

## THE STRUCTURAL GEOLOGY STUDY AND SLOPE STABILITY ANALYSIS IN KARANGBAWANG VILLAGE, AJIBARANG, CENTRAL JAWA

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### ABSTRACT

*Engineering geology or Geotechnical is the application of geological science in engineering practice for the purpose of ensuring that geological factors affecting the location, design, construction, operation and maintenance of engineering works have been properly identified and taken into account. Engineering geology research can be carried out during the planning, environmental impact analysis, civil engineering design, optimization engineering and construction stages of public and private projects, as well as in the post-construction and project investigation stages. Engineering geology research is carried out by a geologist or an educated engineering geologist, trained professionals and has the ability to recognize and analyze geological hazards and adverse geological conditions. The whole purpose is to protect life and property from damage as well as solutions to geological problems. Geological observations made in the form of geological structures in the form of joints and faults are very important parameters carried out in the planning stage of a development because it is very influential in the short, medium and long term stability of a civil building. Detailed measurements and mapping of the intensity level of geological structures will be able to assist engineering geologists in making recommendations for a civil construction project. Geological engineering study of the Ajibarang area and its surroundings, especially in the area of PT.development project crusher and conveyor. So that it will get good slope safety and can be used as the basis for the development of the crusher and conveyor at PT. Semen Bima.*

**Keywords:** geotechnical, fracture, geological structure

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### PRELIMINARY

#### Location and Regional Achievement

The research location is in the crusher and conveyor construction project area of TP Semen Bima which is located in the village of Karangbawang, Ajibarang District, Banyumas, Central Java. The research location is approximately 200 kilometers from the Yogyakarta City with a travel time of approximately 4 hours by motorbike or car.

## **RESEARCH METHODOLOGY AND STAGES**

The methodology used is field and laboratory research. When the work stages include preparation (desk study), field observations, making 3D models and making preparing papers.

- **desk study**

The desk study includes collection of related references, preliminary studies, preparation of research plans, creation of base maps and determination of traverses.

- **Field Observation**

Field observations were used to collect data on lithology and structural geology. Observation in the field using a geological hammer, geological compass, GPS, loupe, meter etc.

- **Studio Works**

The studio's work includes making slope stability analysis with all data taken at all points in the field.

## **GEOLOGICAL AND REGIONAL STRATIGRAPHY**

The geological research area is included in the Bogor-North Serayu Basin on the 1996 Geological Map sheet by The Geological Survey Centre.

### **Physiography**

The physiography of Central Java by Van Bemmelen (1949) is divided into 6 zones, namely :

1. Quaternary Volcanic Zones
2. Alluvial Plain Zone of North Java
3. Bogor Anticlinorium Zone North Serayu-Kendeng
4. Central Java Depression Zone
5. South Serayu Mountain Zone
6. South Java Mountain Zone

Research area is part of the anticlinorium of Bogor, South Serayu-Kendeng (Van Bemmelen, 1949) which is dominated by hilly morphology with a distinctive formation of hilly folds and the lava plains of Mount Slamet.

### **The Regional of Structural Geology**

The regional geological structure of the Java Island includes 3 patterns, namely the Meratus Pattern (northeast-southwest), the Sunda Pattern (north-south) and the Java Pattern (west-east) according to Pulunggono and Martodjojo (1994) (**Figure 1**).

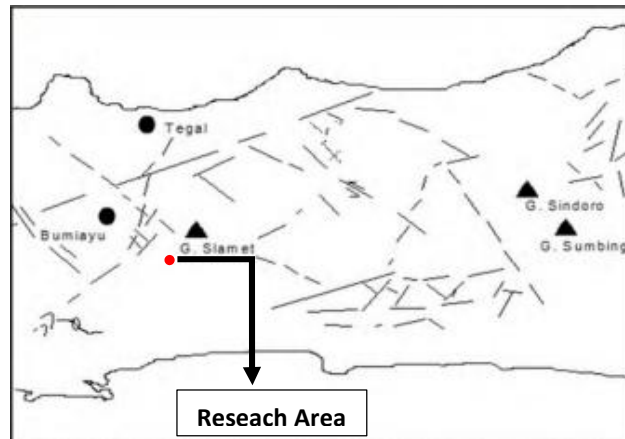


Figure 1. Structural Geology Pattern of Central Java (Sujanto, 1975).

## DATA AND DISCUSSION

All data that has been analyzed will be discussed in this here until the results and recommendations.

## THE RESEARCH AREA

The research area is a development area of PT Semen Bima in Karangbawang village, Ajibarang Sub-District, Banyumas District, Central Java (Figure 2).

