DEPARTMENT OF BUILDING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

CONSTRUCTION OF ASPHALT ROAD IN FLEXIBLE PAVEMENT

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FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

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(PERAK)

DECEMBER 2019

It is recommended that the report of this practical training provided

by

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entitled

CONSTRUCTION OF ASPHALT ROAD IN FLEXIBLE PAVEMENT

be accepted in partial fulfillment of the requirement for obtaining the 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 are stated herein, prepared during a practical training session that I underwent at Jabatan Kerja Raya Jajahan Bachok for a duration of 20 weeks starting from 5 August 2019 and ended on 20 December 2019. 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.

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I would also like to thank all 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 Encik Fareh bin Majid Supervising Lecturer who is responsible in guiding and giving encouragement regarding my practical report. En Muhammad Naim bin Mahyuddin, Practical Training Coordinator and Dr. Dzulkarnaen bin Ismail, Programme Coordinator, I value the time, effort, encouragement and 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. Not to be forgotten, a big thanks to my friends who willing to help me with their knowledge and guide me to finish this report.

Last but not least, my special thanks to my beloved parents for their sacrifices over the years. My parents play an important role to help me to finish this report by providing accommodations and allowance. Thank you so much.

ABSTRACT

The internship report in construction industry contains four chapters in which I try to explain on detail in my five-month experience at Jkr Bachok. The content of all chapters is broadly explained.Pavements is essential features of the urban communication system and provides an efficient means of transportation. Flexible pavements are preferred over cement concrete roads because of their certain advantages like they can be strengthened and improved in stages with the growth of traffic. The flexible pavements are expensive in regard to initial cost and maintenance. The largest advantage of using flexible pavement is its durability and ability to hold a shape against traffic and difficult environmental conditions. The main objective of this study is to identify the equipment and machineries for road construction which is used in this project. Secondly, to identify the method installation for flexible pavement which is in this report the detail about asphalt pavement construction will be explained. Another objective is to determine the problem and solution when construct the road.

CONTENTS **PAGE NO**

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1.0

INTRODUCTION

1.1 Background and scope of study

Flexible pavement can be defined as one consisting of a mixture of asphalt or bituminous material and an aggregate placed on a base of a granular material compacted with suitable quality in the coating above the subgrade. The typical flexible release consists of bitumen surface courses over basic courses and sub-courses. Surface courses may consist of one or more layers of bitumen or Asphalt.(Wikipedia,2019)

The flexibility of flexible pavement structures is achieved by the combined action of different layers of pavement. The layers below have a lower strength but are just as important in the composition of the pavement. The subgrade layer is responsible for moving the load from the top layer to the ground. The flexible junction is designed such that the load reaching the subgrade does not exceed the capacity of the subgrade ground bearing. As a result, the thickness of the coating above the subgrade varies depending on the strength of the soil affecting the cost of pavement to be built.

There are three types of flexible pavement, conventional layered flexible pavement, full-depth asphalt pavement, and contained rock asphalt mat. However, the aim of this is to discover the construction of full-depth asphalt pavement at a conjected area which is at the Fishermen's Market.

Next, different flexible pavement is composed of a series of layers with the highest quality material at or near the surface of pavement but rigid pavement is comprised of one layer Portland cement concrete slab or relatively high flexural strength. Other than that, for flexible pavement, it reflects the deformations of subgrade and subsequent layers on the surface and for rigid pavement; it can bridge over localized failures and areas of inadequate support. The stability of flexible pavement depends upon the aggregate interlock, particle friction, and cohesion and for rigid pavement, the structural strength is provided by the pavement slab itself by its beam action.

In conclusion, there are a few layer of road pavement that can be discuss and study, however, the aim of this case study is to discover the asphalt pavement construction at the project site.

The client for this project is Lembaga Kemajuan Ikan Malaysia. The project tittle is "**(Kerja-kerja Peningkatan Pasar Nelayan Bachok)"** . The study was carried out at the site located at Lot 415 Mukim Bandar Bachok, Negeri Kelantan.

The study are focused on the asphalt pavement construction of the project on the site. All the important data have been collected and recorded such as the layer of pavement that apply and used in this project. There are six layer of pavement construction but the discussion focus more on how pavement have been constructed.. The material, plant and machineries and the method of the contsruction are also being discovered.

1.2 Objectives of the Report

To achieve the aim and goals of this report, there a few objectvies needed to be fulfill which are;

i) To identify the equipment and machineries for road construction
ii) To identify the method installation for flexible pavement
iii) To determine the problem and solution when construct the road

1.3 Scope of study

I have been assigned to Jabatan Kerja Raya, Bachok, Kelantan. The scope of study is focused to the project of "Kerja-kerja peningkatan Pasar Nelayan Bachok, Kelantan".

The scope of this report is general related to road construction but more focus on asphalt concrete in flexible pavement. This research was based on observation during the practical training session for five month in a JKR Bachok.

