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WATERPROOFING PROCESS OF SWIMMING POOL

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**PRACTICAL TRAINING REPORT
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CHAPTER

1

(INTRODUCTION)

1.1 INTRODUCTION

Practical Training refers to work experience that is relevant to professional development prior to graduation. One of the requirements for the students of Diploma in Building Surveying to complete the program is the students must complete at least 14 weeks of Practical Training. It started on 1st December 2016 until 31th March 2017. During the four months of practical training at Zikay Group Sdn. Bhd, Kampung Baru, Kuala Lumpur, have learned how theory and practical can be combined together in useful ways and how remarkable and enjoyable practical training could be. While deadlines and skills are highly demanded, creativity is not limited and true innovation occurs throughout my practical training at Kembang Serantau Sdn Bhd. As a result, more knowledge can gained and learned new things and most importantly had experienced the real working environment all by myself. In term of relationship, feel was lucky enough to work with a group of enthusiastic and communicative people, who for whatever reason willing to share their knowledge and experience of what they are doing. Besides, the atmosphere at Kembang Serantau is unique and hope that it will stays that way. The experience gained has been an eye opening to me and thoroughly recommend other students to do their industrial training at here to enable them to have the same experience as at Kembang Serantau Sdn Bhd.

1.2 OVERVIEW

The practical training takes 4 month to complete the study taking the diploma as a Building Surveyor. Honestly, within 4 months the practical training that have been faced, there are many subject that can be learn out of the subject have been teach by our lecture in class. Almost every department had pursued and there is much knowledge has learned. Next, also had joined many units to do the maintenance works and Construction work.

There are many type of maintenance and construction work have done while in Kembang Serantau team in Mercu Zikay as maintained the facilities in the building when the problem occur. A part of this, renovation works also give a new and different knowledge about construction works compare to new building than want to be construct. This high rise building in Mercu Zikay, Kampung Baru contains parking lot from level 1 until level 12, and followed by hotels and apartments until level 40. At the roof top of the building, there is helipad provided.

Thoroughly, this practical training has given more imputes about the maintenance work especially during construction works in a large and high rise building which are too different if compare with small building such as house.

1.3 OBJECTIVE OF PRACTICAL TRAINING

The objective of the practical training is one slot in the university education system, particularly in the fields of building surveying course before allows a student to be awarded a diploma in their respective fields. The training will enable students to achieve real direction of training.

Objectives that can be achieve are such as to learn on process of waterproofing based on how their installer to the swimming pool at construction site where it is more easier to understand than learning on class that based on book compare to experience by self at construction site. Next, it is also for apply the experience gained in the practical training for future learning in the university. Promote teamwork spirit also can be gained during cooperation in solving problems that occur.

Last but not least, establish university-industry collaborations and produce a proper technical report such as process of waterproofing for swimming pool are related to the practical training.

1.4 SCOPE OF WORK

Zikay Group Sdn Bhd has been started as a company that involve in landscaping for the first and until now become a large company with its own name which is construction work is their core business now. In this company, there have a lot of department such as Human Resource, Headquarters, Accounts and Construction. As an internship student that under Building Surveyor course, construction site has been choose for this 4 months.

- Day to day follow the progress of waterproofing process.
- Checking the sequence of waterproofing process.
- Administration and office works.
- Make an inspection to the claim of the payment work for the contractor.
- Checking work done such as thickness (drop) for bath room, toilet and shower, tiling, waterproofing, door frame for fabrication, window frame and finishes.
- Explore on structure works.

With a lot of experienced that gained from Kembang Serantau team, waterproofing process of swimming pool has been chosen as case study for this report.

1.5 METHODOLOGY OF REPORT

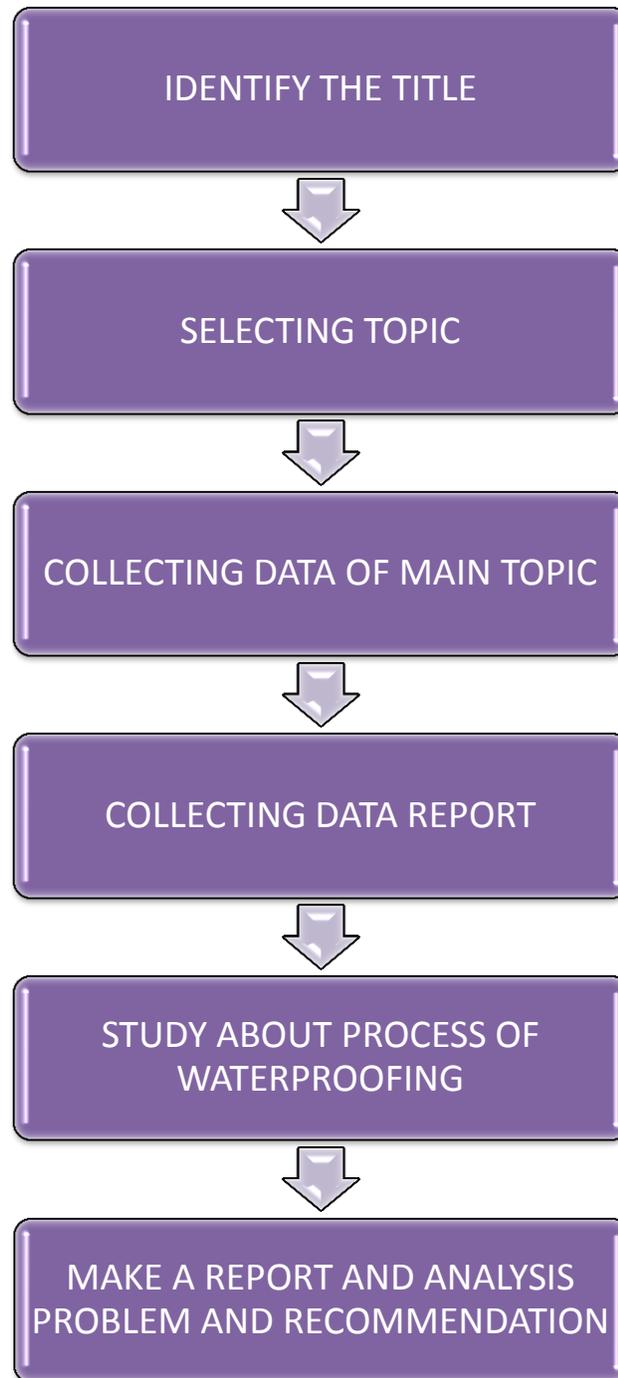


Chart 1.1 Methodology of Report

1.6 COMPANY BACKGROUND



Zikay Group was built-in in 1995 subsequent the establishment of Kembang Serantau Sdn Bhd which was team in 1991. Stemming from a modest landscape contracting outfit providing services to Property developers, the Group has involved into a advantageously diversified organization with a cumulative paid-up capital of in the region of RM53 million.

Presently, the Group has established a sizeable number of subsidiaries that holds together its business associates, and combines its joint venture company's right under its wings, with property development as its core business. In tandem with its business growth, the Group's transitional journey has seen its workforce from a two-man operation to its existing recruitment of 600 staff strength ranging from professionals, skilled and experienced technical staff to the dedicated, hardworking and responsible labour force.

Most business operations are centralized from the headquarters and channelled from Zikay Centre situated in the heart of Kuala Lumpur. As customer satisfaction continues to be axiom of Zikay Group's service priority, it endeavours

to maintain itself as the customer's preferences in providing comfortable and quality living environment, products and services at affordable prices.

Today, the Group has formed several synergistic divisions ranging from property development, construction, information & communication technology, agriculture, security services, real estates, food and beverages, international ventures and education services.