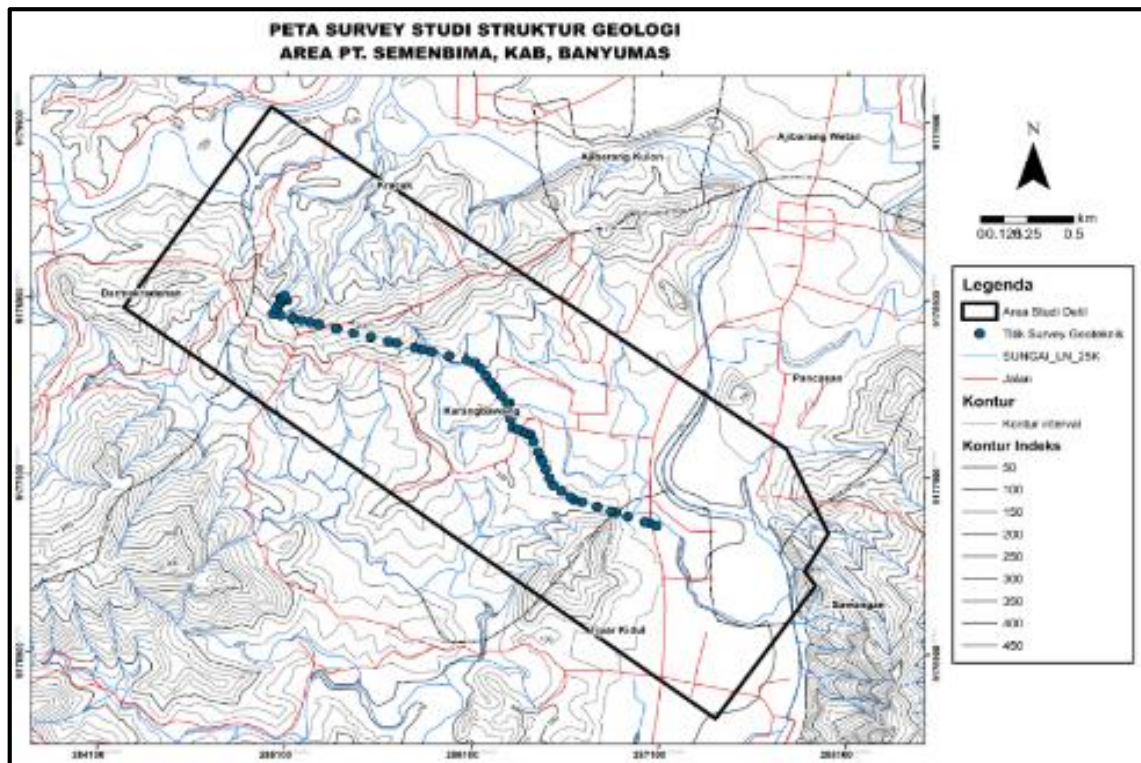


Figure 2. The Research Area (in the black box of this map)



## THE TRAVERS MAP AND OBSERVATION LOCATIONS

The survey results include 12 observation points, as shown in **Figure 4**. The development of crusher and conveyor striking northwest-southeast from the location where the limestone raw material is taken to the PT Semen Bima factory.



**Figure 4.** The Map of Observation's Location

## ANALYSIS OF GEOLOGICAL STRUCTURE AND SLOPE STABILITY

Along the road for the development of crusher and conveyor construction of PT Semen Bima, detailed geological structure measurement were made regarding the lithology to be cut and the slope stability analysis was carried out. This is necessary in order to anticipate the occurrence of soil and rock movements, countermeasures, and recommendations. This slope stability analysis requires measurement data in the form of: strike and dip of layer, strike and dip of slope, strike and dip of fractures, and friction angle value. The friction angle value used in this study was taken from several studies, limestone has a value of 30 and a tuff of 13.

### Slope Stability Analysis at Observation Location 4

The result of slope stability analysis in limestone of Tapak Formation, maybe will be toppling go to the south and maybe will be sliding go to the north (**Figure 5**).

