEOTECHNICAL INVESTIGATION (SOIL SAMPLING)
27 February 25 – March 3, 2023	▪ GEOTECHNICAL INVESTIGATION (SOIL SAMPLING) ▪ CHAPTER 4 (ENTITLED PROJECT AREA)
28 March 6 – 13, 2023	▪ GEOTECHNICAL INVESTIGATION (SOIL SAMPLING) ▪ ARCHITECTURAL PLANS ▪ STRUCTURAL PLANS ▪ ELECTRICAL AND PLUMBING PLANS

29-30 March 14 – 26, 2023	▪ ARCHITECTURAL PLANS ▪ STRUCTURAL PLANS ▪ ELECTRICAL AND PLUMBING PLANS ▪ CHAPTER 5 (ENTITLED PROPOSED PROJECT)
31 April 1 – 9, 2023	▪ ARCHITECTURAL PLANS ▪ STRUCTURAL PLANS ▪ ELECTRICAL AND PLUMBING PLANS ▪ DETAILED ESTIMATES OF MATERIALS, PROJECT COST ▪ CONSTRUCTION OF PROJECT WORK SCHEDULE ▪ CHAPTER 6 (PROJECT IMPLEMENTATION) ▪ MAKING OF APPENDICES
32-33 April 10 – 21, 2023	▪ ARCHITECTURAL PLANS ▪ STRUCTURAL PLANS ▪ ELECTRICAL AND PLUMBING PLANS ▪ DETAILED ESTIMATES OF MATERIALS, PROJECT COST ▪ CONSTRUCTION OF PROJECT WORK SCHEDULE ▪ CHAPTER 6 (PROJECT IMPLEMENTATION) ▪ CHAPTER 7 (SUMMARY, CONCLUSION, AND RECOMMENDATION ▪ MAKING OF APPENDICES ▪ FINALIZATION OF CHAPTER 1 TO CHAPTER 7 ▪ PREPARATION FOR THE FINAL DEFENSE

34-36 April 24 – May 13, 2023	▪ CHAPTER 7 (SUMMARY, CONCLUSION, AND RECOMMENDATION ▪ FINALIZATION OF CHAPTER 1 TO CHAPTER 7 ▪ CONSULTATION WITH ADVISER AND COURSE COORDINATOR ▪ PLAGIARISM TEST ▪ PREPARATION FOR THE FINAL DEFENSE
37-40 May 15 – June 9, 2023	▪ SUBMISSION OF FINAL PAPER FOR FINAL DEFENSE WITH ENDORSEMENT FORM ▪ PREPARATION FOR THE FINAL DEFENSE ▪ DISTRIBUTION OF PAPERS TO THE PANELIST AND ADVISER ▪ FINAL DEFENSE ▪ REVISION OF THE FINAL PAPER ▪ SUBMISSION FOR THE FINAL DOCUMENT, AND EXECUTIVE SUMMARY ▪ FINAL EXAMINATION ▪ BOOK BINDIING ▪ TURN-OVER TO BENEFICIARY

APPENDIX C
LETTERS AND CERTIFICATIONS

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

September 02, 2022

Mayor Atty. Paul Vincent De La Cruz
Municipality of Nueva Valencia
Guimaras, Province

Dear Mayor De la Cruz,

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. Ian Paul R. Gacho, The Team's Project Leader, you may reach him through mobile phone number at: 09617597430 (Smart) or email at: ianpaul.gacho-18@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

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

Date: April 25, 2023

CERTIFICATION OF APPROVED ARCHITECTURAL DESIGN

This is to certify that **ZURINIE G. ZALDIVAR**, Municipal Planning and Development Coordinator and Head of Municipal Planning and Development Office (MPDO) of the Local Government Unit of Nueva Valencia, Province of Guimaras had approved the proposed architectural design of the project study entitled:

PROPOSED DESIGN OF A SEAFOOD MARKET AT BARANGAY CABALAGNAN FISH PORT, NUEVA VALENCIA, GUIMARAS

as presented by the following researchers:

Arcenio, Keyzel G.
Avelino, Carl Vincent B.
Fantilanan, Mary Beth G.
Gacho, Ian Paul R.
Magnate, Darwin F.

ZURINIE G. ZALDIVAR
Municipal Planning and Development Coordinator

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

RECEIVED
RECORDS SECTION
2-13-2023
TIME: 4:04 PM
BY:
MUNICIPAL MAYOR
MUNICIPALITY OF NUEVA VALENCIA

Date: February 13, 2023

Hon. Atty. Paul Vincent G. De la Cruz
Mayor, Municipality of Nueva Valencia
Nueva Valencia, Guimaras

Dear Hon. Atty. Paul Vincent G. De la Cruz:

Warm Greetings!

The 4th year students at CPU College of Engineering, Department of Civil Engineering are now in the implementation stage of the project study course CE 4231 (Civil Engineering Project II). It is in this stage and course that our approved project study methodologies are carried out to achieve the project study objectives. For the information concerning the proposal stage in the course CE 4131 (Civil Engineering Project I), the letter received by your good office is attached for your reference.

Our approved project study title is "Proposed Design of a Seafood Market at Barangay Cabalagnan Fish Port, Nueva Valencia, Guimaras". The following are the team members involved in this project study:

Arcenio, Keyzel G.
Avelino, Carl Vincent
Fantilanan, Mary Beth G.
Gacho, Ian Paul R.
Magnate, Darwin F.

In our study, we are to conduct a geotechnical investigation to identify the profile and properties of the soil within our project site located at Barangay Cabalagnan Fish Port. This will be done through an open pit test method. The obtained soil samples will be tested in accordance with the minimum testing requirements and the geotechnical report will be attached to the final manuscript of this project study.

On this regard, we would like to request permission from your good office to allow us to gather a soil sample on the project site at Barangay Cabalagnan on February 15, 2023. Moreover, it is highly appreciated if any representative from your good office will accompany us during the conduct of our stated activities.

We are hoping for your kind consideration. Please feel free to contact any of the undersigned if you have any questions or clarifications. Thank you very much.

Yours truly,

KEYZEL G. ARCENIO
keyzel.arcenio-18@cpu.edu.ph
09760564130.

CARL VINCENT AVELINO
carlvincent.avelino-18@cpu.edu.ph
09073964599.

MARY BETH G. FANTILANAN
marybeth.fantilanan-18@cpu.edu.ph
09567868571

IAN PAUL R. GACHO
ianpaul.gacho-18@cpu.edu.ph
09617597430

DARWIN F. MAGNATE
darwin.magnate-18@cpu.edu.ph
09300487698

Noted by:

ENGR. SHEVANEE RUTH G. DELA CRUZ
Project Study Coordinator

ENGR. SHEVANEE RUTH G. DELA CRUZ
Project Study Adviser

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

CERTIFICATION

This is to certify that the Project Study entitled **PROPOSED DESIGN OF A SEAFOOD MARKET AT BARANGAY CABALAGNAN FISH PORT, NUEVA VALENCIA, GUIMARAS** by **Keyzel G. Arcenio, Carl Vincent B. Avelino, Mary Beth G. Fantilanan, Ian Paul R. Gacho, and Darwin F. Magnate** was checked for grammar and other mechanics of writing.

Issued this 19th of July 2023.

XYLENE ANN B. TEÑOSO, LPT
Faculty Member

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

May 12, 2023

CERTIFICATION

This is to certify that the project study entitled **"PROPOSED DESIGN OF A SEAFOOD MARKET AT BARANGAY CABALAGNAN FISH PORT, NUEVA VALENCIA, GUIMARAS"** by **Keyzel G. Arcenio, Carl Vincent B. Avelino, Mary Beth G. Fantilanan, Ian Paul R. Gacho, Darwin F. Magnate,** have undergone Turnitin Similarity Checking with a passing percentage of **10%** 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

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

Date: April 25, 2023

Municipal Planning and Development Office
Municipality of Nueva Valencia
Province of Guimaras

To whom it may concern:

Warm Greetings!

The 5th year students at CPU College of Engineering, Department of Civil Engineering are now in the implementation stage of the project study course CE 4231 (Civil Engineering Project II). It is in this stage and course that our approved project study methodologies are carried out to achieve the project study objectives.

Our approved project study title is **"Proposed Design of a Seafood Market at Barangay Cabalagnan Fish Port, Nueva Valencia, Guimaras"**. The following are the team members involved in this project study:

Arcenio, Keyzel G.
Avelino, Carl Vincent
Fantilanan, Mary Beth G.
Gacho, Ian Paul R.
Magnate, Darwin F.

On this regard, we would like to ask your good office for a copy of the following documents, if available:

1. Soil Categories Map of Nueva Valencia
2. Slope Distribution/Topographic Map of Nueva Valencia

The document requested will be used as a part of our project study. We will give full credit to your office in its inclusion. Please feel free to contact any of the team members if you have any questions or clarifications. Thank you very much.

Yours truly,

KEYZEL G. ARCENIO
keyzel.arcenio-18@cpu.edu.ph

IAN PAUL R. GACHO
ianpaul.gacho-18@cpu.edu.ph

CARL VINCENT AVELINO
carlvincent.avelino-18@cpu.edu.ph

DARWIN F. MAGNATE
darwin.magnate-18@cpu.edu.ph

MARY BETH G. FANTILANAN
marybeth.fantilanan-18@cpu.edu.ph

APPENDIX D

Summary of Fish Catch and Shell/Mollusks Gathering Season in the Municipality of Nueva Valencia *(Coastal Environmental Profile - Nueva Valencia)*

Dominant Fish	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Samaral												
Ngisi-Ngisi												
Indangan												
Kanturayan												
Gurayan												
Salmonete												
Gusaw												
Sulig												
Lagaw												
Tambilawan												
Putian												
Pak-An												
Bukaw-Bukaw												
Salungasig												
Aloy												
Bulaw												
Tangigue												
Inid												
Ubod												
Nipa-Nipa												
Gingaw												
Tabagak												
Alimusan												
Tulingan												
Bansa												
Rari												
Malasugi												
Mangagat												
Abo												
Pagi												
Moymoy												
Ibis												
Barongoy												
Kilawan												
Ampahan												
Bulao												
Gumaa												
Bais												
Sapsap												
Batikuling												
Lison												
Barira												
Dangit												
Balanak												
Liwit												
Balantyong												
Marot												
Bolinaw												
Shell/Mollusk												
Kasag												
Alimango												
Pasayan												
Lukon												
Lukos												
Pugita												

Imbao												
Banagan												
Litob												
Bakalan												
Damisol												
Sikad2												
Sisi												
Manlot												
Baka2												
Dawat												
Bug-Tan												
Sobra2												

Legend:

- Peak
- Moderate
- Peak
- &Spawning
- Low
- Spawning

APPENDIX E
PROOF OF LOT OWNERSHIP
(TAX DECLARATION)

Republic of the Philippines
MUNICIPALITY OF NUEVA VALENCIA
PROVINCE OF GUIMARAS

TAX DECLARATION OF REAL PROPERTY

TD No. : 99-0876 (03002) **Property Identification No. :** 075-03-002-07-011

Owner: **MUNICIPAL GOVERNMENT OF NUEVA VALENCIA** TIN:

Address: **POBLACION, NUEVA VALENCIA, GUIMARAS** Telephone No. :

Administrator/Beneficial User: TIN:

Address: Telephone No. :

Location of Property: (Number and Street) **CABALAGNAN** (Barangay/District) **NUEVA VALENCIA, GUIMARAS** (Municipality & Province/City)

OCT/TCT/CLOA No. : Survey No. : **CAD 1256-D**

CCT : Lot No. : **9490**

Date : Blk. No.

Boundaries: North: -
East: -
South: -
West: -

KIND OF PROPERTY ASSESSED :

[X] LAND

[ ] BUILDING No. of Storeys : Brief Description :

[ ] MACHINERY Brief Description :

[ ] OTHERS Brief Description :

Classification	Area	Market Value	Actual Use	Assessment Level	Assessed Value
RES	2,903.00 SQM	870,900.00	RES	20 %	174,180.00
Subtotal :	2,903.00 SQM	870,900.00			174,180.00

Total Market Value : **P 870,900.00** Total Assessed Value : **P 174,180.00**

Total Assessed Value: ONE HUNDRED SEVENTY FOUR THOUSAND ONE HUNDRED EIGHTY AND 00/100

Taxable [ ] Exempt [X]

Effectivity of Assessment : **2016**

Approved By:

JOSE MELQUIAS D. GAJE, REA — PROVINCIAL ASSESSOR

09/09/2016 — Date

This declaration cancels TD No. :

Previous PIN : **075-03-002-07-011**

Previous Owner : **MUNICIPAL GOVERNMENT OF NUEVA VALENCIA**

Previous Administrator :

Previous Area (sqm) : **0.00** Previous M.V. Php : **0.00** Previous A.V. Php : **0.00**

MEMORANDA: Issued pursuant to Section 204 of R. A. 7160 and in view of Lot Plan prepared by G. P. Artieda Surveying Office.

Note: This declaration is for real property taxation purposes only and the valuation indicated herein are based on the schedule of unit market values prepared for the purpose and duly enacted into an ordinance by the SANGGUNIANG PANLALAWIGAN under Ordinance No. RES. NO. 142 dated 2002-10-30. It does not and cannot by itself alone confer any ownership or legal title to the property.

GENERATED BY : ETRACS v2.5 PRINTED BY : AMANDO CLARIN PRINT DATE : 2023-04-25 07:32:43

APPENDIX F
GEOTECHNICAL REPORT

GEOTECHNICAL REPORT

On the Soil Tests Performed

In Partial Fulfillment of the Project Study Entitled

Proposed Design of a Seafood Market at

Barangay Cabalagnan Fish Port, Nueva Valencia, Guimaras

For the Course

CE 4231 Civil Engineering Project II

By

Arcenio, Keyzel G.

Avelino, Carl Vincent B.

Fantilanan, Mary Beth G.

Gacho, Ian Paul R.

Magnate, Darwin F.

May 2023

Introduction

This report on geotechnical aspects has been prepared for the purpose of investigating the soil-bearing capacity necessary for the proposed Seafood Market project. It thoroughly explains the methods that were employed to obtain the required information for the foundation plan of the project study.

The chosen soil sampling technique for subsurface exploration is the open test pit method, which is a feasible and cost-effective option for shallow depth site investigations. This process involves excavating a pit on the site from which soil samples can be collected at different depths. With the open pit method, it is possible to examine natural soil layers and obtain both disturbed and undisturbed samples conveniently.

On February 19, 2023 the researchers conducted a soil sampling process in favorable weather conditions. An excavator working on the flood mitigation project on the project site assisted the researchers in digging for the open test pit method. The proponents had already predetermined one borehole location in the project area. The soil samples were collected by excavation through the borehole at (five inches) 5’ from the ground level. As soon as water was observed on the excavated surface, the soil sampling process came to a stop. A soil sample from the current embankment for the flood mitigation project was also obtained to be tested to determine its properties. The embankment for the proposed project will be assumed to have the same soil type as the current embankment for the ongoing flood mitigation project. The soil samples were then conveyed to the soil laboratory in their natural state.

Last February 22-23, 2023, soil samples were subjected to testing in order to acquire their properties for the purpose of design.

The sample soils underwent tests for moisture content, sieve analysis, unit weight and specific gravity. The natural soil was not tested for the atterberg’s limit and

unconfined compression test since the soil is categorized as a “poorly graded sand”. The embankment for the proposed seafood market is assumed to be well-compacted at every 0.5 meter depth of soil and the soil bearing capacity is obtained as 75 kPa from the table 304-1 from the NSCP 2015 as shown in Figure 43.

Figure 43

Allowable Foundation and Lateral Pressure

Table 304-1 Allowable Foundation and Lateral Pressure

Class of Materials[1]	Allowable Foundation Pressure[2] (kPa)	Lateral Bearing Below Natural Grade[3] (kPa/m of depth)	Lateral Sliding[4]	
			Coefficient[5]	Resistance[6] (kPa)
1. “Intact” Tuffaceous Sandstone [a]	1,000	300	-	-
2. “Lightly Weathered” Tuffaceous Sandstone [b]	500	150	-	-
3. Sandy Gravel and /or Gravel(GW & GP)	100	30	0.35	-
4. Well-graded Sand, Poorly-graded Sand, Silty Sand, Clayey Sand, Silty Gravel and Clayey Gravel (SW, SP, SM, SC, GM and GC)	75	25	0.25	-
5. Clay, Sandy Clay, Silty Clay and Clayey Silt (CL, ML, MH, and CH)	50 [c]	15	-	7

[1] *A geotechnical site investigation is recommended for soil classification (Refer to Section 303).*

[2] *All values of allowable foundation pressure are for footings having a minimum width of 300mm and a minimum depth of 300mm into the natural grade. Except as noted in Footnote 'a', an increase of 20% is allowed for each additional 300mm of width and/or depth to a maximum value of three times the designated value. An increase of one-third is permitted when using the alternate load combinations in Section 203.4 that include wind or earthquake loads.*

Laboratory Tests Performed

Various laboratory tests were conducted on the soil samples obtained through the open test pit technique.

Moisture Content

Moisture content refers to the proportion of water present as compared to the solid mass of particles in a given soil sample, expressed as a percentage. This technique entails determining the quantity of water present in soil by weight through laboratory processes.

Grain Size Analysis Test

The purpose of performing a grain size analysis test is to calculate the proportion of each grain size that is present within a soil sample. The outcome of the test can then be utilized to plot the grain size distribution curve, which serves as a classification system for the soil and predicts its behavior.

Specific Gravity Test

Specific gravity of soil solids is characterized as the weight of soil solids to the weight of an equal volume of water. This tells how much heavier or lighter the substance is in comparison to water.

Unit Weight Determination

The product of density and gravity acceleration leads to the calculation of unit weight. In academic terms, unit weight refers to the gravitational force that arises from the material mass present in a unit volume, and it is measured in Newtons per cubic meter using the SI system of measurement.

