DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

UNIVERSITI TEKNOLOGI MARA (PERAK)

HIGHWAY CONSTRUCTION FOR KUALA TERENGGANU BYPASS

Prepared by:

NUR SHAFIRA AMIRA BINTI MOHAMED ZAIDI

AP1165E

2019280796

DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

FEBRUARY 2022

It is recommended that the report of this practical training provided

By

NUR SHAFIRA AMIRA BINTI MOHAMED ZAIDI

2019280796

entitled

HIGHWAY CONSTRUCTION FOR KUALA TERENGGANU BYPASS

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

Report Supervisor	:	_____ Ts. Azira Binti Ibrahim
Practical Training Coordinator	:	_____ Dr. Nor Asma Hafizah Binti Hadzaman
Programme Coordinator	:	_____ Dr. Dzulkarnaen Bin Ismail

DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

FEBRUARY 2022

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 Iswarabena SDN. BHD for duration of 18 weeks starting from 23rd August 2021 and ended on 10hb January 2021. It is submitted as one of the prerequisite requirements of BGN310 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

…….

Name : NUR SHAFIRA AMIRA BINTI MOHAMED ZAIDI

UiTM ID No : 2019280796

Date : 10hb JANUARY 2022

ACKNOWLEDGEMENT

Assalamualaikum WBT.

Alhamdullillah, praise to Allah, the Most Merciful, the Most Graceful.

I would like to deliver my sincere gratitude for the guidance, advice and help rendered throughout the period of training by the following group of amazing individuals. First and foremost, I want to extend a warm thank you to Mr. Mohamad Rizal Bin Mamat for the chances and opportunity given, to conduct my training at Iswarabena Sdn. Bhd. Mr. Mohamad Rizal team of professionals comprising of Pn Syazwani, Pn Suriana, Pn Azmalisa, Pn Afifah, Pn Sahida, Pn Zubaidah, Pn Rosmanira, En Afzal, En Khairi and En Afiq, have gave me a chance to learn and develop my skill in understanding, knowledge and feel of real time projects, and the theory involved in analysis of structures, temporary building, and civil works. They are also responsible towards streamlining and assessing my training. It is such an honor for me to be given the opportunity to complete my internship with all of you.

I would also like to deliver my special thanks to the UiTM lecturers that have taught and nurtured me in becoming a better student and person. I would also like to extend my deepest appreciation to the lecturers who are directly involved during my training stint. To Ts. Azira Binti Ibrahim, Supervising Lecturer, Dr. Nor Asma Hafizah Binti Hadzaman, Practical Training Coordinator and Dr. Dzulkarnaean Bin Ismail, Programme Coordinator, I appreciate the time, effort, encouragement, and brilliant ideas that they have contributed towards the successful completion of my training, this report and the valuable knowledge that have been shared over the last few semesters.

Before I finish, my special thanks to my beloved parents for their sacrifices over the years. Also, for those who do not list in the above but support me in different areas I would like to thank all. This project report would not have been possible without the support of many people.

Thank you so much.

ABSTRACT

Highway construction is one of the biggest infrastructure construction all around the world. This highway construction will bring lots of convenience especially to the users. The report in broad-spectrum contains lots of contents in which will be explain in detail about the highway construct that constructed by the main contractor, Iswarabena Sdn. Bhd. This report was conducted for the construction of *Projek Membina Kuala Terengganu Bypass* located at Bukit Bayas, Jalan Pasir Panjang, 21100 Kuala Terengganu. The content of all chapters is broadly explained, and it is constructed from the practical basis of the site work ended all months. The objectives for this report are to identify the procedure for highway construction and machineries and equipment used. It is also focus on observing the problems occurred and solutions taken to solve the problems. This paper focus point is about method statement for highway construction including UHPC-beam that have been applied for this Kuala Terengganu Bypass. There are eleven procedures for the highway construction which start from site clearance until quality control and assurance. Over 6 years of this construction development, there are many winding up, problems and suggestion occurred on the project that the company runs. The extension of time is the most crucial problems since the contractor will face the financial problems, but the client agrees to extend the project period under Extension of Time (EOT3). Also, the revise of drawing also caused a problem since it can cause confusion and will affect the work progress and all the staff.

CONTENTS **PAGE NO**

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1.0

INTRODUCTION

1.1 Background of Study

In highway construction, there are a few elements used to make it success and it is involves in a heavy work. Bridges are a common feature of the built environment and one of the key elements of civil engineering. There are two types of beam bridges which are simple beam or cantilever structures. The cantilever structures generally constructed from steel truss or pre-stressed concrete units. Also, the cantilever bridge basically will transmit loads through piers central to the beam. Meanwhile, the simple beam bridge is horizontally self-supporting and transmits loads vertically through piers or abutments.

Before this, highway construction applied the old method and version which is I-Beam or U-Beam. The Euler–Bernoulli beam equation shows that the I-shaped section is a very efficient form for carrying both bending and shear loads in the plane of the web. On the other hand, the cross-section has a reduced capacity in the transverse direction, and is also inefficient in carrying torsion, for which hollow structural sections are often preferred. But, after some detail research from the founder of the former Kulish Design Company, the company discovered the unique properties of ultra-high-performance concrete (UHPC).

Ultra-high-performance concrete (UHPC) offers innovative solutions for building new highway construction and preserving the existing bridges. Ultra-high-performance concrete (UHPC) can improve the strength, simplicity, and durability of prefabricated bridge element connections on new bridges. Even the highway construction that use UHPC is quite expensive compared to the old version which are I-Beam and U-Beam, but the maintenance cost is low and rarely happened. One UHPC beam can covered up to 38 metres for each beam while the old version can only reach up to 10 metres for each beam.

Hence, the Ultra-High-Performance concrete (UHPC), often used in the construction of major infrastructure. For example, Malaysia has been manufacturing its own version using proprietary technology at a fraction of the cost. Since then, UHPC has successfully improved the transportation infrastructure across the country. UHPC has the potential to transform the precast concrete industry.

1.2 Objectives

The following is the objectives of the study:

i) To identify the procedure for highway construction,

ii) To identify the machineries and equipment used,

iii) To observe the problems occurred and solutions taken to solve the problems.

1.3 Scope of Study

Kuala Terengganu Bypass built along 5.875km included four bridge and two Vehicular Box Culvert. Its construction from the intersection Tok Molor, Kuala Ibai which is from Channel (CH0) to the intersection Durian Burung CH5875. The main road of Kuala Terengganu Bypass was built based on the standards U5 at CH0 and end at the CH5875 with a slip road (T5) consisting of three (3) major intersections with traffic light facilities and U-turn at the CH900 (J1), CH3450 (J2) and CH4900 (J3).

Kementerian Kerja Raya Malaysia (JKR) creating new routes in Kuala Terengganu to facilitate road users for traffic diversion during peak hours and festive seasons from Kuala Ibai/ Chendering to Manir/ Batu Enam.

