

**DEPARTMENT OF BUILDING
FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING
UNIVERSITI TEKNOLOGI MARA
(PERAK)**

DECEMBER 2019

It is recommended that the report of this practical training provided

by

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entitled

DRAINAGE WORK

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 Exxomas Sdn Bhd 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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ACKNOWLEDGEMENT

In the name of Allah, the Most Gracious and the Most Merciful. Alhamdulillah, all praises to Allah for the strengths and His blessing in completing this practical report. It gives us immense pleasure to express our deepest sense of gratitude and sincere thanks to our highly respected and esteemed to Sr. Anas Zafiro Bin Abdullah Halim for his valuable guidance, encouragement and help for completing this report. I am thankful to him for providing immense guidance for this report. His useful suggestions for this whole work and co-operative behavior are sincerely acknowledged.

Furthermore, I would like to express our gratitude to all Prime Engineering Consultant company team that has guide me throughout the internship period. I am thankful for their aspiring guidance, information and friendly advice during the internship at office and site visit. I am sincerely grateful to them for sharing their experience and knowledge together with information related to my topic and the construction industry. Hence, I express my warm thanks to Mr. Azman Bin Mansor and Sir Muhammad Nabil Fikri and other staffs as the engineer and team for their support and guidance.

Last but not least, my deepest gratitude goes to my beloved parents for their endless love, prayers, encouragement and their understanding regarding the importance of this practical report. Also, not forgetting to those who directly and indirectly contributed in this practical report, your kindness means a lot to me.

ABSTRACT

Drainage is a system of pipework, usually installed below ground level, to convey the discharge from sanitary fittings, rainwater gutters and down pipes to a suitable disposal installation. The purpose of making this report is to determine the process of preparing drainage work in office and on site. Data and information for making this report through observation, interview, site visit and document review. The process began from the office for designing purpose before proceed to the site. After all the authorities gave their approval of design from road and drainage drawing, drainage work could began on the site as in the schedule. Throughout this project, there were a few problems occur before and during construction. Solutions have taken to overcome the problems. Based on the ponder of the case consider, it can be concluded that the strategies of development project are appeared, issues happened has been recognize and the solution is taken.

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CHAPTER 1 : INTRODUCTION

Drainage is a system of pipework, usually installed below ground level, to convey the discharge from sanitary fittings, rainwater gutters and down pipes to a suitable disposal installation. The usual method of disposal is to connect the pipework to the public sewer which will convey the discharges to a Local Authority sewage treatment plant. Circular closed conduits are used as sewers and open channel drains used as surface water drainage. Surface water as a result of rainfall must be drained as fast as possible out of the development area to avoid flash flood.

Drainage amenities are required to protect the road against damage from surface and subsurface water. Traffic safety is also important as poor drainage can result in dangerous conditions like hydroplaning. Poor drainage can also compromise the structural integrity and life of a pavement. Drainage systems combine various natural and manmade facilities such as ditches, pipes, culvert, curb to convey this water safely. (Monckton P. L) 1983.

Subsurface drainage systems are provided to drain away subsurface water in order to increase the stability of the ground and footings of buildings by inducing a more stable moisture regime and reducing foundation movements due to the variations in the soil moisture content. (Bureau of Reclamation) 1978.

Drainage is the process of seizure and elimination of water from over and under the district of the road surface. Drainage can be surface where water is transmitted on the road surface and drainage channels or subsurface where the water flows underneath the roadway structure. (Chudley R) 2010.

It is essential that suitable provision is made for road drainage to ensure that a road pavement perform suitably. Few importance of drain is to prevent flooding of the road and ponding on the road surface. Next, drainage is also important to protect the bearing capacity of the pavement and the sub grade material and it is important to avoid corrosion of side slopes. (Simmons H. L) 2011.

External surfaces that are paved with concrete, natural artificial paving slabs, bricks or granite sets, should be laid with slight slopes or falls to gullies or channels. They should be laid to fall away from the external walls of the building to prevent possibility of water collecting at the base of the wall. (Local Authority Sewage)

1.1 Objectives

While on the internship session, I able to:

- i. To investigate process of preparing drainage work in office and on site.
- ii. To determine problems occurred before and while construction.
- iii. To determine solution for problems.

