UNIVERSITI TEKNOLOGI MARA

DEPARTMENT OF BUILDING
UNIVERSITI TEKNOLOGI MARA
(PERAK)

CONSTRUCTION OF RAFT FOUNDATION

Prepared by:

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DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

JULY 2019

It is recommended that the report of this practical training provided

by

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entitled

The Construction of Raft Foundation

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 Paramount Property Sdn Bhd for a duration of 14 weeks starting from 25 February 2019 and ended on 31 May 2019. It is submitted as one of the prerequisite requirements of DBG307 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

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Lastly, also special thanks to my parents for the support they gave me to complete this report from the first day until the last day of my practical training.

ABSTRACT

A raft foundation is basically a thick reinforced concrete slab laying on large area of ground reinforced with steel bars that supports the column or wall and transfer the load to the ground. Raft foundation basically used to support structures like residential and commercial building where the soil condition of the area is soft and poor. This type of foundation will be used when the floor areas are small and structural loading are low such as in one or two-storey residential construction. Raft foundations can be fast and cost-saver to construct, because they did not required deep excavations compared to strip or pad foundations. Raft foundation use less material as they combine the foundation with the ground slab. The aim of this report is to understand more about the construction process of raft foundation. The objective of this report is to study the method uses, the equipment, and the machinery used for the construction. This report also contains the procedure of constructing the raft foundation from the setting out work to the complete raft foundation. The work for the construction must follow the process to avoid any failure or delay work that might affect the cost or time of the work.

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1.0 INTRODUCTION

1.1 BACKGROUND AND SCOPE OF STUDY

A raft foundation is basically a thick reinforced concrete slab laying on large area of ground reinforced with steel bars that supports the column or wall and then transfer the load to the ground. Raft foundation basically used to support structures like residential and commercial building where the soil condition of the area is soft and poor. This type of foundation will be used when the floor areas are small and structural loading are low such as in one or two-storey residential construction. Raft foundations can be fast and cost-saver to construct, because they did not required deep excavations compared to strip or pad foundations.(Chudly,R & Greeno,R, 2010)

Raft foundations can be fast and cost-saver to construct, because they did not required deep excavations compared to strip or pad foundations. This type of foundation commonly used in rural areas for commercial building or residential. Raft foundation also good for construction of basement or underground. The process consists of excavating the soil for the purpose of finding strong soil component, compact and undisturbed natural soil. Common construction materials such as spacer, formwork, reinforcement and concrete used to construct this type of foundation.(Cathy,Cassidy, 2003)

The raft foundation is the most common and popular type of foundation for building as it is simple to construct and its effectiveness on poor soil condition. Drainage might be required in certain condition under raft foundation and geotextile barriers might be required to avoid free draining materials to be clogged by any encompassing soil. The soil condition needs to be investigated and the loading condition of the building must be analysed for optimal use of the foundation for safety purpose.(Civil Engineering, 2018)

1.2 OBJECTIVE

The construction of raft foundation consists of many steps and procedures. It is to ensure that the construction process is well prepared and constructed to make sure there is no failure to the structure. So, the objective for this construction of raft foundation is to:

1) To study the procedure of constructing the raft foundation
2) To identify the advantages of raft foundation to building.
3) To study the process involve in construction of raft foundation.
4) To study the machineries and equipment used in constructing raft foundation.

1.3 SCOPE OF STUDY

The scope of study focuses on the procedure and method of construction, machinery and equipment used in constructing the raft foundation in Bukit Banyan. The scope of study for the raft foundation construction are :

1) Setting out
2) Excavation for plumbing
3) Excavation for raft foundation
4) Fixing formwork for raft foundation
5) Sand binding for raft foundation
6) Applying anti-termite treatment
7) Laying blue plastic cover
8) Installing steel bar & BRC
9) Installing spacer block
10) Concreting for raft foundation
11) Concrete vibrating and levelling the concrete surface
12) Carry out slump test
13) Carry out compressive test for test cube

1.4 METHOD OF STUDY

Two methods are used to collect the information for this report. The methods are primary and secondary. Primary methods are method that is raw and obtained directly from observation, or experimentation. The resources from this method is original and not been documented. Secondary methods are the data that have already available collected by someone else. Other sources of secondary data are from books, magazines or newspaper.

1) Observation.

   This method is been done directly at the construction site. Notes are taken and a camera is used to take the picture of any work process or any information during observation.

2) Interview.

   Interviews were also conducted to get more details information about the project. This method had been done by interviewing the people who are directly involved in the project such as site supervisor, engineers and workers.

3) Books.

   Book also have been used as other sources to get more information about the project and work being done. Several books have been used to obtain the procedure of the work.

4) Drawing.

   Drawing details about the raft foundation such as size and type of steel bar used. Drawing plans have been provide by the supervisor. It gives more understanding as the drawing shows in details the arrangement of bars and measurement of the foundation.

2.0 COMPANY BACKGROUND

2.1 INTRODUCTION OF COMPANY

As one of a developing country and in the race of being one of the most developed country during year 2020, all parties whether it is from private company or government need to work together to achieve the goal. As one of registered construction company, the first project run by Paramount Construction is Taman Patani Jaya, Sungai Petani in 1980. This company managed to finish the project which is 173 -acre (1600 units) mixed development schemes exceeding RM200 million. Paramount Construction is also a developer for Taman Sutera which is a collaboration development plan with 23 -acres (212 units) low-cost, also located in Sungai Petani, Kedah.

Paramount Construction Sdn Bhd is one of the best construction company that have the best record in Sungai Petani as a trusted, responsible and has well-established interest in property development in achieving the company's vision and mission. Besides, Paramount Construction Sdn Bhd also constructed a 493 -acres urban development known as Bandar Laguna Merbok, Sungai Petani which was completed in 2012.

Now, Paramount Construction Sdn Bhd is continuing its development in Bukit Banyan, Sungai Petani. The total area of land to be built is 520 -acres. Bukit Banyan is located just a minute away from the North-South Highway and the town of Sungai Petani. Thus, Paramount Construction are responsible to construct a project that involve civil engineering works and building works.

Figure 2.1 Company Logo

VISION

- Changing lives and enriching communities for a better world.