This study is purposely conducted to understand about the bridge construction and all the plant and machinery used during the construction. The study is focuses on the method statement of highway construction for '*Cadangan Membina dan Menyiapkan Projek Kuala Terengganu Bypass*'.

1.4 Methods of Study

This study is conducted to gain perfect understanding and can achieved the objectives list. It should be arranged in a systematic sequence.

1.4.1 Observation (Site Visit)

A lot of things can be learnt from observing what is going on at any given time as construction sites are generally busy and dynamic places. Site visit can give the clear vision that help to understand better as the progress can be seen. For any enquiry regarding to the site works, we can directly ask to the supervisor at the site or to the sub-contractor appointed by Iswarabena Sdn. Bhd. Everyone is seemed very helpful the answer can be achieved as fast as lightning. The technology such as cell phone is used to record any important information such as the process of beam launching and parapet installation. The visit is be done three times per week.

1.4.2 Unstructured interview

Essentially, the unstructured interview is one of the effective method to collect and gather information about the highway construction starting from the basic part until the completion. The interview can be done depends on each department. For example, if the study is related to the structure, we can either choose site supervisor or site engineer who have more experience on that. Meanwhile, for the safety and health regulations, can directly ask site safety supervisor or to the safety and health officer. Everyone is very helpful and make the work become smooth and easier. Unstructured interview is more flexible as we can ask everyone, and it generate qualitative data using open question. Also, unstructured interview has increased validity because it gives the opportunity to probe for a deeper understanding and can ask for clarification.

1.4.3 Document reviews and color-coded notes

For extra knowledge about the project, can read and go through every document in the site office as can see all the progress from the start of this project until now. Also, the notes supposed to be color-coded so that it can be understandable especially when it comes to the main point. Color-coded can make the notes become easy to be tracked to review it again in future.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 Introduction of Company

Iswarabena Sdn. Bhd. with registration number 454984-U was in-cooperated on the 10th of December 1997. It was leaded by the Director since year 2007 that had more than 30 years working experience in construction line. He had vast experiences in construction work ranging from road work, infrastructure, and construction of bridges, buildings, schools for both government and private sectors throughout Peninsular Malaysia, Sabah, and Sarawak. Hundreds of projects were completed throughout whole Malaysia under his supervision. Backing by a team of well experienced, dedicated, qualified both in technical and skill competent staff and management team, the company is committed to give and provide a good services and quality products to its clients. Iswarabena Sdn. Bhd. Is committed in delivering quality construction services to its clients, minimizing adverse impact on the environment, and protecting the safety and health of its clients, employees, workers, the public and other stakeholders. The professional panel involved consists of panel of engineers, architects, surveyors, and contractors. Figure 2.1 shows that the front view of the main office and staff.

Figure 2.1: The front view of the main office and staff.

Source: Iswarabena Sdn. Bhd (2018).

This is achieved by undertaking the following:

- Meeting with clients' needs and requirement as mutually agreed and complying with legal and other requirements.
- Protecting the environment, preventing environmental pollution, and conserving natural resources.
- Preventing injury and ill health at workplace, managing projects effectively and efficiently.

2.2 Company Profile

Table 2.1: The table of the company profile.

Company's name	Iswarabena Sdn. Bhd.
Type of business	Construction contractor, specialist in construction work ranging from road work, infrastructure, and construction of bridges, buildings, schools for both government and private sectors throughout Peninsular Malaysia, Sabah, and Sarawak.
Established	10th December 1997
Firm Registration No	454984-U
Contractor Grade	G7
Company Address	No. 101 Jalan Tun Sri Lanang, 81900 Kota Tinggi, Johor.
Tel No	07 8838 636, 07 8835 636
Fax.	07 8828 636
Office No	07 8822 636
Email	info@iswarabena.com
Starting Capital	RM50,000,000.00
Paid-up capital	RM50,000,000.00
Authorised capital	RM 100,000,000.00
Bank Account	Iswarabena Sdn. Bhd. CIMB Bank
Auditor	Pn. Sarah
Director	• YBHG. Tan Sri Selvarajoo Sinnaiyah • Ts. Dr. Tharmesh Selvarajoo • Tuan Haji Ramlay Bin Talsim • Ruziana Binti Karim • Tuan Haji Md Daud bin Abdul Gapoor

