



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

**GABION WALL INSTALLATION  
AT AKADEMI BINAAN MALAYSIA WILAYAH UTARA  
SINTOK, KEDAH**

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It is recommended that the report of this practical training provided

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**Entitled**

**Practical Report Title  
GABION WALL INSTALLATION**

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

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DECEMBER 2018

STUDENT 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 Akademi Binaan Malaysia (ABM) for duration of 14 weeks starting from 3<sup>rd</sup> September and ended on 7<sup>th</sup> December 2018. It is submitted as one of the prerequisite requirements of DBG307 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

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## **ABSTRACT**

A gabion wall is a retaining wall made of stacked stone-filled gabions tied together with wire. Gabions walls are usually battered or stepped back with the slope rather than stacked vertically. The aim of this study is to explore the soil stabilization to prevent erosion. Methods of study use were observation and interviews. It was found that the methods used to construct the gabion for project 'Membina Tembok Penahan Gabion' and material used were containers constructed of wire mesh or other material and filled with loose stones or other similar materials. The purpose of the installation of a gabion in a project is to prevent from a landslide and ground settlement in case there are rain and the stagnant water on the construction site. Gabion role is to retain the construction to its place and avoid it from any defects on the planned projects. In a nutshell, without the help of gabion in the construction process, the nearby places especially the river will be in damage because of the eroded lands.

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## CHAPTER 1: INTRODUCTION

The gabion wall is also called retaining wall. A standard gabion wall consists of numerous individual metal wire baskets, or cages, joined together by wire ties to form a unified structure. You can build a single level of baskets or stack baskets on top of each other for a taller wall. The size of the baskets and the rocks varies according to the builder's needs. In some cases, crushed stone is used in place of rocks. (Dougias,1989)

The most common civil engineering use of gabions was refined and patented by Gaetano Maccaferri in the late 19th century in Sacerno, Emilia Romagna and used to stabilize shorelines, stream banks or slopes against erosion. Other uses include retaining walls, noise barriers, temporary flood walls, silt filtration from runoff, for small or temporary/permanent dams, river training, or channel lining. They may be used to direct the force of a flow of flood water around a vulnerable structure. (Wikipedia,2016 )

Rock is the most typical filler for its durability, longevity, and stability. Often the filler is chosen for its aesthetic attributes, or by what can be recycled from a site. Some considerations depend on a wall's purpose. For a retaining wall, the rock must be dense enough to support the load. A hard rock such as basalt is typical. (Donald H. Gray Robbin,1982)

Advantages of gabions can include;

1) Sustainable – Carbon footprint analyses show that the use of a gabion solution can reduce CO2 emissions by up to 80% compared to a concrete retaining wall of the same height. If allowed to grow, vegetation can establish within a gabion wall, which can further contribute to carbon sequestration of the solution. (Pennsylvania,1990)

2) Beautiful at a glance – Aesthetics are important. Large unobtrusive concrete structures are unnecessary, as gabion walls contribute an element of prestige to your infrastructure. Classic concrete walls or retaining walls are monolithic, while gabion retaining wall blocks, filled with local material, are more in sympathy with their surroundings. Gabion structures can also be designed so that re-vegetation takes place when plants colonize the interstitial spaces between the rock fill, thus returning the solution to nature. We could say that gabions are a way to secure nature with itself. (Pennsylvania,1990)

3) Scalable – Even if the baseline technology remains the same, the wire-mesh of each retaining wall block can be adapted to different needs. Gabions structures, furthermore, are perfectly

scalable as they can be used for massive structures but also for small-scale constructions.  
(Pennsylvania,1990)

4) Smart and flexible – Who says that gabions are only a rural solution? Many modern buildings and infrastructure being designed or updated today are making use of gabions in order to renew their look and meet the demands of sustainability. Gabion solutions constitute an architectural lever when it comes to landscaping and urban design. (Pennsylvania,1990)

5) Scalable – Even if the baseline technology remains the same, the wire-mesh of each retaining wall block can be adapted to different needs. Gabions structures, furthermore, are perfectly scalable as they can be used for massive structures but also for small-scale constructions.  
(Pennsylvania,1990)

## Types of Gabions

According to (Manuela Escarameia, 1998) there are number of gabion configurations that can be selected based on their cost and function. Common types of Gabion are as follows:

### 1. Gabion baskets

It is a net wire mesh that produced in box-shaped and in different sizes.

