DEPARTMENT OF BUILDING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

CONSTRUCTION METHOD OF SUPERSTRUCTURE FOR TERRACE HOUSE

Prepared by:

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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

Wan Nurul Izzah Binti Wan Ibrahim
2017208776

entitled

Construction Method of Superstructure for Terrace House

be accepted in partial fulfilment 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 MKH Berhad for a duration of 20 weeks starting from 5th August 2019 and ended on 20th December 2019. It is submitted as one of the prerequisite requirement of BGN310 and accepted as a partial fulfilment of the requirements for obtaining the Diploma in Building.

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Date : 13th December 2019

ACKNOWLEDGEMENT

Bismillahirrahmanirrahim.

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

I would like to extend my heartfelt gratitude for the guidance, advice and help rendered throughout the period of training by the following group of amazing individuals. First and foremost, I would like to thank Mr. Hooi Yue Chor for the opportunity given, to conduct my training in his esteem company. His team of professionals compromising of En. Ahmad Affandi and En. Muhd Juzeri, have enabled me to learn and develop my understanding, knowledge and feel of real time projects, and the theory involved in analysis of structures, building and civil works. They are also responsible towards streamlining and assessing my training. Also to the site personnel of Standard Builders Work, the main contractor who have extended their cooperation and help to further enhance my ability in understanding the procedures in construction, tests procedures, site safety and best practices in the industry. It is an honour for me to be given the opportunity to work with all of you.

In preparation of my report, I would also like to expand my gratitude to 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 Pn. Azira Binti Ibrahim, Supervising Lecturer, 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.

Last but not least, my special thanks to my beloved parents for their sacrifices over the years.

Thank you so much.

ABSTRACT

This report was about the Construction Method of Superstructure for Terrace House. The objective of writing this report was to describe the construction procedures of superstructure for terrace house, identify machineries and the problems with its solutions. The method of study that had been used to obtain the information was by site visits, interviews and document reviews with Project Executives and main contractor at Kajang East Precint 1, 37332, Semenyih, Selangor. The method for this project started with proposal followed by tendering, selection of contractor, work progress, work completion and the maintenance work. In results, the procedures had been obtained, the machineries had been identified and the problems with its solutions had been investigated easily. Finally, all of the information was to complete the report.

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CHAPTER 1.0

INTRODUCTION

1.1 Background and Scope of Study

Structures may be defined as those structures that carry the loads through their beams and girders to column and to the ground. The important feature is the capacity to transfer heavy loads over large spans. It can be used in the construction of bridges, parking lots, warehouses, industrial buildings, sport facilities and so on. There are a few types of structure that was applied in Malaysia such as Concrete Structure, Steel Structure and Timber Structure.

Superstructure is the part of the structure that is constructed above the ground level. It is the portion of a building which serves the purpose of structure's intended use. It includes columns, beams and slabs. (Gopal Mishra, 2019). Superstructure are extensively used for high rise building for ease of construction purpose. There are a few types of system that is applicable in Malaysia which are Frame System, Panel System, Box System and IBS.

For Concrete Structure, column can be defined as a vertical structural member designed to transmit a compressive load. A column transmits the load from roof slab and beam, including its own weight to the foundation. Meanwhile, beam is a structural member which spans horizontally between supports and carries loads which act at right angles to the length of the beam. (Nilantha Perrera, 2015).

Meanwhile, flat slab is supported by column and drop panel. The flat slab system has been adopted in many buildings constructed recently due to the advantage of reduced floor heights to meet the economical and architecture demands. The design of flat slabs is typically governed by the punching shear strength at failure. (Mohd Rizwan Bhina and Dr. D. K. Paul, 2013).

1.2 Objectives

The objective of this report is:

i. To identify the procedure of constructing superstructure of double storey terrace house.

ii. To identify the machineries used in the construction of superstructure

iii. To identify the problems and its solutions in constructing superstructure.

1.3 Methods of Study

1.3.1 Observation

Observation regarding the process of constructing the superstructure of terrace house was made throughout the industrial training period. The site was initially just started constructing ground beam level and then further develops to complete blocks of terrace houses. The observations were recorded by taking pictures and writing notes on site.

1.3.2 Interviews

Interviews were conducted on site with the client and the contractor regarding the construction problems and its solutions. The answers were recorded by jotting down notes. The client would explain a lot regarding the questions.

1.3.3 Document Reviews

Method statement and detailed drawings available in the site office was studied in order to gain further understanding about the project.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 Introduction of Company

MKH Berhad (Metro Kajang Holdings Berhad) is an established and respected property developer. It was incorporated in Malaysia as a private limited company on 27 September 1979 under the name of Srijang Bena Sdn. Bhd. The Company later changed its name to Srijang Holdings Sdn. Bhd. and subsequently to Metro Kajang Holdings Sdn. Bhd. Then, it was converted to a public limited company known as Metro Kajang Holdings Berhad which was subsequently listed on the Main Market of the Bursa Malaysia on 18 October 1995. Since 1979, MKH has earned a distinguished reputation in improving people's lives by building good quality homes.

