



## DCC 6203:CIVIL ENGINEERING PROJECT 2

Title : Rainwater Overflow Divert Device

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# CHAPTER 1

## INTRODUCTION

### 1.1 INTRODUCTION

In general, flash floods or rain can be defined as a natural phenomenon that occurs due to greed and easy take on human beings. From its literal point of view, flash floods are a state of water drowning or inhaling a wide area that is immediate or unexpected. This phenomenon is said to be a terrible phenomenon that can lead to loss of life and property damage. This flash flood and heavy rain usually occurs in urban areas like Kuala Lumpur, Shah Alam, Kota Bahru, Georgetown and so on. The statistics show that the death and property damage increase every year. Therefore, the authorities always think of the best way to avoid damage and death in addition to caution and take precautionary measures.

### 1.2 PRODUCT BACKGROUND

The sand barrier that used in Malaysia is a conventional way of being out of date. Therefore, authorities need to use more modern methods and easy handling methods. This product is an innovation created to ward off all the problems found by conventional. This innovation has two core functions of driving and blocking water. This innovation is created because Malaysia does not have any modern technology that can prevent flash floods at early stage.

This innovation uses two main material, metal plate and wood with fiberglass .Metal plate serves as surfaces and wood as a base. With some additives added such as rubber and light reflector accessories. This innovation works as a barrier by blocking the flow of water from stagnant and as a driving tool water to other places. This innovation has a significant difference in conventional ways of cost, lifespan, handling and handling time..

### **1.3 PROBLEM STATEMENT**

The handling process of sand barrier is quite difficult. The sand barrier is the only way that the responsible parties such as PBT and JPS have to do. These sand barrier need to produce step by step. Sand barrier has low durability. Sand barrier use sack as their main material. This material does not last long and can prone to decay when exposed to sunlight and rain. Stagnant area will cause difficulties to road users. This is because of puddles or water currents crossing the road causing loss of control and accidents.

### **1.4 OBJECTIVE OF RESEARCH**

1. To produce Rainwater Overflow Divert Device.
2. To conducting impaction test and stability test.
3. To compare the characteristics of Rainwater Overflow Divert Device and Sand Barrier.

### **1.5 SCOPE OF STUDY**

1. The study only focus on Rainwater Overflow Device.
2. This study only focuses on performance and durability of Rainwater Overflow Divert Device.

## **1.6 IMPORTANT OF RESEARCH**

The incentives found in this study can result in a low budget flood that can be owned by the authorities. Furthermore, the studies are done to produce portable flood barrier that can reduce the damage or loss of life caused by flash floods. Lastly, the studies are done to reduce the rate of road accidents due to rain.

## **1.7 SUMMARY OF CHAPTER**

This chapter explains introduction of the product that we want to do. This chapter explains about flash flood and flood barrier that used by our country. I also state the problem statement, objective, scope of study, important of research, research questions and operation of research. The product that we do will substitute the conventional flood barrier which is sand barrier by modern flood barrier. It is Rainwater Overflow Divert Device.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 INTRODUCTION**

A literature review is a comprehensive summary of previous research on a topic. The literature review surveys scholarly articles, books, and other sources relevant to a particular area of research. The review should enumerate, describe, summarize, objectively evaluate and clarify this previous research. It should give a theoretical base for the research and help to determine the nature of the research. The literature review acknowledges the work of previous researchers, and in so doing, assures the reader that the work has been well conceived.

#### **2.2 CONCEPT OF FLOOD**

Flood is the most devastating natural disaster experienced in Malaysia. Throughout Malaysia including Sabah and Sarawak, there is total 189 river basins (89 in peninsula Malaysia, 78 in Sabah and 22 in Sarawak), with the main channels flowing directly to the South China Sea and 85 are prone to become recurrent flooding. Flood can be defined as a body of water, rising, swelling and overflowing land not usually thus covered. The main reason of flood happened in Malaysia are from continuous rain, unorganized drainage system, and river corrosion. In order to decrease the flood happened in Malaysia, there are several ways that Malaysia used. One of the ways is by using sand barrier systems.

## **2.3 PREVIOUS RESEARCH**

### **2.3.1 SANDBAG BARRIER**

Sandbags barrier is a temporary barrier, or wall, one to two feet high, that is constructed by stacking sand-filled or earth-filled sandbags and placing them to divert mud and other debris flows away from buildings. Sandbags barrier are an effective deterrent against damaging flood waters. Sandbags can also be used to fortify existing flood control structures and limit the effects of sand boils.

Sandbags are one of the flood control used by many countries and also Malaysia. It is the major defense mechanisms of people against flood. Even though, sandbags are widely used in lots of countries, there are several disadvantages of the sandbags.

The disadvantages are:

- I. Sandbags produce lot of mess.