2.3 Company Organisation Chart

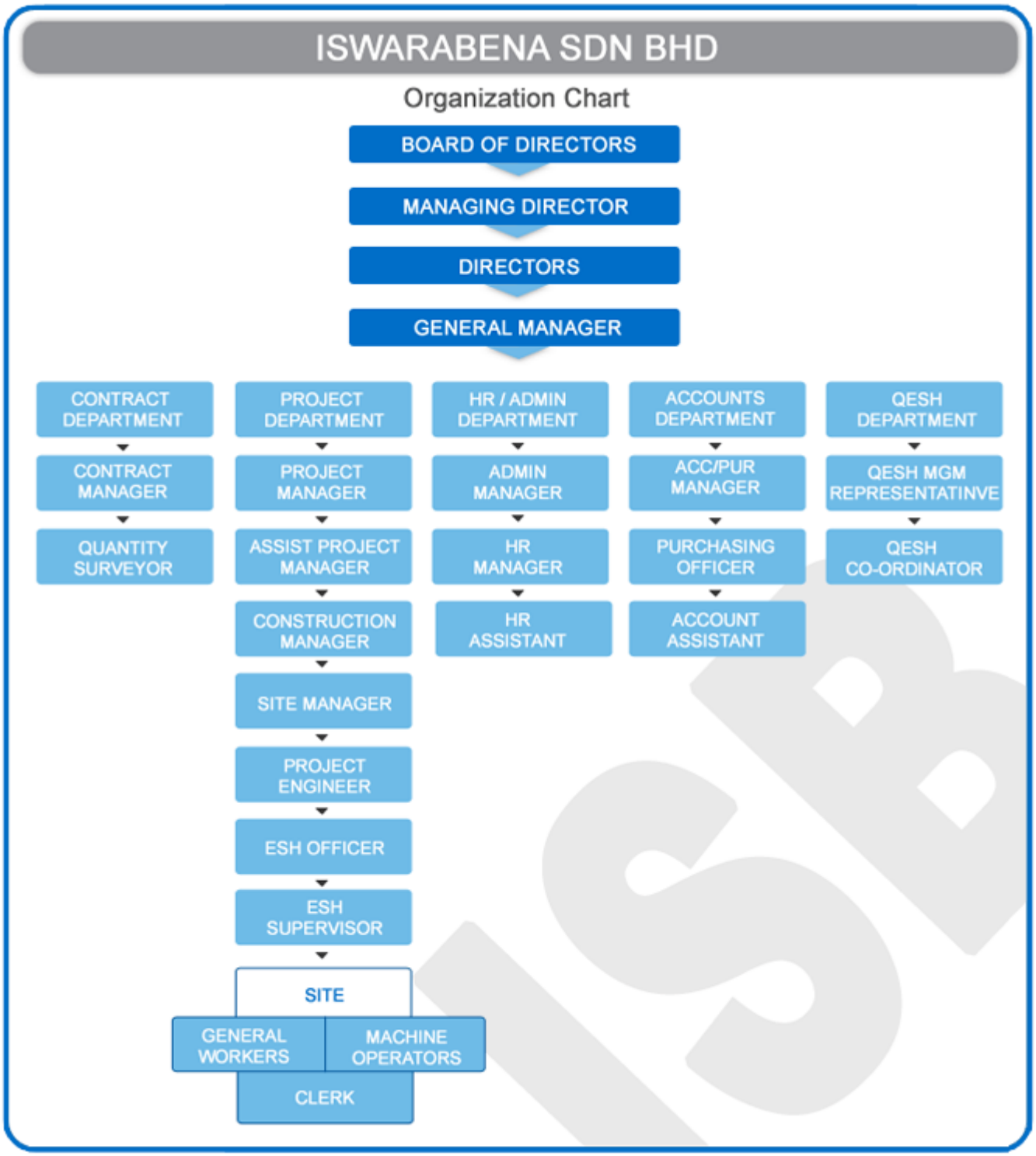


Figure 2.2: Company Organization Chart.

Source: Iswarabena Sdn. Bhd. (2018).

2.4 List of Projects

2.4.1 Completed Projects

Table 2.2 Table for completed projects

No.	Project Title	Project Value	Start Date	Completion Date	Project Duration	Client
1.	Laying of Main Road Pavement Final Layers Bandar Bukit Raja.	43,480,770	16.12.2016	05.05.2017	5 months	Sime Darby USJ Development Sdn. Bhd.
2.	Site Clearance and Earthworks Bandar Bukit Raja.	48,135,000	29.03.2017	06.12.2017	9 months	Sime Darby USJ Development Sdn. Bhd.
3.	Design, Build, Testing, Commissioning and Maintenance Works to Putra Heights Interchange.	68,172,600	26.04.2017	25.02.2018	10 months	Sime Darby USJ Development Sdn. Bhd.
4.	Kerja-kerja menaiktaraf Sungai Kesang.	53,077,054	15.08.2016	13.08.2018	2 years	Jabatan Pengairan dan Saliran (JPS)
5.	Construction and Completion of Earthworks for Development of Phase 3A.	37,410,000	29.03.2018	11.04.2019	1 year	Sime Darby USJ Development Sdn. Bhd.
6.	Rancangan Tebatan Banjir Lembah Bertam.	63,077,554	24.07.2017	03.08.2020	3 years	Jabatan Pengairan dan Saliran (JPS)
7.	Construction and Completion of Earthworks for Development of Phase 2(R11).	65,490,000	09.04.2019	04.01.2021	2 years	Sime Darby USJ Development Sdn. Bhd.
8.	Construction and Completion of Sewer Pipes for Infineon Technologies (M) Sdn Bhd.	8,172,600	01.09.2020	23.03.2021	6 months	Visi Nusajaya Sdn. Bhd.

2.4.2 Project in Progress

Table 2.3 Table for project in progress

No	Project Title	Project Value (RM)	Start Date	Completion Date	Project Duration	Client
1.	Projek Membina Kuala Terengganu Bypass.	222,442,318	27.07.2016	15.09.2022	6 years	Jabatan Kerja Raya (JKR)
2.	Pembinaan Loji Rawatan Kumbahan Serantau Bandaraya Melaka.	73,077,854	06.03.2017	09.08.2021	4 years	Jabatan Perkhidmatan Pembentungan Kementerian Sumber Tenaga, Teknologi Hijau dan Air
3.	Menaiktaraf Jalan Persekutuan FT 83.	88,135,000	02.05.2017	26.10.2021	4 years	Jabatan Kerja Raya (JKR)
4.	Pembinaan Rangkaian Paip Pembentungan di Bandaraya Melaka	93,480,770	06.03.2017	09.08.2021	4 years	Jabatan Perkhidmatan Pembentungan Kementerian Sumber Tenaga, Teknologi Hijau dan Air
5.	Design and Build for Construction Bukit Raja Interchange (Stage 1)	53,780,770	30.01.2020	29.07.2022	2 years	Sime Darby Property (Bukit Raja) Berhad.
6.	Projek Pemuliharaan Muara Muara Sungai di Negeri Melaka	63,480,990	26.04.2021	26.04.2023	2 years	Jabatan Pengairan dan Saliran Malaysia
7.	Construction and Completion of Earthworks, Main Drain and Pond for Development of Phase 1B.	78,172,600	02.07.2021	01.01.2023	2 years	Sime Darby Property Berhad

