DEPARTMENT OF BUILDING SURVEYING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

UNIVERSITI TEKNOLOGI MARA

PERAK

TITLE

CONSTRUCTION MANAGEMENT
Installation of Reinforcement Bar & Concreting Works

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DIPLOMA IN BUILDING SURVEYING

PRACTICAL TRAINING REPORT

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ACKNOWLEDGEMENT

First of all, I would like to say Alhamdulillah and thank goodness to Allah for giving me the life and time to perform the industrial training. In the course of practical training for four months, many of those who supported me for completing my report. I would like to thanks a lot to one of Director Tenaga Z-L Sdn Bhd En. Ir. Wan Rumaizee Zaabar (Director-in-charge Mechanical Engineering) and En. Ahmad Shukri Abd. Aziz as a (Associates Structural Engineer) for accept my letter offer practical training and giving me the opportunity to do practical training in this company. In addition, thanks to this persons such as Mr Ng KengWai as a technical manager, En Yusof Mahat as Resident Engineer (R.E) and En Zahid B Ismail as Clerk of Work (C.O.W) who are given more information and guidance to me about construction. He also given full faith to me to completing all my practical training work. Additionally, not forgetting to my parents who are giving supportive in financial terms in the success of this practical training. They also often provide support and encouragement to me to completing my report. I would also like to thank my supervisor, En Nor Amin Mohd Radzuan because assisted me to completing my practical training report. A special thanks to all my friends who have been helping me in completing this practical report, only Allah who can return their favor. Finally, I am happy and grateful to be given the opportunity to undertake practical training in this company and I learned a lot of experience in the working life.

ABSTRACT

In this practical report contains information about the selected case studies of the installation reinforcement bars and concreting work. This report is available on methods of practical experience gained in the 4 month practical training period at the construction site based on observation and experimentation. This started a string of practical reports with company background, corporate information, organizational charts and also followed by a list of current and past projects. Selected case studies in this practical report is the installation reinforcement bars and concreting work. The installation of reinforcement bars play an important role in setting up a building especially in high buildings. Installation of reinforcement bars and correct can affect the structural strength of a building. When the installation work being carried out by the steel bars and skilled laborers, the parties involved in a construction site assigned as clerk of work (C.O.W) from consultant and site engineer from contractor shall be carry out monitoring on the structural drawings were available. Before the concreting works are carried out, such as the resident engineer (R.E) of the professional consultant shall carry out his duty to make an inspection of the installation of the steel bar. The installation work of steel bars which has finished followed by concrete work that will be poured into the formwork was installed by a carpenter. This process is known as 'reinforced concrete'. Selection is based on grade concrete building elements such as foundations, beams, floors, columns, staircases and so on. Selection is done due to the concrete grade concrete mix different content in terms of the quantity of the mixture. The main purpose of the reinforcement bars installed in concrete is to facilitate the flow of current to the load to be borne. Reinforced concrete is able to maintain the structural strength of the building and to maintain the building's lifecycle. There are a number of the professionals involved in the field work of installation reinforcement bars work and concreting work. Among the most important are professional engineers building structure. The role of structural consulting engineers is to design the structure based on the existing architectural drawings and providing structural design drawings. There are also other things that are provided in this report as the introduction of practical concrete and steel, the types of commonly used grades and tests conducted on these construction materials. In addition, in practical report also provides the types of machinery used in assembly for installation reinforcement bars and concreting work. Next, the most important thing during the work on the construction site is safety. There are some problems that occur when the work of installation reinforcement bars and steel erection work performed if not monitored by certain parties. Some of the problems are mentioned in this report and the solutions are also stated too. Overall, this practical report can explain everything about the installation reinforcement bars and concreting works done which gain some knowledge.

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INTRODUCTION AND

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1.1 INTRODUCTION

Practical training is a course that should be completed by all students who take the final semester in Diploma Building Surveying. In the previous semester 5, students were given briefings about the practical training content. During the practical training briefing, students are given the opportunity to find their own place to complete practical training in their respective industries more easily.

I decided to choose a consultant engineering firm Tenaga Z-L Sdn Bhd as a place to conduct my practical training. This consultant engineering firm is located nearest to my house at Kuala Lumpur. Every Monday, I was assigned to go to the site project in Bangi, Selangor for one day per week. The next day, from Tuesday until Friday I was assigned to do calculation taking-off from Quantity Surveyor Department (QSD).

During the practical training, I learned about the installation of reinforcement steel bar and the installation of concreting work. The installation of rebar work is under Civil & Structure Department (C&S) from Zaidun-Leeng Sdn Bhd. This consultant firm is a main Head Quarters (HQ) office for Tenaga Z-L Sdn Bhd. Tenaga Z-L consultants engineering is one of the branches to headquarters Zaidun-Leeng Sdn. Bhd. This group of the company consist of all Malay's staff only.

This practical training syllabus is starting from 10th June 2013 until 30th September 2013. The duration of practical training Diploma in Building Surveying is around 4 months and the credit hours for this subject is eight. Finally, I will learn and experience how the environment and situation while in the workplace. In addition, student will get a chance to prepare any report according to the topics that relevant to the work during the practical training.

1.2 OBJECTIVES OF THE STUDY

The report will cover on the methods used in the construction work at the project site in particular the work of installation reinforcement bar and concreting work. In this report will further explain on:

- The procedures and the preparation process of construction materials for steel bars and concrete.
- It will explain on the installation of reinforcement bars according to the structural drawings that has been issued by the structural engineer.
- To determine the methods of work performed concreting work on construction sites.
- To carried out the equipment and machinery used in this topic of training practical report.
- To carried out the safety equipment on the construction site.
- To determine the parties involved in the construction period of the installation reinforcement bar work and concreting work.

1.3 SCOPE OF WORK

The scope of work in this report is based on observations of practical and learning for 4 months practical training period carried out at the construction site. The scope of the study are as installation of reinforcement bar and concreting works that have been carried out on site with the Hotel and Apartment *Koperasi Permodalan Felda* (KPF) Bangi, Selangor. The study was conducted from the beginning of the period until the expiration practical to ensure that the objectives of the study can be achieved successfully.

1.4 METHOD OF STUDY

1.4.1 Main method

i) Interview

Interview is one of the most common method used in gaining information and also very effective among the others. Interview method can be completed by directly face to face meeting or interviewing with the person who is involved in the construction works of installation reinforcement bar and concreting works. The face to face method is used because the person or the party mostly the general workers could give their cooperation by giving information and explanation about this construction works. Most of the works are done by the general workers therefore the general workers has more experience and expert on the works and know all the problems related to the works and also the solution if a problem persists.

ii) Observation

Observation is the other method that can help in gaining a lot of information. This method are not just for gaining information, but also good in learning something, it can help increase the level of knowledge about the construction of installation reinforcement bar and concreting works if observed properly. Any untruthful works on construction site can be detected using the observation method. Finally, the originality of works can be clearly seen by using this method.

1.4.2 Secondary Method

i) Printed Media / Book Reference

The most supported method in gaining any information about the construction of installation reinforcement bar and concreting works and also the easiest method to gain information. This method is too common for the research because of the facts are provided more to theoretical rather than practical. The information gained in the books are usually obtained from research and study, the most effective information are need to be from experience on practical. There are also other source to be gained information which is printed media. Usually printed media will always update their information according to new ones rather than reference books that is permanently printed and will not be updated.

ii) Electronic Media

Electronic media is another source of information that can be used for the gaining of information. It is the most easy and fast way to gain information especially in the scope of construction. Although, the information gained are more to from the internet, the information may be good, but it still needs to check with its validity, who are the author, when was the information written, without checking all of that, the information gained could be improper and wrong. Therefore in order to use this method, some checking needs to be done.

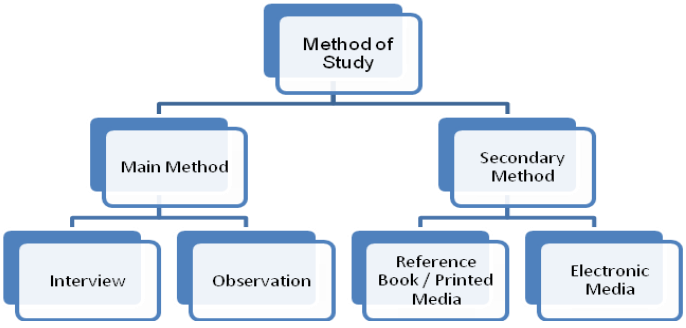


Figure 1.1: Method of Study

1.5 COMPANY PROFILE

Photos 1.1: Tenaga Z-L Sdn Bhd

TENAGA Z-L SDN BHD is one of seven companies in the Zaidun-Leeng group companies. Located at 4th floor, Bangunan Ming, Jalan Bukit Nanas 50250, Kuala Lumpur. The other companies in the group are Perunding UZL Sdn Bhd (Sarawak), Zaidun-Leeng (Sabah) Sdn Bhd, Leeng Consultants Pte Ltd in (Singapore) and Perunding LCE and Bolton Hennesy Sdn Bhd in Brunei and Zaidun-Leeng (India) Pte Ltd.

TENAGA Z-L SDN BHD is incorporated in 1984 and presently provided engineering services for commercial, industrial, highway, residential, education and material handling project ; advisory and management services for manufacturing process. Since 1984, the company has carried out planning, design and supervision of the construction buildings, foundations, bridge, highway, mechanical and engineering services.

The company has also in recent years provide consultancy for engineering design in respect of the following projects :

- Damansara Puchong Expressway
- Building Refurbishment
- Proton Factory
- Malaysian Oxygen Berhad – Gas Plant
- Toshiba Factory
- Sony Factory
- NEC Factory

1.6 CORPORATE INFORMATION

a) Current Particular of company

Date of Incorporation	:	10th January 1984
Place of Incorporation	:	Malaysia
Company No.	:	112810 U
Registered Office	:	No. 6 & 8, Jalan Gereja
		3rd Floor, 50100 Kuala Lumpur.
Authorised Capital	:	RM250 000.00
Paid Up Capital	:	RM250 000.00

b) Shareholders

Name	No. of Share	Percentages
Ir. Mr Hamdzah Abdul Rahman	99,999	39.99
Ir. Mr Wan Rumaizee Zaabar	75,001	30.01
Ir. Mr Hasni @ Mohd Zikri Ibrahim	75,000	30.00
TOTAL	**250,000**	**100**

c) Board of director

Name	Position
Ir Mr. Hamdzah Abdul Rahman	DIRECTOR (Civil Engineer)
Ir Mr. Wan Rumaizee Zaabar	DIRECTOR (Mechanical Engineer)
Ir Mr. Hasni @ Mohd Zikri Ibrahim	DIRECTOR (Electrical Engineer)

Secretary	:	Lee Choong Phing (LS 00382)
Auditors	:	Messrs C.H Yap & Co.
Banker	:	OCBC Al-Amin Bank Berhad (Jalan Tun Perak)

1.7 QUALITY POLICY

We, Tenaga Z-L Sdn Bhd (TZL) provides Civil, Structural, Mechanical and Electrical Engineering design and site supervision services, all the engineering services and supporting services, all the engineering services and supporting services related to this industry shall comply to our Quality Policy as follow and in line with ISO 9001 requirement.

C – COMPLY TO QUALITY MANAGEMENT SYSTEM;

C – COMMIT TO SERVICES & PRODUCT QUALITY;

C – CONTINUAL IMPROVEMENT &

C – CUSTOMER ORIENTED.

1.8 LOGO COMPANY

Photos 1.2: Logo Company of Consultant Engineering Tenaga Z-L Sdn Bhd

1.9 LOCATION PLAN

Photos 1.3: Location Plan of Tenaga Z-L Sdn Bhd

Symbol of ★ shown the location of headquarters (HQ) office of Zaidun-Leeng Sdn Bhd. This company is located at 4th , 5th and 6th floor of Bangunan Ming, Jalan Bukit Nanas, 50250, Kuala Lumpur. The location of Tenaga Z-L Sdn Bhd is located at 4th floor in the same building with Zaidun-Leeng office of Bangunan Ming.

1.10 ORGANIZATION CHART

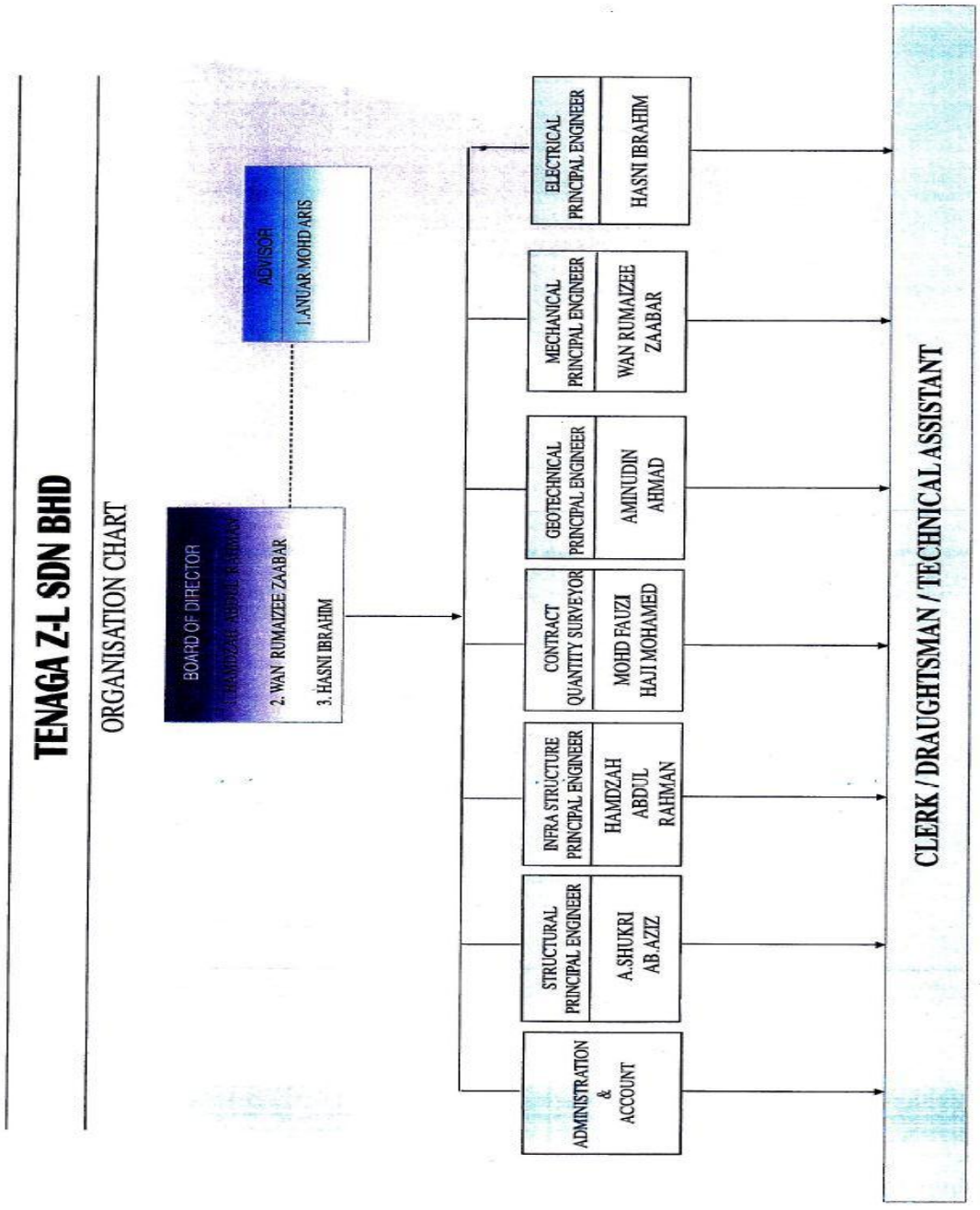


Figure 1.2 : Organisation Chart Tenaga Z-L Sdn Bhd

1.11 SCOPE OF WORK

The company presently provided engineering services for commercial, industrial, residential, education and material handling projects; advisory and management services for manufacturing complexes processes. This scope of work has supported by staffs Zaidun-Leeng Sdn Bhd to completing in certain projects. Since 1984, this company has carried our planning, design and supervision of the construction of:

- Foundation : Bored Piles
  Steel Piles
  Pre-cast Concrete Piles
  Pre-stressed Complete Piles
- Bridge
- Multi - Storey building including those with deep basements.
- Infrastructure for big and small housing schemes and factories.
- High and long span steel structure such as aircraft hangars for Boeing 747's.
- Aircraft runway pavement.
- Highways.
- Water supply.
- Water supply including treatment works and pipelines.
- Land and drainage improvement and reclamation works.
- Material handling.
- Electrical services of building, factories.
- H. V. electrical sub-stations of building, factories and are furnaces.
- Specialized conveyor systems.
- Log handling systems.

1.12 LIST OF PROJECT

a) Particulars of Past Projects

No.	Project Title	Scope of service	Contract Value	Year Start	Year Completed
1.	Western Kuala Lumpur Traffic Dispersal Scheme Package A1 (Part), Package B1, B2 and Package C.	Sub-specialist to Zaidun-Leeng Sdn Bhd for Geotechnical and utility relocation .	RM700 Millions	1996	2000
2.	Lebuhraya Damansara – Puchong (LDP), Package 2, Section 3&4.	Sub-specialist to Zaidun-Leeng Sdn Bhd for Geotechnical and utility relocation.	RM200 Millions	2000	2004
3.	Cadangan Membina Persimpangan Bertingkat Jalan Kg. Pandan / Jalan Perkasa, Kuala Lumpur secara'Design & Build'.	Design and Supervision	RM15 millions	2001	2005
4.	Refurbishment of Bangunan Dato' Zainal.	Mechanical & Electrical works	RM4 millions	2004	2006

Table 1.1(a): Particulars of past projects

No.	Project Title	Scope of service	Contract Value	Year Start	Year Completed
5.	Renovation and Interior Design Fit-out Works to ING Building at Taman Shamelin Perkasa Cheras, Kuala Lumpur.	Mechanical & Electrical works	RM1.2 millions	2008	2008
6.	Cadangan Rekabentuk Kioks berkaitan untuk Dataran Wawasanita, Tingkat 3 & 4, Kompleks Pertama Kuala Lumpur.	Design and Supervision of M & E Services	RM3.5 millions	2007	April 2009
7.	The Development, Design, Financing, Insurance, Procurement, Construction, Installation, Testing Commisioning, Ownership, Operation, Management and Maintenance of A 2.8 Mega Watt Hydroelectric Power Plant in Kuala Krai Kelantan.	Independence Checking Engineer on behalf of Kuwait Finance House	RM24 millions	2008	December 2010

Table 1.1(a): Particulars of past projects (cont'd)

No.	Project Title	Scope of service	Contract Value	Year Start	Year Completed
8.	Cadangan Membina Jejambat Konkrit Sehala (Directional Ramp) di Persimpangan Jalan Kepong / Jalan Gajus, Jalan Kepong, Kuala Lumpur.	Civil & Structural Consultant	RM18 millions	2006	2010
9.	Pembinaan Kompleks Mahkamah Baru, Kuantan, Pahang.	Mechanical Works	RM170 millions	2009	2011
10.	Fire Certification Scheme for MAS at MAS Complex A and B, Subang, Selangor.	Mechanical & Electrical Works	RM210 thousands	2009	2011
11.	Proposed construction and completion of Pedestrian Bridge and covered Walkway for Selected LRT Station (Pasar Seni, Sultan Ismail, Plaza Rakyat, Jalan Hang Tuah and Bandaraya) at Wilayah Persekutuan Kuala Lumpur.	Project Manager and Consultant for Civil, Structure, Electrical and Mechanical	RM18 millions	2007	2012

Table 1.1(a): Particulars of past projects (cont'd)

No.	Project Title	Scope of service	Contract Value	Year Start	Year Completed
12.	Proposed Gas Plant for X-Fab Malaysia Project – Bulk Gas Supply System, Lot 1270 Block 12, Muara Tebas Land District, Samajaya Free Industrial Zone, 93350 Kuching, Sarawak.	Architectural, Civil & Structural, Electrical	RM12 millions	2009	2012
13.	Rumah Guru Desa Perwira, Kuala Lumpur.	Civil & Structural	RM21 millions	2010	2012
14.	Cadangan Membiadan Menyiapkan Projek IBS bagisekolah SMK Sultan Abu Bakar, Kuantan, Pahang.	Mechanical& Electrical Works	RM7.8 Millions	September 2011	Mac 2013
15.	Professional Consultant Services for Detailed Investigation on Lifts Modernization at Menara Bumiputra, Bank Muamalat Malaysia Berhad.	Mechanical works	Design Stage	March 2013	April 2013

Table 1.1(a): Particulars of past projects (cont'd)

No.	Project Title	Scope of service	Contract Value	Year Start	Year Completed
16.	Professional Consultant Services to Conduct Study, Review and Propose on Upgrading of Chiller & Main AHU Starter Panel at Menara Bumiputra, Bank Muamalat Malaysia Berhad.	Mechanical Works	RM250 thousands	January 2013	Jun 2013
17.	Proposed Upgrading of Fire Sprinkler Pumps, Water Tanks, Replacement of Main Sprinkler Pipe Risers and its Associated Works for Menara Etiqa, No.23, Jalan Melaka, 50100, Kuala Lumpur. For Messrs Etiqa Insurance & Takaful.	Mechanical & Electrical Works	RM600 thousands	January 2013	July 2013

Table 1.1(a): Particulars of past projects (cont'd)

b) Particulars of Current Projects

No.	Project Title	Scope of service	Contract Value	Year Start	Year Completed
1.	Proposed Upgrading Existing 3-Storey Factory at Lot 12, Rawang Integrated Industrial Park, Mukim Rawang, Selangor.	Mechanical & Electrical works	RM1.5 millions	October 2012	October 2013
2.	Lot 1770, UNISIA Customer Services Center, Jalan Raja Laut, Kuala Lumpur.	Mechanical & Electrical works	RM2 Millions	Mac 2011	December 2013
3.	Cadangan Merekabentuk, Membina, Menaiktaraf, MengubahsuaidanMenyiapkan Makmal-makmal FSG serta Kerja-kerja Berkaitan di Bengkel Kejuruteraan Lama untuk Fakulti Sains Gunaan (FSG), UiTM Shah Alam, Selangor. (Fasa 1)	Mechanical & Electrical works	RM4.1 Millions	Mac 2011	December 2013

Table 1.1(b): Particulars of current projects

No.	Project Title	Scope of service	Contract Value	Year Start	Year Completed
4.	Proposed Building Development at 11 & 12, Section 19, Petaling Jaya, Selangor for Messrs Perodua Sdn. Bhd.	Mechanical & Electrical works	RM20 millions	September 2011	Mac 2014
5.	Professional Consultant Service for Modernization and Upgrading of VVIP Lift at Menara Bumiputra, Bank Muamalat Malaysia Berhad	Mechanical works	RM450 thousands	2013	2014
6.	Cadangan Pembangunan Semula Kem Tentera Darat di Bawah Program 'Army Care' secara Reka Bina di Kem Lok Kawi, Kota Kinabalu, Sabah. Untuk Jabatan Arah Perumahan dan Pembinaan Markas ATM-Bahagian Logistik Pertahanan, Kementerian Pertahanan Malaysia.	Mechanical & Electrical works	RM45 millions	August 2012	Jun 2014

Table 1.1(b): Particulars of current projects (cont'd)

No.	Project Title	Scope of service	Contract Value	Year Start	Year Completed
7.	Proposed mixed development of Hotel, Banquet Hall, Services Apartment and Garden Restaurant at Bandar Baru Bangi, Lot PT 30324, PT 30325, PT 30326 District Kajang, Hulu Langat, Selangor.	Civil & Structural (C&S) and Mechanical & Electrical works (M&E) Zaidun-Leeng Sdn Bhd	RM148 millions	July 2011	July 2014
8.	Army Camps Rehabilitation Project (Army Care) Under Ministry of Defence Malaysia through Private Financial Concept Initiative (PFI) by Lembaga Tabung Angkatan Tentera.	Mechanical Works	RM68.5 Millions	December 2013	2015
9.	Proposed Bandar Baru Chemor on Lot 12397, Mukim of Hulu Kinta Daerah Kinta, Perak. - Entrance Interchange	Civil & Structural	RM15 millions	2012	2016
10.	Cadangan Pembangunan Semula Pasar Chow Kit di Jalan Raja Bot, Kuala Lumpur.	Mechanical & Electrical works	RM18 Millions	January 2012	2017

Table 1.1(b): Particulars of current projects (cont'd)

CHAPTER 2:

LITERATURE

REVIEW

2.1 LITERATURE REVIEW : STEEL

2.1 DEFINITION OF STEEL

In other words, steel is also known as iron. It is a type of malleable iron and is a ductile material. Carbon content between 0.12% to 1.8%. Steel is the main material used as well as the structure and fasteners, fastening and hawker. By reason of having high tensile strength, it is used for reinforced concrete and pre-stressed concrete. Steel is available in solid form, plate and hollow.