Sandbag is basically contains sand, after being soaked or entered with water, the sand becomes mud. These produce more work and hassle because of the cleaning process. Besides, the sandbags might be contaminated with unsafe materials. **Jill de Guzman, ASIAN CENTER FOR FLOOD CONTROL (2016)**



II. Making sandbags are time consuming

Producing sandbags consumes a lot of work. From purchasing of sacks and sands, filling the sacks with sand, and piling the sandbags to entry-point of water. The flood might have been there already before the sandbags are finished.

**Jill de Guzman, ASIAN CENTER FOR FLOOD CONTROL**

**(2016)**



**Figure 1:** People filling up the sand into the bag

III. Sandbags need lot of manpower.

To get the protection done before the flood reached an area, an average 5 to 10 people are needed for the sandbagging. This shown that sandbags barrier is not an effective ways to control flood.

**Jill de Guzman, ASIAN CENTER FOR FLOOD CONTROL**

**(2016)**



**Figure 2:** Manpower used for sandbagging

IV. Durability of sandbag is low.

Sandbags can only withstand a short amount of water. It cannot even tolerate a strong amount of water pressure. Sandbags are easily broken when exposed to heavy rains and flash floods because of the cheap materials.

**Jill de Guzman, ASIAN CENTER FOR FLOOD CONTROL  
(2016)**



**Figure 3:** Sandbag that is broken after the flood.

V. Sandbags are inefficient solution for flood.

A common misconception is that sandbags are a cheap cost- effective method of flood defense; however this is not the case. If the overall cost of sandbags per time of usage is computed, it will still cost a lot. Sandbags are basically not designed for long term use. It will just repeat the expenses and process of making it over and over again.

**Jill de Guzman, ASIAN CENTER FOR FLOOD CONTROL  
(2016)**



**Figure 4:** The sandbags cannot stop the water

## 2.3.2 ARTICLES FROM NEWSPAPER ABOUT SANDBAG BARRIER



Figure 5: Articles from the newspaper

1. Sandbag barrier are cause of quick flash flood

Menurut Asri Mohd Noor, Harian Metro, berkata, **banjir kilat berlaku begitu pantas berikutan benteng tebing sungai berhampiran rumahnya pecah akibat arus deras.** Katanya, pada mulanya dia tidak nampak benteng sungai itu pecah kerana paras air naik melepasi dan memasuki halaman rumahnya. "**Saya meletak guni pasi sebagai benteng untuk mengelakkan air sungai melimpah sejak lebih tiga tahun lalu dan walaupun ada benteng, jika hujan lebat terlalu lama air sungai tetap melimpah namun tidak sampai masuk ke dalam rumah,**" katanya.



**Figure 6:** Picture shows that the sandbag are broken

2. Sand barrier cost are expensive

Dalam pada itu, **Penguasa Daerah JPS Hulu Selangor,** berkata, pihaknya terpaksa meletakkan benteng beg pasir itu bagi tempoh jangka pendek kerana isu itu perludiselesaikan dalam tempoh masa panjang bersama pihak tuan rumah. "Bukan saja melibatkan tuan rumah, tetapi juga pihak pejabat tanah dan JPS sendiri. "**Beg pasir yang kita sediakan juga menelan kos sebanyak RM20,000** dan kesemua kos ditanggung JPS," katanya. Tambah beliau, penduduk tidak perlu lagi berasa risau kerana walaupun benteng itu bersifat sementara, tetapi ia mampu menghalang air sungai masuk ke jalan di Taman Kelisa "Untuk pelan jangka panjang pula, kita akan bina tembok besar tetapi ia menelan kos yang cukup besar. Tetapi semua ini kita akan bincangkan nanti," katanya.

**Halim Masri, Penguasa Daerah JPS Hulu Selangor, 2018**

### **2.3.1 MATERIAL USED FOR OVERFLOW RAINWATER DIVERT DEVICE.**



## I. Sheet metal plate



- Sheet metal has a low weight to thickness ratio, which means it's easy to transport and easy to work with.
- Sheet metal is extremely strong and durable, making it the ideal high-strength material in a diversity of applications from harsh agricultural environments and high traffic environments, to extreme temperatures.
- Sheet metal is malleable, which means it can be formed, cut, bent or stretched into just about any shape, allowing sheet metal fabricators to offer their customers highly specialized solutions and custom-designs to meet just about any specification.
- Sheet metal can also be repaired relatively easily, which makes it a practical choice in many different applications.
- Its relatively low cost is also an advantage in both one-off design situations and in situations involving large quantities for mass production.