1.2 Scope of study

Study was carried out in two places which were in office and in site. The office was placed at Sg. Ramal, Kajang meanwhile the site was placed at Jenderam Hilir, Mukim Dengkil. The study was carried out in two places because observations were made from the office to the site for the preparation of drainage work. The project was Shell Dengkil gas station for the occupants of the main road which connects from Kuala Lumpur to Sepang and usually people went to KLIA used the road.

The study focuses on drainage work which prepared from office for design purpose by using autocad that done by engineer. This project used three types of drain which were pre-cast U drain and wide R.C drain and sump or inspector chamber included for any changed direction of drain. After design work done, engineers had to submit Road and Drainage drawing to the authorities such as Indah Water Konsurtium, Jabatan Perairan Selangor (JPS) and SYABAS for apporoval of drawing that design by the engineers. Road and Drainage drawing was include the flow of drain to the outlet and the flow of road such as in and out of the area.

After engineers had their approval by the authorities, the drawing submitted to the contractor and the drainage work on the site could be proceed and will began by following the schedule. The study also focuses on preparation of drain on site especially the installation of drainage. Installation of pre-cast U drain were chosen and noted and observation was made to gain more information and details about drainage work.

1.3 Research Method

1. Observation.

On the work day, observation was made on Ir. Nabil did the design process for road and drainage drawing and made calculation for drainage. Some instructions was told by Ir. Nabil on calculation for invert level for each sumps/inspection chambers and draft the design by using Autocad. The observation took a few weeks to get details of information on how the process went. Note was made after the observation done.

2. Interviews.

Interview was carried out to understand more about the process with engineers, drafters. Interview with engineer was about the overall process and roles of SYABAS, JPS and JKR on why do engineers had to get approval for the drawing of road drainage before proceed the work at the site. Meanwhile interview with drafters was about the periods for finishing the road and drainage drawing plan.

3. Site visit.

The construction was about a development of a building for Shell gas station. Some information about the site was told by Ir. Nabil including the preparation of drainage work during the site visit. A contractor, Ah Tong also gave some information on how drainage work prepared.

4. Document reviews.

Document reviews which had permission by the engineers for more understandings. Construction drawing was given while observation was made and information such as company profile was given.

CHAPTER 2 : COMPANY BACKGROUND

Incorporated in 2005, PRIME ENGINEERING CONSULTANT is a Civil and Structural engineering consulting firm. The main objective of the company is to actively participate and contribute toward the development of the country through government and private sector project in accordance with Malaysian vision 2020 policy.

The company is quite young in age, but with the support of our technical staff such as engineers and draughtsman with vast experience in consulting and construction field, the company able to provide a good professional service to their client.