Having gained a strong foothold in Kajang for over three decades, MKH has transformed into a Metropolitan developer by venturing into urban circles such as Damansara, Bangsar, Mont Kiara, Shah Alam, Cheras, Petaling Jaya and other parts of Greater Kuala Lumpur. Little did the Group know that it has contributed to the nation by improving the quality of people's lives through integrated townships, quality developments, and well-designed communities for people to call home. Today, the group has developed and undertaken more than 30,000 units of mixed development projects with a value exceeding RM12.0 billion.

2.2 Company Profile

Figure 2.1: Company Logo.

The MKH Berhad brand identity or logo as in Figure 2.1, as it is commonly called, is inspired by one of nature's most powerful and majestic manifestations – waterfalls.

Powerful cascading waterfalls carry power from their sheer drop that is constantly moving symbolises creative energy in MKH Berhad. Waterfalls are formed over thousands of years of flow and earth movements, and these symbolise the experience that guides MKH Berhad.

The stylised "M" symbol of the visual identity represents the vast resources, experience and positive creative energy flowing in MKH Berhad. The bold strokes are designed to symbolise the solid financial standing and performance of MKH Berhad.

The cyan (light blue) colour of the symbol is the colour of success, while the darker, navy blue of the letters "MKH" represent the professionalism of MKH as a property developer.

Table 2.1: Metro Kajang Holdings Berhad Company Profile.

Title	Description
Name Of Company	Metro Kajang Holdings Berhad.
Group Company Secretary	Tan Wan San (MIA10195).
Board of Director	Tan Sri Dato' Chen Kooi Chiew (Executive Chairman).
Date of Incorporation	27th September 1979.
Registered Address	Wisma MKH, Jalan Semenyih, 43000 Kajang, Selangor Darul Ehsan.
Mailing Address	Wisma MKH, Jalan Semenyih, 43000 Kajang, Selangor Darul Ehsan.
General Manager	Tee Wai Seng.
Legal Form	Public Limited Company.
Sector	Property Development and Construction, Plantation, Hotel and Property Investment.
CIDB Grade	G7 – B,CE,ME
Principal Banker	Affin Bank Berhad, Al Rajhi Banking and Investment, Hong Leong Bank Berhad, RHB Bank
Website	http://mkhberhad.com/
Telephone Num.	
Email	ccm@mkhberhad.com
Company Registration Number	50948-T.
Share Capital	RM613, 315, 284.00

