DESIGN AND IMPLEMENTATION OF LINE 2 AVALANCHE HANDLING IN TENGGARONG, EAST KALIMANTAN, INDONESIA

ABSTRACT

This research is a planning activity for Line 2 Avalanche in KutaiKartanegara Regency. This activity is carried out to improve the transport system and support human mobility in supporting a better economy. This activity also aims to improve the quality of vital roads and produce maximum road technical design in accordance with the Terms of Reference (KAK) that has been determined. This activity includes problem identification, field survey, technical approach to work implementation, activity plan, field data collection, subsequent work plan, work implementation schedule, organisation and personnel, and road technical planning flow chart. In carrying out this activity, there were several problems encountered, such as damage to the road being repaired. This activity also involves field data collection, data collection from topographic surveys, data collection from traffic surveys, and data collection from pavement condition surveys. The results of this activity are expected to produce technical road design planning documents that include design drawings, cost budget plans (RAB), technical specifications, activity reports, photo documentation, and tender documents for physical activities (implementation).

Keywords: road, avalanche, transportation, landslide

INTRODUCTION

KutaiKartanegara Regency is experiencing very rapid development, both the need for good road facilities and infrastructure is something that is expected by the community and is a supporting factor for smooth economic transportation. Landslide which occurred on roads limits, has caused a reduction in the flow of transport. Also make these roads become less safe and comfortable to walk on. So it is considered necessary to do repairs / handling avalanches so the smooth mobilization can be achieved safely and comfortably back [9,10].

Avalanche (slides) is the slope forming material movement caused by the sliding, along one or more areas of landslides. The land mass that moves bias fused or broken - broken. Genesis mass movement is the mass transfer of soil and rock in the vertical direction, oblique or horizontally from its original position caused by the mass balance disorders at the time that moves downward through the sliding plane or slope forming material. The loss of mass balance of soil and rocks on a slope can be caused by the influence geological, conditions inundated, physical properties of soil, earthquake and human activity

Given the condition of the existing road infrastructure, there is a lot of damage / landslides both due to natural factors, as well as human factors in this case vehicles so that repairs and improvements need to be made to meet the increasingly high road needs. In the planning process as a guideline for implementation, it is necessary to consider factors, such as comfort, safety, environment and other factors that support more mature and planned planning. In conducting technical planning of avalanches, the following Basic Technical Planning Criteria must be fulfilled:

- Strength and stability of the structure (structural safety);
- Durability and long-term feasibility (durability);
- Ease of inspection (inspectability);
- Ease of maintenance (maintainability);
- Comfort for road users (rideability);
- Economical;
- Ease of implementation;
- Aesthetics; and

- Impact on the environment at a reasonable level and likely to be minimal

The guidelines describe the load cases which have to be considered for design, but they do not specify how the avalanche expert has to define an avalanche scenario which is the base to perform avalanche simulations.

METHODS

3.1.Data Collection Method

The data collection method in this research is generally described as follows:

- Conduct a preliminary survey related to the existing conditions of the work and submit a work plan and schedule of planning work.
- Conducting an aerial photo mapping survey (Drone) so that aerial photos are obtained that describe the handling plan area.
- Conduct a survey and identify the handling plan for the area to be handled.
- Conducting measurement surveys with measuring instruments for topographic mapping (with RTK / Total solution and GPS tools) to be plotted on aerial maps and outlined in working drawings of the entire area.
- Conduct an inventory survey of land conditions at the work site.
- Conduct a survey of tidal and rainfall data measurements.
- Survey the actual basic prices of materials, wages and tools in the field,
- required for the preparation of EE documents and Plan Drawings.
- Conduct surveys and coordination with local officials, community leaders,
- Fishermen/Farmer Groups or communities located around the field.