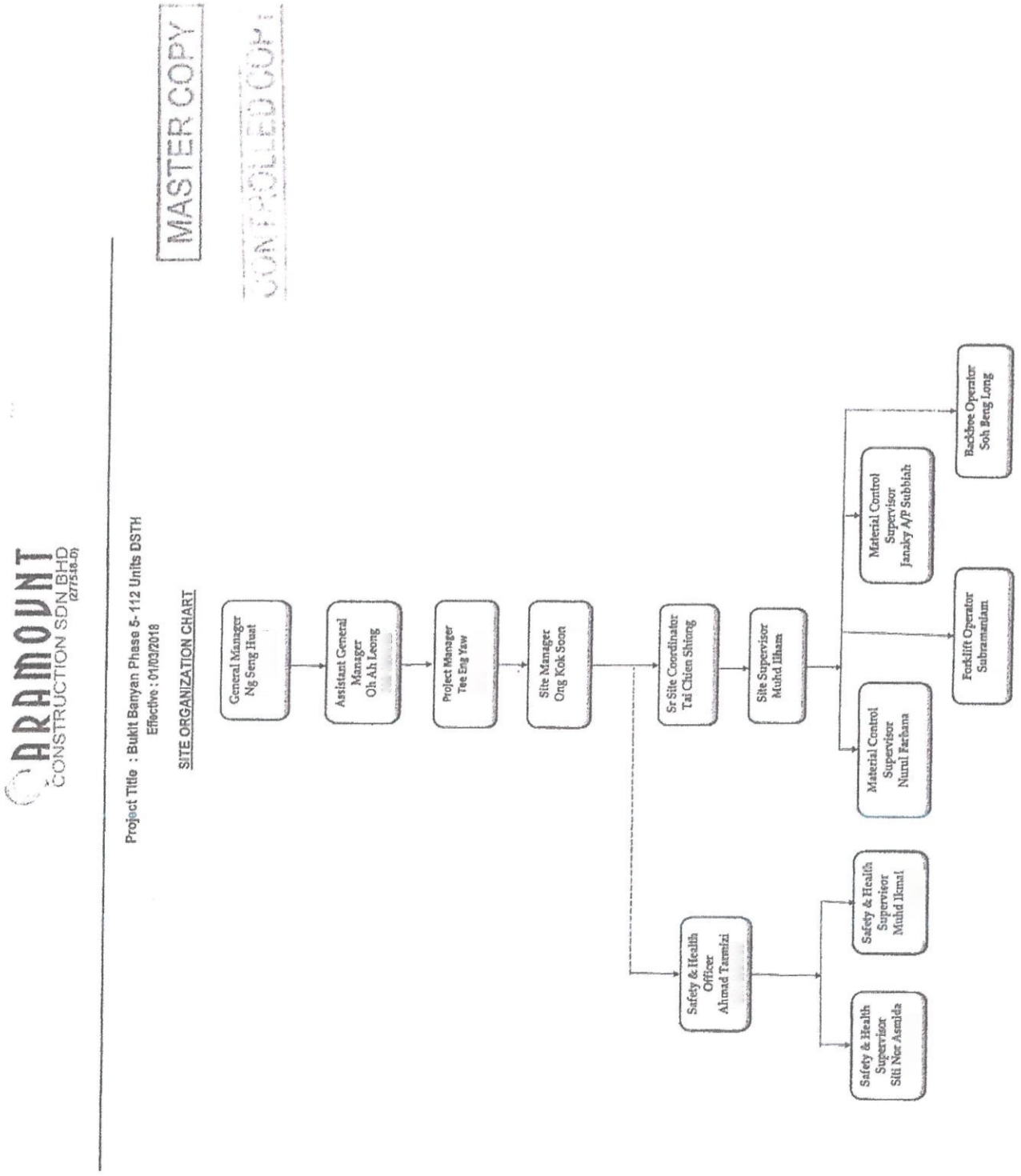
MISSION

- To deliver superior products and service that benefit society, and shape future generation of leaders and thinkers.
- To care for the safety and health of our people, and we believe in developing their talents through empowerment and enabling them to maximise their potential.
- To grow their business to deliver sustainable and responsible shareholder returns while ensuring that we continue to protect our environment.
- Be bold in technological innovations to be market leaders in our core business.
- To leverage on the synergies within our business ecosystem to create unique product offerings.

Figure 2.2 Paramount Property (Utara) Sdn. Bhd.

2.2 ORGANIZATION CHART

Figure 2.3



2.3 LIST OF PROJECTS

2.3.1 COMPLETED PROJECT

No	Project	Cost	Title of Project	No. of Unit
1	AZELIA 	RM45,540,000	Cadangan Membina 138 Unit Rumah Semi-D Dua Tingkat Azelia (Phase 1) Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman	138
2	AZELIA ELITE 	RM44,800,000	Cadangan Membina 121 Unit Rumah Semi-D Dua Tingkat Azelia Elite (Phase 1) Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman	121
3	EUGENIA 	RM48,600,000	Cadangan Membina 111 Unit Rumah Semi-D Dua Tingkat Eugenia (Phase 1) Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman	111
4	AZELIA ELITE 2 	RM42,120,000	Cadangan Membina 112 Unit Rumah Teres Dua Tingkat Azelia Elite 2 (Phase 2) Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman	112

5	AZELIA 2 	RM39,900,000	Cadangan Membina 111 Unit Teres Dua Tingkat Azelia 2 (Phase 2) Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman	111
6	EUGENIA 2 	RM44,280,000	Cadangan Membina 124 Unit Rumah Semi-D Dua Tingkat Eugenia 2 (Phase 3) Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman	124
7	AZELIA 3 	RM36,050,000	Cadangan Membina 103 Unit Rumah Teres Dua Tingkat Azelia 3 (Phase 3) Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman	103
8	AZELIA ELITE 3 	RM42,120,000	Cadangan Membina 108 Unit Rumah Teres Dua Tingkat Azelia Elite 3 (Phase 3) Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman	108

Source: Paramount Property (Utara) Sdn Bhd

Table 2.1

2.3.2 PROJECT IN PROGRESS

No	Project	Cost	Title of Project	No of Unit
1	AMARYN 	RM53,136,000	Cadangan Membina 141 Unit Rumah Teres Dua Tingkat Amaryn (Phase 4) Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman	141
2	CITRA ELITE 	RM20,156,000	Cadangan Membina 103 Unit Rumah Teres Satu Tingkat (Phase 6) Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman	103
3	CITRA TOWNHOUSE 	RM25,560,000	Cadangan Membina 234 Unit Rumah Teres Dua Tingkat (Phase 6) Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman	234
4	EMILIA 	RM74,485,100	Cadangan Membina 149 Unit Rumah Teres Dua Tingkat (Phase 6) Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman	149

5	SIERRA HILLSIDE 	RM54,393,200	Cadangan Membina 68 Unit Rumah Semi-D Dua Tingkat Sierra Hillside (Phase 7) Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman	68
6	SIERRA LAKESIDE 	RM14,000,000	Cadangan Membina 28 Unit Rumah Semi-D Dua Tingkat Sierra Lakeside(Phase 7) Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman	28

Source: Paramount Property (Utara) Sdn Bhd

Table 2.2

3.1 CASE STUDY

Project	:	Cadangan Membina 185 Unit Rumah Teres Setingkat (Phase 6) Di Atas Plot 1773-1957, Di Atas Lot Pt 1593, Pt 1595, Pt 5957 Dan Pt 5958, Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman
Developer	:	Paramount Property (Utara) Sdn Bhd
Architect	:	KL Wong Architect Sdn Bhd
Structure & Civil Engineering	:	Perunding THD Sdn Bhd
M & E Engineer	:	Tafa Perunding Sdn Bhd
Contractor	:	Paramount Property (Utara) Sdn Bhd

