



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

STAIRCASE

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It is recommended that the report of this practical training provided

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entitled

STAIRCASE

be accepted in partial fulfillment of requirement has for obtaining 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 WCT BERHAD for duration of 20 weeks starting from 23 August 2021 and ended on 7 January 2022. It is submitted as one of the prerequisite requirements of BGN310 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

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ABSTRACT

Staircase is a one of the basic components that connect different floors in building structure. Therefore, this report will explain the detail of method construction of staircase and the problem with their solution. This report is carried out at DTC W407 site Pavillion Damansara Town Centre, Damansara Kuala Lumpur. The objective of the report is to gain knowledge and information on staircase construction method and identify the issue on staircase and the way to overcome the issue. It will focus on staircase construction flow to determine the method that are use and the problems that are faced. To illustrate the method of constructing a staircase from setting out to the finishing work that must be follow the sequence of work as per approved in method statement. It also investigates the problem that might occur in construction of staircase with the effective solution to eliminate the problem without cause any trouble that prevent future work.

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CHAPTER 1.0

INTRODUCTION

1.1 Background of Study

A stair flight is a set of steps or stairs that connects two landings. A staircase, often known as a stairwell, is a set of stairs that leads from one floor to another and contains landings, newel posts, handrails, balustrades, and other components. A stairwell is a vertically expanding compartment in a building where stairs are put. A stair hall is a set of stairs, landings, passageways, or other parts of a public hall that must be passed through to get from the ground level to the upper floors of a building. (Wikipedia, 2021)

Staircase is important in building because its help people to climb from level to level with safe environment. There many types of staircases, but the aim of the case study is to investigate the construction of U-Shaped Staircase. U shaped staircase can be defined as two parallel flights of straight stair connected by landing to give 180-degree bend. (Kueka-studio, 2021)

The advantages of U-shaped staircase are it can fit easy into architectural plan and provide some architectural interest. Their landing also provided a useful resting point. The cons in u shaped staircase are they are difficult to cast and build. (Acadiastairs, 2017)

1.2 Objectives

- i.** To Demonstrate method of staircase construction.
- ii.** To identify problem and solution of staircase.

1.3 Scope of Study

This study is carried out at Office Tower, Pavilion Damansara Trade Center site-Kuala Lumpur from 23 September 2021 until 1 December. The focus of this study is the Method of staircase construction. Throughout this report, demonstrate Method of staircase construction and identify their problem will be aim of this study. The study will be conduct in site inspection, site progress and interview. From this study, information and knowledge gain is method of staircase construction and their problem and defect with their solution.

1.4 Methods of Study

1) Observation

The observation method will be conduct on site itself which is office tower staircase DTC Site itself. Observation will be running on-site inspection with consultant and site weekly progress report. This method of study will observe the condition and requirement of staircase with the help of site coordinator and consultant.

2) Interview

Interview will be running anytime formal or informal. The people that usually involve is site coordinator, consultant and skilled workers. The interview will carry out at site, office and meeting room if having any issue and problem with staircase construction. With interview, important information such as method construction and defect can be secure.

3) Document review

This method will be conducted in office and document room with help of site coordinator and QAQC Department. Document such as RFWI form, site drawing and company profile will be reviewed to gain some information for essential of the study.

The image shows a Request for Work Inspection (RFWI) form. At the top right, it is labeled 'RFWI'. The logo 'WGT' is on the top left. The title 'REQUEST FOR WORK INSPECTION' is centered. Below the title, the project details are listed: 'CADANGAN PEMBANGUNAN YANG MELIBATKAN 9 BLOK PEJABAT, 3 BLOK PANGSAPURI, SERVIS DAN POOLRUH DI ATAS LOT 54325, JALAN DAMANKLELA, OFF LEBUHRAYA SPRINT, PUSAT BANDAR DAMANSARA, MUKIM KUALA LUMPUR, WILAYAH PERSEKUTUAN KUALA LUMPUR UNTUK TETUAN IMPIAN EKSPRESI SDN. BHD.' The form has several sections: 'To' and 'Attn' fields, an 'RIN No' field, and two date fields for inspection and commencement. The 'Description of Works' section includes 'Location: STBA OTS L9' and 'Type of Work: REQUEST FOR WORK INSPECTION OF PRIOR (BEFORE) CONCRETING WORKS AT STAIRCASE STBA OTS L9'. There is a note about the contractor's responsibility. The bottom section has two columns for signatures: 'Submitted by (Contractor's Rep)' with name 'MUHAMMAD FAH' and 'Received by (Consultant /Client's Representative)'. There are also fields for 'C.C.' (1-4) and 'Inspection Response' with checkboxes for 'Inspection passed', 'Remedial works listed below to be completed but no further inspection required', and 'Remedial works listed below to be completed and re-inspection is required.' The form ends with 'Signature' and 'Date' fields for the client representative.