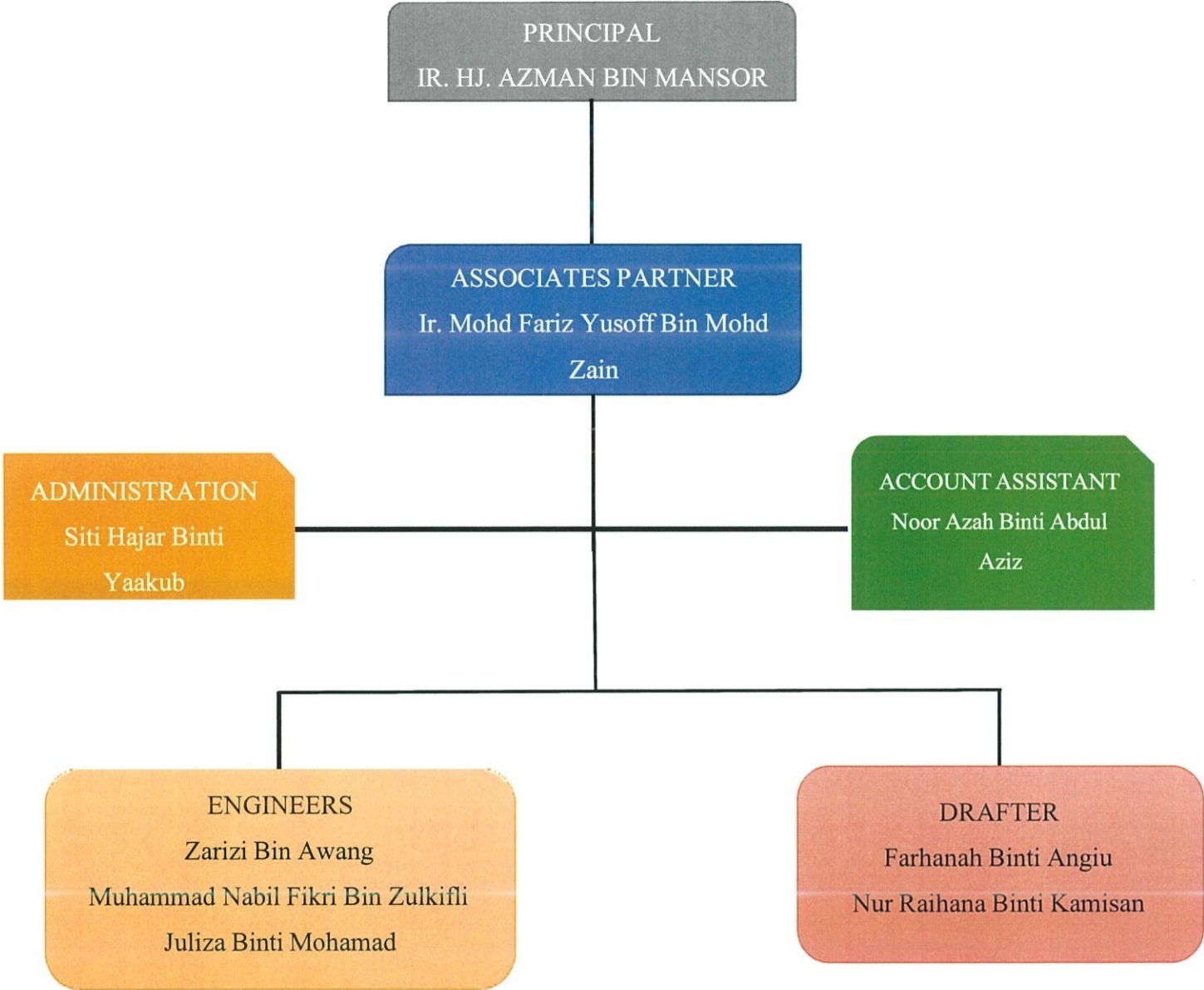
Their team of Professional Engineer, Designers, Draughtsman and other technical support are experienced in all aspects of C&S building services construction as well as design and intergration with other services.

In today's competitive business climate, it is increasingly beneficial to have a consultant that can provide the experience, knowledge and skills to ensure the successful completion of the projects at hand and are able to provide design capabilities. Our intention is committed to maintain a highly professional staff to fulfill the requirements of our various clients and to offer them the most value for their investment in the facilities and projects constructed and minimize future maintenance works.

2.2 Completed Projects.

No.	Client	Project Particulars	Project Cost (RM)
1.	Kementerian Kemajuan Luar Bandar	Projek Bekalan Air Luar Bandar (BALB) Sistem Retikulasi Tahun 2011/2012 bagi Selangor Zon2 untuk Kementerian Kemajuan Luar Bandar dan Wilayah	RM 12,063,806.00
2.	J.A Manan Development	Membina dan Menyiapkan 20 unit 2 tingkat rumah teres di Mukim Batu, Daerah Gombak, Majlis Perbandaran Selayang. (Tmn Gombak Permai Phase 2E)	RM 3,052,994.14
3.	Gold Cold Transport Sdn Bhd	Cadangan sebuah gudang penyejuk dua tingkat dengan ruang pejabat dan satu tingkat sub besmen dan satu unit kebuk sampah di alamat No.5, Jalan Sg. Kayu Ara 32/40 Seksyen 32, 40460 Shah Alam.	RM 8,722,896.00
4.	FPG Oleochemicals Sdn Bhd	Cadangan Tambahan kepada kilang sedia ada untuk sebuah kilang kemudahan Atlantis Bottle Blowing (BOB) di Kuantan Port Industrial Area, Pahang Darul Makmur	RM 9,521,182.50
5.	Jabatan Pengangkutan Jalan	Projek Bangunan Tambahan Jabatan Pengangkutan Jalan (JPJ), Padang Jawa, Selangor	RM 3,000,000.00
6.	Kementerian Sumber Manusia	Cadangan Projek Pembangunan Fizikal (naik taraf) Institut Latihan Perindustrian (ILP) Kuala Lumpur yang mengandungi i. Sebuah dewan kuliah & cafeteria 3 tingkat ii. Sebuah asrama lelaki 4 tingkat iii. Sebuah asrama perempuan 4 tingkat di atas tapak sediaada, Jalan Kuchai Lama, K.L	RM 18,426,550.63
7.	Kementerian Pertahanan Malaysia	Tawaran Bagi Projek Perolehan Peralatan Dan Pembinaan Infrastruktur Sistem Satelit Bumi untuk Angkatan Tentera Malaysia	RM 10,400,000.00
8.	Jabatan Kerja Raya Selangor	Cadangan Membina dan Menyiapkan Pejabat JKR Sepang, Daerah Sepang, Selangor Darul Ehsan	RM 10,031,311.00
9.	Jabatan Kerja Raya Selangor	Cadangan Membina dan Menyiapkan Pejabat JKR Gombak, Daerah Gombak, Selangor Darul Ehsan	RM 7,634,690