My main topic is more focused on the flexible pavement. Identify the method installation for flexible pavement and determine the advantages of flexible pavement used at the site. Equipment and machineries are used for construction of flexible pavement. Asphalt road construction in flexible pavement has 4 stage of process which is subgrade, prime coat, asphaltic concrete binder course, tack coat and asphaltic concrete wearing course. All of this stage will be discussed in detail in chapter 3

1.4 Research Method

1.4.1 Primary Method

During my internship period, I practiced three methods of research to gain knowledge and information to assist in completing this report from various people and sources. To conduct this study, three method of study have been used to complete this report which is by interviewing the expert individuals at site and office, observation on construction site, and using document review to complete this task.

i) Interview

Interview is a meeting of people face to face, especially for consultation between the workers such as an expert supervisor as they have a great knowledge through the years of studying and wonderful experiences to collect more data and knowledge. People who have been involved in this project can provide more information in detail about construction. Interview session is the method that can provide a lot of accurate information and gain more knowledge about the construction industry especially about flexible pavement for road construction. This method is being done with many staff of JKR and staff from the consultant team. This interview is fully supported by the staff at JKR and the consultant team.

ii) Observation

During the internship, the observation has been done at the office, site and the progress of the work during working hours. Observation is carried out at the office and site to see progress throughout the time working there. Observation is the crucial part in completing my practical report where it can make the eyes open wider by experiencing the true situation and gain more knowledge on how road was constructed, and some pictures are also been taken. Other than that, it's also made the interns to understand and know the procedures of the work.

iii) Document review

Document review is a formalized of data involving the examination of existing records or documents. Observation from document also were carried from document tender, C&S drawing, M&E drawing and architectural drawing, company profile to gain detail information for completing this report.

1.4.2 Secondary Method

i) Book

Using some related book to find more information from the author of the book has studied more deeply regarding pavement work. The title of the book is standard specification for road works. The book is from JKR Malaysia.

ii) Internet

Used for secondary source when the detail or information that need to obtain more information about pavement for roadwork.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 Introduction of Company

Jabatan Kerja Raya was established in 1872 and is led by Major J.F.A McNair. The events that directed to the establishment of the JKR began in early 1872 when the British East India Company - the trade between England, India, and China - require a secure station to improve their trading ships. They discovered Penang to be suitable for this purpose due to its strategic spot. In 1786, they influenced the Sultan to liberate the rights on Penang to their companies. They managed to acquire Penang in 1791 over and done with an agreement. In 1825, through the Anglo-Dutch Treaty, Malacca was returned to the British in exchange for Bencoolen. In 1819, Rafel made an agreement with Sultan Hussein and Temenggong Abdul Rahman to British in order to get rights over Singapore. Three of these areas (Penang, Malacca, and Singapore) led to the establishment of Straits Settlements in 1826.

Other reasons that led the British to govern the province as Tanah Melayu is rich in tin and planting soil is fertile. Road paving when the Pangkor Engagement (1874) added the British influence in Tanah Melayu. Throughout the year, they intended to make inroad in Perak, Selangor, and Negeri Sembilan. Hence, a discussion was held in order to persuade the Malay rulers by their Residents and Subordinate Officers to consult and advice. Thereafter, the resident system arrives in Pahang. In 1896, the system was administered centrally in Kuala Lumpur. All four states and Kuala Lumpur were known as Tanah Melayu Bersekutu.

2.2 Company Profile

Jabatan Kerja Raya Jajahan Bachok is a company that was established on 24th May 2004 by DYMM Al-Sultan Kelantan Tuanku Ismail Petra Ibni Al-Marhum Sultan Yahya Petra. Principal address that has been register is JKR Jajahan Bachok, 16500 Bachok, Kelantan. JKR is responsible for implementing infrastructure development and maintenance projects for various ministries, departments, statutory bodies and state governments such as roads, buildings, airports, ports and jetty. In the early stages of establishment, JKR Kelantan is divided into four territories which are supervised by the executive engineer. Table 1 below shows the summary of the divided territory.

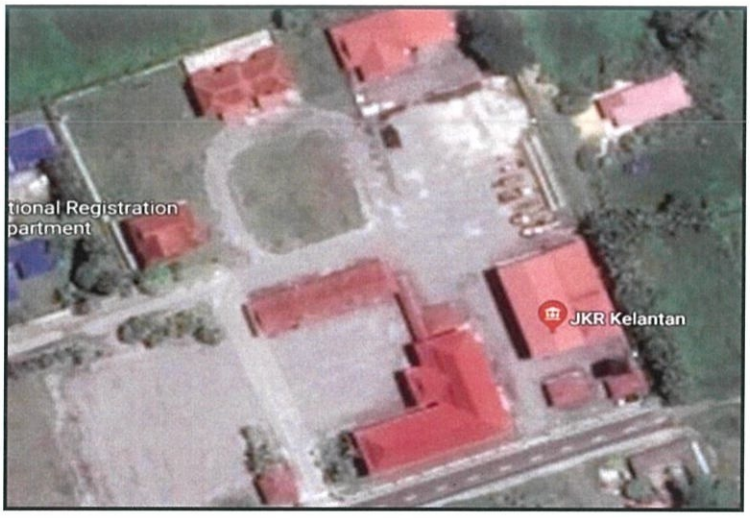

Figure 2.1: Location of headquarters
(Source: Google Maps)