2.3 Organization Chart

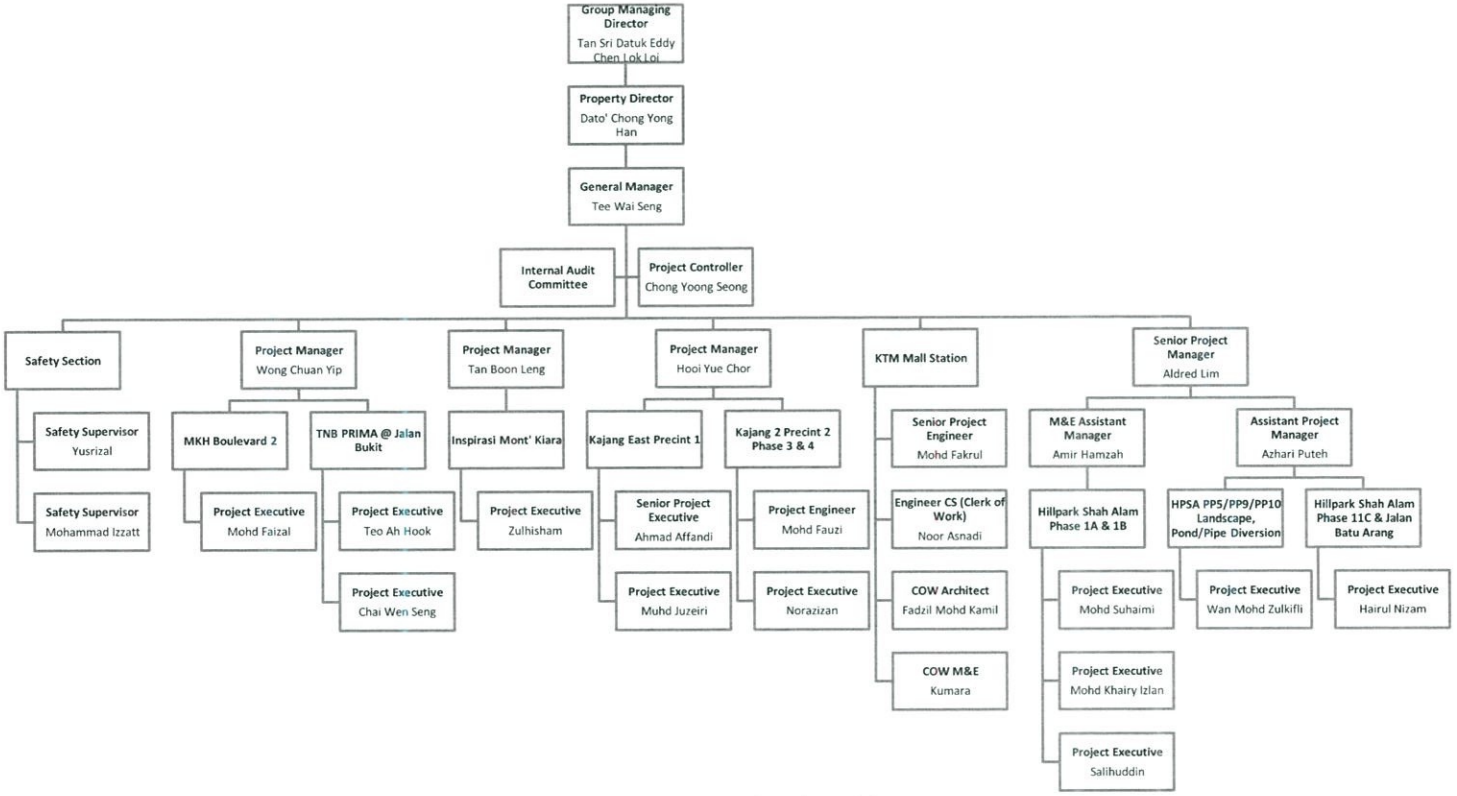


Figure 2.2: Organization Chart.

2.4 List of Projects

2.4.1 Completed Projects

Table 2.2: List of MKH Berhad Completed Projects.

No.	Project Title	Main Contractor	Contract Value (RM)	Commencement Date	Completed Date
1.	**Kajang East (Precint 3)** Proposed Construction and Completion of 116 Units Terrace House, Precint 3 consisting, 3 Units 2 Storey Terrace House Type F1a, 3 Units 2 Storey Terrace House Type F1a(M), 23 Units 2 Storey Terrace House Type F1b, 23 Units 2 Storey Terrace House Type F1b(M), 2 Units 2 Storey Terrace House Type F1c, 2 Units 2 Storey Terrace House Type F1c(M), 1 Units 2 Storey Terrace House Type F1d, 1 Units 2 Storey Terrace House Type F1d(M), 3 Units 2 Storey Terrace House Type F2a, 3 Units 2 Storey Terrace House Type F2a(M), 23	Metro Kajang Construction SDN. BHD.	19, 690, 000.00	18 February 2014	19 May 2015

	Units 2 Storey Terrace House Type F2b, 23 Units 2 Storey Terrace House Type F2b(M), 2 Units 2 Storey Terrace House Type F2c, 2Units 2 Storey Terrace House Type F2c(M), 1 Units 2 Storey Terrace House Type F2d, 1 Units 2 Storey Terrace House Type F2d(M) and 1 Unit TNB Substation on Lot 1996, Mukim Semenyih, Daerah Hulu Langat, Selangor Darul Ehsan for Aliran Perkasa SDN. BHD.				
2.	**Kajang East (Precint 1)** Construction & Completion of Road, Drainage, Sewerage & Water Reticulation Works at Main Access Road from Precint 1 Club House to Precint 4 for Proposed Mixed Development on Lot 1990, 1996, 25301 & 25310, Mukim Semenyih, Daerah Hulu Langat, Selangor Darul Ehsan for Aliran Perkasa SDN. BHD.	WD Infra SDN. BHD.	4, 430, 000.00	20 April 2016	19 December 2016

3.	**Hillpark 3 (Pumping Station)** Proposed Construction and Completion of Retaining Wall, Road, Drainage, Sewerage Works for Phase 2 for Proposed Residential Development on Lot 2118, 2119,2120, 2121, 2122, 2217, 2230, 2822, 2823, 2824 PT 10952, PT 10953 & Part of Government Land, Mukim Semenyih, Daerah Hulu Langat, Selangor Darul Ehsan for Kajang Resources Corporation SDN. BHD.	G&P Infra SDN. BHD.	708, 000.00	28 March 2016	2 January 2017

2.4.2 Projects in Progress

Table 2.3: List of MKH Berhad Projects in Progress

No.	Project Title	Main Contractor	Contract Value (RM)	Commencement Date	Completed Date
1.	**Kajang East Precint 1 Phase 2 & 4** Proposed Construction & Completion of 329 Units Terrace House & 28 Units Semi-D House in Precint 1, Kajang East Consisting Phase 2 97 Units 2 Storey Terrace House (22'x70'), 38 Units 2 Storey Terrace House (22'x75'), 1 Unit Electrical Substation on Lot PT 37332, Mukim Semenyih, Daerah Hulu Langat, Selangor Darul Ehsan & Proposed for Construction & Completion of 329 Units Terrace House & 28 Units Semi-	Standard Builders Work SDN. BHD	46, 386, 464.95	11 February 2019	10 May 2020

	D House in Precint 1, Kajang East Consisting Phase 4 86 Units 2 Storey Terrace House (22'x70') on Lot PT 37332, Mukim Semenyih, Daerah Hulu Langat, Selangor Darul Ehsan for Aliran Perkasa SDN. BHD.				
2.	**Inspirasi Mon't Kiara (Main Building)** Proposed Construction & Completion of Mixed Development Consisting 2 Blocks 44 Storey Service Apartment (640 Units), 2 Units Shop, Resident Facilities, Swimming Pool, 7 Storey Car Park on Podium, Basement Car Park Level 1 & 2, Mechanical Facilities & Guard House on Lot 13753 (Jalan Kiara 4), Mukim Batu, Kuala Lumpur, Wilayah Persekutuan for Alif	Sri Binaraya SDN. BHD.	168, 932, 281.52	18 October 2018	17 June 2021