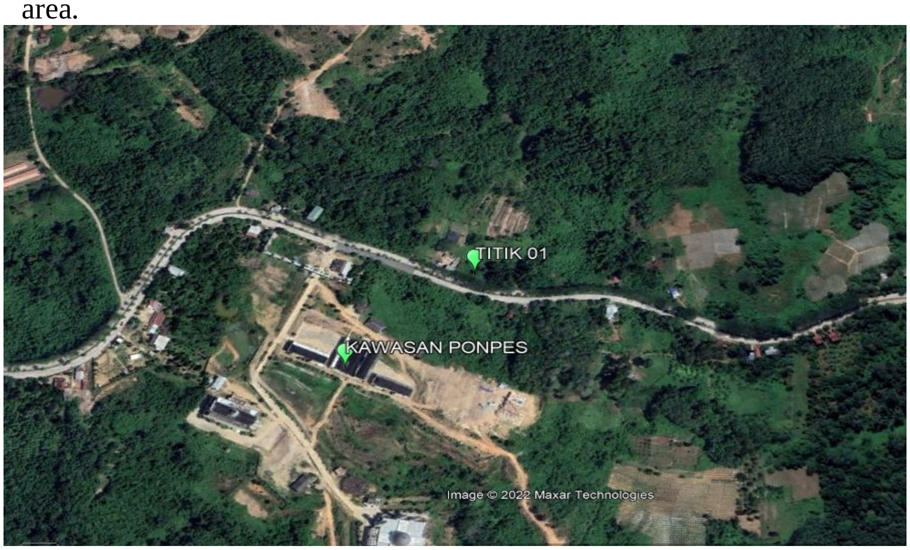


Figure 1. Location of the Soil Investigation

RESULTS AND DISCUSSION

4.1.Soil Investigation Results

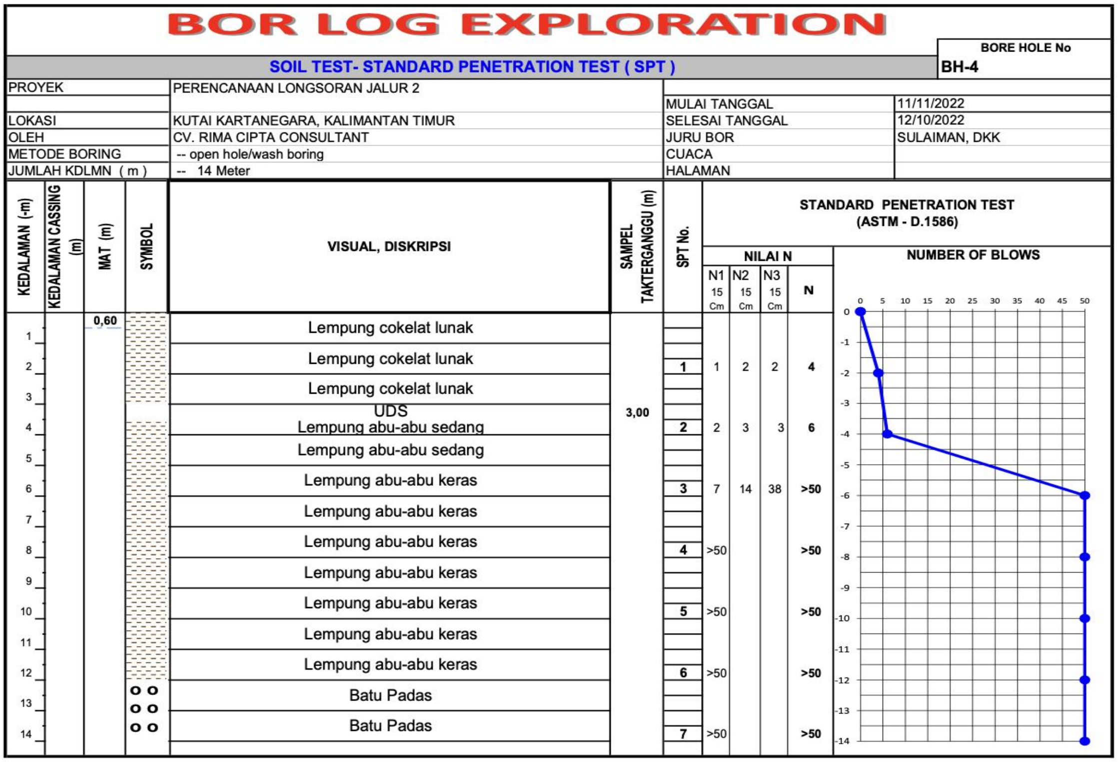


Figure 2.1. Soil investigation results of BH.04

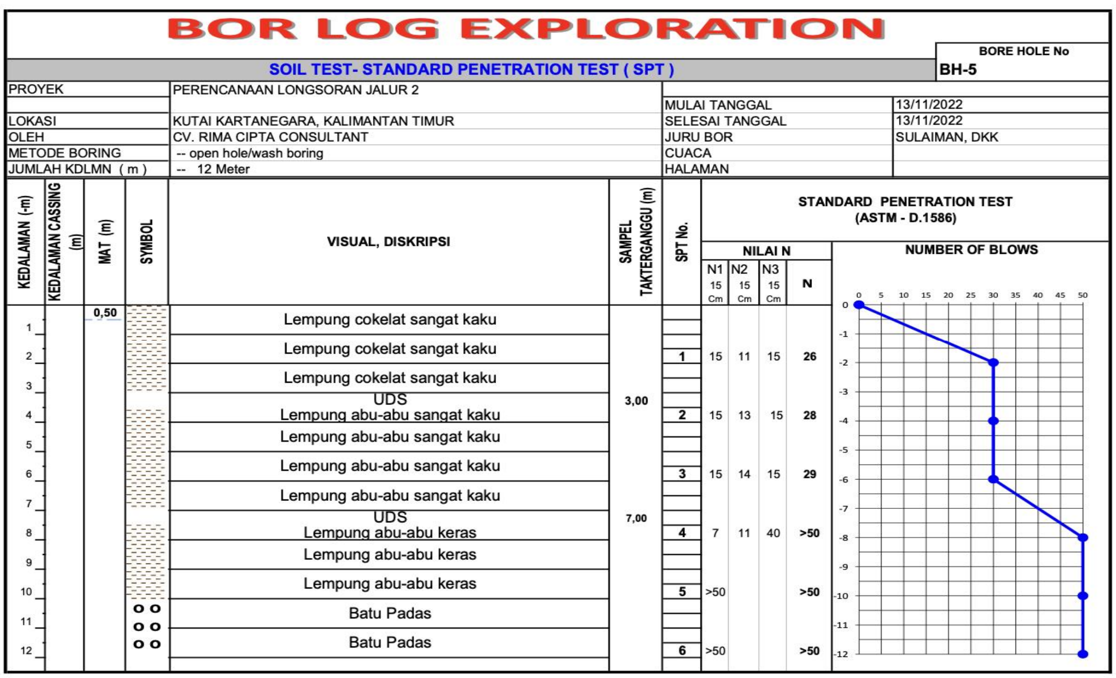


Figure 2.2 Soil investigation results of BH.05

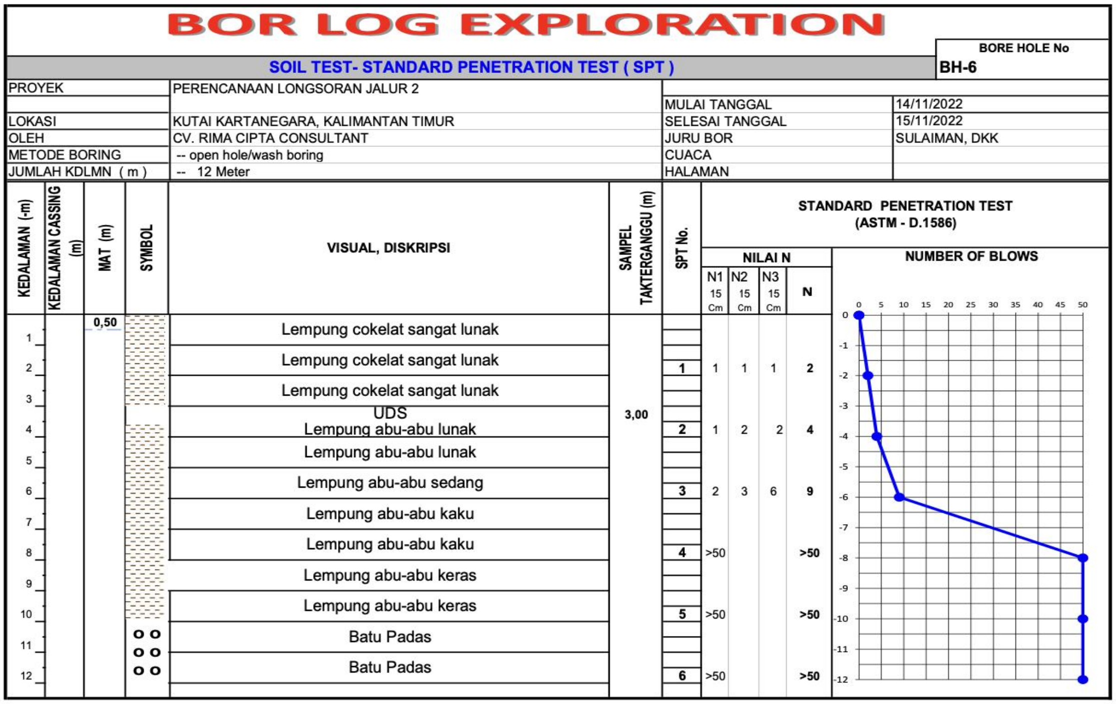
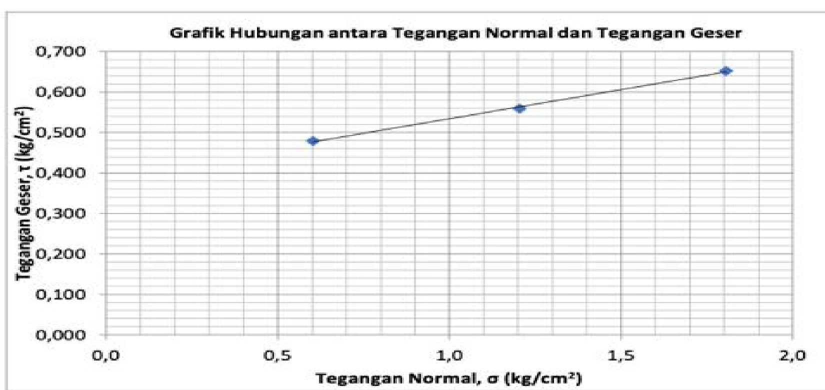


Figure 2.3. Soil investigation results of BH.06

Direct Shear Tests

Waktu (menit)	Penurunan (mm)	Beban N_1 = Bacaan Arloji	18,0 Kekuatan Geser (kg)	Beban N_2 = Bacaan Arloji	36 Kekuatan Geser (kg)	Beban N_3 = Bacaan Arloji	54 Kekuatan Geser (kg)
0	0	0	0	0	0	0	0
1	125	17,50	8,09	22,00	10,16	25,80	11,92