2.1.1 TYPE OF STEEL

Steel can be divided into two main groups, such as mild steel and high tensile steel.

i. Mild Steel (R)

Mild steel is the material commonly used for construction steel works. Strength grades commonly used is Grade 43, Grade 50 and Grade 55 respectively have a minimum ultimate tensile strength, which is 430 N/mm2, 500 N/mm2 and 550 N/mm2.

ii. High tensile steel (Y) / (T)

High tensile steel is steel that has high tensile strength yield. The addition of carbon by 0.6% to 0.9% and 0.5% manganese to 0.9% would result in a higher tensile steel than mild steel. Strength can be increased to 1450 N/mm2 to 1720 N/mm2 and work stress is between 1250 to 1460 N/mm2 N/mm2. High tensile steel is commonly used in pre-stressed concrete work, cable suspension bridges and high tensile bolts.

Sources: (Civil Engineering Studies, Yusof Paal, 2002)

2.1.2 SIZE OF REINFORCEMENT BAR

High-yield Steel

Photos 2.1 : Example type of High-yield Steel Reinforcement Bar (T)

- the strength of reinforcement stress = 460 N/mm2
- notation reinforcement = T
- Size of reinforcement T10, T12, T16, T20, T25, T32, T40 mm Ø

Mild Steel

Photos 2.2 : Example type of Mild Steel Reinforcement Bar (R)

- the strength reinforcement stress = 250 N/mm2
- reinforcement notation = R
- Size of reinforcement R6, R8, R10, R12, R16, R20, R25, R32, R40 mm Ø

Wire mesh

- the strength of the stress = 485 N/mm2

2.1.3 PANEL SCHEDULE OF REINFORCEMENT BAR

1) Mild Steel Round Bar (R)

Size (mm)	Pieces Per Bundle (pcs)	Nominal Weight (MT)
R10	138	1.020
R12	96	1.023
R16	54	1.023
R20	34	1.006
R25	22	1.017
R32	14	1.061
R40	9	1.065

Table 2.1 : Schedule for Mild Steel Reinforcement Bar (R)

2) High Tensile Deformed Bar (T)

Size (mm)	Pieces Per Bundle (pcs)	Nominal Weight (MT)
T10	138	1.020
T12	96	1.023
T16	54	1.023
T20	34	1.006
T25	22	1.017
T32	14	1.061
T40	9	1.065

Table 2.2 : Schedule for High Tensile Deformed Bar (T)

Photos 2.3 : High Tensile Deformed Bar (T)

3) High Tensile Deformed Bar (Y)

Wire Diameter	Pieces Per Tonne	Mass per metre (kg)
Y6	750	0.222
Y8	422	0.395
Y10	270	0.617
Y12	188	0.888
Y16	105	1.580
Y20	67	2.470
Y25	42	3.850
Y32	25	6.310
Y40	17	9.860

Table 2.3 : Schedule for High Tensile Deformed Bar (Y)

Photos 2.4 : High Tensile Deformed Bar (Y)

Sources: (http://www.vulcania.co.za/reinforcedbars_high)

2.1.4 TEST OF REINFORCEMENT BAR

A large part of the structure consists of reinforced concrete in it and reinforcement used depending on the size of the structures involved, and especially sectional area of thick concrete.

Two types of steel is often used in conjunction with steel concrete structure is simple and high yield steel. British Standard BS 4449: 1985 was set only two types of steel grades shall be used, namely mild steel with its strength, fy = 250 N/mm2 and high yield steel with its strength, 460 N/mm2.

Some of the tests conducted on the basis of being against both steel is bending test tensile test. Tensile strength is determined for yield load, ultimate load, the part that failed and elongation characteristics. While bending test was performed to measure the performance of steel. This test is performed on the steel pieces and more focused on the connected via either done welding or bending root face.

Before any steel reinforcement brought to the construction site, the contractor shall on demand, presenting the test certificate and a certificate from the manufacturer shall be submitted to the consultant for approval.

In addition, the contractor shall submit a letter from the laboratory tests which have been approved as required by the Authorized Officer. Any specification that does not comply with the conditions as engineering tests under standard of British Standard (BS) and Malaysian Standard (MS), Authorized Officer reserves the right to take the serious action.

Sources: (JKR Standard Specification for Building works, 1998)

2.1.4.1 There are two type test of steel reinforcement, such as:

a) Bending Test

b) Tensile Test

a) BENDING TEST

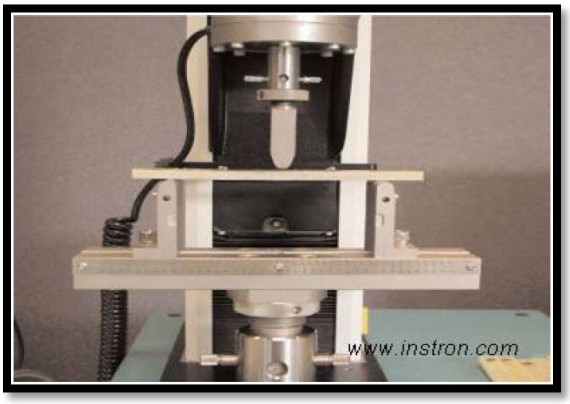
Material and Equipment:

i) Bend Specimens

ii) Micrometer and Vernia Caliper

iii) Permanent Pen

iv) Universal Testing Machine



Photos 2.5 : Example of bend testing under a three-point bend arrangement.

Procedure:

i) Measure the width and thickness of the specimen including the span length in the table provided for the calculation of the stress and elastic modulus. Mark on the locations where the load will be applied under three-point bending.

ii) Bend testing is carried out using a universal testing machine until failure takes place. Construct the load-extension or load-deflection curve if the dial gauge is used.

iii) Calculate the bend strength, yield strength and elastic modulus of the specimen.

iv) Describe the failure under bending and sketch the fracture surfaces in the table provided.

v) Discuss the obtained experimental results and give conclusions.

Sources: (Lab 7 : Bending Test, Mechanical Metallurgy Laboratory 431303, T.Udomphol)

Example Experimental Sheet of Bending Test

Description	Specimen 1	Specimen 2
Thickness, t (mm)		
Width, w (mm)		
Span length, L (mm)		
Flexure load at maximum, P max (N)		
Bend strength at maximum, σ maxb (Mpa)		
Bend strain at maximum, ε maxb' (%)		
Elastic Modulus, E B (Mpa)		
Fracture details		

Tables 2.4 : Experimental data for bend testing of materials

b) TENSILE TEST

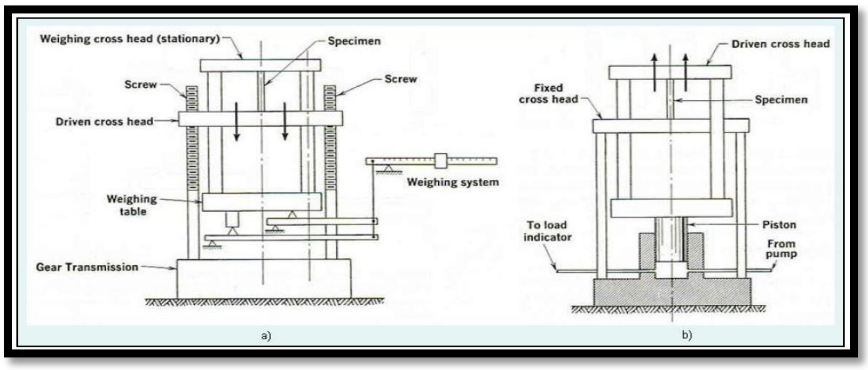
Material and Equipment:

i) Tensile Specimens

ii) Micrometer and Vernia Caliper

iii) Universal Testing Machine

iv) Stereoscope



Photos 2.6 : Schematic showing (a) screw driven machine and (b) hydraulic testing machine

Procedure:

i) The specimens provide are made of aluminum, steel and brass. Measure and record specimen dimensions (diameter and gauge length) in a table provided for the calculation of the engineering stress and engineering strength. Marking the location of the gauge length along the parallel length of each specimen for subsequent observation of necking and strain measurement.

ii) Fit the specimen on to the universal testing machine and carry on testing. Record load and extension for the construction of stress-strain curve of each tested specimen.

iii) Calculate Young's modulus, yield strength, ultimate tensile strength, fracture strain, percentage (%) of elongation and (%) area of reduction of each specimen and record on the provided table.

iv) Analyze the fracture surfaces of broken, specimens using stereoscope, sketch and describe the results.

v) Discuss the experimental results and give conclusions.

Sources: (Lab 3 : Tensile Test, Mechanical Metallurgy Laboratory 431303, T.Udomphol)

Example Experimental Sheet of Tensile Test

Details	Aluminum	Steel	Brass
Diameter (mm)			
Width (mm)			
Thickness (mm)			
Cross-sectional area (mm^2)			
Gauge length (mm)			
Young's modulus (GPa)			
Load at yield point (N)			
Yield Strength (Mpa)			
Load at yield point (N)			
Ultimate tensile strength (Mpa)			
% Elongation			
% Area of reduction			
Fracture strain			
Work hardening exponent (n)			
Fracture mode			
Fracture surfaces (Sketch)			

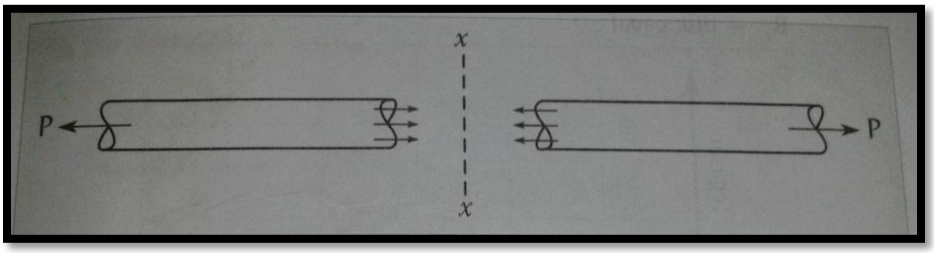
Tables 2.5 : Experimental Data of Tensile Test

2.1.5 CHARACTERISTIC OF STEEL

i. Strength
ii. Elasticity
iii. Ductility
iv. Corrosive Resistance
v. Fire Resistance
vi. Expansion and Contraction

i) STRENGTH.

Steel can withstand tension and compression. However, the long steel will bend when subjected to compression. The steel is subjected to tensile or compressive stresses and strains will experience. Figure 2.2.4.1 (a) shows a steel element under load (P) at both ends. In section *x-x*, power (P) is to be allocated to its internal cohesion. Stress is the force exerted by any cross-sectional area divided by assuming that the load is distributed to the rest of the section.



Photos 2.7 : Steel test with load.

***Formulae to Calculate the Stress **(σ) :**

$$\sigma = \frac{P}{A} \text{ N/mm2}$$

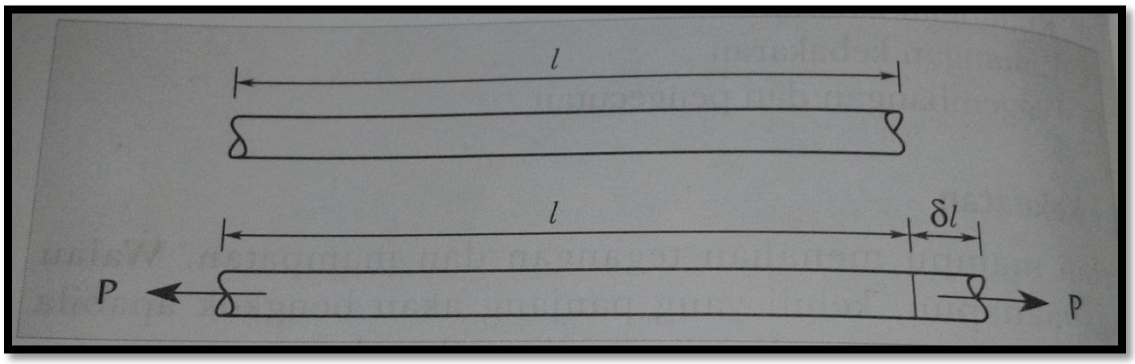
σ = Stress

P = Load

A = Cross Sectional Area

Stress experienced by the steel will result in changes in the steel depends on the direction of the loads. For example, a steel rod applied tensile stress elongates as shown in Figure 2.1.4.1 (b). Deformation, which lengthened the steel have strain. Strain is the elongation ratio occurs at the original length rods.

*Formulae to Calculate the Strain **(ε) :**



Photos 2.8 : Effect of tensile stress on the steel

$$\varepsilon = \frac{\delta l}{l}$$

ε = Strain

δ l = Elongation

l = Length

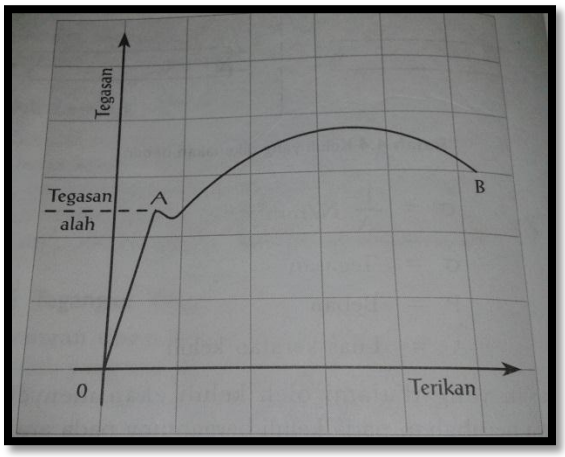
To break the tension tests performed on mild steel will produce as stress-strain curve shown in the figure below.

INDICATIONS:

OA - Elastic

AB - Plastic

B - Points of failure



Photos 2.9 : The stress strain curve for mild steel.

In the initial stages, the strain that occurs is proportional to the stress applied to the elastic limit point of A. Elastic limit is the point of transition from the elastic to the plastic nature. During the elastic properties of steel, the steel is able to return to the original length when the load left. As the load continues to be added after point elastic, steel will continue to suffer from strain and can no longer proportional to the stress. This indicated steels undergo plastic limit. When the load is applied directly after this limit, steel will break.

During plastic nature, elongated steel is unable to return to the original length when the load left. Stress at a point called the elastic limit of the yield stress. Yield stress gives ultimate strength of steel. However, the design will use the stress of work or the permissible stresses derived from the following formula:

Permissible working stress or stress = yield stress / Factor of Safety

Safety factors are used to account for an unprecedented overload, defects and defects in the steel works. Thus, work stress for steel grade 43, grade 50 and grade 55, respectively 165 N/mm2, 230 N/mm2 and 280 N/mm2.

Sources: (Reinforced Concrete Design –To Eurocode 2, Mohamad Salleh Yassin, 2002)

ii) ELASTICITY

Elasticity shows the strain rate experienced by the steel with applied stress. The modulus of elasticity or Young modulus (E) is considered as the ratio of stress and strain.

*Formulae to Calculate the Modulus Elasticity **(E)**:

$$E = \frac{\sigma}{\varepsilon} = \frac{P\,l}{A\,\delta l}$$

E = Modulus of Elasticity / Modulus Young

σ = Stress

ε = Strain

P = Load

l = Length

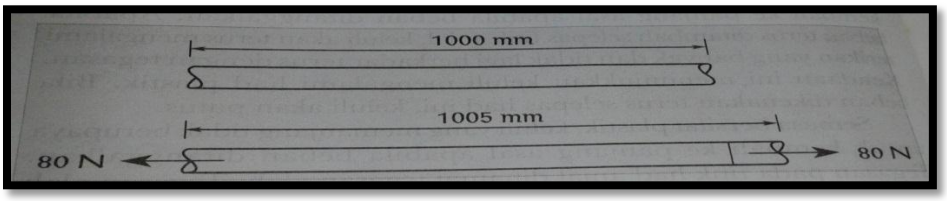
A = Cross Sectional Area

δ l = Elongation

Each material has a specific modulus of elasticity. When the material is stress suffered little deformation, it is said to have a high modulus of elasticity. For example, the modulus of elasticity of steel is 200 N/mm2 and the modulus of elasticity of aluminum is 69 N/mm2. Therefore, the steel will experience a smaller change than aluminum.

Example:

When 1000mm long steel rod 10mm diameter under load (P) 80N, it will be 1005mm lengthwise as shown in Figure 2.2.4 (ii)



Photos 2.10 : Steel rod with load.

Cross Sectional Area (A) = πr^2

= $\pi(5)^2$

= **78.6mm2**

Stress (σ) = P / A

= 80 N / 78.6mm2

= **1.02 N/mm2**

Strain (ε) = δ l / l

= 1005-1000 / 1000

= **0.005**

Modulus of Elasticity (E) = σ / ε

= 1.02 N/mm2 / 0.005

= **204 N/mm**

iii) DUCTILITY

Ductile material is a material which can undergo strain after the elastic limit. Thus, the ductility is the ability of the steel through the plastic limit before dropping out or broken. Ductility can be measured as the percentage of elongation before fracture or break. Percentage of shrinkage in the zone prior to fracture or break can be applied to measure the ductility. Mild steel is between a ductile material.

iv) CORROSION RESISTANCE

The presence of water and oxygen in steel producing hydrated ferrous oxide, commonly known as rust. Sulfur dioxide from industrial smoke and salt of the sea would accelerate the corrosion process. Ongoing corrosion process will reduce the strength of steel. Steel structures exposed to the atmosphere can cause corrosion. Therefore, to prevent corrosion, the steel should be applied with paint, chrome, and other oils.

v) FIRE RESISTANCE

The main properties of the steel is vulnerable to high heat changes imposed on it. Exposure to high temperatures above 55C in a long time will change the molecular bonds of steel. Strength drops even have cooled at normal temperature. Steel structures to fire the old should be replaced because of work stress or the permissible stress has decreased. Thus, in the construction of reinforced concrete structures, concrete cover used to prevent heat flow in steel with instant rates and protect the steel from the heat of fire.

vi) EXPANSION AND CONTRACTION

Steel is the material which is prone to expansion when subjected to high temperatures and easily shrink when cooled higher as against other materials such as concrete, wood and brick. Therefore, the purpose of the steel is bent at the end to tie the two materials. In addition, there is also a spring steel to increase the bond between the two materials.

Sources: (Civil Engineering Studies, Yusof Paal, 2002)

2.2 LITERATURE REVIEW : CONCRETE

2.2 DEFINITION OF CONCRETE

Concrete is a material made from cement, fine aggregate, coarse aggregate and water are mixed in a certain mixing ratio. For the normal mixture, the mixture of cement, sand and aggregates are determined according to weight ratio or volume ratio. However, the preferred weight ratio. For example, a mixture of 1:2:4 means 1 part cement, 2 parts fine aggregate and 4 parts of coarse aggregate. Concrete mixture ratios such as 1:3:6, 1:4:8 1:1.5:3 and is also used to produce certain concrete. Water used for concrete mixture usually by a suitable cement water ratio as 0.5 or 0.6. Water cement ratio is the weight ratio of water to the weight of the cement used in a concrete mix. The mixture is left to harden due to chemical reaction between the cement with water. During the wet concrete, it can be formed by the formwork.

Concrete is widely used in building construction, especially in columns, beams and floor slabs. Concrete is also used in the construction of bridges, sewerage works, roads, railways, dams, structures in the sea and so on.

2.2.1 CONCRETE MATERIALS

The main materials used to make concrete is cement, fine aggregate, coarse aggregate and water.

a) CEMENT

Cement has two important properties, namely cohesive properties and adhesion properties. This attribute can bind lumps of aggregate to form hard and solid bodies. The main material for produce cement is limestone and clay.

There are several types of cement, such as:

- Ordinary Portland Cement
- Rapid Hardening Portland Cement
- Low heat Portland cement
- Sulphate Resistant Cement
- Colored Cement

Influence on the strength of cement concrete and cement fineness is determined by the chemical composition as a result of hydration. Concrete strength increases as finer cement particles.

b) AGGREGATES

Aggregates can be obtained either in the form of crushed or not crushed. Aggregates are divided into two types such as, fine aggregate (sand) and coarse aggregate (gravel). Fine aggregate size is less than 5 mm, while coarse aggregate size greater than 5 mm. Fine aggregate (sand) can be obtained from rivers and mines, while the coarse aggregate may be obtained from the quarry.