CHAPTER 3.0

CASE STUDY

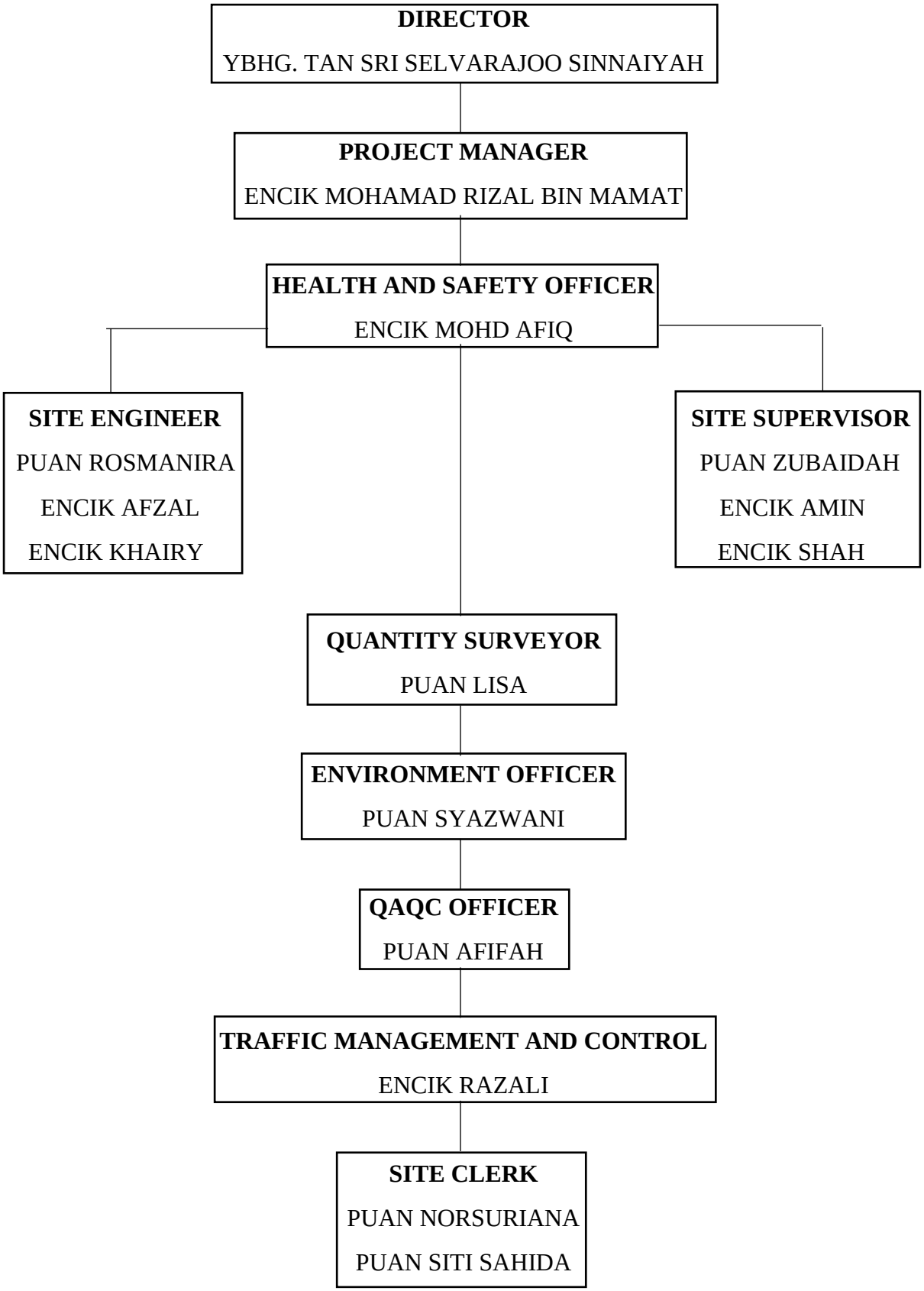
3.1 Introduction to Case Study

The project carried out was *Cadangan Membina Kuala Terengganu Bypass* which located at Bukit Bayas, Jalan Pasir Panjang, 21100 Kuala Terengganu. The total project cost Two Hundred Twenty-Two Million Four Hundred Forty-Two Thousand Three Hundred, and Eighty-Ringgit Malaysia (RM222,442,318). The duration of the construction are 6 years starting from 27th July 2016 and the expected date of completion is on 15th September 2022. There are several parties involved in this project. Jabatan Kerja Raya (JKR) as the client, Iswarabena Sdn. Bhd. as the contractor, and Jannacks Consultant as the consultant. Figure 3.0 shows that the location of the project based on the satellite map that was obtained from the website of Jabatan Kerja Raya Wilayah Persekutuan.

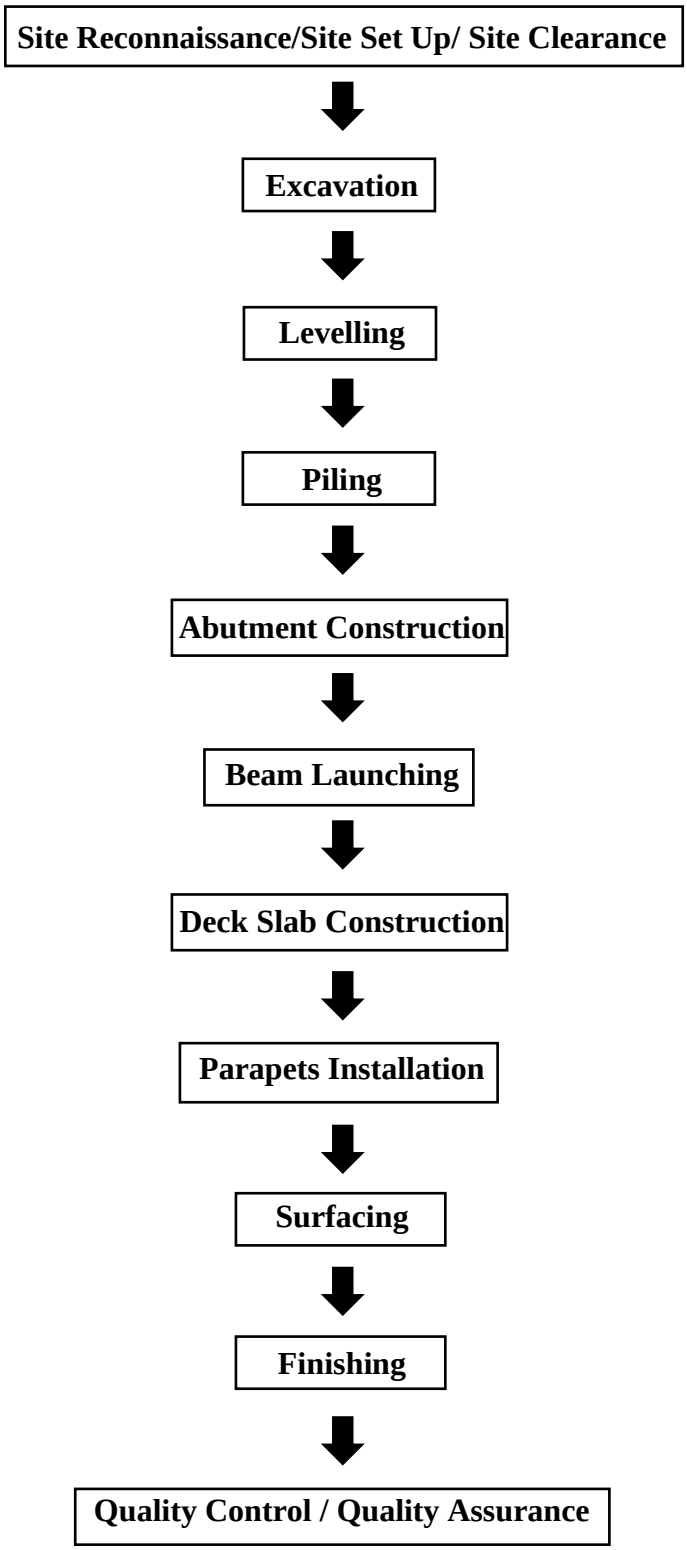
Figure 3.0: Location of the project based on the satellite map.

Source: Jabatan Kerja Raya Wilayah Persekutuan (2018).

3.2 Kuala Terengganu Bypass Organizational Chart



3.3 Procédures for Highway Construction



3.3.1 Site Reconnaissance/Site Set Up/ Site Clearance

Prior to the project starting, a Site Waste Management Plan (SWMP) will be drawn up for continuous monitoring throughout the project under the Site Waste Management Plans Regulations 2008. Clear up site. Several crane operators will do the site clearance included demolish the villagers' houses, trees, dividers, street lightings, and so on using mobile crane and backhoe loaders. Figure 3.1 shows that the site clearance process to demolish the existing tree at the site.

Figure 3.1: Site clearance process to demolish existing tree.

3.3.2 Excavation

After the site clearance have been done, lots of plastic barriers and concrete barriers will be placed around the site. The exposed edge will be protected by ensuring that no personnel can get close because the process can be dangerous to the personnel and the villagers around. During this excavation process, a 360-degree excavator will be used to dig out the asphalt road surface and will also use to fill that exists behind the existing sheet-pile abutment wall down to a level suitable for the piling mat and formation for the abutment base. Figure 3.2 shows a 360-degree excavator is digging out the asphalt road surface at the construction site Kuala Terengganu Bypass.