Used in highway and railway works.

It would be economical unless filling materials are not available from quarries near the project site.



Figure 1: Shows the gabion baskets

Source: Books of River and Channel Revetments

## 2. Gabion Mattresses

- Gabion mattresses, also known as reno mattresses.
- Gabion mattresses height is shorter than the other types of measurements as it might be observed from the Fig. 3.
- It is employed in the channel coating for preventing erosion. So, it tackles wave and erosion induced velocity.
- Common size, 6 m long by 2 m wide by 0,3 m high.

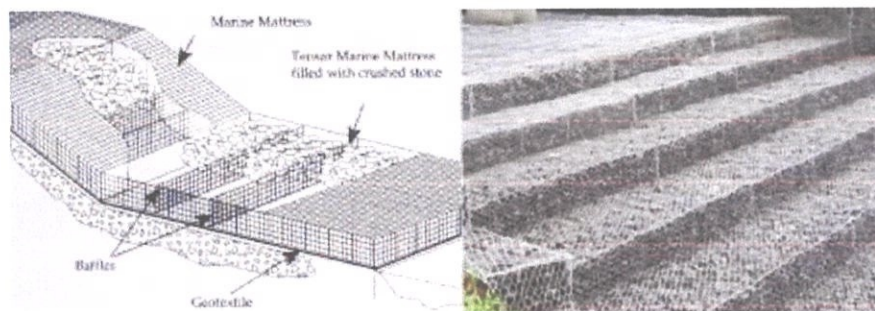


Figure 2: Shows the Gabion Mattresses

Source: Books of River and Channel Revetments

### 3. Gabion sacks

- This type of gabions is formed quickly.
- It has a porous and flexible structure.
- Gabion sacks are usually used in hydraulic works in emergency conditions.

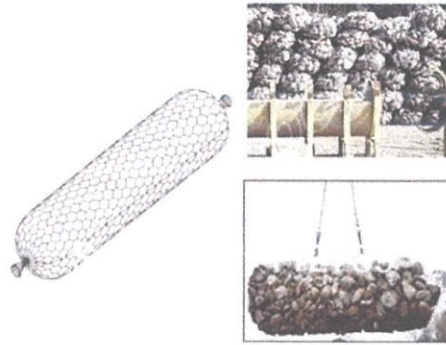


Figure 3: Shows the Gabion Sacks

Source: Books of River and Channel Revetments

### 4. Gabion wire mesh

- It is utilized to keep the possible rock and stone fall on the highway and railway surfaces.
- Gabion wire mesh maintains stability of the slope close to highway and railways.
- It is applied for anti-erosion to slope.
- It enhances embankment soil strength in combination with geogrid reinforcement.



Figure 4: Shows the Gabion Wire Mesh

Source: Books of River and Channel Revetments

## 5. Decorative Gabion Elements

- It is used indoor and outdoor decoration, garden design and landscaping.
- Gabion elements offer suitable environment for the growth of plant roots