Photos 2.11 : Crushing process to be coarse aggregates

Aggregates are the highest material content in concrete. Thus, the aggregate can affect the strength and durability of concrete. Between the natures of the aggregates to be known for producing quality concrete is:

- Texture
- Shape of Grains
- Grain size
- Grading
- Strength of Aggregate
- Physical properties such as relative density, porosity and resistance to acids and alkalis.
- Cleanliness of the aggregates. Aggregates must be free of organic material.

c) WATER

Water used in the concrete mix to produce a chemical reaction of cement, which is to bind the fine aggregate to coarse aggregate. When water is mixed with cement hydration process took place. Hydration causes solidification and hardening while releasing heat in the concrete mix. Clean water is needed for the concrete mix. For example, tap water used must be free from impurities. If the water used contains other chemicals that can prevent the hydration process, the strength of concrete cannot reach the required level.

d) ADDITIVES

The additives are used to alter the characteristics of concrete and facilitate concrete work. The additives are mixed into the concrete with an appropriate rate and must be mixed evenly and uniformly. Among the types of additives are as follows:

a. Accelerator

Calcium chloride is an ingredient commonly used pedal in concrete work. This material is intended to accelerate the initial solidification rate. If used excessively, it can cause corrosion of reinforcement bars. These materials are used in building structures that mold should be removed in advance and on the structure of the building for the cold climate.

b. Decelerator / Retarders

These materials are intended to slow the rate of initial solidification and it can slow down the solidification of concrete up to an hour. Typically, it is used in hot climates to overcome the effects of high temperature on concrete. It helps reduce bleed and drying shrinkage. Materials commonly used are sugar, salt solution, and a solution of zinc borate. Retarders also used in ready mixed concrete mix.

c. Air Entrapment

This material is designed to trap air in the concrete. In addition, these materials also facilitate concrete work without the use of water. These additives are commonly used in countries with colder climates. 1% by weight of cement additives will cause 5% entrained air, but can weaken the 4% to 7% strength concrete. Materials commonly used are vegetable oils and animal fats.

d. Adaptive Mixer

When the ratio of cement used low water, the movement of concrete flow is reduced, but the strength of concrete is increased from 10% to 20%. These additives are needed to help cement spread more effectively in order to accelerate the water viscosity properties. In addition, it also can maintain the required workability, although water cement ratio decreases. Such additives needed to make concrete high stress. Materials commonly used are sodium gluconate and calcium sulphate lingo.

Sources: (Civil Engineering Studies, Yusof Paal, 2002)

2.2.2 TYPE OF CONCRETE

Usually depends on the type of concrete applications. Among the types of concrete used in construction are:

i. Mass Concrete

Mass concrete or solid concrete is concrete that has no reinforcement. This depends on the concrete to bear the burden of its own weight. There are half-dams and retaining walls are built with concrete mass. In addition, concrete blocks made of concrete mass used as wave breakers.

ii. Reinforced Concrete

Concrete has high compressive strength and low tensile strength. Concrete of structures require high tensile reinforcement to resist the tensile stresses generated. We call this reinforced concrete. Beam will bend a little and eventually unable to resist fracture due to tensile stresses in the soffit. Beam will crack at the bottom and will eventually break.

During construction, the reinforcement shall be fixed firmly to prevent displacement occurs on the reinforcement during concrete pouring is done. Reinforcement tied to intercept using soft wire. Spanner block placed between the formwork to line reinforcement with reinforcement during concrete pouring. Spanner thickness is equal to the thickness of the concrete cover. The cover is used in order to protect reinforcement from heat, moisture, and chemical reactions. Before pouring the concrete done, the reinforcement shall be clean from dust, oil, rust or other substances that can weaken the bond between the concrete reinforcement.

Reinforcement used consisted of round steel, welded or net flowering. Steel of flowering and twists are better than round steel.

In addition to tensile stress, shear stress also occurs in concrete structures. Vertical shear force and the resulting horizontal shear force in the beam will cause diagonal tensile and compressive stresses are diagonal. This will cause cracks in reinforced concrete near the diagonal strut as a result of high tension. Thus, the shear reinforcement is required to overcome shear.

iii. Pre-stressed Concrete

Reinforced concrete will bend slightly when subjected to loads. Although the beam did not fail because the tensile stress at the bottom is hampered by reinforcement, but cracks will occur at the bottom as a result of the bending. To overcome this problem, pre-stressed concrete must be used. Pre-stressed concrete can be defined as pre-compacted. Compression applied to the tensile stresses that occur during limb is loaded. Applied compressive stress will impede or offset tensile stresses. Pre-stressed concrete has a high tensile strength. This means that as long as the tensile stresses imposed does not exceed the tensile pre-compacted, cracking will not occur. If the stress exceeds the pre-stressing, cracks can occur and these cracks will close back when the load is removed. High tensile steel tendons used for pre-stressed concrete. *There are two methods for pre-stressed concrete assertion, the concrete pre-tensioned and post-tensioned concrete.

a. Pre-tensioning concrete

Pre-tensioned concrete made by pouring concrete into the formwork after the tendons are tensioned between two walls off. When the concrete is strong enough, the tendon is removed from the abutment of concrete and cut to length. Compressive force transferred to the concrete through the bond that exists between the tendons to the concrete.

b. Post-tensioning concrete

Post-tensioned concrete made by pouring concrete into a formwork and allowed to harden before the concrete tensile apply. Post-tensioned concrete construction method initiated by inserting the tendon into the mains at the position specified by the profile and then the concrete will be poured. When the concrete has reached the required strength, the tendons are tensioned and anchored at both ends of the concrete. Deliberate tendon profile curve in post-tensioned concrete to distribute stresses sectional effectively.

- REINFORCED CONCRETE AND PRE-STRESS CONCRETE

In pre-stressed concrete construction, reinforcement required total weight is about one fifth of that required for reinforced concrete. Amount of concrete needed even less and this will reduce the burden on themselves. Materials for pre-stressed concrete tested first during the manufacturing process and whether any defects in material or mixture ratio could be detected. Pre-stressed concrete beams can accelerate the process of building a large project such as a bridge or crossing over.

Sources: (Civil Engineering Studies, Yusof Paal, 2002)

2.2.3 CONCRETE MIXING

Concrete can be mixed into 3 types, such as:

a) mixing with used spade

b) mixing with mixer machine

c) supply of ready mix plant

Usually mixing concrete using spade or concrete mixer is for small quantities. Content of cement should be added about 10% more to facilitate the work of brewing. During the mixing of concrete in this way, the material will be mixed dry mixture first. Then water is added little by little until sufficient water measurements. Mixing work done until the mixture is uniform.

For a large project such as for high-rise buildings, the amount of concrete required is substantial. Concrete mix is usually prepared from the mixing plant. The mixture concrete is mixing from batching plant or on the construction site must be comply with the specified mix ratio to produce quality concrete.

Photos 2.12 : Example of manual mixing concrete with using spade

Photos 2.13 : Example type of mixing with manual mixer machine used at construction site hotel & apartment Felda, Bangi.

Photos 2.14 : Concrete Batching Plant from PA Concrete Sdn Bhd used in Project Hotel & Apartment Felda, bangi, Selangor.

2.2.4 GRADE OF CONCRETE

2.2.4.1 Types of Concrete Grades

At present, the type of concrete mix over the grades specified as a particular concrete. Among the type of grade concrete is such as:

i) G15 (1:3:6)
ii) G20 (1:2:4)
iii) G25 (1:1/2:3)
iv) G30 (1:1:2)

This grade is defined as 'Characteristic Compressive Strength'. The unit is in N/mm2. Water of cement ratio is the weight of water over weight of cement and it is should be between 0.5 to 0.6.

Example Type of Mixture Content:

i) Mixture Ratio of (1:2:4)

1 part of cement : 2 parts of fine aggregates (sand) : 4 parts of coarse aggregates (gravel). This type of ratio is commonly used in reinforced concrete works and pre-cast concreting work.

ii) Mixture Ratio of (1:3:6)

1 part of cement : 3 parts of fine aggregates (sand) : 6 parts of coarse aggregates. This mixture is used in concreting works that are commonly used as the base and concrete floor.

iii) Mixture Ratio (1:9)

1 part of cement : 9 parts of fine aggregates (sand). This type of ratio is used for 'Screed Concrete'. Screed Concrete is normally used in:

- to provide a cleaner surface in especially to make reinforcement work.
- to prevent the new hole of excavation from water erosion.

Sources: (Testing of Materials and Structures, Mahyuddin Ramli, 1992)

Material used in mixture content of Mortar:

Normally the mixture content of standard concrete is cement + fine aggregates (sand) + coarse aggregates + water but for produce a mortar the mixture is just cement + fine aggregates (sand) + water. Coarse aggregates (gravel) is not required in this content because the size of mortar is thin. In other words, mortar is known as 'glue' because the function is to stick the surface of brick to each other.

*Thickness of mortar is around 1/4" inch until 3/4" inch (6.35mm – 19.05mm)

Photos 2.15 : Example the type of mortar used to stick brick to each other.

2.2.4.2 Table of Grading and Mixing Concrete at Batching Plant by Standard Specification JKR

Grade	Water (l)	Cement (kg)	Fine Aggregates (kg)	Coarse Aggregate (kg)	Chemical Fluid (l)
G20	185	320	890	970	1.92
G25	185	360	860	970	2.16
G30	185	400	830	980	2.28
G35	185	460	800	980	2.52
G40	185	520	770	970	2.76
G45	185	560	770	970	2.76
G50	185	600	770	970	2.76

Table 2.6 : Table of Grading and Mixing (JKR Standard)

2.2.4.3 Grade of Concrete for General Usage

No.	Grade	General Usage
1.	G7	Solid Concrete
2.	G10	Solid Concrete
3.	G15	Reinforced Concrete with Light Aggregates
4.	G20	Reinforced Concrete with Solid Aggregates
5.	G25	Reinforced Concrete with Solid Aggregates
6.	G30	Pre-stressed Concrete Pre-Tensioned
7.	G40	Pre-stressed Concrete Pre-Tensioned

Table 2.7 : Concrete grade in general used

Sources: (Testing of Materials and Structures, Mahyuddin Ramli, 1992)

2.2.5 CONCRETE TEST

During concrete work performed, samples shall be taken from the concrete being poured. Tests on new concrete including slump test, compaction test and the air trap test. Although the test cubes in the category of tests on hardened concrete, the methods provide test cubes from fresh concrete sources of utmost importance.

i) Slump Test

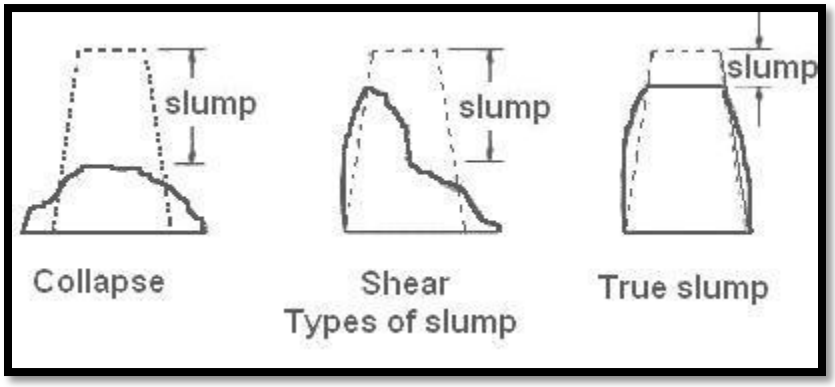
Slump test is suitable for normal stick mix medium to high workability and is most commonly used. Changes in the ruins may indicate a change in the material, the water content or the rate of the mixture.

This frustum molded cone consists of 100mm diameter at the top, the bottom surface of the inner diameter of 200mm and 300mm high, 16mm diameter steel rods and 600mm long. The interior of the mold must be clean and moist before the test. Frustum cones placed on the surface of the base plate. Mold held down and having a large place filled using three layers. Each layer stamped 25 times with rod stuffing. Above the surface and the final layer is flattened with a spatula. Any excess of the mold cleared from the site. Frustum cone mold subsequently in lift on slowly.

Place upside down next to the ruins frustum concrete. Measure and record the decline and that decline occurring types. The decline must be recorded almost 5mm.

Sources: (Testing of Materials and Structures, Mahyuddin Ramli, 1992)

Three types of slump that always happens is that the true slump, shear slump and collapse slump as shown in the figure below.



Photos 2.16 : Type of slump

a) True Slump:

Quality concrete is concrete in true slump. Actual drop occurs due to the cohesion and rich mixture. Rich mixture is a mixture containing a more cement.

b) Shear Slump:

Shear slump occurs due to poor mix. Mix less means less mixture of cement. Shear slump reflects the lack of cohesion in the concrete mix.

c) Collapse Slump:

Collapse slump shows the mix of concrete is wet and produced a low-quality of concrete.

Sources: (Civil Engineering Studies, Yusof Paal, 2002)

The table below shows the rate of concrete slump test.

Slump (mm)	Purpose of use
0	Pre-stressed concrete structure is compacted by heavy vibration
0-25	Mass concrete and compacted by vibration pavement.
25-50	Reinforced concrete and concrete vibrating mass of compacted by hand.
50-100	Reinforced concrete with bending and should be vibrating. Examples: floors, beams, columns, and walls of reinforced concrete compacted by hand.
100-150	Reinforced concrete has a lot of compacted without the vibrating - this compaction work hard to do Example : Transfer Floor Beam and Pump Concrete Target Slump is 100 plus minus 25.

Table 2.8 : The rate of concrete slump test

Sources: (Testing of Materials and Structures, Mahyuddin Ramli, 1992)

ii) Preparation of Test Cubes

Compression test for concrete with a maximum aggregate size of up to 40mm are often made on a 150mm sized cubes to aggregates with a nominal maximum stone size 20mm or less, 100mm cube can be used.

Molds for cubes must be made of steel or cast iron with a small limit for flat dimensions, angles, parallel and surface texture and hardness. Each mold must have a steel base plate which can be removed with a real surface to support the mold and prevent leakage. During concrete work performed, samples shall be taken from the concrete being poured, and the work test cubes made from it.

Sources: (JKR Standard Specification for Building Works, 1998).

The important thing for the concrete is in fully compacted cubes. 150mm cube mold must be filled with three layers of 100mm and mold in two layers. When compaction is done by hand, each layer must be stamped at least 35 times for cubes of 150mm and a minimum of 25 times for cubes and 100mm by 380mm long steel bars, weighing 1.8kg and has a 25mm square surface similar shock. Impact on the concrete must be made in accordance with rules. Taken equal impact on the concrete surface in normal form and not concentrated at one point only.

Sources: (Design and Construction Concrete Floor, Blackledge.G.F. 1975)

In general, six concrete test cubes shall be prepared from the three samples in which two cubes taken from each sample for each day during concrete work done. However, if the mixture or the quantity or quality of the content is modified materials, the Superintending Officer may direct additional cubes made in the same way. All cubes shall be clearly marked and mark the date poured serial number. Three cubes each of a sample to be tested on day 7 and 28. Cube strength shall be calculated from the maximum load at failure are borne by the cube of the load.

Sources: (JKR Standard Specification for building works 1998)

iii) Normal Curing Test Cubes

Immediately thereafter made, place the cubes must be kept free from vibration under damp or similar pad and fully packaged with plastic sheeting to prevent moisture loss. Cubes to be tested at the age of 7 days or more must be stored at a temperature of 5°C ± and cubes to be tested at an earlier age must keep at a temperature of 20°C ± 2°C.

Cubes tested after 24 hours must be removed from the mold just before testing. Cubes tested on more age must be removed from the mold between the ages of 16-28 hours after made. Each cube is visible and marked with black ink for identification purposes and soaked in clean water tank is maintained at a temperature of 20°C ± 2°C until the time of testing.

Sources: (Design and Construction Concrete Floor, Blackledge.G.F.1975)

Required strength can be calculated satisfactorily if the strength of the three cubes is not less than specified cube strength, or if the average strength of the three cubes is not less than specified cube strength and the difference between the maximum and minimum strength should be not exceed 20% of the average strength. If the test on the seventh day did not achieve the desired strength, the Superintending Officer shall be entitled to cease work until the concrete cubes are tested in excess of the 28th day.

Strength required for nominal mix shall be as shown in the table below.

Mixture Ratio	Cube strength of day (7^{th})		Cube strength of day (28^{th})	
Nominal	Early Test	Work Test	Early Test	Work Test
	(N/mm2)	(N/mm2)	(N/mm2)	(N/mm2)
(1:1:2)	26.7	20	40	30
(1:1/2:3)	22.7	27	34	25.5
(1:2:4)	18.7	14	28	21

Table 2.9 : Strength Required for Normal Curing Test Cubes

Sources: (JKR Standard Specification for building works 1998)

2.2.5.1 CURING

In normally, for test cubes will take a certain number of days to be submerged in the tank. The purpose of the cube is soaked in water to create a process of curing.

The presence of water in the concrete will cause of water reaction with cement. The reaction with water is called hydration of cement. Water loss is too early prevents normal hydration and dry concrete will probably have a dusty surface and weak internal structure. This situation can be solved with curing method.

Curing is a process to prevent the evaporation of water from the newly poured concrete for a certain period of time. This allows water to cement reactions occur properly. Curing also reduce shrinkage stress in immature concrete. Additionally, curing also reduce cracking in concrete.

Commonly used method of curing is by closing the concrete mix with wet jute twice a day. In addition, impervious paper or plastic can also be used to cover the surface of newly poured concrete. Concrete using ordinary Portland cement (OPC) and went through the process of achieving strength curing well as in the table below.

Age	3 Days	7 Days	28 Days
Strength	30%	70%	100%

Table 2.10 : Rate of strength concrete based on age

Sources: (Civil Engineering Studies, Yusof Paal, 2002)

2.2.5.2 Calculation of Cube Test (Percentage Strength)

Grade: **G25**

Let say, the load is 500kN.

kN- N (convert unit)

500kN = 500 000N

Calculate:

Area of cube

150mm x 150mm

= **22 500 mm²**

L/A

= 500 000 N / 22 500 mm²

= **22.22 N/mm²**

Type of Grade used is G25

So, the percentage strength of concrete is

22.22 / 25 ⟶ Grade 25

= 0.88

= **88%**

*Therefore, the test is passed because higher than 75%.

Sources: (Testing of Materials and Structures, Mahyuddin Ramli, 1992)

CHAPTER 3:

CASE STUDY

(Apartment & Hotel Felda, Bangi Selangor)

CASE STUDY

3.1 INTRODUCTION PROJECT

Photos 3.1 : Sign board for construction project of Hotel and Apartment (KPF) Bangi, Selangor.

Hotel & Apartment Koperasi Permodalan Felda (KPF) located at Lot PT 30324, 30325, 30326 and 3027 Mukim Kajang, Daerah Hulu Langat, Selangor Darul Ehsan. KPF construction projects Bangi has 3 buildings such as the hotel consists of 23 floors, the apartment of 22-storey and one storey restaurant. The estimated value for overall this project is RM148 millions. The total area of the construction site project area is 5.74 acres or 23,228.96 square meters. The developer of this project is Koperasi Permodalan Felda (KPF) Malaysia Berhad. The architect for this construction project is from MAA Architect located at Kuala Lumpur Central. The consultant engineer is from Zaidun-Leeng Sdn Bhd in which the main office is located at Jalan Bukit Nanas, Kuala Lumpur. This project is started on 21st July 2011 and expected to be completed in 21st July 2014.

3.1.1 PERSPECTIVE VIEW

Photos 3.2 : Perspective View 1&2 for Project Hotel Felda (KPF) Bangi, Selangor.

3.1.2 GENERAL INFORMATION OF CONTRACTOR

Contract Title : PROPOSED COMMERCIAL DEVELOPMENT WITH HOTEL 23-STOREY BUILDING, 1 FLOOR RESTAURANT, 22-STOREY HIGH HOTEL APARTMENT, 1 UNIT ELECTRICAL SUBSTATION, 1 UNIT WAKAF AND 2 UNIT OF GUARD HOUSE MUKIM KAJANG, DAERAH HULU LANGAT, SELANGOR.

Contract No. : LA 9003-04-2010 KPH

Main Contract

Main Contractor	:	SPAZ SDN BHD (502425-P)
Registered Class	:	PKK Class 'A' BUMIPUTERA
PKK Registered No.	:	1407 A 2003 0070
CIDB Registration No.	:	0120020802 – WP073423
SOCSO No.	:	A 37676757
Original Contract Sum	:	RM148 000 000.00
Commencement Date	:	15th January 2011
Commencement of Construction Works	:	21st July 2011
Completion Date	:	21st July 2014
Duration	:	30 Months
L.A.D / Day	:	RM27 000.00

Bond & Insurance

Performance Bond	:	SME Bank BG/CMBC/SP15/2011/042
Contractor All Risk	:	AXA AFFIN GENERAL INSURANCE BHD
Period	:	1/4/2011 until 14/7/2015

3.1.3 SUPER STRUCTURE WORK

Party of Professional Involve

Owner	:	Koperasi Permodalan Felda Malaysia Berhad Blok J, Anjung Felda, Jalan Maktab 54000 Kuala Lumpur
Project Management Consultancy	:	KH ZAM ENGINEERS SDN. BHD. 17B, Jalan Kota Raja H27/H, Hicom Town Centre Seksyen 27, Shah Alam, Selangor Darul Ehsan.
Contractor Design & Build	:	SPAZ SDN. BHD. No.23B, Jalan Bachang, 2 ½ Miles, Off Jalan Ipoh, 51200 Kuala Lumpur.
Architect	:	Arkitek MAA Sendirian Berhad Penthouse Level 21 Tower 3A Plaza Sentral, Jln. Stesen Sentral 5 P.O Box 10455, 50714 Kuala Lumpur.
Civil & Structure Engineer	:	ZAIDUN-LEENG SDN BHD Tkt. 5, Bangunan Ming #05-01, Jalan Bukit Nanas, 50250 Kuala Lumpur.
Mechanical & Electrical Engineer	:	ZAIDUN-LEENG SDN BHD Tkt. 6, Bangunan Ming #06-01, Jalan Bukit Nanas, 50250 Kuala Lumpur.
Quantity Surveyor	:	ARH JURUKUR BAHAN SDN BHD 224A, Jalan Negara 2, Taman Melawati, 50250 Kuala Lumpur.
Landscape Architect	:	PAA LANDSCAPE SDN. BHD. Landscape Architecture & Town Planning. No.34-1, Jalan Tengku Ampuan Zabedah A 9/A Section 9, 40100 Shah Alam, Selangor

3.1.4 SUB-STRUCTURE WORK

Professional Party Involve in (Piling Work for Coordination)

Consultant	:	KAR CONSULTANTS SDN BHD Suite 904, 9th Floor Wisma Hang Sam, No.1, Jalan Hang Lekir, 50000, Kuala Lumpur.
Contractor	:	SB GEOTECHNIC SDN BHD 2-18, Medan Bukit Indah 3, Taman Bukit Indah, 68000, Ampang, Selangor.
Surveyor	:	ABDULLAH TAHA & RAKAN RAKAN Kahar Abdullah , MIS(M), MAALS Jurukur Tanah Berlesen. No.11, 2nd Floor, Jalan Wangsa Setia 1, Wangsa Melawati, Kuala Lumpur.

3.1.5 CONSTRUCTION STAGE

Structure Construction Stage:

a. Preparation for starting construction
b. Earthwork
c. Sub-structure construction
d. Superstructure construction

a) PREPARATION FOR STARTING CONSTRUCTION

After getting permission to enter the construction site, the following must be done, such as:

i) Clean up the construction site.

ii) Provide entrance and exit to the construction site.

iii) Providing temporary road.

iv) Provide temporary parking.

v) Provide temporary building site office, storage of materials and equipment, hut, shelter and canteen.

vi) Provide safe materials such as steel reinforcement, structural steel, sheet piles and other materials.

vii) Provide fencing and hoarding.

viii) Provide safety signs.

ix) Provide signage project.