	Mesra SDN. BHD.				
3.	**Inspirasi Mon't Kiara (Upgrading Works)** Proposed Construction & Completion of Mixed Development Consisting 2 Blocks 44 Storey Service Apartment (640 Units), 2 Units Shop, Resident Facilities, Swimming Pool, 7 Storey Car Park on Podium, Basement Car Park Level 1 & 2, Mechanical Facilities & Guard House on Lot 13753 (Jalan Kiara 4), Mukim Batu, Kuala Lumpur, Wilayah Persekutuan for Alif Mesra SDN. BHD.	Zhongji Construction SDN. BHD.	7, 269, 760.20	3 September 2018	31 October 2019
4.	**MKH Boulevard 2** Proposed Construction & Completion of 1 Block 42 Storey Service Apartment Consisting 2 Storey Shop House (Level 1 &	Sigmal Construction SDN. BHD	111, 101, 933.48	3 July 2019	2 January 2022

	2), 5 Storey Car Park on Podium (Level 3 to 7), 1 Floor Facilities Deck (Level 8), 34 Storey Service Apartment (Level 9 to 42), 1 Floor Sky Lounge Deck (Lower Roof Level), 1 Refuse House. Transit Oriented Development (TOD) on Lot PT 86812 H.S(D) 174628 & Government Land, Jalan Bukit, Mukim Kajang, Daerah Hulu Langat, Selangor Darul Ehsan for Stand Allied Corporation SDN. BHD.				

CHAPTER 3.0

CASE STUDY

3.1 Introduction to Case Study

The project witnessed during the practical training session was the Proposed Construction and Completion of 329 Units Terrace House & 28 Units Semi-D House in Precint 1, Kajang East on Lot PT 37332, Mukim Semenyih, Daerah Hulu Langat, Selangor Darul Ehsan. Total cost of the construction project is estimated to be RM46, 386, 464.95. This project began on the 11th February 2019 and will be completed on 10th May 2020.

These are several parties involved in this project. They are Aliran Perkasa SDN. BHD., a subsidiary company of MKH Berhad as the developer, Surbana Consultans SDN. BHD. as the architect, Standard Builders Work SDN. BHD. as the main contractor and many other engineers involved.

Table 3.1: List of Consultants Involve.

No.	Party	Name of Company	Address
1.	Developer	Aliran Perkasa SDN. BHD.	5th Floor, Wisma MKH, Jalan Semenyih, 43000 Kajang, Selangor.
2.	Architect	Surbana Consultans SDN. BHD.	Suite 11.01, Level 11, Centrepoint North, The Boulevard, Mid Valley City, Lingkaran Syed Putrs, 59200 Kuala Lumpur.
3.	Main Contractor	Standard Builders Work SDN. BHD.	11-1-2, Block B, Jalan 1/125E, Magen Salak Park, Desa Petaling, 57100 Kuala Lumpur.
4.	Structural Engineer	LTE Engineers SDN. BHD.	3-3, Jalan SS 26/4, Mayang Plaza, Taman Mayang Jaya, 47301 Petaling Jaya, Selangor.
5.	Civil Engineer	Perunding Ace SDN. BHD.	25-2, Jalan PJU 5/3, PJU 5, Dataran Sunway, Kota Damansara, 47801 Petaling Jaya, Selangor.
6.	Mechanical & Electrical Engineer	Perunding Timur SDN. BHD.	PJX-HM Shah Tower, Suite L16-1, Level 16, No. 16A, Persiaran Barat, 46050 Petaling Jaya, Selangor.
7.	Landscape Architect	Hoda Designs SDN. BHD.	12-3, Tingkat 2, Jalan SP 2/4, Taman Serdang Perdana, 43300 Seri Kembangan, Selangor.
8.	Quantity Surveyor	Aliran Perkasa SDN. BHD.	5th Floor, Wisma MKH, Jalan Semenyih, 43000 Kajang, Selangor.

Kajang East, Semenyih, Selangor Darul Ehsan covers an area of 137 acres surrounded with developing area. It was divided into 4 precints in which Precint 2, 3 and 4 has complete development and only Precint 1 is under construction. The site is near to Kajang 2, Semenyih which is a development made by MKH Berhad too. Figures below show the location of Kajang East, Semenyih.

Kajang East is in the middle of all amenities where there are hypermarkets, Kajang Specialists Hospital (KPJ), Britania Women & Children Hospital and Pantai Medical Centre within 15 minutes-drive. In lieu of institutions, there is Rafflesia International School and University of Nottingham Malaysia nearby. It is also a golfer's haven with two golf clubs located within the vicinity. The residents can easily commute by utilising the highways or access the Kajang KTM & MRT exchange station.

For this case study, the focus is on the construction method of superstructure for terrace house.

Figure 3.1: Location of Kajang East Precint 1, Semenyih.

Figure 3.2: Location of Kajang East Precint 1, Phase 2, 3 & 4.