Figure 1: RFWI Form

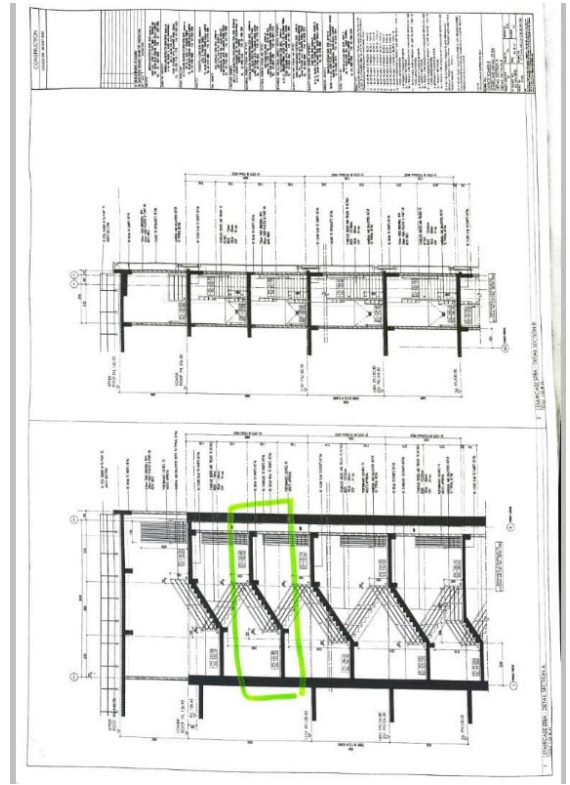
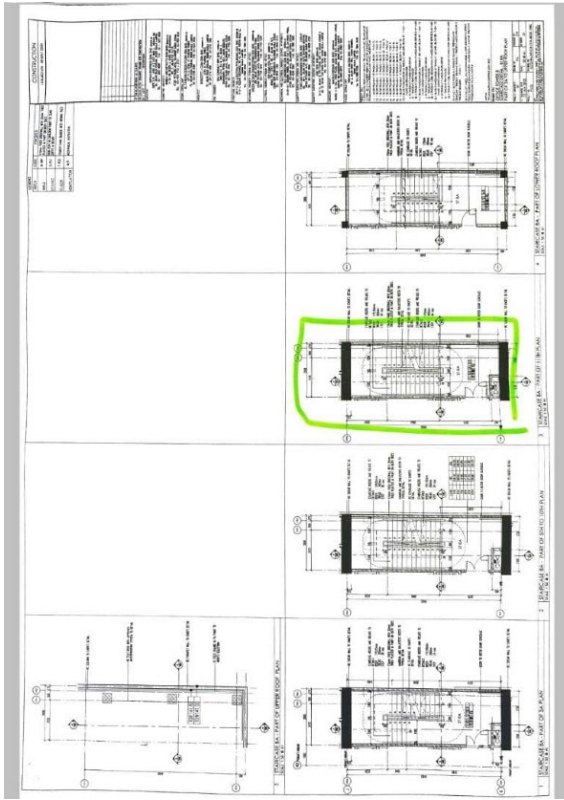


Figure 2: Staircase Drawing Detail Office Tower 8 ST8A Level 9

CHAPTER 2.0

COMPANY BACKGROUND

2.1 Introduction of Company

WCT Berhad is WCT Group's Engineering and Construction Division, which specialises in earthworks, expressway and highway construction, buildings, infrastructure-related works, and management services. WCT Berhad has completed and executed over 400 construction projects totaling about RM40 billion to date. Various local and worldwide construction projects involving F1 racing circuits, airports, dam and water supply schemes, expressways and motorways, civil works, and specialised structures such as retail malls and government administrative centres have benefited from our experience. WCT also won rail-based infrastructure contracts in 2016 and 2017, including the MRT2 and LRT3 projects.