Figure 3.2: A 360-degree excavator is digging out the asphalt road surface.

One of the site engineers from Jabatan Kerja Raya (JKR) will do an inspection by using the dumpy level to make sure that the excavation level has passed the standard and achieve the requirement stated. Also, site engineer from the main contractor side will be assist and responsible if there is any problem occurred on site. Figure 3.3 shows that the site engineer is checking the excavation level using the dumping level.

Figure 3.3: Site engineer is checking the excavation level.

3.3.3 Levelling

There are two (2) surveyors in-charged for this main contractor Iswarabena Sdn. Bhd. There are more than 600 points that they need to shoot for every station from Station 1 to Station 4. The automatic theodolite will give the record of angles both horizontal and vertical angles. Levelling process have been carried out using the theodolites. Figure 3.4 shows that the surveyor is taking the level for piling point with the help of the chainman.

Figure 3.4: Surveyor is taking the level for piling.

The instrument used which is theodolite is functionally as an instrument that consists of internal optical device that makes the reading circles much more accurate than others. Also, theodolite allows to take fewer repeat readings and make the measurements become much quicker.

The advantage of this instrument is that it has more precise measurements and unaffected by the wind and other weather factors. Theodolite can be used both on the sloppy ground and flat ground.

The first step for the levelling process is by marking the benchmark. One (1) of the surveyors will mark the point at which the theodolite will be set up using a surveyor's stake. While the other surveyor will be prepared at point that they want to take the level.

The second step is to set up the tripod stand. The surveyor will set up the tripod stand based on their height to make sure that they can take the measurement later. The height must be in an eye-level to make sure that the reading and measurement that they take are not parallax error. They will make sure that the tripod legs are drive into the ground using the brackets on the sides of each leg.

The third step is to attach theodolite to the tripod stand. The surveyor will mount the theodolite by attaching it above the tripod and screw it in place using the mounting knob. This step is carefully done by the surveyor to make sure that the instruments which is theodolite is not fell to the ground. If that tend to happen, the theodolite measurement will be wrong and not precision.

The next step for levelling process is to measure the height of the tripod stand. One (1) of the surveyors will then measure the height of the tripod stand that have been attached with the theodolite as their guidance to do the survey at other stations. They use the measuring tape and jot down in the piling report. After measuring the height of the tripod stand, they will be adjusting level and vertical plummet. The surveyors will adjust the level of the theodolite by moving the tripod stand and will the help of the bubble on the theodolite. If the bubble is center, it is means that the instrument is in the balance and right position. The vertical plummet will ensure that the instruments remain over the stake.

The last step is to aim the crosshairs. The surveyor will aim the crosshairs at the point that they want to measure using the main scope. They will use walkie-talkie as their communication system towards each other as the construction is very noisy. One (1) of the surveyors will be the one who mark the point while the other one will be the one who measure the horizontal and vertical angles. Figure 3.5 shows that the surveyor is aiming the crosshairs for the piling level.

Figure 3.5: The surveyor is aiming crosshairs for piling level.

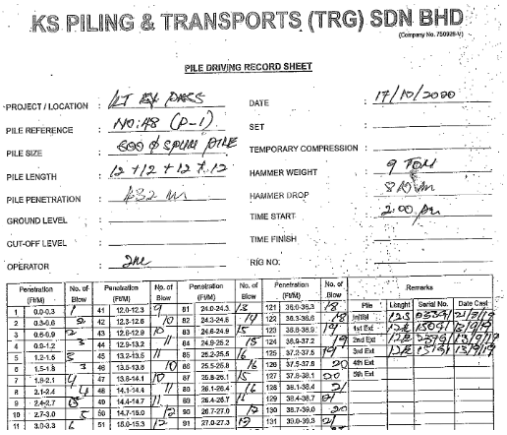
3.3.4 Piling

After the levelling process, the sub-contractor will drive in the piling. There are 2 types of piling which are reinforced concrete square pile and spun pile (diameter 500mm and 600mm). Using the hydraulic hammer, the pile will be forcefully driven until they got the requirement level. Piling will create a stable platform for the piling rig to sit on it. Figure 3.6 shows the piling injection progress using the hydraulic hammer at Station 4.

Figure 3.6: Piling injection using hydraulic hammer.

Pile Driving Analysis Test (PDA test). Sub-contractor in-charged, KS Piling will provide their workers to run the PDA Test or also called as High Strain Dynamic Load Test, at the construction site. This PDA Test is to evaluate shaft integrity, driving stresses, and hammer energy when monitoring the installation. The censor will be placed 0.5m from the ground level. 400 tan PDA Test, 9 tan hammer, and 7.2 maximum energy. All the reading and measurement will be shown in the laptop and the engineer will take a whole report at the end of the testing. Figure 3.7 shows the observation of data analysis for the Pile Driving Analysis Test while the Figure 3.8 is the example of pile driving recording sheet.

Figure 3.7: Observing the data analysis for the Pile Driving Analysis Test.



KS PILING & TRANSPORTS (TRG) SDN BHD

PILE DRIVING RECORD SHEET

PROJECT / LOCATION : LT RX PACKS
PILE REFERENCE : NO:48 (P-1)
PILE SIZE : 600 Ø SPUN PILE
PILE LENGTH : 12 + 12 + 12
PILE PENETRATION : 432 MM
GROUND LEVEL :
CUT-OFF LEVEL :
OPERATOR : ZUL

DATE : 17/10/2020
SET :
TEMPORARY COMPRESSION :
HAMMER WEIGHT : 9 TON
HAMMER DROP : 800 MM
TIME START : 2.00 PM
TIME FINISH :
RIG NO. :

Penetration (MM)	No. of Blow	Penetration (MM)	No. of Blow	Penetration (MM)	No. of Blow	Penetration (MM)	No. of Blow
1 0.0-0.3	1	41 12.0-12.3	9	81 24.0-24.3	12	121 36.0-36.3	18
2 0.3-0.6	5	42 12.3-12.6	10	82 24.3-24.6	14	122 36.3-36.6	18
3 0.6-0.9	2	43 12.6-12.9	10	83 24.6-24.9	15	123 36.6-36.9	19
4 0.9-1.2	3	44 12.9-13.2	11	84 24.9-25.2	18	124 36.9-37.2	19
5 1.2-1.5	5	45 13.2-13.5	11	85 25.2-25.5	16	125 37.2-37.5	19
6 1.5-1.8	3	46 13.5-13.8	10	86 25.5-25.8	16	126 37.5-37.8	20
7 1.8-2.1	4	47 13.8-14.1	10	87 25.8-26.1	15	127 37.8-38.1	20
8 2.1-2.4	4	48 14.1-14.4	11	88 26.1-26.4	16	128 38.1-38.4	21
9 2.4-2.7	6	49 14.4-14.7	11	89 26.4-26.7	14	129 38.4-38.7	20
10 2.7-3.0	5	50 14.7-15.0	12	90 26.7-27.0	19	130 38.7-39.0	20
11 3.0-3.3	6	51 15.0-15.3	12	91 27.0-27.3	19	131 39.0-39.3	21

Remarks

Pile	Lenght	Serial No.	Date Cast
1st Ext	12.3	0553A	2/12/19
2nd Ext	12.3	1507A	6/11/20
3rd Ext	12.3	2579A	15/9/19
4th Ext	12.3	1731A	15/9/19
5th Ext			

Figure 3.8: Example of pile driving recording sheet

Source: Ks Piling and Transports. (2020).