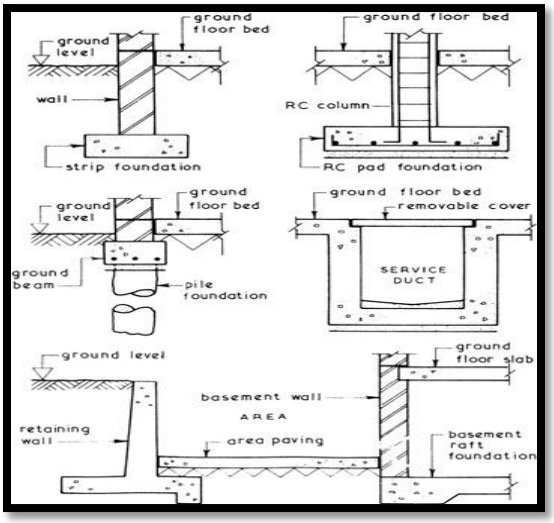
In addition, basic needs such as water, electricity, telephone lines, sanitary and other employees should be provided for comfort. After completing provide basic needs will be determined datum. Next, site survey work will be carried out to obtain the desired level of formation. This also involves determining the work floor level and slope drainage ditches using survey and stake level spikes.

b) EARTHWORK

Earthworks involve formation process provides the required level of working drawings site. Based on the policy level and datum line which was pegged signs, cutting and reclamation work done. For areas with higher levels of soil formation level site, soil cutting is done, while the land reclamation work done for areas with lower levels of soil formation level. Cutting and reclamation work done to level the site is accurate at the formation level.

c) SUB - STRUCTURE CONSTRUCTION

All building structures has the burden to be borne by the estate. Therefore, every building structure begins with the substructure construction. Substructure refers to all parts of the building which is located below the surface of the soil or damp proofing layer. Substructure construction works including piling (if required), foundation, mast stump, the basement (floor and lower wall) and floor base layer.



Photos 3.3 : Example type of cross sectional sub-structure.

Substructure construction work started after installing spikes mark, measure and stake level spikes do. Usually, after the fundamentals and building walls is determined, basic hole excavation will begin. If the soil in the excavated area was soft and crumbly, while retaining drainage should be built to prevent soil collapse on the pit wall. For a large building with high load, piling work done prior to building the foundation site.

Work shall be performed in accordance with working drawings and specifications specified work. Driven pile will be planted at a certain point and further excavation work for the construction of the cap will be made around the pile. Pile head will then be cut to the bottom cap of the excavation, which is up to the marked line. Some of the piles were left protruding reinforcement for concrete combined with the cap.

Further work to provide basic mold and reinforcement in the mold assembly is done. This was followed by the installation of basic pillar reinforcement. Concrete is then poured into molds and left to harden before ground beam construction and continued solid layer under the floor. Substructure that has hardened reclaimed with native soil. Upon completion of construction of the substructure, superstructure construction work continued.

d) SUPER – STRUCTURE WORK

Building superstructure covers all structural members located on the substructure, which is at the top of the ground level. Building superstructure was built in stages and begins with the construction of structures such as pillars, beams earth, floor beams, solid bottom floor, top floor beams, roof beams and roof. This was followed by the construction of another building superstructure such as walls, doors, windows, stairs, ceilings, roof coverings and finishing work.

During the construction of the structure carried out, basic equipment such as the work of building mechanical and electrical systems for plumbing, water supply, electricity, transport and communication systems as well as multimedia, air conditioning system, fire system and cleaning system shall be provided.

Sources: (Civil Engineering Studies, Yusof Paal, 2002)

3.2 SITE ORGANISATION CHART

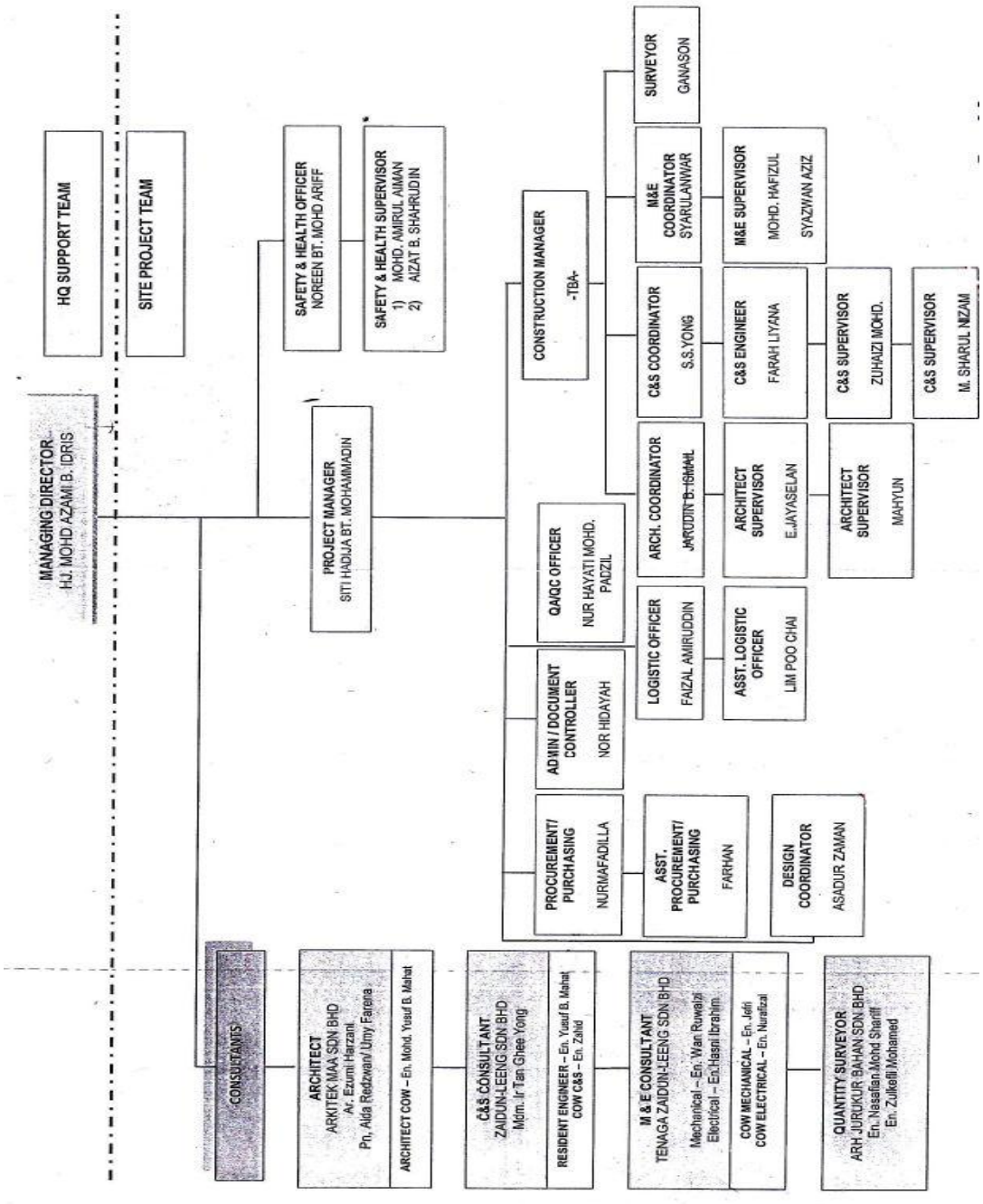


Figure 3.1 : Site Organization Chart

3.3 LOCATION PLAN OF SITE PROJECT

Photos 3.4 : Location of site project hotel and apartment, Bangi, Selangor.

The red circle show the location of construction site project Hotel and Apartment at Bangi, Selangor. If we are from Kuala Lumpur or Seremban, we must exit at Plaza Tol Bangi at South-North Plus Highway. This site project is located nearest the Hitachi Factory and shopping complex WARTA Bangi or known as Bangi Utama.

3.4 SAFETY EQUIPMENT

3.4.1 INTRODUCTION

Safety is an important aspect that should be emphasized in all daily activities no matter where a person is either on land, sea or in the air. Awareness of personal safety is very important to prevent injuries or accidents at work. Attitude of vigilant and cautious at every individual should have that accidents can be avoided.

3.4.2 SAFETY INTEREST IN SITE

Photos 3.5 : Safety signboard at construction site project KPF, Bangi, Selangor.

Priority safety at construction sites is to be considered because there are a lot of construction work that could endanger workers and the general public in the vicinity. This includes work on the construction site involving the use of explosives, excavation, construction of tunnels and tall buildings. Safety should also be a priority when operating construction plant and equipment.

Awareness of personal safety is the main criteria to avoid accidents on construction sites. If this attitude aside, accidents and injuries are from may occur. All parties should adopt vigilant and alert at the construction site. It is therefore important safety first and takes the necessary actions before the occurrence of undesirable.

3.4.3 Safety Equipment used by any person who workers at site project:

a) Safety Helmet

Safety helmet is one of the compulsory safety equipment need to have by each one of the workers at the construction site, not just workers, but also the site staff and the visitors. The function of the safety helmet is to protect the head, basically protection from any object falling from above, especially when the hoisting work is carried out on site, or high rise building.

Photos 3.6 : Safety helmet to protect head from falling objects

b) Safety Boot

In order for the worker to walk safely around the site, safety boot is required by all personnel that enters the site, there are usually 2 types of boot that are commonly used, the first one is the one that have a layer of metal plating covering the toe area while the second one is just ordinary

Photos 3.7 : Safety boots to protect feet from harmful objects on the ground

c) Hand Gloves

Hand glove is important protective equipment just like the safety boots and safety helmet, it is compulsory to wear the hand glove when working. The hand glove is worn on the hand and could protect the hand from any damages when working with hard materials such as rebar of steel reinforcement bars.

Photos 3.8 : Hand gloves to provide protection when working with rough materials

d) Safety Goggles

Safety goggle is protective equipment suited for the eye. It is used to protect the eye from any contaminants that could enter or hurt the eye. The safety goggles are usually wears when cutting the woods that could cause small parts of the wood flew into the eye or cutting the steel using oxy cutter or automated saw that can cause the sparks to get into the eye. The dust from cement could also cause damage to the open eye, therefore the safety goggles are important in a construction site.

Photos 3.9 : Safety goggles can provide protection for the eyes

1

CASE STUDY

CHAPTER 3.8 : REINFORCEMENT BAR WORK

Content

3.5 MACHINERIES

3.5.1 Machineries used on construction site Felda, Bangi.

There are certain things need to be taken in consideration for machineries used when the construction work of installation reinforcement bar and concreting work. The machineries used could affect because if the machine is broken or could not work properly, there will be delay and that could cause problem. The machineries are either provided by the main contractor or the sub-contractor.

List of machineries used:

a) Tower Crane
b) Generator
c) Air compressor
d) Blower
e) Bar bending machine
f) Bar cutting machine
g) Pump Concrete Truck
h) Mobile crane
i) Concrete Bucket
j) Excavator
k) Concrete vibrator
l) Vibrator Poker
m) Power Trowel
n) Concrete Mixer
o) Concrete Mixture Truck

3.5.2 Function of Machineries Used

a) Tower Crane

Photos 3.10 : Tower Crane at Hotel Apartment.

Tower crane are a common fixture at any major construction site. They are pretty hard to miss they often rise hundreds of feet into the air and can reach out just as far. The construction crew uses the tower crane to lift steel concrete, large tools like the air compressor generator set and a wide variety of other building materials. This construction project used two tower cranes such as at hotel have 23-storey height and hotel apartment 22-storey. Therefore, contractor of SPAZ Sdn. Bhd. rent two tower cranes that tower hotel and apartment can be run simultaneously and quickly. The cost to rent this tower crane is RM15,000 per unit. So, the total cost rental of two tower crane is around RM30,000 per months.

b) Generator

Photos 3.11 : Generator used to generates tower crane at Hotel Apartment.

The generator set or known as (GEN-SET) is a machine that generates the power up to support the tower crane and spot light. The color of (Gen-Set) used in this construction site is red and the size 5000mm x 3000mm x 3000mm. The cost per month to rent the (Gen-set) is RM3,400 per unit. This project is used four (Gen-set). So, the total for four (Gen-set) per months is around RM13,600.

c) Air Compressor

Photos 3.12 : Air compressor used at Hotel.

The air compressor machine is a machine that generates high pressure air as its power source to the blower. The color of the air compressor machine used is blue and the size is 3000mm x 1500mm x 1500mm. The air compressor machine uses diesel to generate and requires 12 liters of diesel throughout the day depend on the concreting work. The cost to rent the air compressor is RM700 per months.

d) Blower pipe

Photos 3.13 : The example of cleaning work using the blower pipe.

The function of blower pipe is to clean all rubbish or dust in formwork before concreting work will be carried out. The power source of blower is used high air pressure because need to remove the rubbish in formwork. The cost to rent a blower pipe is in the package of rent an air compressor per unit.

e) Bar Bending Machine

Photos 3.14 : Bar Bending Machine used at construction site Felda, Bangi.

Bar bending machine is normally used for works that involves the reinforcement bars. The bar bender is a powerful machine that could bends the thick diameter of steel by high skilled general workers. This worker is the only skilled person who can operate this machine. The power of bar bender machine is capable to bend until 320 kilograms of steel per day. The cost for this machine is around RM600 per months for rental.

f) Bar Cutter Machine

Photos 3.15 : Bar Cutter Machine used at construction site Felda, Bangi.

Bar cutter machine is normally used besides the bar bending machine is used because before bending the bars, the bars need to be cut according to the right measurement. The bar cutter machine is dangerous machine and only skilled person can only carry out this cutting of steel bar. The power of bar cutter machine is capable to cutting until 500 numbers of steel per day. The costs is around RM600 per months for rental.

g) Pump Concrete Truck

Photos 3.16 : Pump concrete truck

Truck carrying concrete pump pipeline is rented if needed. Truck of concrete pump is used more easily and quickly. Concrete pump requires a strong competitive pressure for concrete passed through in the concrete pump pipeline. Once there, its pressure and strong winds in the pump pipe so the water in the mixing ratio of a grade is more than normal mixing. Slump test performed was higher (100 plus minus 25) compared to the normal (75 plus minus 25).

h) Mobile Crane

Photos 3.17 : Mobile Crane used at construction site.

Mobile crane generally operate a boom from the end of which a hook is suspended by wire rope and sheaves. The wire roped are operated by whether prime movers, the designer are available, operating through a variety transmission. Steam engine, electric motor and internal combustion engine have all been used. The cost to rent a mobile crane is RM850 per day.

i) Concrete Bucket

Photos 3.18 : Standard Concrete Bucket for 3m cubes

Concrete Bucket is usually used to lift the concrete is poured from a concrete mixer truck. Type of concrete used is 'normal type'. An area for a concrete bucket volume is 3m cubes. The type of crane lifting concrete bucket to place high this is like a mobile crane and tower crane. Spaz contractors Sdn. Bhd. has a concrete bucket own and not rent a concrete bucket at any supplier of equipment and construction machinery. The price of one concrete bucket for 3m cube is RM2, 500. There are 3 bucket of concrete used in construction projects.

j) Excavator

Photos 3.19 : Excavator used at this construction site project.

Excavator is a machine used basically to excavate the soil. The soil need to be excavated in order to create the working spaces for the general workers. The excavator could excavated 20m cube in 4 hours depending on the construction of the site. If the condition at site is muddy, it would take much longer to do the excavating jobs. The excavator used 3.1 liters of diesel to excavate 20 meters cube of soil. The cost to rent the excavator is around RM350 per day on RM10,500 per months.

k) Concrete Vibrator

Photos 3.20 : This concrete vibrator is used during the concreting work is carried out.

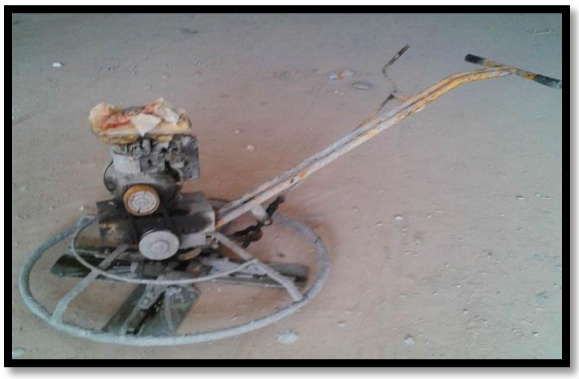
Concrete Vibrator is a machine that generates the power of vibrates to vibrator poker. The concrete vibrator is used petrol to generates and requires 15 liters per day, depending the casting work day. The cost to buy petrol is around RM30 to RM50 for 15liters to 25 liters. This project is used six concrete vibrator. The cost to rent one of the concrete vibrator is RM650 per months. If the total cost rental of overall for six concrete vibrator is RM3,900 per months.

l) Vibrator Poker

Photos 3.21 : Vibrator Poker

Vibrator poker is a hand tool used when pouring the concrete into the formwork, basically the vibrator poker works as a tool to flattened, take out the bubbles, spread the concrete mixture that has been poured into the formwork. The cost to rent a vibrator poker is in the package of rent a concrete vibrator generator.

m) Power Trowel



Photos 3.22 : One of power trowel machine used for floor hardener work.

Power trowel is designed to provide contractor with the features and performed they need. These equipment are used for long periods to the power trowel gives improved operator comfort and easy to control. This power trowel is designed for continuous used on large floors such as at floor area basement Hotel, Apartment and Restaurant Felda, Bangi. The main purposed used this equipment is for carried out the floor hardener work. This work is carried out after the concreting work is done. Floor hardener is one of type for floor finishes in architecture drawing. This type of floor finishes is suitable used at basement car park area.

n) Concrete Mixer

Photos 3.23 : This concrete mixer machine is used to batching concrete manually.

A concrete mixer or cement mixers come in both portable and towable types. These machines mix by the drum turning to create a mixing action to be used with cement mix and stores as large as half inch. A mortar mixer in this category use paddles to create a blending action. The concrete mixer machine is used diesel to generate the roll of the drum to batching the concrete. The cost for this machine is around RM350 per months for rental.

Sources: (http://www.constructioncomplete.com/masonry-equipment)

o) Concrete Mixture Truck

Photos 3.24 : Concrete Mixture Truck at Batching Plant Chin Hin Sdn Bhd.

Concrete mixing truck are made to transport and mix concrete up to the construction site. They can be changed with dry materials and water, with the mixing occurred during transport. The concrete mixing transport truck is maintains the materials liquid state through batching turning of the drum until delivery. The interior of the drum on a concrete mixing truck is fitted with a spiral blades. In one rotational direction, the concrete is pushed deeper into the drum. This is the direction of the drum is rotated or rolled while the concrete is being transported to the building site.

Concrete mixer generally do not travel for from their plant, as the concrete begins to set as soon as it is in the truck. Many contractors require that the concrete be in place within 90 minutes after loading. If the truck is breaks down or for some other reason the concrete hardens in the truck, workers may need to enter the barrel with jackhammers. The dynamite is still occasionally used to break up hardened concrete in barrel under certain circumstances.

Concrete mixing transport truck weight is around 9,070 kg to 13,600 kg and can carry roughly (18,000 kg) of concrete although many varying sizes of mixer truck are currently use. The most common truck capacity for small is 6m cubes and for the large is 8m cubes.

Photos 3.25 : Concrete Mixture Truck is delivery concrete to construction site Felda.

Sources: (http://en.wikipedia.org/wiki/concretemixingtruck)

3.6 RATES

3.6.1 Rates of Equipment & Machineries Used in Project Felda Bangi

No.	Type of machineries	Price (RM)	Quantity	Remarks
1.	Tower Crane	RM15,000 / months	2	
2.	Generator	RM3400 / months	4	
3.	Air Compressor	RM700 / months	1	
4.	Blower	(Package with Air Compressor)	1	
5.	Bar Bending Machine	RM600 / months	2	
6.	Bar Cutting Machine	RM600 / months	2	
7.	Pump Concrete Truck	RM950 / days	1	
8.	Mobile Crane	RM25,500 / months	1	
9.	Concrete Bucket	RM2,500 / unit	3	Own by Contractor SPAZ
10.	Excavator	RM10,500 / months	2	
11.	Concrete Vibrator	RM550 / months	6	
12.	Vibrator Poker	(Package with Concrete Vibrator)	6	
13.	Concrete Mixer	RM350 / months	1	
14.	Spot Light	RM650 / months	6	
15.	Passenger Hoist Lift	RM12,000 / months	2	
Total			**40**	

Table 3.1 : Rates of Equipment and Machineries Used in Project Felda Bangi

3.6.2 Day work Labour Rates

Item	Description	Rate / Day (RM)
1.	General labour (Male)	45.00
2.	General labour (Female)	40.00
3.	Mason	60.00
4.	Carpenter and Joiner	60.00
5.	Concretor	60.00
6.	Bricklayer	65.00
7.	Drainlayer	60.00
8.	Plant Operator	80.00
9.	Lorry Driver	80.00
10.	Steel Bar Bender & Fixer	60.00
11.	Steel and Iron Worker	60.00

Table 3.2 : Rates of Day work Labour for general and skilled worker

3.6.3 Rates of Material Used in Project Felda Bangi

No.	Type of material	Price (RM)	Quantity / Weight	Remarks
1.	Sand (Fine Aggregates)	RM850	33 tonne	
2.	Gravel (Coarse Aggregates)	RM1,015	33 tonne	
3.	Clay brick	RM0.45 / units		
4.	Lightweight brick	RM4.00 / units		
5.	Ordinary Portland Cement (OPC)	RM17.00 / beg	50kg	
6.	Mortar Cement	RM40 / beg	40kg	
7.	Sika Grout Cement	RM29 / beg	25kg	
8.	Adhesive Chemical Cement	RM40 / beg	40kg	
9.	Floor Hardener Cement	RM40 / beg	40kg	
10.	Skim Coat : Based Coat Finish Coat	 RM16 / beg RM19 / beg	 40kg 40kg	
11.	Concrete Ready Mix from Batching Plant	RM180 / m3	1m3	*for Grade G30 Type (Normal)
12.	Plywood	RM40 / pieces	1 pieces	Size 400mm x 800mm
13.	Wood	RM800 / bundles	1 bundle	
14.	Nails	RM36 / boxes	12kg	12kg / boxes
15.	Reinforcement Bar	RM2400	1000kg	

Table 3.3 : Rates of Material Used in Project Felda Bangi

3.6.2.1 MATERIAL USED IN PROJECT FELDA BANGI

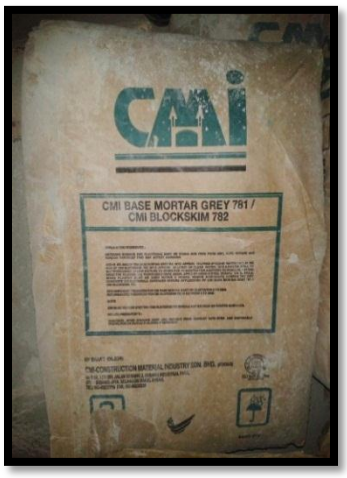
Photos 3.26 : Sand (fine aggregates)