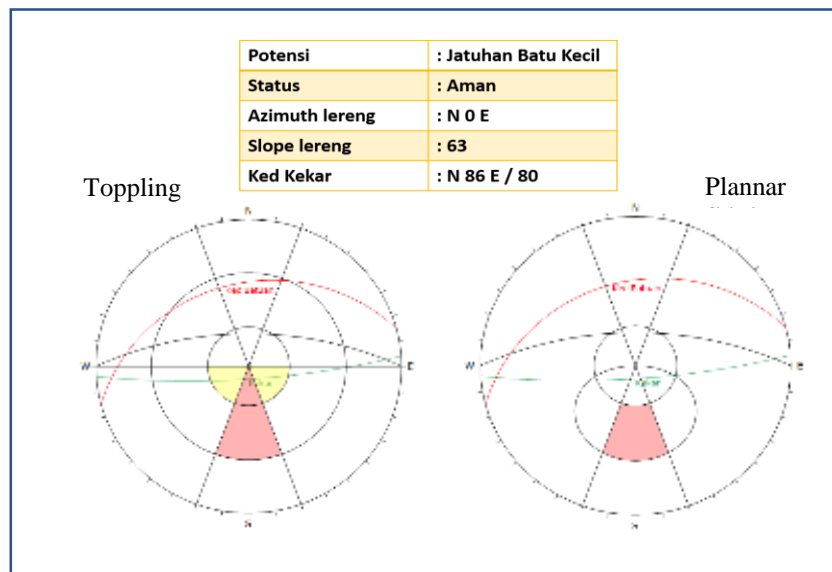


Figure 5. The result of slope stability in location 4.

### The Slope Stability Analysis at Location 6

The slope stability analysis at location 6 in the Limestone of Tapak Formation there will be small sliding abd falling in the form of wedge (Figure 6).

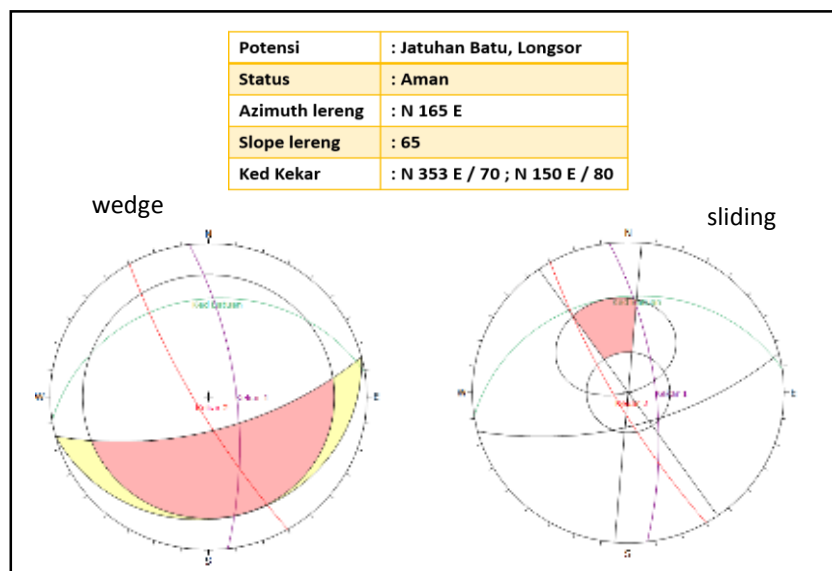
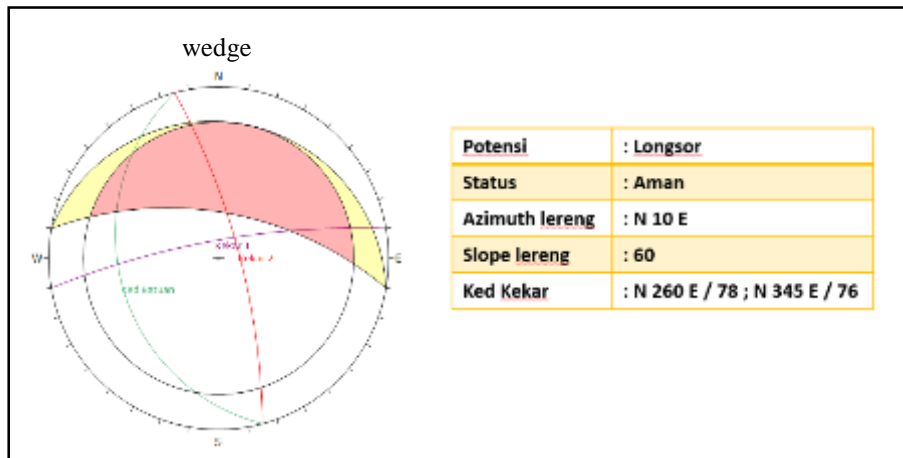


Figure 6. Result of slope stability analysis at location 6.