### **West Australian Steel Sales, Top Benefits Of Using Sheet Metal, 2015**



**Figure 7:** Sheet Metal plate

- Difference in sheet metal plate and zinc

<b>Sheet Metal Plate</b>	<b>Zinc</b>
<ul style="list-style-type: none"> <li>i. Easy transport due to its low weight to thickness.</li> <li>ii. Extremely strong and durable</li> <li>iii. Malleable – can be formed, cut, bent and stretched.</li> <li>iv. Can also be repaired relatively easily.</li> <li>v. low cost</li> </ul> 	<ul style="list-style-type: none"> <li>i. Lightweight</li> <li>ii. Easily formed</li> <li>iii. Durable</li> <li>iv. Recyclable</li> </ul> 

## II. Balau wood

- A very dense, oil-rich tropical hardwood from Southeast Asia, Balau is known for its strength and weather resistant qualities, making it an ideal choice for building outdoor structures like patios or poolside deck and furniture.
- The yellow Balau has a life span of up to 30 years due to high density of the timber which gives it good durability.

### **Local Harwood Flooring, Balau, 2017**

- Characteristic of Balau wood:
  - i. The timber is dense but contains little silica and is therefore relatively easy to work although some adjustment to saws and machine knives may be required on long runs if a good surface finish is required. The color are yellow brown, reddish brown and sometimes purplish brown. The texture is fine to medium and even with the grain wavy and interlocked. Shrinkage rates are medium to low and all species are considered to be lyctid borer susceptible.

### **Kambo Timber, Balau Wood**

- ii. The timber is heavy, high density and very durable. This has made it the most popular in construction, flooring and furniture making. The wood is very sturdy and often used in projects like docks and bridges, which may require water resistant timber.

### **Ocean Timber Product, 2016**

### III. Fiberglass

- Fiberglass refers to a strong, lightweight material that consists of thin fibers of glass that can be transformed into a woven layer or used as reinforcement. Fiberglass is less strong and stiffer than carbon fiber-based composites, but less brittle and cheaper.
- Fiberglass is versatile and considered a foundation of the composites industry. It has shown excellent strength, low weight, bendability and dimensional stability.

#### **Corrosianpedia, Fibreglass, 2019**

- Fiberglass is long lasting, waterproof, corrosion resistant and non-conductive to start with. It is an amazing product that can be molded into practically anything, giving design engineer unlimited possibilities in the ability to make long and sweeping contours, allowing for much more design freedom than metal or wood based structures can.
- Fiberglass is non-conductive and radio frequency transparent. Fiberglass also absorbs sounds wave. Unlike metal, fiberglass has the least expansion and contraction with heat, cold and stress.
- Fiberglass is stronger and it will not rust- perfect for outsides used or in locations near water especially salt water.



**Figure 8:** Fiberglass



- ❖ Balau wood that is coated with the fiberglass make the Balau wood more stronger eventhough the Balau wood itself are stronger. The fiberglass are known to be much stronger than wood. So with fiberglass coating the wood, it will make the wood much stronger. Besides, the fiberglass is waterproof. So it is suitable to use because our product is being used near water.



**Figure 9:** The wood that are coated with fiberglass

#### IV. Light reflective sticker

We chose a light reflective sticker as one of the decorations is because it reflect light when a car pass by our Rainwater Overflow Divert Device. The reflective color will make sure that the driver can see our flood barrier in the dark. If it rains at night, we can put the barrier and people will be easy to recognize the barrier. Reflective tapes are made of special dyes which contain phosphorous in them. Hence, they will be able to reflect light even if there is no light. It can be easily affix them on any kind of surface

**TONY FERRARO, (2012)**



**Figure 10:** Light reflective

#### V. Rubber PVC Water Stopper Seals

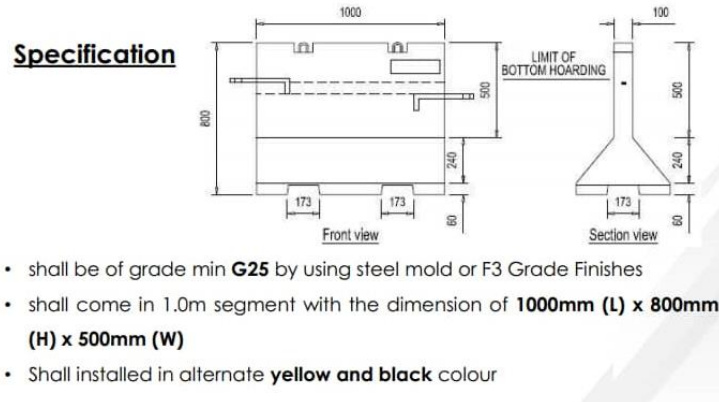
PVC Water Stopper Seals works as a sealant which will avoid the water to past through the flood barrier. Besides, it is easy to install and weld at site and at required angle & shape. It's price is RM 65 for 100 meter and can be buy in Alibaba.com.



**Figure 11:** PVC Water Stopper Seals

### 2.3.2 SIZE REFERENCE

For the size of our product, we decided to use 91.5 cm × 80 cm × 75 cm because this size is almost the same as the size of plastic/concrete barrier set by JKR. We also compare our product size with Noaq Boxwall which also has almost the same size as our product.