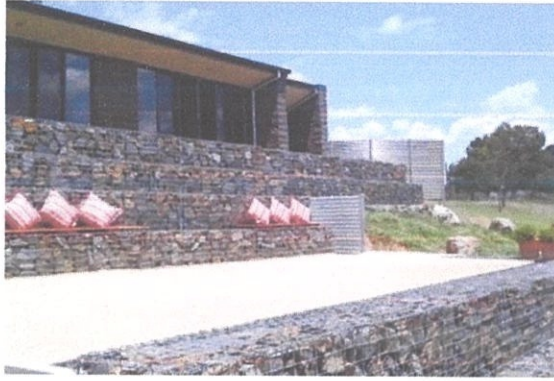


Figure 5: Shows the Decorative Gabion Elements

Source: Books of River and Channel Revetments

## Gabion wire mesh properties

Wire mesh used to manufacture the cage of gabion shall poses certain properties otherwise it might not serve its purpose properly. Table 1 provides the desired properties of gabion wire mesh. (Prete Federick Lagasse, 2007)

Raw material		Gabion wire mesh properties		
Technical properties	Unit	Descriptions	Tolerances	
Mesh	mm	50×70, 60×80, 80×100, and 100×120	—	
Maximum wire thickness	mm	2-5	0.05	
Amount of covering	gr/m <sup>2</sup>	30-300	5	
Tensile strength	MPa	350-2000	2	
Elongation (25cm long)	—	10%	—	
Zinic coating strength	Turns	5	Shall not break or crack	

Table 1: Gabion wire mesh properties

Source: Book of Countermeasures to Protect Bridge Piers from Scour

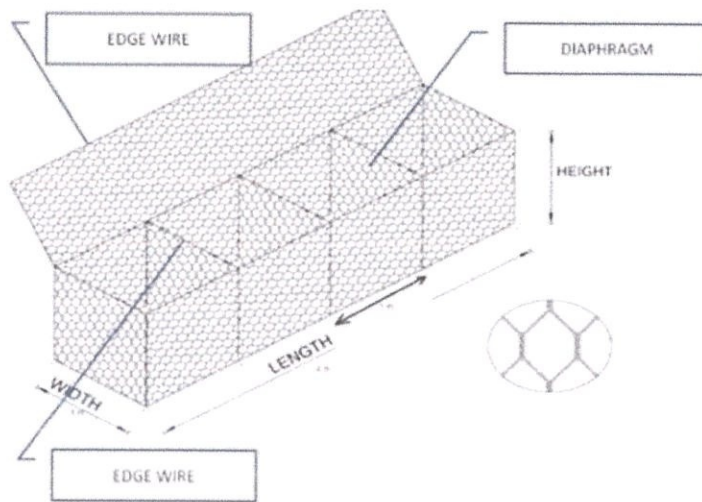


Figure 6: Shows the Wire Mesh Properties

Source: Book of Countermeasures to Protect Bridge Piers from Scour



## **1.1 Objectives**

The objectives this report is:

- i. To investigate the methods, machineries and equipment used for gabion construction for project ‘Pembinaan Tembok Penahan Sungai Gabion’ at Akademi Binaan Malaysia.
- ii. To determine the problems occurred and solutions taken to solve the problems

## **1.2 Scope of Study**

This study was conducted to understand the methods of installation gabion. The study focuses only on the construction of a gabion at the river which is located at Lot 2991 & 2992, Mukim Temin, Jalan Sintok Padang Sanai, Sintok, 06010, Kedah. To add to that, this study focuses only on the construction methods, materials and machineries and the duration of the project.

## **1.3 Research methods**

Methods that used to collect data from the project:

### **1. Observation**

The methods of construct the gabion were observed for three months to collect all the data.

The data was taken by taking picture for every steps of method and have written short notes on how the workers install the gabion according to the steps.

### **2. Interviews**

At the site, had interview session with the supervisor about the project and labors to know how the installation. The interview took about several days to be accomplished. All the data about the interview are jotted down by writing short notes.

### 3. Documents reviews

Refer to the construction drawing to know the design of the building and the actual size of the project according to the site conditions. Progress report is used to know about the ongoing project. Company profile also been used to know about the information and background of the company.