Figure 2.2: Jabatan Kerja Raya Jajahan Bachok

Table 2.1: JKR Divided Territory

Territory	Area	Establishment Year
South	Tanah Merah	1996: JKR Tanah Merah JKR Jeli
East	Kuala Krai, Ulu Kelantan dan Machang	1956: Kuala Krai, Ulu Kelantan dan Machang 1986: JKR Kuala Krai JKR Gua Musang
North	Kota Bharu, Bachok dan Pasir Puteh	1978: JKR Kota Bharu JKR Pasir Puteh dan Bachok 1986: JKR Pasir Puteh dan JKR Bachok
West	Pasir Mas dan Tumpat	1984: JKR Pasir Mas JKR Tumpat

2.2.1 Mission & Visions

1. Vision

   We will be a world-class provider and key of excellence in the areas of asset management, project management and engineering services for national infrastructure development through creative and innovative human capital and the latest technology.

2. Mission

   JKR contributes to the development of the country through:

   - Assist clients in delivering policy and service outcomes through the cooperation of strategic partners
   - Standardization of processes and systems for consistent delivery of results
   - Provide effective and innovative asset and project management
   - Strengthen existing engineering competencies
   - Develop human capital and new competencies
   - Maintain integrity in delivering services
   - Establish a harmonious relationship with the community
   - Preserve the environment in service

2.3 Company Organizations Chart

Below is the organizations chart for main Jkr at Kelantan:

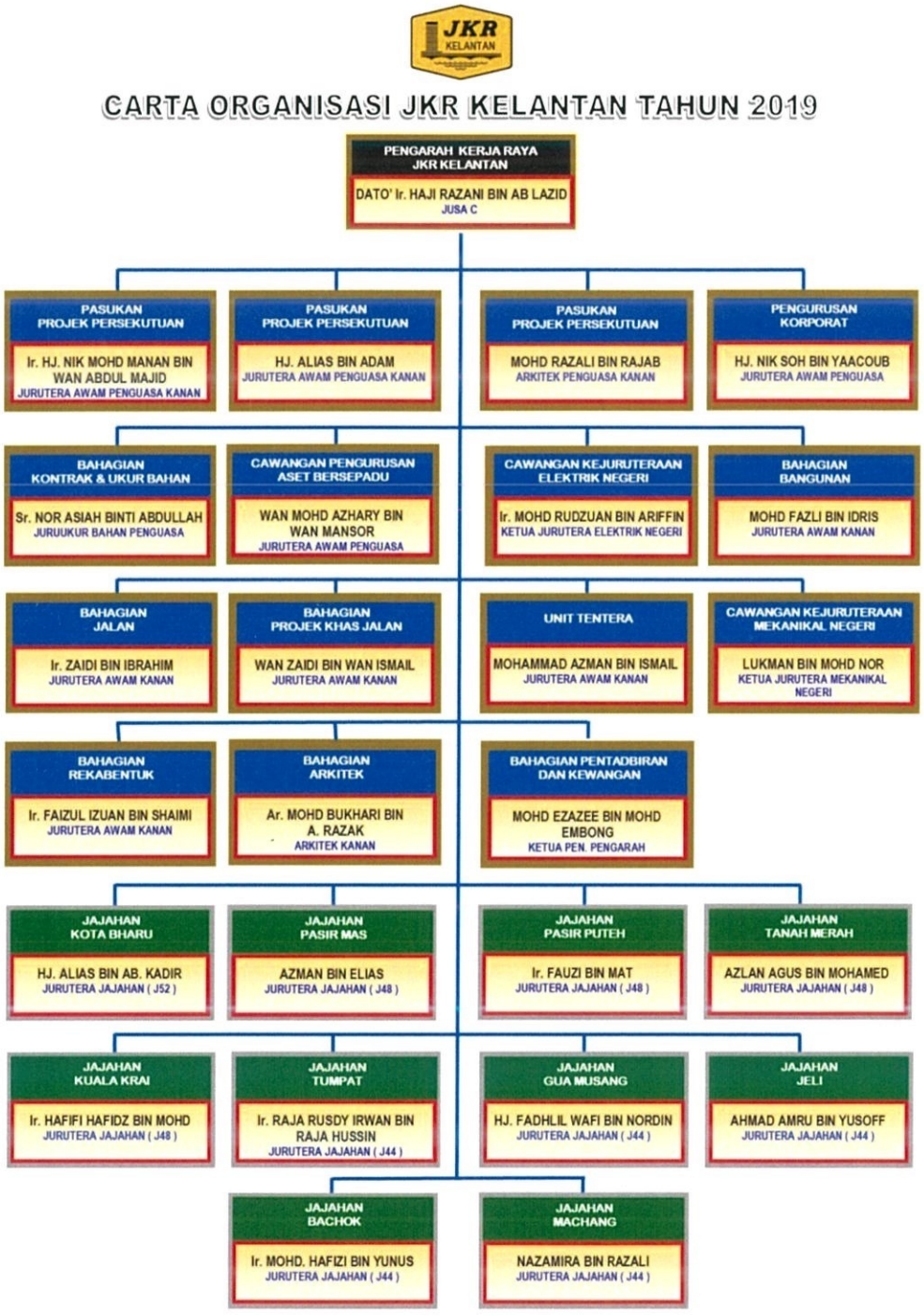

Figure 2.3: Organizations Chart of JKR Kelantan

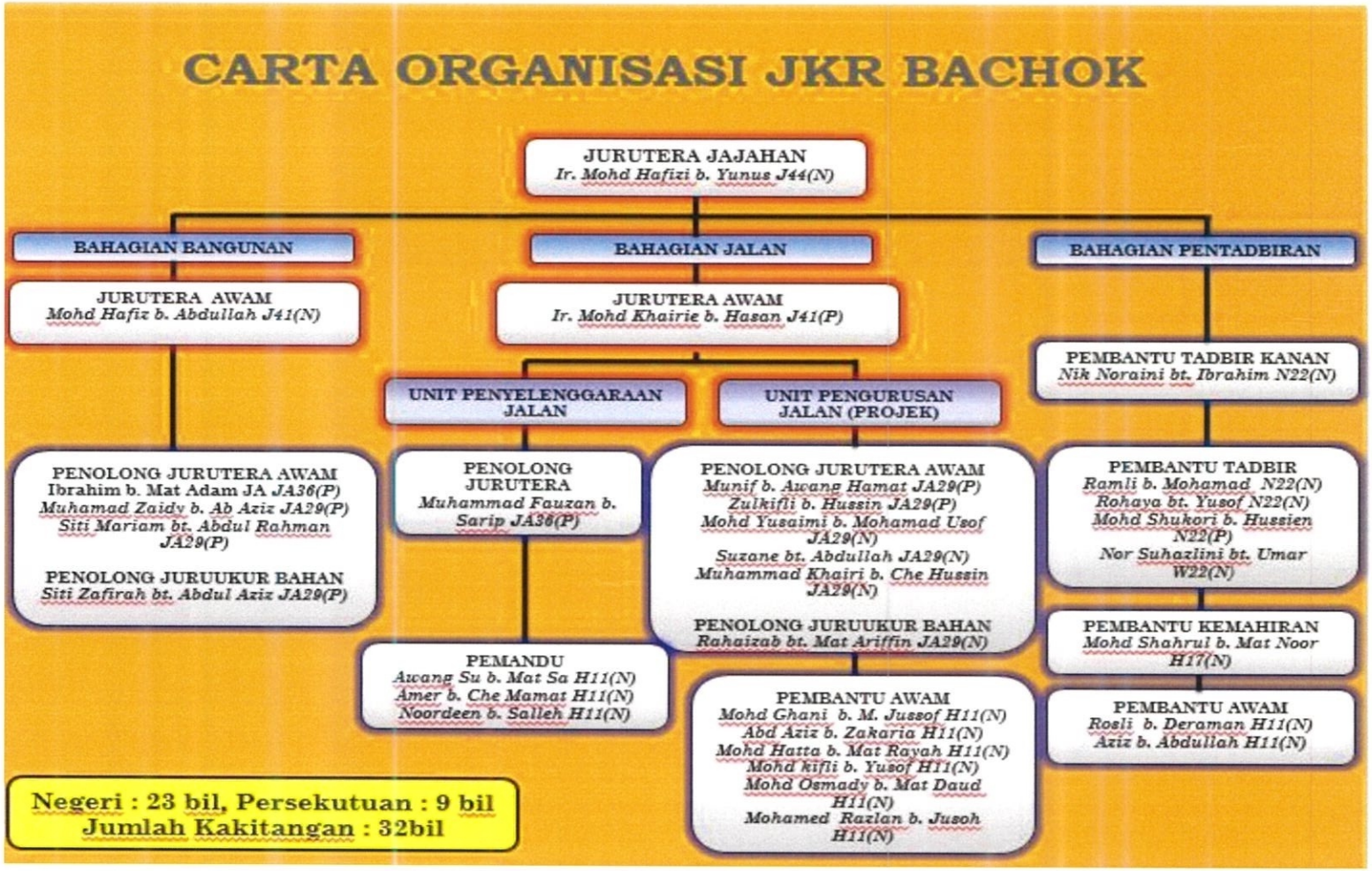

Figure 2.4: Organizations Chart of JKR Bachok

2.4 List of project

2.4.1 List of completed project:

Table 2.2: JKR Bachok Completed Projects

NO	NAME OF PROJECT	DURATIONS	START	END
1	Kerja-kerja membaikpulih kerosakan kecil bangunan di pejabat agama jajahan bachok	12 WEEKS	14/04/2019	06/07/2019
2	Pembinaan dewan serbaguna pusat kegiatan masyarakat serta kerja-kerja lain berkaitan kampung badak 16300 bachok.	26 WEEKS	05/06/2018	04/04/2019
3	Kerja-kerja pembaikan dan baikpulih serta kerja berkaitan di kuaters pegawai IPD Bachok, Kelantan.	14 WEEKS	21/07/2019	26/10/2019
4	Kerja-kerja pembaikian struktur bumbung bangunan blok pra mesra, blok D, E dan F dan pendawaian semula elektrik serta kerja-kerja berkaitan di Sk Pa'Pura, bachok, Kelantan.	23 WEEKS	15/04/2019	22/09/2019
5	Kerja-kerja pembaikan bumbung dan pendawaian semula elektrik serta kerja kerja berkaitan di sk sri kemudi, bachok, kelantan	23 Weeks	15/04/2019	22/09/2019