**Figure 12:** size set by JKR under ATJ 2C/85 (Pindaan 2017)

<b>Damming ability</b>	50 cm (20")
<b>Dimension of boxes (lxwxh)</b>	980 x 680 x 530 mm
<b>Effective length</b>	900 mm (3') per box
<b>Weight</b>	6,2 kg (14 lb) per box
<b>Speed of deployment</b>	Ca 200 m per hour
<b>Minimum curve radius</b>	1,0 m (in both directions)
<b>Material</b>	Polypropylene
<b>Temperature resistance</b>	-30° – +90°C



[www.noaq.com](http://www.noaq.com)

**Figure 13:** Size of Noaq

## 2.4 REFFERENCES

Style	Websites
MLA	<ul style="list-style-type: none"> <li>• Jill de Guzman, 6 disadvantages of sandbagging, 2016 <a href="https://acfc.asia/blogs/6-disadvantages-sandbagging/">https://acfc.asia/blogs/6-disadvantages-sandbagging/</a>. 18 November 2016.</li> <li>• Department Of Irrigation and Drainage, Flood Management, 2017. <a href="https://www.water.gov.my/index.php/pages/view/419">https://www.water.gov.my/index.php/pages/view/419</a>. 2 May 2017</li> <li>• Ocean Timber Product, The Properties and Benefits Of Balau Timber, 2016 <a href="https://www.oceantimber.co.za/single-post/2016/09/20/The-Properties-and-Benefits-of-Balau-Timber">https://www.oceantimber.co.za/single-post/2016/09/20/The-Properties-and-Benefits-of-Balau-Timber</a>. 20 September 2016</li> <li>• Avion Tech Sdn Bhd (1193719-K), 2019 <a href="https://buildingmaterials.com.my/materials/cengal">https://buildingmaterials.com.my/materials/cengal</a></li> <li>• Kambo Timber, Balau Wood <a href="http://www.kamwo.com.my/timber-balau.php">http://www.kamwo.com.my/timber-balau.php</a></li> <li>• Local Harwood Flooring, Balau, 2017 <a href="https://www.rvwoods.com/balau/">https://www.rvwoods.com/balau/</a> . 28 April 2017</li> <li>• Corrosianpedia, Fibreglass, 2019 <a href="https://www.corrosionpedia.com/definition/2474/fiberglass">https://www.corrosionpedia.com/definition/2474/fiberglass</a></li> <li>• West Australian Steel Sales, Top Benefits Of Using Sheet Metal, 2015 <a href="https://www.wasteel.com.au/top-benefits-of-using-sheet-metal-in-construction/#.XUZz4I4zbIV">https://www.wasteel.com.au/top-benefits-of-using-sheet-metal-in-construction/#.XUZz4I4zbIV</a>. 25 April 2015</li> </ul>

## **Chapter 3**

### **RESEARCH METHODOLOGY**

#### **3.1 CHAPTER INTRODUCTION**

Due to Malaysia's geographical location, most flood that occur are natural result of cyclic monsoon during tropical wet season that are characterized by heavy and regular rainfall from roughly October to march. Inadequate drainage system in urban areas also enhance effect of heavy rain though efforts are underway to resolve this. Our group chooseto build a flood barrier to solve this problem that often occur in our country. We believe that our product flood barrier can control flood in our country and reduces damages that occur because of flood in Malaysia.

#### **3.2 RESEARCH DESIGN**

The research design is a data processing procedure that is collected based on specific and systematic planning on the concept of establishing a network of relationships between variables involved in a study (Kerlinger 1970). The design of this study uses survey method. The survey is a descriptive approach widely used in research to collect data and information (Azizi Yahya 2007). According to finik (1995), the survey is a system of collecting data to describe, compare or explain knowledge, attitudes and practices and behaviors. This design also uses experimental method. Experimental method is quantitative research procedure where researchers examine the effects of treatment on the results of the study participants. The experimental study design involves pre and post tests.

### **3.3 DATA COLLECTION METHOD**

Data and information for this study are collected in various ways such as documentation, face-to-face interview (personal interview), direct observation and other methods like video recording.

#### **3.3.1 DOCUMENTATION**

The study was initiated using resources from the internet, journal and article to obtain information regarding the place of study.

#### **3.3.2 FACE-TO-FACE INTERVIEW**

We have choose an experienced worker, Kaliyan @ Selvam A/L Panjanathan that works in wood industry for 32 years as respondent to ask about the characteristics of cengal wood, and it's current prices in market to buy. Other than that, we also choose Encik Rahaimie Sajat and Md Nazley Bin Othman from JPS (Jabatan Pengairan dan Saliran Negeri Selangor) that have 8 years experienced work. We ask about floods in Malaysia and system that we use in our country to control flood.