Photos 3.27 : Gravel (coarse aggregates)

Photos 3.28 : Clay brick

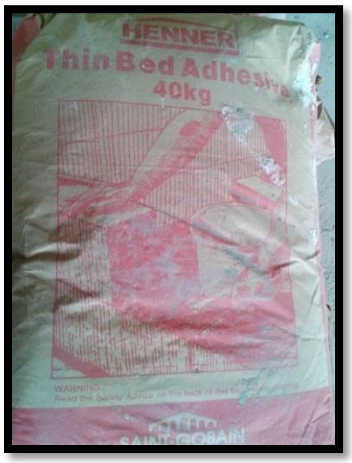
Photos 3.29 : Lightweight brick

Photos 3.30 : Ordinary Portland Cement (OPC)



Photos 3.31 : Mortar Cement

Photos 3.32 : Sika Grout Cement



Photos 3.33 : Adhesive Chemical Cement

Photos 3.34 : Floor Hardener Cement

Photos 3.35 : Skim Coat (Base & Finish)

Photos 3.36 : Concrete ready mix from batching plant

Photos 3.37 : Plywood

Photos 3.38 : Wood

Photos 3.39 : Nails

Photos 3.40 : Reinforcement Bar High Tensile Steel (T) and Mild Steel (R)

3.6.4 Rates of Reinforcement Bar

1 tonne = 1000kg = RM2,400

1 kg = RM2.40

i) Type of steel : **Mild Steel (R)**

No.	Size of diameter Bar	Weight (kg/m)	Weight / 12m	Price 1 bars (12m)	No. of Bars / bundles	Price / bundles
1.	R6	0.222	2.664	RM6.48	370	RM2397.60
2.	R10	0.616	7.392	RM17.76	135	RM2397.60

Table 3.4 : Rates of Reinforcement Bar Type of Mild Steel (R)

ii) Type of steel : **High Tensile Steel (T)**

No.	Size of diameter Bar	Weight (kg/m)	Weight / 12m	Price 1 bars (12m)	No. of Bars / bundles	Price / bundles
1.	T10	0.616	7.392	RM17.76	135	RM2397.60
2.	T12	0.888	10.656	RM25.68	93	RM2388.24
3.	T16	1.579	18.948	RM45.36	53	RM2358.72
4.	T20	2.466	29.592	RM71.04	33	RM2344.32
5.	T25	3.854	46.248	RM110.88	21	RM2328.48
6.	T32	6.313	75.756	RM181.92	13	RM2364.96

Table 3.5 : Rates of Reinforcement Bar Type of High Tensile Steel (T)

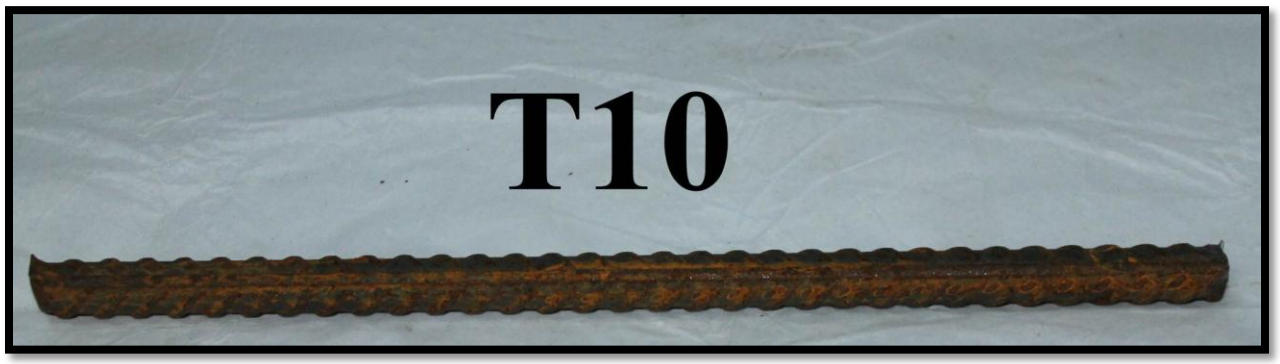
3.6.3.1 REINFORCEMENT BAR

a) Reinforcement Bar for Mild Steel (R)

Photos 3.41 : Mild Steel Reinforcement Bar 6 Ø

Photos 3.42 : Mild Steel Reinforcement Bar 10 Ø

b) Reinforcement Bar for High Tensile Steel (T)



Photos 3.43 : High Tensile Steel Reinforcement Bar 10 Ø

Photos 3.44 : High Tensile Steel Reinforcement Bar 12 Ø

Photos 3.45 : High Tensile Steel Reinforcement Bar 16 Ø

Photos 3.46 : High Tensile Steel Reinforcement Bar 20 Ø

Photos 3.47 : High Tensile Steel Reinforcement Bar 25 Ø

Photos 3.48 : High Tensile Steel Reinforcement Bar 32 Ø

3.7 DESIGNS OF FORMWORK

3.7.1 Definition of formwork

The box can be defined as a form of temporary structure used to support the wet concrete so that it molds to the shape and size required and the concrete support that it can support its own burden. In certain circumstances, the box shape is used as a permanent structure whether in whole or in part. The work also includes the design box works while others such as scaffolding and other supporters.

3.7.2 Requirement of concrete system

These components when installed must be in accordance with the following requirements: -

a) The box design must be completely rigid to avoid any flexing during use.

b) It must have enough strength to carry heavy workload and especially wet concrete during the vibrating of concrete work done.

c) Forms of connections box must close completely to prevent loss of concrete materials are fine.

d) Work on installing and disassembling the box must be in proper form and easy and panel or units of formwork must have an easier to conduct the measurements.

e) If it is made on the construction site, the work must be made in the ability of those who have been assigned.

*When considering factors that include the design of a system, the designer must ensure the existence of all of the above requirements, taking into account all the factors and all the security related contracts.

Sources: (Testing of Material and Structural, Mahyuddin Ramli, 1992)

3.7.3 Type of formwork

The design of formwork made from either wood or steel. The mold of wood used must be in good condition and has been properly dried, the quality and strength that can ensure the robustness of full time concrete is poured, compacted, and current of vibrating concrete is set.

Whereas, if the box shape steel used must be ensured that the form size is correct, free from rust and bolts as well as sufficient for binding. Although the type of mold steel need more support, but it is easier because:

- The compression and vibration of the concrete can be done better and perfect.
- Free from wood vein as found in a formwork of wood.
- Able fully tightened with bolts and nuts.
- Able to be used repeatedly.

To ensure the quality of concrete strength during the casting mold, the mold should be: -

a) Tightened enough to hold the liquid outflow in concrete.

b) Exactly according to the alignment and free from defects at the surface.

c) The connector between the sheets should be with tongue and groove connection mode with tightening band embedded into the groove between two adjacent pieces and cover the connection.

d) The details of construction shall be arranged to facilitate removal and preferably wedge of formwork and bolts used to replace with nails.

e) The formwork for beam and form for such parts shall be designed and constructed so that parts of the sides can be removed without disruption to other parts.

f) Fully of cleaned and free from sawdust, dust mud or other materials that are not required by spraying with clean water.

g) The surface in the form box painted with oil so easily removed.

After the concrete is poured into the box of wood or steel, it should be left for several days to allow the concrete to be strong and robust. The opening of formwork without any compaction or vibration may damage the concrete. This period varies according to the structure, where the minimum of period allowed to the opening of formwork is shown in the table below.

No.	Part of formwork	Duration
1	Edge, beams, columns and walls	2^{nd} – 6^{th} days
2	Ground of beams and slabs (with no loads)	7^{th} – 14^{th} days
3	Side of board (with loads)	(Not less than) 7^{th} days
4	Bottom of board (with loads)	28^{th} days

Table 3.6 : Minimum period to opening the formwork.

3.7.4 Preserving Concrete

Concrete curing is the open or closed of concrete after the concreting work is done. The purpose of curing is to avoid direct sunlight. Concrete curing has two ways normally used, such as: -

a) Water Use

Water may be continuous throughout that part of the work is always moist for long time in need of preservation or instruction given by the Project Superintendent Officer.

b) Use Sacks

To enable the concrete surface is always moist, all the surface is covered with a constantly moist sacks (flush with water) or other means approved by the Superintending Officer Project, for the preservation of not less than 10 days.

Sources: (Testing of Material and Structural, Mahyuddin Ramli, 1992)

3.8 CASE STUDY : REINFORCEMENT BAR WORK

3.8.1 INTRODUCTION

In reinforced concrete work, reinforcement bars is a long round shaped and used as reinforcement. Concrete is usually not able to bear the burden of stress and pressure very effectively. Structures such as pillars, floors, beams and other parts that are often experienced tensile stresses. Thus, ordinary concrete is not suitable, and then it is overcome by the use of reinforced concrete with steel reinforcement in concrete lists.

3.8.2 TYPE OF REINFORCEMENT BAR

- Mild steel (hot rolled mild steel)
- Flowering bar (deformed bars)
- Braid reinforcement (BRC steel fabric)
- High tensile steel wire (high tensile wire)

3.8.3 STORAGE OF REINFORCEMENT BAR

When steel reinforcement up to the site, it should be tied up and sorted according to size and type. Condition of reinforcement bars should be checked and observed corrosion rates and the bending. If rates brushed excessively severe, it must be replaced because it will damage the structure of the building. Reinforcement shall be kept clean and away from dirty oil, dust, soil, steel and other materials.

3.8.4 THE BENDING OF REINFORCEMENT BAR

Structural drawing plays an important role in the work of bending reinforcement. The bending of reinforcement bars work done in accordance therewith. The 'bender' or 'hooker' useful in bending reinforcement bars less than 25mm in size. Main reinforcement bars shall be molded hook at the end. Then it is attached to the mold. For the installation it is tied with fine wire diameter of 1.63mm.

Sources: (Testing of Materials and Structures, Mahyuddin Ramli, 1992)

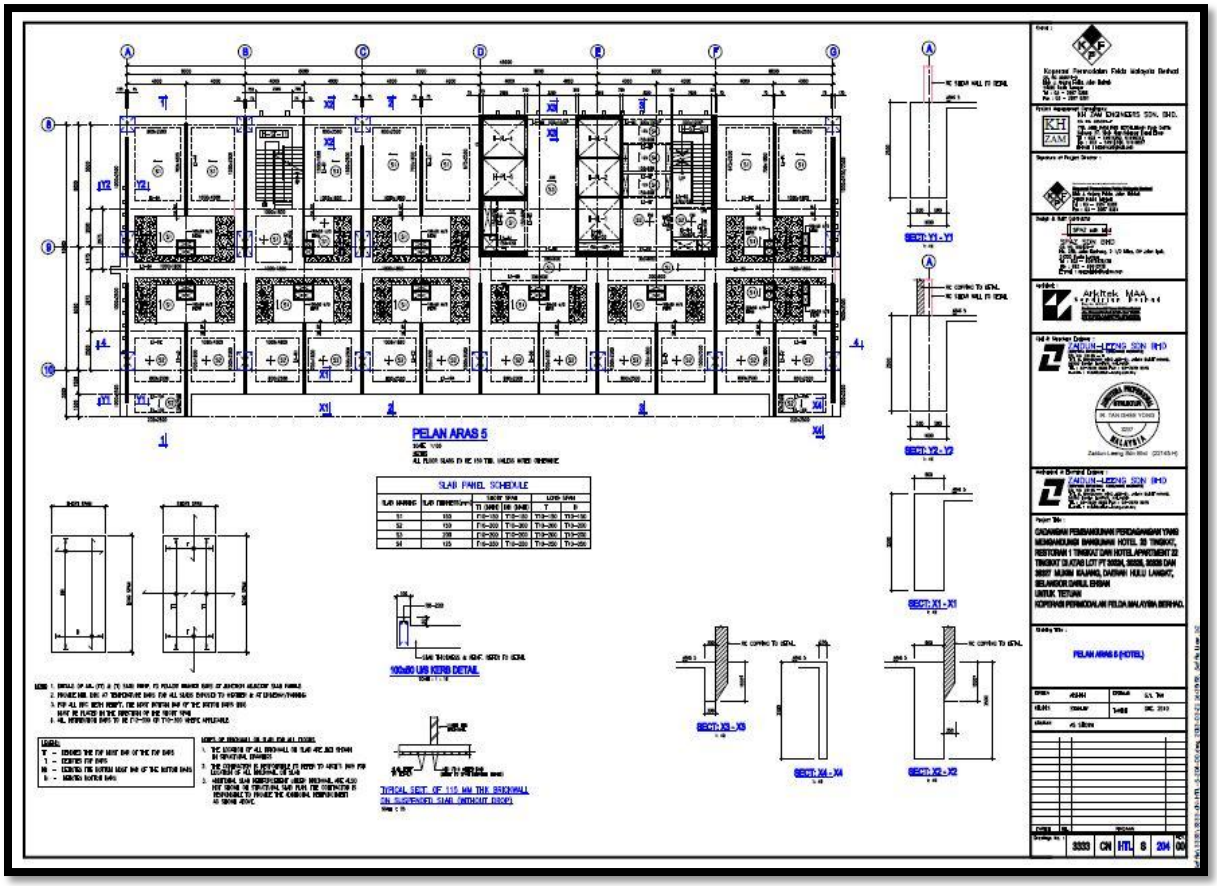
3.8.5 INSTALLATION OF REINFORCEMENT BAR WORK

In my practical training period, the progress of project site Felda Bangi is under the superstructure work. The superstructure work is such as to completing the building element work from basement floor until to finishes. In my observation, I just opportunity to study the important of building element such as installation at floor area, beam, column and staircase. In this topic, I want to explain the installation of reinforcement bar work in certain important part of building element.

The type of typical installation reinforcement bar work building element at site is such as:

i) FLOOR
ii) BEAM
iii) COLUMN
iv) STAIRCASE

i) FLOOR



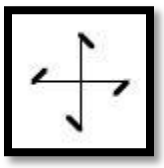
Photos 3.49 : One of type slab structural drawing used in this project.

Installation of steel bars for floor has 4 levels of BB, B, T and TT. BB is meant is 'Most Bottom Bar' and 'B' which also meant is 'Bottom Bar'. The 'TT' we mean 'Top Most Bar' and 'T' is the 'Top Bar'.

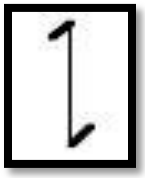
'Top Most Bar' (TT) takes an important role for the steel bars 'TT' is ranked among the top steel bar T, B and BB. In addition, the 'Most Bottom Bar' (BB) is also an important bar and should be pursued first. Steel bars 'BB' is the lowest level. 'BB' also pre-installed in the formwork, followed by the installation of steel bars B, T and TT.

The ' ' symbol in the structural slab panel drawing is a symbol of the installation short bars. 'Short Bar' is meant as 'BB' and 'TT'. The installation of Short Bar is in accordance with the ' ' symbol which means the installed steel bars is on 'vertical'. After that, the installation of Long Span was installed in' horizontal 'and crossed. Steel bars 'Long Span' is like 'B and T'.

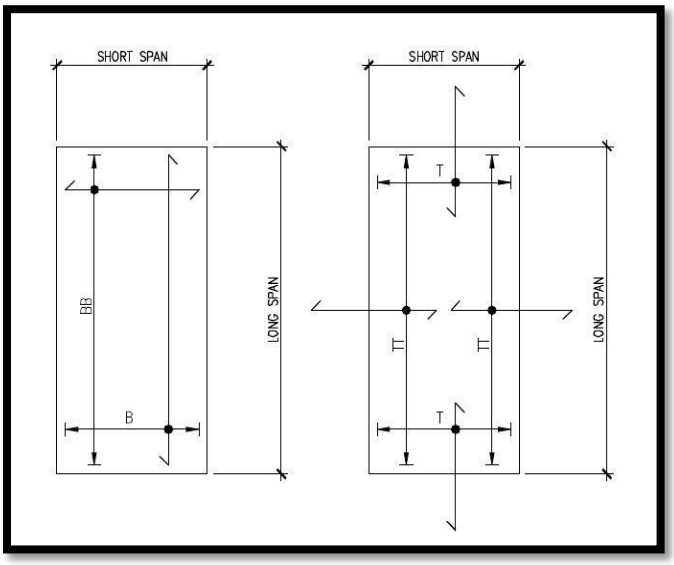
The symbol of is shown that the area of the same size. Therefore, the installation of the short bars can be initiated in vertical or horizontal mounted. The 'S1' in the circle shown in the drawings of concrete structures is to be poured in the formwork. The each type of concrete has been specified in the table floor panels as shown in **Photos** 3.54.



Photos 3.50 : This symbol shows that the installation of short or long iron steel can be mounted in vertical or horizontal.



Photos 3.51 : This symbol indicates that short bar fitting installed in advance and installed vertical also ended with a short bar.



Photos 3.52 : Examples method of rebar installation depending on the area of the same size or not.

LEGEND:

TT – DENOTES THE TOP MOST BAR OF THE TOP BARS
T – DENOTES TOP BARS
BB – DENOTES THE BOTTOM MOST BAR OF THE BOTTOM BARS
B – DENOTES BOTTOM BARS

Photos 3.53 : Legend of reinforcement bar short form for TT,T,BB and B.

PELAN ARAS 5

SCALE 1:100

NOTES

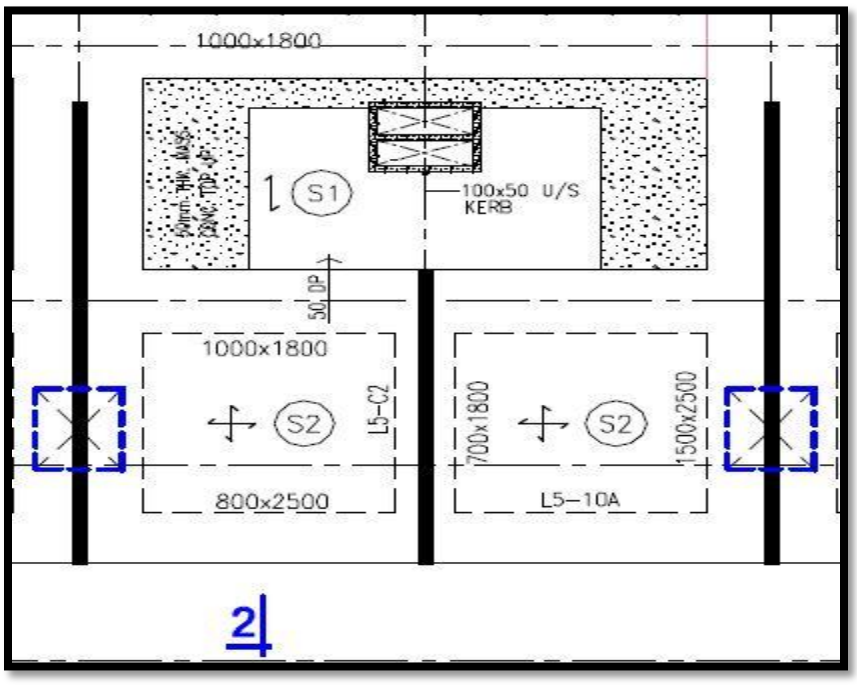
ALL FLOOR SLABS TO BE 150 THK. UNLESS NOTED OTHERWISE

SLAB PANEL SCHEDULE

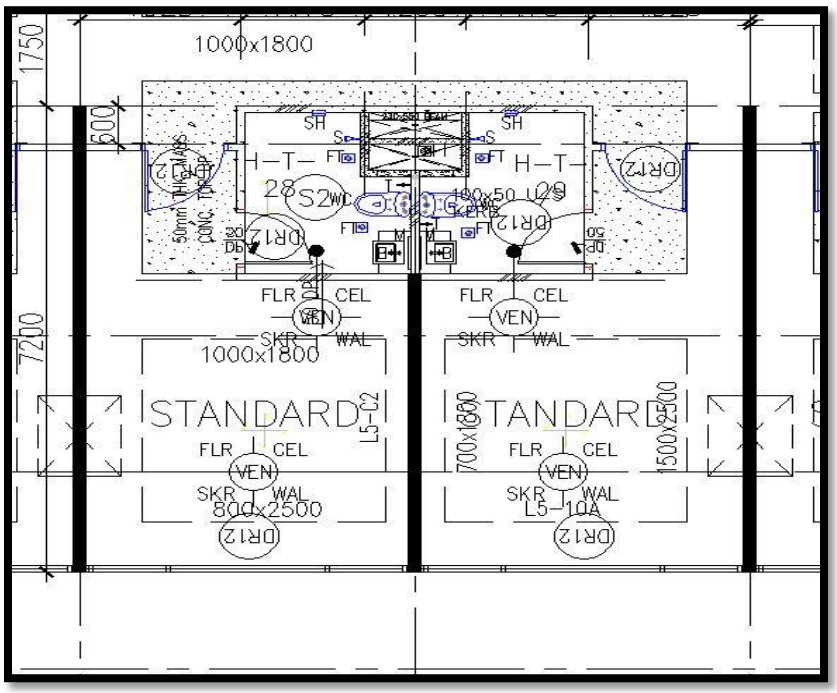
SLAB MARKING	SLAB THIKNESS(mm)	SHORT SPAN		LONG SPAN	
		TT (MAIN)	BB (MAIN)	T	B
S1	150	T10–150	T10–150	T10–150	T10–150
S2	150	T10–200	T10–200	T10–200	T10–200
S3	200	T10–200	T10–200	T10–200	T10–200
S4	125	T10–250	T10–250	T10–250	T10–250

Photos 3.54 : Slab Panel Schedule used in Level 5 Hotel.