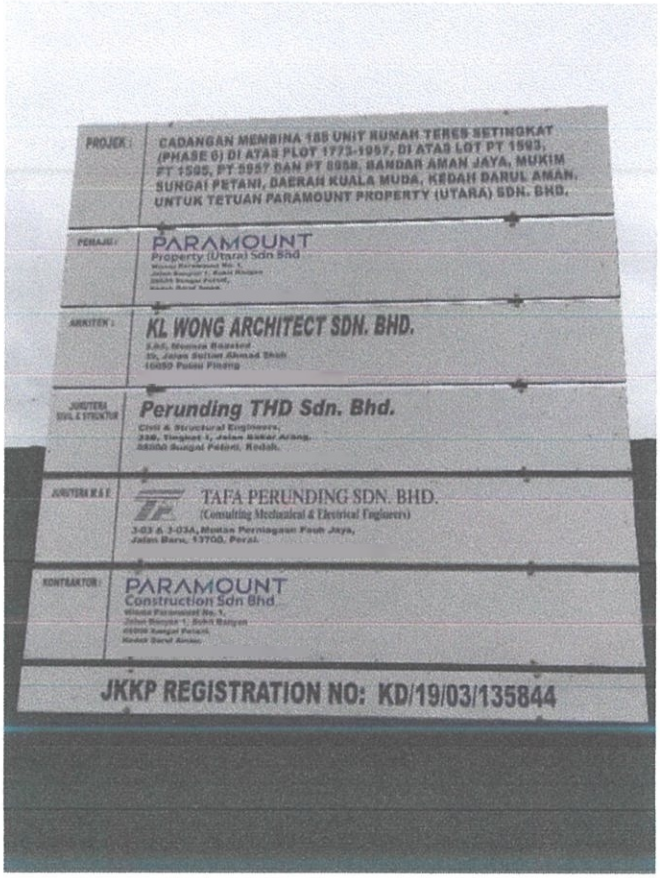
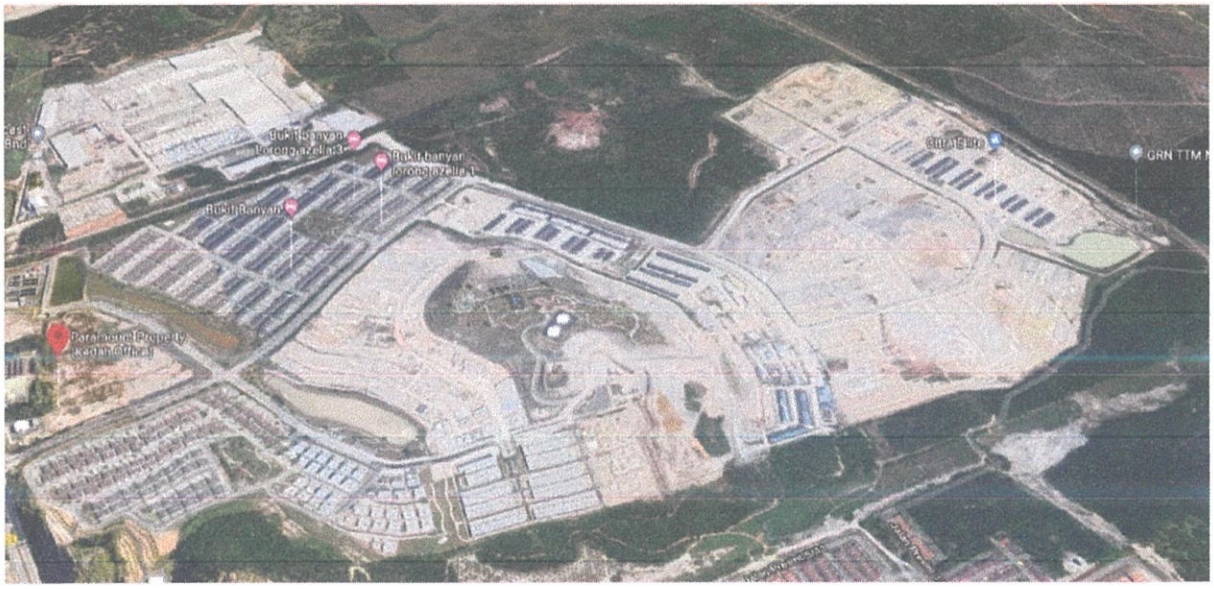


Figure 3.1

Site Plan of 185-unit Single Storey Terrace House Phase 6

Figure 3.2



Location Plan for 185-unit Single Storey Terrace House Phase 6

Figure 3.3

Front view of 185-unit Single Storey Terrace House Phase 6

Figure 3.4

Rear view of 185-unit Single Storey Terrace House Phase 6

Figure 3.5

3.2 CASE STUDY

Raft foundation or mat foundation is basically a large slab laying on the ground that expand over the whole structure thereby supporting the structure and transfer the weight to the ground. It is commonly used in constructing residential or commercial building area that have poor low bearing capacity of soil.

In general, raft foundation is constructed on compacted hardcore base. A layer of concrete will be laid to enable the formation of raft with a waterproof membrane above. The concrete raft contains steel bar reinforcement to prevent cracking and produce additional support such as below internal wall and columns. Thickened reinforced area will be made at perimeter of raft to create an edge beam for the support of external wall.

Raft foundation is popular for the cost saving and fast construction process. However, raft foundation has its own disadvantage which they are exposed to erosion if there is no investigation and inspection made towards the soil and loading condition of the building.

The process of constructing raft foundation are:

1) Setting out
2) Excavation for plumbing
3) Excavation for raft foundation
4) Fixing formwork for raft foundation
5) Sand binding for raft foundation
6) Applying anti-termite treatment
7) Laying blue plastic cover
8) Installing steel bar & BRC
9) Installing spacer block
10) Concreting for raft foundation

11) Concrete vibrating and levelling the concrete surface

12) Carry out slump test

13) Carry out compressive test for test cube

3.3 METHOD OF CONSTRUCTION

1) Setting Out

Figure 3.6

Figure 3.7

Setting out is the outline of the excavation and centre line of the walls. Setting out are made to set up the position of the trench and wall of the house. It is also made to determine the position of corners and rooms. The surveyor will locate the dimension from the layout plan onto the ground so that the construction of the building can be carried out according to the plan.

2) Excavation for plumbing system

Figure 3.8

Excavation for plumbing system are made for delivery of waste material directly to the manhole. The piping system will be installed after the excavation are made. The depth for excavation is usually 475mm deep and it took 4 days to excavate the whole block before the piping system can be installed. This work needs the manpower of 1 backhoe case and 4 plumbers.