2.2 Organization Chart



CHAPTER 3: CASE STUDY

An observation was focused on Prime Engineering Consultant office and gas station Shell Dengkil project which located at Jenderam Hilir, Mukim Dengkil. The preparation of drainage system was observed from the beginning of designed of drainage systems for infrastructure from placing the drain, choosing type of drains for the construction and depth of drains. Also went to the site to observe for the installation of drainage of pre-cast U drain.

The project was undertaken by Billy Tong Song Sdn Bhd as main contractor for this project. The total cost for this project is worth RM 5 million which cover the whole construction. This building is constructed as its objective is to add more facilities for the local people and occupants of the main the road.

The site used a few types of drains as to minimize the cost which was some of them are very economical.



Figure 3.1: Plan view of the site

3.1 Process of preparing drainage system in office and on site.

Preparing drainage system in office.

1. The process began from the office for designing purpose before proceed to the site. Designing work was carried out first by the engineer in the office which was Ir. Muhammad Nabil Fikri. Designing work started with looking at the contour drawing plan that provided by the surveyors so that it could be identify the proper flow of rainwater through the drain to the outlet. After the flow of drain was identified, the engineer started to draw the drain by using Autocad. At the same time, engineer has to decided type of drains that would be used with help of reference for design purpose. Types of drains has been chose for the site which were pre-cast U drain, wide R.C drain with cover including inspector chamber or sump.