1.7 LOCATION PLAN

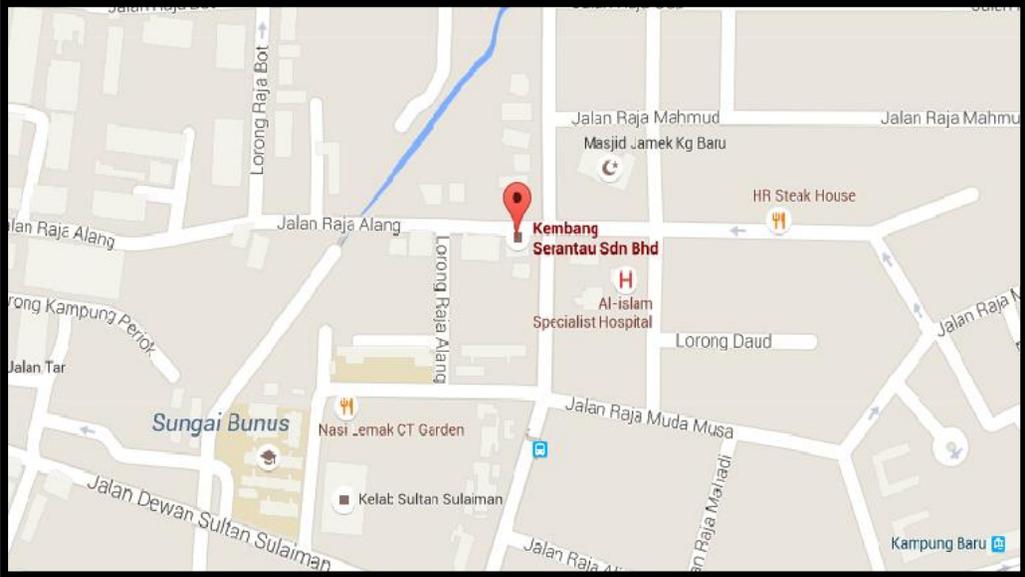


Figure 1.1 Key Pelan of Zikay Group Sdn. Bhd

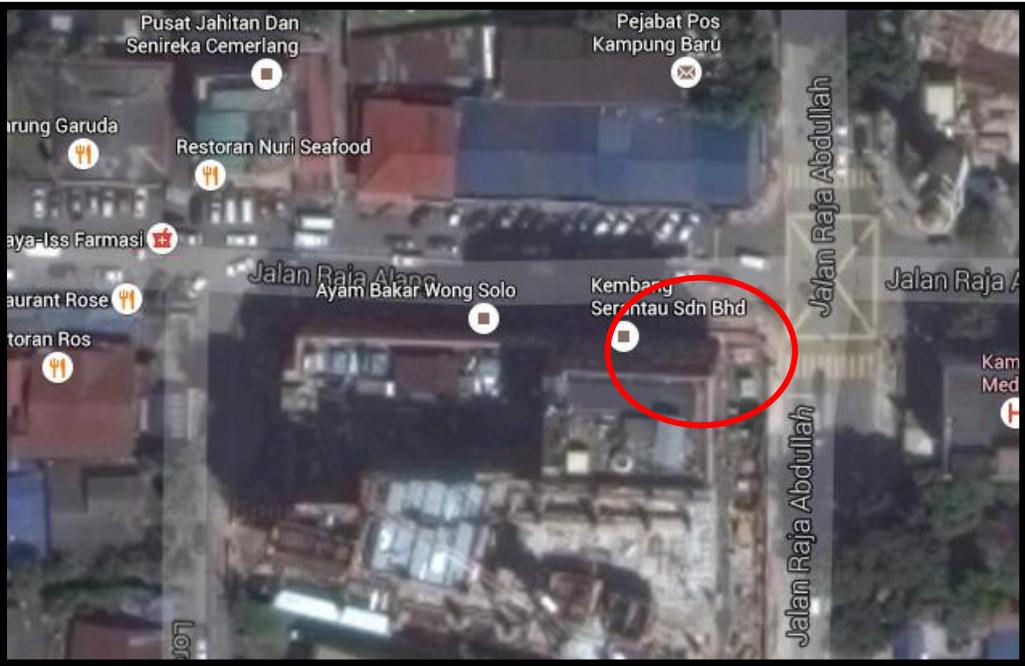


Figure 1.2 Site Pelan of Zikay Group Sdn Bhd



Figure 1.3 Front View



Figure1.4 Right View



Figure 1.5 Rear View



Figure 1.6 Left View

1.8 MISSION, VISSION, TAGLINE AND CORE VALUE

1.8.1 MISSION

Dedicated to providing construction solution in delivery of quality construction, technical and management services to our customers. We will strive to implement a long term relationship with our clients, based on Safety, Quality, Performance and an anticipation of their needs. To help fulfil this mission, we will treat all employees fairly and involve them in the quality improvement process to ensure responsiveness and cost effective work execution.

1.8.2 VISION

Trusted Construction Company in delivery of safety, quality and performance.

1.8.3 TAGLINE

The tagline for this company is building value together.

1.8.4 CORE VALUE

Core value that adapt at this company is teamwork, respect, professionalism and integrity

1.9 QUALITY POLICY AND QUALITY OBJECTIVE

1.9.1 QUALITY POLICY OF KEMBANG SERANTAU SDN BHD (KSSB)

“We are committed to providing building and civil engineering construction services that comply with customer as well as statutory requirements at all times through continual improvement of our quality management system”

1.9.2 QUALITY OBJECTIVE

In order to fulfil the quality policy, KEMBANG SERANTAU SDN BHD has established quality objectives as follow:

1. All product and services are delivered within the contract period – On Time Delivery.
2. All products and services are in compliance with specifications – Towards Zero Defects.
3. All product and services are implemented within the budget.

1.10 ORGANIZATION CHART OF ZIKAY CONSTRUCTION SDN BHD

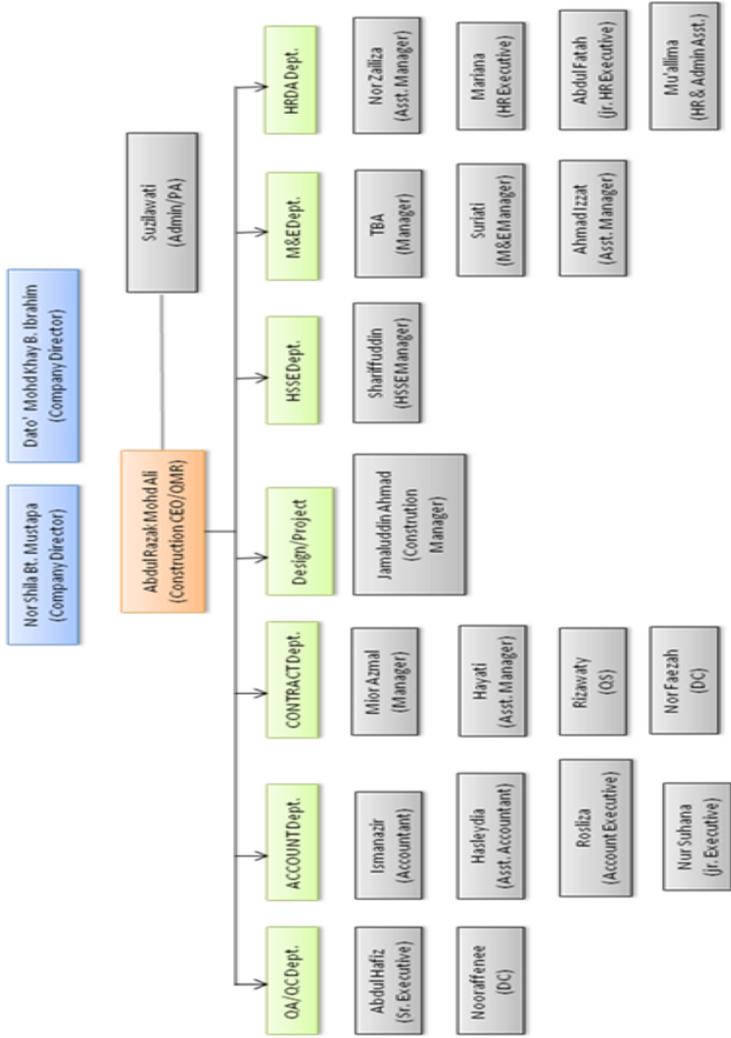


Chart 1.2 Organization chart

1.11 LIST OF PROJECT

1.11.1 COMPLETED DEVELOPMENTS FOR THE PAST 10 YEARS

NO	NAME OF DEVELOPMENT	LOCATION	COMPLETION DATE	GROSS DEVELOPMENT VALUE (RM)
1	TAMAN SUBANG IMPIAN (APARTMENT) Cadangan membina 5 Blok Rumah Pangsa Kos Sederhana 400 Unit, 1 Unit Pusat Komuniti, 1 Unit Tadika, 1 Unit Surau, 1 Unit dobi dan 1 Unit Pejabat Di Atas Premis 1, Selangor Darul Ehsan Untuk Tetuan Pimpin Manis Sdn Bhd.	Subang	2007	55,000,000.00
2	TAMAN SUBANG IMPIAN (TERRACE) Cadangan Kerja-kerja Luar BAgi 48 Unit Rumas Teres 2 Tingkat (20'x70) Fasa 3, Shah Alam, Selangor Darul Ehsan Untuk Tetuan Zikay Development Sdn Bhd.	Subang	2007	11,572,914.00

NO	NAME OF DEVELOPMENT	LOCATION	COMPLETION DATE	GROSS DEVELOPMENT VALUE (RM)
3	SEKSYEN 3, BANDAR BARU BANGI Cadangan Pembinaan PERumahan Bandar Baru Bangi Untuk Tetuan Tuah Tetangga Sdn Bhd.	Bandar Baru Bangi	2004	66,000,000.00
4	SHAH ALAM SEKSYEN 13 Cadangan Pembinaan Pembangunan Yang Mengandungi 34 Unit Institut 4 Tingkat dan 17 Unit Kedai Pejabat 4 Tingkat Terdiri Dari 4 Blok 1(A), Blok 2 (B), Blok 1 (C) Dan Sebuah Pencawang Elektrik.	Rawang	2008	190,000,000.00
5	TAMAN TASIK BIRU, RAWANG (Apartment) Cadangan membina 15 blok rumah pangsa kos sederhana rendah di fasa (2A)	Rawang	2010	21,849,000.00

NO	NAME OF DEVELOPMENT	LOCATION	COMPLETION DATE	GROSS DEVELOPMENT VALUE (RM)
6	44 UNIT DOUBLE STOREY TERRACE TAMAN TASIK BIRU, RAWANG.	Rawang	2013	11,579,866.05
7	SG SIREH KLANG (Residential) Cadangan Pembangunan Perumahan 144 Unit Rumah Teres Kos Rendah 1 Tingkat, 134 Unit	Klang	2000	21,000,000.00
8	(Residential) Cadangan Pembangunan Perumahan Fasa 1, Fasa 2, Fasa 3A diatas Sebahagian Seksyen 3 Tambahan Bandar Baru Bangi, Mukim Kajang, Daerah Hulu Langat Selangor, Darul Ehsan.	Bangi	2014	191,236,781.00

Table 1.1 Completed Developments for The Past 10 years

NO	NAME OF DEVELOPMENT	LOCATION	TARGET COMPLETION DATE	GROSS DEVELOPMENT VALUE (RM)
1	RADIANCE BY ZIKAY KG BARU (SERVICE SUITES & HOTEL)	Kg Baru, KL	APRIL 2016	129,280,100.00
2	SPNB KUNDANG- LAGUNA BIRU FASA 2	Kuang	JUN 2017	174,595,000.00
3	SPNM KUNDANG- LAGUNA BIRU FASA 3 (TERRACE, PUSAT PERNIAGAAN)	Kuang	Dec 2018	100,000,000.00
4	PASIR GUDANG, TAMAN SEROJA, JOHOR. (TERRACE SEMI-D BANGALOW)	Pasir Gudang, Johor	2019	TO BE ADVICE
5	JENGKA PHASE 1 (TERRACE)	Jengka, Pahang	1 SEP 2015	36,894,322.00
6	RADIANCE BY ZIKAY GURNEY	Kuala Lumpur	FEB 2018	259,000,000.00
7	RADIANCE BY ZIKAY CHENANG, LANGKAWI (RESTORAN ANTARABANGSA)	Langkawi	2018	320,000,000.00

Table 1.2 On going development

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION TO SWIMMING POOLS

Swimming Pool or Pool means an artificial basin, chamber or tank used, or intended to be used, for public swimming, diving, or recreative bathing, but does not include baths where the main purpose is the cleaning of the body, nor individual therapeutic tub. Swimming pools come in all shapes and sizes, but nearly all of them, from the backyard personal pool to the water park wave pool, work in the same basic way. Conceptually, swimming pools are pretty simple they're just big basins of water. But on a hot summer day, a swimming pool can seem like the greatest invention known to man.