Laboratory Test Results

Water Content Determination

$$Water\ Content, \% = \frac{W_2 - W_3}{W_3 - W_1}\ x\ 100$$

	EMBANKMENT			NATURAL SOIL		
	Trial 1	Trial 2	Trial 3	Trial 1	Trial 2	Trial 3
Wt. of can (g), W_1	46.5	46.3	48.5	12.4	9.7	10
Wt. of can+soil (g), W_2	396.8	337.2	445.5	150.1	162.3	147
Oven dry weight of can+soil (g), W_3	355.2	332.6	397.9	123.4	130.5	120.3
Water Content, %	13.48	15.58	13.62	24.05	26.32	24.21
Average water content, %		14.227			24.86	

Specific Gravity

$$Specific\ Gravity\ (S.G.) = \frac{m_4}{(m_2 - m_1) - (m_3 - m_4 - m_1)}$$

	EMBANKMENT	NATURAL SOIL
Weight of pychnometer (grams), m_1	49.8	90.2
Weight of pychno + water (grams), m_2	148.8	337.1
Weight of pychno + water +soil (grams), m_3	162.9	397
Weight of soil (g), m_4	25	100
Specific Gravity (S.G.)	**2.29**	**2.49**

Unit Weight

	EMBANKMENT	NATURAL SOIL
Weight of Plastic	0.4	0.3
Weight of soil with plastic	32.7	53
Volume of water	90	100
Volume of water with soil	110	137

	EMBANKMENT	NATURAL SOIL
Mass of Soil	32.3	52.7
Volume of Soil	20	37
Bulk Density of Soil	1.62	1.42
Unit Weight of Soil	15.89	13.93
Dry Density of Soil	1.297	1.243

Sieve Analysis

Embankment

Sieve Size	Diameter (mm)	Weight Retained (g)	Percent Passing (%)	Percent Retained (%)	Cummulative % Retained	Remarks
No. 4	4.75	128.4	12.929	87.071	12.929	Gravel
No. 10	2.36	124.1	12.496	74.575	25.425	Sand
No. 20	0.85	184.4	18.568	56.006	43.994	Sand
No. 40	0.3	201.9	20.330	35.676	64.324	Sand
No. 100	0.15	142.7	14.369	21.307	78.693	Sand
No. 200	0.075	148.7	14.973	6.334	93.666	Sand
Pan	0	62.9	6.334	0.000	100.000	Silt
	Total M=	993.1	100.00			

Results

% Coarse Grained Soil (Gravel + Sand) : 93.67%

% Fine Grained Soil : 06.33%

Coarse Fraction : 93.67%

% Gravel (retained at Sieve No. 4) : 12.93%

% Sand (Passing Sieve No. 4 – No. 200) : 80.74%

% Fine (Passing Sieve No. 200) : 06.33%

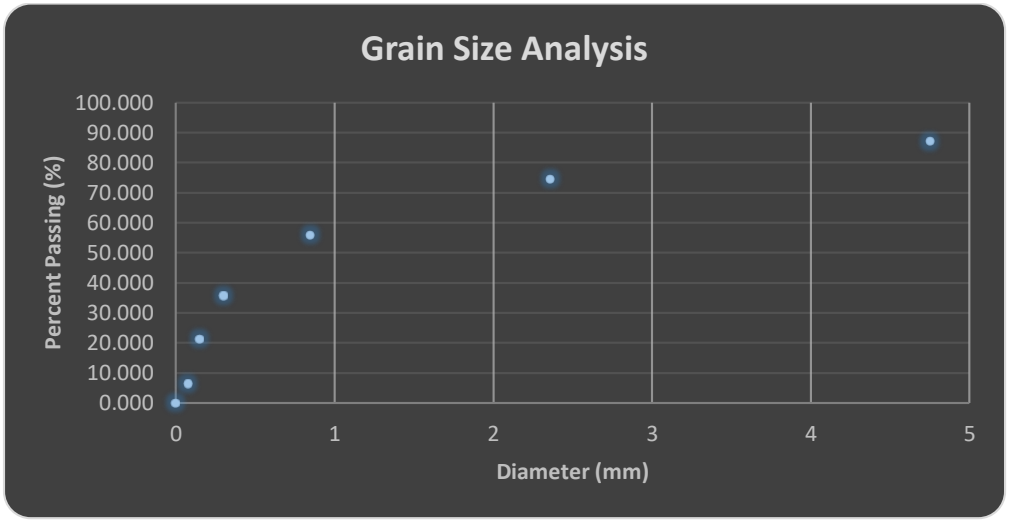
Coefficient of Cc = 0.528

Coefficient of Cu = 12.58

$D_{60} = 1.1748\ mm$

$D_{30} = 0.2407\ mm$

$D_{10} = 0.093364\ mm$



Natural Soil

Sieve Size	Diameter (mm)	Weight Retained (g)	Percent Retained (%)	Percent Passing (%)	Cummulative % Retained	Remarks
No. 4	4.75	93.8	9.459	90.541	9.459	Gravel
No. 10	2.36	147.2	14.843	75.698	24.302	Sand
No. 20	0.85	296.9	29.938	45.760	54.240	Sand
No. 40	0.3	301.6	30.412	15.347	84.653	Sand
No. 100	0.15	94.8	9.559	5.788	94.212	Sand
No. 200	0.075	32.8	3.307	2.481	97.519	Sand
Pan	0	24.6	2.481	0.000	100.000	Silt
	Total M:	**991.7**	100.000			

Results

% Coarse Grained Soil (Gravel + Sand) : 97.519%

% Fine Grained Soil : 02.481%

Coarse Fraction : 97.519%

% Gravel (retained at Sieve No. 4) : 9.445%

% Sand (Passing Sieve No. 4 – No. 200) : 88.06%

% Fine (Passing Sieve No. 200) : 2.481%

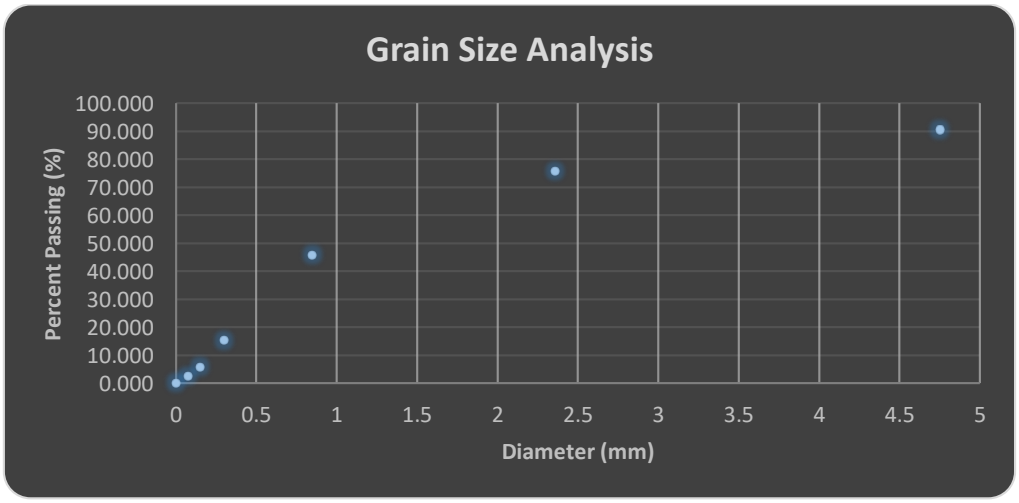
Coefficient of Cc = 0.942

Coefficient of Cu = 7.257

$D_{60} = 1.568\ mm$

$D_{30} = 0.565\ mm$

$D_{10} = 0.216\ mm$



Laboratory Test Results Summary

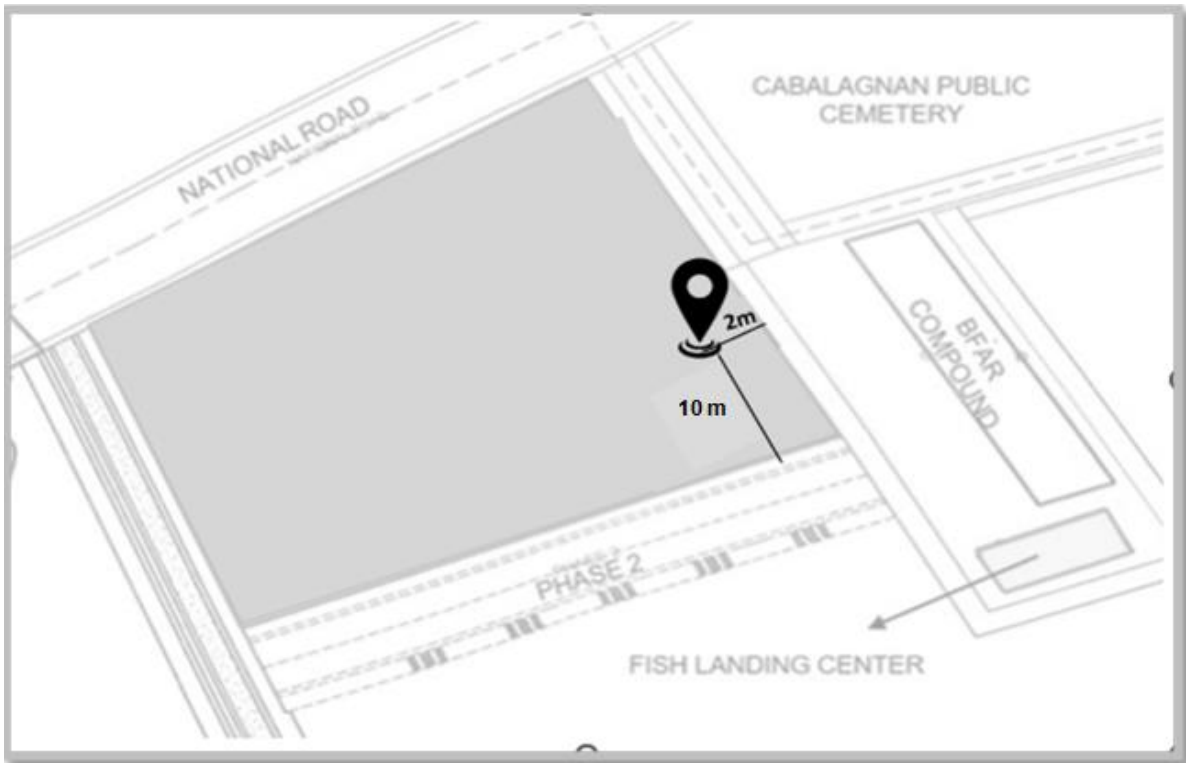
Test Performed	Embankment	Natural Soil
Water Content Determination	24.86	14.22
Specific gravity Test	2.29	2.49
Unit weight Test	15.89	13.93
Density	1.62	1.42
Soil Classification	SP	SP

Evaluation of Results and Recommendations

The results of the geotechnical investigation, together with the project site conditions implies the use of a shallow foundation with footing tie beam for the structure considering that the embankment where the foundation will be placed is well compacted layer by layer at every 5 meters. The natural soil has a high moisture content due to the seawater in the project location making it unsuitable to support the foundation of the structure.

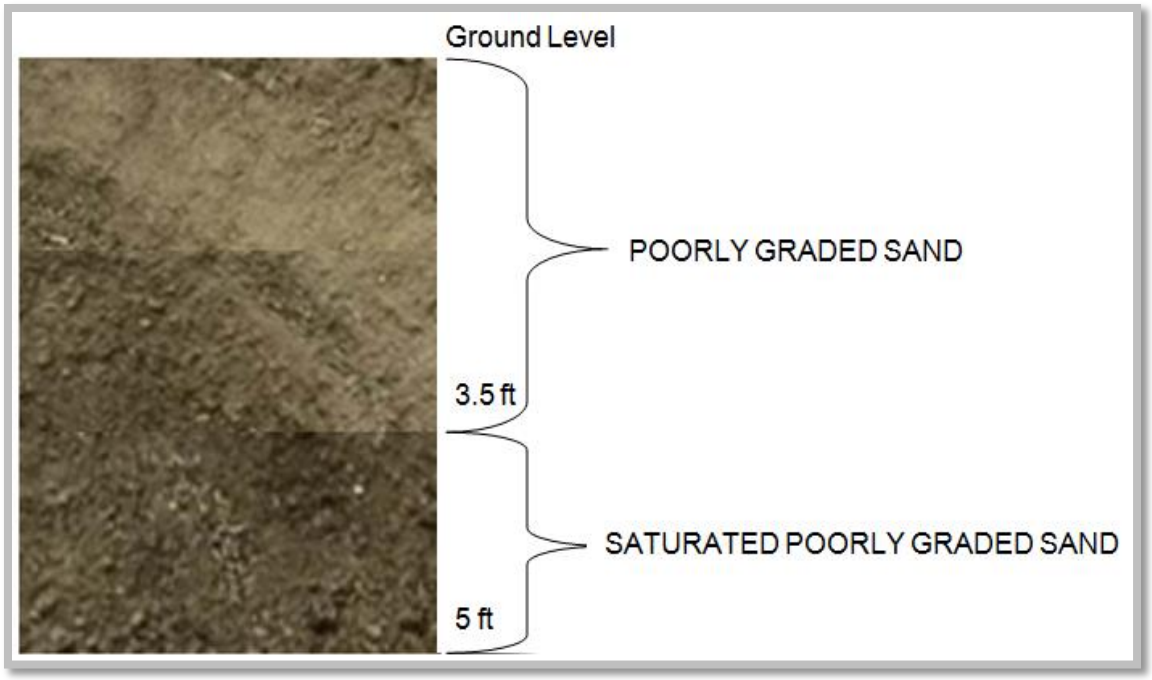
Both the natural soil sample and the existing embankment for the ongoing flood mitigation project also located at the project site are classified as “poorly graded sand”. The Soil bearing capacity of the embankment that is used in the design is identified to be 75 kPa from the NSCP 2015 provisions as shown in figure 43 above. The embankment for the structure is assumed to have the same properties with the existing embankment for the flood mitigation project.

DOCUMENTATION



Borehole Location

Open Test Pit Method



Soil Profile

Sieve Analysis

APPENDIX G
SAMPLE COMPUTATIONS

LATERAL FORCE ANALYSIS

SEISMIC ANALYSIS

Design Base on Shear Computations

Seismic Zone	4	Z= 0.4	fig.208-1, NSCP
Seismic Source Type	A	Large magnitude events	table208-6, NSCP
Distance from near active fault	37 km	scaled measurement	fig.208-2, NSCP
Soil profile type	unknown	Use (SD) stiff soil profole	table208-2, NSCP
Structural system	SMRF	special moment resisting frame	table208-11, NSCP
Lateral force resisting (member)	1 KN	MRF-CONCRETE-SMRF	table208-1, NSCP
Occupancy type	III m.	special occupancy structures	table208-1, NSCP
Total seismic dead load, W	3,746.84 KN		
Total building height, h_n	7.9		

Seismic Data Based on Above Information

R	8.50	table208-11, NSCP
Near source factor, Na	1.00	table208-4, NSCP
X	0.44	table208-7, NSCP
Ca = Xna	0.44	
N_V	1.00	table208-5, NSCP
Y	0.64	table208-8, NSCP
C_V=YN_V	0.64	
Importance factor, I	1.00	table208-1, NSCP
C_t	0.0731	sec.208.5.2.2, NSCP

Calculation and Discussions

Determine the structure period T using method A:

$T = C_t (h_n)^{3/4}$ 0.344459126 EQN. 208-8, NSCP

Determine W = DL + 25% LL slab (Total structural load) EQN. 208.5.1, NSCP

Gross Weight of Structure:

		DEAD LOAD	LIVE LOAD
2nd. Level to roofing			
Roofing	=	3.63	21.78 KN
Column/Beam	=	64.13	
Floor Finishings, ceiling, ect.	=		
		67.76	21.78
Ground level to second level			
Column/Beaam	=	698.84 KN	1,440.00
Wall	=	168.00	
Slab	=	2,160.00	-
Stairs	=	-	
Floor Finishings, ceiling, ect.	=	720.00	
		3,746.84	1,440.00

Weight total:	W @2nd	**73.20 KN**
	W @grnd	**4,106.84 KN**
	W total	**4,180.04 KN**

Determine the base shear:

Total design base shear in a given direction:

$V = (C_V I/RT) W$ = 819.01 KN EQN. 208-4, NSCP

But not exceed the following:

$V = (2.5CaI/R) W$ = 484.89 KN EQN. 208-5, NSCP

But not less than the following:

$V = 0.11CaIW$ = 181.35 KN EQN. 208-6, NSCP

$V = (0.8ZN_V I/R) W$ = 141.06 KN EQN. 208-7, NSCP

Therefore the governing design base shears:

V = 819.01 KN

Lateral force computation for every layer:

Since T= 0.0731 <0.07, Ft=0

V= 819.01 KN total design base shear Compare to wind force

WIND ANALYSIS (Projected Method)

$P = q_h G C_p$ (For Wall Area) $P = q_h G C_p$ (For roof projections)

= 1.55 Kpa (acting to walls) 0.97 Kpa (acting to roof)

Fw = P A acting on walls Fw = P A acting on roof

= 227.85 KN = 32.01 KN

WIND FORCE F = Fw + Fr

= 259.86 KN < 819.01 KN

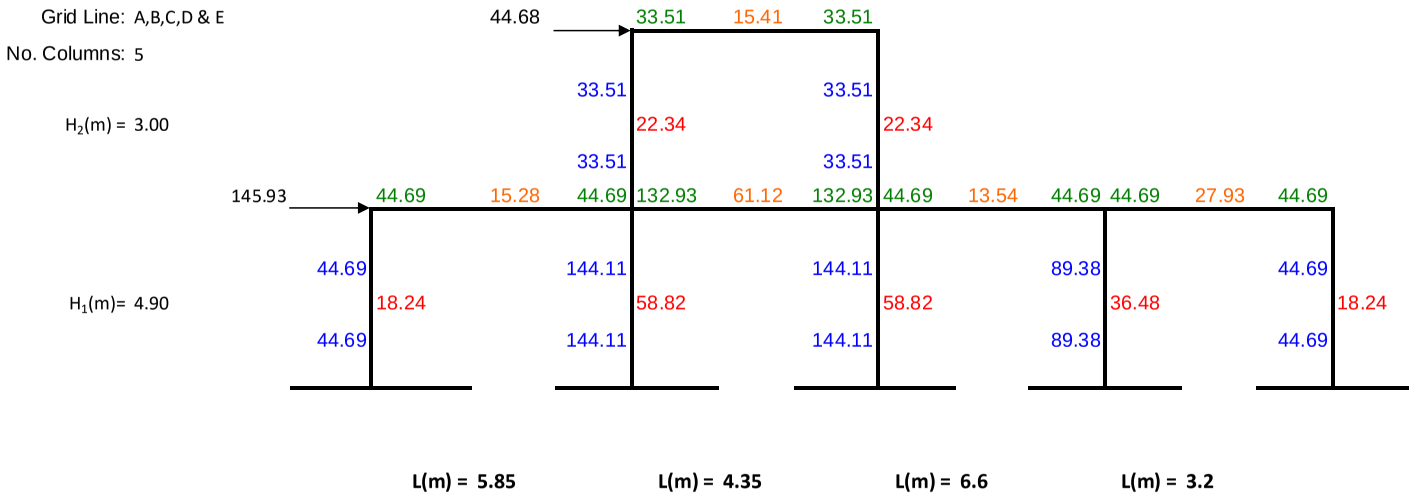
CONTROLING PRESSURE: SEISMIC FORCE CONTROLS !

