



**DEPARTMENT OF BUILDING
UNIVERSITI TEKNOLOGI MARA
(PERAK)**

**THE CONSTRUCTION OF STAIRCASE USING ALUMINIUM
FORMWORK AT IMPIANA SKY RESIDENSI, BUKIT JALIL.**

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(PERAK)**

DECEMBER 2018

It is recommended that the report of this practical training provided

by

**MUHAMAD IMRAN BIN NOR HALIM
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entitled

**THE CONSTRUCTION OF STAIRCASE USING S-FORM
ALUMINIUM FORMWORK**

be accepted in partial fulfillment of the requirement for obtaining the Diploma In Building.

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STUDENT'S DECLARATION

I hereby declare that this report is my own work, except for extract and summaries for which the original references stated herein, prepared during a practical training session that I underwent at WZR Property Sdn. Bhd. for duration 14 weeks starting from 3 September 2018 and ended on 7 December 2018. It is submitted as one of the prerequisite requirements of DBG307 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

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Date : 23 / 3 / 2019

ACKNOWLEDGEMENT

Alhamdulillah, all praises to Allah for the strengths and His blessing in completing this report. Special appreciation goes to my project manager, Sir Aneselam Shan, for his supervision and constant support. His invaluable help of constructive comments and suggestions throughout the experimental and report works have contributed to the success of this research. Not forgotten, my appreciation to my site supervisor, Mr. Zulakmal Bin Idrus for his support and knowledge regarding this topic. My acknowledgement also goes to all the project team and staffs of project low cost apartment with 39 level for their cooperation. Sincere thanks to my lecturer supervisor Miss Jannatun Naemah Ismam for their guidance, advice and moral support during the task is in progress. Thanks for their concern in ensure to being success at training time. Not to forget, great appreciation goes to the rest of Practical Training Coordinator, Miss Nor Azizah Talkis and Faculty's Coordinator Dr Dzulkarnaen bin Ismail. Last but not least, my deepest gratitude goes to my beloved parents, _____ and _____ and also to my siblings for their endless love, prayers and encouragement. To those who indirectly contributed in this report, your kindness means a lot to me. Thank you very much.

ABSTRACT

Staircase is one of the important structure in a building. It provide access and also connect between one floor to another floor. Therefore this report will discuss about how were the staircases is built at a high rise building and the precaution needed to take care while construct the staircase. This report was conducted at Impiana Sky Residensi at Bukit Jalil. There are two objectives in this report, first is to identify the factors need to be considered in staircase construction at Impiana Sky Residensi, Bukit Jalil which is material, formwork, machineries and equipment. Second, is to study the method statement of staircase construction at Impiana Sky Residensi, Bukit Jalil. There are 8 stages of constructing a staircase which is installation of deck panel, installation of reinforce bar, installation of M&E part, installation of wall panel, installation of gun panel, installation of step panel, installation step panel, concreting work and lastly opening back of formwork. A lot of thing has been done to success the construction of staircase like concreting work to form the stair structure and also slump test to see the workability of the concrete direct on the spot before the concrete work is done. The objectives of this report must be supervised properly without any careless in order to gain the right strength of stair to avoid any collapse happened in the future.

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CHAPTER 1.0

INTRODUCTION

1.1 Background and Scope of Study

Stairs is a structure that connected between floors in a buildings. Basically, stair is described as a set of steps leading from one floor to another and a staircase includes the part of the building surrounding the stair. Stairs should be constructed to provide real easy and safe access up and downs, with steps that are either laborious or difficult to climb within a compact area so as to take up no excessive floor area (The goodheart-Willcox Co., 2009).

The function of a stair is quite simple as it is normal daily access from floor to floor and it also must provide easy and rapid escape from the upper level to the ground level in case of emergency happened like earthquake or the building is on fire. This kind of emergency is where the stairs is really needed even though in these modern era have a better means of access like elevator or escalator but the cons is that it can be broken down.

The basic components of a staircase are the tread which the horizontal surface we walk on. Next, the riser where the vertical part between each tread and then stringer which a structural support that holds the treads in place and provides stability. What we call a step is actually a combination of a tread and a riser, or one step up or down from our previous position. In some cases, such as open stairs, the riser is missing and we can see through the stairs (Moulten, 2010).

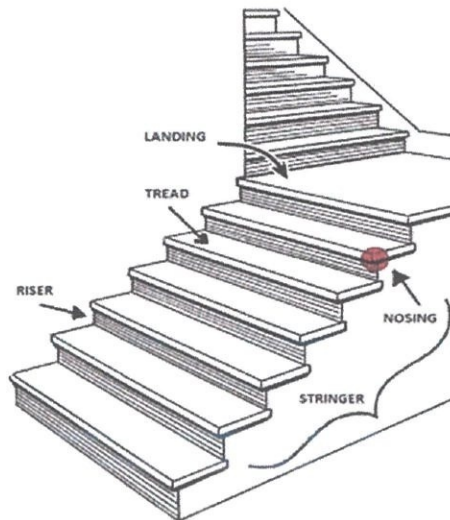


Figure 1.1: The component of stairs from
Source: The Goodheart-Willcox. Co.

