

RELATIONSHIP OF SOIL PROPERTIES AND DYNAMIC LOAD TO DETERMINE TYPE OF LANDSLIDES IN SUMEDANG REGENCY WEST JAVA INDONESIA

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Abstract

Ciherang village is located in Sumedang, West Java Province, Indonesia. The village is very strategic because it connects the two major cities in West Java. Geology of research area consists of Formation Qvb (old volcanic breccia), Qyu (undefined young volcanic consist of tuffaceous sand, lapilli, breccia, lava, and agglomerates). The study was conducted to determine the type of landslide, as well as the role of dynamic loads to landslide in the research area. The methods used in this research are the interpretation of topographic maps, satellite image, engineering geological mapping to determine the distribution of soil types, joint data, soil horizon, disturbed soil sampling (USCS classification, basic and mechanical properties), and the slope geometry measurement. Based on the results of soil description, location A has dark-colored soil, with fine sand grain size, poor sorting, subrounded gravel, having organic content, middle plasticity, and the average value of slope is 57°. At location B the soil is blackish brown soil, fine particle grain size, subangular gravel, middle plasticity, and the average value of the slope is 45°. Type of landslide in this area can be classified into translational landslide. Another factor that led to the landslides is due to dynamic loads that exist on the main road crossing the study are, such as heavy – weight trucks more than 20 ton that pass through the connecting road between Cirebon - Bandung which give rise to vibration.

Keyword : type of landslide, soil description, engineering geology, dynamic load.

1. Introduction

Ciherang village is located in Sumedang, West Java Province, and it connects the two major cities in West Java. In geomorphology this area is located on the slopes of the mountain with an altitude of 720 m above sea level.

Based on the map of geology regional Bandung (P.H Silitonga, 1973) the study area consists of the of Formation Qvb (old volcanic breccia), Qyu (undefined young volcanic consist of tuffaceous sand, lapilli, breccia, lava, and agglomerates).

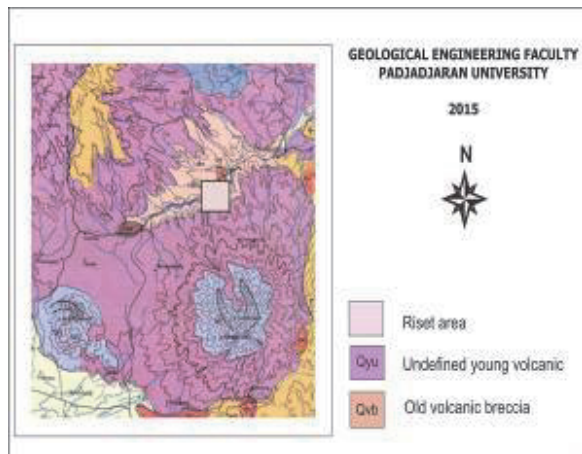


Figure 1. Location of research area

2. Landslide

Slopes are a natural surface appearance which has a height difference. If the height difference of the two places compared with the straight distance horizontally, will obtain the magnitude of gradients (slope). Slope shape depending on the movement of soil erosion and weathering. Slope topography parameters are divided into two parts, the slope and the height difference of relief. Slope stability is closely associated with landslides or ground movement which is the process of mass transfer of land naturally from a high place to a lower place.

This soil movement occurs due to changes in the balance of the soil bearing capacity and will stop after reaching a new equilibrium. Landslide is a slide or sliding or falling of the rock mass / ground or a mixture of both (Sharpe, 1938 in Hansen, 1984). Landslides generally occur if the ground is not able to withstand the weight of the soil layer on top of it because no additional load on the slope surface and reduced power tie between soil grains relief. Varnes (1978) classified the movement of the soil into six (6) types based on the mechanism and material (Table 1).