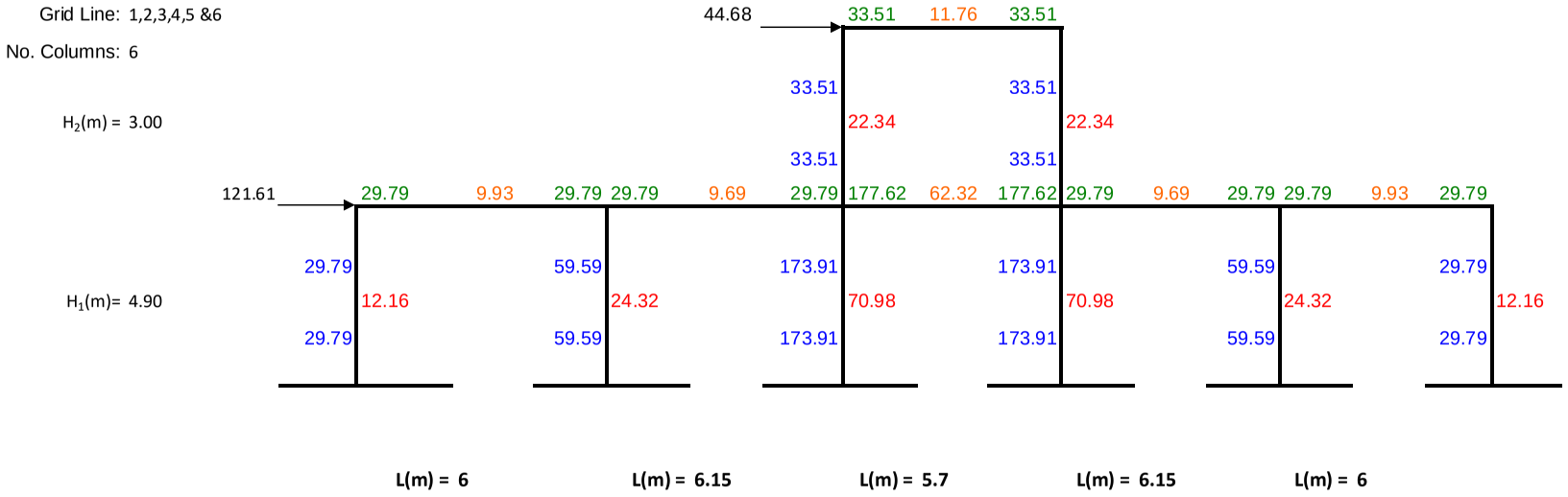
Formula: Fx=(HxWx/HxWxsum)(V-Ft)

	Hx	Wx	HxWx	V-Ft	Fx	
2nd	7.4	168.00	1243.2	819.01	89.35267326	KN
Ground	4.7	2,160.00	10152	819.01	729.6559998	KN
		2,328.00	11395.2			

Solve Frame Analysis by Portal Method

FRAME ANALYSIS





LOADING ANALYSIS (ROOF BEAM)

DESIGN PARAMETER

FOR CONCENTRATED LOAD OF RAFTER

Assume unfactored load

10.74 sq.m	tributary area	(RAFTER)	
LIVE LOAD		0.6	KPa
DEAD LOADS:			
PREPAINTED ROOFING SHEET		0.04	KPa
CEILINGS		0.24	KPa
STEEL MATERIALS		98.33	KG
OTHER DEAD LOADS		0.00	KPa
TOTAL SERVICE LOAD		99.21	KPa
	Dead load	3.97	KN
	Live load	6.441	KN
	total	10.41	KN
	Pu =	15.07	

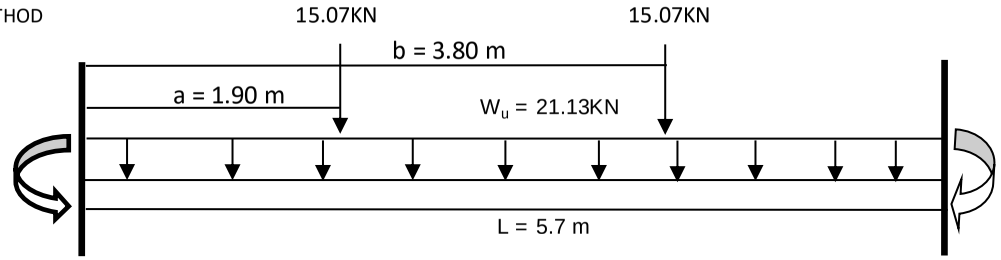
FOR UNIFORM LOAD:

LENGTH	5.70	M
DEAD LOADS:		
BEAM WEIGHT	12.51	KN/M
OTHER DEAD LOADS		KN/M
TOTAL UNIFORM LOAD	12.51	KN/M

Using Working Analysis Method

W due to LL & DL	Me	W due to Earthquake	W due to wt. Beam	Wt = W_1 + W_2/1.4 + W_3
m	KN-m	$M=WL^2/10$	10%(DL+LL)	KN/m
12.51	33.51	10.31	1.25	21.13
-	-			

FIXED-END MOMENT METHOD



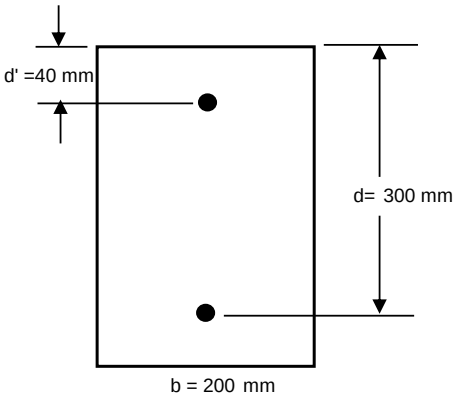
$$M = \frac{WL^2}{12} + \frac{Pab^2}{L^2} + \frac{Pba^2}{L^2} = \mathbf{52.95}\ \mathbf{KN\text{-}m}$$

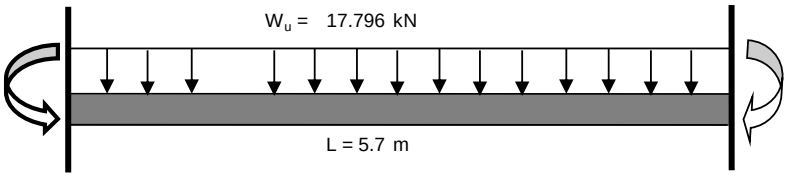
Shear	75.28	75.28
+ M_m	63.70	

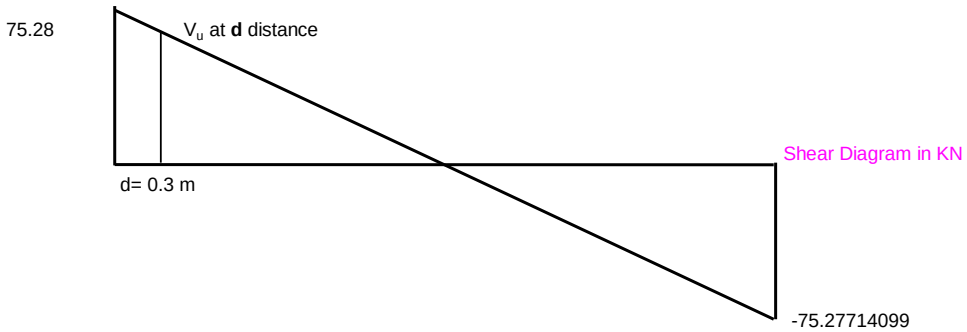
LOAD	END 1		MIDSPAN	END 2	
	V	M	M	V	M
1.2 DL + 1.6 LL	75.28	-52.95	63.70	75.28	-52.95

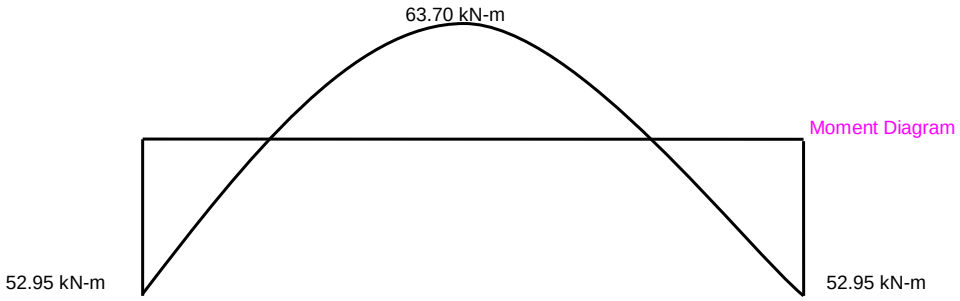
Given:

Wu =	17.80	kN
fc' =	28	MPa
fy =	420	MPa
ϕ =	0.9	
β_1 =	0.85	
Es =	200000	MPa
d =	300	mm
b =	200	mm
d' =	40	mm
L =	5.70	m
cover :	40	mm
using	10	mm ϕ stirrups









AT END 1 :

$$Mn = \frac{Mu}{\phi} = \frac{52.95}{0.9} = \mathbf{58.833333}\ \text{kN-m}$$

Assuming single reinforcement

$$\rho_{max} = \frac{(0.75)(0.85)\beta_1 fc'}{fy} \times \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(0.85)(28)}{420} \times \frac{600}{600 + 420}$$

$$= \mathbf{0.02125}$$

$$As = \rho_{max} b d$$

$$= (0.02125)(200)(300)$$

$$= 1275\ mm^2$$

$$Mu = \rho fy \phi b d^2 \left[1 - \frac{1}{1.7} \times \frac{\rho fy}{fc'}\right]$$

$$= (0.0213)(420)(0.9)(200)(300)^2 \left[1 - \frac{1}{1.7} \times \frac{(0.02125)(420)}{28}\right]$$

$$= \mathbf{117475312.5}\ \text{MN-mm}$$

$$Mu = \mathbf{117.4753125}\ \text{kN-m}$$

$$Mn = \frac{Mu}{\phi} = \frac{117.4753125}{0.9} = \mathbf{130.52813}\ \text{kN-m}$$

130.528125 > 58.83333333

Therefore, **it's a single reinforcement only!**

AT MIDSPAN :

$$Mn = \frac{Mu}{\phi} = \frac{63.70}{0.9} = \mathbf{70.775029}\ \text{kN-m}$$

Assuming single reinforcement

$$\rho_{max} = \frac{(0.75)(0.85)\beta_1 fc'}{fy} \times \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(0.85)(28)}{420} \times \frac{600}{600 + 420}$$

$$= \mathbf{0.02125}$$

$$As = \rho_{max} b d$$

$$= (0.02125)(200)(300)$$

$$= 1275\ mm^2$$

$$Mu = \rho\, fy\, \phi\, b\, d^2 \left[1 - \frac{1}{1.7} \times \frac{\rho\, fy}{fc'} \right]$$

$$= (0.0213) (\quad 420) (\ 0.9) (200) (300)^2 \left[1 - \frac{1}{1.7} \times \frac{(0.02125) (420)}{28} \right]$$

$$= \mathbf{117475312.5} \text{ MN-mm}$$

$$Mu = \mathbf{117.4753125} \text{ kN-m}$$

$$Mn = \frac{Mu}{\phi} = \frac{117.4753125}{0.9} = \mathbf{130.52813} \text{ kN-m}$$

130.528125 > 70.77502895

Therefore, **it's a single reinforcement only!**

AT END 2 :

$$Mn = \frac{Mu}{\phi} = \frac{52.950}{0.9} = \mathbf{58.833333} \text{ kN-m}$$

Assuming single reinforcement

$$\rho_{max} = \frac{(0.75)(0.85)\, \beta_1\, fc'}{fy} \times \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(\ 0.85) (\ 28)}{420} \times \frac{600}{600 + 420}$$

$$= \mathbf{0.02125}$$

$$As = \rho_{max}\, b\, d$$

$$= (0.02125) (\ 200) (\ 300)$$

$$= 1275 \text{ mm}^2$$

$$Mu = \rho\, fy\, \phi\, b\, d^2 \left[1 - \frac{1}{1.7} \times \frac{\rho\, fy}{fc'} \right]$$

$$= (0.0213) (\quad 420) (\ 0.9) (200) (300)^2 \left[1 - \frac{1}{1.7} \times \frac{(0.02125) (420)}{28} \right]$$

$$= \mathbf{117475312.5} \text{ MN-mm}$$

$$Mu = \mathbf{117.4753125} \text{ kN-m}$$

$$Mn = \frac{Mu}{\phi} = \frac{117.4753125}{0.9} = \mathbf{130.52813} \text{ kN-m}$$

130.528125 > 58.83333333

Therefore, **it's a single reinforcement only!**

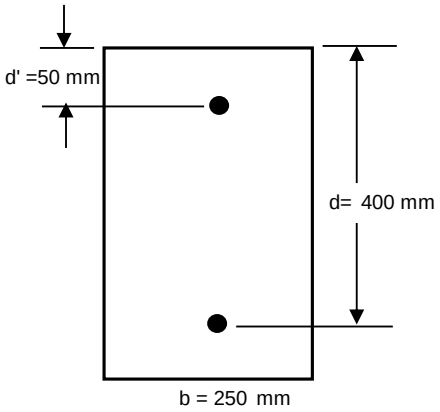
BEAM 2

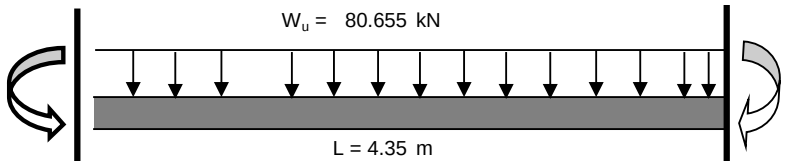
	LOAD	END 1		MIDSPAN	END 2	
		V	M	M	V	M
MDM	1.2DL + 1.6LL	205.67	-161.70	95.39	220.79	-185.88

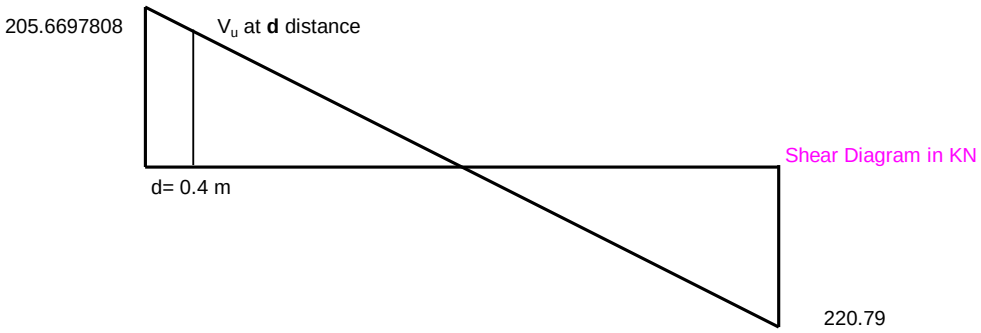
DESIGN OF BEAM REINFORCEMENT

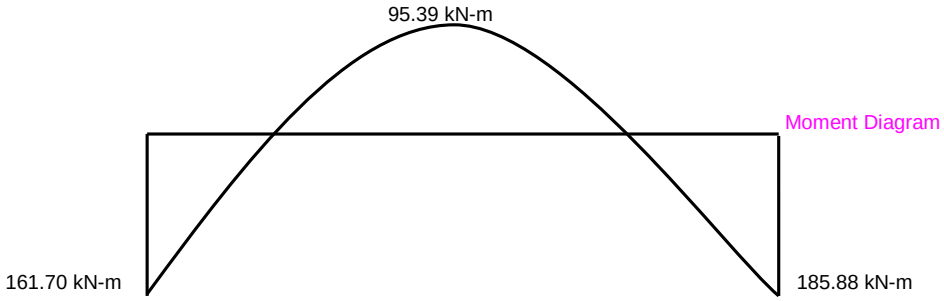
Given:

Wu =	80.65	kN
fc' =	28	MPa
fy =	420	MPa
ϕ =	0.9	
β_1 =	0.85	
Es =	200000	MPa
d =	400	mm
b =	250	mm
d' =	50	mm
L =	4.35	m
cover :	50	mm
using	10	mm ϕ stirrups









AT END 1 :

$$Mn = \frac{Mu}{\phi} = \frac{161.7}{0.9} = \mathbf{179.7} \text{ kN-m}$$

Assuming single reinforcement

$$\rho_{max} = \frac{(0.75)(0.85)\beta_1 fc'}{fy} \times \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(0.85)(28)}{420} \times \frac{600}{600 + 420}$$

$$= \mathbf{0.02125}$$

$$As = \rho_{max} b d$$

$$= (0.02125)(250)(400)$$

$$= 2125 \text{ mm}^2$$

$$Mu = \rho fy \phi b d^2 \left[1 - \frac{1}{1.7} \times \frac{\rho fy}{fc'}\right]$$

$$= (0.0213)(420)(0.9)(250)(400)^2 \left[1 - \frac{1}{1.7} \times \frac{0.02125)(420)}{28}\right]$$

$$= \mathbf{261056250} \text{ MN-mm}$$

$$Mu = \mathbf{261.05625} \text{ kN-m}$$

$$Mn = \frac{Mu}{\phi} = \frac{261.05625}{0.9} = \mathbf{290.0625} \text{ kN-m}$$

290.0625 > 179.6646416

Therefore, it's a single reinforcement only!

AT MIDSPAN :

$$Mn = \frac{Mu}{\phi} = \frac{95.387}{0.9} = \mathbf{105.98547} \text{ kN-m}$$

Assuming single reinforcement

$$\rho_{max} = \frac{(0.75)(0.85)\beta_1 fc'}{fy} \times \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(0.85)(28)}{420} \times \frac{600}{600 + 420}$$

$$= \mathbf{0.02125}$$

$$As = \rho_{max} b d$$

$$= (0.02125)(250)(400)$$

$$= 2125 \text{ mm}^2$$

$$Mu = \rho\, fy\, \phi\, b\, d^2 \left[1 - \frac{1}{1.7} x \frac{\rho\, fy}{fc'} \right]$$

$$= (0.0213) (420) (0.9) (250) (400)^2 \left[1 - \frac{1}{1.7} x \frac{0.02125) (420)}{28} \right]$$

$$= \mathbf{261056250} \text{ MN-mm}$$

$$Mu = \mathbf{261.05625} \text{ kN-m}$$

$$Mn = \frac{Mu}{\phi} = \frac{261.05625}{0.9} = \mathbf{290.0625} \text{ kN-m}$$

290.0625 > 105.9854692

Therefore, it's a single reinforcement only!

AT END 2 :

$$Mn = \frac{Mu}{\phi} = \frac{185.881}{0.9} = \mathbf{206.53465} \text{ kN-m}$$

Assuming single reinforcement

$$\rho_{max} = \frac{(0.75)(0.85)\, \beta_1\, fc'}{fy} x \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(0.85) (28)}{420} x \frac{600}{600 + 420}$$

$$= \mathbf{0.02125}$$

$$As = \rho_{max}\, b\, d$$

$$= (0.02125) (250) (400)$$

$$= 2125 \text{ mm}^2$$

$$Mu = \rho\, fy\, \phi\, b\, d^2 \left[1 - \frac{1}{1.7} x \frac{\rho\, fy}{fc'} \right]$$

$$= (0.0213) (420) (0.9) (250) (400)^2 \left[1 - \frac{1}{1.7} x \frac{0.02125) (420)}{28} \right]$$

$$= \mathbf{261056250} \text{ MN-mm}$$

$$Mu = \mathbf{261.05625} \text{ kN-m}$$

$$Mn = \frac{Mu}{\phi} = \frac{261.05625}{0.9} = \mathbf{290.0625} \text{ kN-m}$$

290.0625 > 206.5346457

Therefore, it's a single reinforcement only!