#### **3.3.3 DIRECT OBSERVATION**

Our group have gone to places that happen flash flood in nearby areas at Shah Alam areas. We went that places observe directly about its current situation of flood and effect to nearby people who live there.

#### **3.3.4 OTHER METHOD**

Nowadays, many new techniques of gathering information are available. We also gather information through video recording from youtubes.

### **3.4 INSTRUMENT OF STUDY**

Research instrument is a tool that used by researcher when doing a research. Instrument of study is used as basic to get data that we want so that we can achieved our objectives. There are two type of method which is quantitative and qualitative. We used qualitative method to do this research. We use interview and survey as our qualitative method.

### **3.5 PROCESS OF MAKING RAINWATER OVERFLOW DIVERT DEVICE.**

**Step 1:** Choose a safe environment location.

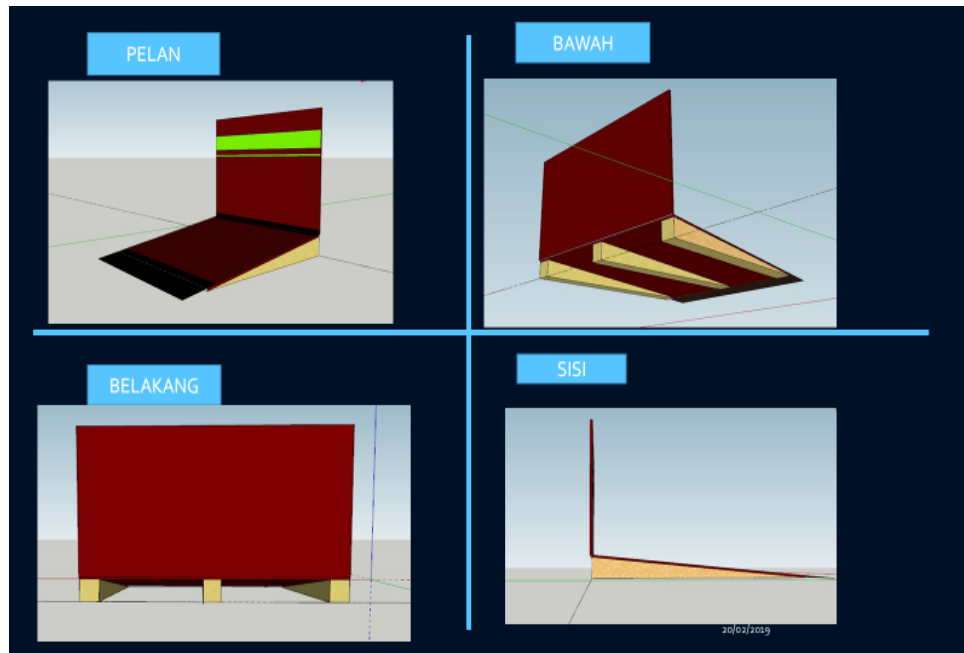
**Step 2:** Collect materials such as metal plate, balau wood with fiberglass, light reflective sticker, rubber PVC water stopper seals and door hinges.

**Step 3:** Cutting the metal plate, balau wood with fiberglass, light reflective sticker and rubber PVC water stopper seals in wanted sizes

**Step 4:** Welding the metal plate first as shown in below pictures and install door hinges between two metal plates.

**Step 5:** Installing Balau wood with fiberglass below the metal plate as a basement.

**Step 6:** Finishing by sticking PVC water stopper seals in the cracks between two metal plates and paste reflective sticker on the sheet metal plate.



### 3.6 USER INSTRUCTIONS

FOLLOW THESE INSTRUCTIONS:

1. Inspect the area where the rainwater overflow divert device is to be constructed.
2. Lay out the barriers and arranged them one by one.
3. Analyses the corners and curve surfaces in the inspected areas.
4. Pump away the water towards the barrier.
5. The barriers will block and drive water to another place.
6. After use, clean the barriers and dry it under sunlight.
7. Then, stacked the barriers and keep in save place.



### 3.7 MATERIAL OF RAINWATER OVERFLOW DIVERT DEVICE

1. Sheet metal plate



2. Wood with fiber glass.



3. Light reflective sticker.



4. Rubber PVC water stopper.



## 5. Door hinges.



### 3.8 TYPE OF TESTING

#### 3.8.1 Impact test

We will conduct the test by using water pump which we will determine the velocity of water that our product can withstand. We will be using different velocity to test our product. Then, we will record the result and make a graph from the result. The test will be conducted on our prototype which has a 3x smaller size than the real one.

