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Contents

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Ciwidey Debris Flow, Bandung, Indonesia

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There are three main factors that cause the Indonesian Archipelago to be a potentially high landslide hazard area. These factors are the topographic, geological and rainfall factors. A wide area of hilly and mountainous land with steep to very steep slopes, making it a weak zone (discontinuities of bedding formation, fault plane, etc), unconsolidated bedrock and earthquake as well as heavy rainfall in the range of 50-200 mm per week in a duration of 4-5 months per year, gives Indonesia a serious problem in landslide hazards. Landslides can occur anywhere at hilly or mountainous areas especially during the rainy season causing damage and the loss of properties, even human life. During the yearly rainy season, an average of 30-40 landslides occurs in Indonesia. Actually more than 40 landslides occur every year but not all of these occurrences are recorded by Directorate of Environmental Geology (DEG). Other types of landslides that frequently occur is the debris slides and slump with dimensions of 10 to 50 m in height, 30 to 500 m in width and 50 to 1000 m in length. These landslides often take place on steep slopes at hilly and mountainous areas that have been develop as agricultural as well as settlement areas.

The Pasir Jambu sub-district, have slopes ranging from 5° to more than 40° with a height between 900 to more than 1,700 meters above sea level. Debris flow disaster occurred at Dewata Tea Plantation on Tuesday, 23 February 2010 around 9am. This area was located in the Pasir Jambu district, Bandung, West Java and the geographical coordinates are 107°28'33.6" East and 07°12'53.1" South. This event killed 44 people and caused severe economic losses. Referring to the Land Movement Vulnerability Zone Map West Java, this debris flow event area was located in the secondary zone of land movement. This means that the area has a high degree of vulnerability to be affected by land movement. In this zone, the debris flow event can occur, especially in areas bordering the river valley, crack line (gawir), cliff road and disturbance slope. Even so, the factor that contributes most to the flow occurrence is the high rainfall and strong erosion. The overall view of debris flow at Dewata Tea Plantation can be seen in Figure 1(a).

Figure 1(a) The overall view of debris flow at Dewata tea plantation

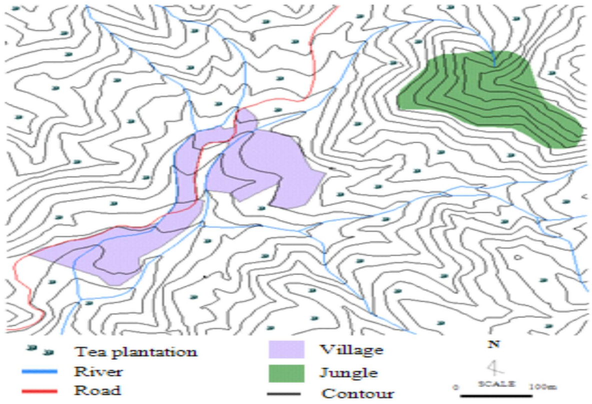
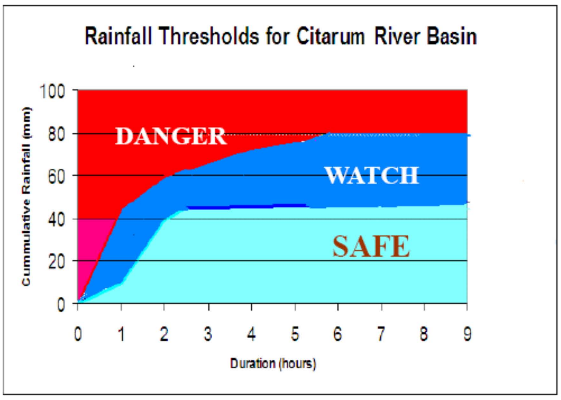


Figure 1(b) Land used in Dewata tea plantation

Land use in this region is mostly for agricultural activities owned by private tea plantations, which are occupied from low to high steep slopes. On the slopes of these hills there are many visible traces of the old landslide crack lines. In this region there have been several incidents of landslides with both large and small size damages and casualties. Figure 1(b) shows the land used in Dewata tea Plantation. The main soil type in this area is sandy clay loam. The soil particle size within the range of 0.002 to 0.75mm.