There are several types of staircases that are used in the construction. Firstly, straight run which it only lead to one direction only and usually continuous with two flight with an intermediate landing. Next, Wide-L where the stair turning 90 degree with the help of level landing. Then, the types of staircases that this project used is the Narrow-U where it consists of two straight flights running in opposite directions and also landing provided at level which direction of flight changes (The Goodheart-Willcox Co., 2009).

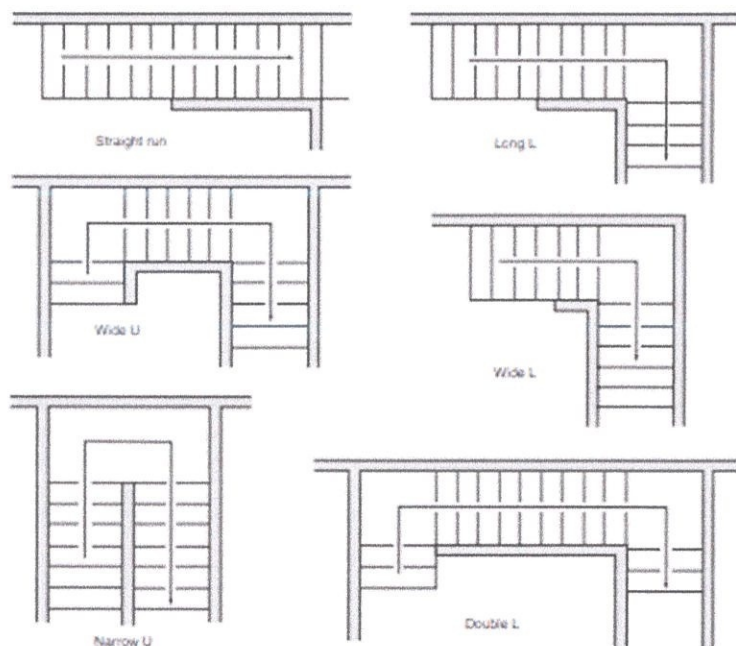


Figure 1.2 : Types of staircases
Source: The Goodheart-Willcox. Co.

The study is carried out at The Earth @ Bukit Jalil, 43300, Kuala Lumpur which located only behind SIRIM Berhad (Standard and Industrial Research Institute of Malaysia). The focus of study is about the factors need to be considered in staircase construction and also the method of construction at the site since the site is fully structure using the S-FORM Aluminium.

1.2 Objectives

There are two objectives that are developed during the task while doing the task:-

- i. To identify the factors need to be considered in staircase construction at Impiana Sky Resindensi, Bukit Jalil
- ii. To study the method statement of staircase construction at Impiana Sky Residensi, Bukit Jalil.

1.3 Method of study

i Observation

Based on observation at site, there are a lot of superstructure element and the method to construct also need a variety of aluminium formwork. Got the chance to watch the construction of superstructure from the installation of top bottom bar, M&E parts until concreting work and already snap the pictures while the workers doing the construct it. From the observation, there is also challenge in constructing a superstructure especially when concreting. The concrete work cannot be done if there is rain which may affect the concrete strength and also give the worker difficulty doing the concrete work which might danger or affect the safety of the worker.

ii Interview

The main purpose of interviewing is to gain more knowledge from an experienced person who already worked long enough in this construction field. The interview session is done at the site office for the Project Manager, En. Anselam Shan since at the office is the only time that got the chance to meet him because he needs to handle two sites here in Bukit Jalil. As for the Senior Supervisor of Civil and Structure, En. Aidil Bin Shawal is basically on-site right at the structure level and he explain right forward at the item like wall, column, slab and staircase. They both is a well-experienced person which make them is a perfect candidate for this interview and also to complete this report.

iii Document reviews

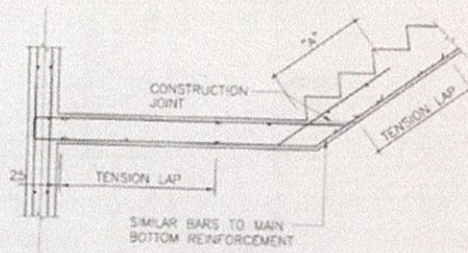
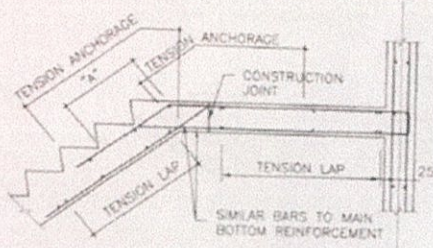
The documents used as references is basically all the drawing in the office which is public drawing for RMM (Rumah Mampu Milik) and the QAQC (Quality Analysis and Quality Control) drawing. Both drawing is very important as they are the references for the whole construction. All the worker, supervisor and engineer will refer the drawing when conducting work and follow exactly the drawing asked to.