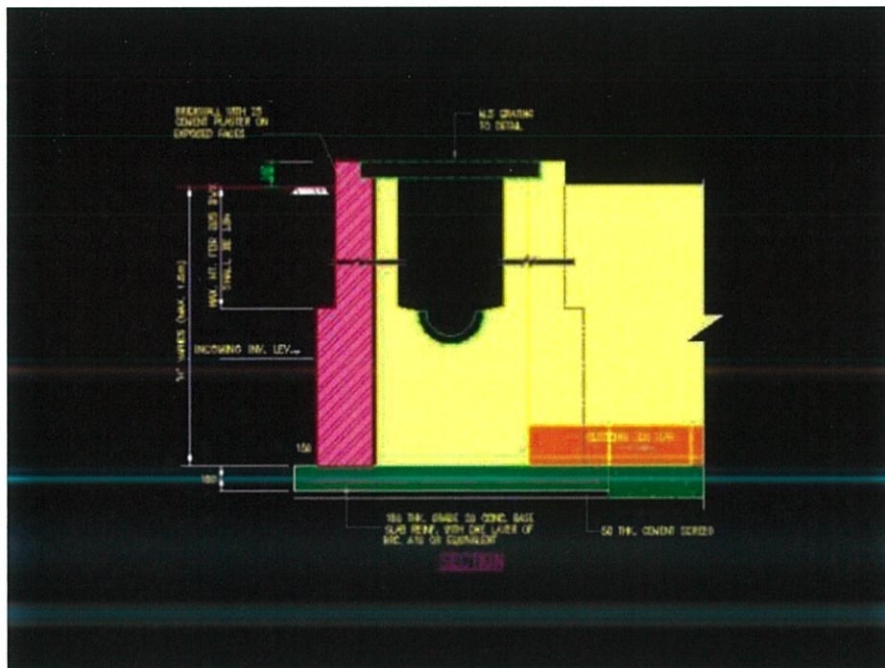


Figure 3.2 : View of wide drain

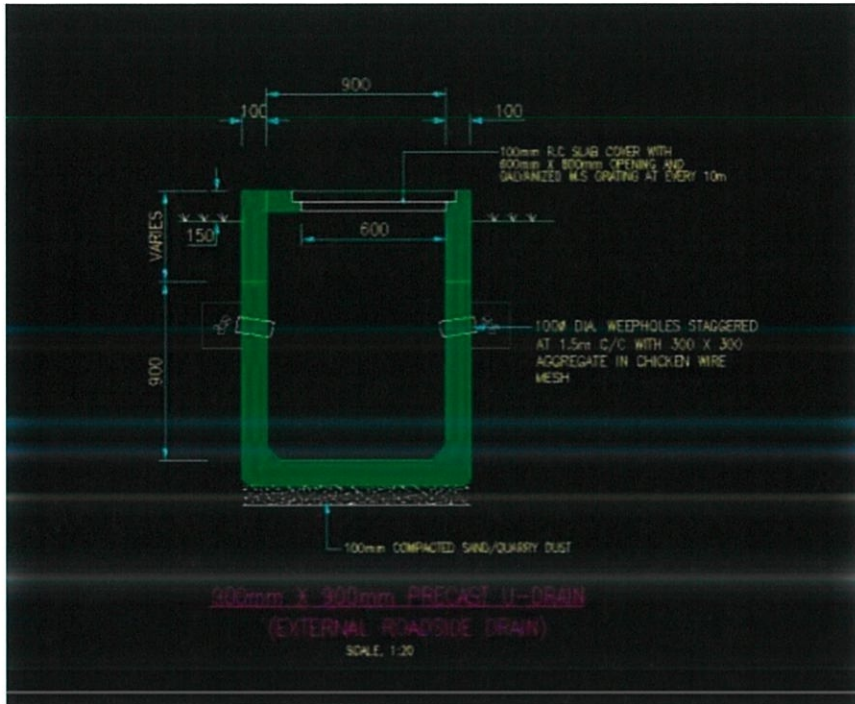


Figure 3.3 : View of pre-cast U drain

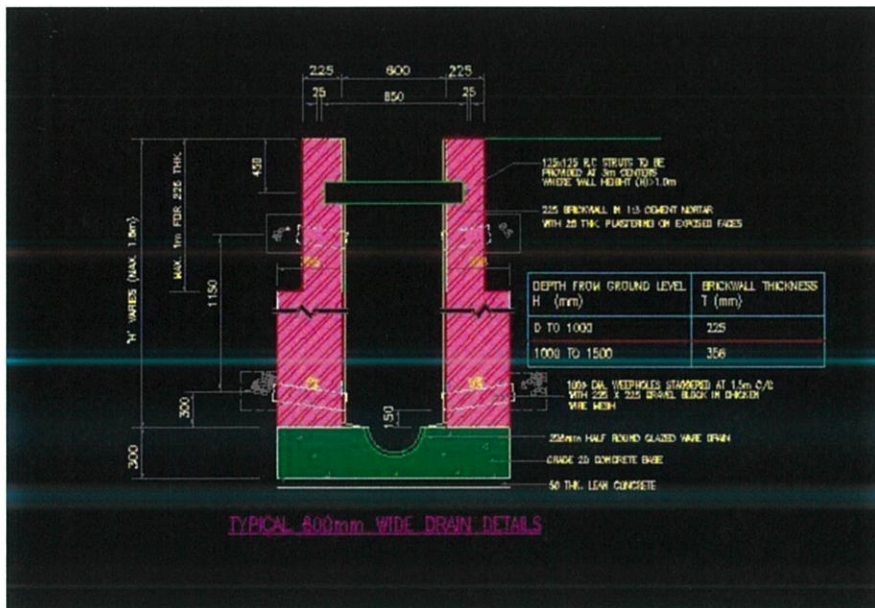


Figure 3.4 : View of wide drain details

2. After the drawing work done, invert level of the drain were calculated by using formula with determined of road level and gradient which ruled by BOMBA. The calculation for invert level carried out is to determine the specific depth of the drain that could be installed on the site.