1. Rainfall thresholds and event

An antecedent rainfall and storm intensity needs to be developed to identify the occurrence of the landslides. To develop rainfall thresholds near Citarum River catchment, observed landslides data from 2003 to 2005 and rainfall data monitoring are used as reference. Observations of daily rainfall at the closest stations to the debris flow event are selected. The rainfall distribution patterns of Dewata Tea Plantation Hourly Automatic Rainfall station are used for disaggregating the daily rainfall data of the selected rainfall station. The plot of the relationships between rainfall durations and cumulative rainfalls at each date when the landslides occurred can be constructed and analyzed for developing rainfall thresholds.



To indicate the different levels of potential hazards, this rainfall intensity duration threshold can be used. Light blue color indicates a lower threshold rainfall which means safe from landslide events. The dark blue color shows that a number of landslide events that can occur and finally the red color (danger) represents an upper threshold which represents highly landslide occasions that can abundantly destroy infrastructures.

From the field observation data, the dimension and the volume of the deposition area was recorded. The forms of debris avalanches have dimensions of 90 m in length and 8 to 80 m in width while the trajectory length, average height and volumes are 800 m, 3 m and 6,000 m^3 respectively. Some of the deposit materials turned towards N250°E and resulted in stockpiling of settlements. The mechanism occurrence of the debris flow in this area is caused by continuously high rainfall nearly 1000 mm/20 days. This factor leads to the cliff slopes filled with water which occurs via the soil pores that caused the weight of the soil to increase. As a result, the shear resistance decreases. Besides that, contact between the soil with thick weathering bedrock (tuff breccias) act as a sliding field supported by the steep slope causing ground movement.

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Use of Surface Waves in Statistical Correlations of Shear Wave Velocity for District of Larut Matang & Selama, Perak.

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This paper presents the development of empirical correlations between shear wave velocity (V_s) and SPT-N value for different categories of soil in district of Larut Matang and Selama. The extensive V_s measurement was carried out by using Multi-channel Analysis of Surface Waves (MASW) technique at the site where the SPT-N values are available. The correlations between shear wave velocity and SPT-N with and without energy corrections were developed in 3 categories of soil: sand, silt and clay.

The propagation of seismic waves near the surface is strongly influenced by the presence of unconsolidated loose sediments overlaying the bedrock resulting in modifications of the ground motion characteristics at the surface. The ground motion parameters at the surface are generally obtained by conducting one dimensional ground response analysis considering only the upward propagating shear waves. In these analyses, the V_s is one of the most important input parameter to represent the stiffness of the soil layers. Based on statistical assessments and taking into account the type of soil, a series of empirical correlations for the prediction of shear wave velocity were developed based on uncorrected and energy corrected SPT-N for different categories of soil. Larut, Matang dan Selama is a district of the northern state of Perak in Malaysia. Larut Matang dan Selama used to be three small different districts and merged into one united district and is located between 4.28° – 5.16°N and 100.36°-100.52°E covers an area of 2,095KM^2. The general geology of the district comprises mostly of sand, silt, clay, gravel and granite.

1. Geotechnical Investigations

It is well known that the average shear wave velocity in the upper 30m (V_s30) of the ground surface is an important factor for seismic site characterization (Borcherdt 1994; Dobry et al. 2000). Therefore, in the present study, the borehole details were collected to a depth of about 30m or up to the bedrock. The SPT's were conducted as per British Standard 1377 Test 19.

2. Multichannel Analysis of Surface Waves

In the present study the MASW tests are carried out using Geometrics make 24 channels Geophone with the interval of 1.5 to 2.5 meters. For 1D MASW surveying, a linear spread configuration is used (Figure 1). The geophones are configured in a straight alignment on the ground surface and interconnected with a spread cable which linked to the seismograph. The distance between the first and last active geophone is the spread length or total offset and the distance between the shot location and the nearest active geophone is the near offset.

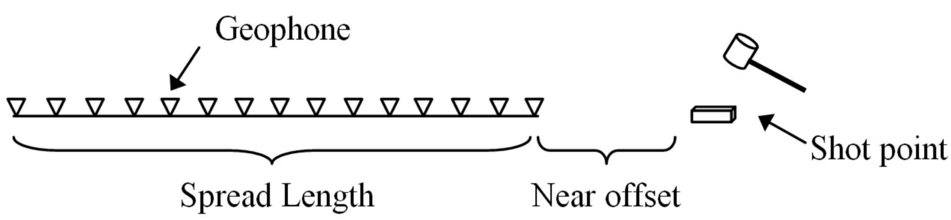


Figure 1 1D MASW survey spread configuration

1. Proposed Empirical Correlations between V_s and SPT- N

In this study, total of 17 project sites in this district has been selected to perform with the 1D MASW survey with 128 data pairs (V_s and SPT-N) were employed in the development of correlations between V_s and SPT-N. The Active Source 1D MASW data has been analyses by use The Pickwin software. The typical shear wave velocity V_s curve is generated (Figure 2).

