DEPARTMENT OF BUILDING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

CONSTRUCTION ENGINEERING IN BUILDING RENOVATION

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DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

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FEBRUARY 2022

It is recommended that the report of this practical training provided

By

MUHAMMAD FARHAT BIN EZRAL MIZARE

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entitled

CONSTRUCTION ENGINEERING IN BUILDING RENOVATION

be accepted in partial fulfilment of requirement has for obtaining Diploma in Building.

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STUDENT'S DECLARATION

I hereby declare that this report is my own work, except for extract and summaries for which the original references stated herein, prepared during a practical training session that I underwent at Mozza Eng Enterprise for a duration of 20 weeks starting from 25th August 2021 and ended on 7th January 2022. It is submitted as one of the prerequisite requirements of BGN310 and accepted as a partial fulfilment of the requirements for obtaining the Diploma in Building.

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First and foremost, praises and thanks to Allah S.W.T, for giving me the strength and calmness of heart throughout these 20 weeks of practical training.

I conducted my practical training at Mozza Eng Enterprise, and went to the site, which is located at Bangi, Selangor. I would like to thank my employers, Encik Mohd Zaidi Bin Zainol Abidin, and Encik Mohd Naim, for the opportunity given, to conduct my practical training in the company. I gained plenty of knowledge whilst working there in the span of 20 weeks. I also gained knowledge that can't be find in books as they taught me and shared with me their years of experience in the field.

I would like to express my deep and sincere gratitude to my academic supervisor, Dr. Hafizah Binti Mohd Latiff, for helping me in getting a place to conduct my practical training. Moreover, she has helped me a lot in writing this report and providing invaluable guidance throughout this practical training. Along with it, I would also like to thank my practical training coordinator, Cik Nor Azizah Binti Talkis, for providing relevant documents for my practical training and documents for state-crossing, which is crucial since we are living in a pandemic. Also, I would like to express my deepest appreciation to all the UiTM lecturers that have taught me since my very first day in campus. I highly value and cherish the knowledge that they have taught me.

Finally, I would like to thank my parents for the endless stream of support that they had given me, and all the sacrifices made in making sure I would have a bright future ahead of me.

ABSTRACT

Civil works is every outcome of building or civil engineering works taken as a whole, which is sufficient of itself to fulfil an economic or technical function and entails one or more elements of a physical infrastructure. The aim of this research is to observe the civil works in building renovation of an existing building in Bandar Baru Bangi, Selangor. The data of the research was collected through observation, interviews, and document reviews. The civil works that were done in the renovation project were construction of clay brick walls, pu grouting waterproofing, construction of concrete bench, skimming, and waterproofing work on roof. Teamwork and communication are key factors for civil works to be done smoothly and fast. Without these two key factors, problems would arise and disrupt the whole project.

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CHAPTER 1: INTRODUCTION

In the construction industry, there are three departments, each manages its own areas of work. These three departments in a construction industry are civil department, mechanical department, and electrical department.

Mechanical work involves the installation, maintenance, repair, or renovation, in whole or in part, of any heating system, cooling system, mechanical refrigeration system or ventilation system or any equipment or piping carrying chilled water, air for ventilation purposes, or natural gas, or the installation, maintenance, repair, or renovation of process piping used to carry any liquid, substance, or material, including steam and hot water used for space heating purposes not under the jurisdiction of the Department of Labour, provided that minor maintenance and repairs are excluded.

Electrical work on the other hand involves the installation of the wiring system for lighting works, installation of telephone wires, and installation of network (IT) cables, supply power to the building. Basically, anything that has to do with electricity is the task of the electrical department.

Civil project is considered as one of the branches of civil engineering and is involved with the maintenance, design, and development of both natural and physically built environments. The involvement of planning, creation, and designing of infrastructures consists of individuals or companies in the civil construction industry. The tasks performed by the civil department is to cooperate with governments or clients, evaluating and investigating building sites to ensure the suitability of land for the creation of infrastructure, creating plans of infrastructure and have it approved by governing bodies and local authorities, creating cost estimates and contracts, contracts tendering and hiring contractors, supervising, and monitoring the project. The civil industry has a wide variety of careers available, such as civil engineers, supervisors, surveyors, site management, project managers, labourers, and more.