2	250	25,50	11,78	31,00	14,32	35,00	16,17
3	375	28,00	12,94	34,50	15,94	40,00	18,48
4	500	31,00	14,32	36,20	16,72	42,00	19,40
5	625	30,80	14,23	36,20	16,72	42,20	19,50
6	750					41,60	19,22

Tegangan normal	=	σ	kg/cm²	=	0,602	1,204	1,806
Tegangan geser	=	τ	kg/cm²	=	0,479	0,559	0,652



From the graph above, it can be seen that:

$c = 0.386$ kg/cm^2

$\varphi = 25{,}86^0$

Figure 3. Results of Laboratory Tests

From the results of analysis and calculation of various drilling materials and physical tests, the retaining wall reinforcement is obtained as presented in the table below:

Table 1. Reinforcement (rebar) status

Pile foundation	Diameter (mm)	Length (m)	Longitudinal Rebar (mm)	Shear Rebar (mm)
Pondasi Bore Pile	450,00	15,00	14D22	P12-100

From the calculation results, it can be concluded that with the reinforcement conditions as shown in the sketch above or the calculation results in this report, all retaining wall elements are able to bear the internal forces acting on each element.

Pile bearing capacity of friction (frictionpile) in the clay soil will be reduced if the pole distance is getting closer, several observations indicate that the total carrying capacity of pile groups friction (frictionpile), often smaller than the product of single pile bearing capacity multiplied by the number of poles in the group. Thus, the magnitude of the total carrying capacity be reduced by reducing the value of which depends on the size, form, distance, and long poles.