2.4.2 List of on-going projects

Below are the table of are a few projects that still on-going under JKR Bachok in the year 2019:

Table 2.3: JKR Bachok Ongoing Projects

NO	NAME OF PROJECT	DURATION	START	END
1	Pembinaan Hospital Bachok (RM 140,000,000,00)	3 years 9 month	27/09/2016	09/08/2020
2	Kerja-kerja peningkatan pasar nelayan bachok, Kelantan (RM175,698.000)	12 weeks	25/08/2019	16/11/2019
3	Kerja-kerja pembaikian struktur, bumbung dan pendawaian elektrik serta kerja-kerja berkaitan di sekolah menengah kebangsaan Badak bachok,Kelantan (RM448,210.00)	14 weeks	31/07/2019	05/11/2019

CHAPTER 3.0

CASE STUDY

3.1 Project Background

The purpose of this project is '*Kerja-kerja peningkatan Pasar Nelayan Bachok, Kelantan'*. The project was proposed by the Lembaga Kemajuan Ikan Malaysia. This project value is RM175, 698.000. Data target for completion is November 2019. The progress that has been complete for this project is 50%. The activities carried out at the site are road construction, installing fence and post and road marking for parking lot. The area of this site is 840.290 m^3. At this time, half of the area has been done.

Among the types of pavement studied are Conventional layered flexible pavement, Full - depth asphalt pavement, and Contained rock asphalt mat. Conventional flexible pavements are considered as laminated systems with high quality materials placed on top to withstand high pressure, and low quality materials placed on lower layers at low pressure surfaces. Subsequently, full - depth asphalt pavements path containing the bitumen layer was placed directly with the soil subgrade layer during construction. This type of pavement is better suited for high traffic and local materials are not available. In addition, contained rock asphalt mats are constructed by placing a thick aggregate layer between the two layers of asphalt. The modified asphalt concrete is more compactly placed on the sub-grade layer of the soil to reduce the vertical compressive strain on the sub-grade soil and protect it from the water surface.

A common layer of conventional flexible pavement include seal coat is a thin surface treatment used for waterproof surfaces and to provide slippery resistance. Next, the tack coat is a lightweight application and usually diluted with water asphalt emulsion. It forms a good bond between the two layers of course binding it must be thin, uniformly cover the entire surface, and fix quickly. Then, the prime coat is the application of low viscosity bitumen to the absorbent surface such as the granular base on which the bonding layer is placed. It provides a bond between two layers.

In contrast to a tent coat, the primary coat penetrates the bottom layer, emits a drain, and forms a waterproof surface.

In addition, Surface courses are layers that come in direct contact with traffic loads containing high quality materials. They are usually made of solid graded asphalt concrete (AC). This layer works to provide features like friction, smoothness, drainage, and so on. Also, it will prevent excess water from surface to base, sub-grade and sub-grade. It must be difficult to overcome obstacles under traffic and provide a smooth and skin resistance surface. It must be water proof to protect the entire base and sub-grade from the effects of water shortages.

Binder course is a layer provides the bulk of the asphalt concrete structure. Its chief purpose is to distribute load to the base course the binder course generally consists of aggregates having less asphalt and doesn't require quality as high as the surface course, so replacing a part of the surface course by the binder course results in more economical design. The thickness of binder in this project is 75mm before compaction. For Base course, the layer of material immediately beneath the surface of binder course and it provides additional load distribution and contributes to the sub-surface drainage it may be composed of crushed stone, crushed slag, and other untreated or stabilized materials.

Then, the sub-base course is the layer of material beneath the base course and the primary functions are to provide structural support, improve drainage, and reduce the intrusion of fines from the sub-grade in the pavement structure If the base course is open graded, then the sub-base course with more fines can serve as a filler between sub-grade and the base course A sub-base course is not always needed or used. For example, a pavement constructed over a high quality, stiff sub-grade may not need the additional features offered by a sub-base course. In such situations, sub-base course may not be provided. Lastly, the topsoil or sub-grade is a layer of natural soil prepared to receive the stresses from the layers above. It is essential that at no time soil sub-grade is overstressed. It should be compacted to the desirable density, near the optimum moisture content.