Figure 3.3: Location of Kajang East Precint 1, Phase 1.

3.2 Construction Method of Superstructure for Terrace House

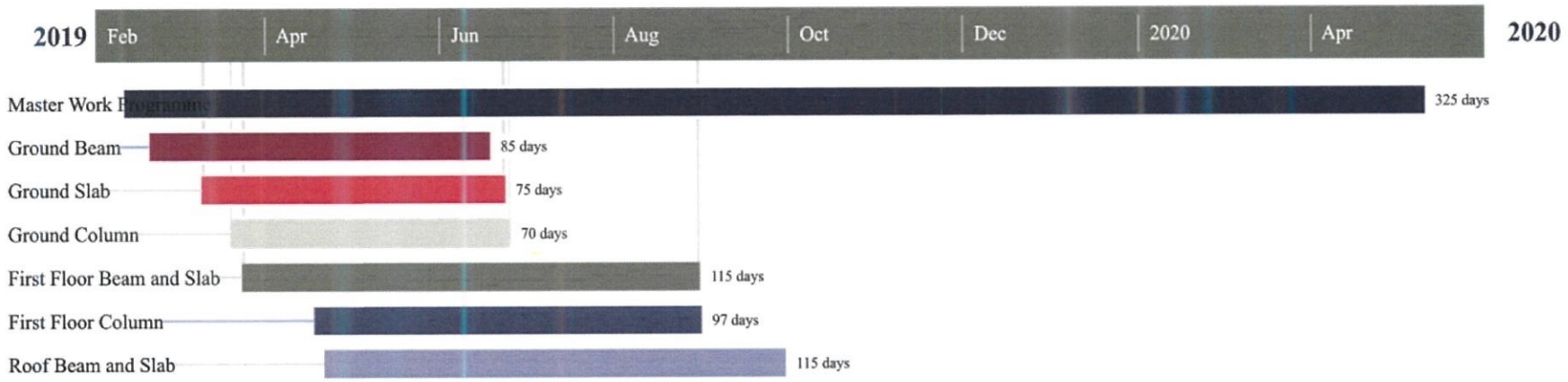


Figure 3.4: Work Programme.

Figure 3.4 indicated work programme scheduled by contractor as reference to ensure the work on site runs smoothly. The master work programme shown that it took about 325 days to complete the whole project including the finishes. The number of days to construct each building elements like beam, slab and column are as shown. The building of the elements started in February 2019 and expected to be finish by August 2019. Based on the observation made on site, the programme was successfully followed.

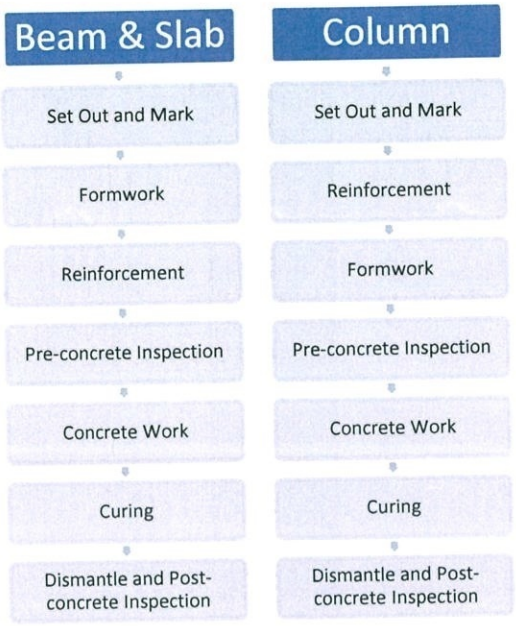


Figure 3.5: Work Flow.

3.2.1 Setting Out and Marking

A meeting between consultant and engineers was held to obtain approval before starting the work.

Block pegging was carried out based on the precomp-plan and Temporary Bench Mark (TBM) was established for future references. More pegs were marked especially at the 4 perimeter corners of the house and checked by licensed surveyor. Straight lines were made by using strings connected to each pegs forming rectangles.

3.2.2 Install Formwork

For ground slab, blinding like Damp Proof Course (DPC) and anti-termite solution were applied underneath lean concrete beforehand. The application of anti-termite solution was shown as in Figure 3.6. Laminated plywoods and woods were deposited near each related house and appropriately covered when not in used.

Figure 3.6: Application of anti-termite on soil.

Formwork and supports were installed properly and accurately to avoid any distortion. The installation of formwork and support as shown in Figure 3.7 were for roof beam and slab.

Figure 3.7: Installation of formwork and supports at roof beam and slab.

3.2.3 Install Reinforcement

Cut and bend steel schedules were prepared, submitted and approved by the Engineer. The reinforcement bars were deposited on site in good condition for each house separately as per cut and bend steel schedules and any rusted bars were discarded.

Approved drawings by Engineer were used to start reinforcement bars installation. Installation of reinforcement bars for ground slab was as shown in Figure 3.8. The reinforcement bar layouts, sections, dimensions and schedules were followed to fix the bars. The bars were properly bound and any loose binders were rejected in the reinforcement bars. The free ends of the binding wire were bended inward.

Figure 3.8: Installation of reinforcement bars at ground slab.