10. STAIRCASES

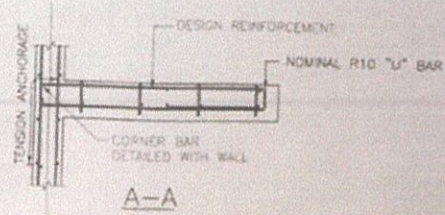
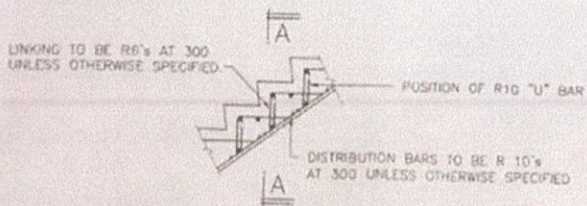
(I) END SUPPORTED WITH LANDINGS

NOTES

- 1.) "U" BARS FOR BOTH LANDING TO BE 50% OF THE AREA OF THE MAIN BOTTOM REINFORCEMENT.
- 2.) 'A' TO BE THE GREATEST OF $0.1 \times$ DESIGN SPAN, TENSION ANCHORAGE LENGTH OR 500



(II) CANTILEVER FROM WALL OR EDGE BEAM



CONTROL DOCUMENTS

Figure 1.3: Construction Drawing at Public drawing

Source : WZR SDN BHD

CHAPTER 2

COMPANY BACKGROUND

2.1 Introduction Of Company



Figure 2.1 : WZR Logo Company

WZR Property was incorporated in Malaysia under the Companies Act, 1965 on 7 December 1999. The company is involved in a diversified range of property services, which include property development and construction.

WZR is focused on establishing itself as a lifestyle developer in residential and commercial development. Its development include. A maiden project of 46-unit commercial development known as The Earth @ Bukit Jalil was successfully launched in 2011. The current development of Pr1ma Alam Damai at Alam Damai, Cheras which comprises of 2,074 units of high-rise apartment.

Upcoming development includes mixed development for Felcra Berhad comprising of 39 storey Felcra Tower, 41 storey Residential Tower, Convention Centre and Shopping Mall at Jalan Semarak, Kuala Lumpur. Another of our future launch schedule in 2015, The Earth Residence Phase 2 at Bukit Jalil comprising of 1,270-unit of condominium and affordable apartments.

Within short span of 11 years, we have secured and completed projects worth RM716 million and current projects valued at RM296 million. Having laid its foundation well, WZR is recognised as a reputable Class A bumiputera contractor registered with Pusat Khidmat Kontraktor.

A privileged CIDB Grade 7 Licensee with the Lembaga Pembangunan Industri Pembinaan Malaysia. A C1 permit holder with Jabatan Perkhidmatan Pembetulan. A registered solid waste disposal contractor with PPSPPA. A registered contractor with Ministry of Finance, Malaysia.

2.2 Company Profile

Registered Name of : WZR PROPERTY SDN BHD
Company

Business Address : 24-26, 1st, 2nd & 3rd Floor, Jalan BK5A/2A, Bandar Kinrara, Puchong, 47180, Selangor, Malaysia

Telephone No. :

Fax No. :

Date of Incorporation : 7th December 1999

Group Chairman : Dato' Sazmi Bin Muah

Name of Directors : 1) Datuk Ahmad Kamal Bin Kasani
2) En. Wan Nadzir Bin Wan Mohamad
3) En. Ibrahim Bin Rahmad
4) Mohamad Takyuddin Bin Yazid