3) Excavation for raft foundation

Figure 3.9

The process of excavation for raft foundation started from the point marking in traverse survey. The excavation is conducted by using the reference line that have been transferred from peg to the ground as gridline for the excavation work. The gridline will be used as guide for the excavation of the raft foundation.

4) Fixing formwork for raft foundation

Figure 3.10

Figure 3.11 Preparation for formwork

The formwork for the raft foundation will be build based on the drawing plan. It need to be built strongly to withstand the impact from the vibration from concrete vibration during

concrete casting. During formwork installation, the carpenter needs to ensure the formwork have no leakage and any open space to make sure there is no overspill concrete that can cause honeycomb.

5) Sand blinding for raft foundation

Figure 3.12

Sand blinding is a process of laying soil on the hardcore layer to produce a clean and dry working surface. Layer of soil usually around 50mm thick is poured over the hardcore ground to level the surface.

6) Anti-termite treatment

Figure 3.13

Anti-termite treatment is a process to prevent any termite problem that might reduce the life span of a building. Before the anti-termite treatment started, the soil layer must be cleaned off any debris or dirty. The treatment was being done by directly applied the liquid treatment onto the all area of sand blinding to prevent the termites.

7) Laying blue plastic sheet cover

Figure 3.14

This process had been done directly after the anti-treatment work. The blue plastic sheet or blue polyethene sheet was laid to cover the sand blinding as well as to prevent any water vapour that might penetrated the floor level in future.

8) Installing steel bar and BRC

Figure 3.15

Figure 3.16 Preparation for steel bar

The installation of steel bar and BRC need the manpower of 5 bar bender and 1 crane to lift the BRC. The BRC need to be checked to make sure it is using the same size and type as in the plan. The type of BRC used in this construction of raft foundation is type A&B. After installation, inspection work was done to ensure the BRC is tied tightly using the barbed wire, vertically placed and the alignment of BRC were correctly done according to the plan.

9) Installing spacer block between reinforcement bar

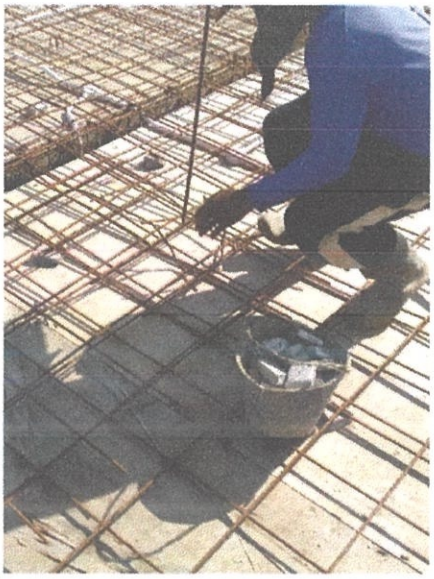


Figure 3.17

Block spacer were used to give a specific height to the reinforcement bar before concrete casting work. The thickness of the spacer block is equivalent to the thickness of the concrete cover.

10) Concreting for raft foundation

Figure 3.18

Concrete casting for raft foundation were done after the BRC and steel bar were completely installed. Before the casting, the area of slab must be clean from any debris and sand. Slump test and cube test were carried out before the concrete casting for the raft foundation to make

sure the suitable strength for the raft foundation. The type of concrete used was a high strength grade which is grade 25 with the ratio of 1:1:2.

11) Concrete vibrating and levelling the concrete

Figure 3.19

Concrete vibration work was done to prevent any air space or bubbles trapped in the concrete mixture that can cause honeycomb and reduce the concrete quality. Concrete vibration process will reduce the internal friction of mix component of cement, aggregate, and water and it will help the concrete mix to move around and fill the empty space.

To prevent rough surface of the concrete, levelling work for the concrete after concrete pouring were done. This to make sure the concrete material will not separate. This work can be done by using trowel.

12) Carry out slump test

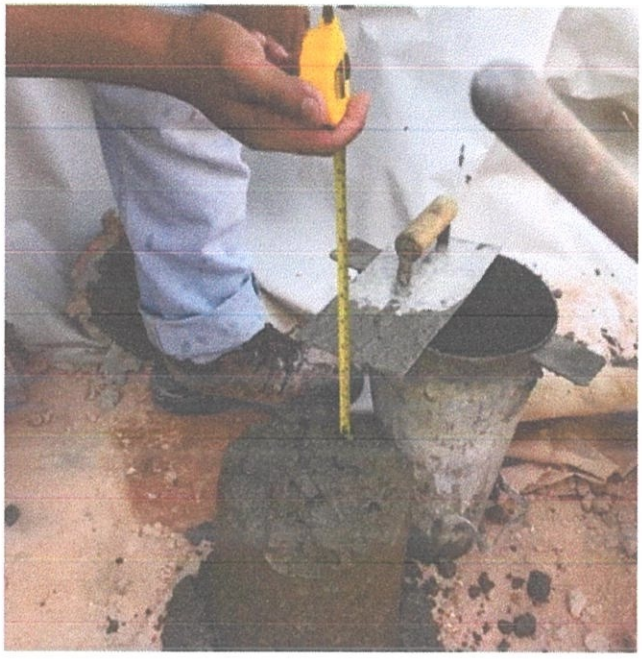


Figure 3.20

Slump test were carried out to measure the consistency of the fresh concrete before it will be used. Slump test also were carried out to check the workability of freshly made concrete.

13) Carry out compressive test for test cube

Figure 3.21

Compressive test for test for test cube were conducted to know if it is suitable for the concrete casting purpose and relates directly to the required designed strength prepared by the designer.

Method Statement Form

PROJECT :Cadangan Membina 185 Unit Rumah Teres Setingkat (Phase 6) Di Atas Plot 1773-1957, Di Atas Lot Pt 1593, Pt 1595, Pt 5957 Dan Pt 5958, Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman

NAME: ADAM

DATE: 28 FEB 2019

ELEMENT :Raft Foundation

Table 3.1

NO	FIGURE	WORK	EQUIPMENT & MACHINERY	LABOUR	DURATION	REMARKS
1		Setting Out Work	-Theodolite	-1 surveyor	-2 days	

Method Statement Form

PROJECT :Cadangan Membina 185 Unit Rumah Teres Setingkat (Phase 6) Di Atas Plot 1773-1957, Di Atas Lot Pt 1593, Pt 1595, Pt 5957 Dan Pt 5958, Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman

NAME: ADAM

DATE: 28 FEB 2019

ELEMENT :Raft Foundation

2		Excavation for plumbing	- PVC pipe -Handsaw	-3 plumber -1 machine operator	-3 days	
3		Excavation for raft foundation -3 days	-Backhoe case -Shovel	-1 machine operator -3 general worker	-3 days	

Method Statement Form

PROJECT :Cadangan Membina 185 Unit Rumah Teres Setingkat (Phase 6) Di Atas Plot 1773-1957, Di Atas Lot Pt 1593, Pt 1595, Pt 5957 Dan Pt 5958, Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman

NAME: ADAM

DATE: 28 FEB 2019

ELEMENT :Raft Foundation

4		Fixing formwork for raft foundation	-Hammer -Nail -Measuring tape	-5 carpenter -3 general workers	-3 days	
5		Sand binding for raft foundation	-Backhoe case -Shovel	-1 machine operator -3 general workers	-2 days	-50 mm thick sand blinding

Method Statement Form

PROJECT :Cadangan Membina 185 Unit Rumah Teres Setingkat (Phase 6) Di Atas Plot 1773-1957, Di Atas Lot Pt 1593, Pt 1595, Pt 5957 Dan Pt 5958, Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman

NAME: ADAM

DATE: 28 FEB 2019

ELEMENT :Raft Foundation

6		Applying anti-termite treatment	-Anti termite chemical -Spray nozzle -Power sprayer	-2 workers -3 general workers	-1 day	
7		Laying blue plastic cover	-Blue polyethene sheet -Cutter	-3 general workers	-1 day	

Method Statement Form

PROJECT :Cadangan Membina 185 Unit Rumah Teres Setingkat (Phase 6) Di Atas Plot 1773-1957, Di Atas Lot Pt 1593, Pt 1595, Pt 5957 Dan Pt 5958, Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman

NAME: ADAM

DATE: 28 FEB 2019

ELEMENT :Raft Foundation

8		Installing steel bar and BRC	-Binding wire tool -Binding wire - 1 crane	-5 bar bender	-3 days	Steel bar and BRC Type A&B (200x200 & 100mm main spacing, 200mm cross spacing)

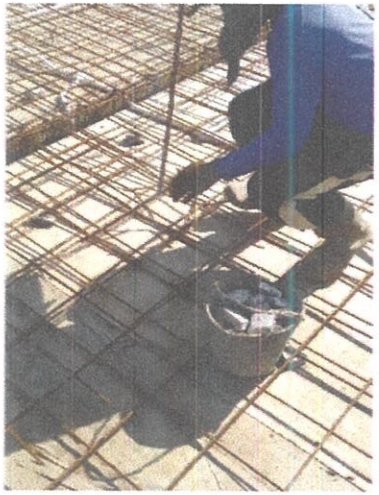
Method Statement Form

PROJECT :Cadangan Membina 185 Unit Rumah Teres Setingkat (Phase 6) Di Atas Plot 1773-1957, Di Atas Lot Pt 1593, Pt 1595, Pt 5957 Dan Pt 5958, Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman

NAME: ADAM

DATE: 28 FEB 2019

ELEMENT :Raft Foundation

9		Installing spacer block between reinforcement bar	-50mm x 50mm, Spacer block	-3 general workers	-1 day	

Method Statement Form

PROJECT :Cadangan Membina 185 Unit Rumah Teres Setingkat (Phase 6) Di Atas Plot 1773-1957, Di Atas Lot Pt 1593, Pt 1595, Pt 5957 Dan Pt 5958, Bandar Amanjaya, Mukim Sungai Petani ,Daerah Kuala Muda, Kedah Darul Aman

NAME: ADAM

DATE: 28 FEB 2019

ELEMENT :Raft Foundation

10		Concreting for raft foundation	-1:1:2, grade 25 concrete -1 crane -1 ready mix concrete mixer	-5 concreter -3 general worker	-2 days	
11		Concrete vibrating and levelling the concrete surface	-Trowel -Concrete vibrator	-3 general workers	-1 day	

Method Statement Form

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NAME: ADAM

DATE: 28 FEB 2019

ELEMENT :Raft Foundation

12		Carry out slump test	-Cone -Measuring tape -Scoop -Tamping rod -Trowel	-1 worker	-1 day	

Method Statement Form

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NAME: ADAM

DATE: 28 FEB 2019

ELEMENT :Raft Foundation

13		Carry out compressive test for test cube	-Cube -Grease -Test cube mould	-1 worker	-1 day	

3.4 MACHINARIES AND TOOLS

Figure 3.22

1) Binding wire

Binding wire is used to tie the jointing between reinforcement bars. It is use widely in construction field to tie the reinforcement bar joint to keep the structure undefiled.

2) Bar binding tool

Bar binding tool is used to help tie the binding wire. It was simple and very easy to use.

3) Measurement tape

Figure 3.23

Measurement tape is a flexible ruler used to measure distance. It is made from metal strip with linear measurement. It is used to measure the length of the reinforcement bar, spacing of the bar and the size of the formwork to ensure it is made according to the plan. This type of measuring tape is commonly used in construction field.

4) Backhoe case

Figure 3.24

Backhoe case is a common machinery used in construction. It consists of digging bucket at the end of two-part arm that is typically attached on the back of the backhoe or front loader. The backhoe case is used to excavate the raft foundation and excavate the drainage system.

5) 16 tonne crane

Figure 3.25

Crane is a machine that is equipped with a hoist rope, chains and sheave to lift and lower the material. It is used to lift heavy load and moved them to another place. Crane also a common machinery used in construction industry to transfer materials to other places. In this case, crane is used to lift the cement bucket during concrete casting work.

6) Concrete mixer

Figure 3.26

Concrete mixer is a machine that combine cement, aggregates such as sand and water to form concrete. The ready-mix concrete mixer will carry the materials and they will maintain the material state by agitation until delivery. They must ensure the concrete material is still perfect until the delivery process to prevent the decreasing quality of the concrete or delay work.

4.0. CONCLUSION

The objective for this report is to learn about the process of construction for raft foundation located at Bukit Banyan, Sungai Petani that being conducted by Paramount Property (Utara) Sdn.Bhd. The purpose of this report is to explain the construction of raft foundation and the machinery and tools used during the project. The work sequence for raft foundation in this report start with setting out for building lines, excavation for plumbing and others. To get the concrete forms that meet all job requirement, the supervisor and engineer must understand the characteristic, properties and behaviours of the materials used. They also must be able to estimate the loads applied to the form and be familiar with the advantages. The selection of the formwork system depends on the available materials, the size of the construction work and these factors affect the total cost of the construction project. To be conclude, raft foundation is the most simple, low cost and time saver on the method of installation and the quality of it. Over the time, increasing number of understanding to raft foundation has led to a lot of improvement towards raft foundation in construction industry.