#### 3.8.2 Stability test

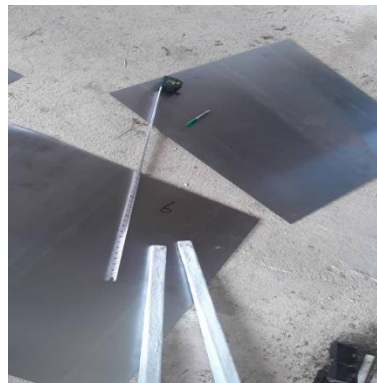
We will conduct the test by making a circular small pond which the pond will be construct by using sand bags and arranged our product with sand bags to see if it can withstand the pressure from the water or not. After the pond is filled with water, we will take video and observe if there is any water leak from the place we put our product. The test also will be conducted on our prototype which has a 3x smaller size than the real one.

### 3.9 ESTIMATION COST OF PROJECT

METAL PLATE	RM60(7feet x 4 feet)
DOOR HINGES	RM10
WOOD WITH FIBERGLASS	RM115
OTHER MATERIALS	±RM30

### 3.10 METHODOLOGY

#### 1) Process of Rainwater Overflow Divert Device.



**FIGURE 1:** The sheet metal plate, balau wood coated with fiberglass and door hinges must be collected.



**FIGURE 2:** The balau wood coated with fiberglass.



**FIGURE 4:** The product after installed.



**FIGURE 3:** The sheet metal plate must be welded first as shown in picture and install door hinges with door lock behind the metal plate.



**FIGURE 5:** The product was colored with white spray as basement before colored with yellow.



**FIGURE 6:** The product was let to dry.



**FIGURE 8:** Conducting test.



**FIGURE 7:** The product was coloured with yellow paint.

## 2) Process of meeting with JPS officers



FIGURE 9: Mr. Rahaime Bin Sajat as assistant engineer giving explanation about flood in our country.



FIGURE 10: Mr. Rahaime Bin Sajat giving explanation about tools used to calculate rainfall.





FIGURE 11: Example of tools to calculate rainfall.

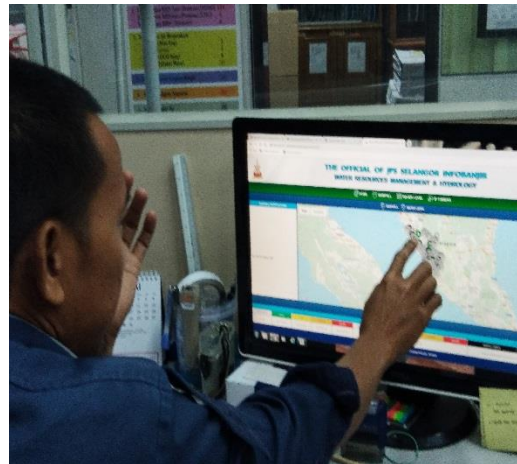


FIGURE 12: Mr. Md Nazley Bin Othman is giving explanation about rainfall from JPS website.

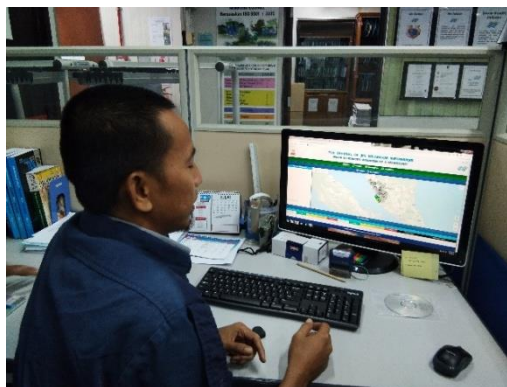


#### **4.1 JPS Officers**

##### **1. Mr. Rahaime Bin Sajat as assistant engineer**



##### **2. Mr. Md Nazley Bin Othman**



##### **3. All JPS officers in hidrology department**



### **3.11 SUMMARY OF CHAPTER**

In this chapter, we are explaining about the ways of handling Rainwater Overflow Divert Device and ways to produce the Rainwater Overflow Divert Device. We also included the research design and data collection method with estimation cost. The research showed that the Rainwater Overflow Divert Device is cheaper and easy to use.



## CHAPTER 4

### PREPARATION FOR COLLECTION OF DATA

#### 4.1 CHAPTER INTRODUCTION

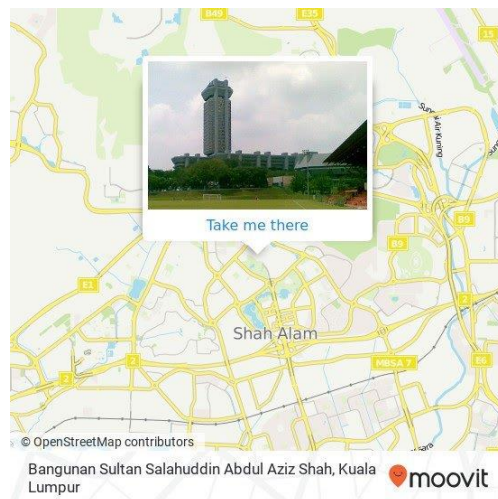
Our group have chosen to build a Rainwater Overflow Divert Device to solve flood problems that often occur in our country. We believe that our product can control flood in our country and reduces damages that occurs. The finalized objectives of our project is

- 1) To produce Rainwater Overflow Divert Device,
- 2) Conducting impaction test and stability test,
- 3) To compare the characteristic of Rainwater Overflow Divert Device with Sand Barrier.

