The 43rd Annual Scientific Meeting of Himpunan Ahli Geofisika Indonesia
Semarang, 24-27 September 2018

Analysis of Slip Field with Resistivity Method : Case Study in Ulubelu Geothermal Area, Lampung, Indonesia

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Abstract. This research was conducted in Ulubelu area using resistivity method with dipole-dipole configuration to know the existence of slip field. The resistivity method is a method of studying the electrical resistance properties of this layer used to determine the slip plane with features of resistivity contrast. Measurements were made on two paths, namely path 5 and path 6. Path length used was 155 m with spacing between 5 m electrode. The result of inversion of measurement data gives RMS error value on path 5 and path 6 is 29.0 and 22.6. The detected slip on the track 5 with a depth of 15 - 30 m below the soil surface. While the field of slip on track 6 with a depth of 20-30 m. The field of slip found in the study area is translation slip. Translation slip consists of a rather hard rock parallel to the slope surface

1. Introduction

The landslide is a mass motion event of the soil, which can be defined as the displacement of slope-forming materials, in the form of real rocks or depositional materials that move down and out of the slopes. One of the most influential causes of landslides is the slip surface. This is because the field of slipping is the field that became the ground of movement of the land mass [1].
One of the geophysical methods that can be used to determine the structure of the soil layer and detect the slip plane is the resistivity method. Resistivity method is a method that studies the nature of electrical resistance of rock layers in the earth. The basic principle of the resistivity method is to send a subsurface current, and to re-measure the potential received at the surface. To be able to display the description of the subsurface condition done 2D and 3D geo-electric data processing. The underground layers depicted as cartesian cross-section with ordinates containing depth and abscissa information contain horizontal distance information and are distinguished by the color of each color having their respective barrier values [3].
Based on this, this study aims to determine the subsurface structure of the survey area by resistivity method using dipole-dipole configuration, determining the existence and depth of the slip plane, and describing the slid area based on the 2D cross-section and estimating the type of possible ground motion.

2. Methodology

Ulubelu geothermal area is administratively included into Tanggamus Regency, Lampung Province. located at coordinates 104 ° 33 '4 "BT and 5 ° 18' 48" LS. Ulubelu is one of the sectors in Northeast fault of Semangka and part of Tanggamus Region.

This measurement is done by using dipole-dipole configuration. The tool used in the measurement is Automatic Resistivity (ARES). The track length used is 155 m with a spacing between 5 m electrodes. The measurement trajectory is designed perpendicular to the slope of the slope.

The apparent resistivity data obtained from the field is selected to eliminate non-continuous data with surrounding data. Furthermore, inversion is done to see the distribution of prison types under the surface which then done the interpretation with the help of geological information.

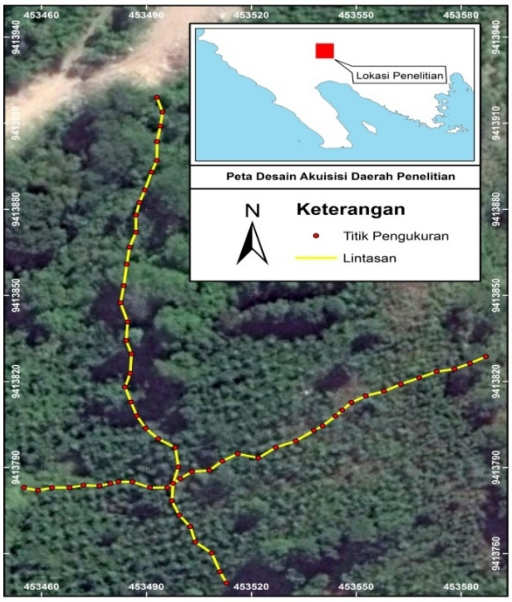

Figure 1. Field Data Acquisition Map

a. *Resistivity Method*

The resistivity method is one of the geophysical methods that utilizes the nature of the type resistance to investigate the underworld conditions. This method is performed by using a direct electric current injected through two current electrodes into the earth, then observing the potential formed through two potential electrodes located elsewhere. The measurable potential difference reflects the state beneath the earth's surface [3].

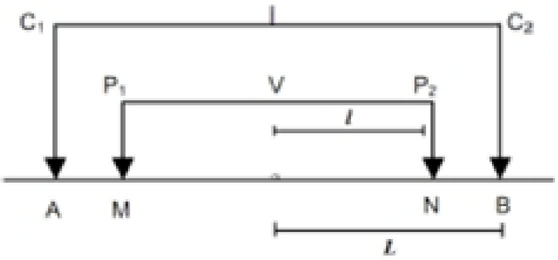

Figure 2. Dipole-Dipole Configuration

Table 1. Rock Resistivity Table [2]

Rock Type	Resistivity (Ωm)
Andesite	$4{,}5 \times 10^4$ (basah) – $1{,}7 \times 10^2$ (kering)
Lava	$10^2 – 5 \times 10^4$
Tuffs	2×10^3 (basah)- 10^5 (kering)
Conglomerate	2×10^3 - 10^4
Sandstone	$1 – 6{,}4 \times 10^8$
Limestone	50 - 10^3
Dolomite	$3{,}5 \times 10^2 – 5 \times 10^3$
Wet clay	20
Clay	1 – 100

The first layer shown in blue and green is an alluvial soil layer, clay soil with a green color is part of dry soil and blue color indicates more moisture content. The field of slip found in the study area is translation slip. Translation slip consists of a rather hard rock parallel to the slope surface. The material that moves above and below the slippery plane is called a landslide material. The boundary between the silent material and the muddy material is called the slip plane [4].

Based on the inversion obtained a cross section which describes the coating resistivity value according to topography. In the geoelectric configuration measurement the dipole-dipole configuration is used to find the slip plane or a different layer and can cause different slope layers to potentially slope fields. The existence of the slip is characterized by the presence of a layer that has a very different resistivity far, generally the lower layer has a greater resistivity and the upper layer has a lower resistivity. High resistivity indicates an impermeable layer and a hard layer, generally a type of igneous rock. Low resistivity indicates as a permeable zone, easily infiltrated by water and more water content.

4. Conclusions

Based on the result of inversion the measurement data give RMS error value on track 5 is 29.0, while on track 6 is 22.6. The slip field in this study was detected at a depth of 15 - 30 m characterized by resistivity contrast. The field of slip found in the study area is translation slip.

References

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