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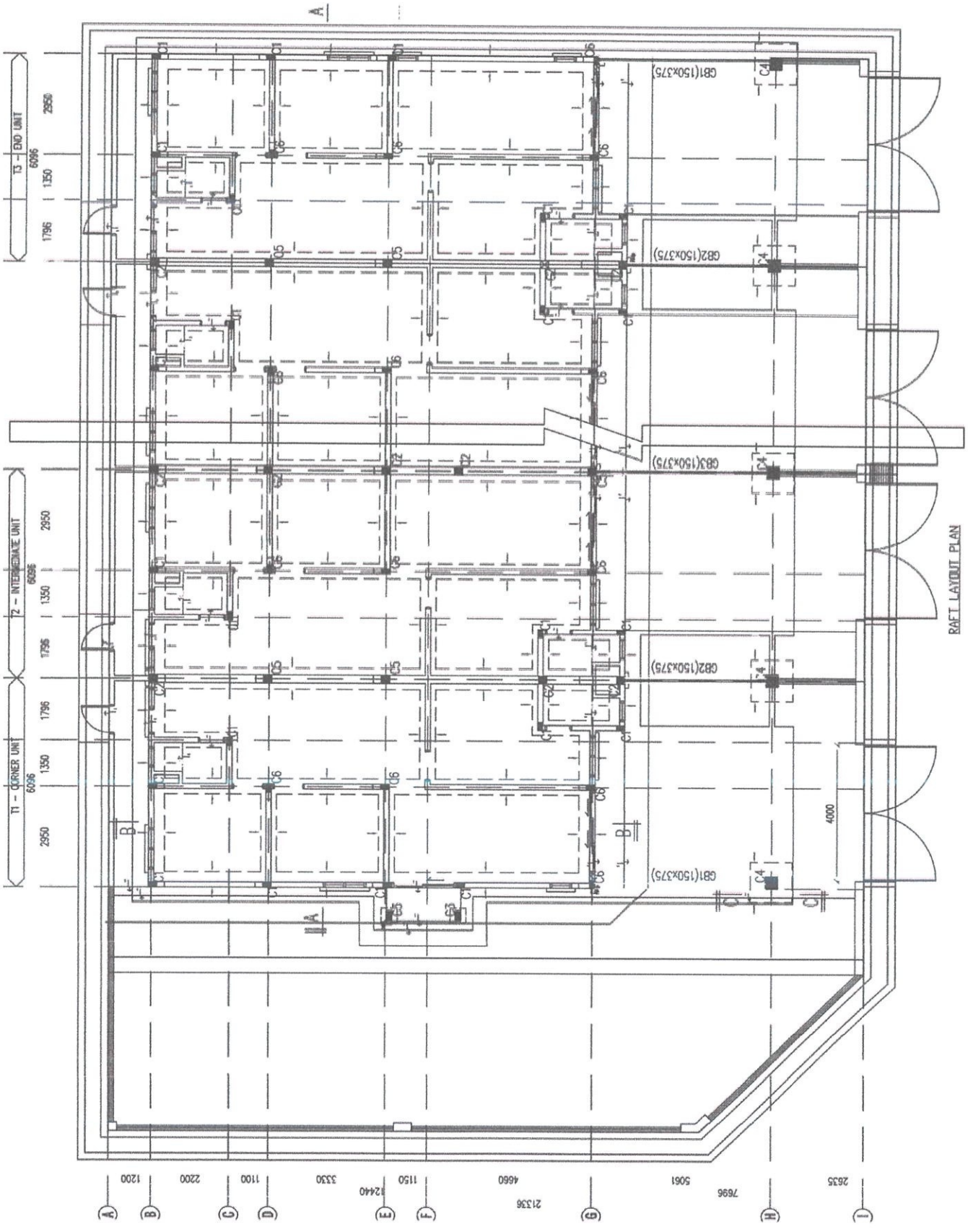
3) Cathy, Cassidy. (2003). Foundation and Concrete Work. The Taunton Press, Newton

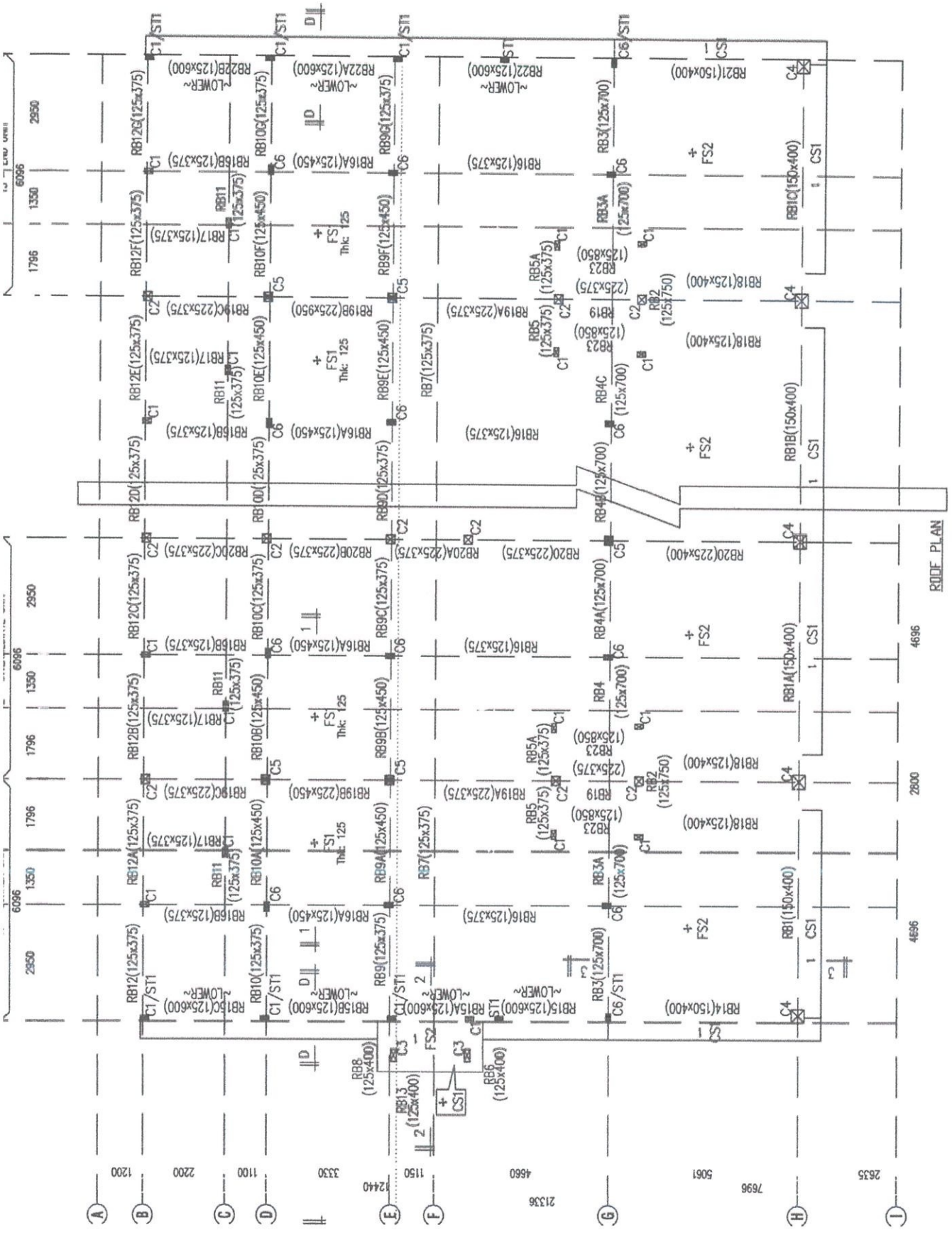
Websites:

1) Wikipedia: https://en.wikipedia.org/wiki/Concrete_slab
2) Designing Building Wiki. (2019). Available from: https://www.designingbuildings.co.uk
3) Civil Engineering. (2018). Available from: https://civiltoday.com/

APPENDICES

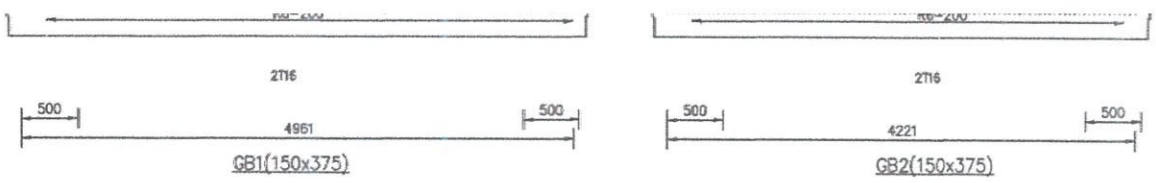
Appendices A: Raft layout plan for 185-unit Single Storey Terrace House





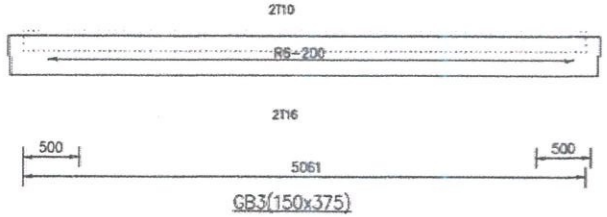
Appendices B: Roof plan of 185-unit Single Storey Terrace House

Appendices C: Typical detail for beam drop



GB1(150x375)

GB2(150x375)



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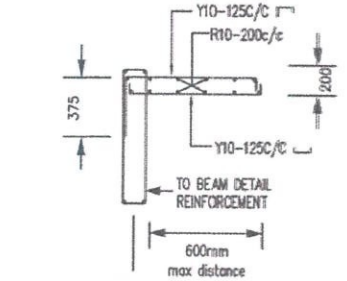
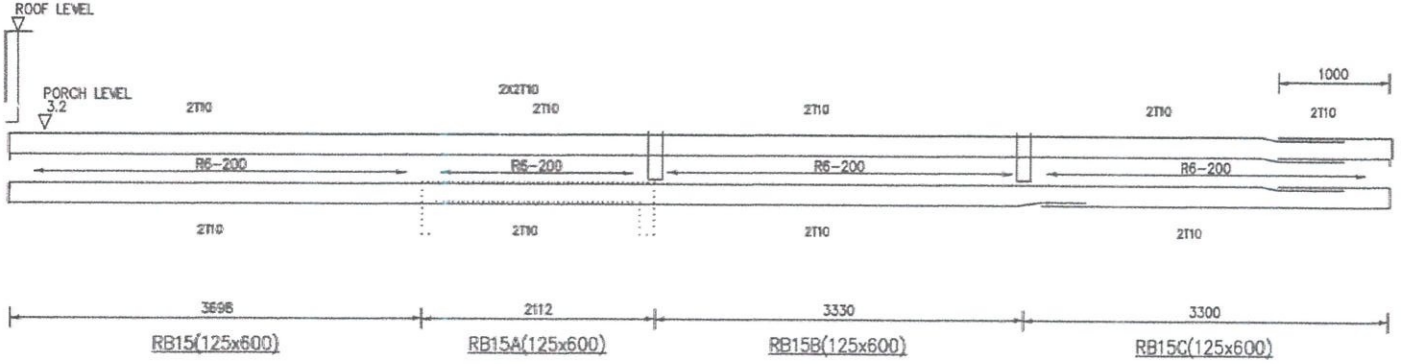


TYPICAL COPING FROM BEAM DETAILS (SECTION D-D)

(SCALE:NTS)



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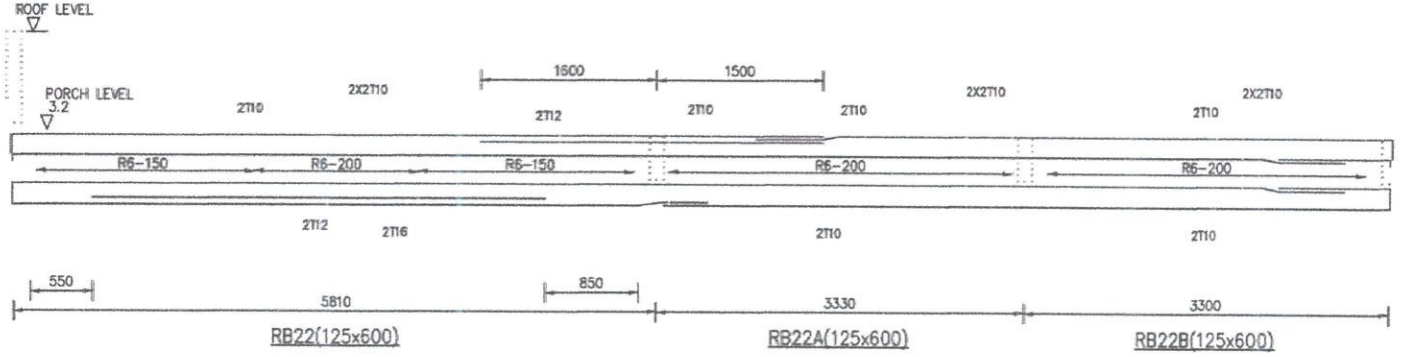