Some important parameters as the trigger landslides, among others, is the slope. The greater the angle of slope the greater the thrust due to increased shear stress is inversely proportional to the normal stress in the form of retaining strength. Besides the dynamic load will also affect the magnitude of the tilt angle. In areas that have a high dynamic load effects, then the angle of the slope should be smaller than the area of influence of the low dynamic loads. Dynamic

load can be either an earthquake or human activities (vehicle traffic).

Table 1. Types of Landslide

No	Type	Subtype	Description
1.	Falls		– Rockfall (bedrock) – Soilfall (Loose material)
2.	Slides	Rotational	– Slump (bedrock or cohesive units of material)
		Planar	– Block-glide (bedrock or cohesive units Loose material) – Rockslide (bedrock) – Debris slide (loose material)
3.	Flows	Dry	– Rock avalanche – Sand run – Loes flow
		Moderately wet	– Debris avalanche – Earth flow
		Very wet	– Sand or silt flow – Debris flow – Mud flow

3. Methods

The method used is the interpretation of topographic maps, satellite imagery, geological mapping techniques, soil sampling later be described and classified based on USCS standards, and measuring the slope geometry.

4. Result

The type of soil in the research area is the result of volcanic eruptions. This soil has a red in color, clay to sand in grain size, fertile, so that the rapidly growing settlements in this area. Based on the results of soil description, location A has dark-colored soil, with fine sand grain size, poor sorting, subrounded gravel, having organic content, middle plasticity, and the average value of slope is 57° . At location B the soil is blackish brown soil, fine particle grain size, subangular gravel, middle plasticity, and the average value of the slope is 45° . Based on USCS classification, this soil including to sand poorly graded (SP). This type of soil when it rains, water will infiltrate into the soil cracks that quickly expands back accumulates at the bottom of the slope, causing lateral movement, it is because it separated and semi plastic. Slope with high slope will increase the propulsive force than the retaining force. Based on sliding plane, type of landslide in research area is translational landslide.



Figure 2. Location A



Figure 3. Location B

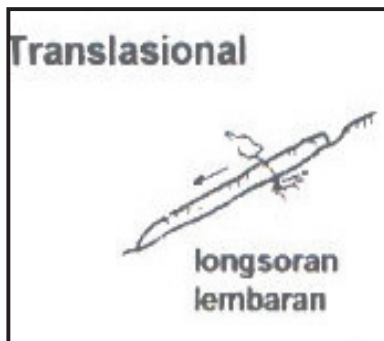


Figure 4. Translational Landslide Model

Beside landslides, other types of ground movement that develops is creep. Creep is a type of slow-moving. Grain size soil is coarse and fine. Type of this landslide is almost unrecognizable. After quite a long time creep landslide types can cause telephone poles, trees, or houses tilted. In Ciherang village house started cracking and the floor separately.



Figure 5. A,B,C. Impact of Creep Movement

5. Conclusion and Discussion

The type of soil found in the area of research is the result of volcanic eruption. This soil has a red in color, sand and clay grain size, and fertile. The type of soil which is less dense when it rains, water will infiltrate into the soil cracks that quickly expands back accumulates at the bottom of the slope, causing lateral movement, it is because it is separated by a semi plastic plasticity level. Slope with high slope will increase the retaining force than the driving force. Population density was a contribution of ground movement due to load that exceeds the soil makes the soil lose the connective power, so comes the movement of soil. governance paddy fields, cultivation, and the puddles on the steep slopes developed in this area. At the root of paddy fields strong enough to bind the grains of soil and make the soil becomes soggy and saturated with water so it is easy to landslides. Because Ciherang village located on the side of the road between the provinces of heavy vehicles such as buses, trucks, minibus passing from morning to night and vice versa then generate vehicle traffic vibration. Consequences thereof is ground, road, floors, and walls cracked.

6. Acknowledgement

Thanks to Faculty of Engineering Geology that easy in our research. And Sumedang District Government that has given permission to conduct research. Thanks to Mr. Delyuzar (Pusat Pengembangan dan Penelitian Geologi Kelautan) for funding this research.

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