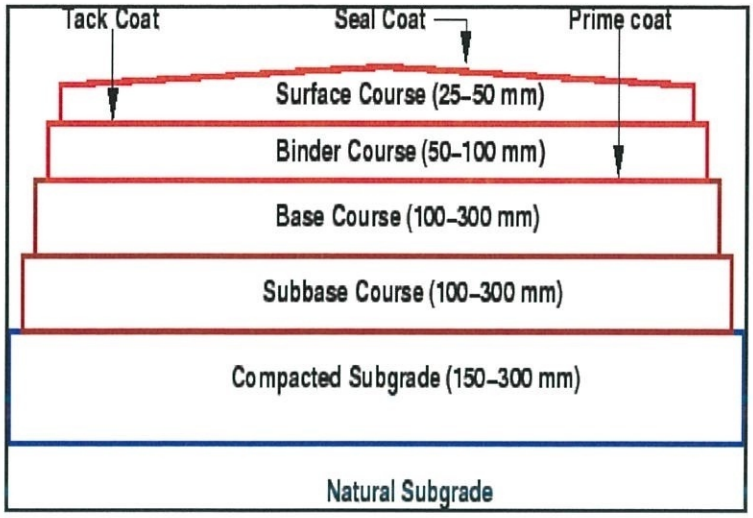

Figure 3.1: Layer of Subgrade

Figure 3.2: Location of Construction Site
Sources: Google Maps, 2019

Figure 3.3: Location for road construction before starting the project

3.2 Equipment and Machineries Use to Construct Road

There are a few equipment and machineries that have been used in this project:

3.2.1 Equipment

i. Measuring Tape

Figure 3.4: Measuring Tape

A tape measure or measuring tape is a flexible ruler that used to measure distance. It is a common measuring tool. Surveyors use tape measures in lengths of over 100 m. This equipment used to measure the area of the site and other work that using measuring tape such as measuring the length of the area and the thickness of asphalt.

ii. Shovel

Figure 3.5: Digging Shovel

Shovel is used to place the asphalt on the small area and at the corner of the area where the paver machine cannot fix.

iii. Steel asphalt rake

Figure 3.6: Steel Asphalt Rake

Rake is a broom for outside use which is a horticultural implement consisting of a toothed bar fixed transversely to a handle, or tines fixed to a handle, and the uses of steel rake in this project is to flatten out excess asphalt and flatten it in its proper place.

iv. Thickness gauge

Figure 3.7: Thickness Gauge

Used to check the thickness of asphalt binder which is 75mm before compaction and after compaction. No specific name for this equipment.

v. Hand compactor

Figure 3.8: Hand Compactor

Hand compactor is used for asphalt in tight areas such as the corners of foundation walls where roller machines cannot reach. Other that, the uses of hand compactor is to compact new asphalt when doing coring test.

3.2.2 Machineries

i. Asphalt paver

Figure 3.9: Asphalt Paver

It shall be equipped with a hopper at the front designed to receive the paving mix from tip-truck. This paver has a mechanical distribution system for spreading the mix evenly and without segregation over the surface to be paved in front of a screeding and compacting unit which shall be equipped with a suitable heating device. Asphaltic paver is used to lay the asphalt binder and asphalt wearing.

ii. Diamond core bit drill

Figure 3.10: Diamond core bit drill

Is a specifically designed to remove an asphalt. Other than that, use to get the sample of asphalt concrete to check and measure the thickness of core are the same as a specifications.

iii. Roller compactor

Figure 3.11: Roller compactor

Steel wheeled Tandem Roller shall be equipped with power steering and dual controls allowing operation from either the left or right side. Roller shall be ballasted so that its total operating weight is in range 8 to 10 tonnes and its driven roll (or rolls) shall exert a rolling force of not less than 3.5 tonnes/meter of roll width. Size of roller is 8 tonnes and is used to compact the asphalt concrete until the thickness of asphalt is the same with the specification.

iv. Tip-Truck

Figure 3.12: Tip-Truck

Used for transporting asphaltic concrete which is binder coat and wearing coat from the mixing plant to the paving sites. The asphalt from the truck should be equipped with covers of canvas or other suitable material to protect the asphalt concrete.

v. Coating spray machine

Figure 3.13: Coating spray machine

Coating spray machine is a painting technique where a device sprays a prime coating and tack coat on the crusher run. It is typically used for covering large surfaces with an even coating of liquid. Spray guns can be either automated or hand-held and have interchangeable heads to allow for different spray patterns but for this project they used hand-held process to spray the coating at the site.

vi. Backhoe

Figure 3.14: Backhoe

Backhoe is an engineering and excavation vehicle that consists of a tractor, shovel, and bucket. Backhoe is common and can be used for any works which include the construction, light transportation of materials, breaking asphalt, paving the road and others. For this project, a backhoe was used to remove and replace soil, and crusher run before starting the process road work. Thickness of the excavated soil is 400 mm where 300mm thickness is for sand and crusher run.

3.3 Construction Method for Flexible Pavement

3.3.1 Material of road construction

Starting from earthwork, the site should be clean and clear before start the roadwork. If the soil is not suitable to make roadwork, excavation work needs to be done to lay a new type of soil. The thickness of sub-base is 200mm follow the specification. Then it will compact using roller compactor. After sub-base has been compact, 300mm thickness of granular materials which is crusher run or other equivalent was laid on the surface. Then compact using an 8-tonne roller compactor. After compaction is done, next progress which is prime coat layer and other layer of road will be lay down on the crusher run.