Stirrups or links as in Figure 3.9 were used to tight the reinforcement bars properly and they were fixed straighten and aligned. Any loose stirrups or links were discarded and they were ensured fixed as per approved drawings.

Figure 3.9: Fixation of links at column.

Compressible filler board or aluminium strip were used as in Figure 3.10. The usage was according to the thickness stated in the approved drawings for expansion joints. Tips coated metal chairs and circular spacers were used for the horizontal bars and verticals bars respectively as a concrete cover. The application was shown in Figure 3.11.

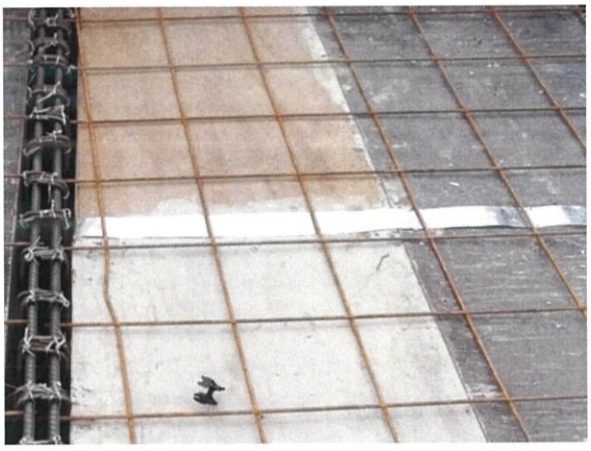


Figure 3.10: Usage of aluminium strip at expansion joint.

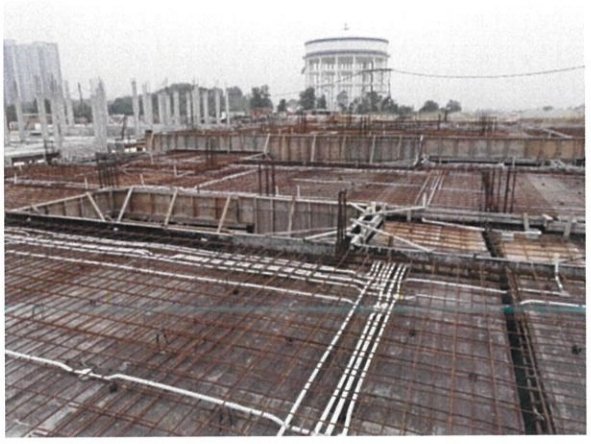


Figure 3.11: Usage of tips coated metal chairs and circular spacers as concrete cover.

Mechanical and Electrical (M&E) works were installed according to approved M&E drawings. The installation of M&E works was shown in Figure 3.12. Proper fixing, alignment and levelling were conducted by fixing the required concrete level at the formwork as per approved drawings.

Figure 3.12: Installation of M&E works.

3.2.4 Pre-concreting Inspection

A pre-concreting inspection was handled by engineer to check and approve before concreting work as per approved drawings. Condition of formwork, reinforcement, M&E works and joints were checked by the engineer. Figure 3.13 and Figure 3.14 was the pre-concreting inspection checklist.

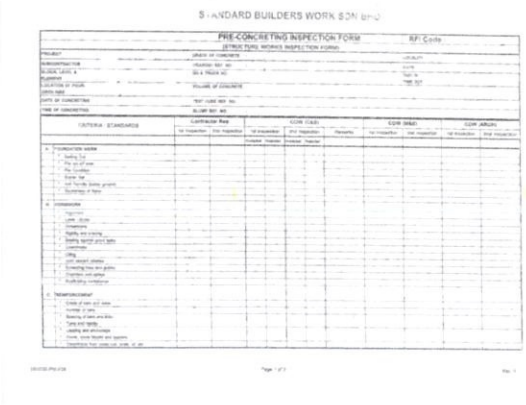


Figure 3.13: Pre-concreting inspection checklist page 1.

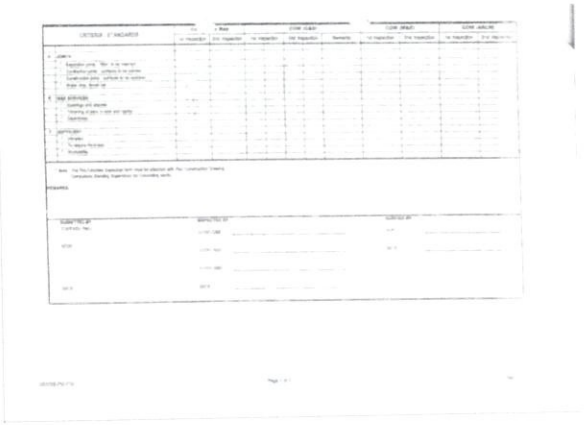


Figure 3.14: Pre-concreting inspection checklist page 2.

3.2.5 Concreting Work

A sketch to display the casting areas, pump location, pump and trucks access and concrete trucks checkpoints were drawn by contractor, which were submitted to the engineer. The concrete trucks first stopped at the entrance for inspection. Slump Test as shown in Figure 3.15 was handled. Cubes for Cube Compression Test were also made. The making of the cubes were shown as in Figure 3.16. The slump was ensured to follow the pre-approved mix design while a set of nine cubes were made for every concrete trucks. Three cubes will be tested at the age of 7 days, three cubes will be tested at the age of 28 days and the remaining will be given to the concrete supplier for their own reference. The concrete was ensured to be unloaded from the concrete truck within two hours from the batching plant.