## **CHAPTER 2: COMPANY BACKGROUND**

Ketari Merah Enterprise is a company registered with the Companies Commission of Malaysia (SSM) on 20 November 2002, start operations at Lot 11, Varsity Mall, Universiti Utara Malaysia. In the year 2008 the company has expanded its business further by opening a new business located in the town Changlun Business Complex II address, 24B, Town Changlun 2, 06010 Changlun, Kedah. Ketari Merah Enterprise is registered with the ministry of finance Malaysia, the Contractor Service Centre (PKK) and the Industrial Development Board Construction of Malaysia (CIDB).

Ketari Merah Enterprise business scope is in construction, ICT, the supply of office equipment and stationery and communications, civil and electrical engineering. Ketari Merah Enterprise is committed to maintaining the quality and reputation for excellence by providing the best service and quality. The company will continue to emphasize the skills and expertise best to ensure quality and service levels that meet customer's needs.

Now, there are lots of big project constructed under Ketari Merah Enterprise. Based on the achievement and experience, Ketari Merah Enterprise will be able to compete with others company to achieve successful in future.

## 2.1 Completed Projects

Ketari merah Enterprise has many projects since its establishment. However, for this study only project completed two years ago till now are listed in the table below:

NO.	PROJECT	COMPLETE DATE
1.	Kerja baik pulih Jalan Raya at Pendang, Kedah	18 January 2018
2.	Double Storey House at Jitra, Kedah	21 December 2017
3.	Pembinaan Jalan Raya, Kuala Nerang, Kedah	16 September 2017
4.	Pembinaan Tembok Penahan at Pendang, Kedah	24 August 2017
5.	Single Storey House at Sik, Kedah	10 July 2017

Table 2: List of Completed Projects of the Company

## 2.2 Ongoing Projects

NO.	PROJECT
1.	Pembinaan Tembok Penahan Gabion at Sintok, Kedah
2.	Single Storey House at Changlun, Kedah
3.	Double Storey House at Paya Pahlawan. Jitra, Kedah
4.	Baik Pulih Jalan Raya at Sempadan Bukit Kayu Hitam, Kedah
5.	Single Storey House at Kuala Perlis, Perlis

Table 3: List of Ongoing Projects

**2.3 Organization Chart**

Ketari Merah Enterprise was established since 2002. The company's directors are Mohd Ghazali Bin Haji Daud. The management of the company headed by Encik Azhar bin Mamat and assisted by Zaimah binti Yusuf. The company also employs several other management and field staffs.