Figure 3.15: process of laying crusher run on the surface

There are four layers or material that should follow until the top layer of the road:

1. Bituminous prime coat

The bituminous was be applied in dry and warm weather when the surface to be treated is essentially dry on crusher run by means of distributors at suitable rates which is 4 litre/sq. meter along 848 m^2. Any areas inaccessible to the distributor spray bar were treated using the distributor's hand spraying system. If necessary, in order to prevent the bituminous prime coat flowing on the sprayed surface, the prescribed prime coat was applied two separate spraying operations. Where the condition of the treated surface indicates that it is necessary, bituminous prime coat additional to that prescribed was applied as the specification hall direct. The bituminous prime coat helps waterproof the aggregate base or sub-base. It also penetrates and binds. After lay the prime coat, it should be wait until 24 hour before proceed to the next progress which is process of binder course.

Figure 3.16: process of spraying bituminous prime coat on crusher run

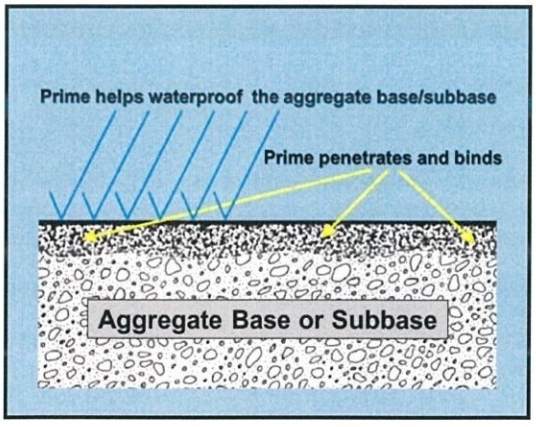

Figure 3.17: Function of Prime Coat
Sources: Google Image, 2019

2. Asphaltic Concrete

The work was consisting of furnishing, placing, shaping and compacting asphaltic concrete binder and wearing course on a prepared and accepted bituminous or bitumen primes pavement course and was included the careful and thorough cleaning of surfaces which are to be covered prior to the applications of bituminous prime coat and tack coat.

Figure 3.1: Testing range of bitumen content

Class of mix	**Normal Range of Design Bitumen Content by Weight of Mix**
AC 10	5.0 – 7.0%
AC 14	4.0 – 6.0%
AC 28	3.5 – 5.5%

i. Binder course (AC28)

The aggregates shall be surface dry and shall be mixed at an appropriate temperature. The mixed material as delivered to the laying site shall be between 130 degrees Celsius to 163 degrees Celsius. Binder course was providing a good shape and regular surface on thin wearing course. The type of material used for a binder course is selected according to the intensity depends on the thickness of the layer. Binder courses of rolled asphalt or dense-coated macadam should be used. The thickness of the binder in this project is 75mm.

The surface to receive the asphaltic concrete binder course shall be free of all damage, loose materials and standing water by sweeping. Prime coat of approved bitumen emulsion shall be applied as per specifications on the prepared surface prior to lay of the asphaltic binder course. The asphaltic concrete binder shall be plant mixed with approved bitumen content. The approved asphaltic concrete binder course shall be delivered to the site by a tipper truck. To prevent the loss of heat, the mixture shall be covered by a tarpaulin. The asphaltic concrete binder course shall be laid by a paver in a single layer.

Compaction shall be carried out using the specified equivalent type of compactors. Rolling shall always commence from the lower to the higher side of the carriageway. The minimum rolling temperature shall be 80 degrees Celsius.

Figure 3.18: Process of laying asphalt concrete binder after prime coat

3. Bituminous Tack Coat

Bituminous Tack Coat of approved bitumen emulsion was applied on binder course. Tack coat was consisting of the careful and through cleaning of the surface of a prepared and accepted bituminous and the furnishing and application to the cleaned surface of a bituminous tack coat prior to the construction of an overlaying bituminous pavement course. Bituminous tack coat was distributed uniformly over the surface to be treated without streaking. The thickness of tack coat that was sprayed on binder is 2 litre/meter^2 and then will compact with roller compactor until 50mm thickness according specification. Function of bituminous tack coat is to bond the surface of binder. After lay the tack coat, it should be wait until 30 or 40 minutes before proceed to the next progress which is process of wearing course.

4. Asphaltic Concrete Wearing Course (AC14)

The purpose of the wearing course is to protect the pavement from the effects of the weather and also provide good regular shaped running surfaces. The wearing course is thinner than the binder course which is 60mm thickness before compaction and 50mm after compaction. The wearing course must be laid by using a paver set. Then, the layer was compact by using an 8-tonne roller compactor. The minimum rolling temperature shall be 125°C. The surface of the asphaltic concrete wearing course was finished to the line grade as required by the drawings and specifications.

Figure 3.19: Process of laying asphaltic concrete wearing course

3.3.2 Coring Process

Pavement coring involves extraction of rod-based materials for laboratory testing and analysis. The purpose of this coring test is to determine the thickness of the asphalt layer, compaction, and asphalt corrosion test was performed before the road marking process.

Procedure:

First, the position of the core machine must be perpendicular to the road surface. During coring, cutting angles should be done with caution. The guide frame for the core machine helps in positioning and maintaining the core in a vertical position throughout the coring process. Excessive pressure should be avoided from causing damage to the core machine. Press up to full depth of asphalt.