2.3 Organization Chart

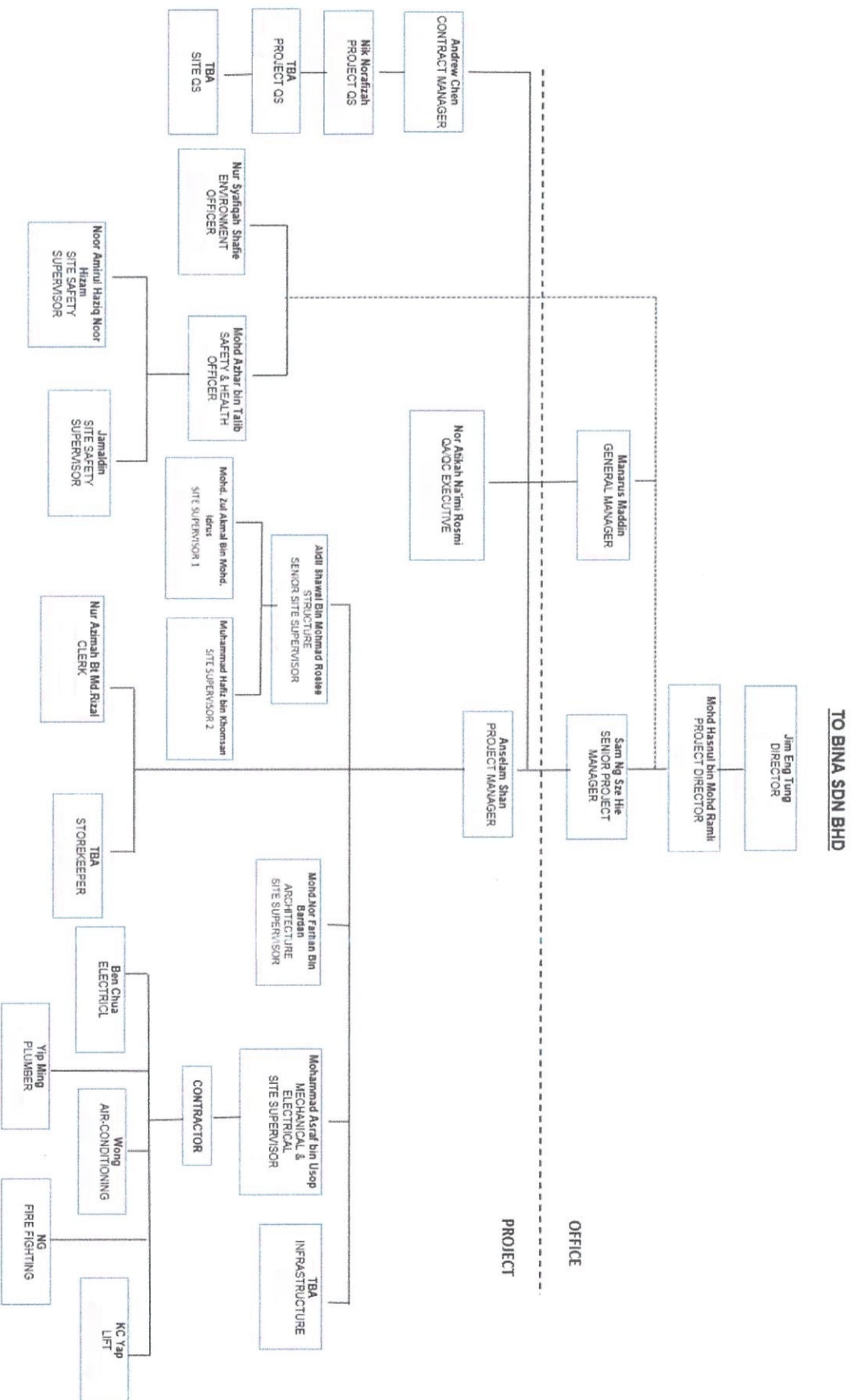


Table of organisation chart 2.1

2.4 List of Project

2.4.1 Completed Project

Table 2.2 : Completed project

| No. | Name of completed project | Client | Location | Category |
|-----|-------------------------------|------------------------|-------------|--------------|
| 1. | The Earth Bukit Jalil | Wealth Plateau Sdn Bhd | Bukit Jalil | Development |
| 2. | PRIMA @ Alam Damai | Transgreen Sdn Bhd | Alam Damai | Development |
| 3. | The Earth Residensi | Wealth Plateau Sdn Bhd | Bukit Jalil | Development |
| 4. | Perumahan Kinrara Berhad | WZR Sdn Bhd | Puchong | Construction |
| 5. | TPPT. Sdn Bhd | Transgreen Sdn Bhd | Kajang | Construction |
| 6. | Horsdale Development | WZR Sdn Bhd | Shah Alam | Construction |
| 7. | Naza TTDI | WZR Sdn Bhd | Shah Alam | Construction |
| 8. | THP Bina Sdn Bhd | Wealth Plateau Sdn Bhd | Putrajaya | Construction |
| 9. | MAIWP | WZR Sdn Bhd | Cheras | Construction |
| 10. | Masjid Al-Ihsan | WZR Sdn Bhd | Puchong | Construction |
| 11. | Kementerian Pertahan Malaysia | WZR Sdn Bhd | Pahang | Construction |
| 12. | Senandung Budiman Sdn Bhd | WZR Sdn Bhd | Putrajaya | Construction |
| 13. | I & P Berhad | WZR Sdn Bhd | Pahang | Construction |

Source : WZR Sdn Bhd

2.4.2 Project In Progress

Table 2.3 : Project In Progress

| No. | Name of project in progress | Client | Location | Category |
|-----|-----------------------------|---------------------------|------------------|--------------|
| 1. | Impiana Sky Residensi | Wealth Plateu Sdn. Bhd | Bukit Jalil | Development |
| 2. | Paraiso | Wealth Plateu Sdn. Bhd | Bukit Jalil | Development |
| 3. | Mayang Mall | Pelabuhan Hartanah Berhad | Kuala Terengganu | Construction |
| 4. | 39 Unit Putrajaya | Senandung Budiman | Presint 16 | Construction |

Source : WZR Sdn Bhd

2.5 Vision, Mission and Objectives

Vision

To be recognized worldwide as a reputable construction and development company of distinction committed to its people, community and environment.