The example structural and architect drawing. (Level 5 Standard Room Hotel) :

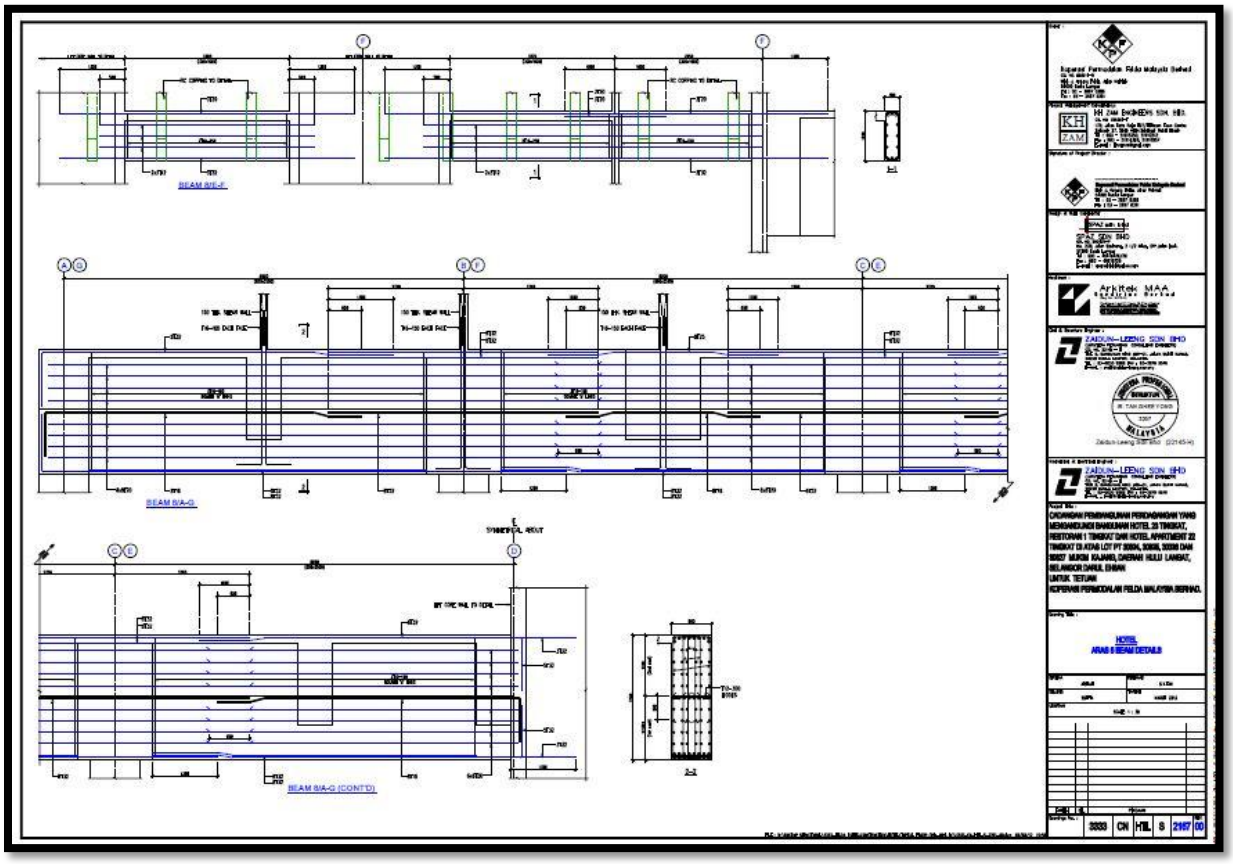


Photos 3.55 : Standard Room Hotel in structural drawing.



Photos 3.56 : Standard Room Hotel in architecture drawing.

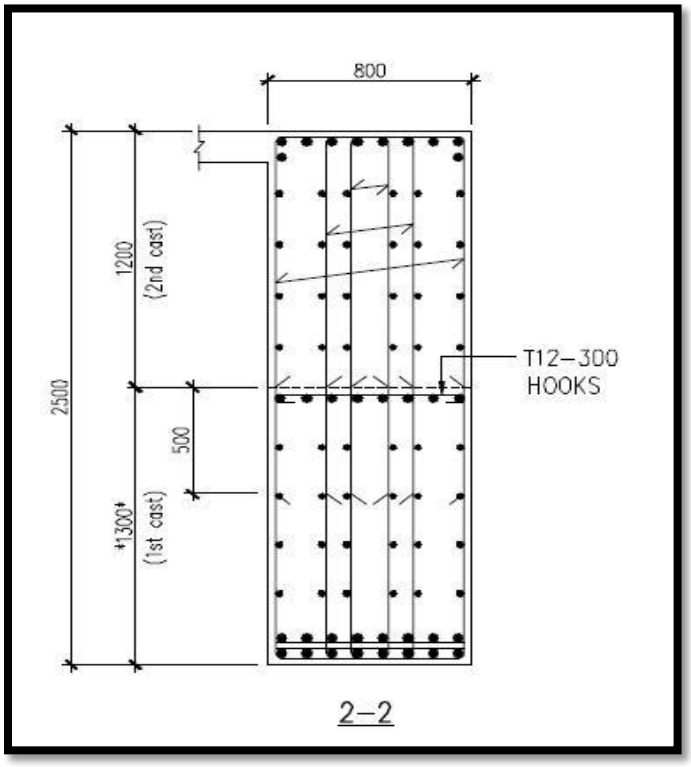
ii) BEAM



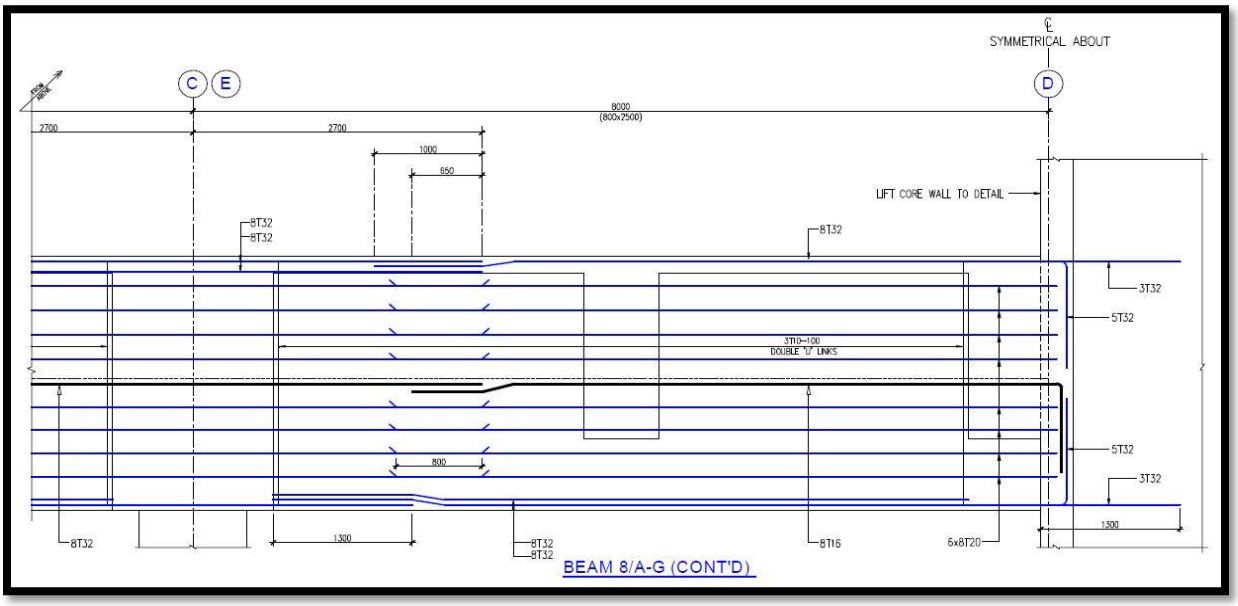
Photos 3.57 : One of type transfer beam detail structural drawing used in this project.

There are two types of beams used in this construction project. The types of beam used is Transfer Beam and Standard Beam. The main purpose is to bear the load transfer beam main 22-storey hotel tower. Typical beam used is from the basement up to level 3. Starting from level 5 until to level 22, which is used a smaller beam because this beam is only in used for shear walls. Similarly, the apartment is used from the basement level until to level 23.

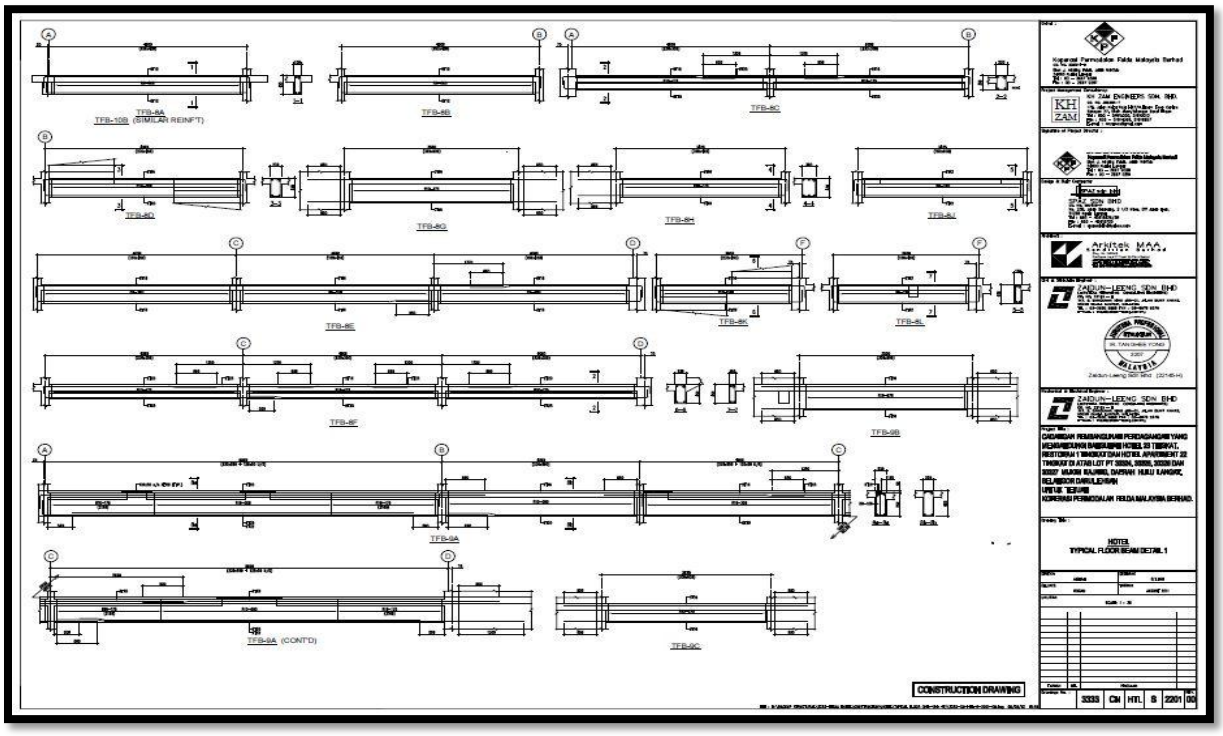
The standard size used to transfer beam at Level 4 Hotel is from 2500mm x 800mm. The size of the steel reinforcement installed in horizontal is T20 and T32, and the link used is T12.



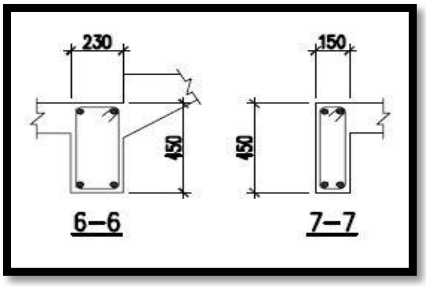
Photos 3.58 : Cross-sectional Transfer Beam.



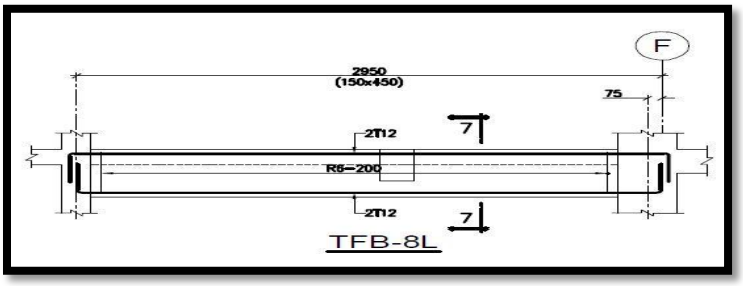
Photos 3.59 : The main bar is installed horizontally in Transfer Beam.



Photos 3.60 : One of type typical floor beam detail in structural drawing.

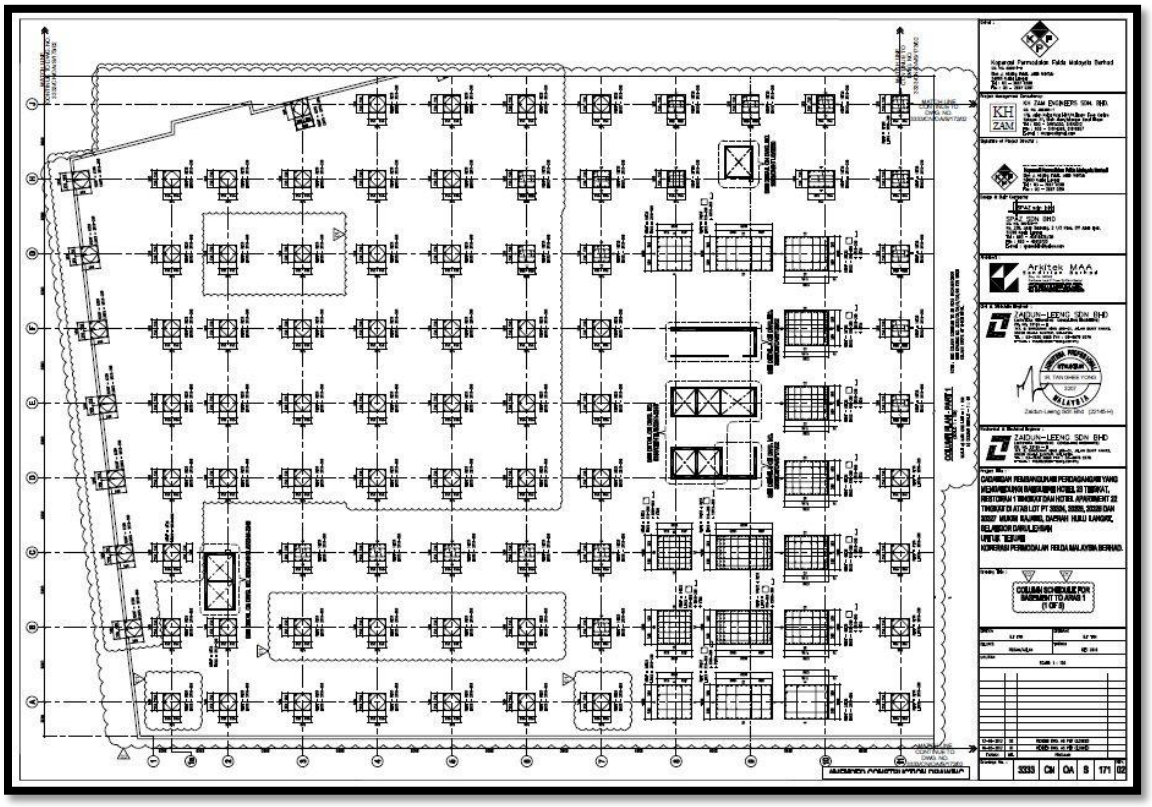


Photos 3.61 : Cross-sectional of typical floor beam.



Photos 3.62 : Side elevation of typical floor beam.

iii) COLUMN



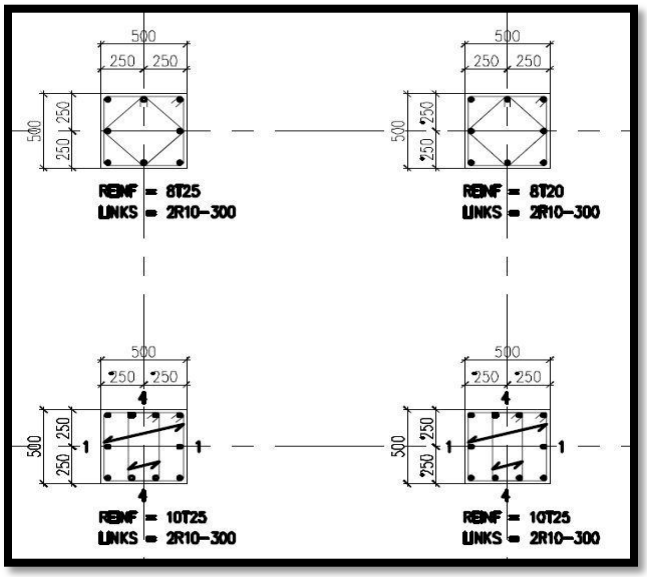
Photos 3.63 : One of type column structural drawing used in this project at Hotel.

Column shed load of work received up to the foundation in the ground. The basic types used are bored pile. There are 2 types of bored pile installed such as Single Bored Pile and Grouping Bored Pile. When bored piled were buried in the ground up to 12m deep, pile cap will be constructed at the top of the bored pile. The excess reinforcement bar out of the pile cap is called the 'starter bars'. Length in each starter bar size is 40D. There is also a starter bar called RC Stump. RC Stump aim is for services that do not interfere with the installation of Pile Cap and Ground Floor Slab.

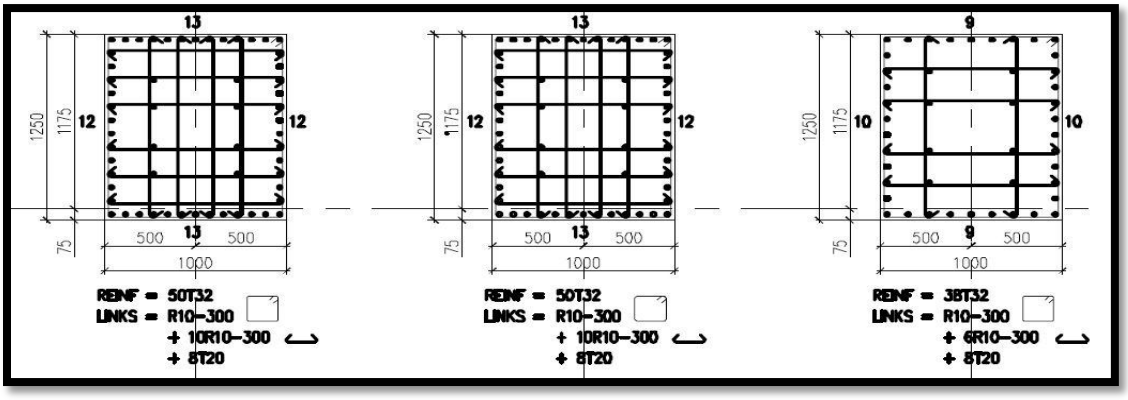
The area around the hotel, the single bored pile is to post only accept loads from the basement level up to level 4. Size for each column is from 500mm x 500mm. Size of reinforcement bar used is T20 and T25. Links used in turn is R10. Reinforcement bars are installed in vertical.

Grouping Bored Pile is used for heavily loaded. Grouping bored pile used in the surrounding of both tower area 22-storey hotel and 23-storey Hotel Apartment. Grouping bored pile other purpose is also to install a larger column size of 1250mm x 1000mm and 1600mm x 1000mm.

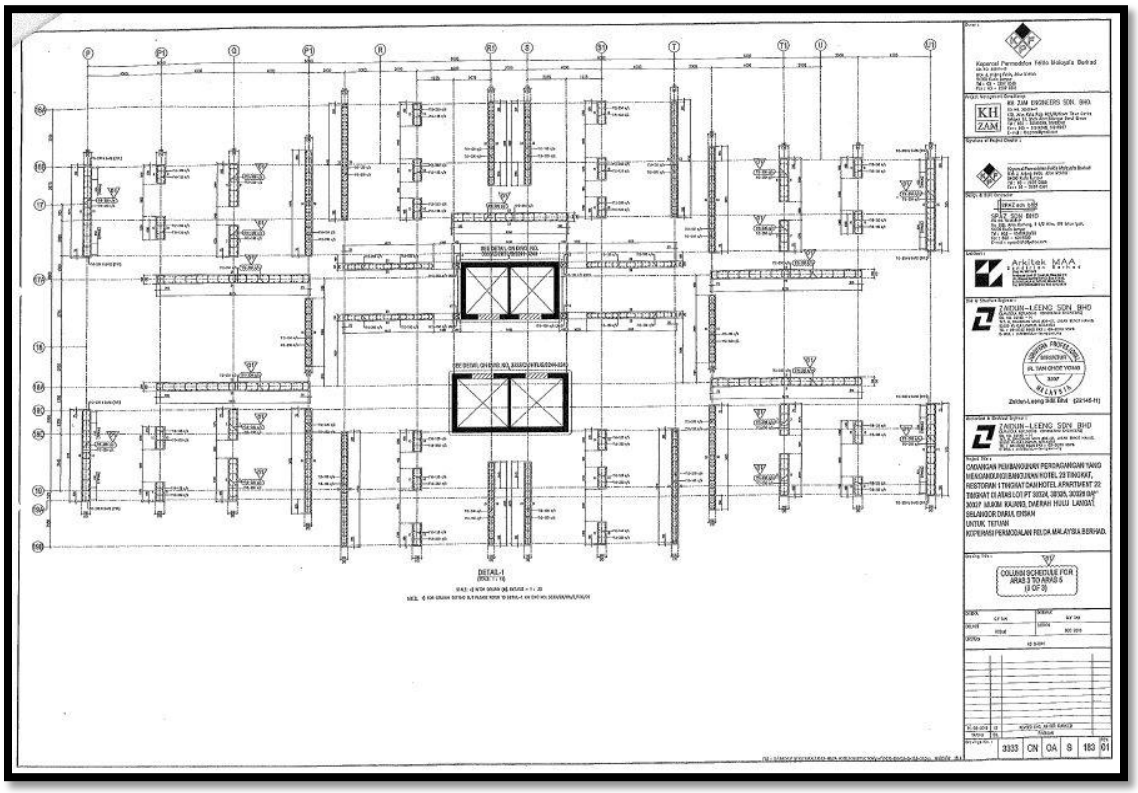
Shear Wall used from the basement level up to level 23 Hotel Apartment serves as a pillar. The thickness of the shear wall size is around 150mm to 200mm. Reinforcement bar size used is T16, T12 and T10. Shear wall mounted horizontally, vertically and produce an intersection. In normally, shear wall reinforcement bars is installed in advance by the skilled of masonry and using a crane to lift it.



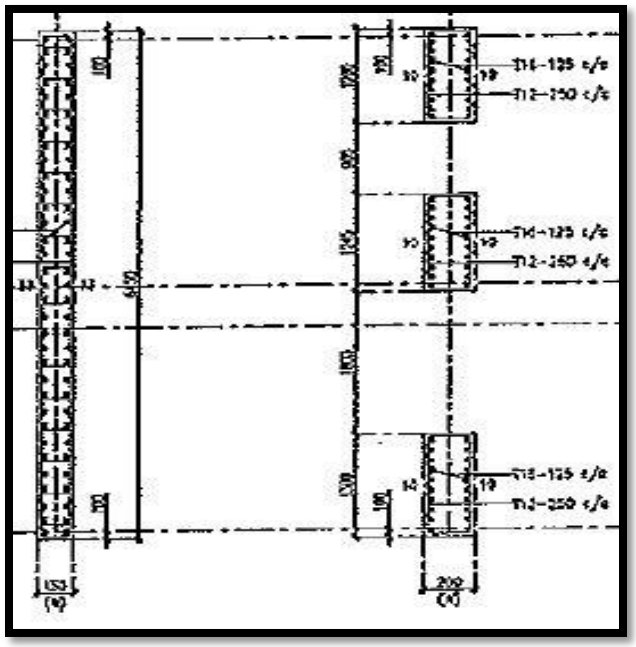
Photos 3.64 : Type of small column used only to support from Level Basement to Level 4 at Hotel.