Pile embankment. An embankment which is supported by piles embedded in soft soil. Pile embankment mostly and widely used to limit the residual settlement after the construction work. Figure 3.9 shows the pile embankment after the hacking process.

Figure 3.9: Pile embankment after the hacking process.

- Reinforced concrete slab is 35/20, cover 40mm.
- Pile working load 700kN and 500 kN.
- High strength geotextile grade 100/50.

3.3.5 Abutment Construction

Timber shutters and steel reinforcement will be constructed in-situ to form the abutment base and walls in a few separate pours. Backfilling around the abutment will be done in layers to ensure adequate compaction and with very careful to ensure there are not licking.

A bearing pad will then be attached above the abutment for guidance to the next process which is beam launching. The bearing pad will be measure so that it is place at its positions. Figure 3.10 shows a general worker is installing the bearing pad above the abutment construction.

Figure 3.10: General worker is installing the bearing pad.

3.3.6 Beam Launching

- Span no's: Five (5) Spans (Abutment A – Abutment B)
- Length: 192.5meter (Abutment A – Abutment B)
- Foundation: 500mm & 600mm (Diameter Spun Pile)
- Launching period: 5 Days (10.00 p.m. to 06.00 a.m.)

The first step for the beam launching is by looking at the structure setting out and survey works. The surveyors from main contractor will make a final inspection on the beam levelling to make sure that it is correct and accurate. Also, the final inspection of the alignment and position will be done and there will be a special team to handle the job.

The second step of the beam launching process is to set the beam construction. The main contractor will make sure that non-shrink mortar grout bed at crosshead beam. Also, for this process, they also look at the bearing pad allocation.

The third step before the beam launching is to do a girder inspection and marking for the Ultra High-performance Concrete (UHPC) U-Bridge. This included the inspection of the beam and reference number marking.

The next step is about the main crane setting out and movement. The main crane (250 ton) and crawler crane (150 ton) will be parked accordingly behind of (Abutment A and Pier 1) to safest condition for beams lifting. Also, mobile crane setting out. Mobile crane (220 ton and 160 ton) will be set up at beam yard to upload beam on the prime mover.

Next is to check the safety on the equipment and surrounding. Surrounding platform condition must be firm and free from construction. Safety toolbox meeting and briefing at site before works commencement. The safety and health officer (SHO) and the site safety supervisor (SSS) will be the team that in-charged before the beam launching start. Figure 3.11 is the safety toolbox leads by the safety and health officer and supervisor.

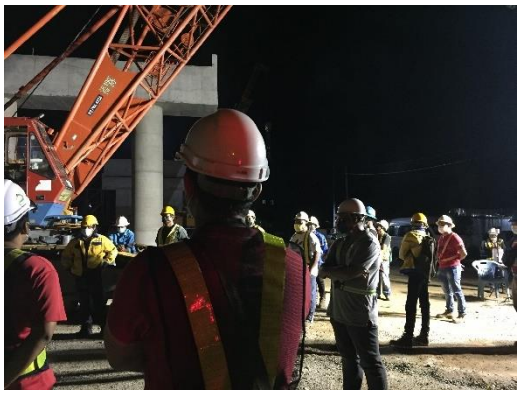


Figure 3.11: Safety and health officer and site safety supervisor leading the safety toolbox.

The beam launching start right away after the safety toolbox. The crawler crane will upload beam. Two (2) units of crawler crane (220 ton and 160 ton) will upload the beam by end section from ground to the prime mover.

Next is the prime movers' movement. The prime movers will transport the beam to the launching position span 1 (Abutment A to Pier 1). The prime movers will be escort by the police traffic since the road will be close for a while. The movement process from the yard to the launching area take around thirty minutes to forty-five minutes. Figure 3.12 is about the prime movers' movement from the yard to the launching area.

Figure 3.12: Prime movers' movement from the yard to the launching area.

Move to the crucial part for the beam launching process which is the main crane lifting. The main crane will hook the beam end and lift-up, both prime movers will drive away from the lifting position. This step required a skilful machine operator with the help of the site engineers in-charged to guide them whenever they need help.

Next, the main crane launching. Both of main crane will launch the beam to the designation point. Once the beam is launched the main crane will setting back to get ready for the next. Figure 3.13 shows the beam launching process at the first spam.

Figure 3.13: Beam launching process at the first span.

After the main crane lifting and launching done, they will move to the next beam launching and span. For the beams no. 1 and no. 2 (Abutment A to P1) remain the same procedure (Step 7 to Step10). Figure 3.14 shows that the general workers are adjusting the bearing pad by the help of the site engineers.

Figure 3.14: The general workers are adjusting the bearing pad by the help of site engineers.

After that is the main crane relocated process. After the span 1(Abutment A to Pier 1) beams launching completed, both cranes will relocate for the next span 2,3,4, and 5. (Pier 1 to Abutment B). Lastly, the launching completed. Beams launching has been successful and completed for the left-hand side (LHS) at Station 4. Figure 3.15 shows the drone view for the completed beam launching.

Figure 3.15: Drone view for the completed beam launching.

3.3.7 Deck Slab Construction

High tensile reinforcement bar (T20) is used in structuring this deck slab. Several general workers will wear the harness, safety helmet, vest and shoes as a safety when working at the high place. They will tie the reinforcement bar using the wire and then put the sponge in between the gap. Figure 3.16 is the picture of installation of high tensile reinforcement bar.

Figure 3.16: Installation of high tensile reinforcement bar.

Steel board will then attach to the structure and will be leaved for 3 days before getting to the next process. Concrete will be then delivered ready-mix by suppliers Tekun Sdn. Bhd. and Mercu Mix Enterprise. The workers will use the concrete vibrator when the concrete is poured into the structure. The concrete vibrator will help to eliminate the air bubbles in the concrete that will reduce the strength of the structure. The grade of the concrete is determined by the site engineer. They will calculate and see the suitable grade based on the working process. The G40J grade used to construct the deck slab.

3.3.8 Parapets Installation

Parapets on bridges of the edge of highway structures prevent users from falling off where there is a drop. Parapet also be meant to restrict views, to prevent rubbish passing below, and to act as a noise barrier. This parapet will reduce the noise pollution to the houses located near the highway. Main contractor, Iswarabena Sdn. Bhd. used parapet that made from the reinforced concrete.