Mission

To accomplish our vision, we shall remain focus in our core business, capitalizing on our strength, experience and expertise gained over the years, continuously researching, adapting and improvising it to meet international standards and in the process, positioning our workforce and resources in a ready state to seize on opportunities that comes along our way, always discharging our duties responsibly as a good corporate citizen.

Objectives

To ensure high-standard contract and construction management services by providing the best people, expertise, skills and competence. To maximize customer's satisfaction by fulfilling, if not exceeding, the promise of timeliness, budget control and quality attainment. To stay at the forefront of new development regarding infrastructural, residential and commercial projects by continuously investing in our human capital, management system and industry expertise

CHAPTER 3.0

CASE STUDY

3.1 Introduction to Case Study

During the ten week(10) training in this company, the students were directly involved in the installation of aluminum form (S form), concrete works and others for the construction of the ‘Rumah Mampu Milik’ (RMM) while for condominium construction (PARAISO) projects, the concrete work, scaffolding installation to support the before concrete, installation of rebar for floor and pole and so on. Various tasks and responsibilities were administered in concrete work, calculating the amount of concrete, making benchmarking work on concrete levels using dumpy level, supervising the installation of floor formwork using wooden plywood and aluminum shapes in both construction sites. This section will explain a detailed understanding of the work procedures on constructing staircase using s-form aluminium.

3.2 Factors should be considered in staircase construction

i. Material

The material needed to build a staircase is surely a concrete. For the construction of ‘Rumah Mampu Milik’, the concretes used is ready mixes since there is also a batching plant at our site. As the ready mixed concrete industry is developing and indirectly makes it the preferred choice among contractors to use this method. The advantages of this method are the supply of concrete to be supplied continuously at the specified time and the quality is more secure. Generally, concrete is a kind of material produced from the combination of cement, fine aggregates (sand) and coarse aggregates mixed with water according to a ratio. Grade concrete used in the construction of this staircase is Grade 35 which the ratio is 3.15 for the cement, 2.67 for the coarse aggregate and 2.62 for the fine aggregate. After those element have been mixed the slump test will be done on-the-spot test to determine the consistency as well as workability of fresh concrete. This test plays a vital role in ensuring immediate concrete quality in a construction project.



Figure 3.1 : Slump Test

Photo 3.1 shows slump test which is very simple and easy to handle. It also demands comparatively less equipment and can be done in a short period of time. These advantages of slump test have made it very popular all over the world. In slump test, workability of concrete is not measured directly. Instead, consistency of concrete is measured which gives a general idea about the workability condition of concrete mix.

After slump test, the next process is cube test as in photo 3.2. Concrete Cube Testing to determine the strength of concrete can be done in both Destructive and Non-Destructive Methods of Testing. Cube test is one of the vital test which is performed to determine the strength of concrete which has been already used in the construction. Cube Testing is a Destructive Testing Method of Concrete Testing, as the cubes are crushed in Compression Testing Machine. The mostly tested cubes in practice are of 150x150x150 size in mm.



Photos 3.2: Cube Test

ii. Formwork

The formwork used is aluminium from S-Form as in figure 3.3 and figure 3.4. The Aluminium Formwork System was developed by W. J. Malone, a Canadian Engineer in the late 1970s as a system for constructing low cost housing unit in developing countries. To be erected by the hundreds, of a repetitive design, the system ensured a fast and economical method of construction. All the components are properly manufactured in the factory as per the dimensions provided by the architect. The following figures shows the various internal fittings used to assemble the formwork into correct posture.

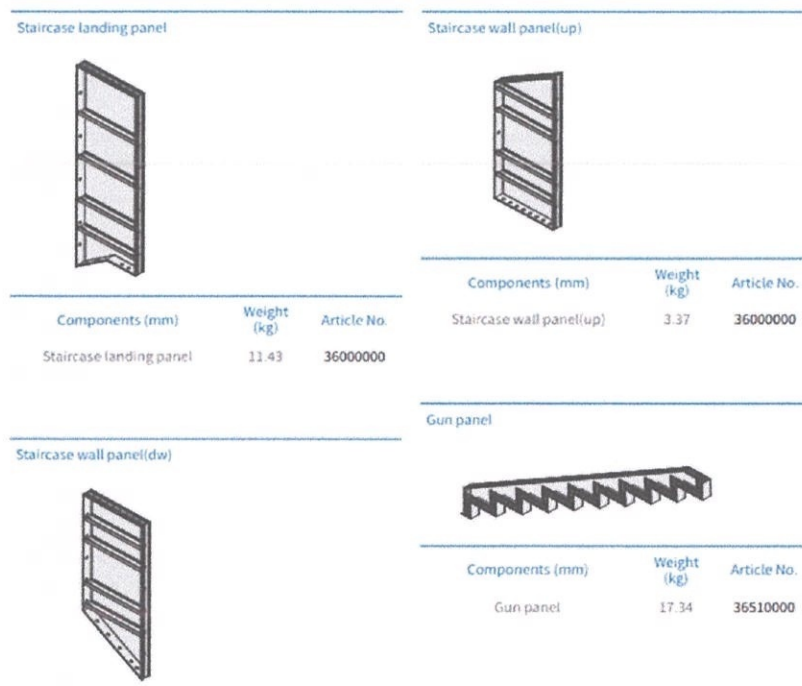


Figure 3.3 : Components of S-Form aluminium formwork from S-Form e-brochure.