Civil construction is an important part to the construction industry because it provides much of the design aspect to the field. Civil construction contributes a lot to the society by the building of infrastructures which also contributes a percentage to the economy. Construction engineers oversee the construction of building based off the plans and design provided by civil engineers and architects. Civil engineers are also capable of the construction of buildings, but it is mostly the work and scope of construction engineers. Lastly, there are many departments in a construction project, however, the aim of this is to discover the construction engineering works in the renovation of Wisma Oleifera, Bandar Baru Bangi, Selangor.

1.1 Objectives

The objectives of this study are:

1. To describe the procedure of construction works.
2. To identify the problems occurred on site.
3. To determine the solutions to the problems.

1.2 Scope of study

This study focuses on the construction engineering works of the renovation of Wisma Oleifera, Bandar Baru Bangi, Selangor Darul Ehsan. Wisma Oleifera is a palm oil research facility which is owned by the Malaysia Palm Oil Board (MPOB). Wisma Oleifera is where the research of palm oil is conducted.

The renovation works involves the entire building, including the outside. Renovation works consists of demolition, construction of clay brick walls, installation of new air-

conditioning units, installation of gypsum ceilings and PU walls, construction of concrete benches, painting of emergency stairs and walls, installation of new furniture, and installation of piping system.

However, this study does not include mechanical and electrical(M&E) works such as wiring system, fire-fighting system, air-conditioning system, elephant trunk system, and fume cupboard system. Electrical works are done by a sub-contractor which was hired by the main contractor.

1.3 Research methods

1. Observation

The procedure of civil works was observed on site for 5 days every week, except on Saturdays and Sundays. The observations are works that are done by the labourers, such as the construction of clay brick walls, installation of wires, installation of PU walls, etc. The data from the observation were recorded by writing on the site progress diary. Besides that, the pictures of the observation were taken using a smartphone, brand: Honor 8x, model: JSN-L22.

2. Interview

Interviews were done on site when involves works that are not in the job scope. For example, the installation of air-conditioning units, installation of wiring system, fume cupboards checking and testing, and gas testing. Questions were asked to the mechanical and electrical engineer, and specialists regarding it. Interviews were also done with the project manager regarding the materials and layout of the building plans. The data collected was written down in a notebook for future references.

3. Document reviews

Documents such as the layout plans of the building and the bill of quantities (BQ) was referred to. The company profile was also referred to study the background and history of the company. Photos that were taken are filed in the site progress report with photos of the building before, after, and works that were being done by the labourers. This report is to show proof to the client that all work was done. All confidential documents are in softcopy form and are kept in the laptop of the contractor.

CHAPTER 2: COMPANY BACKGROUND

Mozza Eng Enterprise is located at No. 32A-2, Jalan PJU 8/5B, 47820 Bandar Damansara Perdana, Selangor. Mozza Eng Enterprise specializes in building bungalow houses, interior renovation, office and shop house, renovation, and painting. This is a private company, which is owned by Mohd Zaidi Bin Zainol Abidin.

Mozza Eng Enterprise has been incorporated in Selangor, Malaysia since 21st November 2011, and started its initial business operations as a civil engineering contractor company before being involved in building construction works.

The vision of Mozza Eng Enterprise is to become one of the top master developers in Malaysia driven by its core businesses in property development and construction. Moreover, the missions of Mozza Eng Enterprise is building strong relationships with strategic partners, consistently delivers excellent services, active in supporting the communities in which it does business, satisfying all parties by synergistic and sustainable relationships in realizing the holistic business goals, collective team-work efforts in their striving towards achievement of excellent quality and business goals for long term strategic business goals and performance, and continuously contributing to the organisation, society, and nation building agenda.

2.1 Completed Projects

Mozza Eng Enterprise has done many projects as shown in Table 1.