Figure 3.15: Reading of slump test was measured.

Figure 3.16: Making of the nine cubes.

During concreting work, the concrete was properly compacted using mechanical vibrator as shown in Figure 3.17.

Figure 3.17: Concreting work which vibrator was used to compact the concrete.

3.2.6 Curing

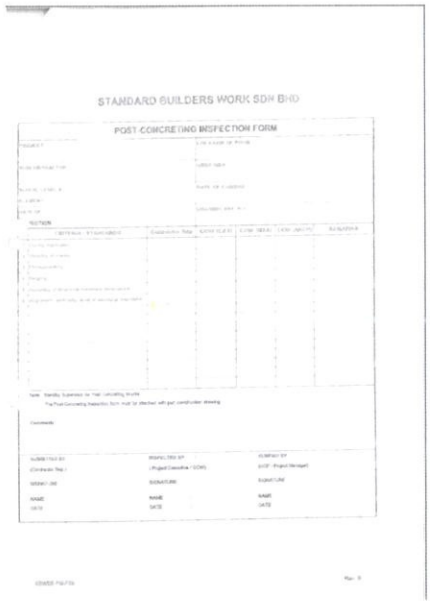
The casted area was properly cured by covering the concrete using wet hessian cloth. Curing process was shown as in Figure 3.18. Clean and clear water was used for the curing process.

Figure 3.18: Wet hessian cloth was used for curing process.

3.2.7 Dismantle of Formwork and Post-concreting Inspection

After 24 hours, the formwork was carefully dismantled as in Figure 3.19 and a post concreting inspection was handled by engineers. The engineers determined the defects on the concrete as shown in Figure 3.20 and further action was taken if necessary to ensure the structure is safe.

Figure 3.19: Dismantle of formwork.


STANDARD BUILDERS WORK SDN BHD

POST-CONCRETING INSPECTION FORM

Figure 3.20: Post-concreting inspection checklist.

3.3 Machineries Involved

3.3.1 Backhoe

Backhoe as in Figure 3.21 is an excavating equipment or digger, consisting of a digging bucket at the end of an articulated arm. Articulated arm is mounted on the back of a tractor or front loader. The arm closest to the vehicle is known as the boom, while the arm which carries the bucket is known as the dipper stick. The boom is attached to the vehicle through a pivot known as king-post, which allows the arm to pivot left and right, through 180 to 200 degrees.

Figure 3.21: Backhoe with a digging bucket.

3.3.2 Mobile Crane

Mobile crane as shown in Figure 3.22 is a machine equipped with a hoist rope, wire ropes or chains, and sheaves that can be used to lift and lower materials and to move them horizontally. It is mainly used for lifting heavy things and transporting them to other places.

Figure 3.22: Crane on site.

3.3.3 Excavator

Excavator as in Figure 3.23 is a heavy construction equipment consisting of a boom, stick, bucket and cab on a rotating platform. The cab sits on top of an undercarriage with tracks or wheels. All movement and functions are accomplished through the use of hydraulic fluid, with hydraulic cylinders.

Figure 3.23: Excavator on site.

3.3.4 Vibrator Poker

Vibrator poker as shown in Figure 3.24 is a tool used during concreting works. It ensures that the concrete pour is free of air bubbles and are even so that the concrete remains strong and has a smooth finish even after removal of the form work. It consists of an electric weight encased in a housing and driven by a diesel engine. Poker diameters range from 25 to 75 mm.

Figure 3.24: Vibrator poker to compact concrete.

3.3.5 Genset

Genset as in Figure 3.25 is an independent source of electrical power to supply electric at places with no access of primary electric power supply especially from TNB.

Figure 3.25: Genset to power up machines.

3.4 Problems and solutions

3.4.1 Defects in Concrete Structure

Types of defects in newly made concrete structures can be many. These defects can be due to various reasons or causes. Therefore, after the dismantle of formwork, engineers shall handle a post-concreting inspection on the concrete structures to determine the defects presence on it. The defects that will be determined are as in Table 3.2.

Table 3.2: Types of Defects

No.	Defects	Causes	Preventive action
1.	**Crazing** Crazing is the formation of closely spaced shallow cracks in an uneven manner.	Insufficient curing	Proper curing
2.	**Cracking** Cracks are very deep and unsafe to use that concrete structure.	Improper mix design, insufficient curing.	Use low water:cement ratio and maximise aggregate in concrete mix, prevent use calcium chloride as admixture, proper curing, apply loads only when concrete has gain its maximum strength.
3.	**Honeycombing** Honeycomb shown in Figure 3.26 is a rough, pitted surface or voids in concrete.	Insufficient vibration, segregation, improper placement, leakage of grout through joints.	Proper vibration, prevent pouring concrete mix from height, ensure no leakage at joints.
4.	**Bulging** Bulging is a formation of hollow bumps on concrete surface.	Presence of entrapped air in concrete mix, improper finishing.	Use good proportion of concrete mix, proper curing, proper techniques for placing and finishing.
5.	**Dimension Inaccuracy** Inaccurate dimension of concrete structure was shown in Figure 3.27.	Defective workmanship, bad detailing.	Proper detailing, handle pre-concreting inspection.
6.	**Curling** Distorted into cured shape by upward or downward movement of edges or corners.	Differences in moisture content or temperature between top slab and bottom slab.	Use low shrink concrete mix, provide control joints, provide heavy reinforcement at edges, provide edges with great thickness.