Invert Level	Interval
$\text{DRAINING} = 15.92$ \rightarrow $\text{water supply road level (EL)}$	
Invert Level from existing to the right	Invert Level from existing to the left
1) IL = $15.90 - \left(\frac{1}{100} \times 20.0m \right)$ = 15.80	1) IL = $15.90 - \left(\frac{1}{100} \times 0.0m \right)$ = 15.90
2) IL = $15.80 - \left(\frac{1}{100} \times 51m \right)$ = 15.75	2) IL = $15.97 - \left(\frac{1}{100} \times 6.0m \right)$ = 15.94
3) IL = $15.75 - \left(\frac{1}{100} \times 9.6m \right)$ = 15.69	3) IL = $15.84 - \left(\frac{1}{100} \times 4.5m \right)$ = 15.82
4) IL = $15.69 - \left(\frac{1}{100} \times 1.0m \right)$ = 15.62	4) IL = $15.82 - \left(\frac{1}{100} \times 20.1m \right)$ = 15.71
5) IL = $15.62 - \left(\frac{1}{100} \times 14.7m \right)$ = 15.56	5) IL = $15.71 - \left(\frac{1}{100} \times 50.5m \right)$ = 15.45
6) IL = $15.56 - \left(\frac{1}{100} \times 2.3m \right)$ DRAIN = 15.50	6) IL = $15.63 - \left(\frac{1}{100} \times 10.0m \right)$ = 15.67
	7) IL = $15.67 - \left(\frac{1}{100} \times 29.9m \right)$ = 15.51
	8) IL = $15.51 - \left(\frac{1}{100} \times 11.4 \right)$ = 15.45

Figure 3.5 : Calculation of invert level of sumps for external sides

- Then, invert level for each sumps were put into the drawing called road and drainage drawing plan was prepared with a detail section for drainage system after get confirmed type of drain that will use by engineer as shown in appendix I. All drawings were complete with exact dimension in plan and details, gradient, type of drain that confirmed by engineer. All drawings were submitted to SYABAS, IWK and JPS for approval. After SYABAS has approved, then the construction work on site could be proceed.

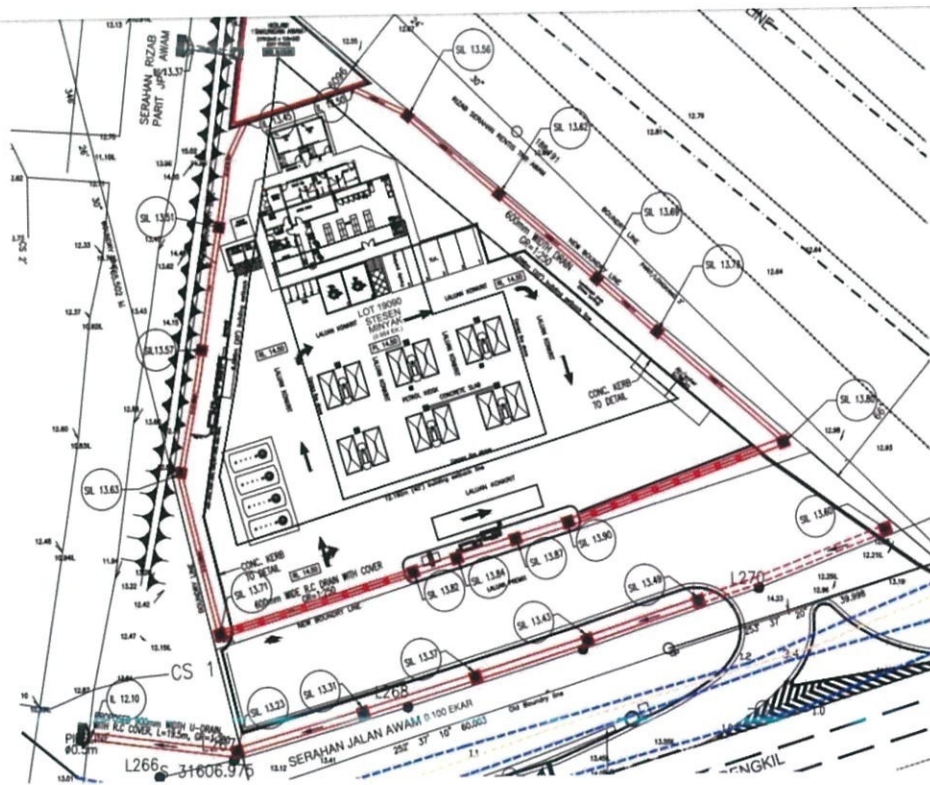


Figure 3.8 : Closer look of road and drainage drawing

Preparing drainage system in site.