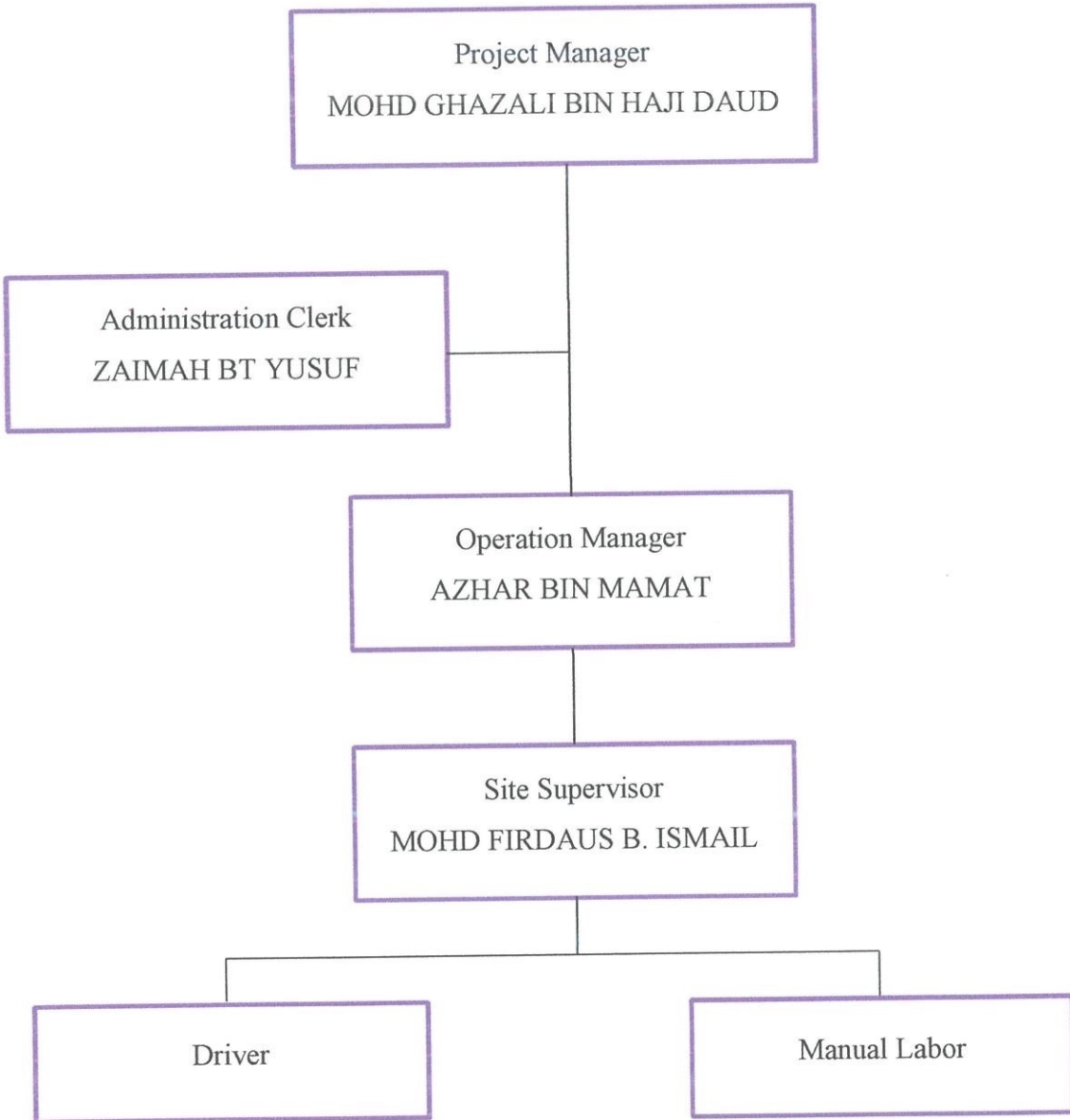


Figure 7: Organization Chart

### CHAPTER 3: CASE STUDY

The project of this case study was a gabion construction i.e. the ‘Cadangan Pembinaan Tembok Penahan Sungai ‘Gabion’. The total of construction project cost was Ringgit Malaysia Five Hundred Thousand (RM 500,000.00). The duration of the construction contract and the completion of this project were 24 weeks starting from 28th June 2018 and the expected completion date is on 28th December 2018. However, the project was delayed with the approval of extension of time until January 2018. The project was conducted by four labours and only two machineries used. The area of the river where the gabion was constructed was surrounded by offices, trainee’s hostel and forest. So, it required a suitable method for doing this project and doing clearance of the trees, bushes and rubbish at the area before the construction started.



Figure 8: Location of the project

### 3.1 Methods

The methods of gabion wall installation are:

First, project start to identify the location of the site project to make sure the method of installation is correct and suitable with the places.



Figure 9: Selected area

After had the correct place, it continued with clearance. Clearance activity was executed to clear all the trees, bushes and rubbish to make the job easier during the process.



Figure 10: Clearance conducted by backhoe

Before installed the gabion cage, the base area for the cage was excavated for 1 feet equal to 0.3085 meter depth from the ground level using excavator. Design a mark to construct a stone retaining wall using yarn and plywood according to the plan provided.



Figure 11: Base area of the cage was excavated using excavator

Prepare equipment according to production instructions and job specifications. The gabion cage was made with size 1 meter  $\times$  2 meter using steel wire and been coated by PVC coated galvanized wire gabion and arranged according to the drawing plan.