Photos 3.65 : Type of large column used to support tower of Hotel.

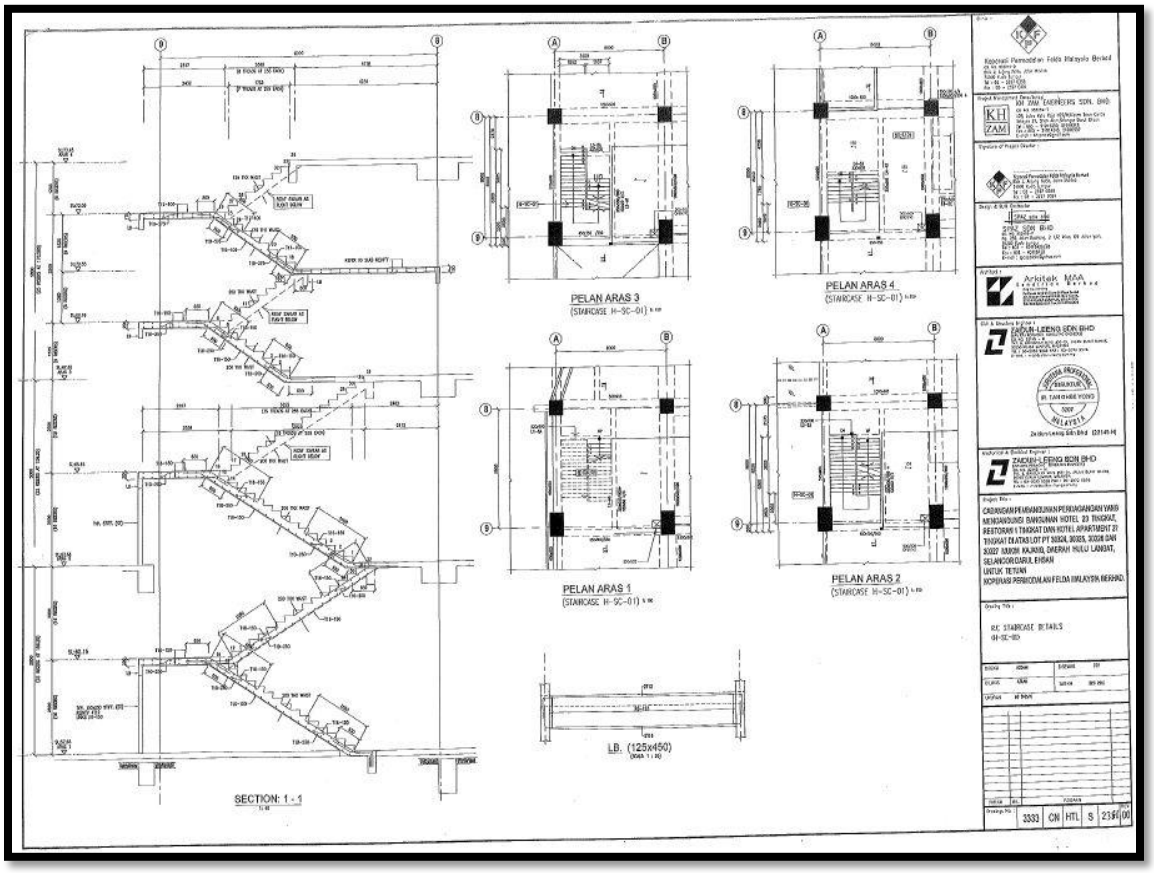


Photos 3.66 : One of type shear wall structural drawing used in this project at Apartment.



Photos 3.67 : Example the dimension thickness of shear wall.

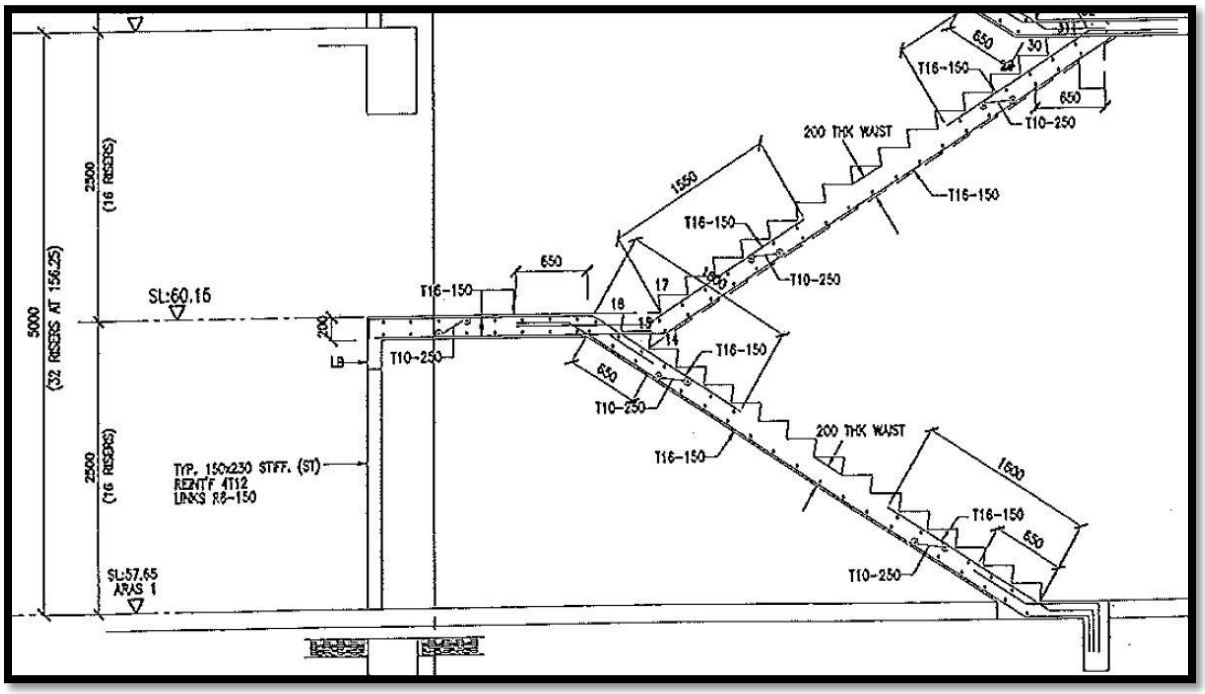
iv) STAIRCASE



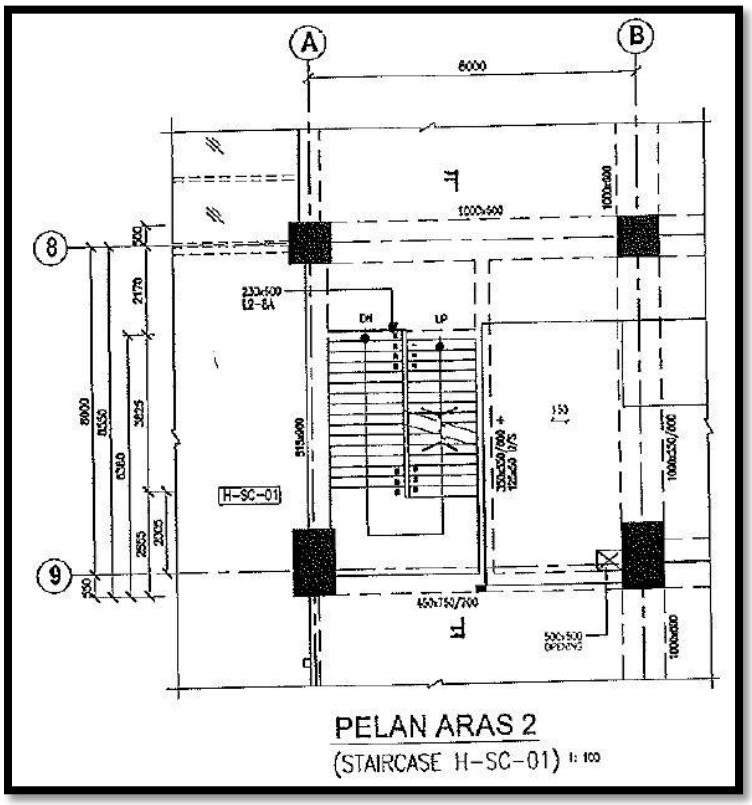
Photos 3.68 : One of type staircase structural drawing used in this project.

In usually, the floor will be built next level prior to construction work carried stairs. During the installation of steel reinforcement in each upper floor, there is reinforcement bar that out in every space in the building stairs.

Protruding steel reinforcement is called 'starter bars'. Long habit starter bar is 40D. 'D' which means the diameter of the steel reinforcement bars used at starter bar. Examples diameter steel used is T12. Then the 40D will be multiplied by 12. So, the total length of starter bar is around 480mm.



Photos 3.69 : Staircase section drawing



Photos 3.70 : Staircase from plan drawing.

2

CASE STUDY

CHAPTER 3.9 : CONCRETE WORK

Content

3.9 CASE STUDY : CONCRETING WORK

3.9.1 PROCESS OF DELIVERY CONCRETE

3.9.1.1 Process of Delivery Concrete To Construction Site

Firstly, supplier of concrete submit the design for trial mix for variation grade to consultant for approval. After consultant approve, supplier will carry out trial mix at batching plant. Compression test on concrete cube block will be carried out at the batching plant. Concrete cubes were soaked for 7 days, 14 days and 28 days in the pool water to be tested. After that, the cube would weigh in advance and will be tested concrete cube compression using concrete compression test machine. All information will be recorded. Then, cube test result will submit to consultant for approval. Finally, if all the information is based on specification that have been set, then concrete mix design will approved by consultant engineer. Then, concrete mix design will be supplied to construction site.

a) Parties involve in process at Batching Plant.

1) Consultant Engineer.

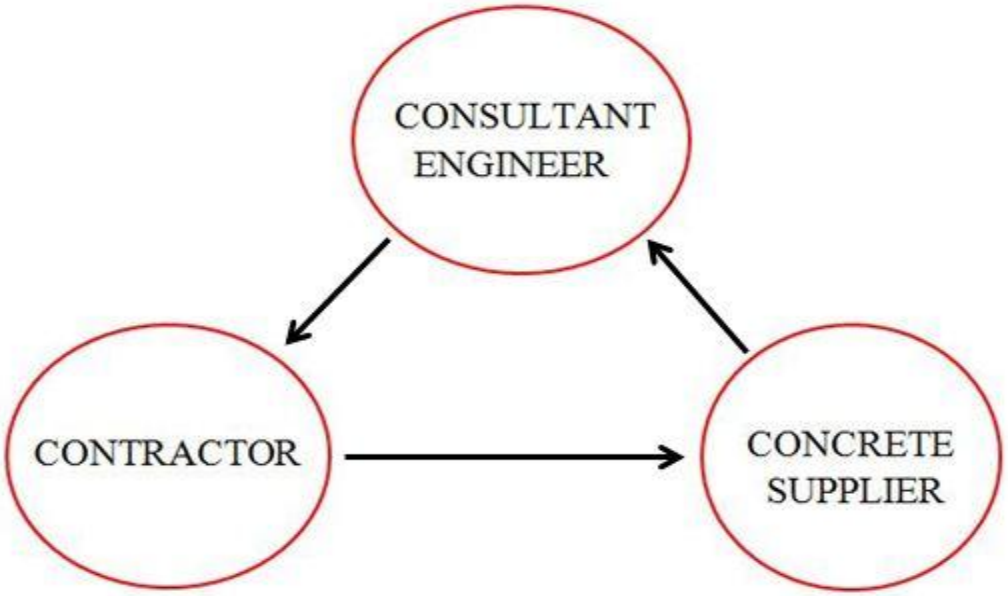
Apart from reinforcing steel structure design based on architectural drawings, structural engineers also choose the appropriate grade of concrete building elements schedule has been prepared as in **Tables** 3.7.

2) Contractor.

Among the duties of contractor is like concrete orders to suppliers. In addition, a representative of the contractor and the consultant shall go to the batching plant to conduct monitoring during concrete cube test carried out.

3) Concrete Supplier.

Among the concrete supplier duties is to prepare concrete mix designs were based on client order. In addition, concrete supplier is also sent to the construction site with using concrete truck.



Figures 3.2 : Process to order the ready mix concrete at Batching Plant.

b) List of Batching Plant Concrete Suppliers used in this project.

i) Chin Hin Concrete Factory , Teras Jernang, Bangi, Selangor.

ii) Unique Mix Sdn Bhd Kajang, Selangor.

iii) Tru-Mix Concrete Sdn Bhd, Bandar Bukit Jalil, Selangor.

iv) PA Konkrit Sdn Bhd, Nilai, Negeri Sembilan.

v) R&K Ready Mix Concrete Sdn Bhd, Bandar Sg Long, Kajang, Selangor.

c) Concrete Grade To be Used in KPF Hotel and Apartment Project

No.	Element	Grade
1.	Pile Caps & Basement Beams	G40
2.	Basement Slab (Suspended)	G40
3.	Basement Slab (Non-Suspended)	G35
4.	Transfer Floor Beam & Slab	G40
5.	All other Floor/Beam	G35
6.	Lift Wall	G35
7.	Shear Wall	G35
8.	Column	G35
9.	Retaining Wall	G40
10.	Staircase	G40
11.	Swimming Pool / Water Retaining Structure	G40
12.	Lean Concrete	G20

Table 3.7 : Table of concrete grade used in this project.

3.9.2 CONCRETE PREPARATION PROCESS

3.9.2.1 Concrete Preparation Process at Batching Plant

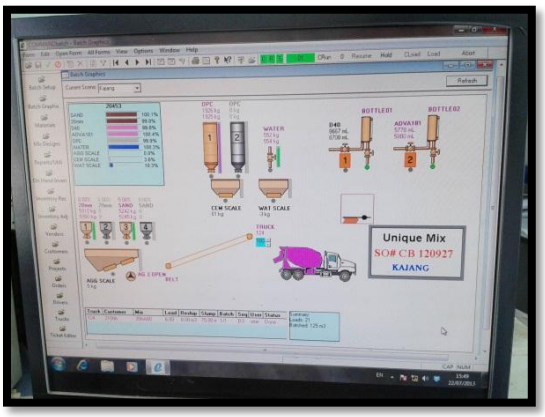
From my observation, the supplier concrete for this project is such as from CHIN HIN concrete factory Teras Jernang, Bangi, Selangor, UNI-MIX Concrete from Kajang, TRU-MIX concrete from Bandar Bukit Jalil, PA Koknkrit Sdn Bhd from Nilai, Negeri Sembilan and R&K Readymix Concrete Sdn Bhd from Bandar Sg. Long, Kajang, Selangor. The type of grade concrete normally used in this project is such as G35 and G40. For grade G20 is for Lean concrete. At the time of practical training is carried out, I had the opportunity to go to a concrete plant project site. My purpose to go into this concrete mixing plant is to know how the method of concrete mixture in progress. Among the concrete mix plant project site is CHIN HIN concrete factory. The quantities of material used for mixture concrete must be measured using computerized system. This computerized system is located in the panel room. The operator handle this computerized system is En. Husin.

The process to provide the mixture of concrete is as follows:

1) Setting the batching concrete from computerized system
2) Measured the quantity of water
3) Measured the quantity of an aggregates
4) Measured the quantity of sand
5) Measured the quantity of cement
6) Measured the quantity of liquid chemical fluids (ADVA 181 & D40)
7) Mixture concrete in the truck
8) Testing work

PROCESS OF CONCRETE AT BATHCING PLANT

i) Setting the batching concrete from computerized system.



Photos 3.71 : Computerized System

The first material to be measured is water. The quantity of water will be measured using computerized system. The quantity of water is measured by grade. For grade G20, the water is used 185 liters, the grade G30 was used 185 liters while the Grade G40 is used 175 liters.

ii) Measured the quantity of water.

Photos 3.72 : Quantity of water

After measuring the quantity of water is done, the water will be put into concrete truck mixture. The volume of water is to be added is depends on the grade concrete to be required.

iii) Measured the quantity of an aggregates.

Photos 3.73 : Coarse Aggregates (Gravel)

After that, the second material to be measured is aggregates. The quantity of aggregates is also must measure by grade. For grade G20, the aggregates is used 965kg/m3 and the grade G30 was used 976kg/m3 while the grade G40 used 1000kg/m3. After the measured is done, the aggregates must be put into truck mixture.

iv) Measured the quantity of sand.

Photos 3.74 : Fine Aggregates (Sand)

Next, the third material used for batching concrete is sand. Sand was measured first and will be put into the mixer truck. Quantity of sand is also measured by grade. For grade 20, the sand is used 927kg/m3 and the grade G35 was used 854kg/m3 while for grade G40 used 818kg/m3.

v) Measured the quantity of cement

Photos 3.75 : The two barrels of this tower intended to keep the material of cement

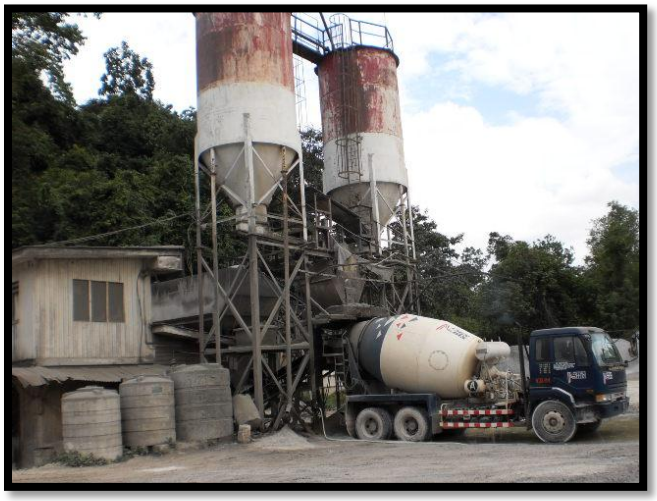
For the next material is cement. The type of cement choosing for this project is Ordinary Portland Cement (OPC). The content of cement is also measured first. After the measured of quantity cement used is complete, this material will be put into truck. For grade G20, the cement is used 270kg/m3 and the grade G35 was used 330kg/m3 while for grade G40 is used 380kg/m3.

vi) Measured the quantity of liquid chemical fluids (ADVA 181 & D40)

Photos 3.76 : Chemical Fluids (ADVA 181 & D40)

After that the last material used is chemical fluids. The function of this material is to retarder the concrete in concrete mixture during the concrete is sent to construction site. This type of chemical fluids is divided into two such as ADVA 181 and D40. Chemical fluid ADVA 181 is yellow color and suitable used to around grade 35 and below. Chemical fluid D40 is black color and suitable for grades 40 and above.

vii) Mixture concrete in the truck



Photos 3.77 : The mixture truck is ready to roll

When the mixing of all material is finished and will be completed, the mixer truck must be roll around 10 minutes to give the best batching, before the concrete is used.

viii) Testing work

Before sending the concrete to the construction site, the testing work of concrete shall be carried out. Among the type of test concrete is such as Slump test and Cube test. The purposed of testing is to make the sure the concrete is used for safety.

3.9.3 CONCRETE TEST

From my observation, before the concrete work done, some concrete tests will be done at the construction site. The testing will be done is such as the Slump Test and Cubes Test. The purpose of this test is done to test the strength and workability of concrete. If the test does not meet the required conditions, then the concrete from a supplier batching plant concrete cannot be used.

The concrete tests are played a role important as it will affect the structure of the building to be built. Therefore, the tests such as slump test and cube test should be done on new concrete. These tests can also determine whether the mixture is suitable for use or in order to achieve the required compressive strength in the construction work.

3.9.3.1 The type of concrete tests:

a) Slump Test

b) Cubes Test

a) SLUMP TEST

The test of concrete commonly performed to measure the workability at the construction site is such as slump test. The purpose of testing is to ensure the kind of slump that decline occurred. Among the types of declines occur as a true slump, shear slump and collapse slump. Every test of concrete slump, the reduction of concrete will be recorded.

Equipment and Materials:

i. 300mm tall of Frustum Cone. The diameter of top surface is 100mm and bottom diameter is 200mm. There are two handles on the sides.

ii. The steel rods diameter is 16mm and 600mm length.

iii. Ruler or Measure Tape.

iv. Base Plate from galvanized steel 607mm x 404mm x 2mm.

v. Trowel.

vi. Wheelbarrow.

vii. Aluminum Scoop.

Photos 3.78 : Frustum Cone.

Photos 3.79 : Stuffing made of steel rods.

Photos 3.80 : Measuring Tape.

Photos 3.81 : Galvanized Steel Plate.

Photos 3.82 : Trowel.

Photos 3.83 : Wheelbarrow.

Photos 3.84 : Aluminum Scoop.

Procedure:

i. Take a sample of concrete from the first concrete mixer truck. Take a sample of concrete using a wheelbarrow.

ii. Placed the frustum cone on the base plate.

iii. The sample of concrete mix is filled into the frustum cone and is divided into four layers.

iv. Each layer should be compacted with a rod stuffing 25 times.

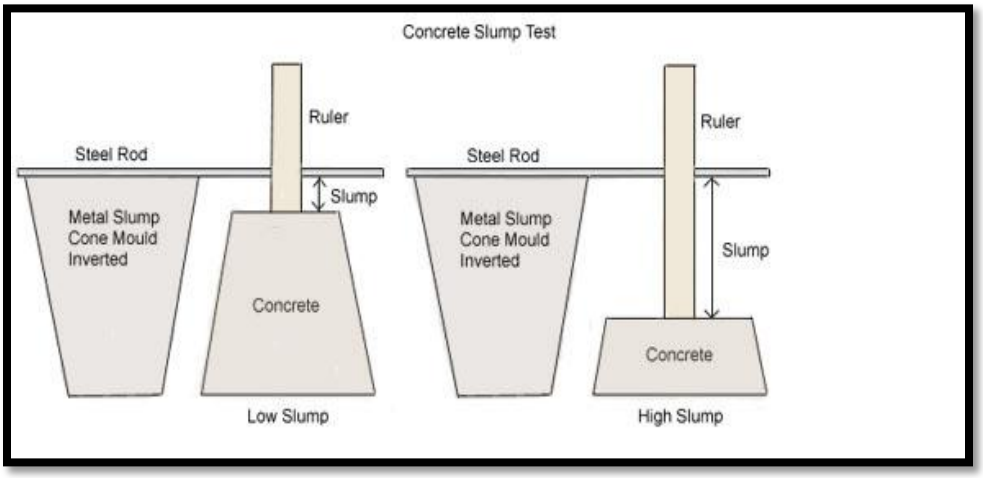
v. Surface at the top and the last, will be flattened by using trowel.

iv. Next, a vertical pull frustum slowly and observe in their concrete.

v. Place upside down next to the ruins frustum concrete.

vi. Measure and record the decline and that decline occurring types.

vii. The decline can be measured as shown in the picture below.



Photos 3.85 : Concrete slump can be measured as shown in this photos.

Photos 3.86 : Procedure Step 1.

Photos 3.87 : Procedure Step 2.