Table 1: Completed projects

Project's Name	Price (RM)	Duration	Started	Finished	Client
Proposal to install guardrails and flexible poles on the road leading to the faculty of Built Environment, UiTM Selangor Branch, Puncak Alam Campus.	202,000.00	2.7 months	15/11/19	06/02/20	UiTM
Proposal to repair and beautify the lane at Ampang Point for MPAJ.	468,300.00	2 months	22/04/19	22/06/19	MPAJ
Landscape maintenance work and cleaning of Zone 5 area (covering playground area and landscape circle Banyan 1, Banyan 2, Hibiscus, Areca, and Bromelia), Bandar Seri Coalfield Mukim 1 Ijok, Kuala Selangor district for a period of 2 years + 1 year.	348,840.00	24 months			Majlis Daerah Kuala Selangor
Proposed housing for civil servants PPA1M, Prensit 11 Putrajaya, scope: walkway cover work.	324,148.50	1 month	01/12/17	31/12/17	Akar Graphic Centre Sdn. Bhd.
Supply and installation of anti-climb fencing work.	135,000.00	1 month	01/12/17	31/12/17	Akar Graphic Centre Sdn. Bhd.
Proposed renovation work on the office of Tabung Haji Jeli (Kelantan) for the Board of Tabung Haji Malaysia.	427,120.00	3 months	15/08/16	15/11/16	Wrap Resources Sdn. Bhd.
Mill and pave works on the main road of section 5A Antara Gapi.	35,052	2 weeks			PKNS

2.2 Ongoing Projects

Mozza Eng Enterprise currently has an ongoing project as shown in Table 2.

Table 2: Ongoing projects

Project's Name	Price (RM)	Duration	Started	Finished	Client
Proposed renovation of Wisma Oleifera, Bandar Baru Bangi, Selangor Darul Ehsan.	1,842,000.00	22 weeks	01/09/21	14/02/22	MPOB

2.3 Organisation Charts

At Mozza Eng Enterprise, the Manager is the one responsible in handling the overall construction project. Under the Manager, the Project Manager manages the materials and machineries, the Surveyor oversees the surveying of the project and site, the Supervisor supervises the labourers on working and safety, and the Quantity Surveyor oversees and manages the costs of the project.

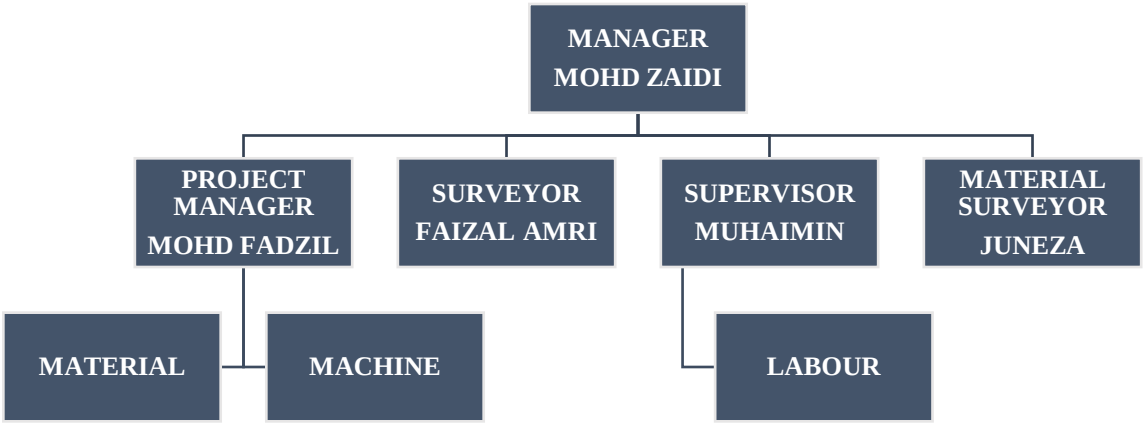

Figure 1: Organisation chart of Mozza Eng Enterprise

2.3.1 Site Organisation Chart

The chart below is the chart of those who are involve on site of the renovation work of Wisma Oleifera, Bandar Baru Bangi, Selangor Darul Ehsan, as shown in Figure 2.