AT END 1 :

SINGLY REINFORCED BEAM

$Mu = \phi\ Rn\ b\ d^2$

$179.6646 = 0.9\ Rn\ (\ 250\ )\ (\ 400\ )^2$

$Rn = 4.990684\ Mpa$

$$\rho = \frac{0.85\ fc'}{fy}\left[1 - \sqrt{1 - \frac{2\ Rn}{0.85\ fc}}\right]$$

$$\rho = 0.85\ \frac{28}{420}\left[1 - \sqrt{1 - \frac{2\ (\ 4.99068\ )}{0.85\ (28)}}\right]$$

$\rho = 0.013488$

$$\rho_{min} = \frac{1.4}{fy} \text{ or } \frac{\sqrt{fc'}}{4\ fy} = \frac{1.4}{420} \text{ or } \frac{\sqrt{28}}{4 \times 420}$$

$= 0.003333333$ or 0.003149704 Therefore, use **0.00333**

$$\rho_{max} = \frac{(0.75)(0.85)\ \beta_1\ fc'}{fy} \times \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(\ 0.85)\ (28)}{420} \times \frac{600}{600\ + 420} = \mathbf{0.02125}$$

when $\rho_{min} < \rho < \rho_{max}$

Therefore, use **0.01349** for As

$As = \rho\ b\ d_1$

$= (\ 0.01349\ )\ (\ 250)\ (\ 400\ )$

$= \mathbf{1348.775432}\ mm^2$

minimum edge distance = cover - stirrupϕ - 2 x stirrupϕ

$= (\ 50\ ) + (\ 10\ ) + (\ 2 \times 10\ )$

$= \mathbf{80}\ mm$

For tension reinforcement:

using 25 mm ϕ bars Ad = 490.8738438

$$N = \frac{As}{Ad} = \frac{1348.775432}{490.8738438} = 2.748$$ say **3** pcs.

arrangement: 2 bars horizontally

checking the spacing:

$$S = \frac{250 - 2(\ 50\ ) - 2(\ 10\ ) - 2(\ 25\ )}{1} = 80\ mm > 25\ mm$$ **OK!**

AT MIDSPAN :

SINGLY REINFORCED BEAM

$Mu = \phi\ Rn\ b\ d^2$

$105.9855 = 0.9\ Rn\ (\ 250\ )\ (\ 400\ )^2$

$Rn = 2.94404\ Mpa$

$$\rho = \frac{0.85\ fc'}{fy}\left[1 - \sqrt{1 - \frac{2\ Rn}{0.85\ fc}}\right]$$

$$\rho = 0.85\ \frac{28}{420}\left[1 - \sqrt{1 - \frac{2\ (\ 2.94404081\ )}{0.85\ (28)}}\right]$$

$\rho = 0.00751$

$$\rho_{min} = \frac{1.4}{fy} \text{ or } \frac{\sqrt{fc'}}{4\ fy} = \frac{1.4}{420} \text{ or } \frac{\sqrt{28}}{4 \times 420}$$

$= 0.003333333$ or 0.003149704 Therefore, use **0.00333**

$$\rho_{max} = \frac{(0.75)(0.85)\ \beta_1\ fc'}{fy} \times \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(\ 0.85)\ (28)}{420} \times \frac{600}{600\ + 420} = \mathbf{0.02125}$$

when $\rho_{min} < \rho < \rho_{max}$

Therefore, use **0.00751** for As

$As = \rho\ b\ d_1$

$= (\ 0.00751\ )\ (\ 250)\ (\ 400\ )$

$=$ **750.6851772** mm^2

minimum edge distance = cover - stirrupϕ - 2 x stirrupϕ

$= (\ 50\ ) + (\ 10\ ) + (\ 2 \times 10\ )$

$=$ **80** mm

For tension reinforcement:

using 25 mm ϕ bars Ad = 441.5625

$$N = \frac{As}{Ad} = \frac{750.6851772}{441.5625} = 1.700$$ say **2** pcs.

arrangement: 2 bars horizontally

checking the spacing:

$$S = \frac{250 - 2(\ 50\ ) - 2(\ 10\ ) - 2(\ 25\ )}{1} = 80\ mm > 25\ mm$$ **OK!**

AT END 2 :

SINGLY REINFORCED BEAM

$Mu = \phi\ Rn\ b\ d^2$

$206.535 = 0.9\ Rn\ (\ 250\ )\ (\ 400\ )^2$

$Rn = 5.73707\ Mpa$

$$\rho = \frac{0.85\ fc'}{fy}\left[1 - \sqrt{1 - \frac{2\ Rn}{0.85\ fc}}\right]$$

$$\rho = \frac{0.85\ (28)}{420}\left[1 - \sqrt{1 - \frac{2\ (\ 5.73707349\ )}{0.85\ (28)}}\right]$$

$\rho = 0.01589\ Mpa$

$$\rho_{min} = \frac{1.4}{fy} \text{ or } \frac{\sqrt{fc'}}{4\ fy} = \frac{1.4}{420} \text{ or } \frac{\sqrt{28}}{4 \times 420}$$

$= 0.003333333$ or 0.003149704 Therefore, use **0.00333**

$$\rho_{max} = \frac{(0.75)(0.85)\ \beta_1\ fc'}{fy} \times \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(0.85\ \ )\ \ (28)}{420} \times \frac{600}{600\ + 420} = \mathbf{0.02125}$$

when $\rho_{min} < \rho < \rho_{max}$

Therefore, use **0.01589** for As

$As = \rho\ b\ d_1$

$= (\ 0.01589\ )\ (\ \ 250)\ \ (\ 400\ \ )$

$= \mathbf{1588.662357}\ mm^2$

minimum edge distance = cover - stirrupϕ - 2 x stirrupϕ

= (50) + (10) + (2 x 10)

= **80** mm

For tension reinforcement:

using 25 mm ϕ bars Ad = 490.8738438

$$N = \frac{As}{Ad} = \frac{1588.662357}{490.8738438} = 3.236$$ say **4** pcs.

arrangement: 2 bars horizontally

checking the spacing:

$$S = \frac{250 - 2(\ 50\ ) - 2(\ 10\ ) - 2(\ 25\ )}{1} = 80\ mm > 25\ mm$$ **OK!**

DESIGN OF ONE-WAY SLAB

Given:

live load:	4.8	kPa	fc' =	21	mPa		
			fy =	230	mPa	L :	1.35 m
floor finish:	1.2	kPa	ϕ =	0.9		cover =	20 mm
ceiling finish:	0.24	kPa	β_1 =	0.85			
mech. duct allowance:	0	kPa	conc. unit wt.=	23.5	kN/m^3		
electrical load:	0	kPa					
partition load:	0	kPa	using	10	mm rebars		
miscellaneous load:	0	kPa				A_d = 78.54	mm^2

Solution:

minimum slab thickness, h

$$h = \frac{L}{24} = \frac{(1.35)(1000)}{24} = 56.25 \text{ mm}$$

say **h** = **60** mm

Use h= **150** mm

assume effective depth, d

d = h - cover - half of bar diameter

= 150 - 20 - 5

= **125** mm

Dead Loads:

slab self-weight = h x conc. unit wt.= (0.15) (23.5) = 3.54 kPa

floor finish	=	1.2	kPa
ceiling finish	=	0.24	kPa
mech. duct allowance	=	0	kPa
electrical load	=	0	kPa
partition load	=	0	kPa
miscellaneous loads	=	0	kPa
		4.98	kPa

Factored Load:

W_{UDL}= 1.2 (DL) = 1.6 (4.98) = 5.970 kPa

W_{ULL}= 1.6 (LL) = 1.6 (4.8) = 7.68 kPa

$W_U = W_{UDL} + W_{ULL}$ = **13.650** kPa

At END 1 :

$$M_u = \frac{W_u L^2}{11} = \frac{(13.65)(1.35)^2}{11} = \mathbf{2.2616} \text{ kN-m}$$

$$Rn = \frac{M_U}{\phi b d_1^2} = \frac{2.262 \times 10e6}{0.90 \times 1000 \times (125)^2} = \mathbf{0.161} \text{ MPa}$$

$$\rho = \frac{0.85 fc'}{fy} \times \left[1 - \sqrt{1 - \frac{2 Rn}{0.85 fc'}} \right]$$

$$= \frac{(0.85)(21)}{230} \times \left[1 - \sqrt{1 - \frac{2 \times 0.161}{0.85 \times 21.0}} \right] = \mathbf{0.00070}$$

$$\rho_{min} = \frac{1.4}{fy} \text{ or } \frac{\sqrt{fc'}}{4 fy} = \frac{1.4}{230} \text{ or } \frac{\sqrt{21}}{4 \times 230}$$

= 0.00608696 or 0.004981061 Therefore, use **0.00609**

$$\rho_{max} = \frac{(0.75)(0.85)\,\beta_1\, fc'}{fy} \times \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(\ 0.85)\ (\ 21)}{230} \times \frac{600}{600 + 230} = \mathbf{0.03577}$$

when $\rho_{min} > \rho < \rho_{max}$

Therefore, use **0.00609** for As

$As = \rho\ b\ d$

$= (\ 0.00609\ )\ (\ 1000\ )\ (\ 125\ )$

$= \mathbf{760.869565}\ mm^2$

using 10 mm bars

$$S = \frac{Ad\ (1000)}{As} = \frac{(\ 78.54)\ (1000)}{760.8695652} = 103.224\ mm$$

say S = **100** mm

$S_{max} = 3h = 3\ (\ 60\ ) = 180\ mm$ or 450 mm

Therefore, $S_{max} =$ **180** mm

$S < S_{max}$ Therefore S = **100** mm

At MIDSPAN :

$$M_u = \frac{W_u\ L^2}{16} = \frac{(\ 13.65\ )\ (\ 1.35\ )^2}{16} = \mathbf{1.5548}\ kN\text{-}m$$

$$Rn = \frac{M_U}{\phi\ b\ d_1^{\,2}} = \frac{1.555 \times 10e6}{0.90 \times 1000 \times (125\ )^2} = \mathbf{0.111}\ MPa$$

$$\rho = \frac{0.85\ fc'}{fy} \times \left[1 - \sqrt{1 - \frac{2\ Rn}{0.85\ fc'}} \right]$$

$$= \frac{(0.85)(\ 21\ )}{230} \times \left[1 - \sqrt{1 - \frac{2 \times 0.111}{0.85 \times 21.0}} \right] = \mathbf{0.00048}$$

$$\rho_{min} = \frac{1.4}{fy} \text{ or } \frac{\sqrt{fc'}}{4\ fy} = \frac{1.4}{230} \text{ or } \frac{\sqrt{21}}{4 \times 230}$$

$= 0.00608696$ or 0.004981061 Therefore, use **0.00609**

$$\rho_{max} = \frac{(0.75)(0.85)\,\beta_1\, fc'}{fy} \times \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(\ 0.85)\ (\ 21)}{230} \times \frac{600}{600 + 230} = \mathbf{0.03577}$$

when $\rho_{min} > \rho < \rho_{max}$

Therefore, use **0.00609** for As

$As = \rho\ b\ d$

$= (0.00609) (\ \ 1000) (125\ \ )$

$= \mathbf{760.869565}\ mm^2$

using 10 mm bars

$S = \frac{Ad\ (1000)}{As} = \frac{(\ 78.54)\ (1000)}{760.8695652} = 103.224\ mm$

say $S =$ **100** mm

$S_{max} = 3h = 3\ (\ 60\ ) =$ 180 mm or 450 mm

Therefore, $S_{max} =$ **180** mm

$S < S_{max}$ Therefore $S =$ **100** mm

At END 2 :

$M_u = \frac{W_u\ L^2}{10} = \frac{(\ 13.65\ )\ (\ 1.35\ )^2}{10} =$ **2.4877** kN-m

$Rn = \frac{M_U}{\phi\ b\ d_1^2} = \frac{2.488\ x\ 10e6}{0.90\ x\ \ 1000\ x\ (125\ \ )^2} =$ **0.177** MPa

$\rho = \frac{0.85\ fc'}{fy}\ x\ \left[1 - \sqrt{1 - \frac{2\ Rn}{0.85\ fc'}} \right]$

$= \frac{(0.85)(\ \ \ 21\ )}{230}\ x\ \left[1 - \sqrt{1 - \frac{2\ x\ 0.177}{0.85\ x\ 21.0}} \right] =$ **0.00077**

$\rho_{min} = \frac{1.4}{fy}$ or $\frac{\sqrt{fc'}}{4\ fy} = \frac{1.4}{230}$ or $\frac{\sqrt{\ 21}}{4\ x\ 230}$

$=$ 0.00608696 or 0.004981061 Therefore, use **0.00609**

$\rho_{max} = \frac{(0.75)(0.85)\ \beta_1\ fc'}{fy}\ x\ \frac{600}{600 + fy}$

$= \frac{(0.75)(0.85)(\ \ 0.85)\ (\ \ 21)}{230}\ x\ \frac{600}{600\ +\ 230} =$ **0.03577**

when $\rho_{min} > \rho < \rho_{max}$

Therefore, use **0.00609** for As

$As = \rho\ b\ d_1$

$= (0.00609) (\ \ 1000) (125\ \ )$

$= \mathbf{760.869565}\ mm^2$

using 10 mm bars

$S = \frac{Ad\ (1000)}{As} = \frac{(\ 78.54)\ (1000)}{760.8695652} = 103.224\ mm$

say $S =$ **100** mm

S_{max} = 3h = 3 (60) = 180 mm or 450 mm

Therefore, S_{max} = **180** mm

S < S_{max} Therefore S = **100** mm

temperature bars :

A_{st} = 0.0020 b h

= 0.0020 (1000) (60)

= 120 mm^2

$$s_{st} = \frac{Ad\,(1000)}{A_{st}} = \frac{(\,78.54\,)\,(\,1000\,)}{120} = 654.5 \text{ mm}$$

say S = **650** mm

S_{max} = 5h = 5 (60) = 300 mm or 450 mm

Therefore, S_{max} = **300** mm

S > S_{max} Therefore S = **300** mm

DESIGN OF TWO-WAY SLAB

Given:

short side A:	5.7	m	fc' =	21	mPa		
long side B:	6.6	m	fy =	230	mPa		0.8636
			ϕ =	0.9			
			β =	0.85			

LOADS:

live load:	4.8	kPa	conc. unit wt.=	23.6	kN/m^3		
floor finish:	1.2	kPa	C_A =	0.000		using	12 mm RSB
ceiling finish:	0.24	kPa	C_{ADL} =	0.05		cover =	40 mm
mech. duct allowance:	0	kPa	C_{ALL} =	0.05			
electrical load:	0	kPa	C_B =	0.000		A_d =	113.10
partition load:	0	kPa	C_{BDL} =	0.026			
miscellaneous load:	0	kPa	C_{BLL} =	0.026			

SOLUTION:

$$\text{ratio m} = \frac{5.70}{6.60} = 0.864 > 0.500$$ **Two-way Slab!**

$$h = \frac{2\,(\,5.70 + 6.60\,)\,(1000)}{180} = 136.67 \text{ mm}$$

say **h** = **140 mm** > h_{min} = 90 mm **140** mm

use h= **150** mm

d_1 = h - (cover) - (half of rebar ϕ) = **104** mm

d_2 = h - (cover) - (rebar ϕ) - (half of rebar ϕ) = **82** mm

Dead Loads:

slab self-weight = h x conc. unit wt.=	(0.15) (23.6)	=	3.54 kPa
floor finish		=	1.2 kPa
ceiling finish		=	0.24 kPa
mech. duct allowance		=	0 kPa
electrical load		=	0 kPa
partition load		=	0 kPa
miscellaneous loads		=	0 kPa
			4.98 kPa

Factored Load:

W_{UDL} =	1.2 (DL)	=	1.2 (4.98)	=	5.98 kPa
W_{ULL} =	1.6 (LL)	=	1.6 (4.8)	=	7.68 kPa
		W_U =	W_{UDL} + W_{ULL}	=	**13.66** kPa

Solving for Moments:

A. Short Span, Middle Strip

at continuous edge

$M_A = (Wu)\,(C_A)\,(A^2)$

= **0.00** kN-m

at midspan

$M_{ADL} = (Wu_{DL})\,(C_{ADL})\,(A^2)$

= **9.71** kN-m

$M_{ALL} = (Wu_{LL})\,(C_{ALL})\,(A^2)$

= **12.48** kN-m

$M_A = M_{ADL} + M_{ALL}$ = **22.18** kN-m

B. Long Span, Middle Strip

at continuous edge

$M_B = (Wu)\,(C_B)\,(B^2)$

= **0.00** kN-m

at midspan

$M_{BDL} = (Wu_{DL})\,(C_{BDL})\,(B^2)$

$= \mathbf{6.77}$ kN-m

$M_{BLL} = (Wu_{LL})\,(C_{BLL})\,(B^2)$

$= \mathbf{8.70}$ kN-m

$M_B = M_{BDL} + M_{BLL} = \mathbf{15.47}$ kN-m

Strength Design:

A. Short Span, Middle Strip

at continuous edge

$$Rn = \frac{M_A}{\phi\, b\, d_1^2} = \frac{0.00 \times 10e6}{0.90 \times 1000 \times (104)^2} = \mathbf{0.00}\ \text{MPa}$$

$$\rho = \frac{0.85\, fc'}{fy} \times \left[1 - \sqrt{1 - \frac{2\,Rn}{0.85\, fc'}}\right]$$

$$= \frac{(0.85)(21)}{230} \times \left[1 - \sqrt{1 - \frac{2 \times 0.00}{0.85 \times 21.0}}\right] = \mathbf{0.00000}$$

$$\rho_{min} = \frac{1.4}{fy} \text{ or } \frac{\sqrt{fc'}}{4\,fy} = \frac{1.4}{230} \text{ or } \frac{\sqrt{21}}{4 \times 230}$$