A “swimming pool” is any outdoor enclosure located at a private residence (a) designed, intended, or used for the containment of water, whether construction below ground level or above ground level, (b) having a surface area of one hundred (100) square feet or more and a depth of eighteen (18) inches or more, and (c) which is designed, intended, or used for swimming, wading, or other recreational use by the owner or tenant of the property upon which the pool is constructed, or by their family or invited guests without payment of a fee.

2.2INTRODUCTION TO WATERPROOFING

2.2.1 WHAT IS WATERPROOFING

“Water insulation” is the type of insulation used against the negative impact of water or moisture on materials such as wood, metal, rock, brick, etc. in order to prevent damage caused by water or humidity in the Parts of the structure or in whole, and to ensure long lasting, healthy, convenient and secure structures.

2.3 CONSTRUCTION METHOD FOR SWIMMING POOLS

In construction field, there are a lot of methods that can be used. There is some flow chart for construction method of swimming pool;

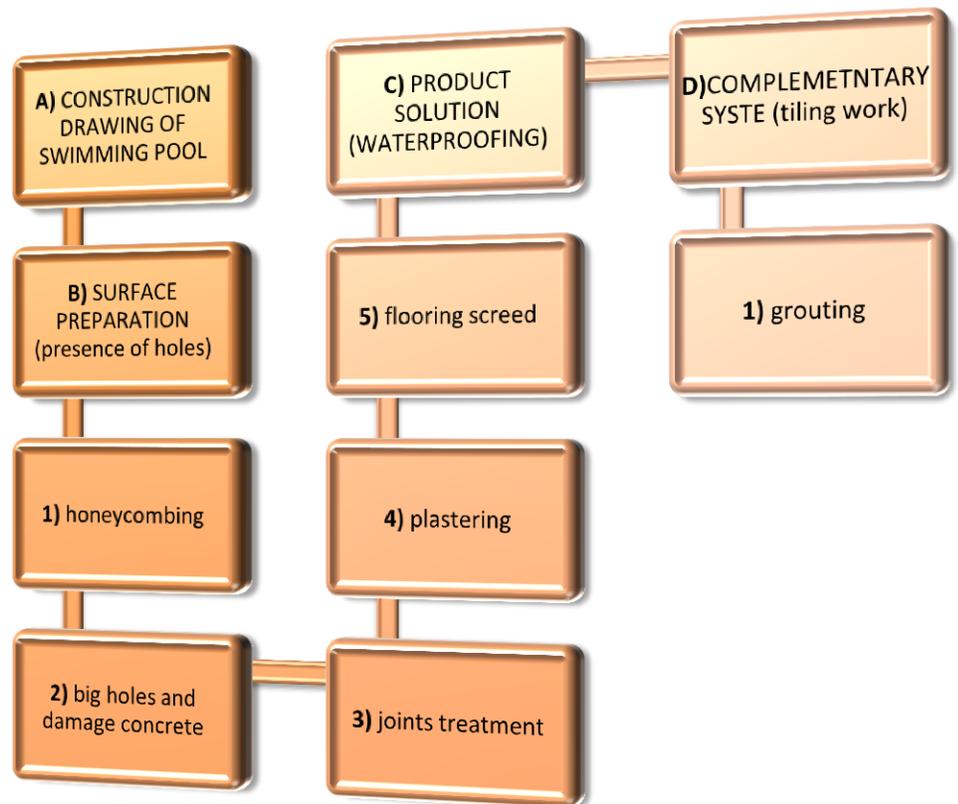


Chart 2.1 Method of Construction of swimming pool

2.3.1 CONSTRUCTION DRAWING

Construction drawing is the part of the contract documents that gives a graphic symbol of the work to be done in the construction of a project. The main purpose of construction drawings that also called plans, blueprints, or working drawings is to show what to be built, while the specifications focus on the materials, installation techniques, and quality standards. Yet, the difference is not clear cut. Most designers put basic construction information in the drawings and use the specs to elaborate on materials, techniques, and standards to be met.

2.3.2 SUBSTRATE PREPARATION

The cement base products are ideal for this application. The concrete is to be treated before fixing the tiles and the following steps are to be considered:

PREPARATION OF THE SURFACE

Remove dust, oil and any remainders by using grinders and fresh water only; all substrate must be sound and clean.

1) PRESENCE OF HOLES



Figure 2.2 Presence of holes

Mostly in newly built swimming pools, holes will appear caused by molding or else; such holes must be cleaned and damped. Use the plugging mortar weber.dry 150 BLC and keep it moist for a period of 15 min. If any cracks are present, they can be treated the same way.

2) HONEYCOMBING



Figure 2.3 Honeycombing

In some newly built swimming pools, honeycombing may be found occurred by concrete pouring or pumping. Honeycombing areas must be cleaned by removing all damaged concrete and existing laitance and the damp the concerned areas with water and use weber.rep 331 TX for filling Honeycombing area and the cracks if any.

3) BIG HOLES AND DAMAGED CONCRETE



Figure 2.4 Big holes and damaged concrete

In the case of big holes or damaged concrete in old or new swimming pools, all damaged areas must be chiseled, cleaned and damped with fresh water. Weber.rep 331 TX is to be applied in one or two layers depending to depth of holes.

4) JOINTS TREATMENT



Figure 2.5 Joints treatment

All joints between vertical walls and ground must be treated by creating a groove of 2 cm deep and 2 cm wide and reconstitue on the 90° corner an angle curve form in an appropriate thickness with a non-shrink thixotropic mortar like weber.rep 331 TX , at least 3 days before the application of webe.dry 110 FX. In case it is impossible to have a curve form, open a groove of 2x2 or 3x3 cm , clean it and damp it with fresh water before filling it with weber.dry 150 BLC.

5) PLASTERING



Figure 2.6 Plastering

The substrate of the concrete walls must be aligned in order to have the tiles fixed therefore plastering work is to be applied after repairing work. Apply one coat of weber.premix key coat on thickness of 2 to 6 mm manually or by using a Tyrolienne spraying device.

For a better curing, keep spraying water twice a day. After 3 days of the curing process, apply one single layer of weber.premix fiber. Thickness can reach 15 mm and carry additional 3 days of curing. In case more thickness is required to achieve the alignment, then scratch the finishing coat and apply another one following the previous steps.

6) FLOORING SCREED



Figure 2.6 Flooring Screed

The concrete floor has to be aligned as well, by using floor screed weber.floor 600 SCR. Mix 50 kg of weber.floor 600 SCR with 5.5 liters of fresh water and pour the mixed product onto the floor and spread it with a steel trowel for a thickness up to 50 mm. Control joints in the existing substrate should be respected. For large areas, joints should be created every 25 m². Avoid fast drying in case of hot temperature or wind by regular curing process.

2.3.3 PRODUCT SOLUTION

1) WATERPROOFING



Figure 2.7 Waterproofing

After assuring that all the above steps have been maintained, the water tank is ready to receive the final product in the cement waterproofing system, weber.dry 110FX - the flexible high performance product is to be used in 3 layers:

- 1st layer with sufficient thickness 0.5kg/m^2 :
 - Use a brush or a roller.
 - Fix 20 cm width of fiber mesh on all corners, joints and cracks while the waterproofing layer is still wet.
- When dry, apply the 2nd and 3rd layer in proportions of $0.5\text{-}1\text{ kg/m}^2$

It is recommended that the tiling start one week from the application of weber.dry 110 FX. When needed flood test on weber.dry 110 FX can be carried out prior tiles fixing. Allow one week curing before flood test.

2.3.4 COMPLEMENTARY SYSTEM

1) TILING



Figure 2.8 Tiling

Walls and floor of the swimming pool are ready to receive the final step of this system. The tiles are to be fixed by using weber.col flex as follows:

- Mix the two components of weber.col flex by pouring the powder in the liquid progressively while stirring the liquid. An electric mixer with low rotation speed (< 300 rpm) can be used. Mix until a uniform lump free paste is obtained.
- Apply weber.col flex evenly on the substrate. Use a notched trowel to have the required thickness. Apply the tiles on the substrate and press them firmly, while making sure that the paste does not slip from the tile sides. weber.col flex can also be applied on the back of tiles to ensure full adhesion on the entire surface.