### The Slope Stability Analysis at Location 7

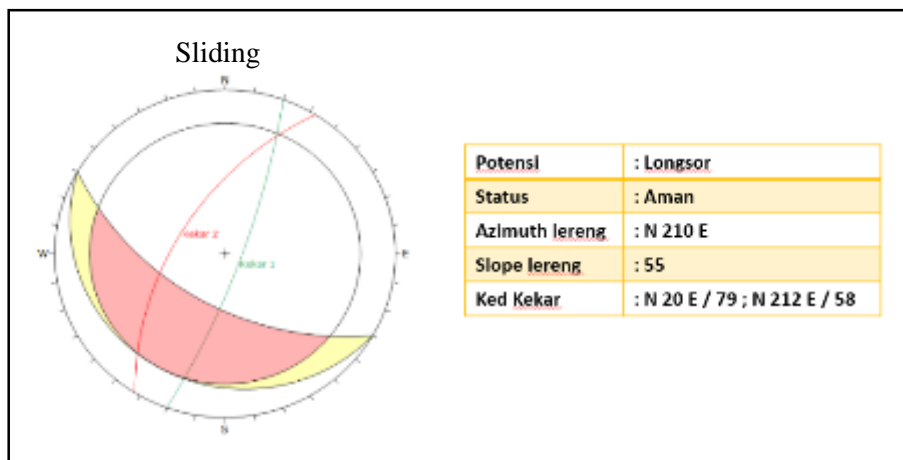
The slope stability analysis at location 7 in the tuffaceous sandstone of Halang Formation, if the lithology have weathering there could be landslide like wedge (Figure 7).



**Figure 7.** Result of slope stability analysis at location 7

### The Slope Stability Analysis at Location 10

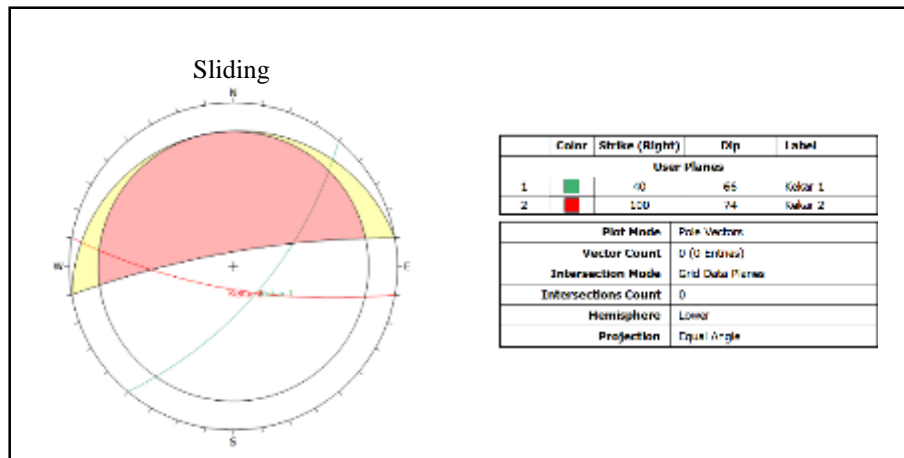
The slope stability analysis at location 10 in the tuffaceous sandstone of Halang Formation, if the lithology have weathering there could be landslide go to the northwest (**Figure 8**).



**Figure 8.** Result of slope stability analysis at location 10

### The Slope Stability Analysis at Location of Karang Bawang village

The slope stability analysis at location of Karang Bawang Village in the tuffaceous sandstone of Halang Formation, could be landslide go to the north (**Figure 9**).



**Figure 9.** Result of slope stability analysis at location of Karang Bawang Village

## DISCUSSION

This discussion will compile the results of slope stability analysis, drill location to 3D models for the development of crusher and conveyor construction for taking raw materials in the form of limestone for the Tapak Formation.

### Lithology in the Research Area

The lithology found in the research area in the PT Semen Bima development area is in the form of sandstones of Halang Formation Middle Miocene age and Limestones of Tapak Formation Upper Miocene age.

### Slope Stability in Every Observation Point

The result of slope stability analysis at all locations are basically safe. The result of slope stability analysis at location 4 will occur toppling and small sliding if the lithology is weathered. Whereas the result of slope stability analysis at location 6 will occur wedge and small sliding if the lithology is weathered. When the result of slope stability analysis at location 7 will occur small wedge. The result of slope stability analysis at location 10 will occur small sliding if mining is done from below. Whereas The result of slope stability analysis at location of Karang Bawang Village will occur small sliding to.