From the results of the analysis of the bearing capacity of the foundation, it is obtained as follows (Table 1):

Foundation Type: Bore Pile
Plan Depth: 15 metres
Diameter Plan: 450 mm
Longitudinal Reinforcement of Bored Pile: 14D22
Tensversal Reinforcement of Stuffed Piles: P12 - 100

Based on the results of the analysis of the bearing capacity of the foundation with the above plan data, it is found that the pile foundation (pile group) is able to carry the vertical load acting on the retaining wall structure to be forwarded to the foundation.

The centre-of-mass path line calculated by the centre-of-mass model is in close agreement with the observations when energy loss due to impact is neglected. The model is applicable for studying the influence of terrain inclinations, impact velocity and dam configurations on the avalanche centre-of-mass path line. However, the model result are still encumbered with uncertainties, even though the parameters describing the features above are included. Whether the whole avalanche is climbing the wall depends on the same features.

For the initial conditions before the avalanche slope was not analysed because the slopes are experiencing landslides have safety factor of less than 1.25. As well as the limitations of the data geometric slope and soil parameters on the slopes. Slope stability analysis is used as a measure of whether the handling of the landslides that occurred already has safety factor exceeded theof 1.25.

CONCLUSION

The quality of materials used in the calculations, as presented in the Table below and with the expectation that the materials used in the field match or meet these standards.It may be difficult to model the terrain satisfactorily using the proposed avalanche channel. In future work a better approximation to the cross-section profiles will be attempted. From the present simul ation it is clear that the model is too sensitive to centrifugal.

Disclaimer (Artificial intelligence)

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Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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Details of the AI usage are given below:

1.

2.

3.

REFFERENCE

1. Haryanto, Nice. 2015. Treatment Planning Avalanches Amandit River Hulu Sungai Selatan. Banjarbaru. Final Degree Program Tier One (S1) in Civil Engineering University Mangkurat.
2. Jóhannesson, T., Gauer, P., Issler, D. and Lied, K. (eds.). 2009. The Design of Avalanche Protection Dams. Practical and theoretical developments and results. (contributions by Barbolini, M., Domaas, U., Faug, T., Harbitz, C.B., Hákonardóttir, K.M., Issler, D., Naaim, F., Naaim, M., and Rammer, L.), European Commission EUR 23339,
3. Djunaedi, R. R. (2020). Gravity Type Retaining Wall Planning (Case Study: DsnLio, KecamatanCireunghas). Jurnal Student Teknik Sipil, 55-64.
4. Pragustus, D., Mandagi, A. T., & A. E., T. (2019). Slope Stability Analysis with Soil Nailing Reinforcement Using Slide 6.0 Software (Case Study: ManadoTomohon Road Section). JurnalSipilStatik, 1445-1452.
5. Surya, A., Azhar, M. F., & Abdurrahman. (2021). Planning of Retaining Walls at Jalan GubernurSyarkawi (Sp. EmpatHandilBakti – Bypass Banjarmasin). JurnalKacapuri11(2):53-66.
6. Eti Rahayu, Haryo Edi Wibowo, MradiptaLintangAlifcantaMoktikanana, Agung Setianto, Agung Harijoko. 2023. Source Determination of Debris Avalanche Deposit based on the Morphology and Distribution of Hummocky Hills on the Northeastern Flank of G. Sundoro and G. Sumbing, Central Java, Indonesia. Indonesian Journal of Geography Vol 55, No 3 (2023): 463-472 DOI: 10.22146/ijg.88213
7. Adhitya PrakasaAji and Markawie. 2018. Design Of Landslides Treatment With Counterfort Wall On City Limits Roads Tanah Grogot-Lolo Kuaro, Paser Regency, Tana Paser, The Province Of Kalimantan Timur. CERUCUK. 2(01):53-70
8. RafieiRenani H, Martin CD. Factor of safety of strain-softening slopes. J Rock Mech Geotech Eng. 2020;12(3):473–83.
9. Nabil PS, Ramdhani Y. Application of bidirectional gated recurrent unit algorithm for rainfall prediction. Jurnal Teknik Informatika CIT Medicom. 2023 Sep 30;15(4):188-98.
10. Rahmadania D, Rusdiansyah R. Case study of the causes of failure of combination of gabion and geotextile construction to handle landslides on the slope of kariangau substation, balikpapan, east borneo. CERUCUK. 2022 Jul 8;6(1):67-82.