Figure 3.20: Core drilling machine was used during coring process

Core sampling of road pavement has been carried out to check the thickness of pavement whether it achieves the requirement that has been stated in the drawing after the process of road construction was completed. The point of coring was determined by the site supervisor based on calculation for the length of the road. The thickness of the sample has been measured using a tape and the result has been recorded for data. This coring process is the process for removing a cylindrical sample from the road pavement to check the thickness of the road pavement and used for the test at lab.

Figure 3.21: Measuring the thickness of asphaltic concrete

Two points were taken as the thickness of asphalt core in different areas along the site during coring process and recorded as shown below (Table 3.2).

Figure 3.2: The thickness of each point

POINT OF CORING	**THICKNESS OF PAVEMENT (mm)**
C1	110
C2	120

Subsequently, the core hole was restored. The person responsible for the coring process washes the waste from the site to avoid any imperfections on the surface and removes the water from the hole by slapping it with a sponge. Further, the coating with emulsified bitumen is used in the core hole and fills in the hole with a thickness similar to the existing pavement with hot asphalt or in other word, the hole from the pavement must be backfill with the hot new asphalt to replace the old. Repeated the same steps until the sample from all point has been measured and recorded.

Figure 3.22: The core hole was restored by new asphalt

Figure 3.23: Compact the asphalt using hammer compactor at C1 point

Figure 3.24: compact the asphalt using hammer compactor at C2

3.3.3 Road Marking

Thermoplastic materials and road marking paints were applied on a surface that is clean and dry. The glass powder is also used to give the line a glow in the dark. Road marking cannot be processed if it over loose detritus, mud or extraneous matter or over the old material or paint marking incompatible with the paint being applied. Surface to be applied should be inspected first thoroughly for best result. On bituminous road surface this should be assured that surface is free from dust, oil spillage, grease, moisture cracks / big voids and excessive bleeding of bitumen. Before starting the process, Road Mark will be heated in stainless steel container fitted with mechanical stirrer by gradually rising temperature to avoid burning / overheating. The temperature when heated the road line is 130 Celsius. The surveyor will locate and mark all main Outlines, Spots and Coordinates for every type of marking and signs. These Outlines will be clearly marked using yellow chalk line and tapes.

Figure 3.25: Workers locate and marks the line using yellow chalk

Then, they carefully mix and prepare paint material in accordance with manufacture direction and use suitable thinner that approved and only within recommended limits. While painting adjacent areas and installations shall be protected by using of masking tape or other approved precautionary measures. They start the process by using road marking machine. While they laid the line, glass powder is also sprinkled on the line. The function of the glass powder is to affect the lighting at night to create

a road mark. Apply additional coat where under coats, stain or other condition show in final coat.

The completed road markings were not being opened until the material has fully set and this will be usually being not less than 1 hour after the materials have been laid. The parking lot will be opened when all the line are dry to avoid the line being damaged because of the vehicles.

Figure 3.26: Process of road marking

Figure 3.27: Glass powder is also sprinkled on the line

3.4 Problem and Solution during Construction of Road

It is an important component in ensuring safety and health for site workers, visitors, and the general public. There are some problems found during the site. Before the project was started the first problem was the lands are soft soil. The method solution is ground treatment (remove and replace) that was carried out by the geotechnical method. The lands are replaced with suitable soil to increase the stability of the structure of the topsoil.

Figure 3.28: Remove and replace soil before lay the crusher run

Weather forecast is one of the problems at the construction site. If the weather is in bad condition, the construction will have to stop the work and this will cause the late progress for this roadwork. When asphaltic concrete was laid in heavy rain, the asphalt will lose its strength. The solution for this problem is the contractor must have a backup plan schedule for the construction. Preparing the construction schedule is a must to avoid any problem happen.

Next, cheating by the contractor when checking the thickness of the pavement during the coring process was carried out. The solution for the problem is rechecking the measurement for the thickness of pavement that was carried out by Encik Zaidy since the result for the coring does not achieve the requirements that have been stated in the drawings.

Another problem is loud noise from construction works lead to disturbance to neighbourhood. The solution for this problem is to move static plant and equipment far away from the neighbourhood to reduce the noise produced during work begins. Then, Problem that may be happen at the site is the compaction of new road pavement that has been done by contractor is not in good condition and did not follow the JKR specification standard. Solution, the site engineer from JKR must guide the contractor at site to make sure all the work is good and follow the JKR specification standard.

CHAPTER 4.0

CONCLUSION

Flexible pavement is a very complex structure and has different types and systems. There are various types of materials and machinery that using in this project at the 'Kerja-kerja Peningkatan Pasar Nelayan'. The method of fabricating and installing is very orderly which makes the construction road strong and safe to use. After successfully completing this report, many new theories in theory as well as in practical pavement for road construction have been proven that this method is very suitable and safe to develop in 'Kerja-kerja Peningkatan Pasar Nelayan'. The method of installation for asphaltic pavement from the beginning of the project until the project is completed in detail. At the same time, there are advantages and disadvantages that can be explained using this method. Based on this overall report, flexible pavements are good roads but not cheaper roads. These roads should be considered only if sufficient funds are available. The thickness of the pavement and the reinforcement should not be compromised.

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APPENDIX