#### 4.2 AGENCIES TO COLLECT DATA

The suitable agencies that we used to gather information about our project is

- 1) Pejabat JPS (JABATAN PENGAIRAN SELANGOR)- Bahagian Hydrology



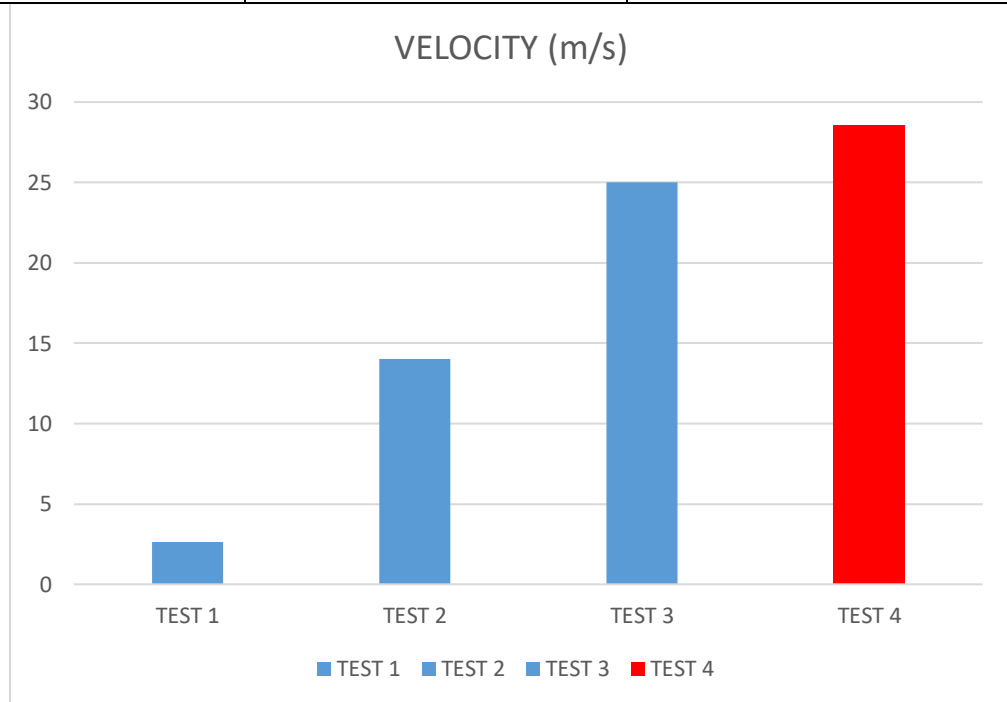
**FIGURE 1:** Pejabat JP

### 4.3 DATA COLLECTION FROM RESULT

#### 1. Impaction test

**Table 1:** The result from impaction test

TEST	TIME TAKEN (s)	VELOCITY (m/s)
1	0.38	2.63
2	0.07	14.0
3	0.04	25.0
4	0.035	28.57



**Graph 1:** The graph shows result from impaction test

From the impaction test, we know that the lower the time taken the higher the velocity for the water flows towards flood barrier in 1 meter. We conduct the test by using the ping pong ball as a medium to measure the velocity. We learn this method from a website and it is acceptable. Other than that, the flood barrier only can withstand the velocity of water until 25 m/s. The flood barrier starts to move backwards when the higher velocity is used such as 28.57 m/s. This shows the test 4 is a failure.

## 2. Stability test



**Figure 1:** The flood barrier tested by making a circular small pond.

From the stability test, we learn that our product is able to withstand water up to 35.5 cm from the ground. This shows that we can use this product in flood areas. This is because according to the data obtained from JPS, the maximum flood height in Selangor is 30 cm.

### 3. Effectiveness test



**Figure 2:** The flood barrier was used to change the flow of water beside paddy field

From the effectiveness test, we learn that our product able to change the flow of water to other place. The test was carried out beside the road. This shows that we can reduce the accident due to slippery roads in raining days by change the flow of rain water from road to beside drains.

### 4. Comparison between Rainwater Overflow Divert Device and sand barrier

PORTABLE FLOOD BARRIER		SAND BARRIER
Long term	<i>LIFE EXPECTANCY</i>	Short term
Low cost	<i>COST</i>	High cost
Easy	<i>WAY OF HANDLING</i>	Complicated
Take shorter time (10 minutes of installation)	<i>INSTALLATION PERIOD</i>	Take longer time

## **QUESTIONNAIRE ABOUT A STUDY ON RAINWATER OVERFLOW DIVERT DEVICE**

The questionnaire is constructed as follows to shows about Rainwater Overflow Divert Device.