2) GROUTING



Figure 2.9 Grouting

After the fixation of tiles, all the area must be cleaned with fresh water and kept untouched for 24 hours in order to allow the tiling to be set, then all the tiles joints should be filled with weber.epox easy or weber.joint perfect. Apply weber.epox easy or weber.joint perfect with a rubber spatula into the joints by filling all the gaps. Remove surplus grout with a damp sponge. Use the product within its pot life,after mixing. When the grout is dry, clean the tiles with a dry cloth

2.4 METHOD OF WATERPROOFING COMMONLY USED IN CONSTRUCTION

2.4.1 CEMENTITIOUS WATERPROOFING



Figure 2.10 Cementitious waterproofing

Cementitious waterproofing is the easiest method of waterproofing in construction. The materials for cementitious waterproofing are easily available from suppliers of masonry products, and they're easy to mix and apply. This method is often used in the internal wet areas such as toilets. This method is usually a rigid or semi-flexible type waterproofing, but since it is used in internal areas such as toilets, it is not exposed to sunlight and weathering. Thus cementitious waterproofing does not go through contract and expansion process.

Applications of Cementitious Waterproofing:

Cementitious waterproofing is used in the following type of structures:

- Water Treatment Plants
- Sewage Treatment Plants
- Bridges
- Dams
- Railway & Subway Systems
- Marine Cargo Ports & Docks
- River Locks/Channels & Concrete Dykes

2.4.2 LIQUID WATERPROOFING MEMBARANE



Figure 2.11 Liquid waterproofing membrane

Liquid membrane is a thin coating which consists of usually a primer coat and two coats of top coats which are applied by spray, roller, or trowel. It offers more flexibility than the cementitious types of waterproofing. The liquid cures into a rubbery coating on the wall. The elongation properties of the coating can reach as high as 280%. The durability of the waterproofing coating depends on what type of polymer the manufacturer use for the making of the liquid waterproofing. Liquid waterproofing membrane can be of spray-applied liquid membrane composed of polymer-modified asphalt. Polyurethane liquid membranes in separate grades for trowel, roller, or spray are also available from various manufacturers.

2.4.3 BITUMINOUS COATING WATERPROOFING



Figure 2.12 Bituminous coating waterproofing

Bituminous coating is a type of coating used for waterproofing and flexible protective coat in accordance with its formulation and polymerization grade. Its flexibility and protection against water can be influenced by the polymer grade as well as reinforcement of fiber. Bituminous coating is also called as asphaltating. The most common applications of bituminous coatings include areas that are beneath screed wet. It is an excellent protective coating and waterproofing agent, especially on surfaces such as concrete foundations. Bituminous coating is made of bitumen based materials and it is not suitable for exposure to sunlight. It becomes very brittle and fragile when long exposure to the sunlight unless it is modified with more flexible material such as polyurethane or acrylic based polymers. The flexibility of the finished products always depends on the solid content of the polymer added to the bitumen.

2.4.4 BITUMINOUS MEMBRANE WATERPROOFING



Figure 2.13 Bituminous membrane waterproofing

Bituminous membrane waterproofing is a popular method used for low-sloped roofs due to their proven performance. Bituminous waterproofing membrane have torch on membrane and self-adhesive membrane. Self-adhesive compounds comprise asphalt, polymers and filler; additionally, certain resins and oils may be added to improve adhesion characteristics. The self-adhesive type has low shelf life as bonding properties of the membrane reduces with time. Torch on membrane have exposed and covered types. Exposed membrane often has mineral granular aggregate to withstand the wear and tear of the weathering and the other types of membrane, contractor need to apply one protective screed to prevent the puncture of the membrane.

2.4.5 POLYURETHANE LIQUID MEMBRANE



Figure 2.14 Polyurethane Liquid Membrane

Polyurethane liquid membrane method of waterproofing is used for the flat roof area and exposed to weathering. This waterproofing method is expensive. Polyurethane Liquid Membrane can offer higher flexibility. Polyurethane is very sensitive to moisture content present, therefore before application, one has to be very careful evaluating the moisture content of the concrete slab, otherwise peeling or de-bonding of membranes may happen after some time.

2.5 BENEFITS OF WATERPROOFING

1. It strengthens the structure

Concrete waterproofing prolongs the lifespan of your building by limiting ways that water and moisture can enter through ceiling, walls and floor. If these areas are well protected from water intrusion, the structure can avoid damage such as rust, rotting, corrosion and deterioration.

2. Prevents mould

Concrete waterproofing isn't only about ensuring the structures integrity but also preventing health problems. Moisture build-up in the ceiling and walls causes fungus or mould growth. The microorganisms can cause serious health issues such as allergies, asthma and a weakened immune system.

3. It reduce maintenance costs

Concrete waterproofing is a cost efficient solution to save on expensive repairs. When your building is free from water damage, you can expect to have less problems maintaining it.

4. Provides a healthy environment

Good waterproofing systems help a create a clean living and work space. It safeguards the property as well as the people in it.

5. It increase property value

No one wants a property with waterproofing problems. Concrete waterproofing systems can prevent structural damage from water seepage. It maintains the aesthetic look of the building and adds value to your property.

CHAPTER 3

CASE STUDY

(WATERPROOFING PROCESS FOR SWIMMING POOL AT CASE STUDY)

3.1 INTRODUCTION OF CASE STUDY



Figure 3.1 Mercu Zikay

Cost of Mercu Zikay worth Ringgit Malaysia 144 million. The main contractor of Mercu Zikay is Kembang Serantau Sdn Bhd. and the developer is Pembangunan Kampung Baru Sdn Bhd. This project supported by several supervision and consultants which are Z&SR Architectural Ventures Sdn Bhd, Asia Pacific Engineering Consortium Sdn. Bhd., Perwira Al-Shura Consulting Engineerings Sdn. Bhd., Perdana Jurukur Bahan and Sitecap Sdn. Bhd. Date of commencement on December 1, 2012. The construction period take approximately 30 months and the duration of liability period is 24 months. Liquidated and ascertained damages worth Ringgit Malaysia 42,512.00 per day.

Located in Kampung Baharu, Kuala Lumpur, the oldest Malaysian residential area in Kuala Lumpur in Mercu Zikay is the only condominium in this residential enclave to give views of the panoramic scene of Kuala Lumpur City Centre. At Mercu Zikay, get chance discover the embodiment of a way of life entered on cosmopolitan city in Kuala Lumpur.

Mercu Zikay comprises 289 exquisite hotel rooms and 130 service suite units, giving a wide selection of 1 to 5 bedrooms service suites as well as luxury duplexes. Mercu Zikay features a 4 star hotel facilities and full condominium facilities together with a function room, a gymnasium, a lap pool, a wading pool, Jacuzzi equipped leisure pools and BBQ pits, together with thoughtfully landscape pavilions and gardens.

Besides, Mercu Zikay show amazing views of Petronas Twin Towers that a mere 1 km distance and magnificent 360 degree view of Kuala Lumpur city skyline. An exclusive 40 storey tower with a collection of 289 hotels rooms and 130 service suite units, will recommend luxury, convenience and enjoyment can be experience.

3.2 PROJECT PARTICULAR

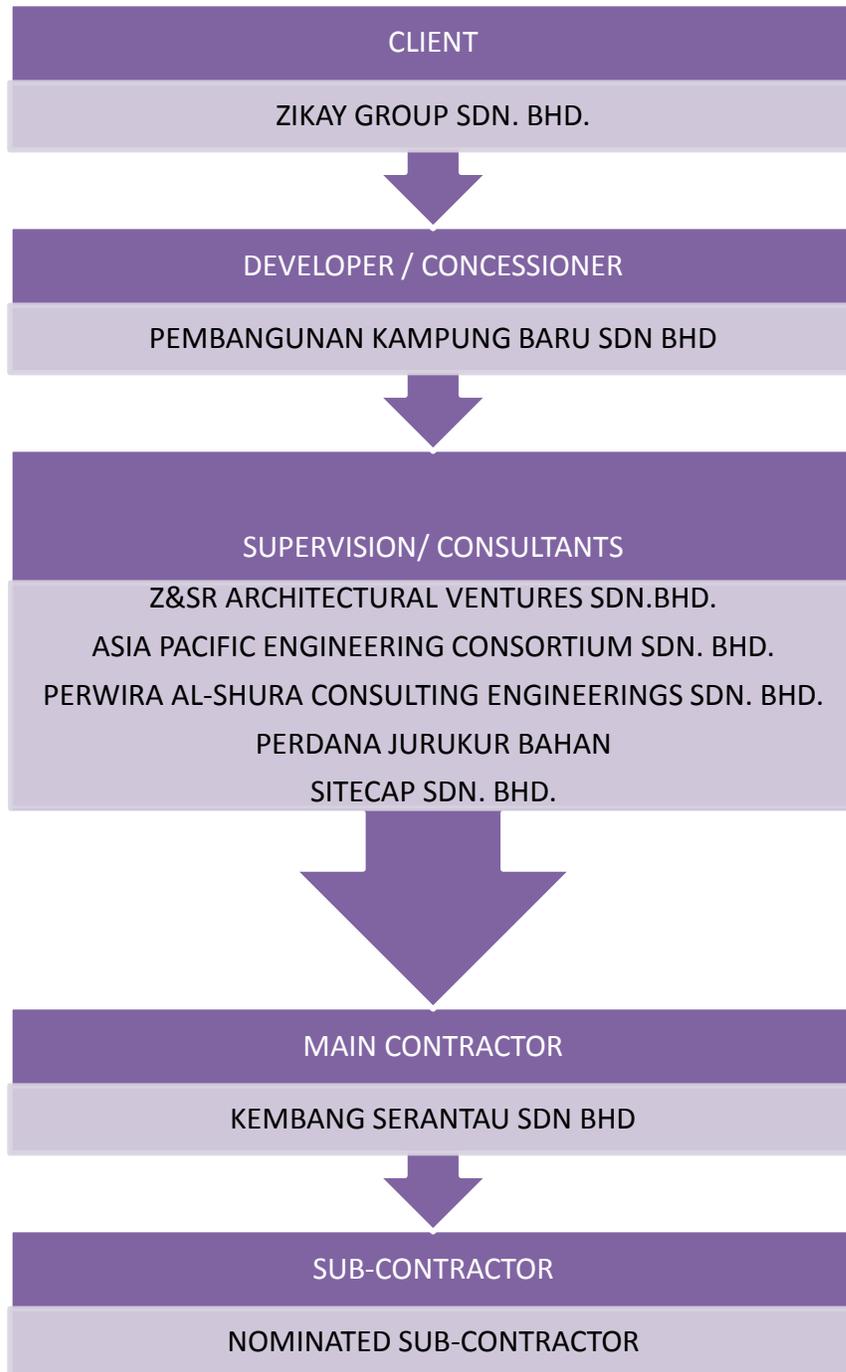


Chart 3.1 Project particular

3.4 LOCATION OF SWIMMING POOL

The swimming pool structure is located at Level 14 of Mercu Zikay, Jalan Raya Alang Kampung Baharu Kuala Lumpur. These Swimming pools are divided into two (2) types of swimming pool which is main pool and kids pool. The depth of swimming are also based on type of the swimming pool.