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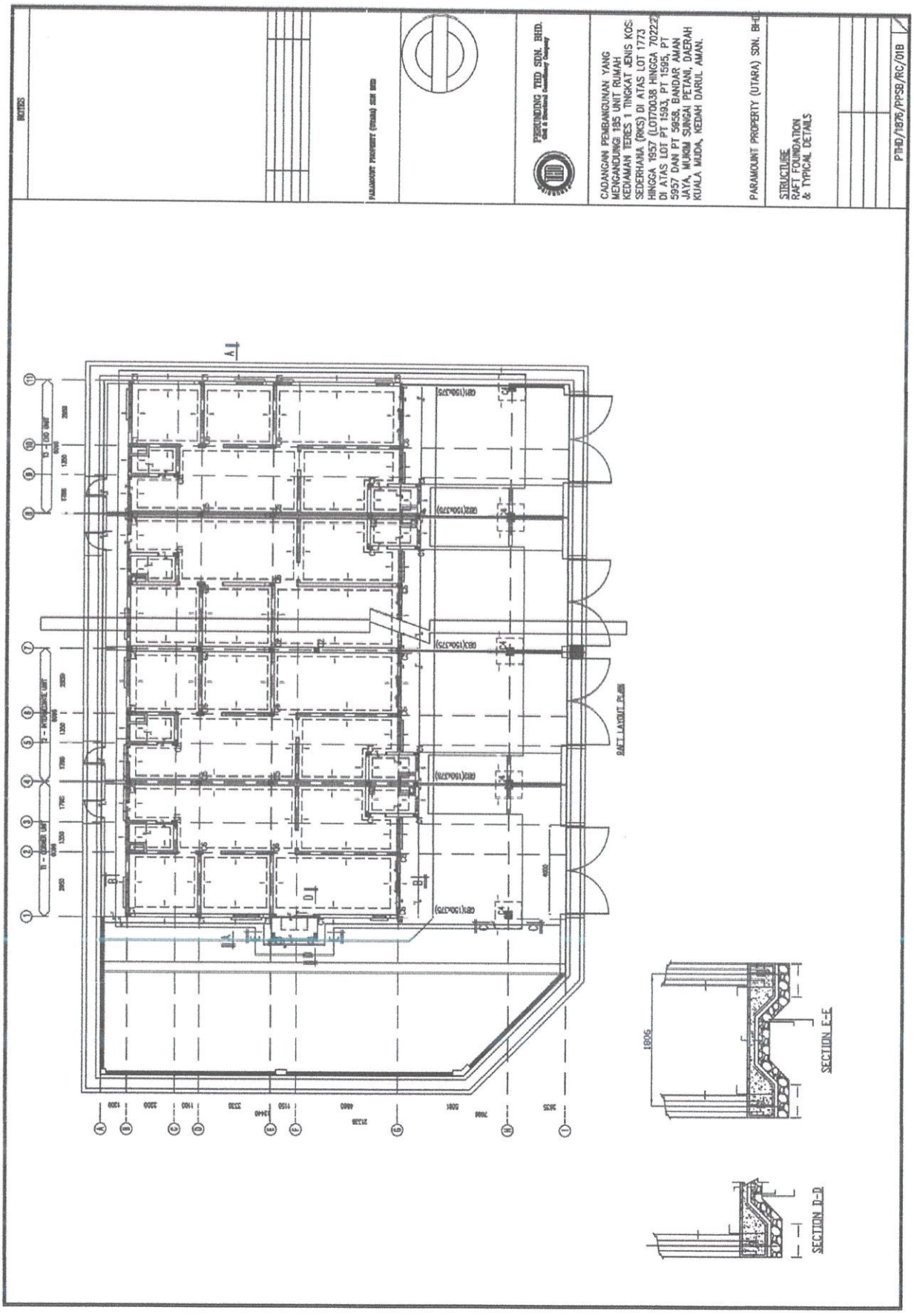

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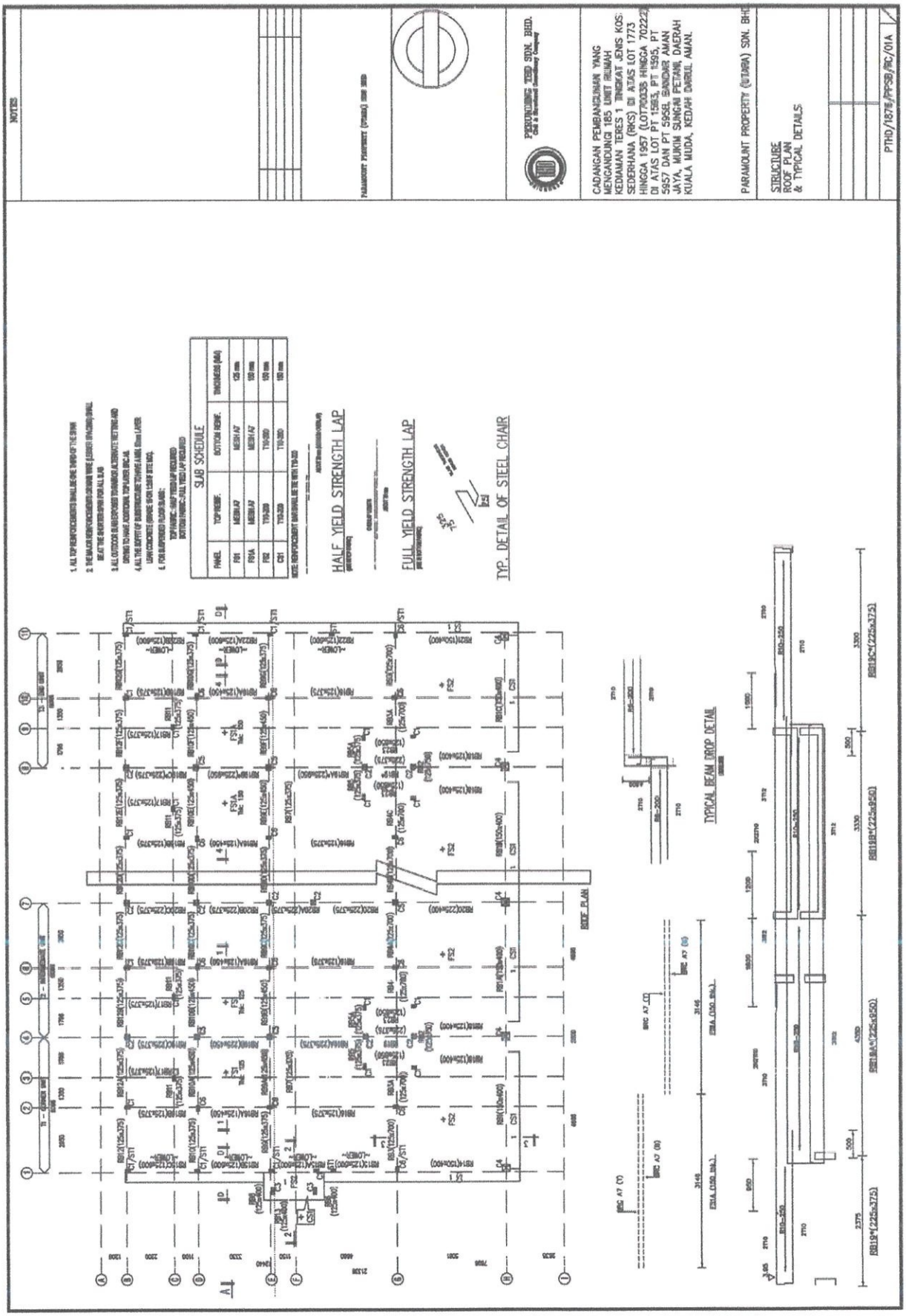
Appendices E: Raft foundation and typical details for 185-unit Single Storey Terrace House



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Appendices E(a): Raft foundation and typical details for 185-unit Single Storey Terrace House