In European standards, parapets are defined as a sub-category of "vehicle restraint systems" or "pedestrian restraint systems". (Chislom Hugh, 1911)

Two (2) general workers will attach the precast parapet to the crane. Crane handled by skilful operator will hoisting the precast parapet wall from the ground level to the requirement position at the bridge. Figure 3.17 shows the precast parapet that was placed under the bridge.

Figure 3.17: Precast parapet that was placed under the bridge.

Next is the general workers (based on each sub-contractor) will wait above the highway structure to attach the precast parapet to the existing high tensile reinforcement bar (T20) that linked with the deck slab. Figure 3.18 is the installation of the precast parapet by the general workers.

Figure 3.18: Installation of the precast parapet.

The jointing between precast parapet and high tensile reinforcement bar (T20) will be welded to make sure that the structure is strong enough to support each other. After that, the precast parapet will be concrete after the welding process done. They used concrete grade 20 (G20) from suppliers Tekun Sdn. Bhd. Figure 3.19 shows the concreting work for the precast parapet.

Figure 3.19: Concreting work for the precast parapet.

3.3.9 Surfacing

Surfacing consists of pre-formed sheets based mainly on bituminous polymetric and elastomeric materials. They are bonded to the bridge deck, to form a continuous membrane, and using roller-applied bitumen adhesive. Figure 3.20 shows the layers of the soil for surfacing process.

Figure 3.20: Layers of the soil for surfacing process.

3.3.10 Finishing

Street lighting, traffic lights, dividers and all the vegetation will then be installed to the highway as for the final touch. This process will be done at the end of the highway construction since it is included in the final touch. Figure 3.21 is the street lighting that installed at the highway.

Figure 3.21: Street lighting installation at the highway.

3.3.11 Quality Control / Quality Assurance

All the progress will be inspected by the site engineer from the client, Jabatan Kerja Raya (JKR). They will determine whether the structure is passing the requirement or not. Site engineer from Iswarabena Sdn. Bhd. will also do the site visit to check every work progress. Figure 3.22 shows that the inspection from the Jabatan Kerja Raya (JKR).

Figure 3.22: Inspection from the Jabatan Kerja Raya (JKR).

3.4 Machineries and Equipment

3.4.1 Théodolite Survey

Figure 3.23: Theodolite Survey.

Figure 3.23 shows a theodolite survey. A theodolite survey which consists of moveable telescope that can rotate around horizontal and vertical axes and provide angular readouts, is a precision optical instrument used to compute the angles between designated visible points in the horizontal and vertical planes. It is most widely used for leveling process at the site during the setting out and levelling process. It is also used to shoot and measure the excavation level whether it has achieved the requirement level or not. Every theodolite consists of bubble that play important role to make sure that the instrument is stable.

3.4.2 Tripod

Figure 3.24: Tripod.

A tripod essentially is a portable three-legged stand that have been used as a platform to support the theodolite when functioning. The three-legged (triangular stance) design provides good stability against gravitational loads and the height can be adjust according to our height and comfort. Figure 3.24 shows a tripod at the highway construction.

3.4.3 Measuring tape

A measuring tape or also known as tape measure is a flexible ruler that have been used to measure distance. Basically, measuring tape can reach 100m length but very convenient to use on site. It is also easy to be carry since the size is very small and compactible. It used to measure a short distance or offset and the depth and the dimension of the trench. It uses the metre and inch unit. Figure 3.25 shows a measuring tape that been used to measure the length of the excavation level.

Figure 3.25: Measuring Tape.

3.4.4 High Volume Air

Figure 3.26: High Volume Air.

An instrument called a high-volume air sampler is used to collect TSP samples. The high-volume air sampler draws a large known volume of air through a pre-weighed filter for 24 hours (Queensland Governmant,2017). The sample achieved in the site will then sent to the laboratory for further testing. This machine can show the actual condition and environment of the site whether it is safe for the workers and the villagers around or not. Figure 3.26 is the high-volume air that have been used to take the air sample at the construction site.

3.4.5 Concrete Vibrator

Figure 3.27: Concrete Vibrator.

A concrete vibrators is actually an instrument that have been used to eliminate the air bubbles in the concrete structure when the concrete is poured from the concrete mixture truck to the structure of the bridge. Generally, when doing the concreting works, there are thousands of air bubbles appeared which next substantially weaken the concrete structure.

This concrete vibrators will help to eliminate it by vigorously shaking it. Figure 3.27 is the concrete vibrator that used to either vibrate the concrete when pouring into the structure or when making the plinth mixture.

3.4.6 Excavator

Figure 3.28: Excavator.

An excavator is the machine that we used to excavate the various types of soil. The bucket that attach in front of the excavator is replaceable and if the front bucket is exchange with the other attachments, then the purpose of the excavator can be different and multi-purpose. For example, an excavator can also be a pile driver, a hammer and hydraulic jack. An excavator also comes in numerous size. The size is dépend to its bucket size, length of arm, and it operation speed. Figure 3.28 is the excavator that commonly used in every construction all around the world.

3.4.7 Mobile Crane

Figure 3.29: Mobile Crane.

A mobile cranes is designed as a simple machines to both raise and lower objects, as well as to move objects horizontally. A mobile crane can easily be moved from one point to another point compared to the other types of crane. This next can leads to a cost-effective as the process of moving this crane from one location to the next is very easy. Essentially, this mobile crane is functionly as a machine that lift an objects and move it to a short distance. Also, mobile crane help in constructing the tower crane. Figure 3.29 is the mobile crane that controlled by a skillful crane operator.

3.4.8 Crawler Crane

Figure 3.30: Crawler Crane.

A crawler crane is one of the crane that mounted on an undercarriage with a complete set of track, or crawler. This components are the one that contribute to provide stability and mobility. A crawler cranes basically range in lifting capacity up to 660 tons. Also, a crawler cranes can save time by making short work of the toughest jobs. One of the advantage of crawler crane is that they can move around on site and perform each lift with just a little set-up. This because the crane is stable on its tracks with no outriggers. Figure 3.30 is the crawler crane that have been commonly used during the toughest jobs.

3.4.9 Concrete Mixture Transport Truck

Figure 3.31: Concrete Mixture Transport Truck.

The concrete mixture transport truck is functionally to maintain the material's liquid state through agitation, or turning of the drum, until delivery. The interior of the drum on a concrete mixing truck is fitted with a spiral blade. In one rotational direction, the concrete is pushed deeper into the drum. For this Kuala Terengganu Bypass project, each concrete mixture truck fits $10m^2$ for every trip. The duration time given by the main contractor for the supplier is 2 hours from their factory to the construction site. Figure 3.31 shows the concrete mixture transport truck from the supplier Mercu Mix Sdn. Bhd.

3.4.10 Hydraulic Hammer

Figure 3.32: Hydraulic Hammer.

A hydraulic hammer is one of the modern types of piling hammer widely used in the construction site instead of air and diesel hammers for driving steel pipe, precast concrete, and timber piles. One of the advantages of this hydraulic hammers is that it is more environmentally acceptable than older, less efficient hammers as they generate

less noise and pollutants. In many cases the dominant noise is caused by the impact of the hammer on the pile, or the impacts between components of the hammer, so that the resulting noise level can be likely to a diesel hammer. (Satyender Mittal, 2017). Figure 3.32 shows the hydraulic hammer used on site.