This swimming pool is located outside of the building at Level 14. Function of the swimming pool is to give entertainment for the occupant that living in Mercu Zikay apartment and hotel.

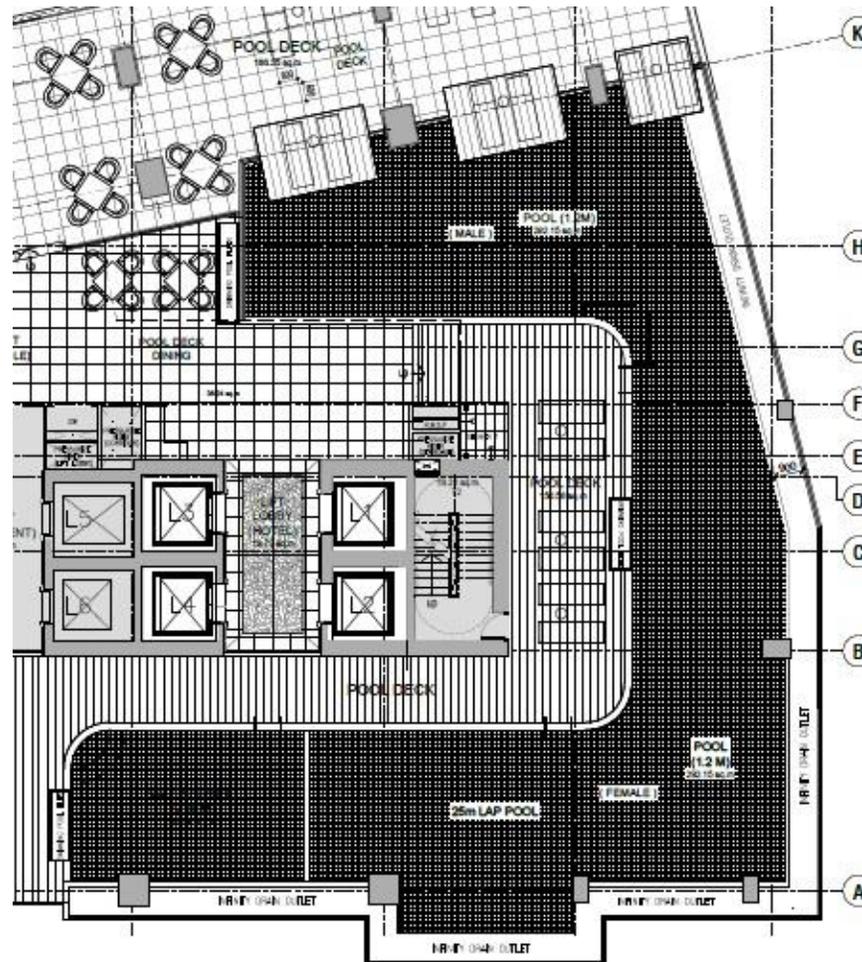


Figure 3.2 Swimming pool

3.5 TYPE OF WATERPROOFING FOR SWIMMING POOL

There are many type of product and method of waterproofing for swimming pool that can use in construction. Product and method of waterproofing for swimming pool we can choose based on type, design and material of swimming pool that we want to construct. For example, type of waterproofing are used for this case study is crystallization system and flexible cementitious system. The product from the crystallization is greenseal 200, while for the flexible cementitious system is Greenseal Flexi 201.

3.6 GREENSEAL 200

Greenseal 200 is brush or spray applied as a slurry coat on the surface of concrete structures to create waterproofing barrier for the structures. It can be also applied by broadcasting the dry powder onto horizontal concrete surface at the time of initial set and power floating the powder into the green concrete. When hardened, it is resistant to many salts and alkalis while offering protection against sea water, mild acidic conditions, frost damage and waste water. The surface of the concrete become hard and is good for vehicular traffics.



Figure 3.3 Sample of Greenseal 200

3.6.1 ADVANTAGE

- Waterproof – to prevent surface problems, e.g. fungus growth, cracking, and able to withstand positive and negative water pressure.
- Cost Effective – Repair and rehabilitate old and problematic concrete by sealing off hairline cracks.
- Wide performance window – Easy application and suitable for various construction structures and sites.
- Protections – no special protective system is required.
- Greenseal 200 penetrates deeply and seals concrete capillary tracts or shrinkage cracks up to 1mm.
- Can be applied to moist or concrete that has set but yet to be hardened.
- Increase resistance to frost, weathering, salt water, aggressive ground water and many chemicals.
- Greenseal 200 is non- toxic and is approved for portable water use.

Product properties:-

Tests	Test Results	Standard
Water Penetration Test: - Untreated (without GS200) - Treated (with GS200)	51.3 mm 18.7 mm (174.3% improvement)	DIN 1048 - 1991
Flexural Strength (28 d), N/mm ²	5.05	ASTM C 348 - 86
Tensile Strength (28 d), N/mm ²	2.42	ASTM C 190 - 85
Compressive Strength (28 d), N/mm ²	57.5	ASTM C 109
Coefficient of Permeability Test	1.10×10^{-12}	Cell Method
Toxicity Test	Non toxic	BS6920:Part1:2000
Average Water Vapour Transmission Rate (g/hour.m ²)	11.773	ASTM:E96:94
Water Permeability Test under 10 bars (Coefficient of permeability, k in m/sec)	0.27×10^{-11}	-
pH Test (pH)	11.25 @ 29.9°C	-

Figure 3.4 Product properties

3.6.2 APPLICATION METHOD

Before applying Greenseal 200 onto the treated surface, ensure the substrate is moist but no visibly wet. To ensure that there is sufficient bond to the smooth surface, application must take place shortly. Greenseal 200 can be applied by using brush or broom with fine bristles, by spray gun as well as dry sprinkle method.

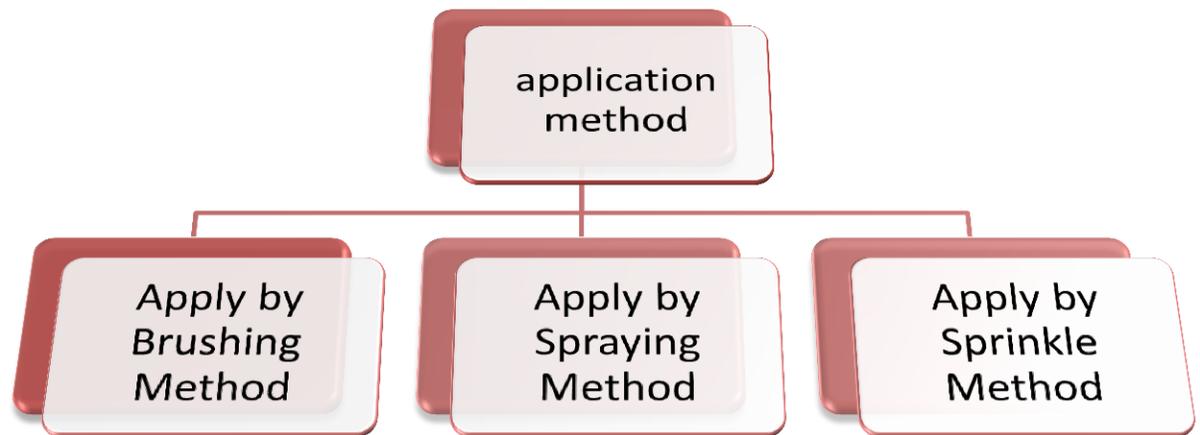


Chart 3.3 Application method

A) APPLY BY BRUSHING METHOD

Greenseal 200 when mixed properly look like a flowable paint and is easy to apply. Apply Greenseal 200 at the rate of 0.75kg/m²/coat. It is recommended to mark-up an area approximately 33m² which is enough to be covered with one bag (25kg) of Greenseal 200 for the first coat application. When the first coat of Greenseal 200 starts to dry, apply the second coat in perpendicular direction at the same rate of 0.75kg/m².

B. APPLY BY SPRAYING METHOD

Hose down the entire concrete surface to be treated with clean water and allow the surface to be partly dry so that it is damp. Remove any surface water or ponding prior to application. For spraying method, it is of great important that the mixing of GS200 with water should be mechanically mixed by a stirrer and ensures that no lump should ever remain in the mixture.