Most of the preventive action has been taken by the engineers to ensure the structure of the terrace houses are strong and steady. The problems have been minimized by detail pre-concrete inspection, observation throughout the concrete work and finishing and post-concrete inspection by engineers. Yet, if only 1 out of 20 houses faces these defects, them it will be considered as acceptable but if there is 1 out of 10 houses that faces these defects, then a more detail investigation will be handled.

Figure 3.26: Honeycomb at first floor beam.

Figure 3.27: Inaccurate dimension or placing of column at first floor.

Figure 3.28: Left over formwork which got stuck in the concrete due to inaccurate installation of formwork.

3.4.2 Corrections in Drawings

It is a must for every project to have detail architecture drawing and structural drawing. However, it becomes a major problem when these two drawings are not sync. In this case, based on architectural drawing as in Figure 3.29, there shall be windows installed at second floor. Meanwhile, in the structural drawing as in Figure 3.30, a column was drawn.

To solve this problem, a meeting between client, architect, consultant and engineer was held. The meeting has come to decision to maintain the architectural drawing and change the structural drawing by relocate and resize the nearby columns and beams.

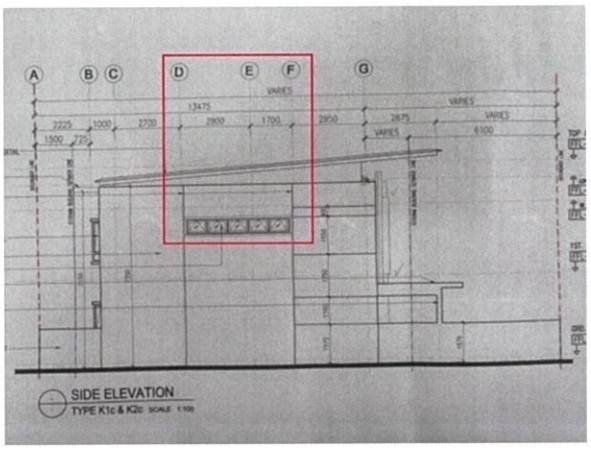


Figure 3.29: Architectural drawing which has windows at second floor grid line D-F.

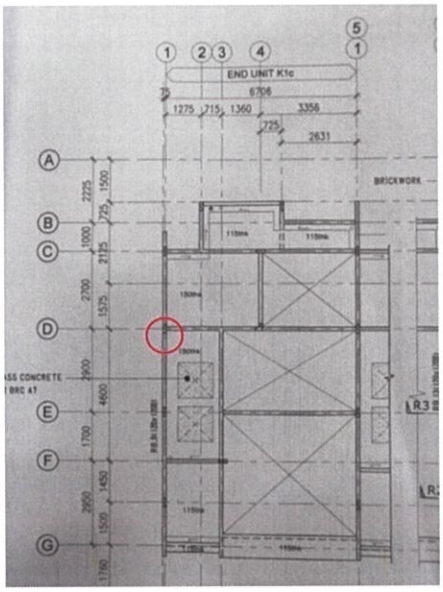


Figure 3.30: Structural drawing which has a column at grid line 1E.

CHAPTER 4.0

CONCLUSIONS

4.1 Conclusions

It is clear that house is a basic need for everyone. Other than bungalows or apartments, terrace house is also a wise decision and mostly chosen by the people to own. Terrace house has so many benefits to offer by being a stress-free property choice. This is because the resident can has a flexible owning without having a very big yard to look after yet not too small like flats.

From the case study that has been conducted, the construction method of superstructure for terrace house starts from the ground beam and ground slab. Then, further to columns, beams and slabs. Each element has almost the same steps of construction which starts with setting out and marking, carpentry, reinforcing and concreting.

Despite facing many problems in constructing the houses, all parties like the client, main contractors and engineers solved these problems professionally. The construction seemed to be progressing smoothly.

REFERENCES

Books:

1. Ahmad A. Hamid and Mohamad Bolhassani (2016). "Introduction to Design of Building Structures". BookBaby, Philadelphia.

2. Mohd Rizwan Bhina and Dr. D. K. Paul (2013). "Assessment of R.C. Flat Slab Building". GRIN Publishing.

Website:

1. Noel, M. (2014), (September 2019). "Quality Assurance & Quality Control in Construction". Available from: https://www.qualityengineersguide.com

2. Gopal Mishra (2019), (August 2019). "The Constructor". Available from: https://theconstructor.org

3. Nilantha Perrera (2015), (August 2019). "Basic Civil Engineering". Available from: https://www.basiccivilengineering.com.html