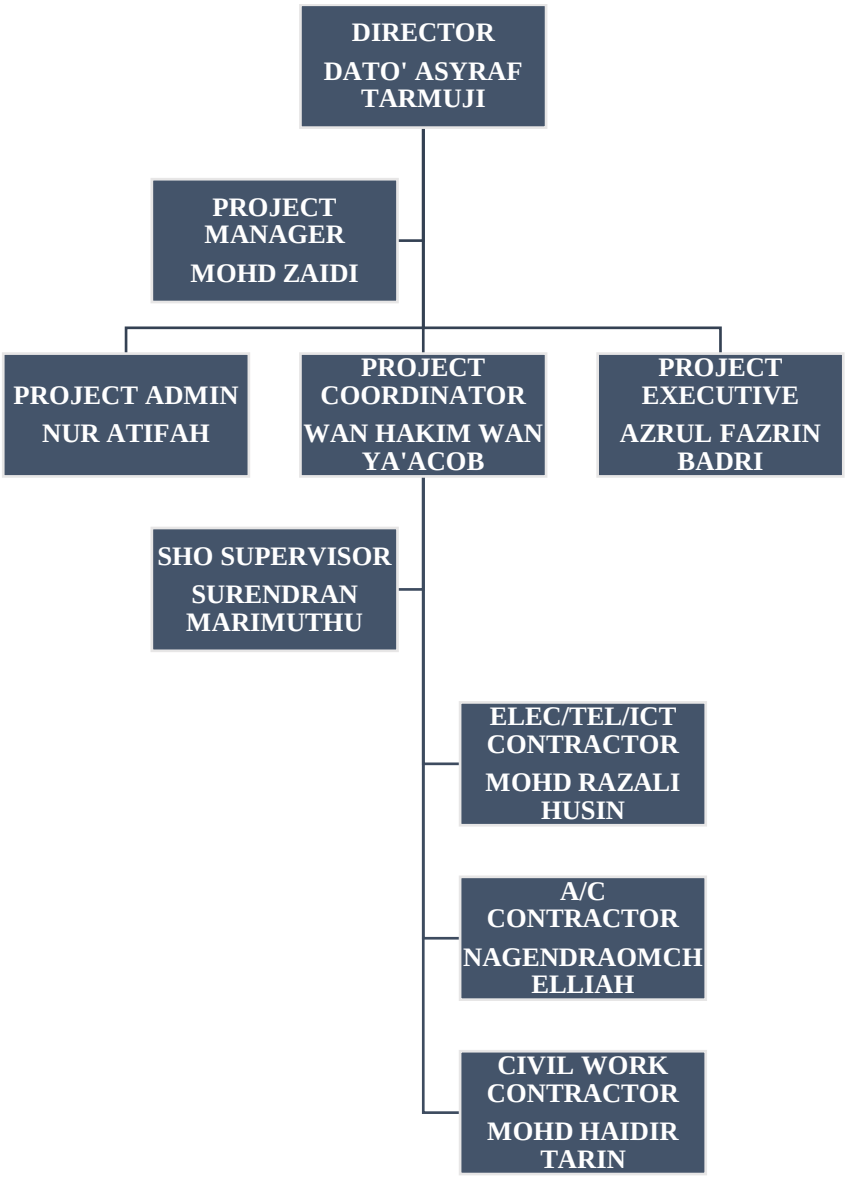

Figure 2: Site Organisation Chart

CHAPTER 3: CASE STUDY

The case study of this report is the construction engineering works of the Wisma Oleifera renovation project, which is located at Bandar Baru Bangi, Selangor Darul Ehsan. This project was proposed by the Malaysian Palm Oil Board (MPOB). The site plan, Figure 1 and 2 respectively, show the proposed site of the Wisma Oleifera renovation.