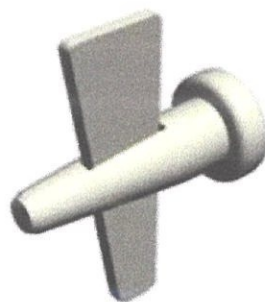


Figure 3.4 : Round Pin & Wedge from S-Form e-brochure.

iii. Machineries and equipment

a. Concrete Mixer Lorry



Photos 3.3 : Concrete Mixer Lorry

This lorry will carry the concrete from the batching plant to the concrete pump and pour it to be pump in order to send the concrete up the building (Photo 33).

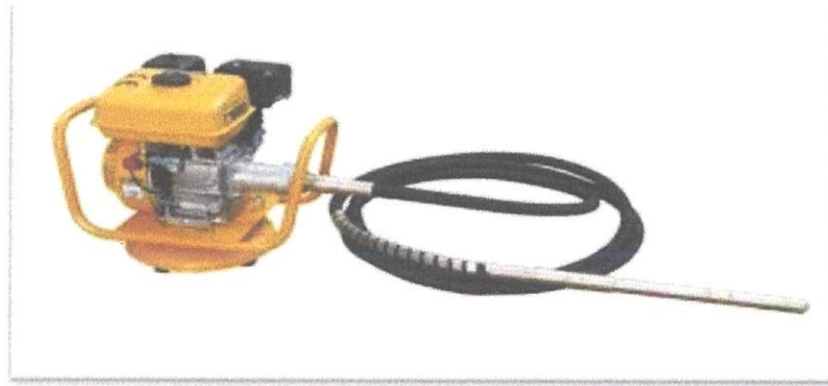
b. Concrete Pump



Photos 3.4 : Concrete pump

This concrete pump will help pumping up the concrete to the building after the pouring of concrete inside this machine.

c. Concrete Vibrator



Photos 3.5 : Concrete Vibrator

A concrete vibrator is a construction tool typically used on concrete pouring sites as in photo 3.5. This is so that the concrete remains strong and has a smooth finish even after removal of the form work.

3.3 Method statement of constructing staircase using S-Form aluminium

There are several process to complete the construction of staircase using S-Form aluminium:-