Photos 3.88 : Procedure Step 3,4 and 5.

Photos 3.89 : Procedure Step 6.

Photos 3.90 : Procedure Step 7.

Photos 3.91 : Procedure Step 8.

b) CUBES TEST

Tests are done to test the strength of concrete is compressive strength test and tensile strength test. However, the compressive strength test is preferred. Compressive strength tests were conducted in a test cube.

Equipment and Materials:

i. Mold concrete cubes measuring 150mm or 100mm. It is used for the size of the aggregate does not exceed 40mm and 25mm. Cube molds for the test shall be made of steel or cast iron with a smooth surface. Each mold must have a base of steel plate to support and prevent leakage.
ii. The steel rod diameter is 16mm and 600mm length.
iii. Trowel.
iv. Scoop.
v. Wheelbarrow.
vi. Weight scales for concrete cubes.
vii. Compression testing machine.
(This weight scales and machine is on the batching plant. Thus, the work of the concrete compression test cubes will be conducted in the batching plant).

Photos 3.92 : Mold concrete cubes.

Photos 3.93 : Steel Rod for Cube Test.

Photos 3.94 : Weight scales for concrete cubes.

Photos 3.95 : Compression Testing Machine.

Procedure:

i. Take the excess samples of concrete from the same concrete mixer truck used for slump test.

ii. Mold made of steel shall be in accordance with standard size cubes adjust the 150mm x 150mm.

iii. Cramped site on mold plate with bolts and nuts.

iv. Mold and base plate shall be cleaned and painted with oil on all parts of the mold to prevent sticking on the side of a concrete cube.

v. Fill the concrete mix from wheelbarrow into the mold concrete and is divided into three layers.

vi. Each layer must be compacted 25 times with rod stuffing.

vii. This process should be carried out systematically and impact spread uniformly across the surface of the concrete.

viii. Concrete surfaces should be leveled so that the same level with the top of the mold.

ix. When the process of making concrete cube was finished, the cube should be wrapped with plastic for 24 hours before the mold is removed. Label the concrete cubes.

x. Once the cube mold is removed, the concrete cubes shall be soaked in water to create concrete hydration process or known as a curing process.

xi. Cubes made will be sent to batching plant, depending on the concrete batching plant used to test at that time. In this time, the concrete used for the test are from Chin Hin Concrete Sdn Bhd.

xii. Compressive strength testing of concrete cubes shall be carried out studies on concrete aged 7 days, 14 days and 28 days.

Results:

Each cube strength values should be recorded and compared with the value of the desired strength. The purpose of the concrete test 7 days and 14 day work is to predict whether concrete strength can be achieved or not on the 28th day. In most circumstances, the strength of the concrete has reached 70% at day 7.

Photos 3.96 : Procedure Step 1,2,3 and 4.

Photos 3.97 : Procedure Step 5.

Photos 3.98 : Procedure Step 6,7 and 8.

Photos 3.99 : Procedure Step 9.

Photos 3.100 : Procedure Step 10 and 11.

Photos 3.101 : Procedure Step 12.

3.9.3.2 CALCULATION COMPRESSION TEST

Calculation of compression test from test cubes report.

Cube Ref	Date Cast	Date Tested	Age (Days)	Weight (kg)	Density (kg/m3)	Maximum Load (kN)	Ultimated Strength (N/mm^2)
4	3/06/2013	01/07/2013	28	8.02	?	900	?

Table 3.8 : Test Cube Report from Chin Hin Concrete Sdn Bhd

Date : 01/07/2013

Client : SPAZ Sdn Bhd

Concrete Grade : 35P

Slump Test : 90 ± 25

Location of Structure : Hotel Slab & Beam

Grid Line : (A-D, 7-10)

Level : 4

Cube Dimension : 150mm x 150mm x 150mm

a) CALCULATION FOR DENSITY (kg/mm³)

Weight (w) = 8.02kg

Dimension = 150mm x 150mm x 150mm

Dimension Converter:

0.15 x 0.15 x 0.15

= 0.003375 mm³

* Convert from mm³ – m³

DENSITY = weight

Dimension

= 8.02kg

0.003375mm³

= **2376.29 kg/mm³**

b) CALCULATION FOR ULTIMATE STRENGTH (N/mm²)

Max. Load = 900kN

Area of cube = 150mm x 150mm

Area = 150mm x 150mm

= 22500/1000

= 22.5mm²

ULTIMATE STRENGTH = Load

Area

= 900

22.5

= **40N/mm²**

@

ULTIMATE STRENGTH = Max. Load x 1000/Area of cube

= 900N x 1000N

(150mm x 150mm)

= 9000N

225mm²

= **40N/mm²**

3.9.4 CONCRETING WORK

During the practical training period of 4 months, there was some construction work done on the construction project site Felda, Bangi. Some of the construction work performed is as concrete works.

In my observation, the concreting work that has been carried out is on under the superstructure work. The type of superstructure work has been done is at floor area, beam, column and staircase.

Concrete works will be carried out after installation works mold box and reinforcement bar installation is complete. Concrete works will be carried out by general and skilled worker. The equipment and machinery used in concrete works are as the air compressor, blower, pump concrete truck, concrete mixture truck, tower crane, concrete bucket, concrete mixer, spade, concrete vibrator and vibrator poker.

After installation of reinforcement bars and formwork has been completed in pairs by carpenters and masonry, the parties involved, such as engineers who were assigned on site should first check whether the installation is in accordance with specifications or not. The specifications set forth in the structural drawing provided by the structural consultant engineer.

The concrete works are carried out as in:

a) Floor
b) Beam
c) Column
d) Staircase

a) FLOOR

The average grade for all other floor used in this project is grade G35. The thickness of slab is around 150mm until 200mm, depending the function on that area. In normally, in the toilet or in the areas that receive water reservoir, slab thickness is thin because there are several layers to be installed as water proofing and tiles. In addition, installation slab in this area, the drop must be installed. The drop is around 50mm until 150mm.

After the inspection the installation of formwork and reinforcement bar works has been completed, the concrete works will be carried out. The concrete is put into the formwork slab, the vibrator will be used during the concrete pour to compress the volume of concrete in the formwork. The main purpose must be undertaken in the concrete vibrator works is to prevent defects occur. Among the types of defects are as a honeycomb.

Concrete vibrator is also to compress the concrete was poured in the formwork. The aim is to move the stuck in the concrete reinforcement steel iron that has been in close pairs. Furthermore, this way will meet the concrete moves to the empty spaces. Therefore, the types of defects such as honeycomb can be overcome.

After the work was completed the concrete work on the run, then the concrete will be allowed to dry for 7 days in advance. When the concrete has matured and has hardened completely, then formwork removal work will be carried out. After the removal of formwork work, the parties involved shall undertake the inspection in advance, so that the area was safe for use in concrete. The purpose of the checking and inspection lot is done to ensure the safe use of concrete in the long term.

Concrete for Slab

Photos 3.102 : Concreting work for slab at Hotel Aras 5

Photos 3.103 : Concreting leveling work

b) BEAM

There are some similarities between the concept of installation works beams and columns. The concept of the installation of formwork is more or less the same. Among the concept is the same equation as the work of the installation formwork, but there is a significant difference in pairs of beams horizontally and vertically mounted poles.

In addition, among the most important role is the work of the mold box assembly. Mold box assembly to be installed first beam and follow the installation works the bar. Upon completion of the installation and assembly of the mold box has finished all reinforcement bar, thus the concrete work will be carried out.

Grade of concrete required for concreting work beam is divided into two such as G35 and G40. Concrete grade for G35 is used for normal and small beam, while the grade G40 are used to a greater beam or known as Transfer Beam.

In normally, the concrete work for the floor and a small beam is carried out at the same time. Thus, the first steps are concreting work for beam and then, follow to the concreting work for floor. The aim is to ensure that the concrete in the formwork of beam space can be fully met.

Concrete work for transfer beam is different because there are two or three layers of concrete actions to be undertaken. For example, Transfer Beam measuring 2500mm high will be divided into two or more layers of concrete work or known as the (1^{st} and 2^{nd} cast).

This is because the installation of a large size and a lot of reinforcement bar and volume of concrete that has not been properly hardened and will cause too heavy. The main purpose installation of the beam is received the load of current flows and will be function when the reinforced concrete of beam has hardened properly. Installation of the reinforcement bar too much will be effect to scaffolding cannot fully support and most likely will cause fracture and collapse.

Thus, the concrete work for Transfer Beam will be carried out two or three times based on the size of the volume is designed. In conclusion, the concrete work for installation of Transfer Beam is take a time compared to other concreting work.

Concrete for Beam

Photos 3.104 : Concreting work for slab and beam at Landscape area for Apartment

Photos 3.105 : Concreting work for beam

Photos 3.106 : Compacting of concrete using by vibrator

c) COLUMN

As stated in the attachment the description of concreting work for beam is more or less the same as column. Installation of reinforcement bar for column is installed vertically where the beam is installed horizontally. Among the significant differences between the beam and the column is the work of the installation of formwork.

Installation of formwork is installed after the installation of reinforcement bar work has been completed. Reinforcement bar was a tying first in shape of square, round or any shape that is designed to be lifted using a crane tower or mobile cranes. At the bottom of the steel bar will be bound together with starter bars protruding from the surface area of slabs and the length of starter bar is 40D.

After the installation of steel reinforcement has been completed, the work for installation formwork is on the run. After all installation work and reinforcement steel and formwork were completed in pairs and in bushes, concrete works will be carried out.

Concrete grades used for column is G35. In most circumstances, laborer (mason) will climb the scaffolding where installed close to the formwork columns. The aim is to facilitate (mason) conducting concrete work easily and control the flow of the carrying concrete by using concrete bucket. Each layer of concrete is poured into the formwork columns, compaction works by using concrete vibrator. The aim is to conduct concrete reinforcement steel stuck in the empty space.

Large column mounted on the bottom of the tower hotel is measuring 1250mm x 1000mm and 1600mm x 1000mm. The aim is to shed the burden of the transfer beam at level 4. Formwork that needs to be done in pairs at the center of the hole and concrete in drainage pipes enter using concrete pumps.

Large column was conducted twice the concreting work or known as (1st and 2nd cast cast) . The formwork is installed too high and will most supporters in pairs while also commonly referred to as ‘shoring’. The aim is to support or resist the formwork is upright column and robust. Shoring that is installed on the sides of the formwork with a tilt of 60 degrees. Shoring will be in pairs on each side of the formwork surfaces.

Concrete for Column

Photos 3.107 : Concreting work for Large Column

Photos 3.108 : Installation of formwork for Small Column

Photos 3.109 : After the concreting work (1^{st}Cast) for Large Column Hotel

d) STAIRCASE

The grade for all staircase used in this project is grade G40. The height of each floor is around 2975mm. The type of staircase used in this apartment area is semi-curved. Each staircase has a platform or known as landing in the middle tier. Before the landing is built, there are 8 or 9 riser and then the landing will resume with the construction of the riser and thread to the next level. The thickness of slab landing is around 150mm until 175mm. The thickness of each riser is around 175mm and thread width was about 255mm.

After the inspection of installation formwork and reinforcement bar works has been completed, the concrete works will be carried out. The concrete is put into the formwork staircase, the vibrator will be used during the concrete pour to compress the volume of concrete in the formwork. The main purpose must be undertaken in the concrete vibrator works is to prevent defects occur. Among the defects that often occur as a honeycomb.

Concrete vibrator is also to compress the concrete was poured in the formwork. The aim is to move the stuck in the concrete reinforcement steel iron that has been in close pairs. Furthermore, this way will meet the concrete moves to the empty spaces. Therefore, the types of defects like this can be prevented.

After the concreting work was completed, then the concrete will be allowed to dry for 7 days in advance. When the concrete has matured and has hardened completely, then formwork removal work will be carried out. After the removal of formwork, the parties involved shall undertake the inspection in advance, so that the area was safe for use in concrete. The purpose of the checking and inspection lot is done to ensure the safe use of concrete in the long term.

Concrete for Staircase

Photos 3.110 : Before concreting work for staircase

Photos 3.111 : After all concrete work for staircase has been completed

CHAPTER 4 :

PROBLEM

AND

RECOMMENDATION

PROBLEM AND RECOMMENDATION

In conclusion, on a practical period of my study, there were some problems and things that are not in the desired place on the construction site. Some of these problems can be listed in my observations are as defects arising during the work on the construction on the run. In addition, site conditions messy and dirty and safety rules are not followed are also described in this chapter. There are also some additional suggestions on sheets describe in this chapter and proposed the problems.

The problems listed in the first paragraph above are defects in the during construction stage. Among the types of defects that occur as Rebar Exposed, Honeycomb, formwork not removed, decayed timber and fungi. The type of common defect is rebar exposed. The one of possible causes is wrong measured . The remedies for this defect are cutting the reinforcement bars. The second defect is honeycomb. Some of the causes that occur as during concrete work are not carried out according to methods that have been set in the specification. This is because the vibrator works not properly carried out. Therefore, the cast concrete in the formwork is not able to move the empty space. The remedies for this defect are re- plaster of a hollow or in areas that have the honeycomb. The third defect formwork is not removed. Some of the causes that arise are as fitting the formwork is not perfect and not according to or into the concrete layer thickness were determined in the original plan drawings. Among other causes such as the labor workers are not properly remove the formwork. Next, there are some minor defects that occurred the mold and rot in the wood scupper drain. Some of the causes that occur as a wooden of formwork and left too long will cause the wood is exposed to water flow. This will cause mold and rot the wood. The ways to overcome this kind of defect is like removing the wood and concrete on the part of the measurements scupper drain that has been set in the construction drawings.

In conclusion, I suggested to the parties involved to take action in the event of any defects and damages occurred in the construction area. Any defects that are considered small or ' minor defects ' not monitored and counter will cause the serious damage will occur.

The other problems that can be practical during my observation were as construction site conditions are messy, helter-skelter and dirty. Among the issues that could be raised in this category problems are such as not installing warning signs in dangerous areas , construction materials and machinery and equipment are not organized and uncluttered , the stagnant water in the bottom of the tower crane and at the lift pit. In addition, installation of steel scaffolding and green netting is not installed on the side of the building is also one of the issues that can be listed in this category such problems. Furthermore, there is a significant matter by the management of contractor installation of interlocking brick ' was not carried out in the vicinity of the main entrance of the construction site on the main road.

The solutions listed in the first problem of this issue is as reinforcement bar, wood, nails and other construction materials collected and the excess shall be placed in one place. Equipment and machinery are to be stored in one place or in a storage room to facilitate use if needed. Additionally, the things like this can also keep in maintenance of perishable and cannot be used again. Next, I like to suggest that the stagnant waters at the bottom of the tower crane and around the lift pit can be issued immediately with water suction machine or known as dewatering machine. The aim is to overcome such problems prevent ‘Aedes Mosquito’ breeding in the reservoir area. Among the areas that need to be installed warning signs are around the floor on the left perforated floor should be covered with boards and warning signs (Caution !) in the surrounding area. In addition, in the vicinity of Lift Shaft also shall to install warning signs because there is no barrier at all levels and the functions are to movement the car lift move from the ground floor up to the top level.

Next, nets are colored green to be installed by the side of the scaffolding from the ground floor to the level that has been completed at that time. The purpose is to prevent objects such as wood, steel, concrete stones or other construction materials that fall within the area of the green netting only. Among the issues that most significantly not handled by the management contractor is the installation of interlocking brick in the vicinity of the main entrance site. I recommend installation of interlocking brick this should be carried out at the start of construction operations. Installation of interlocking brick must be installed on the outside of the main gate of the construction site on the main road. The main objective is to pay attention to other road users to slow down when they arrived at the main road facing the main entrance at the around of construction site area. This is because to warn other road users to be careful if there is construction Lorries in and out of the construction site.

The next problem is not practicing safety rules, especially when carrying out installation reinforcement bar and concreting work. The safety rules are not followed is such as the safety protection. The safety equipment protection can devices easily caused an accident occurs at a construction site. For example, labor workers not wearing safety protection, boots and protective gloves when doing any work at construction site. Not only laborers and skilled workers only need to wear protective equipment safety , even professional parties such as architects , engineers, surveyors, contractors and anyone who comes into the construction site should give priority to the safety rules especially safety protection equipment. Therefore, I propose to the parties involved in the safety department that appropriate to take the serious action on problems that occur like this. Safety rules such as personal safety protection equipment at the construction site play a very important role because it can involve accidents such as injury and can kill if such a thing is overstated and not caring.

In addition, there are some additional suggestions as another successful industry training program organized by the university. Hopefully, the universities and the industry to figure out the best time for student diploma in building surveying will come to the practical training of 16 weeks during this time to extend further this period. The main objective of such a thing proposed to allocate excess time for students to learn and know more things practiced in the training industry. In addition, the outside also can learn and know the background of the firm is known in detail, as well as to facilitate the operations to communicate with the firm.

CHAPTER 5 :

CONCLUSION

CONCLUSION

In conclusion, during the four months practical training period passed, there are different kinds of knowledge about construction that I have learned while on the construction site. There are a few things I learned that among these are the types of steel reinforcement bar used, the size of the rebar, storage of reinforcement bar and the most important is the main title of this practical report, the installation of reinforcement bar in superstructure work such as floors, beams, columns and stairs. Type of reinforcement bar used in construction sites (KPF) Project Bangi, is like High tensile steel (T) and Mild Steel (R). Nowadays, the type of High tensile steel for (Y) bar is rare and not used again. The strength of reinforcement bar values for (T) is fy=460 N / mm ² and mild steel (R) is only fy = 260N/mm ². The size of reinforcement bar used in construction sites (KPF) project are as T10 , T12 , T16 , T20 , T25 and T32, while for mild steel also is just R6 and R10 are used as stirrup or known as link. Next is concerned with the storage of reinforcements bar. When reinforcement bar has come at a construction site, then the steel must be in place in a spacious and clean. In normally, the length of the reinforcement bar is 12m each and the tie rod to size in one bundle. If the diameter of the reinforcement bar is large, then number of reinforcement bar is less in one bundle. Weight of each bond is in the range of 1000kg or 1 tonne. Normally, reinforcement bar in order to be up to the construction site of 100 tons, depending on the circumstances.

In my observation, I can learn a bit about the work of installation of reinforcement bar in building elements such as the surface of the floor, beams, columns and stairs. The each element of this building has their own functions. For example, the surface floor in the building received the burden of either live load or dead load. One of the main functions pairs of reinforcement bar in concrete is to shed the burden of the current flow from one place to another. For example, the upstairs floor will drain the burden to the beam. Reinforcement bar is installed in the beam horizontally and lengthwise. Load flow will move horizontally through the installation of reinforcement bars for beams and will continue to flow downward through the reinforcement bar in the column. Column is the vertical component of a structure built to carry the load. Column also serves to receive the load of the beam and the roof to the foundation distributed. The basic types foundations used in the project are bored pile. Bored pile is divided by two types such as single bored pile and grouping bored pile. The depth of the bored pile installed in the ground surface is around 12 meters.

The next component structure is about the staircase. Staircase is a component of a link between the two levels of structure. The staircase functions are consisting of thread and riser to move from one floor to another floor levels. During installation reinforcement bar work carried to the floor, there are some who are going to come out a little from the floor. This type of steel is known as a 'starter bars'. The length of starter bar is around 40Ø from the size of the reinforcement bar.

The similarity between the reinforcing steel installation for floor and stairs are reinforcement bar methods in terms of short and long term. The symbol normally used in this method is like B for bottom bars, BB to Bottom Most Bars, T for Top Bars and TT also is the Top Most Bars. At the surface of the floor and the stairs there are 4 levels of reinforcement steel in cross pairs. There are two rows of starter bars protruding from the floor surface. The first starter bars are tied with reinforcement bar length or known as BB. BB installed vertically and followed with a short bar B, T, and at the top end and is TT. TT will be tied to the second steel starter bars. Ordering the installation method for staircase is (BB, B, T & TT) while for floor installation also is (B, BB, TT & T). In this case, if the area is not the same floor area, then a short reinforcement bar is known as the main bar must be installed at the beginning and end.

After that is concerned with the concrete work. Concrete is the second title contained in this practical training report. Concrete plays an important role in the construction. There is a variety of concrete knowledge about what I can learn, whether from practical or theoretical. The things that can be learned while on the construction site is like concrete delivery process to the construction site, the preparation of concrete process at batching plant, concrete test and concrete work.

Projects for *Koperasi Permodalan Felda* (KPF), *Bangi* is a high -rise building projects or big projects. Therefore, the project must undergo a process to order a concrete ready mix at nearest concrete batching plant. This process is involves some parties such as the consultant engineer, contractor and supplier. When this process is completed, then the supplier will carry out the process of ready mix concrete mixing at batching plant. The type of materials used is water, aggregates, sand, cement and chemical fluids or known as retarder. The main function of chemicals placed in the concrete mix is to slow the drying process of the concrete inside the concrete truck. After that, the concrete will be delivered to the construction site. When arrival at the construction site, the test should be conducted before concrete is used.

In most normally, the types of concrete tests carried out on the construction site is like slump test and cube test. Test cubes should be soaked in a pool of water designed to create a curing process. Concrete cubes will be left in a pool of water for 7 days, 14 days and 28 days. After that, the concrete will be conducted next test of concrete compression test. This cube compression test should be carried out at the batching plant by location of ready mix concrete booked. In addition, I had the opportunity to learn how to complete the test cubes report and the methods of calculating the density and compression strength.

Next is concerned with the concrete work. Concrete work carried out on the construction site is in the superstructure. Among them is like conducting concrete work floor, beams, columns and stairs. Concrete grade has been assigned in accordance with building elements used in this project. In usually, grade of concrete used for the stairs is G40 while the floor grade is G35. Beam is divided into two type such as small beam and transfer beam. Typical beam used were G35 and Transfer Beam also used grade G40. Columns are divided into two types such as large column and small column. Small column is of (single bored pile) while the large column is from (Grouping bored pile). Grade concrete for small column are G35 and concrete grade large column is G40. There are some similarities between the concrete work for beams and columns such as the formwork is installed horizontally. The formwork is to be installed in a horizontal beam and for column is vertical. In normally, concrete work will be carried out once the beam concrete work to the floor. Concrete should be poured in the formwork for beam first and next is on the floor. Once the concrete has been poured in the formwork, the vibrator works will be carried out. The main purpose of this process is done to avoid the defects occur when the formwork is opened after a concrete has hardened. The types of defects that occur are as a honey comb. Therefore, the parties involved must to undertake the monitoring and inspection during concrete work done.

Besides that, I get to learn about the use of equipment and machineries during the installation of reinforcement bar and concrete work is on the run. There are some equipment and machinery is under the rental list and contractor self- ownership. Furthermore, I was able to examine the expenditure incurred on this project (KPF), Bangi. The types of adverse price are in terms of cost of construction materials, cost of labor and the cost of equipment and machinery. A wealth of knowledge can be learned while on the construction site. Finally, I am satisfied and happy to go and finish my practical training period for four months and I hope that I can practice that given at the future.

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APPENDIX