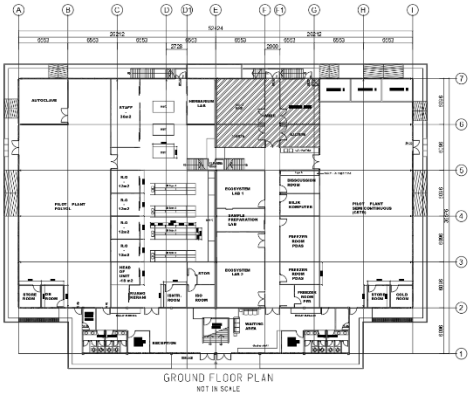

Figure 3: Ground floor plan of Wisma Oleifera

(Source: Courtesy of Vision Vibe Sdn Bhd)

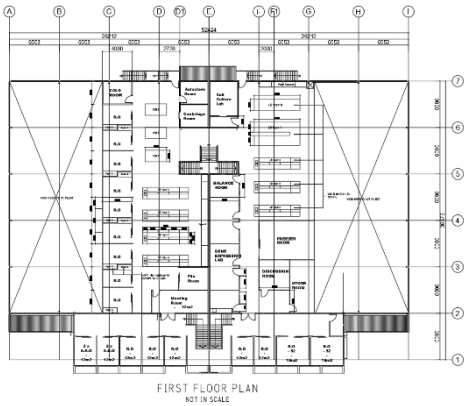

Figure 4: First floor plan of Wisma Oleifera

(Source: Courtesy of Vision Vibe Sdn Bhd)

Wisma Oleifera is a palm oil research building owned by the Malaysian Palm Oil Board (MPOB) and is located at an industrial area at Bandar Baru Bangi, Selangor. As shown in Figure 3 is the site, Wisma Oleifera where the renovation work will be observed. The building is surrounded by other industrial buildings such as a bread-making factory, metal factory, motor vehicle parts factory, and a lighting factory. The project

Figure 3: Front view of Wisma Oleifera, Bandar Baru Bangi, Selangor

started on 1st September 2021 and is scheduled to be completed on 14th February 2022. The value of the project is RM 1,842,000.00 with a provisional sum of RM 50,000.00. The overall area of the project is 1.14 acres. The project consists of 11 renovation works, as detailed out in Table 3.

Table 3: The project works and percentage of completion in 5 months

	Completion Percentage				
Works	**Month 1 (Sep)**	**Month 2 (Oct)**	**Month 3 (Nov)**	**Month 4 (Dec)**	**Month 5 (Jan)**
Site clean-up	15%	30%	40%	45%	45%
Electrical wires installation	42%	69%	75%	80%	85%
Concrete bench construction	0%	5%	56%	70%	80%
PU wall installation	0%	0%	0%	0%	0%
Air-conditioning installation	0%	2%	10%	17%	20%
Paint application on walls (undercoat)	0%	37%	60%	100%	100%
Installation of new firefighting system	0%	0%	0%	0%	0%
Construction of clay brick walls	50%	100%	100%	100%	100%
Removal of existing A/C units	10%	56%	85%	100%	100%
Removal of damaged ceilings	35%	70%	100%	100%	100%
Removal of existing firefighting system	0%	0%	100%	100%	100%

3.1 To describe the procedure of construction works

1. Clay brick wall

Based on the bill of quantities (BQ) of the project, two rooms will have clay brick partition walls constructed. Before the construction of the clay brick wall, these two rooms used to have a polyurethane partition wall (PU) which was taken down by the previous contractor that oversaw the project.

Before the construction of the wall started, the ratio between sand, water, and cement is determined. The ratio of sand, water, and cement used is 1:1:3, and the thickness of the wall is 115m. The construction began with the measurement of the wall. After measuring, points are marked to know where the clay bricks will be laid on. This will avoid the clay bricks from not being aligned and straight. The cement mortar was spread onto the floor before laying the clay bricks. Exmet wires were used to absorb stress and vibration in building and were embedded at every fourth joint of the cement mortar. The clay bricks were layered until it reached the height of 3m, and the opening gap will then be covered by the ceiling which will be installed later. The wall was left to dry for a week before reaching its full strength. After the clay brick wall was completely dry, plastering work was commenced by layering a mixture of cement, water, and sand. Plastering was done to protect the wall. After the plaster was set, skim coating was done to smooth out the surface of the wall and to ready the wall for the application of undercoat and final coat of paint.