3.4.11 Backhoe Loaders

Figure 3.33: Backhoe Loaders.

A backhoe loader consists of three main components which are a tractor, a loader, and a backhoe. In the construction site, each piece of equipment is suited to a particular sort of work. The backhoe is basically used to compact material, dig up hard, or to lift heavy loads, such as a sewer box. Next the tractor is used to move the other two components from place to place, and the operator also manoeuvres it when using the loader. (Constro Facilitator, 2020). Figure 3.33 shows the backhoe loaders for earthworks process.

3.4.12 Damp Truck

Figure 3.34: Damp Truck.

A dump truck is a heavy machinery that have been used in the construction site to actually transport the large amount volumes of loose materials such as sand and rocks. Also, we used damp truck to transfer the waste materials on site such as unnecessaries wood and steel. The dump truck also have à dump box which is powered by hydraulics, that allow the operators to lift and tip the loads automatically. Figure 3.34 shows the dumper truck.

3.4.13 Sheet Pile Driving Machine

Figure 3.35: Sheet Pile Driving Machine.

A sheet pile driving machine is the only machinery that can be used to install the sheet pile. The driver will manually control the grip of the sheet pile and next installed it along the soil treatment and excavation area. A skilled general worker needed to handle this machine since it is very dangerous. The sheet pile can be likely to be dislodged if the machine is not well handled. Figure 3.35 shows the sheet pile driving machine that used to install the sheet pile at the soil treatment area.

3.5 Problem and Solution

3.4.1 Changes to the original drawing plans.

The client, Jabatan Kerja Raya (JKR) have changed the original drawing plans which leads to the additional of the cost. The work progress that involves in the changes of drawing plans is piping system.

After a few technical meeting and discussion with the director from both client, Jabatan Kerja Raya (JKR) and main contractor, Iswarabena Sdn. Bhd. They agreed that the client will be responsible for all the additional cost that incurred. With a few terms and regulations which is confidential, the main contractor needs to work based on what have been stated.

3.5.2 Extension of time (EOT)

Extension of time has been done several times due to a few factors. The extension of time (EOT) clause provides a mechanism for the completion date of a construction project to be adjusted or completed where necessary, while also offering protections to the client. (Property Guru,2021)

Bridge construction for Kuala Terengganu Bypass should be complete by 2019, but because of a few problems, they need to extend the period as they need to have extra time to carefully do the work.

One of the factor is that the land payment issues to the villagers. The amount of the compensation is very huge and consumes a large allocation.

- ✓ EOT1 – Extend to July 2020
- ✓ EOT2 – Extend to August 2021
- ✓ EOT 3 – Extend to September 2022

Figure 3.36: Technical meeting between main contractor and client.

The solution is that the client, Jabatan Kerja Raya (JKR) willing to responsible to add extra payment and will be responsible for all the total losses incurred. They will be the one who pay for the villagers' house compensation, and it costed around RM150,000,000.00. Figure 3.36 shows the technical meeting between the main contractor and client that was held in the meeting room.

3.5.3 Proctor test

The amount of pressure from the automatic proctor driller is way too different from one to another sample. This will lead to an unstable graph that they will see at the end of the proctor test. If the graph is not stable, they need to repeat the test until they get the best result. Each test cost around RM200. The test was done by the lab technician from the main contractor and will be inspected by all the site engineers from the Jabatan Kerja Raya (JKR). Figure 3.37 shows the proctor test that was held at the laboratory by the lab technician.

Figure 3.37: Proctor test at the laboratory.

As for the solution, they use the manual blow as it will produce the same pressure for each sample. Also, the manual blow will produce a less noise pollution compared to the automatic proctor driller. Lab technician will blow 25 times for each sample, and it make the measurement and data analysis become much more accurate compared to the automatic proctor driller.

CHAPTER 4.0

CONCLUSION

To summarize this report, the highway construction is not simply be construct without any acknowledgement. The right method and system are required to be used in the infrastructure construction. This report is based on the site which is for *Cadangan Membina Kuala Terengganu Bypass* which located at Bukit Bayas, Jalan Pasir Panjang, 21100 Kuala Terengganu.

The main objective of the project is to investigate the methods statement for bridge construction, to identify the machineries and equipment used, and to observe the problems occurred and solutions taken to solve the problems.

Based on the observation at the site project, there are few things that arise and considering it as the problem and should compulsorily solve at the site. Along the project is running on, one of the problems that arise at the construction site is during the proctor test because it is an unexpected problem related to the proctor drilling machine.

Lab technician, site supervisor and site engineer are the main important person that carried all the responsibility to conduct and handle all the problems and solution at the site. The person who is in-charge will suggest the best solution to overcome the problem.

Technical meeting will be held every 2 weeks or when needed to see and check the overall progress for the construction site. Technical meeting essentially involved both clients, Jabatan Kerja Raya, and the main contractor, Iswarabena Sdn. Bhd. The meeting will show the actual view on the site so that the planning and further action can be take.

References

Roy Holmes. (1995). Introduction to Civil Engineering Construction. College of Estate Management Reading. England. College of Estate Management.

Satyender Mittal. (2017). Pile Foundation: Design and Construction. United Kingdom. ISBN CBS.

Chislom, Hugh. Ed. (1911). The Encyclopaedia Britannica Company. London and New York. Cambridge University Press.

Queensland Government. (2017). High and low volume air samplers, total suspended particulate matter (TSP) [Online]. Available: https://www.qld.gov.au/environment/pollution/monitoring/air/air-monitoring/measuring/samplers. Retrieve on 27 March 2017.

Constro Facilitator. (2020). Backhoe loaders – An overview of parts and functions [Online]. Available: https://www.constrofacilitator.com/backhoe-loaders-an-overview-of-parts-and-functions/ . Retrieve on 28 January 2020.

Property Guru. (2021). What's The Extension Of Time For Construction In Malaysia All About [Online]. Available: https://www.propertyguru.com.my/property-guides/a-simple-guide-to-extension-of-time-for-construction-in-malaysia-25638 . Retrieve on 31 March 2021.

Iswarabena Sdn. Bhd. (2018). The company profile and background [Online]. Available: https://iswarabena.com/. Retrieve on 15 August 2018.

Jabatan Kerja Raya. (2017). Projek Membina Kuala Terengganu Bypass [Online]. Available: https://www.jkrwpp.gov.my/. Retrieve on 24 November 2017.

Igor De la Varga, Zachary Haber, and Benjamin Graybeal. (2018). Enhancing Shrinkage Properties and Bond Performance of Prefabricated Bridge Deck Connection Grouts: Material and Component Testing. ASCE Journal of Materials in Civil Engineering, 30(4): 9-12.

Kier Construction Limited, Southwest Devon Waste Partnership. (2011). Method Statement. Journal of Construction of Access Bridge. 788(001): 650-700.