1. After all the authorities gave their approval of design from road and drainage drawing, drainage work could began on the site as in the schedule. All the works for drainage were followed to the schedule. The installation was started with excavated the soil to the required depth as for invert level for drains.
2. Crusher run has been laid on the lowest ground for drain and then compacted by using compactor as to level the layer of crusher run. Crusher run was used as a slab to retain the drain from not being sunk into the ground.
3. After crusher run was laid and compacted in all trench for drain, mortar was laid on the compacted crusher run as to level the surface.
4. Installation of pre-cast U drain started after a few hours mortar were laid. The drain was brought to the site a day before drainage work began.
5. Mortar joint filled the gaps between two pre-cast U drain after installation of drain done. Mortar used to fill the gaps as shown in Figure 3.9 as to avoid gaps that can cause leak. After all mortar dried and became hard, finishing work began with inspection to detect any defects or incomplete work done by the workers.



Figure 3.9 : Closer look of gap filled with mortar joint



Figure 3.10 : Mortar joint in all drains on external sides



Figure 3.11 : Installation of pre-cast U drain completed

3.2 Problems occur before and during construction work.

Every work and construction are very likely to get problems especially during construction. During this project goes, there were a few problems occur before construction and during construction. There are problems with utilities and authorities. Some of the problems caused a delayed of construction duration and contractor can lost huge amount of money due to delayed construction. This project cannot say that it was not went smoothly.

1. There were a few problems occur for this project which were before and during the construction. Before the construction began, the site was placed with utilities near to the site which made problems and risky towards the site area. The site area for Shell gas station was stated just near with TNB substation. What it made a problem is the TNB substation has high voltage which is very risky that can lead to fatal accident in the future.
2. Other than that, the site also was placed near by the river in around 10 meters in duration. It became a problem because the land would have high moisture content that can cause a settlement which is dangerous. This problem also

would give defects to the building such as cracked wall and overturning of building or collapse building.

3. The problem occurred during the construction work was a soil problem. Seems the site was near by the river and rain in often, the soil became silt.
4. Others, while on construction, problem occurred was the roadwork for additional lane for way in to the site could not continue due to two underground pipes existing was in the same area where the roadwork has to be. If the roadwork continued, those two pipes could have crack or leak and the road surface will bumpy.
5. The main road in front of the site also being a problem where the road was feared floods easily due to nearby the river. Recently the occupants of the road often complained that water was easy raised whenever heavy rain.

3.3 Solution taken to overcome problems

1. Every problem has solutions to overcome and become better than before. Planning for taking solutions towards problems occurred is very important whenever facing problems.
2. Utilities problem like TNB substation and river were the first problem faced where the site placed between them. Solution has taken with report to the TNB first to tell that the site area was nearby TNB substation. After received the report, TNB requested to engineer to offset 30 metres from the substation. Engineer and surveyor have made 30 meters offset the site from the substation as requested by TNB.

3. Along with that, engineer also reported to Jabatan Perairan dan Saliran (JPS) about the site was nearby to river. JPS also requested to offset the site 20 meters from the river which soil were dryer and strong.
4. Engineer has sent an application letter to SYABAS for relocation of two pipes as requested by JKR. So far the approval was in consideration.
5. Solution has made where the road would be rise up to 150mm after the construction for the site done and then the roadwork could be proceeded.

CONCLUSION

Based on the ponder of the case consider, it can be concluded that the strategies of development project are appeared, issues happened has been recognize and the solution is taken. Observation has made at the office and site visit also made to get significant information. Furthermore, interview was made with engineers for further information like project detail and for more understanding. The method that used for the preparation of drainage work in office and on site are the common method like other consultant and contractor use for the preparation and it moreover convey with the theory. However, all through investigation and observation there were issues within the construction. The construction site became a bit smaller due to utilities nearby the site to avoid any accidents happen in the future. Not only that, the construction has to delay due to get permission for relocation of pipes underground for the roadwork can be start.

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