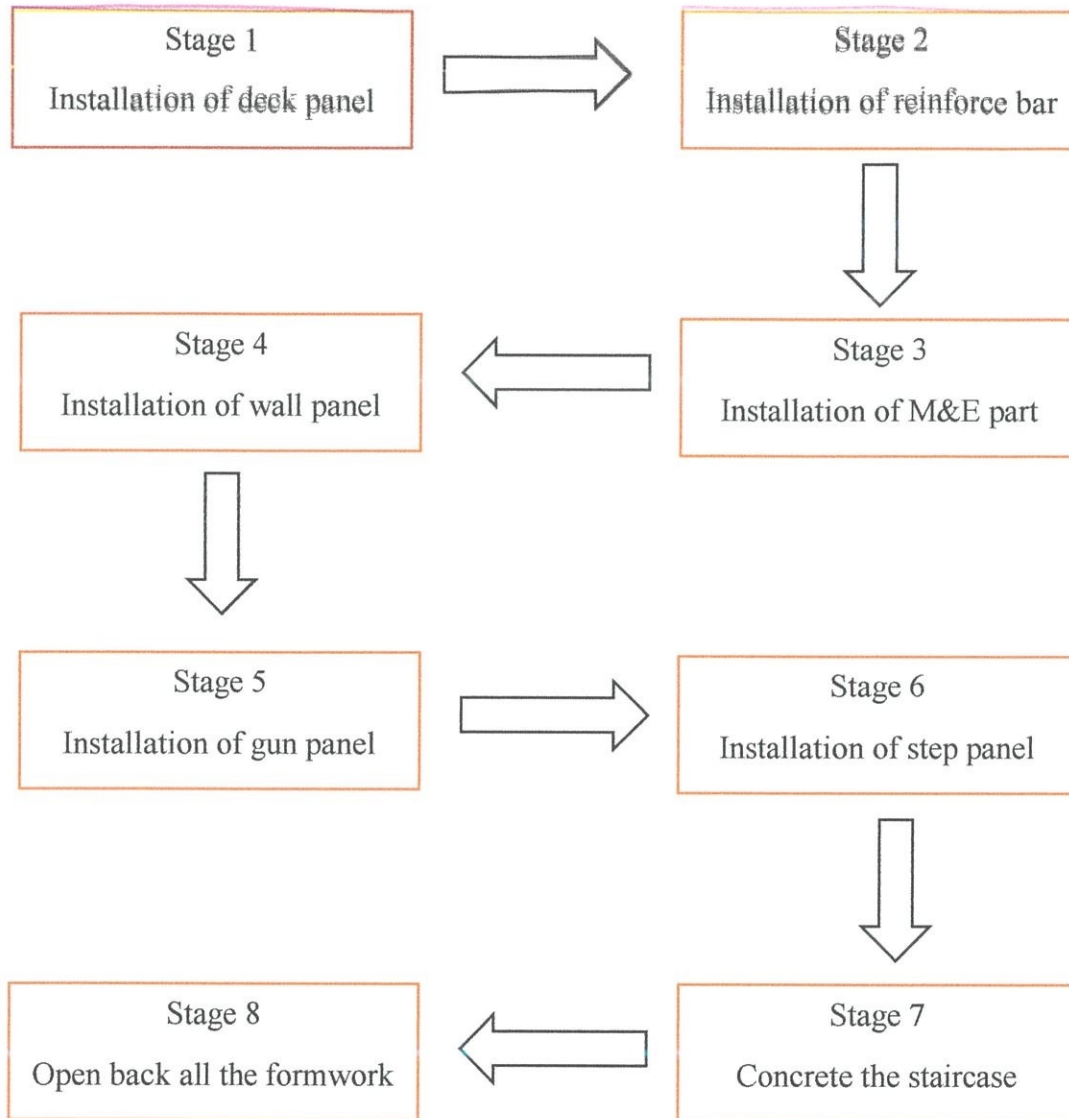
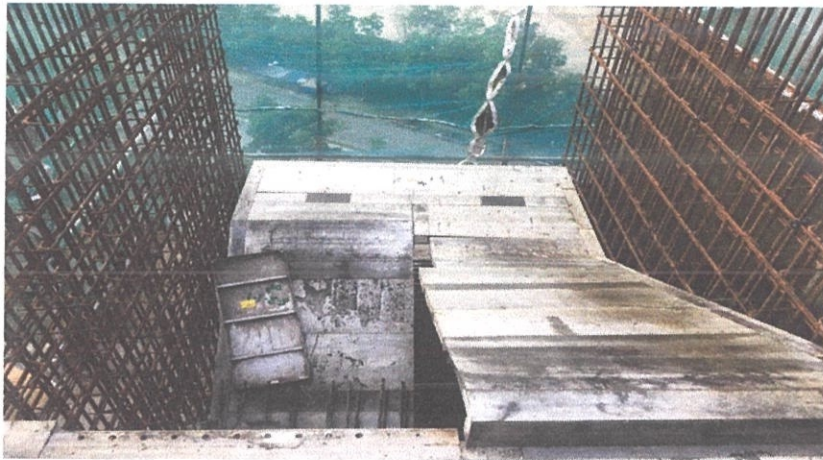


Figure 3.3 : The flowchart of staircase construction process

3.3.1 Process of construct staircase using S-Form aluminium

Staircase is a thing that connected the lower level with an upper level. It is also called as superstructure since the staircase is located at above the ground level or sub-structure. So here are the method to construct staircase :-

- i) Installation of deck panel from Photo 3.6, which sustain the weight of concrete while pouring and casting jobs to form slab. Basically, deck panel is the base for the rebar and electrical part since those part will be installed right on the deck panel.



Photos 3.6 : Deck panel at staircase

- ii) Installation of reinforcement bar and the electrical pipe conduct at Photo 3.7. After the deck panel at has been done then the rebar and the electrical part can be installed. The rebar must be installed properly according to the construction drawing and the size also have to make sure using the size as stated in the construction drawing. The electrical pipe point also has been given at construction drawing of electrical point which it must be placed correctly at the place and space given between the rebar. Reinforcement bar is used to help the concrete much stronger than normal concrete and the electrical pipe conduct is where the electrical wire will be installed to let current the current to the level. Before closing the rebar with the formwork the Resident Engineer will check first the rebar to proceed or not.



Photos 3.7 : Rebar and electrical pipe that has been installed at staircase.

iii) The installation of aluminium formwork which include the wall panel at Photo 3.8, gun panel at Photo 3.9 and step panel at Photo 3.10. All these formwork is used to form the concrete as stair. Wall panel function to form a wall around the staircase which will cover people inside. Gun panel also function as a wall but it located at below the wall panel and beside the step panel which will only help the form of the riser and tread of stair. Step panel is the form of the riser and the tread at a stair which locked with the gun panel to make sure that the concrete form a shape that it supposed to be without any defect.