$= 0.006086957$ or 0.004981061 Therefore, use **0.00609**

$$\rho_{max} = \frac{(0.75)(0.85)\,\beta_1\, fc'}{fy} \times \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(0.85)\,(21)}{230} \times \frac{600}{600 + 230} = \mathbf{0.03577}$$

when $\rho_{min} > \rho < \rho_{max}$

Therefore, use **0.00609** for As

$As = \rho\, b\, d_1$

$= (0.00609)\,(1000)\,(104)$

$= \mathbf{633.04}\ mm^2$

using 12 mm bars

$$S = \frac{Ad\,(1000)}{As} = \frac{(113.10)\,(1000)}{633.04} = 178.66\ \text{mm}$$

say S = **170** mm

$S_{max} = 2h = 2\,(140) = 280$ mm or 450 mm

Therefore, $S_{max} =$ **280** mm

$S < S_{max}$ Therefore S = **170** mm

at midspan

$$Rn = \frac{M_A}{\phi\, b\, d_1^2} = \frac{22.18 \times 10e6}{0.90 \times 1000 \times (104)^2} = \mathbf{2.28}\ \text{MPa}$$

$$\rho = \frac{0.85\,fc'}{fy} \times \left[1 - \sqrt{1 - \frac{2\,Rn}{0.85\,fc'}}\right]$$

$$= \frac{(0.85)(\quad 21\ )}{230} \times \left[1 - \sqrt{1 - \frac{2 \times 2.28}{0.85 \times 21.0}}\right] = \mathbf{0.01064}$$

$$\rho_{min} = \frac{1.4}{fy} \text{ or } \frac{\sqrt{fc'}}{4\,fy} = \frac{1.4}{230} \text{ or } \frac{\sqrt{21}}{4 \times 230}$$

$$= 0.006086957 \text{ or } 0.004981061 \text{ Therefore, use } \mathbf{0.00609}$$

$$\rho_{max} = \frac{(0.75)(0.85)\,\beta_1\,fc'}{fy} \times \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(\quad 0.85)\ (\quad 21)}{230} \times \frac{600}{600 + 230} = \mathbf{0.03577}$$

when $\rho_{min} < \rho < \rho_{max}$

Therefore, use **0.01064** for As

$$As = \rho\, b\, d_1$$

$$= (\ 0.01064\ )\ (\quad 1000\ )\ (\ 104\ )$$

$$= \mathbf{1106.30}\ mm^2$$

using 12 mm bars

$$S = \frac{Ad\,(1000)}{As} = \frac{(\ 113.10)\ (1000)}{1106.30} = 102.23 \text{ mm}$$

say S = **100** mm

S_{max} = 2h = 2 (140) = 280 mm or 450 mm

Therefore, S_{max} = **280** mm

S < S_{max} Therefore S = **100** mm

B. Long Span, Middle Strip

at continuous edge

$$Rn = \frac{M_B}{\phi\, b\, d_2^2} = \frac{0.00 \times 10e6}{0.90 \times 1000 \times (82\quad)^2} = \mathbf{0.00}\ MPa$$

$$\rho = \frac{0.85\,fc'}{fy} \times \left[1 - \sqrt{1 - \frac{2\,Rn}{0.85\,fc'}}\right]$$

$$= \frac{(0.85)(\quad 21\ )}{230} \times \left[1 - \sqrt{1 - \frac{2 \times 0.00}{0.85 \times 21.0}}\right] = \mathbf{0.00000}$$

$$\rho_{min} = \frac{1.4}{fy} \text{ or } \frac{\sqrt{fc'}}{4\,fy} = \frac{1.4}{230} \text{ or } \frac{\sqrt{21}}{4 \times 230}$$

$$= 0.006086957 \text{ or } 0.004981061 \text{ Therefore, use } \mathbf{0.00609}$$

$$\rho_{max} = \frac{(0.75)(0.85)\,\beta_1\, fc'}{fy} \times \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(\quad 0.85)\,(\quad 21)}{230} \times \frac{600}{600 + 230} = \mathbf{0.03577}$$

when $\rho_{min} > \rho < \rho_{max}$

Therefore, use **0.00609** for As

$As = \rho\, b\, d_2$

$= (\ 0.00609\ )\,(\quad 1000\ )\quad (\ 82\ \ )$

$= \mathbf{499.13}\ mm^2$

using 12 mm bars

$$S = \frac{Ad\,(1000)}{As} = \frac{(\ 113.10)\,(1000)}{499.13} = 226.59\ mm$$

say S = **220** mm

$S_{max} = 2h = 2\,(\ 140\ ) = 280\ mm$ or $450\ mm$

Therefore, $S_{max} =$ **280** mm

$S < S_{max}$ Therefore S = **220** mm

at midspan

$$Rn = \frac{M_B}{\phi\, b\, d_2^{\,2}} = \frac{15.47 \times 10e6}{0.90 \times 1000 \times (82\ \ )^2} = \mathbf{2.56}\ MPa$$

$$\rho = \frac{0.85\, fc'}{fy} \left[1 - \sqrt{1 - \frac{2\, Rn}{0.85\, fc'}} \right]$$

$$= \frac{(0.85)(\quad 21\ )}{230} \left[1 - \sqrt{1 - \frac{2 \times 2.56}{0.85 \times 21.0}} \right] = \mathbf{0.01205}$$

$$\rho_{min} = \frac{1.4}{fy} \text{ or } \frac{\sqrt{fc'}}{4\, fy} = \frac{1.4}{230} \text{ or } \frac{\sqrt{21}}{4 \times 230}$$

$= 0.006086957$ or 0.004981061 Therefore, use **0.00609**

$$\rho_{max} = \frac{(0.75)(0.85)\,\beta_1\, fc'}{fy} \times \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(\quad 0.85)\,(\quad 21)}{230} \times \frac{600}{600 + 230} = \mathbf{0.03577}$$

when $\rho_{min} < \rho < \rho_{max}$

Therefore, use **0.01205** for As

$As = \rho\, b\, d_2$

$= (\ 0.01205\ )\,(\quad 1000\ )\quad (\ 82\ \ )$

= **987.84** mm^2

using 12 mm bars

$$S = \frac{Ad\,(1000)}{As} = \frac{(\,113.10)\,(1000)}{987.84} = 114.49 \text{ mm}$$

say S = **110** mm

S_{max} = 2h = 2 (140) = 280 mm or 450 mm

Therefore, S_{max} = **280** mm

S < S_{max} Therefore S = **110** mm

Use S= **100** mm

RESULTING TABLE

SLAB		Middle Strip		Column Strip	
		As (mm^2)	S (mm)	As (mm^2)	S (mm)
short span	cont. edge	633.04	100.00	422.03	200.00
	midspan	1106.30	100.00	737.53	100.00
	disc. edge	368.77	200.00	245.84	200.00
long span	cont. edge	499.13	200.00	332.75	200.00
	midspan	987.84	100.00	658.56	100.00
	disc. edge	329.28	200.00	219.52	200.00

DESIGN OF SQUARE TIED COLUMN

Given:

Pu = 486.74 kN
fc' = 28 MPa
fy = 414 MPa
initial ρ = 0.1
ϕ = 0.7

where $\rho = \frac{A_s}{A_g}$; $A_s = \rho A_g$

Solution:

Selecting column dimensions:

$$P_u = 0.8\,\phi\,[\,0.85\,f'_c\,(A_g - A_s) + f_y\,(A_s)\,]$$

$$487 \times 10^3 = 0.8\,(0.65)\,[\,0.85\,(28)\,(Ag - 0.05\,A_g) + 414\,(0.05\,A_g)\,]$$

$$A_g = 21612.347 \text{ mm}^2$$

Use: 450 mm x 450 mm
A_g = 202500 mm^2

Selecting longitudinal (main) bars:

$$P_u = 0.8\,\phi\,[\,0.85\,f'_c\,(A_g - A_s) + f_y\,(A_s)\,]$$

$$487 \times 10^3 = 0.8\,(0.65)\,[\,0.85\,(28)\,(202500 - A_s) + 414\,A_s\,]$$

$$A_s = 1080.6173 \text{ mm}^2$$

Use: 8 -- 20 mm ϕ **OK! Above minimum req'd rebars (4 Bars)**
A_s = 2513.2741 mm^2 **OK! Above minimum req'd rebars (Ast)**

checking ρ :

ρ_{gmin} = 1% of A_g = 0.01
ρ_{gmax} = 8% of A_g = 0.08

$$\rho = \frac{A_s}{A_g} = \frac{2513.2741}{202500} = 0.012$$

ρ_{gmin} < ρ < ρ_{gmax} **OK for rho min! Also OK! for rho max**

Design of ties:

Use **10** mm ϕ size of ties.

(a) 16 d_l = 16 (20) = 320 mm
(b) 48 d_l = 48 (10) = 480 mm
(c) least lateral column dimension = 450 mm

Therefore, **320 mm controls!**

DESIGN OF SQUARE COLUMN FOOTING

Assume unfactored load

9.72 sq.m tributary area

LIVE LOAD	4.8	KPa
DEAD LOADS:		
PARTITIONS	2.63	KPa
FLOOR FINISHED	1.2	KPa
CEILINGS	0.24	KPa
SLAB WEIGHT	3.54	KPa
OTHER DEAD LOADS		KPa
TOTAL SERVICE LOAD	12.405	KPa

Dead load	73.92	KN
Live load	46.66	KN
total	120.58	KN
Pu =	175.41	
Ps=	132.63	KN

	HEIGHT	LN.M	TOTAL AREA
CHB WAL	1.5	6.075	9.113

WEIGHT	2.8	KPA
CONVERTI	2.63	KPA

Given:

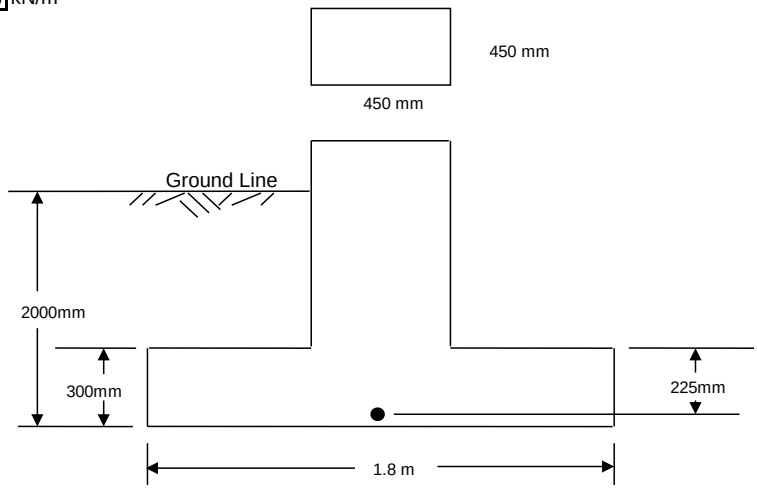
DL =	73.92	kN
LL =	46.66	kN
fc' =	21	MPa
fy =	280	MPa
ϕ =	0.9	0.75
q_a =	75	kN/m^2
conc weight =	23.54	kN/m^3
soil weight =	16	kN/m^3

a = 450 mm (column dimension)

depth of footing = 2000 mm

cover = 75 m

α_s = 40



Solution:

Assume h = 300 mm deep footing

d = **225** mm

$q_e = q_a - (h \times \text{conc weight}) - (\text{soil height} \times \text{soil weight})$

$$= 75 - \frac{300}{1000}(23.54) - \frac{1700}{1000}(16)$$

$$= \mathbf{40.738}\ kN/m^2$$

$$A_f \text{ required} = \frac{DL + LL}{q_e}$$

$$= \frac{73.9206 + 46.656}{40.738}$$

$$= 2.95981 \text{ m}^2$$

Use : 1.8 m x 1.8 m footing

$A_f =$ 3.24 m^2

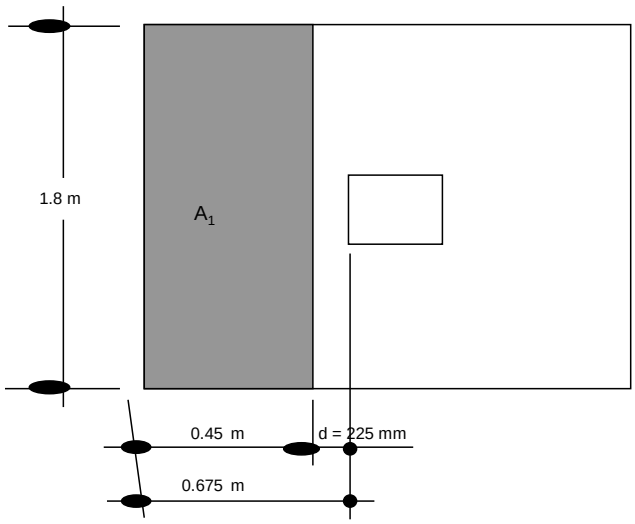
bearing pressu`

$$q_u = \frac{1.2\ DL + 1.6\ LL}{A_f}$$

$$= \frac{1.2\ (\ 73.9206\ ) + 1.6\ (\ 46.656\ )}{3.24}$$

$$= \textbf{50.418} \text{ kN/m}^2$$

a.) depth ***d*** required for **one-way** or beam shear :



$V_{u1} = q_u\ (\ A_1\ )$

$= (\ 50.418\ )\ [\ (\ 0.45\ )\ (\ 1.8\ )\ ]$

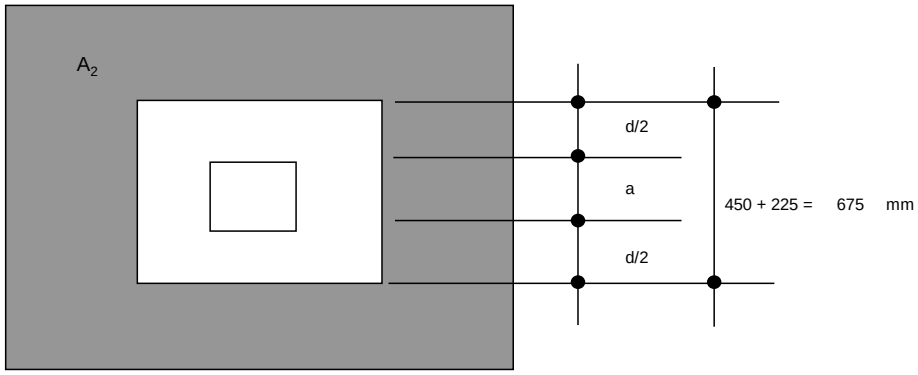
$= \textbf{40.839}$ kN

$$d = \frac{6\ V_{u1}}{\phi \sqrt{fc'}\ (\ b_w\ )}$$

$$= \frac{6\ (\ 40.839\ )\ (10\ )^3}{(\ 0.75 \sqrt{21}\ (\ 1800\ )}$$

$= \textbf{39.608}$ mm < 225 mm **OK!**

b.) depth ***d*** required for **two-way** or punching shear :



b_o = 4 (675) = 2700 mm

V_{u2} = q_u (A_2)

= (50.418) [(3.24) - (0.675)^2]

= **140.383** kN

$$d = \frac{3\,V_{u2}}{\phi \sqrt{fc'}\ (b_o)}$$

$$= \frac{3\,(140.383)\,(10)^3}{0.75\sqrt{21}\ (2700)}$$

= **45.384** mm < 225 mm **OK!**

$$d = \frac{12\,V_{u2}}{\phi\left[\frac{\alpha_s\, d}{b_o} + 2\right]\sqrt{fc'}\ (b_o)}$$

$$= \frac{12\,(140.383)\,(10)^3}{0.75\left[\frac{(40)\,d}{2700} + 2\right]\sqrt{21}\ (2700)}$$

Solving **d** by Quadratic Equation :

where a = 137.4772708 d^2
b = 18559.43156 d
c = -1684591.425

$$d = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

d = 62.15280389 mm or -197.1528039 mm

Therefore d = **62.153** mm < 225 mm **OK!**

determine steel area (d = 225 mm)

cantilever length = $\frac{l - a}{2} = \frac{1.8 - 0.45}{2} =$ **0.675** m

take moment at face of the wall :

Mu = (50.42) (0.675) (1.8) $\left[\frac{0.675}{2}\right]$ = **20.675** kN-m

$$Rn = \frac{Mu}{\phi\, b\, d_1^2} = \frac{20.675 \times 10e6}{0.90 \times 1800 \times (225)^2} = \textbf{0.252} \text{ MPa}$$

$$\rho = \frac{0.85\, fc'}{fy} \times \left[1 - \sqrt{1 - \frac{2\, Rn}{0.85\, fc'}}\right]$$

$$= \frac{(0.85)(21)}{280} \times \left[1 - \sqrt{1 - \frac{2 \times 0.252}{0.85 \times 21.0}}\right] = \textbf{0.00091}$$

$$\rho_{min} = \frac{1.4}{fy} \text{ or } \frac{\sqrt{fc'}}{4\, fy} = \frac{1.4}{280} \text{ or } \frac{\sqrt{21}}{4 \times 280}$$

= 0.005 or 0.004091585 Therefore, use **0.00500**

$$\rho_{max} = \frac{(0.75)(0.85)\, \beta_1\, fc'}{fy} \times \frac{600}{600 + fy}$$

$$= \frac{(0.75)(0.85)(0.85)(21)}{280} \times \frac{600}{600 + 280} = \textbf{0.02771}$$

when ρ_{min} > ρ < ρ_{max}

Therefore, use **0.00500** for As

As = ρ b d
= (0.00500) (1800) (225)
= **2632.500** mm^2

using 20 mm bars ; Ad = 314.16

$$S = \frac{Ad\ (B)}{As} = \frac{(314.16)\ (1800)}{2632.5} = 214.8102564 \text{ mm}$$

say S = **210** mm
No of Bars= **9** pcs of 20 mm Ø RSB

APPENDIX H
BILL OF QUANTITIES

Project: **PROPOSED SEAFOOD MARKET**
Location: **: BGRY. CABALAGNAN, MUNICIPALITY OF NUEVA VALECIA, PROVINCE OF GUIMARAS**
Duration: **: 156 WORKING DAYS**