Figure 3: WCT Berhad Logo

Source: <https://images.app.goo.gl/aAVxfdFux9V7Z7e66>

2.2 Company Profile

WCT Group established on January 14, 1981, when WCT Earthworks & Building Contractors Sdn Bhd, a small one-machine firm specializing in earthworks, was incorporated. The firm has effectively developed a larger presence and a solid reputation after many years in the market. The firm was thereafter listed on the Kuala Lumpur Stock Exchange in 1995. WCT successfully reorganized its corporate structure on July 8, 2013, under WCT Holdings Berhad, a listed investment holding company, as the firm continued to expand in popularity (WCT). WCT operates through two subsidiaries, WCT Berhad and WCT Land Sdn Bhd, under the new structure. WCT Berhad specializes in engineering and building where WCT Construction Sdn Bhd is one of its parts. WCT Land Sdn Bhd, on the other hand, specializes in property development, investment, and management. Then, WCT has grown into a global brand recognized for its dependability and skills throughout the years. WCT has become a well-known industry heavyweight due to its capacity to offer first-rate goods and services. WCT now employs over 2000 people and operates a huge fleet of equipment and gear.

2.3 Company Organisation Chart

Management Organization Chart (Headquarter)

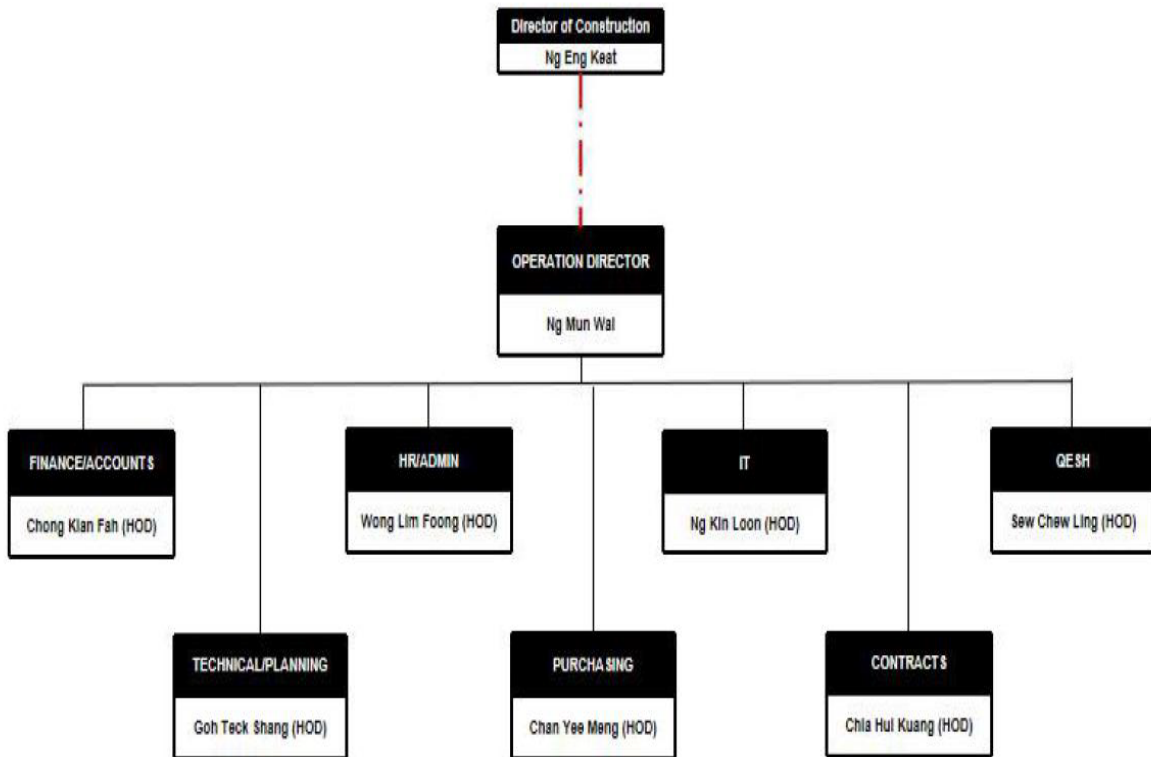


Figure 4: WCT Headquarter Organization Chart

Management Organization Chart (DTC Site W411)