Figure 4: The construction of clay brick walls at Autoclave Lab and Centrifuge Lab

2. Polyurethane grouting (PU Grouting)

Polyurethane grouting is a technique of waterproofing which is done on concrete ceiling or concrete wall that suffers from water leakage. Waterproofing is an important step in renovation work to stop water from entering cracks or flowing down which will then cause mold to grow and will risk the health of the occupants in the building.

Specialists investigated the cause and location of water leakage on concrete ceiling before drilling. The floor was covered by plastic sheets to protect it from dusts and spillage since grouting work is usually messy. After identifying the cause and location of water leakage, holes were drilled on

the ceiling where there are cracks. A metal injection port was then inserted into the holes. The PU grout was injected via the injection ports using a high-pressure grouting machine. Injection was done twice to ensure that the grout material covers every crack in the concrete. The mixture will react and expand and toughen. After the grout has dried, the injection ports were removed, and the holes were sealed with waterproof cement compound.

Figure 5: PU grouting work on concrete ceiling

3. Concrete bench

The construction of concrete bench began with the setting out of concrete bench to determine the measurements of the bench as specified in the bill of quantities (BQ). The length of concrete bench varies in each room, but the height is the same. The height of the concrete bench is 0.90m or 900mm with a thickness of 100mm. After setting out was done, formwork was constructed as a support to hold the concrete mixture. Clay bricks were used as a foundation to hold the load. Reinforcement bars were drilled into the wall to strengthen the slab and to avoid the slab to break apart in half if too much load is applied. Then, cement, aggregate, and water were mixed to form a concrete mixture with the ratio 1:1:2. The concrete used is grade 25 which has a compressive strength of 25MPa or 3625psi. The concrete mixture was poured evenly onto the formwork until it reached the thickness of 100mm. The concrete mixture was then left to dry for 2 days. After the concrete was set, the formworks were taken off and plastering work was done on the clay brick foundations to even the surface and to protect the clay bricks. Skim coat was applied onto the plastered clay bricks to smoothen the surface. Epoxy resin was applied on the concrete slab as the finishing and epoxy resin is used because it is resistant to acid and any chemicals.

Figure 6: Construction of concrete bench

4. Waterproofing on roof

Waterproofing work was done on the roof by removing the existing flashing which functions to direct rainwater away from reaching into any openings that will cause leakage on walls and ceilings. Protected and concealed by the flashing, the existing silicone that sealed the opening on the roof was removed by using a scraper

and collected into a gunny sack for disposal. After removing the existing silicone, new silicone was applied on the opening. Silicone was used to seal openings as it is a water-resistant material and can block water from passing through any openings. The brand of silicone used is V-Tech, type VT-210, and has a volume of 300ml. The silicone tube was placed into the caulking gun which functions to hold the silicone tube and make the application of silicone easy. The caulking gun was held at an angle of 45 degrees and the trigger was squeezed to release the silicone. The silicone was applied along the opening and smoothed by using fingers. After 24 hours, the newly applied silicone was completely cured and ready to be exposed to water. Paint sealer was applied on the wall and silicone as extra protection. When the paint was dry, the silicone was concealed with new flashing. After the new flashing was installed, silicone was applied in the openings between the flashing and the wall.

Figure 7: Removal of existing silicone

5. Skim coat application

Skim coat is a technique used to smoothen a wall and is a great way of making old walls look new again by hiding defects such as imperfect taping job or small cracks on walls. Skim coat is typically made of white cement, limestone, and water. Skim coat is usually done after the plastering of walls and is crucial for the application of paint and final coating on a wall.