Mix 2.5 parts of GS200 to 1 part water by volume and mix thoroughly with a slow stirrer for at least 3 minutes. Ensure that GS200 mixture is stirred properly into flowable thick consistent slurry. It is imperative to ensure that GS200 is thoroughly mixed. The mixture should be used up within half hour, after which time it will start to thicken. On no account add extra water to restore workability. Before the applicator start to spray, he has to properly map out the area to ensure that 1 bag of GS200 of 25kg should approximately cover an area of 33m² for the first coat.

When spraying starts, the applicator must ensure the first spray pattern to be consistent from left to right or from right to left. The pressure of air compressor should be adjusted sufficiently but not with excess air pressure. As too much air pressure will bounce GS200 off the wall or concrete, especially during the spraying of wall. Under no circumstances, material bounced off the wall should be picked up from the floor for application. The first coat should be allowed to dry overnight or thoroughly before the second coat applied. Pre-wet

the concrete surface again as mentioned above and continues with the second coat of spraying. Ensure that the spray pattern remains consistent throughout. On completion of spraying, the gun shall be thoroughly washed and cleaned with water to ensure that no GS200 material is left inside the gun or hose.

C. APPLY BY SPRINKLE METHOD

The method of broadcasting of GS200 is recommended to be done by a specialized waterproofing applicator. Broadcasting of GS200 powder onto a fully laid concrete would cause a faster reaction between the chemicals since the chemical uses moisture of hydration in the concrete. The dry sprinkle method is most likely to be employed for horizontal surfaces only.

Sprinkle on concrete surface method:

When the freshly laid concrete slab has reached plasticity, the concrete must be smoothed out and flattened with a vibrating straight edge. When the thumb is pressed hard on the surface, leaving a 3-5mm deep print, this is an indication that the concrete is ready for a low speed mechanical power float. The float is held flat to float the GS200 into the concrete.

Broadcast 1.5kg/m² of GS200 powder onto the concrete surface. Ensure that the GS200 is thoroughly floated into the concrete. The power floating shall leave the concrete a smooth surface after floating with a high speed mechanical power float. Should some GS200 powder still remain on the surface, sprinkle to ensure the powder is wet and floated into the concrete. The concrete slab can be used for traffic after it has set for 24 hours. A light mist of water may be required to allow moisture and curing of GS200.

TECHNICAL DRAWING USING GREENSEAL 200 WATERPROOFING SYSTEM.

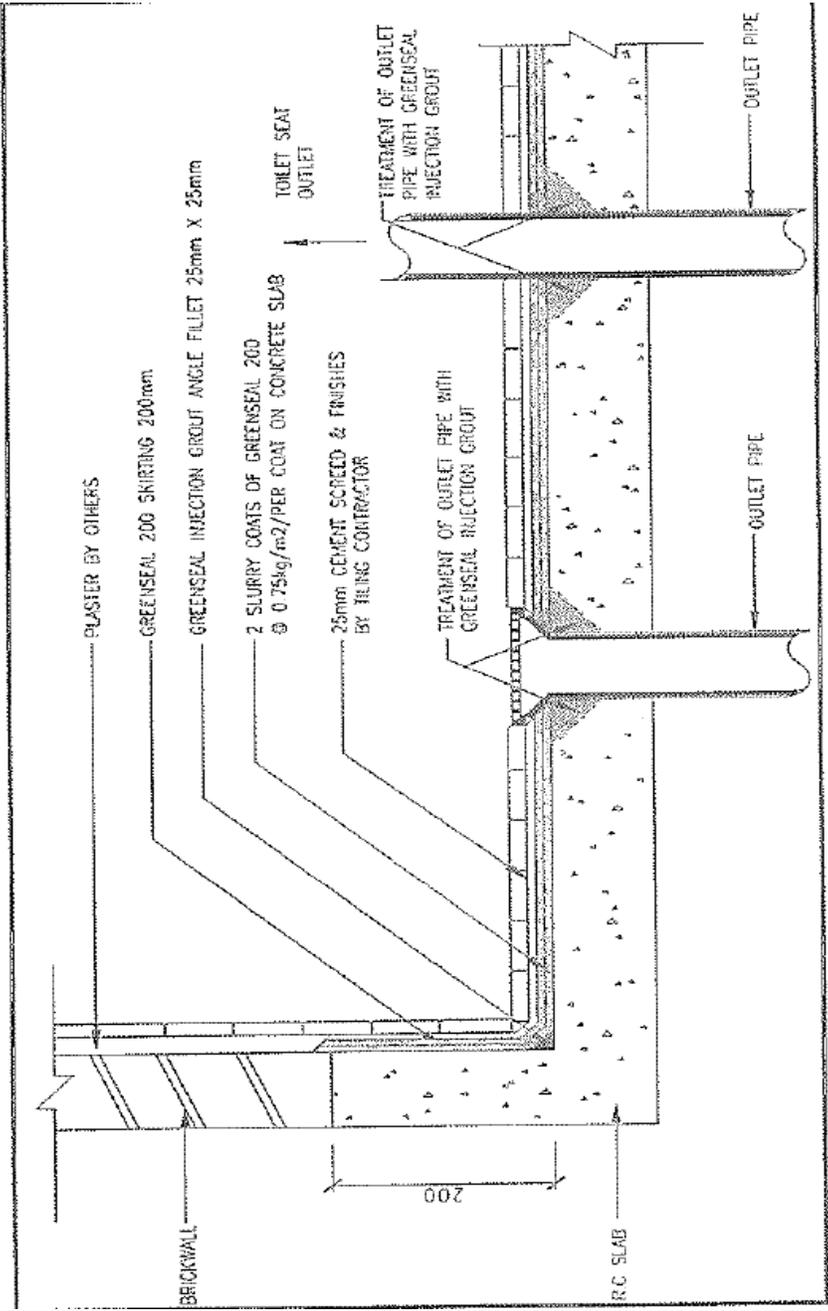


Figure 3.5 Greenseal 200 waterproofing system

3.7 FLEXI GREENSEAL 201

Greenseal Flexi 201 is a flexible cement based polymer modified waterproofing coating. Its 2 parts components consist of Portland cement, well graded sand and plasticizer. It is formulated with specially graded fine quartz high quality polymer to create a brushable smoothly slurry with excellent bonding and adhesion properties to most substrates.

It is suitable to be applied to concrete and mortar to prevent water infiltration by filling and sealing pores, voids, hairline crack of all concrete. Nonetheless, it still provides a breathable coating with allows the transmission of water vapour. Greenseal Flexi 201 also acts as a protective layer against water penetration in swimming pools and water tanks and is non-toxic.



Figure 3.6 Sample of Greenseal Flexi 201

3.7.1 ADVANTAGE

- Applied directly to the concrete by brush
- Good elongation
- Can be applied on damp surfaces.
- Excellent adhesion bonds to porous and non-porous surfaces
- Non-toxic and is approved for portable water use.
- Non-corrosive to steel and iron.
- High resistance to carbon dioxide and chloride ion diffusion.

Product properties:-

Test	Test Results	Standard
Water Penetration	0 mm (no water penetration)	DIN 1048
Toxicity	Non toxic	BS 6920 : Part 1:2000 / SPAN
Adhesive strength	1.1 N/mm ²	ASTM D4541
Tensile strength	>1.5 N/mm ²	ASTM D412
Abrasion resistance	1.52 g/h.m ²	ASTM D4060-84
Water vapour transmission	1.02 g/h.m ²	ASTM E96
Elongation at break	>80%	ASTM D412
Hardness (Shore A)	65	ASTM D2240
Set to touch	55mins	ASTM D1640
Chloride Content	0.003% weight	Potentiometric Titration
Crack Bridging	No Crack at 2mm	ASTM D836
Thickness of dry film	> 1 mm	Greenseal Laboratory

Figure 3.7 Product properties

3.7.2 APPLICATION METHOD

Apply Greenseal Flexi 201 with a stiff brush or spray onto the prepared surface approximately 1.0kg/m² per coat. Two coats are required. After the application of the 1st coat of Greenseal Flexi 201 allow it to dry. When the 1st coat is dry, the 2nd coat can be applied. The procedure of application for 2nd coat of Greenseal Flexi 201 is the same as the 1st coat except that application should be applied counter cross wise to the 1st application coat.

Application Interval of each should be at least 1-2 hours apart. To avoid pin holes and to ensure a full coverage, apply each coat from a different direction.

TECHNICAL DRAWING USING GREENSEAL FLEXI 201 WATERPROOFING SYSTEM.