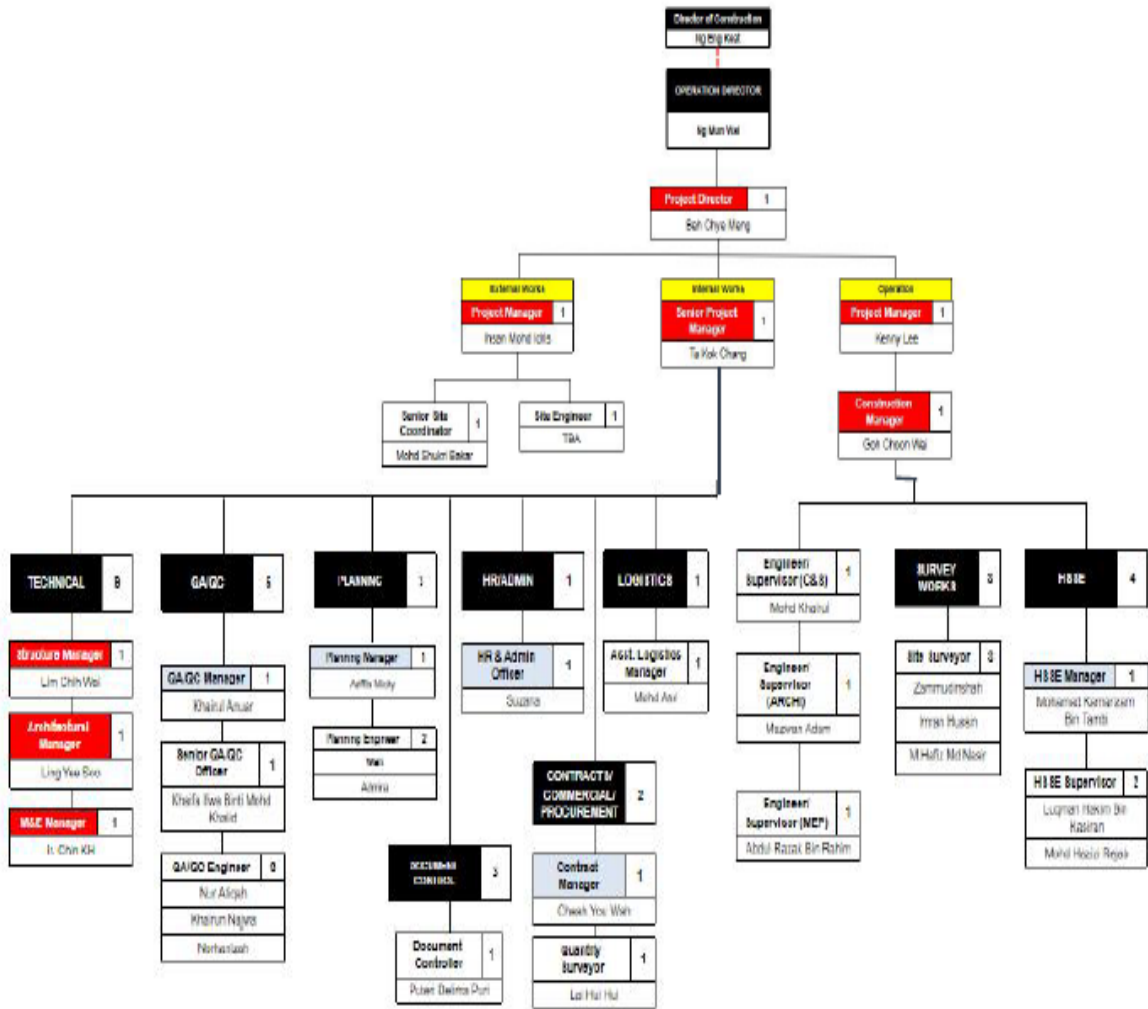


Figure 5 : DTC Site W411 Chart Organization

2.4 List of Projects

2.4.1 Completed Projects

No.	Project Title	Project Value	Start Date	Completion Date	Project Duration	Client
1	Mytown Shopping Centre, Jalan Cochrane, Kuala Lumpur	RM700 million	2014	16 February 2017	3 Years	Boustead SDN BHD
2	Sepang International Circuit, Selangor, Malaysia	RM308 million	1 November 1997	7 March 1999	3 Years	Sepang international Circuit SDN BHD
3	Kota Kinabalu International Airport Sabah, Malaysia	RM704 million	Mid 2008	4 March 2010	2 Years	Malaysia Government

Table 1: Finished Project

2.4.1- Project in Progress

No.	Project Title	Project Value	Start Date	Client
1	Pavillion Damansara Trade Center site- DTC W407, Damansara, Selangor	RM2 Billion	2018	Pavillion
2	LRT3 (TD1, GS02 & GS03) Bandar Utama to Johan Setia, Malaysia	RM1.7 Billion	2017	Prasarana Malaysia Berhad
3	MRT2 (V204 & S204) Bandar Malaysia South Portal to Kampung Muhibbah, Malaysia	RM972 million	November 2016 and September 2017,	Mass Rapid Transit Corporation Sdn Bhd

Table 2: Project on Progress

CHAPTER 3.0

CASE STUDY

3.1 Introduction to Case Study

This project is known as Pavilion Damansara Height (PDH). Pavilion Damansara Height is located within the luxury enclave of Damansara Height with specific location of Pavilion, Lot 480023, Jalan Beringin, Bukit Damansara, 50490 Kuala Lumpur, Wilayah Persekutuan Kuala Lumpur. Previously this project was given to China Construction Yangtze River (CS3) however when our country are fighting against Covid-19 Pandemic all the Chinese worker were send back to China and affected the project progress because of lack of worker has result to changes of contractor. Hence, PDH project has been given to WCT and directed by Mr. Beh Chye Meng for Architectural, super structure and sub structure whereas Mr. Ihlsan for Infrastructure. This projected costed about 2 billion and expected to be completed in 2022.