The skim coat powder was mixed with water with the ratio of 2:1 in a bucket. The mixture was mixed until it had a paste-like consistency. After it reached a paste-like consistency, the first layer was applied on the wall. 12-inch taping knife were used to apply the skim coat mixture on the wall. Scraping was done downwards in columns at 10-degree angle to the wall with slightly more pressure applied to the left side of the knife than the right. This was done to ease out imperfections on the left side but leaves a low ridge on the right side. A second pass adjacent was made to the first column. Pressure was kept on the left side of the knife, thus eliminating ridges on the left. After the application of skim coat, the skim coated walls were left to dry for 3 hours before the final coating of skim coat. After the walls were completely dry, they were sand by using fine 180-grit sandpapers to remove noticeable lines on walls due to overlapping strokes of skim coat. Second application of skim coat was done on the

Figure 8: Application of skim coat on wall

walls after the walls were sand. The process is the same as the application of the first layer of skim coat.

3.2 To identify the problems occurred on site

Problems in a workplace is nothing uncommon and it can happen anywhere whether it be a construction site, hospital, school, court, or an office, problems are inevitable. There were a few problems that happened during the renovation project at Wisma Oleifera, Bandar Baru Bangi, Selangor. These problems are nothing major, but even a minor problem caused a few delays on the project.

Below are the problems that occurred at Wisma Oleifera renovation project:

1. Resignation of labourers

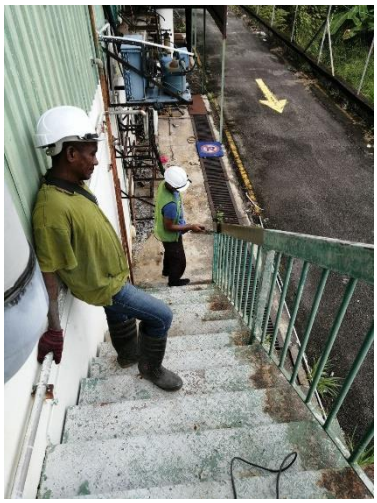

Figure 9: Labourers painting on staircase

The renovation work at Wisma Oleifera started on 1st September 2021 and at that time there were three unskilled labourers whose work were to clear and clean-up the site, painting, demolition, and removal and disposal of existing unwanted elements in the building. Their working period was from 8am-4am with an hour of lunch break at 12pm or 1pm. Their salary was decent and standard for a work of their skill. On 7th October 2021, all three of the labourers resigned with neither a resignation letter nor informing the employer/main contractor, Encik Mohd Zaidi Bin Zainol Abidin. The reason for their departure is unknown but it could probably be due to dissatisfaction of salary. The departure caused delays to the project which went weeks without any unskilled labourers.

Three weeks later, on 29th October 2021, Encik Mohd Zaidi Bin Zainol Abidin managed to find and hire four new labourers. Unlike the previous labourers, these four new labourers are skilled labourers. The main job of these labourers was to construct six new concrete benches for the laboratory rooms. The newly hired labourers resigned on 1st November 2021, after incorrectly construct a concrete bench. All the concrete benches that were constructed by them were 15% in completion before their departure. Their departure did not cause a long or serious delay as new labourers were hired on 3rd November 2021 to complete their unfinished work.

Figure 10: Concrete bench construction in Herbarium Lab

On 1st October 2021, a team of 3 unskilled labourers was hired to skim coat and paint the interior walls of the building. On 9th October 2021, they resigned with neither a resignation letter nor informing Encik Mohd Zaidi Bin Zainol Abidin beforehand. The reason for their departure was due to a conflict with their boss. Their departure caused almost a month of delay in wall painting work. The work was then done by new labourers.

Figure 11: Application of undecoat paint on wall

On 9th December 2021, the team that was hired by Encik Mohd Zaidi Bin Zainol Abidin on 3rd November 2021 resigned from their work. The reason to their resignation was due to late pay. The payment was supposed to be made on the 30th November 2021 and was due a week which caused the labourers to protest and not attend for work for 2 days. On 30th December 2021, a new team of 3 skilled labourers was hired and continued completing works that were left undone for weeks.