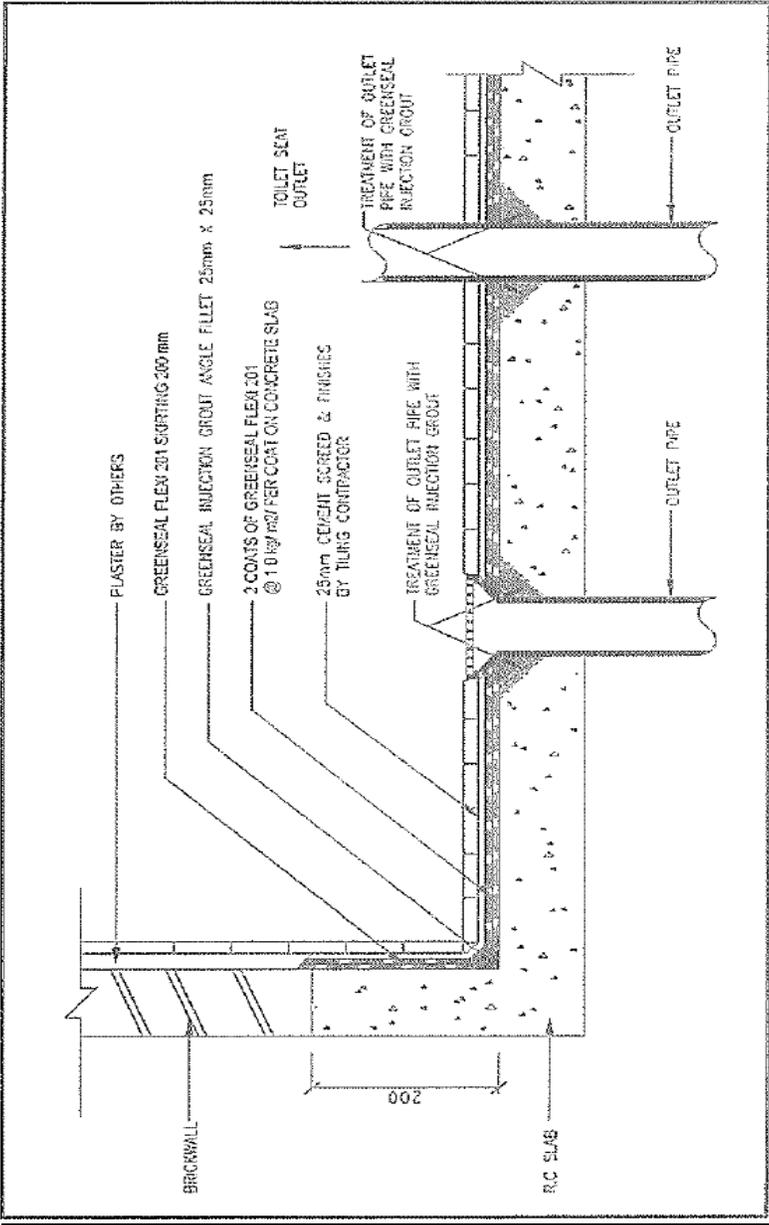


Figure 3.8 Greenseal Flexi 201 waterproofing system

3.8 WATERPROOFING METHOD STATEMENT ON CASE STUDY

GREENSEAL 200 (1 coat) + FLEXI 201 (2 coats) CEMENTITIOUS WATERPROOFING

Greenseal Flexi 201 is flexible cement based of 2 components polymer modified waterproof coating. It is suitable to be applied to concrete and mortar to prevent water infiltration as to fill and seal pores and voids cracks and hair line of all substrates and yet provides a breathable coating which allows water vapour transmission. It acts as a protective layer against aggressive gas such as carbon dioxide.

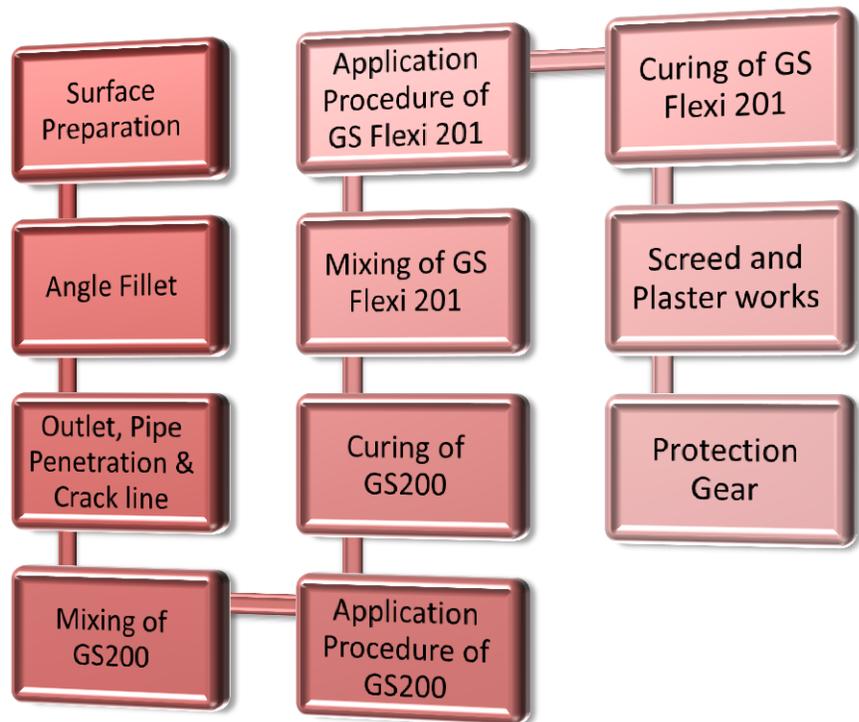


Chart 3.4 Waterproofing process

1) Surface preparation

- Main contractor is to wood float or steel trowelled the surface to receive the waterproofing material.
- All surface to be treated with Greenseal product must be thoroughly inspected, the concrete surface must be clean and free from oil, grease, paint, loose dust, mud and laitance.
- Horizontal surfaces should not have curing agents or hardeners applied prior to the Greenseal application.
- Honeycombs should be hacked off to expose the concrete.
- All chipping and loose particles should be removed, clean surface with water before repairing.
- Ensure all concrete surfaces are hosed down with water as moistures must be present in the capillaries prior to the application Greenseal GS200
- New concrete must be at least three days old before it should be treated.

2) Angle fillet

- At all junctions between slabs and walls, do an angle fillet of 25mm x 25 mm with Greenseal Injection Grout.
- Mix 3 parts of GS Injection Grout to 1 part water to mix thoroughly to a mortar consistently and applied with a trowel to form an angle fillet.

3) Outlet, pipe penetration and Crack line

- Around all outlets hacked around the pipe sleeve to make a V groove joint surrounding the outlets and pipes to depth of 25mm.

- Wash thoroughly this hacked off areas to expose the clean concrete surfaces between outlet pipe and concrete.
- Mix Greenseal Injection Grout 2 ½ parts to 1 parts of water in a container and stirred thoroughly for at least 3 minutes until the mixture become a thick consistency slurry and pour the mixture or grout into the hacked off V grooved and level to concrete level.
- Hack along the crack area and pour the mixture or grout into the hacked off V grooved and level to concrete level.

4) Mixing of GS200

- Mix 2.5 parts of Greenseal 200 to 1 part water by volume and mix thoroughly for at least 3 minutes. The mixing of GS200 and water can be done with a slow stirrer and mix for 3 minutes, to ensure the GS200 is totally being stirred properly into a flowable thick consistency slurry. If using hand with a stick rod to stir GS200 and water, the applicator must ensure that after mixing 3 to 5 minutes that no lump of GS200 must remain in the mixture. It is imperative to ensure that GS200 is thoroughly mixed. The mixture should be used up within half hour, after which time it will start to thicken. On no account add extra water to restore workability.

5) Application procedures of GS200

- Hose down the entire concrete surface to be treated with clean water and allow the surface to partly dry so that it is damp, removing any surface water or ponding prior to application.
- Before applying the GS200 wait until the running water had dried and the concrete is still damp, dip the brush into the pail of GS200 mixtures and apply the GS200 mixture on the concrete surface. GS200 mixed properly looks like a flowable paint and should be easy to apply, the first coat of Greenseal 200 at the rate of 1kg/m². To achieve that the applicator should map out approximately an area sizeable enough where 1 bag of GS200 should be able to cover approximate 25 m² of area for one coat application at the rate of 1.0kg/m².

6) Curing of GS 200

- The Greenseal GS200 should dry before apply Greenseal Flexi 201 in top.
- After application of Greenseal Gs200, apply 2 coats of Greenseal Flexi 301 before plastering and screed.

7) Mixing of GS Flexi 201

- GS Flexi 201 is supplied in 2 components, to generate consistent slurry, pour the liquid component into a pail following by adding in the powder component gradually to the liquid. In the meantime, use a stirrer to stir the mixture until the mixture is free from lumps. Take note of the consistency of the slurry. The consistency of the slurry can be altered by reducing or adding in powder component.
- No water or other material should be added in the mixture.

8) Application Procedure of GS Flexi 201

- All surface to be thoroughly inspected the surface (GS200) must be clean and free from oil, Grease, paint, loose dust, mud and littance.
- Apply first coat of GS Flexi 201 with a stiff brush onto the prepared surface with 1 kg/m² per coat, 2 coats are required.
- When the first coat of Flexi 201 is in half/fully dry condition, the second coats of GS Flexi 201 are then ready to applied at the rate of 1.0kg/m² on top.
- Interval of each coat should be 2-3 hours minimum. To avoid pin holes and ensure full coverage, apply each brush coat at different direction.
- Be caution , no standing water or excessive water shall be remained on the substrate that to be applied with GS Flexi 201.
- For best result, apply GS Flexi 201 under shaded sheller to prevent rapid drying of the coating.

9) Curing of GS Flexi 201

- The freshly applied GS Flexi 201 shall be protected from direct rain, dirt, oil, grease or other loose particle for at least 12 hours.
- It is foot trafficable after 24 hours and resistant to light mechanical stress after 3 days. Permanent water pressure resistance shall be achieved after a full hardening of 7 days.

10) Screed and plaster works

- All plastering on wall and screed (min15mm thick) for slab to be applied on top of GS201.

11) Protection gear

- General product are alkaline materials and prolonged contact with the skin is best avoided as it could give rise to irritation. To minimize such risks, we recommended the use of rubber gloves when handling or sprinkling our products.

3.9 METHOD STATEMENT FOR WATER PONDING TEST

A. Prior to full Water Ponding Test

1. Inspect the concrete surface of the pool slab and wall prior to structural ponding test to the pool.
2. Repair all the defective surface such as honeycomb, crack lines and treat all the concrete cold joint.
3. Seal all the piping and M&E openings by using suitable sealing material.

B. Process to Full Water Ponding Test (Structural test)

1. Fill up the pool gradually to the full high of the pool.
2. When the water level reached 1 ft. level. Stop fill up the pool and start visual inspection on pool wall and below pool floor slab (level 13).
3. Let the 1 ft. water level sit for 4 hours period of time with observation, before continuing to fill up the water.
4. When the water level reached 2 ft. stop fill the water and let it for observation.
5. Leave the test for another 48 hours before release the ponding test water.