Figure 6: Pavillion Damansara Height Illustration

Source: <https://images.app.goo.gl/vBPhZTuiJn6TnUtK7>

Pavilion Damansara Height (PDH) are also known as DTC Project currently are divide into 2 phases with a specific code which is W407 for Phase 1 and W411 for Phase 2. This project implies execution and completion of sub-structure and super-structure which consist this item for phase 1:

- i. 8 levels of basement parking lot.
- ii. 7 levels of podium retail form level Lower Ground to Level 3A.
- iii. 9 Blocks of Office Tower.
- iv. 3 Blocks of Residential Tower
- v. External Infrastructural works such as drainage and road.
- vi. Facade Construction.
- vii. Landscape work
- viii. Architectural work
- ix. Mechanical, Electrical and Plumbing (MEP) Work.

For Phase 2 the different only can be seen at the number of office tower and residential block:

- x. 2 blocks of residential tower
- xi. 1 block of office tower
- xii. 9 level of podium from Ground level to Level 6

As assigned in office tower, staircase is commonly seen in there which is U-shaped type staircase. In architectural department, there are many works that involve staircase such as formwork, concrete casting, brickwork, plastering, railing, screeding, skimming and especially inspection. While being tasked in architect team, many knowledge about staircase gained. Focusing on method on constructing staircase, the case study will take investigate on how staircase is built, inspect and finishing. This case study also will investigate the problem of staircase such as defect, obstacle and outstanding work with their solution to solve the problem.