BILL OF QUANTITIES

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE (Pesos)	AMOUNT (Pesos)
	P ROPOSED SEAFOOD MARKET				
I.	**GENERAL REQUIREMENTS**				
1	Permits and Clearances	1.00	l.s	36,000.00	36,000.00
a 1	Project Billboard / Signboard	2.00	each	11,994.50	23,989.00
b 1	Occupational Safety and Health Program	6.00	mos.	34,900.00	209,400.00
c 1	Mobilization / Demobilization	1.00	l.s	240,000.00	240,000.00
d 1	Layout and Staking	1.00	lot	65,000.00	65,000.00
e **II.**	**TEMPORARY FACILITIES FOR THE ENGINEER**				-
2a	Provision of the Office for the Engineer	1.00	l.s	144,000.00	144,000.00
2b	Maintenance of the Office for the Engineer	6.00	mos.	13,800.00	82,800.00
III.	**EARTHWORKS**				-
3a	Clearing and Grubbing	1.00	lot	18,720.00	18,720.00
3b	Excavation	435.24	cu.m.	687.15	299,076.00
3c	Embankment From Excavation	536.43	cu.m.	565.06	303,114.00
3d	Gravel Bedding	29.02	cu.m.	2,879.43	83,549.40
IV.	**CIVIL WORKS**				-
4a	**Reinforcing Steel Bars**				
1	Footing	7,509.34	kgs.	75.00	576,764.89
2	Coulumn	6,288.69	kgs.	75.00	470,238.02
3	Beam	13,708.59	kgs.	75.00	142,858.29
4	Slab on Grade	6,719.33	kgs.	75.00	126,322.24
5	Slab on RD	6,719.33	kgs.	75.00	126,322.24
4b	**Concrete Works**				
6	Footing	87.05	cu.m	33,612.31	2,925,951.50
7	Coulumn	46.78	cu.m	33,961.08	1,588,699.40
8	Beam	56.43	cu.m	33,822.27	1,908,590.74
9	Slab on Grade	90.00	cu.m	33,596.67	3,023,700.00
10	Slab on RD	90.00	cu.m	33,596.67	3,023,700.00
4c	**Formworks and Scaffoldings**				
11	Footing	110.88	sq.m.		68,046.00
12	Coulumn	415.18	sq.m.		223,131.00
13	Beam	704.24	sq.m.		347,808.00
4	Slab on Grade	600.00	sq.m.		285,450.00
15	Slab on RD	600.00	sq.m.		321,500.00
V.	**Masonry Works**				-
5a	100mm CHB Non-Load Bearing (Including Steel Reinforcement)	689.64	sq.m.	1,395.90	962,668.00
VI	**ARCHITECTURAL WORKS**				-
6a	Cement Plaster Finish	1,379.28	sq.m.	1,836.27	2,532,733.64
6b	Painting Works (CHB Walls)	1,552.08	sq.m.	185.80	288,377.97
6c	Painting Works (Steel)	198.00	sq.m.	381.59	75,554.00
6d	Polished Concrete Topping	600.00	sq.m.	259.42	155,650.00
VII	**ROOFING AND CEILING WORKS**				-
7a	Roofing Works	1.00	lot	194,080.12	194,080.12
7b	Ceiling (1/2 THK Ficem - Metal Frame)	1.00	lot	159,606.50	159,606.50
VIII	**OPENINGS**				-
8a	Fabrication and Installation of Doors & Windows	1.00	l.s	718,384.00	718,384.00
IX	**PLUMBING WORKS**	1.00	lot		-
9a	DRAINAGE AND PLUMBING ACCESSORIES	1.00	lot	582,280.98	582,280.98
9b	SEPTIC VAULT	1.00	lot	137,892.56	137,892.56
9c	DETENTION TANK	1.00	lot	550,437.50	550,437.50
9d	CATCH BASIN	1.00	lot	115,019.00	115,019.00
X	**ELECTRICAL WORKS**	1.00	lot	1,387,992.56	1,387,992.56
				TOTAL CONSTRUCTION NET COST	**₱ 24,525,407.54**

THIRTEEN MILLION NINE HUNDRED FIFTEEN THOUSAND ONE HUNDRED SIXTY EIGHT PESOS AND 64 CENTAVOS

APPENDIX I
DETAILED ESTIMATES

Project: : PROPOSED SEAFOOD MARKET
Location: : BGRY. CABALAGNAN, MUNICIPALITY OF NUEVA VALECIA, PROVINCE OF GUIMARAS
Duration: : 156 WORKING DAYS

DETAILED ESTIMATE

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE (Pesos)	AMOUNT(Pesos)	
	: PROPOSED SEAFOOD MARKET					
I.	**GENERAL REQUIREMENTS**					
A.	***Permits and Clearances***	***1.00***	***l.s***			
	A. Labor:					
	Permits and Clearances	*1.00*	*l.s*	*30,000.00 / lot*	*30,000.00*	
	Sub-Total				*30,000.00*	
	Total Direct Cost			=	*30,000.00*	
	OCM			=	*1,500.00*	
	Contractor's profit			=	*1,500.00*	
	Contractor's tax			=	*3,000.00*	
	Total Indirect Cost				*6,000.00*	
	Cost of the item			=	***₱ 36,000.00***	
	Unit cost of the item			=	*36,000.00*	*/l.s*
B.	***Project Billboard / Signboard***	***2.00***	***each***			
	A. Materials:					
	Tarpaulin with text 8x8	*1*	*pc.*	*4,000.00 / pc.*	*4,000.00*	
	Tarpaulin with text 4x8	*1*	*pc.*	*4,000.00 / pc.*	*4,000.00*	
	Marine Plywood (3/4" thk)	*2*	*pcs.*	*1,250.00 / pc.*	*2,500.00*	
	Rough Lumber 2x2x8	*20*	*pcs.*	*135.00 / pc.*	*2,700.00*	
	C.W.N. Asst.	*2*	*kilos*	*145.00 / kilo*	*290.00*	
	Sub-Total				*13,490.00*	
	B. Labor:					
1	*Foreman*	*2*	*days*	*600.00 / day*	*1,200.00*	
6	*Laborer*	*2*	*days*	*400.00 / day*	*4,800.00*	
	Sub-Total				*6,000.00*	
	Minor Tools			=	*600.00*	
	Total Direct Cost			=	*19,490.00*	
	OCM			=	*975.00*	
	Contractor's profit			=	*975.00*	
	Contractor's tax			=	*1,949.00*	
	Total Indirect Cost				*3,899.00*	
	Cost of the item			=	***₱ 23,989.00***	
	Unit cost of the item			=	*11,994.50*	*/each*
C.	***Occupational Safety and Health Program***	***6.00***	***mos.***			
	A. Materials:					
	PPE	*6.00*	*mo.*	*15,000.00 / mo.*	*90,000.00*	
	Safety Signages	*1.00*	*l.s*	*15,000.00 / l.s*	*15,000.00*	
	Sub-Total				*90,000.00*	
	B. Labor:					
1	*Safety Officer*	*156*	*days*	*500.00 / day*	*78,000.00*	
	Sub-Total				*78,000.00*	
	Total Direct Cost			=	*168,000.00*	
	Minor Tools			=	*7,800.00*	
	OCM			=	*8,400.00*	
	Contractor's profit			=	*8,400.00*	
	Contractor's tax			=	*16,800.00*	
	Total Indirect Cost				*41,400.00*	
	Cost of the item			=	***₱ 209,400.00***	
	Unit cost of the item			=	*34,900.00*	*/l.s*
D.	***Mobilization / Demobilization***	***1.00***	***l.s***			
	A. Labor:					
	Mobilization / Demobilization	*1.00*	*l.s*	*200,000.00 / l.s*	*200,000.00*	
	Layout and Staking	*1.00*	*lot*	*20,000.00 / lot*	*20,000.00*	
	Sub-Total				*200,000.00*	
	Total Direct Cost			=	*200,000.00*	
	Minor Tools			=	*0.00*	
	OCM			=	*10,000.00*	
	Contractor's profit			=	*10,000.00*	
	Contractor's tax			=	*20,000.00*	
	Total Indirect Cost				*40,000.00*	
	Cost of the item			=	***₱ 240,000.00***	
	Unit cost of the item			=	*240,000.00*	*/l.s*
E.	***Layout and Staking***	***1.00***	***lot***			
	A. Labor:					
	Layout and Staking	*1.00*	*lot*	*50,000.00 / l.s*	*50,000.00*	
	Sub-Total				*50,000.00*	
	Total Direct Cost			=	*50,000.00*	
	Minor Tools			=	*5,000.00*	
	OCM			=	*2,500.00*	
	Contractor's profit			=	*2,500.00*	
	Contractor's tax			=	*5,000.00*	
	Total Indirect Cost				*15,000.00*	
	Cost of the item			=	***₱ 65,000.00***	
	Unit cost of the item			=	*65,000.00*	*/l.s*

II.	**FACILITY FOR ENGINEERS**							
A	***Provision of the Office for the Engineer***	***1.00***	***l.s***					
	Provision of the office for the Engineer	*1.00*	*l.s*	*120,000.00*	*/ l.s*		*120,000.00*	
	Sub-Total						*120,000.00*	
	Total Direct Cost					*=*	*120,000.00*	
	OCM					*=*	*6,000.00*	
	Contractor's profit					*=*	*6,000.00*	
	Contractor's tax					*=*	*12,000.00*	
	Total Indirect Cost						*24,000.00*	
	Cost of the item					***=***	***₱ 144,000.00***	
	Unit cost of the item					*=*	*144,000.00*	*/l.s*
B	***Maintenance of the Office for the Engineer***	***1.00***	***l.s***					
	Operation and maintenance of the office for the engineer	*6.00*	*mos.*	*11,500.00*	*/ mos.*		*69,000.00*	
	Sub-Total						*69,000.00*	
	Total Direct Cost					*=*	*69,000.00*	
	OCM					*=*	*3,450.00*	
	Contractor's profit					*=*	*3,450.00*	
	Contractor's tax					*=*	*6,900.00*	
	Total Indirect Cost						*13,800.00*	
	Cost of the item					***=***	***₱ 82,800.00***	
	Unit cost of the item					*=*	*82,800.00*	*/l.s*
III.	**EARTHWORKS**							
A	***Clearing and Grubbing***	***1.00***	***lot***					
	A. Labor:							
	Clearing and Grubbing	*1.00*	*lot*	*15,600.00*	*/ lot*		*15,600.00*	
	Sub-Total						*15,600.00*	
	Total Direct Cost					*=*	*15,600.00*	
	OCM					*=*	*780.00*	
	Contractor's profit					*=*	*780.00*	
	Contractor's tax					*=*	*1,560.00*	
	Total Indirect Cost						*3,120.00*	
	Cost of the item					***=***	***₱ 18,720.00***	
	Unit cost of the item					*=*	*18,720.00*	*/lot*
B	***Excavation***	***435.24***	***cu.m.***					
	A. Labor:							
	1 Foreman	*7.00*	*days*	*650.00*	*/ day*		*4,550.00*	
	8 Laborer	*7.00*	*days*	*450.00*	*/ day*		*25,200.00*	
	Sub-Total						*29,750.00*	
	B. Equipment							
	1 Backhoe	*7.00*	*days*	*31,000.00*	*/ days*		*217,000.00*	
	Sub-Total						*217,000.00*	
	Total Direct Cost					*=*	*246,750.00*	
	Minor Tools					*=*	*2,975.00*	
	OCM					*=*	*12,338.00*	
	Contractor's profit					*=*	*12,338.00*	
	Contractor's tax					*=*	*24,675.00*	
	Total Indirect Cost						*52,326.00*	
	Cost of the item					***=***	***₱ 299,076.00***	
	Unit cost of the item					*=*	*687.15*	*/cu.m.*
C	***Embankment From Excavation***	***536.43***	***cu.m.***					
	A. Materials:							
	Surplus Materials	*536.43*	*cu.m.*	*400.00*	*cu.m.*		*214,572.00*	
	Sub-Total						*214,572.00*	
	B. Labor:							
	1 Foreman	*5.00*	*days*	*650.00*	*/ day*		*3,250.00*	
	8 Laborer	*5.00*	*days*	*450.00*	*/ day*		*18,000.00*	
	Sub-Total						*21,250.00*	
	C. Equipment							
	1 Plate Compactor	*5.00*	*days*	*3,000.00*	*/ days*		*15,000.00*	
	Sub-Total						*15,000.00*	
	Total Direct Cost					*=*	*250,822.00*	
	Minor Tools					*=*	*2,125.00*	
	OCM					*=*	*12,542.00*	
	Contractor's profit					*=*	*12,542.00*	
	Contractor's tax					*=*	*25,083.00*	
	Total Indirect Cost						*52,292.00*	
	Cost of the item					***=***	***₱ 303,114.00***	
	Unit cost of the item					*=*	*565.06*	*/cu.m.*
D	***Gravel Bedding (100mm thk)***	***29.02***	***cu.m.***					
	A. Materials							
	Screened Gravel	*29.02*	*cu.m.*	*1,400.00*	*/ cu.m.*		*40,622.40*	
	Sub-Total						*40,622.40*	
	B. Labor:							
	1 Foreman	*4.00*	*days*	*650.00*	*/ day*		*2,600.00*	
	8 Laborer	*4.00*	*days*	*450.00*	*/ day*		*14,400.00*	
	Sub-Total						*17,000.00*	
	C. Equipment							
	1 Plate Compactor	*4.00*	*days*	*3,000.00*	*/ days*		*12,000.00*	
	Sub-Total						*12,000.00*	
	Total Direct Cost					*=*	*69,622.40*	
	OCM					*=*	*3,482.00*	
	Contractor's profit					*=*	*3,482.00*	
	Contractor's tax					*=*	*6,963.00*	
	Total Indirect Cost						*13,927.00*	
	Cost of the item					***=***	***₱ 83,549.40***	
	Unit cost of the item					*=*	*2,879.43*	*/cu.m.*

IV.	**CIVIL WORKS**						
A	***REINFORCE STEEL BARS***		***40,539.88***	***0.00***			
		FOOTING					
	A. Materials						
		20mm dia. RSB	*7,434.99*	*kgs.*	*60.50 / kg.*		*449,816.90*
		#16 GI Tie Wire	*74.35*	*kgs.*	*80.00 / kg.*		*5,947.99*
		Sub-Total					*455,764.89*
	B. Labor:						
	1	*Foreman*	*11.00*	*days*	*650.00 / day*		*7,150.00*
	6	*Skilled Workers*	*11.00*	*days*	*600.00 / day*		*39,600.00*
	15	*Laborer*	*11.00*	*days*	*450.00 / day*		*74,250.00*
		Sub-Total					*121,000.00*
		Total for footing					*576,764.89*
		COLUMN					
	C. Materials						
		12mm dia. RSB	*767.23*	*kgs.*	*60.50 / kg.*		*46,417.54*
		16mm dia. RSB	*132.64*	*kgs.*	*60.50 / kg.*		*8,024.48*
		25mm dia. RSB	*5,326.56*	*kgs.*	*60.50 / kg.*		*322,256.88*
		#16 GI Tie Wire	*62.26*	*kgs.*	*80.00 / kg.*		*4,981.14*
		Sub-Total					*327,238.02*
	D. Labor:						
	1	*Foreman*	*13.00*	*days*	*650.00 / day*		*8,450.00*
	6	*Skilled Workers*	*13.00*	*days*	*600.00 / day*		*46,800.00*
	15	*Laborer*	*13.00*	*days*	*450.00 / day*		*87,750.00*
		Sub-Total					*143,000.00*
		Total for Column					*470,238.02*
		BEAM					
	E. Materials						
		12mm dia. RSB	*2,919.74*	*kgs.*	*60.50 / kg.*		*176,644.51*
		20mm dia. RSB	*10,653.12*	*kgs.*	*60.50 / kg.*		*644,513.76*
		#16 GI Tie Wire	*135.73*	*kgs.*	*80.00 / kg.*		*10,858.29*
		Sub-Total					*10,858.29*
	F. Labor:						
	1	*Foreman*	*12.00*	*days*	*650.00 / day*		*7,800.00*
	6	*Skilled Workers*	*12.00*	*days*	*600.00 / day*		*43,200.00*
	15	*Laborer*	*12.00*	*days*	*450.00 / day*		*81,000.00*
		Sub-Total					*132,000.00*
		Total for Beam					*142,858.29*
		SLAB ON GRADE					
	G. Materials						
		10mm dia. RSB	*6,652.80*	*kgs.*	*60.50 / kg.*		*402,494.40*
		#16 GI Tie Wire	*66.53*	*kgs.*	*80.00 / kg.*		*5,322.24*
		Sub-Total					*5,322.24*
	H. Labor:						
	1	*Foreman*	*11.00*	*days*	*650.00 / day*		*7,150.00*
	6	*Skilled Workers*	*11.00*	*days*	*600.00 / day*		*39,600.00*
	15	*Laborer*	*11.00*	*days*	*450.00 / day*		*74,250.00*
		Sub-Total					*121,000.00*
		Total for SG					*126,322.24*
		ROOF DECK					
	I. Materials						
		10mm dia. RSB	*6,652.80*	*kgs.*	*60.50 / kg.*		*402,494.40*
		#16 GI Tie Wire	*66.53*	*kgs.*	*80.00 / kg.*		*5,322.24*
		Sub-Total					*5,322.24*
	J. Labor:						
	1	*Foreman*	*11.00*	*days*	*650.00 / day*		*7,150.00*
	6	*Skilled Workers*	*11.00*	*days*	*600.00 / day*		*39,600.00*
	15	*Laborer*	*11.00*	*days*	*450.00 / day*		*74,250.00*
		Sub-Total					*121,000.00*
		Total for RD					*126,322.24*
		Total Direct Cost				=	*1,442,505.68*
		Minor Tools				=	*63,800.00*
		OCM				=	*72,126.00*
		Contractor's profit				=	*72,126.00*
		Contractor's tax				=	*144,251.00*
		Total Indirect Cost					*352,303.00*
		Cost of the item				**=**	***₱ 1,794,808.68***
		Unit cost of the item				=	*44.27 /kg.*
B	***Concrete Works***		***370.26***	***0.00***			
		FOOTING					
	A. Materials						
		Portland Cement	*1,131.65*	*bags*	*210.00 / bag*		*237,646.50*
		Washed Sand	*566.00*	*cu.m.*	*1,200.00 / cu.m.*		*679,200.00*
		Screened Gravel	*1,131.70*	*-*	*1,400.00 / -*		*1,584,380.00*
		Sub-Total					*2,501,226.50*
	B. Labor:						
	1	*Foreman*	*3.00*	*day*	*650.00 / day*		*1,950.00*
	6	*Skilled Workers*	*3.00*	*days*	*600.00 / day*		*10,800.00*
	15	*Laborer*	*3.00*	*day*	*450.00 / day*		*20,250.00*
		Sub-Total					*33,000.00*
	C. Equipment						
	1	*Transit Mixer*	*87.05*	*cu.m*	*4,500.00 / cu.m*		*391,725.00*
		Sub-Total					*391,725.00*
							2,925,951.50
		COLUMN					
	D. Materials						
		Portland Cement	*608.14*	*bags*	*210.00 bag*		*127,709.40*
		Washed Sand	*305.00*	*cu.m.*	*1,200.00 cu.m.*		*366,000.00*
		Screened Gravel	*608.20*	*cu.m.*	*1,400.00 cu.m.*		*851,480.00*
		Sub-Total					*1,345,189.40*
	E. Labor:						
	1	*Foreman*	*3.00*	*day*	*650.00 / day*		*1,950.00*
	6	*Skilled Workers*	*3.00*	*days*	*600.00 / day*		*10,800.00*
	15	*Laborer*	*3.00*	*day*	*450.00 / day*		*20,250.00*
		Sub-Total					*33,000.00*
	F. Equipment						
	1	*Transit Mixer*	*46.78*	*cu.m*	*4,500.00 / cu.m*		*210,510.00*
		Sub-Total					*210,510.00*
							1,588,699.40