Figure 12: Gabion cage already installed

The workers filled up the gabion cage carefully with the rocks before installed at the site of the river. Spread the mortar thoroughly and place a random stone and then fix the position of a random stone so that it is upright and follow the yarn guides that have been made.





Figure 13: Filled up the rocks into the gabion cage

Then, tied the cage firmly with steel wire to make sure it can absorb load pressure from the rock structure. The tie that can be made is flatterring and embossing.



Figure 14: The cage was tied using steel wire

Last, the gabion started to install at the side of the river for every 50 meter with four layers of gabion cage filled with rocks.



Figure 15: Gabion cage already installed at the side of the river

### 3.2 Problems and Solutions

The project was conducted for six months. Since June 2018 and expected will finish on December 2018. During the project there are a lot of problems that they faced. First, the problem is:

#### **i. Uprooted**

The retaining wall will reverse if the supported ground exceeding the wall capacity. This is due to an imbalance of active and passive pressure acting on the retaining wall. This failure occurs when the force acting against the wall causes it to rotate at the front of the lower edge of the heels below the wall. To achieve stability, the reverse resisting moment must exceed the moment which causes it to reverse.

Solution of this problem is the company should use a suitable supported based on the capacity. A suitable supported ground beam will prevent from an unwanted incident on the construction site.

#### **ii. The involvement of water towards the wall**

The involvement of groundwater affected the stability of the walls. The increased water content in the soil will cause the weight of the land unit to increase. It will lead to power increase that supported the soil. The wall can't be stable if there were an increasing soil unit that origin from the water underground.

The solution of this case is management about the water flow has to make sure the drainage system is in a good condition and can be structure to avoid from the occurrence of the wall instability.

## CONCLUSION

From the investigation based on gabion, the methods used to accomplish the process of gabion are containers constructed of wire mesh or other material and filled with loose stones or other similar materials. The gabion wall can be constructed with a vertical, stepped or sloping front faced and is designed as a conventional gravity wall against overturning, sliding and excessive base pressure and the steel gabion cage itself can be protected by galvanizing or plastic coating, or the whole cage may be made from polymer grid material. The solely reason is to prevent from the landslide on the construction site. Based on the observation this is the only and merely way to build the gabion. The methods are same as the one in theory. If there are something that been carried out differently it is based on the types of the project and also based on the company.

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## APPENDICES



Figure 16: Shows location of the project

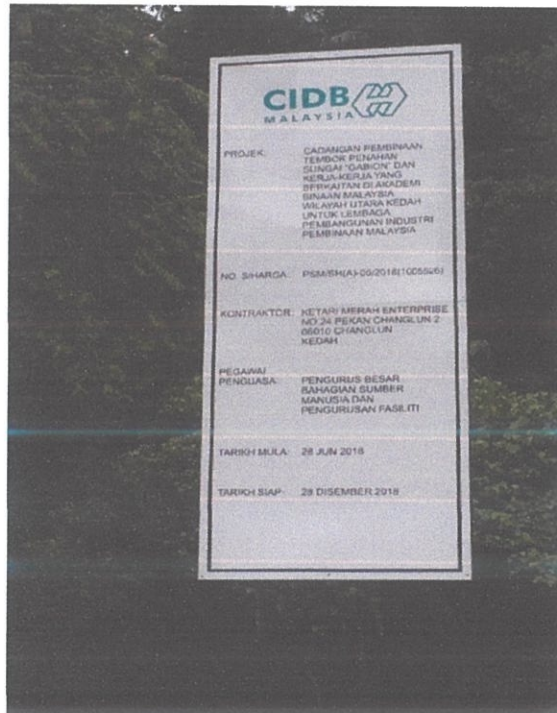


Figure 17: Project Signboard



Figure 18: Sign of construction work in progress



Figure 19: The River that been choose to construct gabion