### ***SECTION A: Demographic Information***

#### **INSTRUCTION:**

The following questions are related to your demographics. Please answer all the questions.

1. **NAME :**
2. **GENDER :**
3. **RACE :**
4. **AGE :**
5. **DEPARTMENT :**
6. **WORKING EXPERIENCE :**

### ***SECTION B: Scale to measure Rainwater Overflow Divert Device***

#### **INSTRUCTION:**

The following statements relate to Rainwater Overflow Divert Device. Please answer the following questions.

1. Is that our country had been used Rainwater Overflow Divert Device before this?  
 **YES**                       **NO**
  
2. Is that our country did not buy Rainwater Overflow Divert Device that had been used by other country?  
 **YES**                       **NO**
  
3. Is that the sand barrier is a good method to be used for flood?  
 **YES**                       **NO**

4. Is that our country is making Rainwater Overflow Divert Device or making research about it?

**YES**                       **NO**

5. Is that the sand barrier will be cost high?

**YES**                       **NO**

6. Do you think our product will give beneficial to our country?

**YES**                       **NO**

7. Does our country give priority to flash flood problems and try to solve it?

**YES**                       **NO**

## **CHAPTER 5**

### **CONCLUSION AND RECOMMENDATION**

#### **5.1 INTRODUCTION**

We have built a Rainwater Overflow Divert Device to control flood in our country and reduces damages that occurs. We have achieved our objectives of this project which is

- 4) We have successfully produced Rainwater Overflow Divert Device
- 5) We also have successfully conducted impaction test and stability test,
- 6) We also compare the characteristic of Rainwater Overflow Divert Device with Sand Barrier.

#### **5.2 GOOD PROPERTIES OF RAINWATER OVERFLOW DIVERT DEVICE**

There are a lot of good qualities in Rainwater Overflow Divert Device which is

1. Have good durability toward water
2. Easy to use and easy to handle
3. Easy to carried and easy to move
4. Reduces the usage of sand barrier in flood by using the Rainwater Overflow Divert Device
5. Reduces the cost and more effective.

#### **5.3 RECOMMENDATION**

We would be appreciating if anyone would like to improve our product in the future. This is because our product is capable to driving and blocking water during flash flood by replacing sand barrier but still, we are unable to perform many tests on the product due to lack of time and also due to several factors. These are the some of the suggestion that we made to improve our product.

1. Testing the flood barrier in the right place. Our group just testing the product in Politeknik Sultan Salahuddin Abdul Aziz Shah and beside road side at paddy field. In the future, we can get a better accurate data if the product is tested in real flash flood.
2. Design and produce the product by using more cheaper materials. Although our group make research about materials but still in the future, we can find many more materials with low cost and try to produce portable flood barrier with more cheaper products. This will reduce the cost of flood barrier.
3. Do research more precisely about other ways to prevent flash flood and also try to make portable flood barrier in different sizes. In our country, JPS give more attention to drainage system to prevent flash flood but still it cannot prevent the flood. So we can do research about the ways of Malaysia uses to prevent flash flood and compare with our product.

## **5.4 CONCLUSION**



The conclusion of this research that using Rainwater Overflow Divert Device by replaced sand barrier are:

1. The Rainwater Overflow Divert Device is durable, easy to carried, consume less time to install and needs less manpower.
2. The Rainwater Overflow Divert Device can withstand until 25 m/s which is better than sand barrier and good to used in flood.
3. The Rainwater Overflow Divert Device is very effective in driving and blocking water.

After the all tests, it shows that using the Rainwater Overflow Divert Device is much better than the sand barrier. This is because the Rainwater Overflow Divert Device overcome all weakness of sand barrier. In conclusion, the portable flood barrier is a very useful product and safe to used in flood.

## ATTACHMENT OF PROJECT

### GANTT CHART PROJECT 1

	W 1	W 2	W 3	W 4	W 5	W 6	W 7	W 8	W 9	W 10	W 11	W 12	W 13	W 14	W 15
<b>PROJECT 1</b> WHAT IS RESEARCH															
PROPOSE SUITABLE TOPIC AND SUBMIT PROJECT PROPOSAL FORM															
PREPARED PROPOSAL REPORT															
PRESENTATION 1															
RESEARCH WRITING															
PREPARE LITERATURE REVIEW															
RESEARCH METHODOLOGY; RESEARCH DESIGN, DATA COLLECTION, METHODS OF LAB WORKS															
PRESENTATION 2															
PRODUCE THE PRINTED PROJECT REPORT CONSISTING CHAPTER 1, 2 AND 3.															
PRESENTATION 3															
SUBMIT REPORT															