		BEAM							
G. Materials									
		Portland Cement		733.69	bags	210.00	/ bag	154,075.74	
		Washed Sand		367.00	cu.m.	1,200.00	/ cu.m.	440,400.00	
		Screened Gravel		733.70	cu.m.	1,400.00	/ cu.m.	1,027,180.00	
			Sub-Total					1,621,655.74	
H. Labor:									
1		Foreman		3.00	day	650.00	/ day	1,950.00	
6		Skilled Workers		3.00	days	600.00	/ day	10,800.00	
15		Laborer		3.00	day	450.00	/ day	20,250.00	
			Sub-Total					33,000.00	
I. Equipment									
1		Transit Mixer		56.43	cu.m	4,500.00	/ cu.m	253,935.00	
			Sub-Total					253,935.00	
								1,908,590.74	
		SLAB ON GRADE							
J. Materials									
		Portland Cement		1,170.00	bags	210.00	bag	245,700.00	
		Washed Sand		585.00	cu.m.	1,200.00	cu.m.	702,000.00	
		Screened Gravel		1,170.00	cu.m.	1,400.00	cu.m.	1,638,000.00	
			Sub-Total					2,585,700.00	
K. Labor:									
1		Foreman		3.00	day	650.00	/ day	1,950.00	
6		Skilled Workers		3.00	days	600.00	/ day	10,800.00	
15		Laborer		3.00	day	450.00	/ day	20,250.00	
			Sub-Total					33,000.00	
L. Equipment									
1		Transit Mixer		90.00	cu.m	4,500.00	/ cu.m	405,000.00	
								405,000.00	
								3,023,700.00	
		ROOF DECK							
M. Materials									
		Portland Cement		1,170.00	bags	210.00	bag	245,700.00	
		Washed Sand		585.00	cu.m.	1,200.00	cu.m.	702,000.00	
		Screened Gravel		1,170.00	cu.m.	1,400.00	cu.m.	1,638,000.00	
			Sub-Total					2,585,700.00	
N. Labor:									
1		Foreman		3.00	day	650.00	/ day	1,950.00	
6		Skilled Workers		3.00	days	600.00	/ day	10,800.00	
15		Laborer		3.00	day	450.00	/ day	20,250.00	
			Sub-Total					33,000.00	
O. Equipment:									
1		Transit Mixer		90.00	cu.m	4,500.00	/ cu.m	405,000.00	
			Sub-Total					405,000.00	########
			Total Direct Cost				=	12,470,641.64	########
			Minor Tools				=	16,500.00	
			OCM				=	623,533.00	
			Contractor's profit				=	623,533.00	
			Contractor's tax				=	1,247,065.00	
			Total Indirect Cost					2,510,631.00	
			Cost of the item				**=**	**₱ 14,981,272.64**	
			Unit cost of the item				=	40,461.49	/cu.m.
C	**Formworks and Scaffoldings**			**2,015.12**	**sqm**				
		FOOTING							
A. Materials									
		Forms and Scaffoldings		110.88	sqm	450.00	/ sqm	49,896.00	
			Sub-Total					49,896.00	
B. Labor:									
1		Foreman		3.00	day	650.00	/ day	1,950.00	
12		Laborer		3.00	day	450.00	/ day	16,200.00	
			Sub-Total					18,150.00	
								68,046.00	
		COLUMN							
C. Materials									
		Forms and Scaffoldings		415.18	sqm	450.00	sqm	186,831.00	
			Sub-Total					186,831.00	
D. Labor:									
1		Foreman		6.00	day	650.00	/ day	3,900.00	
12		Laborer		6.00	day	450.00	/ day	32,400.00	
			Sub-Total					36,300.00	
								223,131.00	
		BEAM							
E. Materials									
		Forms and Scaffoldings		704.24	sqm	450.00	sqm	316,908.00	
			Sub-Total					316,908.00	
F. Labor:									
1		Foreman		6.00	day	650.00	/ day	3,900.00	
10		Laborer		6.00	day	450.00	/ day	27,000.00	
			Sub-Total					30,900.00	
								347,808.00	
		SLAB ON GRADE							
G. Materials									
		Forms and Scaffoldings		600.00	sqm	450.00	sqm	270,000.00	
			Sub-Total					270,000.00	
H. Labor:									
1		Foreman		3.00	day	650.00	/ day	1,950.00	
10		Laborer		3.00	day	450.00	/ day	13,500.00	
			Sub-Total					15,450.00	
								285,450.00	
		ROOF DECK							
I. Materials									
		Forms and Scaffoldings		600.00	sqm	450.00	sqm	270,000.00	
			Sub-Total					270,000.00	
J. Labor:									
1		Foreman		10.00	day	650.00	/ day	6,500.00	
10		Laborer		10.00	day	450.00	/ day	45,000.00	
			Sub-Total					51,500.00	
								321,500.00	
			Total Direct Cost				=	1,245,935.00	
			Minor Tools				=	15,230.00	
			OCM				=	62,297.00	
			Contractor's profit				=	62,297.00	
			Contractor's tax				=	124,594.00	
			Total Indirect Cost					264,418.00	
			Cost of the item				**=**	**₱ 1,510,353.00**	
			Unit cost of the item				=	749.51	/sqm

V MASONRY WORKS

A 100mm CHB Non-Load Bearing (Including Steel Reinforcement) — 689.64 sq.m.

A. Materials

CHB 4"	14,698.00	pcs.	18.00 / pc.	264,564.00
Portland Cement	594.00	bags	210.00 / bag	124,740.00
Fine Aggregates	50.00	cu.m.	1,200.00 / cu.m.	60,000.00
Reinforcing Steel	3,663.00	kgs.	58.00 / kg	212,454.00
#16 Tie Wire	57.00	kgs.	80.00 / kg	4,560.00
Sub-Total				666,318.00

B. Labor:

1	Foreman	13.00	days	650.00 / day	8,450.00
6	Skilled Workers	13.00	days	600.00 / day	46,800.00
12	Laborer	13.00	days	450.00 / day	70,200.00
	Sub-Total				125,450.00

Total Direct Cost	=		791,768.00
Minor Tools	=		12,545.00
OCM	=		39,589.00
Contractor's profit	=		39,589.00
Contractor's tax	=		79,177.00
Total Indirect Cost			170,900.00
Cost of the item	**=**	**₱**	**962,668.00**
Unit cost of the item	=		1,395.90 /sq.m.

VI ARCHITECTURAL WORKS

A Cement Plaster Finish — 1,379.28 sq.m.

A. Materials

Portland Cement	896.53	bags	2,100.00 / bag	1,882,717.20
Fine Aggregates	55.17	cu.m.	1,200.00 / cu.m.	66,205.44
Sub-Total				1,948,922.64

B. Labor:

1	Foreman	15.00	days	650.00 / day	9,750.00
8	Skilled Worker	15.00	days	600.00 / day	72,000.00
10	Laborer	15.00	days	450.00 / day	67,500.00
	Sub-Total				149,250.00

Total Direct Cost	=		2,098,172.64
Minor Tools	=		14,925.00
OCM	=		104,909.00
Contractor's profit	=		104,909.00
Contractor's tax	=		209,818.00
Total Indirect Cost			434,561.00
Cost of the item	**=**	**₱**	**2,532,733.64**
Unit cost of the item	=		1,836.27 /sq.m.

B Painting Works (CHB Walls) — 1,552.08 sq.m.

A. Materials

Concrete Neutralizer	31.59	gal.	250.00 / gal	7,896.76
Concrete Sealer/Primer	63.17	gal.	120.00 / gal	7,580.89
Patching Compound	79.60	gal.	520.00 / gal	41,391.66
Semi Gloss Latex (two coats)	124.45	gal.	560.00 / gal	69,693.66
Sub-Total				126,562.97

B. Labor:

1	Foreman	12.00	days	650.00 / day	7,800.00
6	Skilled Worker	12.00	days	600.00 / day	43,200.00
10	Laborer	12.00	days	450.00 / day	54,000.00
	Sub-Total				105,000.00

Total Direct Cost	=		231,562.97
Minor Tools	=		10,500.00
OCM	=		11,579.00
Contractor's profit	=		11,579.00
Contractor's tax	=		23,157.00
Total Indirect Cost			56,815.00
Cost of the item	**=**	**₱**	**288,377.97**
Unit cost of the item	=		185.80 /sq.m.

C Painting Works (Steel) — 198.00 sq.m.

A. Materials

Red Oxide Primer	9.00	gal.	780.00 / gal.	7,020.00
Enamel Paint	20.00	gal.	520.00 / gal.	10,400.00
Paint thinner	50.00	lit.	120.00 / lit.	6,000.00
Sub-Total				23,420.00

B. Labor:

1	Foreman	10.00	day	650.00 / day	6,500.00
2	Skilled Worker	10.00	day	600.00 / day	12,000.00
4	Laborer	10.00	day	450.00 / day	18,000.00
	Sub-Total				36,500.00

Total Direct Cost	=		59,920.00
Minor Tools	=		3,650.00
OCM	=		2,996.00
Contractor's profit	=		2,996.00
Contractor's tax	=		5,992.00
Total Indirect Cost			15,634.00
Cost of the item	**=**	**₱**	**75,554.00**
Unit cost of the item	=		381.59 /sq.m.

D Polished Concrete Topping — 600.00 sq.m.

A. Materials

Cement	120.00	bags	210.00 / bag	25,200.00
Sand	60.00	cu.m.	1,200.00 / cu.m	72,000.00
Almagre (25 bags)	60.00	bags	150.00 / bag	9,000.00
Sub-Total				106,200.00

B. Labor:

1	Foreman	2.00	day	650.00 / day	1,300.00
8	Skilled Worker	2.00	day	600.00 / day	9,600.00
12	Laborer	2.00	day	450.00 / day	10,800.00
	Sub-Total				21,700.00

Total Direct Cost	=		127,900.00
Minor Tools	=		2,170.00
OCM	=		6,395.00
Contractor's profit	=		6,395.00
Contractor's tax	=		12,790.00
Total Indirect Cost			27,750.00
Cost of the item	**=**	**₱**	**155,650.00**
Unit cost of the item	=		259.42 /sq.m.

VII	**ROOFING AND CEILING WORKS**	**1.00**	**lot**					
A	**Roofing Works**	**1.00**	**lot**					
	A. Materials							
	1.2MM THKX50MMX75MM C-PURLINS	15.00	pcs	1,000.00	/	pc	15,000.00	
	150MM x 75MM x 2.0 MM THK C-PURLINS W/ 10 MM RSB WEB BARS SPACED @ 0.3M	24.00	pcs	1,250.00	/	pc	30,000.00	
	Prepainted Metal Sheets (Long Span,0.4mm thk)	68.06	sq.m	420.00	/	sq.m.	28,585.20	
	Fascia Cover	36.00	pcs	185.00	/	pc	6,660.00	
	Gutter	8.20	pcs	185.00	/	pc	1,517.00	
	Teck screw	67.46	pcs	2.00	/	pc	134.92	
	Blind rivets	5.00	pcs	1.00	/	pc	5.00	
	Cutting disk	12.00	pcs	250.00	/	pc	3,000.00	
	grinding disk	5.00	pcs	250.00	/	pc	1,250.00	
	Welding Rod	20.00	kgs.	120.00	/	pc	2,400.00	
	Sub-Total						88,552.12	
	B. Labor:							
1	Foreman	7.00	days	650.00	/	day	4,550.00	
6	Skilled Worker	7.00	days	600.00	/	day	25,200.00	
12	Laborer	7.00	days	450.00	/	day	37,800.00	
	Sub-Total						67,550.00	
	Total Direct Cost					=	156,102.12	
	Minor Cost					=	6,755.00	
	OCM					=	7,806.00	
	Contractor's profit					=	7,806.00	
	Contractor's tax					=	15,611.00	
	Total Indirect Cost						37,978.00	
	Cost of the item					**=**	**₱ 194,080.12**	
	Unit cost of the item					=	194,080.12	/lot
B	**Ceiling (1/2 THK Ficem - Metal Frame)**	**1.00**	**lot**					
	A. Materials							
	1/2 Thnk. Ficem Board	60.00	pcs	550.00	/	pc	33,000.00	
	Metal Furring (3m length)	187.00	pcs	200.00	/	pc	37,400.00	
	Carrying Channels	60.00	pcs	170.00	/	pc	10,200.00	
	Hanger Bars/ Rod	164.00	pcs	90.00	/	pc	14,760.00	
	Channel	5.00	pcs	10.00	/	pc	50.00	
	Wall Angle	40.00	pcs	130.00	/	pc	5,200.00	
	Rivets	2,299.00	pcs	1.50	/	pc	3,448.50	
	1" Metal Screw	658.00	pcs	2.50	/	pc	1,645.00	
	Sub-Total						105,703.50	
	B. Labor:						.	
1	Project Engineer	3.00	days	850.00	/	day	2,550.00	
1	Foreman	3.00	days	650.00	/	day	1,950.00	
4	Skilled Worker	3.00	days	600.00	/	day	7,200.00	
10	Laborer	3.00	days	450.00	/	day	13,500.00	
	Sub-Total						25,200.00	
	Total Direct Cost					=	130,903.50	
	Minor Tools					=	2,520.00	
	OCM					=	6,546.00	
	Contractor's profit					=	6,546.00	
	Contractor's tax					=	13,091.00	
	Total Indirect Cost						28,703.00	
	Cost of the item					**=**	**₱ 159,606.50**	
	Unit cost of the item					=	159,606.50	/lot
VIII	**OPENINGS**	**1.00**	**lot**					
A	**Fabrication and Installation of Doors and Windows**	**1.00**	**lot**					
	A. Materials							
	D1- 2100mm x 2625mm ALUMINUM ROLL UP DOOR ENTRANCE AND EXIT 2 COLD STORAGE	2.00	sets	22,260.00	/	set	44,520.00	
	D3 - 2100mm x 1200mm, WOODEN PANEL DOOR LOCATED AT OFFICE	1.00	sets	25,200.00	/	set	25,200.00	
	D4 - 2100mm x 800mm PVC PANEL DOOR WITH LOUVER LOCATED AT COMFORT ROOM	1.00	sets	20,000.00	/	set	20,000.00	
	W1 - 1200mm x 5325mm PREPAINTED TUBULAR 25MMX200MM G.I. FRAMING WITH 25MMX25MM G.I. WINDOW PREPAINTED WELDED TUBULAR 25MMX25MM G.I. WINDOW GRILLS	2.00	sets	8,500.00	/	set	17,000.00	
		1.00	lot	170,000.00	/	set	170,000.00	
	W2 - 1200mm x 5325mm PREPAINTED TUBULAR 25MMX200MM G.I. FRAMING WITH 25MMX25MM G.I. WINDOW PREPAINTED WELDED TUBULAR 25MMX25MM G.I. WINDOW GRILLS	1.00	lot	174,600.00	/	set	174,600.00	
	Sub-Total						451,320.00	
	B. Labor:							
1	Foreman	20.00	days	650.00	/	day	13,000.00	
4	Skilled Worker	20.00	days	600.00	/	day	48,000.00	
10	Laborer	20.00	days	375.00	/	day	75,000.00	
	Sub-Total						136,000.00	
	Total Direct Cost					=	587,320.00	
	Minor Cost					=	13,600.00	
	OCM					=	29,366.00	
	Contractor's profit					=	29,366.00	
	Contractor's tax					=	58,732.00	
	Total Indirect Cost						131,064.00	
	Cost of the item					**=**	**₱ 718,384.00**	
	Unit cost of the item					=	718,384.00	/l.s

IX	**PLUMBING WORKS**		**1.00**	**lot**					
A	***DRAINAGE AND PLUMBING ACCESSORIES***								
	A. Materials								
		water closet & Lavatory complete w/fittings & accessories		*4*	*sets*	*7,000.00*	*/*	*set*	*28,000.00*
		floor drain							
		Cold Water Line Distribution System							
		PPR Pipes							
		25mm dia		*385*	*lm*	*271.76*	*/*	*pc*	*104,625.68*
		90 º Elbow							
		25mm dia		*35*	*pc/s*	*67.32*	*/*	*pc*	*2,356.20*
		Tee Equal							
		25mm dia		*7*	*pc/s*	*81.18*	*/*	*pc*	*568.26*
		Female Threaded Apdapter							
		25mm dia		*5*	*pc/s*	*999.01*	*/*	*pc*	*4,995.07*
		End Caps							
		25mm dia		*5*	*pc/s*	*51.36*	*/*	*pc*	*256.81*
		Coupling							
		25mm dia		*10*	*pc/s*	*58.91*	*/*	*pc*	*589.05*
		Gate Valve							
		25mm dia		*2*	*pc/s*	*6,445.12*	*/*	*pc*	*12,890.24*
		Water Meter 25mmØ		*3*	*set/s*	*18,050.56*	*/*	*pc*	*54,151.68*
		Miscellaneous and Consumables		*1*	*lot*	*5,000.00*	*/*	*pc*	*5,000.00*
		Water Consumption for market until project is fully turned ove		*1*	*lot*	*170,000.00*	*/*	*pc*	*170,000.00*
		Testing and Commissioning		*1*	*lot*	*25,000.00*	*/*	*pc*	*25,000.00*
		Others (please specify)							
		Water tank		*1*	*lot*	*25,000.00*	*/*	*pc*	*25,000.00*
		Sub-Total							*405,432.98*
	B. Labor								
	1	*Foreman*	*12.00*		*days*	*650.00*	*/ day*		*7,800.00*
	4	*Skilled Worker*	*12.00*		*days*	*600.00*	*/ day*		*28,800.00*
	8	*Laborer*	*12.00*		*days*	*450.00*	*/ day*		*43,200.00*
		Sub-Total							*79,800.00*
		Total Direct Cost						*=*	*485,232.98*
		OCM						*=*	*24,262.00*
		Contractor's profit						*=*	*24,262.00*
		Contractor's tax						*=*	*48,524.00*
		Total Indirect Cost							*97,048.00*
		Cost of the item						***=***	***₱ 582,280.98***
		Unit cost of the item						*=*	*582,280.98* */lot*
B	***Septic Vault***								
	A. Materials								
		Structural Concrete for Slab on fill, and Cover (0.5 cu.m)							
		Coarse Aggregates	*4.50*		*cu.m*	*1,400.00*	*/ cu.m*		*6,300.00*
		Fine Aggregates	*2.25*		*cu.m*	*1,200.00*	*/ cu.m*		*2,700.00*
		Portland Cement	*45.00*		*bags*	*210.00*	*/ bag*		*9,450.00*
		Reinforcing Steel of Reinforced Concrete Structures (125.21 KGS)							
		10mm RSB	*356.00*		*kgs*	*50.00*	*/ kgs*		*17,800.00*
		Formworks and Falseworks (for Septic Vault)							
		6mmx1.2mx2.4m ord. plywood	*4.00*		*pcs*	*370.00*	*/ pc*		*1,480.00*
		Coco Lumber	*48.00*		*bd ft*	*25.00*	*/ bd ft*		*1,200.00*
		Assorted Common Wire Nails	*1.00*		*kg*	*100.00*	*/ kg*		*100.00*
		100mm CHB Non-Load Bearing (including RSB) (20.25 sq.m)							
		100 mm thk CHB (Non-Load Bearing)	*525.00*		*pc*	*18.00*	*/ pc*		*9,450.00*
		Portland Cement	*34.13*		*bag*	*210.00*	*/ bag*		*7,166.25*
		Fine Aggregates	*1.71*		*cu.m*	*1,200.00*	*/ cu.m*		*2,047.50*
		reinforcing steel	*34.00*		*kg*	*50.00*	*/ kg*		*1,700.00*
		#16 Tie wire	*2.00*		*kg*	*80.00*	*/ kg*		*160.00*
		Cement Plaster Finish (24.75 sq.m)							
		Portland Cement	*2.22*		*bags*	*210.00*	*/ bag*		*465.81*
		Fine Aggregates	*0.30*		*cu.m*	*1,300.00*	*/ cu.m*		*390.00*
		Sub-Total							*60,409.56*
	B. Labor								
	1	*Foreman*	*10.00*		*days*	*650.00*	*/ day*		*6,500.00*
	2	*Skilled Worker*	*10.00*		*days*	*600.00*	*/ day*		*12,000.00*
	8	*Laborer*	*10.00*		*days*	*450.00*	*/ day*		*36,000.00*
		Sub-Total							*54,500.00*
		Total Direct Cost						*=*	*114,909.56*
		OCM						*=*	*5,746.00*
		Contractor's profit						*=*	*5,746.00*
		Contractor's tax						*=*	*11,491.00*
		Total Indirect Cost							*22,983.00*
		Cost of the item						***=***	***₱ 137,892.56***
		Unit cost of the item						*=*	*137,892.56* */lot*
C	***Detention Tank***		***1.00***	***lot***					
	A. Materials								
		Structural Concrete for Slab on fill, and Cover (0.5 cu.m)							
		Coarse Aggregates	*8.00*		*cu.m*	*1,400.00*	*/ cu.m*		*11,200.00*
		Fine Aggregates	*0.40*		*cu.m*	*1,200.00*	*/ cu.m*		*480.00*
		Portland Cement	*104.00*		*bags*	*210.00*	*/ bag*		*21,840.00*
		Reinforcing Steel of Reinforced Concrete Structures (125.21 KGS)							
		10mm RSB	*4,983.00*		*kgs*	*50.00*	*/ kgs*		*249,150.00*
		Formworks and Falseworks (for Septic Vault)							
		6mmx1.2mx2.4m ord. plywood	*48.00*		*pcs*	*370.00*	*/ pc*		*17,760.00*
		Coco Lumber	*96.00*		*bd ft*	*25.00*	*/ bd ft*		*2,400.00*
		Assorted Common Wire Nails	*15.00*		*kg*	*65.00*	*/ kg*		*975.00*
		100mm CHB Non-Load Bearing (including RSB) (20.25 sq.m)							
		100 mm thk CHB (Non-Load Bearing)	*1,950.00*		*pc*	*18.00*	*/ pc*		*35,100.00*
		Portland Cement	*126.75*		*bag*	*210.00*	*/ bag*		*26,617.50*
		Fine Aggregates	*6.34*		*cu.m*	*1,200.00*	*/ cu.m*		*7,605.00*
		reinforcing steel	*354.00*		*kg*	*50.00*	*/ kg*		*17,700.00*
		#16 Tie wire	*20.00*		*kg*	*80.00*	*/ kg*		*1,600.00*
		Cement Plaster Finish (24.75 sq.m)							
		Portland Cement	*48.00*		*bags*	*210.00*	*/ bag*		*10,080.00*
		Fine Aggregates	*1.30*		*cu.m*	*1,300.00*	*/ cu.m*		*1,690.00*
		Sub-Total							*404,197.50*
	B. Labor								
	1	*Foreman*	*10.00*		*days*	*650.00*	*/ day*		*6,500.00*
	2	*Skilled Worker*	*10.00*		*days*	*600.00*	*/ day*		*12,000.00*
	8	*Laborer*	*10.00*		*days*	*450.00*	*/ day*		*36,000.00*
		Sub-Total							*54,500.00*
		Total Direct Cost						*=*	*458,697.50*
		OCM						*=*	*22,935.00*
		Contractor's profit						*=*	*22,935.00*
		Contractor's tax						*=*	*45,870.00*
		Total Indirect Cost							*91,740.00*
		Cost of the item						***=***	***₱ 550,437.50***
		Unit cost of the item						*=*	*550,437.50* */lot*