3.2 Staircase Construction Method

Staircase construction started with staircase setting out. Setting out is the process of transferring the architectural plans into the ground and it determine the location of staircase boundaries, centre line and structural part. It also determine the proper angle and level of the structure and staircase correct extent. Using Gridline in Architectural drawing as reference and measuring tape is the way Setting out is done. After that, there will be Inspection Attend by main contractor, sub-contractor and consultant to confirmed the measure on the ground before proceed into formwork. After the inspection, the workers began to install the formwork of the staircase. Formwork is a term that refer to temporary or permanent molds or other similar material. In context of concrete work, the falsework supports the shuttering mould. The mould in formwork is built up with steel, woods, and fabricated form.



Figure 7: Formwork Installation

When the installation of formwork is done, the process of staircase is proceeds to installation of reinforcement bar. Reinforcement bar or rebar is steel bar that functioning to increase staircase the tensile strength of the concrete to prevent cracking and breaking. Size, quantity and spacing between rebar are correct when install them. Also, rebars are installed in correct position and clean and acceptable condition. Covers, anchorage, lapsand links are correct. After Installation of rebar is done, M&E will proceed to install their stuff such as pipe and wiring. M&E can be

defined as the mechanical and electrical system installed. Then there will be another layer of reinforcement bar install. Before proceeding further, there will be inspection involving M&E department for M&E item installation and C&S department for structure and reinforcement bar inspection. The inspection is carried out to avoid any error and miss alignment that may cause the staircase get NCR in future. Non conformity report or NCR is a construction document that discusses deviations from specifications or work that does not meet the quality requirement. After all inspection is done, the construction will be hand over to architect department for proceed to install the staircase step formwork. According to architectural plan, the riser will be 170mm and tread will be 260 mm while the step will be 40 nos. Riser can be known as vertical surface of stair while tread is the horizontal of the stair and the part of the stair you step on.



Figure 8: Rebar Installation



Figure 9: M&E Item Installation

After the installation finished, the inspection of overall of the staircase formwork will be conducted by main contractor and consultant also sub-contractor. The inspection is carried out to check the circumstances of the staircase. The formwork must be erected with correct dimension as per drawing and formwork has aligned and leveled correctly strutted and rigid. All ties, props, fittings and other components are secured. Also, surface of the formwork is already housekeeping, cleaned and has no deformation. Gaps between formwork panels are sealed off and area to receive concrete is cleaned and free from slurry/ laitance. Then mould oil is applied and concreting level marked. After the inspection meets the requirement, the consultant will approve and signed the inspection form which is called RFWI. RFWI or Request for Work Inspection form is a form where the main contractor or the sub con submit to consultant before inspection is carried out. The RFWI is a mandatory form that must be done to proceed inspection. Without RFWI and inspection the work also will get NCR that may cause to redo the work.