C. After the Water Level at full Height

1. Carry out inspection and monitoring for every 2 hours (9.00am-6.00pm) until 48hours after full height level.
2. Carry out joint inspection together with the client, main contractor and waterproofing specialist after 48 hours or when the water for pool is at the full height.
3. Check the pool soffit and wait for any watermark/dampness or leakages.
4. Should there be any watermark/dampness or leakages found, carry out repair work by using polyurethane pressure grouting by specialist until no more watermark/dampness or leakages is found.
5. Leaves the test for another 48 hours before release the ponding test water.

D. After complete of ponding test

1. Release the ponding test water gradually by monitoring the drain channel capacity.
2. Ponding test water will be release with minimum volume due to using temporary piping connection. Temporary piping connection will be connect to nearest drainage (to be advised by Main Contractor)
3. Carefully and manually control the drainage valve to control the water pressure.
4. Carefully monitoring the temporary piping connection during water release until the process is finish.
5. Clean the whole pool and get the signature for approval on water ponding activity.
6. Proceed with application of water ponding coating.

3.10 ACTUAL PROCESS OF WATERPROOFING INSTALLATION

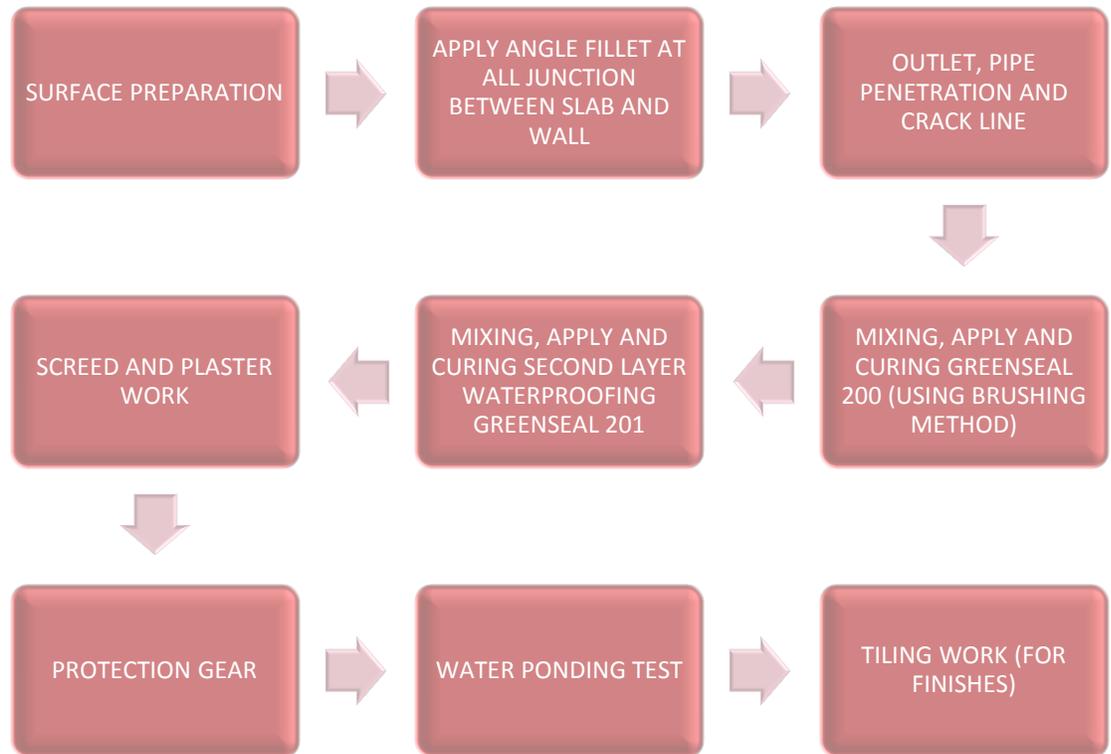


Chart 3.5: waterproofing process installation

CHAPTER

4

(PROBLEM & RECOMMENDATION)

4.1 PROBLEM AND RECOMMENDATION

- 1) There is a lot of honeycomb and unwanted rubbish at the swimming pool area. So, the general worker cannot apply waterproofing wisely.
 - Proper preparation requires removing any contaminants on the substrates surface including grease, residues and dust, as well as all loose materials such as those resulting from honeycomb and laitance. Possible methods of cleaning include pressure washing, scarifying, sandblasting and grinding. After final preparation, remove all dust by vacuuming. Clean the surface with a wet sponge and let it dry before applying the membrane.



Figure 4.1 swimming pool areas

- 2) Water pressure at site are very low and it may take time to pump the water into the swimming pool during the waterproofing testing was going.



Figure 4.2 swimming pool areas

CHAPTER

5

(CONCLUSION)

5.1 CONCLUSION

The 16 weeks spent in Kembang Serantau Sdn. Bhd. (KSSB) for Mercu Zikay's project in construction site has been unique experience to the trainee. It was an eye-opener to how real world tasks are dealt with and the exposures to both on-field and office work was a welcoming practice. Being in different units through the practicum course manages to teach the trainee different management skills, hard and soft skills that cannot be learned in the class room. A part of it, construction of elevator core is a title for this case study.

During this training period, trainee can see a various instruments and plant machine that used during project being constructed, especially focused on waterproofing process. Other that get a knowledge from managers and supervisors, general workers also give an extra knowledge about how waterproofing process being construct as they did do all the works by their self at site.

The training period not only full office work, but also had in at construction site and office site. It is such as supervisors gave a detail explanation about construction drawing and teach steps by steps until fully understand. Also following day by day progress for waterproofing.

Besides that, there also a several problems occur during swimming pool waterproofing process such as There is a lot of honeycomb and unwanted rubbish at the swimming pool area. So, the general worker cannot apply waterproofing wisely. Next, Water pressure at site are very low and it may take time to pump the water into the swimming pool during the waterproofing testing was going.

Through practical training, trainee has gain an exposure to systematic work condition an environment that is conducive coupled with friendly staff that are always there to help. Hoping all of knowledge that has been gained can be use and help in future.

CHAPTER

6

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CHAPTER

7

(APPENDIXES)

**RE-INSPECTION FOR RECTIFICATION WORK ON THE WATERPROOFING
LAYER (PEEL OFF)**



RECTIFICATION WORK CARRIED OUT ON 30/7/2016 (SATURDAY)



**WATER PROOFING FOR PONDING TEST AT SWIMMING
POOL LEVEL 14**

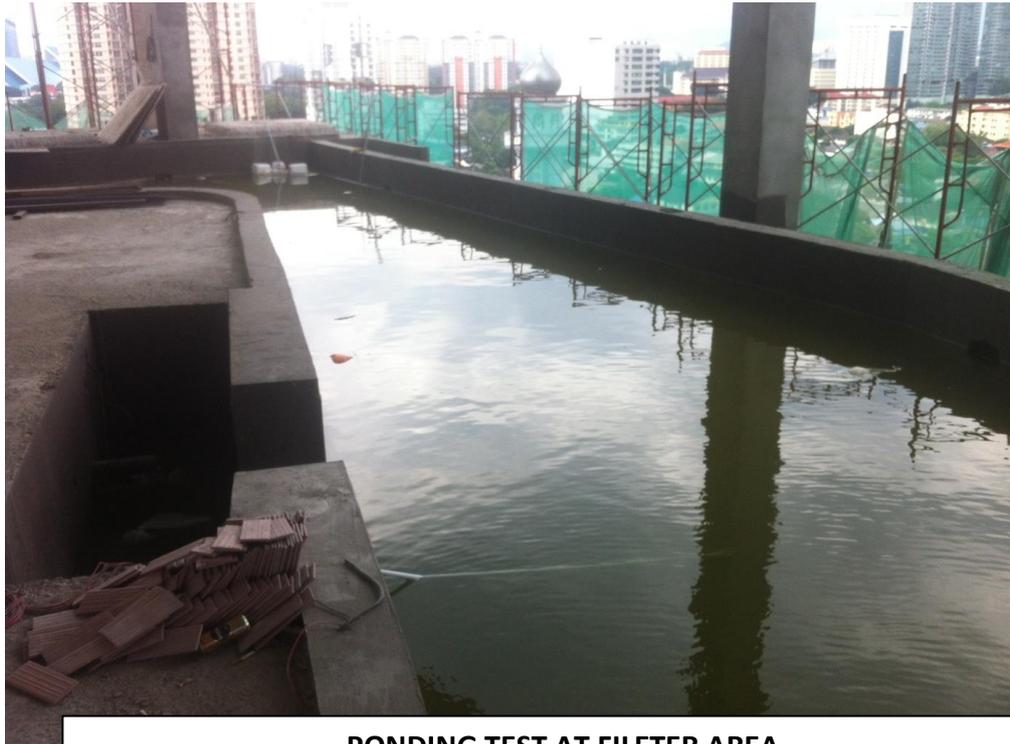
AT FILETER AREA





WATER LEVEL 720MM





PONDING TEST AT FILETER AREA



INSPECTION AT SOFFIT SLAB LEVEL 13M

**DURING INSPECTION BETWEEN C&S C.O.W AND W/PROOFING
APPLICATOR, WE FOUND THAT THERE ARE 4 NO OF WATER MARK**



**NO.1 WATER MARK –
THE INSPECTION CARRIED OUT ON 22/7/16 DURING RAINY
WEATHER**

PONDING TEST AT FILETER AREA





**NO WATER MARK AT THIS AREA ESPACIALLY AT THE CONSTRUCTION
JOINT BETWEEN KERB FOR U CHANNEL AND SLAB.**