D	**CATCH BASIN**	**1.00**	**lot**					
	A. Materials							
	Structural Concrete for Slab on fill, and Cover (0.93 cu.m)							
	Coarse Aggregates	2.00	cu.m	1,400.00	/	cu.m	2,800.00	
	Fine Aggregates	1.00	cu.m	1,200.00	/	cu.m	1,200.00	
	Portland Cement	13.00	bags	210.00	/	bag	2,730.00	
	#16 Tie wire	1.00	kg	80.00	/	kg	80.00	
	Reinforcing Steel of Reinforced Concrete Structures (79.8 KGS)							
	10mm RSB	1,040.00	kgs	50.00	/	kgs	52,000.00	
	Formworks and Falseworks (for Septic Vault)							
	6mmx1.2mx2.4m ord. plywood	31.60	pcs	370.00	/	pc	11,692.00	
	Coco Lumber	24.00	bd ft	25.00	/	bd ft	600.00	
	Assorted Common Wire Nails	1.00	kg	100.00	/	kg	100.00	
	Sub-Total						71,202.00	
	B. Labor							
1	Foreman	5.00	days	650.00	/	day	3,250.00	
2	Skilled Worker	5.00	days	600.00	/	day	6,000.00	
6	Laborer	5.00	days	450.00	/	day	13,500.00	
	Sub-Total						22,750.00	
	Total Direct Cost					=	93,952.00	
	OCM					=	4,698.00	
	Minor Tools					=	2,275.00	
	Contractor's profit					=	4,698.00	
	Contractor's tax					=	9,396.00	
	Total Indirect Cost						21,067.00	
	Cost of the item					**=**	**₱ 115,019.00**	
	Unit cost of the item					=	115,019.00	/lot
X	**ELECTRICAL WORKS**	**1.00**	**lot**					
	A. Materials							
	Panel Board (OLP) Nema-1, Surface Mounted, MCCB	1.00	assy	56,265.65	/	assy	56,265.65	
	Main				/			
	1 - 70AT/100AF, 3P				/			
	Branches				/			
	5 - 30AT/100AF, 2P				/			
	Wires and Cables				/			
	22 mm² THWN	140.00	lm	496.69	/	lm	69,536.88	
	14 mm² THWN	120.00	lm	409.64	/	lm	49,156.80	
	5.5 mm² THWN	180.00	lm	89.94	/	lm	16,188.48	
	3.5 mm² THWN	427.00	lm	68.94	/	lm	29,435.67	
	Conduits				/		0.00	
	63mmØ PVC	380.00	lm	331.72	/	lm	126,052.08	
	15mmØ PVC	480.00	lm	74.84	/	lm	35,925.12	
	Pull Box, Utility Box, Junction Box				/		0.00	
	Junction Box	20.00	pc/s	139.52	/	pc/s	2,790.48	
	Utility Box	48.00	pc/s	130.28	/	pc/s	6,253.63	
	Square Box	8.00	pc/s	148.76	/	pc/s	1,190.11	
	Wiring Devices				/		0.00	
	Single Gang Snap Switch	6.00	pc/s	745.18	/	pc/s	4,471.07	
	Two Gang Snap Switch	3.00	pc/s	871.72	/	pc/s	2,615.17	
	20A, 2P+G, 250V Duplex Receptacle Outlet	20.00	pc/s	1,056.37	/	pc/s	21,127.40	
	Freezer Outlet	3.00	set	1,744.96	/	set	5,234.88	
	Lighting Fixtures				/		0.00	
	Downlight 10W PL, 150mmØ	17.00	pc/s	1,337.77	/	pc/s	22,742.09	
	Exhaust Fan	2.00	set	5,458.12	/	set	10,916.25	
	Emergency Light with 1.5 Hr. Battery Back-Up	6.00	set	6,650.70	/	set	39,904.20	
	2 Hp WAC, 220v/1ph/60hz	3.00	unit	55,250.00	/	unit	165,750.00	
	KiloWatt Hour Meter	3.00	unit	10,710.00	/	unit	32,130.00	
	Connector, Locknut and Bushing	1.00	lot	7,000.00	/	lot	7,000.00	
	Miscellaneous and Consumables (Pull Wire, Nail, Torch, Pai	1.00	lot	14,000.00	/	lot	14,000.00	
	Electric Consumption for Market until project is fully turned o	1.00	lot	90,000.00	/	lot	90,000.00	
	Others (please specify)							
	Solar Panels	20.00	units	9,500.00	/	lot	190,000.00	
	Sub-Total						998,685.96	
	B. Labor							
1	Foreman	13.00	days	650.00	/	day	8,450.00	
4	Skilled Worker	13.00	days	600.00	/	day	31,200.00	
6	Laborer	13.00	days	450.00	/	day	35,100.00	
	Sub-Total						74,750.00	
	Total Direct Cost					=	1,073,435.96	
	Minor Tools					=	99,868.60	
	OCM					=	53,672.00	
	Contractor's profit					=	53,672.00	
	Contractor's tax					=	107,344.00	
	Total Indirect Cost						314,556.60	
	Cost of the item					**=**	**₱ 1,387,992.56**	
	Unit cost of the item					=	1,387,992.56	/lot

	SUMMARY:		
I	**TOTAL PROJECT COST**	**₱**	24,525,407.54

APPENDIX J
PROJECT SCHEDULING

PROJECT SCHEDULE

Project Duration: 156 Calendar Days

Project Name: PROPOSED SEAFOOD MARKET AT BGRY. CABALAGNAN, MUNICIPALITY OF NUEVA VALECIA, PROVINCE OF GUIMARAS

ITEM NO.	DESCRIPTION	COST	WEIGHTED PERCENTAGE		DURATION	CALENDAR WEEKS (7 days every week)
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
I.	**GENERAL REQUIREMENTS**																												
	Permits and Clearances	₱36,000.00	0.147%	0.147%	14.00	0.073%	0.073%																						
	Project Billboard / Signboard	₱23,989.00	0.098%	0.098%	2.00			0.098%																					
	Occupational Safety and Health Program	₱209,400.00	0.854%	0.854%	138.50			0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%	0.039%
	Mobilization / Demobilization	₱240,000.00	0.979%	0.979%	7.00			0.489%																					0.489%
	Layout and Staking	₱65,000.00	0.265%	0.265%	3.00			0.265%																					
II.	**FACILITIES OF THE ENGINEER**																												
	Provision of the Office for the Engineer	₱144,000.00	0.587%	0.587%	5.00				0.587%																				
	Maintenance of the Office for the Engineer	₱82,800.00	0.338%	0.338%	130.00					0.017%	0.017%	0.017%	0.017%	0.017%	0.017%	0.017%	0.017%	0.017%	0.017%	0.017%	0.017%	0.017%	0.017%	0.017%	0.017%	0.017%	0.017%	0.017%	0.017%
III.	**EARTHWORKS**																												
	Clearing and Grubbing	₱18,720.00	0.076%	0.076%	2.00				0.076%																				
	Excavation	₱299,076.00	1.219%	1.219%	7.00				0.348%	0.871%																			
	Embankment From Excavation	₱303,114.00	1.236%	1.236%	5.00					1.236%																			
	Gravel Bedding	₱83,549.40	0.341%	0.341%	4.00					0.341%																			
IV.	**CIVIL WORKS**																												
	* **REINFORCEMENT STEEL BARS**																												
	Footing	₱576,764.89	2.352%	2.352%	11.00						1.283%	1.069%																	
	Column	₱470,238.02	1.917%	1.917%	13.00							0.147%	0.885%	0.885%															
	Beam	₱142,858.29	0.582%	0.582%	12.00										0.291%	0.291%													
	Slab on Grade	₱126,322.24	0.515%	0.515%	11.00								0.234%	0.281%															
	Slab on RD	₱126,322.24	0.515%	0.515%	11.00											0.234%	0.281%												
	* **Formworks**																												
	Footing	₱68,046.00	0.277%	0.277%	3.00							0.277%																	
	Column	₱223,131.00	0.910%	0.910%	6.00									0.910%															
	Beam	₱347,808.00	1.418%	1.418%	6.00											1.418%													
	Slab on Grade	₱285,450.00	1.164%	0.582%	3.00									1.164%															
	Slab on RD	₱321,500.00	0.582%	0.582%	10.00												0.349%	0.233%											
	* ***Concreting Works***																												
	Footing	₱2,925,951.50	11.930%	38.918%	3.00								11.930%																
	Column	₱1,588,699.40	6.478%	6.478%	3.00										6.478%														
	Beam	₱1,908,590.74	7.782%	7.782%	3.00												7.782%												
	Slab on Grade	₱3,023,700.00	12.329%	12.329%	4.00										12.329%														
	Slab on RD	₱3,023,700.00	12.329%	12.329%	4.00														12.329%										
V.	**Masonry Works**																												
	100mm CHB Non-Load Bearing	₱962,668.00	3.925%	3.925%	13.00															2.114%	1.812%								
VI.	**Architectural Works**																												
	Cement Plaster Finish	₱2,532,733.64	10.327%	10.327%	15.00																	4.131%	4.131%	2.065%					
	Painting Works (Masonry)	₱288,377.97	1.176%	1.176%	12.00																		0.588%	0.588%					
	Painting Works (Steel)	₱75,554.00	0.308%	0.308%	10.00																			0.185%	0.123%				
	Polished concrete topping	₱155,650.00	0.635%	0.635%	2.00																				0.635%				
VII.	**ROOFING AND CEILING WORKS**																												
	Roofing Works	₱194,080.12	0.791%	0.000%	7.00																	0.678%	0.113%						
	Ceiling (1/2 THK Ficem - Metal Frame)	₱159,606.50	0.651%	0.651%	3.00																		0.651%						
VIII.	**OPENINGS**																												
	Fabrication and Installation of Doors & Windows	₱718,384.00	2.929%	2.929%	20.00																				0.01025	0.01025	0.00879		
IX.	**PLUMBING WORKS**																												
	DRAINAGE AND PLUMBING ACCESSORIES	₱582,280.98	2.374%	2.374%	12.00							1.187%	1.187%																
	SEPTIC VAULT	₱137,892.56	0.562%	0.562%	10.00																						0.281%	0.281%	
	DETENTION TANK	₱550,437.50	2.244%	2.244%	10.00																						1.122%	1.122%	
	CATCH BASIN	₱115,019.00	0.469%	0.469%	5.00																							0.469%	
X.	**ELECTRICAL WORKS**	₱1,387,992.56	5.659%	5.659%	13.00										2.612%	2.612%	0.435%												
	TOTAL PROJECT COST	**₱24,525,407.54**	100.000%																										
	TOTAL PERCENTAGE (%)					0.073%	0.073%	0.891%	1.051%	2.503%	1.338%	2.737%	14.292%	3.295%	21.766%	4.611%	8.903%	0.288%	12.385%	2.169%	1.867%	4.865%	5.538%	2.894%	1.839%	1.081%	2.338%	1.928%	0.545%
	CUMULATIVE PERCENTAGE (%)					0.07%	0.15%	1.04%	2.09%	4.59%	5.93%	8.67%	22.96%	26.25%	48.02%	52.63%	61.53%	61.82%	74.21%	76.38%	78.24%	83.11%	88.65%	91.54%	93.38%	94.46%	96.80%	98.73%	100.00%
	MONTHLY CASH FLOW					₱18,000	₱18,000	₱218,50	₱257,68	₱613,94	₱328,25	₱671,18	₱3,505,2	₱808,175	₱5,338,0	₱1,130,9	₱2,183,5	₱70,748	₱3,037,3	₱532,01	₱457,96	₱1,193,1	₱1,358,2	₱709,72	₱450,96	₱265,09	₱573,33	₱472,84	₱133,65
	CUMULATIVE CASH FLOW					₱18,000	₱36,000	₱254,50	₱512,19	₱1,126,1	₱1,454,4	₱2,125,5	₱5,630,7	₱6,438,9	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###

APPENDIX K
PERT CPM

APPENDIX L
DESIGNER'S VITAE

Arcenio, Keyzel G.

Keyzel Gavan Arcenio, 23, is the daughter of Ptr. Arnel Reyes Arcenio and Mrs. Juliet Gavan Arcenio. She was born on March 02, 2000 at Brgy. La Paz, Nueva Valencia, Guimaras. She is the youngest among three siblings.

As a pastor's kid, she grew up at church. She is a child of God and loves doing her ministry for Christ. She love dogs and takes care of six of them.

She finished her elementary education at La Paz Elementary School and completed her Junior and Senior High School at Cabalagnan National High School in Guimaras.

Currently, she is enrolled as a fifth year student at Central Philippine University taking up Bachelor of Science in Civil Engineering.

Avelino, Vincent Carl B.

Carl Vincent B. Avelino, born on October 19, 1999, is 23 years old. Josephine A. Bacusa and Jose M. Avelino are his parents. On Isagani Street at Pontevedra, Capiz, he resides.

He enjoys basketball, playing online games, listening to music, socializing with friends, and travelling.

He graduated from Step By Step Christian academy in Ilawood Pontevedra, Capiz, for Elementary and Junior High School. He graduated from Hercor College at Lawaan, Roxas City, for his senior high school.

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

Fantilanan, Mary Beth G.

Mary Beth Gayosa Fantilanan, 23, is the eldest daughter of Mr. Roberto F. Fantilanan and Mary Ann Felisa C. Gayosa. She was born on July 2, 2000, and is a resident of Brgy. Concepcion, Dumalag, Capiz.

She loves to play volleyball, and hopes of travelling to other countries. She loves listening to music, especially opm and kpop that suits her mood. She hopes to attend one a BTS concert and wishes to meet them.

She graduated from Concepcion Elementary School. She completed her Junior and Senior High School at Saint Martin Academy, Inc.

She is currently enrolled at Central Philippine University, taking up Bachelor of Science in Civil Engineering. She was part of the Engineering Women's Volleyball team for the year 2018-2023.

Gacho, Ian Paul R.

Ian Paul R. Gacho, 23, was born on June 2, 2000. He is the eldest son of Mr. Conrado Gacho and Mrs. Rosalie Gacho. He has a younger brother named Ivan Gacho. He is a resident of Brgy. Cabalagnan, Nueva Valencia, Guimaras.

He is fond of playing video games. He likes to build and generate designs of structures within the realms of his favorite video games. He dreams of travelling the world and trying extreme activities like skydiving.

He graduated elementary at Cabalagnan Elementary School and finished secondary at Cabalagnan National High School. He is currently enrolled at Central Philippine University, taking up Bachelor of Science in Civil Engineering and was a University Scholar from 2018 up to 2021.

Magnate, Darwin F.

Darwin Francisco Magnate, 23, is the son of Mrs. Helma Francisco Magnate and Mr. Silverio Tupas Magnate. He was born on November 24, 1999, and is a resident of Carles, Iloilo.

He possesses a deep passion for exploration and a desire to visit renowned destinations across the globe in order to gain insights into diverse cultures and traditions. In his leisure time, he thoroughly enjoy watching science fiction and horror movies. Furthermore, he firmly uphold the belief that hard work and unwavering determination are crucial in attaining life's aspirations.

He successfully completed his primary education at Gabi Elementary School. Subsequently, he graduated from Granada National High School Ballesteros Campus, where he attended both his junior and senior high school years.

Currently, he is taking up a Bachelor of Science in Civil Engineering at Central Philippine University.