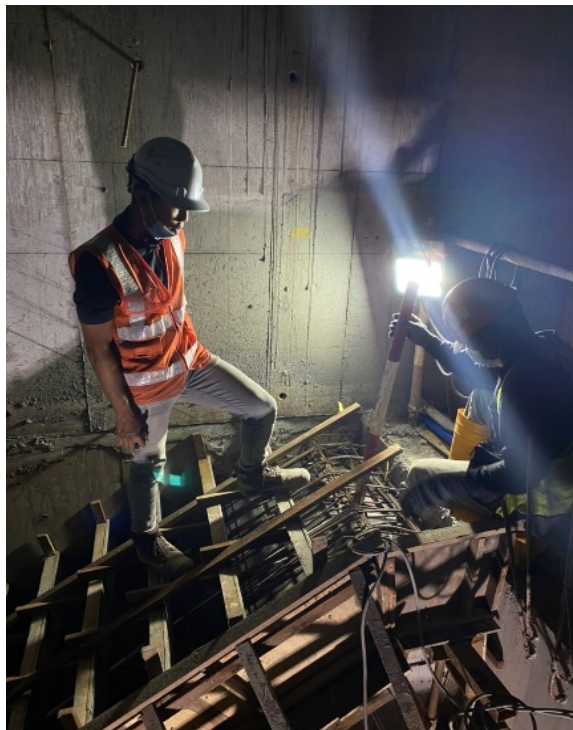


Figure 10: Overall Formwork Inspection

After the inspection is approved by consultant. The work is continued to concreting work. Concrete delivered in correct grade and as per approved design mix. Concrete grade that are used to cast in staircase is 30,40. Slump test is carried out to measure the consistency of the concrete before it cast into the staircase formwork. Slump test also can be indicator of an improperly mixed batch. Slump of each batch in within tolerance. The concrete is placed as per approve method. After that, the vibration and compaction carried out to eliminated internal friction between aggregate particles. The process of vibration and compaction doesn't take too long or else the concrete will get segregation. Segregation in concrete is a type of particle segregation in concrete applications, in which particulate materials tend to separate due to differences in particles size, density and form. After the casted concrete is dry, the curing compound is applied to as per specified avoid the concrete crack because of heat. Curing compound is a essential toward concrete making for the hydration of the cement. The compound is sprayed after 45 minutes concrete casted. This compound helps to prevent the concrete from the loss of their moisture content. Lastly, the concrete finish level according to drawing and not overcasted. After that, there will be another inspection for the casted concrete to check the condition of the concrete. When the inspection is done and approve by consultant, the formwork is ready to dismantle 1 week after inspection.



Figure 11: Casted Concrete Formwork

After 1 week, the formwork is dismantled for proceeding into brickwork. The setting out is carried out to transfer the drawing into the ground. After the setting out is done, the work proceeds into inspection and begin to laying bricks. The brick material is common brick wall material and the compress strength of clay brick is less than 20 N/mm based on B.S3921. Brickwork is constructed in accordance to B.S5628. After laying brick, the work continues with laying tie rod. Bonding tie/ bar is using two pieces of 350mm long and 6mm diameter bar, one end bend and cast or plant into concrete and other end built into joint of brick wall not exceeding 600mm centre. For bonding bricks, it used 1:3 cement sand mix of cement mortar mix and the thickness of mortar is around 10mm. After that, lintel and stiffener installed. Then, the brick is cleared for plastering work.



Figure 12: Brick Installation

Plastering work is the process of covering the rough and uneven surfaces or walls with plaster. Plaster is a mixture of lime or cement concrete and sand with a specific quantity amount of water. Before start the plastering work, level is installed to determine the level of plaster. Level peg is the makers for plaster thickness and provision at min. 1200mm interval horizontally and vertically that ensure highest level peg is above ceiling level. The brick is wetted one day before the plastering work begin. During plastering work, the first coat of plaster is applied on areas that

have greater deviation from the intended finish surface. For the interface between brick wall, provide reinforcement as form exmet to prevent cracking. The surface required thickness and consistency is monitored by the 1200mm level peg. After the completion of first coat, the adhesion of plaster is checked for any hollow sound. After that, the finishing coat of plaster is applied at whole area to finish to the plane and shape required then level smoothly using wooden trowel. After the vertical and horizontal of plastering joint is checked and ensure they are straight, place is cleared and ready for skim coat work.



Figure 13: Plastering Work



Figure 14: Level Peg Work

The work is continued with skim work which is applied to make the surface smooth. Skim have 2 coat which is base coat and finish coat. Before starting skimming, wall is ensured that have excess irregularity on surface. Also, the loose particles, foreign material are removed and the substrate are clean form dust and oil. Then, the base coat is applied to the wall surface with the thickness of 2-5mm. After the base coat is thumb dry, the finish coat is applied approximately 2mm over the base coat and trowel it smoothly. When skim work is done, the surface is secured even, have no hole, free from trowel mark, tears and blisters. The edges of wall aligned and consistent also straight.

Lastly the work is proceeds in to screeding and railing. The railing work began with cleaning the installation area and marking the bolt position. Then, the bolt is installed. After that, the erection of railing and hand railing is conducted. All the wielding work is caried out under supervision of wielding. After work of installation or erection is done, they proceed to inspection of staircase railing before starting screeding work. Screeding work will carry out when railing work and inspection is

done. Screeding work is the work of flattening poured concrete into a smooth, flat layer prior to finishing the surfaces. Before laying screeds, the mechanical and electrical services under screed already completed, inspect, approved, and protected. Also, the post-concreting inspection is already approved by consultant. The level peg is already been casted and their height is already even and inspected. For staircase, variance of tread and riser is not more than 5mm. When screeding work is conducted the surface evenness is not more than 3mm per 1.2m run. Step nosing is installed along with screeding work. After finishing the screeding, workers will ensure no hollowness sound detect, no excessive trowelling surface and rough or patchy surface also free from laitance and stain. After that the staircase is will be inspected for any outstanding work or any defect and problem before hand-over the job into painting work for finishing.