Figure 12: Labourers removing existing a/c ducts

2. Stock issue of air-conditioning units

The air-conditioning system is an important element, especially in a large and enclosed building as it provides ventilation and cool air. Wisma Oleifera has 25 air-conditioning units on the ground floor, while there are 42 air-conditioning units on the first floor which gives a total of 67 units of air-conditioner. The types of air-conditioning system in Wisma Oleifera comprises of wall mounted air-conditioner and ceiling cassette. Other renovation works were consistent and swiftly done, such as electrical work and civil work. In contrast, the installation of air-conditioning units was halted for weeks due to stock issue. Only four indoor and outdoor units of wall mounted air-conditioner were available, and one unit of ceiling cassette was installed. Furthermore, the installation of new ceiling boards and paint on walls were halted because ceiling cassettes must be installed beforehand to avoid new ceiling boards and newly painted walls to be dirty which would be another problem. After a discussion with the sub-contractor in charge of the air-conditioning units, it was stated that the stock of air-conditioning units will be available on the month of February 2022. The project was supposed to be in full completion on February 14th, 2022. To avoid exceeding the end date as promised in the contract, new approach had to be considered.

3.3 To determine the solutions to the problems

1. Formal paperwork for labourers

Construction labourers usually not have any official ‘black and white’ documents for their employment. Thus, labourers can quit their jobs without informing their employer or handing an official resignation letter since they are not owned by the company they are working for and won’t be punish by the law. Therefore, by hiring labourers with formal documents, they are not allowed to leave their job without prior notice to their employer with an official resignation letter and without any reasonable reasons.

2. Proposing a different air-condition brand

In the Bill of Quantities (BQ) of the Wisma Oleifera renovation project, the brand for the air-conditioning units is Acson. Wall mounted air-conditioning units were available and were bought and installed. Ceiling cassette air-conditioning unit came to a problem due to stock issue. To overcome this issue, a different air-conditioning brand can be proposed to the client. A ceiling cassette air-conditioning unit of a different brand but with the same specifications and horsepower as in the Bill of Quantities (BQ) is the same as the initial brand, Acson. Should the client agree with the proposal, it will give way for other halted works to be done and the project will be completed exactly as written in the contract and not extended which would leave a bad reputation for the company.

CHAPTER 4: CONCLUSIONS

In conclusion, the construction engineering plays a huge role and importance in the construction industry as it is responsible of the actual building of the infrastructure. The construction industry contributes a lot to the economy and the advancement of society. The procedures were the same as studied in theory. Civil works such as the construction of clay brick walls uses a mixture of cement, sand, and water which was applied onto each layer of clay bricks as a binding agent. This will also hold the clay bricks in place and not fall over due to vibration on the building. PU grouting was done by the injection of polyurethane into the concrete ceiling through injections ports which were drilled into the ceiling. The PU material will expand, sealing the cracks inside the concrete and harden. Concrete benches were constructed using a mixture of cement, aggregates, and water. Formworks were built to hold the mixture. Reinforcement bars were drilled into the wall for support. Clay bricks were constructed to hold the load of the concrete slab. After the cement was poured, it was left to cure for 24 hours, and formworks were removed after it was completely dry. The roof was waterproofed by applying a new layer of silicone on the openings where water can enter. Skim coat was done on walls to cover any defects on walls and for paint to be easily applied on the wall. Problems are common and happen to other industries as well. The problems that happened on site were on the labourers and stock of ceiling cassette air-conditioning units. There were issues regarding on the claim of money which was made to the client by the project manager. Thus, it caused the salary of the labourers to be in pending for more than a week which caused the labourers to leave the job. And the stock issue of air-conditioning units caused a few works to delay. Despite these problems, it was not strenuous to be solved. Communication and teamwork are important in the construction industry. Everybody involved in the construction work should be able to communicate and work well with each other to avoid any unwanted problems during the construction work.

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