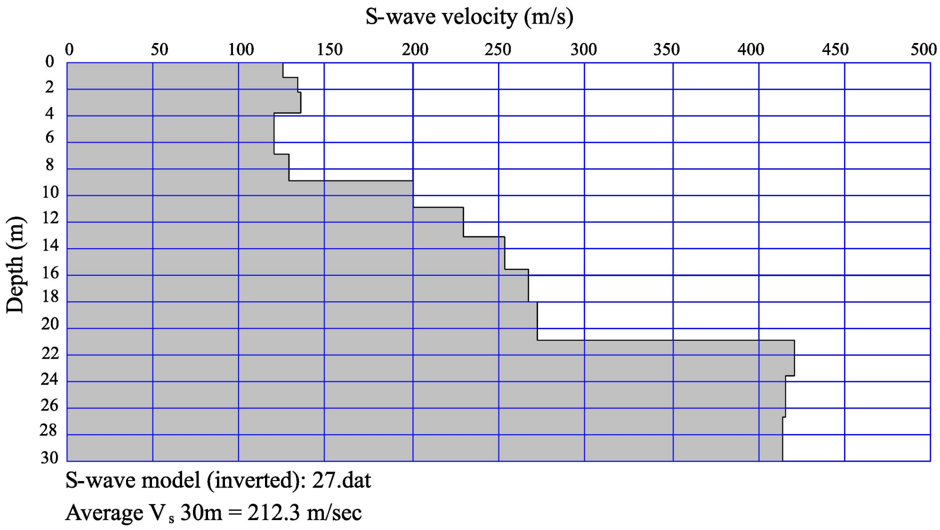
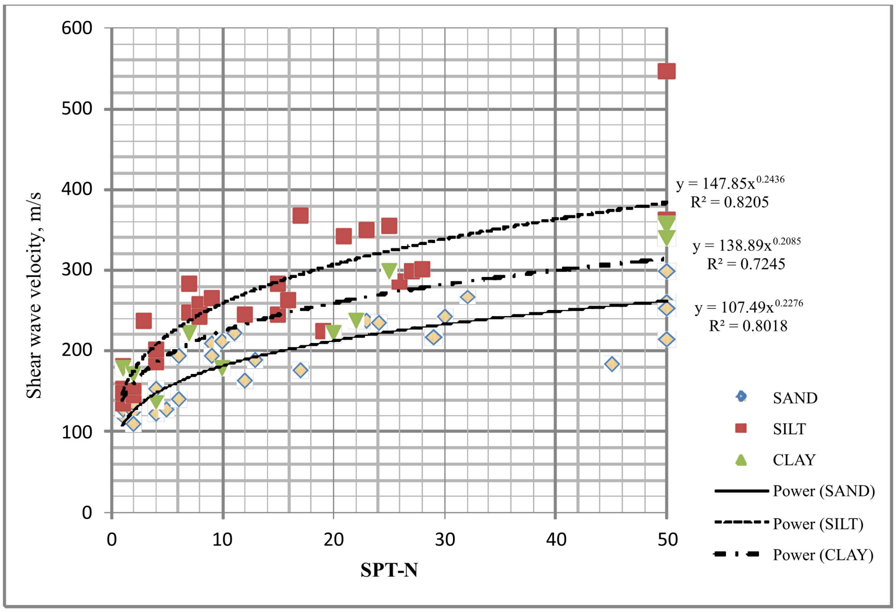


Figure 2 Typical shear wave velocity,V_s curve

To calculating the average V_s, the associated Uniform Building Code, UBC (1997)/IBC site classifications can be determined the condition of site. The result shows that the study area is fall to the Class D site classification. In this analysis, results between V_s (m/s) and corresponding uncorrected SPT-N values for four categories of soil like for sand, silt and clay (Figure 3).

Conclusions

From the collected data, it shown a moderate regression equations fit of the complied data for the investigated soils at the research area. In order to comply with the International Building Code (IBC) or Uniform Building Code (UBC), and National Earthquake Hazards Reduction Program (NEHRP), it is necessary to know the "Soil Site Class". Therefore, a proper site classification and knowledge of the seismic shear wave (S-wave) is very important and critical because structures will generate a large dynamic loads and the impact is subjected to the safety of the structure itself.



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