### The Location of Crusher

The former location of the crusher at location 4 was change to locations 7 and 8. The location of the 22.5m x 13m, the crusher built on the fresh tuffaceous sandstone,



bromnish gray in color and very strong to support the crusher. But it is recommended that there is still a drill check-2 at this location.

The location of this crusher is very advantageous because it is cloce to the limestone of the Tapak Formation as the raw material for cement and the conveyor is not disturbed by the limestone unloading activity.

### The Condition of Structural Geology

From the result of Observation throughout the development area of PT Semen Bima, **no active fault** were found. The main fault with a northwest-southeast tred is an old fault that is no longer active. In this fault zone, the rock is easily weatered.

### 3D Modeling in The Development Area of PT. Semen Bima

The result of observations from the 3D model of cement raw material which are limestone of Tapak Formation dipping from 20-30 degre to the northeast. We can also be seen the safe ride of conveyor road. We can also know that there are limestone reserves that have not been counted to meet the shotage of reserves needed for the ongoing operation of PT Semen Bima. Re-calculation of reserves should be carried out, so that a more accurate amount of new reserves will be obtained.

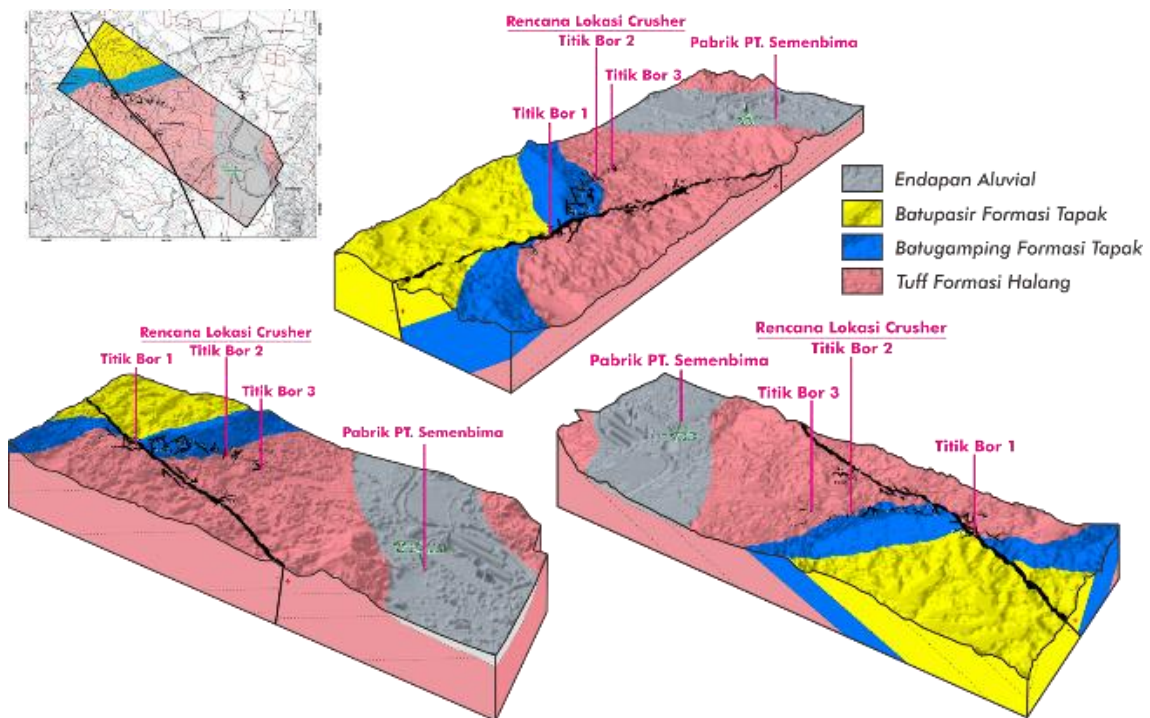


Figure 10. The 3D Model of PT Semen Bima development area

## **CONCLUSIONS**

Based on surface geological research, several conclusions can be drawn, namely :

1. In the research area including 2 lithology, namely limestone of Tapak Formation and tuffaceous sandstone of Halang Formation.
2. Found the right slip fault in the research area, which is no longer active.
3. Based on slope stability analysis, the conveyor development plan route can be categorized as geologically safe with several recommendations.

## **RECOMMENDATIONS**

Based on structural analysis and it is recommended to carry out drill checks in 3 locations :

1. Location-1 with coordinate **X:285218; Y:9178765**
2. Location-2 with coordinate **X:285804; Y:9178655**
3. Location-2 with coordinate **X:286168; Y:9178458**

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