Figure 15: Screeding work And Curing Compound



Figure 16: Railing Installation

3.3 Staircase Problem And Their Solution

In staircase construction, there also problem that site coordinator was faced that may cause delay of next work. To avoid the delay, site coordinator need to solve the problem with effective solution so the next work can be done smoothly without any issue. As example, when the plastering work is done and proceed to skimming the staircase but there are some problems such as outstanding work, areas are not housekeeping and defect that may difficult the skimming work from proceed. So, site coordinator will arrange the sequence of work and find the solution to settle the problem. The problem can be found through inspection, update progress and site walk.

The first problem is the level of landing not same as specification to continue the screeding work. This happen when the casting concrete is not following the RL Level. These may cause the screeding work not even and the landing is short. To fix this problem, the height level peg screed will be adjust their level to make it even. This method only can be used when the landing to screed surface height is not more than 20 mm. If the height is exceeding 20 mm, the screeding work cannot continue because it will make the finishing level not even also the railing cannot get the requirement height which is 1000mm because of the adjusted level peg height.



Figure 17: Inspection Staircase Level

Moreover, another problem is the step height is not even to proceed the screeding and install nosing. When the step height is not even, the staircase cannot be screed because it not comply with staircase criteria because it is no safe to use for people. This problem happened when the concreting work of staircase is not cast properly that cause the riser of the step is not even. To solve this problem, site coordinator will arrange the hacking work of the staircase step to fix the uneven riser. Hacking work is a process of partial removing the concrete stone or brick wall, synonymously chipping or indenting the concrete surface. After the uneven step has been hack, the staircase is ready to be screed and the nosing is approved to be install.



Figure 18: Inspection Staircase

Furthermore, problem that can be witness is defect on concrete of staircase such as honeycomb. Honeycomb can be defined as a rough, pitted surface in concrete created by insufficient filling of concrete against formwork, which is caused by using overly stiff of concrete or failing to vibrate it properly after it has been poured. This can cause the structure of the staircase not safe and might fall cause of hollow space and cavities left in concrete. To fix the honeycomb defect, hacking work can be conducted with hack all the loose concrete until solid concrete is achieved. Then, washed all the concrete leftover with water to ensure perfect bonding between the concrete and repair material.



Figure 19: Hacking Work For Honeycomb Defect

CHAPTER 4.0

CONCLUSION

To summarize all what have been write, the staircase is an important essential part in building. Its help people to climb the building with safe circumstance and comfortable. Staircase also playing a big part on structure of the building itself. Constructing a staircase is not easy and need to comply with the specification of staircase in order the staircase can be used properly and safe. The Some problem might been encounter when construct a staircase.

The method of staircase construction is typically used in the site which is started with formwork, concreting work and finishing work that contains brick work, plaster and skimming, railing and screeding. The U-shaped staircase is the type of staircase that construct here as per client wish. The structure, finishing and safety must me ensure and considerate to avoid any bad situation in future. Therefore, all works of staircase need to be monitored and inspected before approved and hand over the works.

Moreover, construction is not perfect therefore there is always problem and issue that faced and witnessed. Constructing staircase also have their own problem such as defect, wrong sequence installation and outstanding work. Therefore, as a site coordinator, they are assigned to solve the problem immediately to ensure that any work after can be done smoothly and not delayed. Problem in construction can be solved with many methods in any circumstance as long as its not disturb or prevent another construction.

Lastly, staircase is an important element in the building. It helps people to climb and going down from level to level in the building. Different type of staircase has different method of constructing according to their characteristics. Its is important to construct a staircase properly to avoid problem.

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