Photos 3.8 : The installtion of wall panel



Photos 3.9 : The installation of gun panel



Photos 3.10 : The installation of step panel

iv) Concreting work for staircase like Photo 3.11 and Photo 3.12. After all the formwork has been pinned and joint properly then the concreting work will be done. The concrete will start from the top and then it will goes down to the wall panel and step panel. To ensure the compactness of the concrete inside the formwork then the vibration work will be done together with the concreting work.



Photos 3.11 : Concreting work at staircase

Photos 3.12 : Vibration work at staircase

v) Open back all the formwork used at staircase like Photo 3.13 and Photo 3.14. This work usually will be done right when the concreting work is settled but to open the formwork must make sure 7 hours after the concrete work not right when the concrete work is done. It takes time for the concrete to really dried and harden inside the formwork after the concreting work.







Photos 3.13 : Work of opening the formwork at staircase






Photos 3.14 : Work of opening formwork at staircase

3.3.2 Method Statement of construction of staircase using S-Form Aluminium

| 1. Prepared by : Muhamad Imran Bin Nor Halim | | 3. Date: 14/12/2018 | | | | |
|--|--|--|-------------------|---------------------------------------|--|----------|
| 2. Element: Construction of staircase using S-Form Aluminium | | 4. Page No. 1 | | | | |
| NO | OPERATION | SEQUENTIAL DIAGRAM | MACHINERY & PLANT | MANPOWER/ LABOUR | EQUIPMENT | DURATION |
| 1. | Installation of deck panel as base for the rebar, electrical part and also the concrete will lay on. |  | | 1 Site Supervisor 2 General Labour | Hammer Prop | 1 days |
| 2. | Installation of rebar and the electric pipe conduct for the electricity |  | | 1 Site Supervisor 4 General Labour | Electric conduct pipe Reinforcement bar Cooper wire Twister rebar | 1 days |

| NO | OPERATION | SEQUENTIAL DIAGRAM | MACHINERY & PLANT | MANPOWER/ LABOUR | EQUIPMENT | DURATION |
|----|---|--|-------------------|---------------------------------------|-----------|----------|
| 3 | Installation of wall panel formwork to form a wall concrete at the staircase. |  | | 1 Site Supervisor 1 General Labour | Hammer | 1 days |
| 4. | Installation of gun panel to connect the wall panel and the step panel. |  | | 1 Site Supervisor 1 General Labour | Hammer | 1 days |

| 1. Prepared by : Muhamad Imran Bin Nor Halim | | 3. Date: 14/12/2018 | | | | |
|--|--|--|---------------------------|---------------------------------------|-----------|----------|
| 2. Element: Construction of staircase using S-Form Aluminium | | 4. Page No. 3 | | | | |
| NO | OPERATION | SEQUENTIAL DIAGRAM | MACHINERY & PLANT | MANPOWER/ LABOUR | EQUIPMENT | DURATION |
| 5. | Installation of step panel to form the riser and the tread. |  | | 1 Site Supervisor 2 General Labour | Hammer | 1 days |
| 6. | Concreting work to form the staircase and also vibration work to compact it. |  | Concrete pump Vibrator | 1 Site Supervisor 2 General Labour | | 1 days |

| 1. Prepared by : Muhamad Imran Bin Nor Halim | | 3. Date: 14/12/2018 | | | | |
|--|--|---|-------------------|---------------------------------------|-------------------|----------|
| 2. Element: Construction of staircase using S-Form Aluminium | | 4. Page No. 4 | | | | |
| NO | OPERATION | SEQUENTIAL DIAGRAM | MACHINERY & PLANT | MANPOWER/ LABOUR | EQUIPMENT | DURATION |
| 7 | Opening back all the form after the concrete work. |  | | 1 Site Supervisor 2 General Labour | Crowbar Hammer | 1 days |

CHAPTER 4.0

CONCLUSION

As conclusion from this report, stair is one of the important structure in a building since it connecting one level to another level. Based on the first objective, there is a few factors need to be study which is the material used, the formwork used and also the machinery and equipment used before constructing a staircase. Firstly, the concrete grade because without the right grade of concrete the concrete might not be strong as is it should be and will give many disadvantages like cracking of concrete or even worse the concrete stair will collapse. The grade used is grade 15, grade 35 and grade 40 is very typical grade for commercial building which have a good strength and other than that the method used to determine the grade which is slump test and cube test is also the thing that can be learned. The formwork used is S-Form aluminium which is a very good choice for high rise building and it is also an easier way to form a structure. The aluminium formwork not only easier the work but it create a good quality and a smooth surface for a structure rather than using a plywood formwork which to form the structure is already difficult and takes time. The pin and joint also must be done properly to avoid any leaking of concrete while doing the concreting work. Other than that, the machinery used also is really a basic machinery in a construction so there will be no problem during the construction of the staircase. There are 8 stages of constructing a staircase which is installation of deck panel, installation of reinforce bar, installation of M&E part, installation of wall panel, installation of gun panel, installation of step panel, installation step panel, concreting work and lastly opening back of formwork. To form a good staircase must follow all the stages without skip any of it.

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