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# An Analysis Of Stability Slope By The Use Of Bamboo As An Alternative Bracing (A Case Study: Road Area Grogol Semarang City )

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***Abstract-*** Landslides often occurs because caused by rain , earthquake , and the load that stands in an area of the slope . .then of it badly needed handling landslide effective and efficient , to danger due to landslide could be on tap . During this in handling landslide do with using a retaining wall of land, the plaster , and the installation of geotextile. In this research by the use of bamboo terucuk as bracing of slopes on urban Village Road Grogol Pudak Payung Semarang City it is hoped can increase the stability of a slope , the reeds are in use is bamboo a rope with a diameter of 15 cm and bamboo betung with a diameter of 25 cm. Analysis on the plaxis v.8.2 and geoslope. The results of the study showed that, 1) of a series of land test showed c = 37.265 kn/$m^2$, $\varphi$ = 13º, $\gamma$sat = 18.854 kn/$m^3$, $\gamma$unsat = 14.866 kn/$m^3$. 2) bamboo data : ea bamboo petung = 7.31x$10^5$ kn/m, ei bamboo petung = 850.25 kn.$m^2$, ea bamboo tali = 6.3x$10^4$, ei bamboo tali = 145.6 kn.$m^2$. 3) the condition slope in the way of grogol unstable which the figures security the state of experience is sf = 1.4866, and after in give burden sf = 1.4856, after in give bracing of with the bamboo and analysis from safety factor is showed factors sf = 1,8339 where the was assumed safer if safety factor (sf) >1.5.

***Keywords:*** *stability slope , bamboo petung , bamboo rope , security factor* **.**

## 1. Introduction

Semarang city is the provincial capital of central java have lowland and high. As a growing, semarang city active in work implementation mainly residential improvements as a city that the region many having hills and the many residences in up in the hills and the slope. As in the road grogol located at the payung south of semarang. The in the their grogol is sliding more or less along 13 m a more or less 8 m , so as to create disquiet for the people around. During this in doing bracing at the slope unstable wearing a sheet pile, the plaster, or retaining walls. Suppose bracing if do is of course many cost therefore there should be a alternative to reduce the cost of would be cheaper, through the use of the natural result about owned the utilization of bamboo as bracing slope.

### Research objectives

- Plan stability and efficiency bamboo as material bracing of a slope that will be used in the way of grogol located in urban village pudak payung semarang south.
- Plan is bracing of with the bamboo can be used or not.

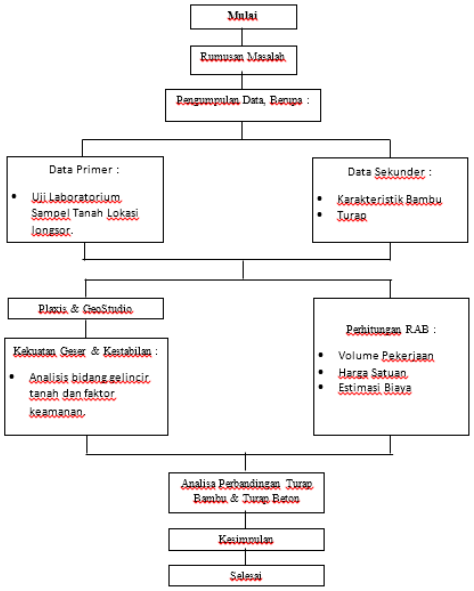
**The problem**

- Analysis of stability slope by bracing terucuk bamboo never do.
- Count budget required to the location of the project is the grogol located at the pudak payung south of semarang.
- Age of endurance or age bamboo service did not put the most basic.

**Benefits research**

- Apply the science which have obtained writer for sit was lecture in sultan agung islamic university semarang in the form of work writing duty the end.
- Increases knowledge and views the for an audience of the program plaxis and geo studio used on their work end of this.
- Share information on material bracing alternative that's using bamboo obtained from the results of the analysis using program plaxis geo and studio.

## 2. Research Methodology

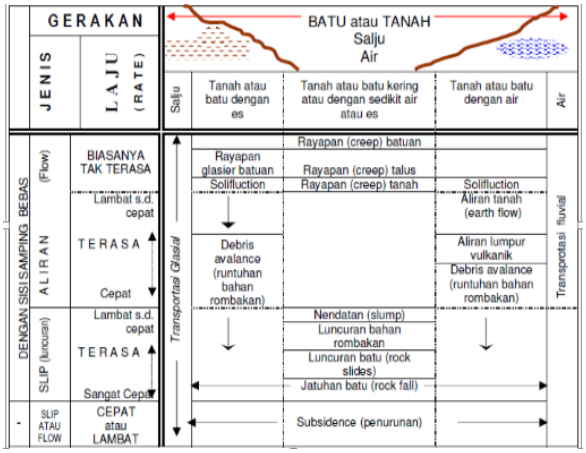



## 3. The General Review

Understanding avalanche of (landslide) with a land ( mass movement ) have in common. The land is displacement a land mass / stones at an upright direction, horizontal or inclined from the beginning. Movements of the ground includes motion and flow and avalanche. By definition is an avalanche of is part of ground motion (*purbohadiwidjodjo, in pangular, 1985*). If by definition this mass migration / stones at an upright direction including movements of the ground, then movement vertical synchronization causing bulging the foundation could collapse in input in type of ground motion. Major groups

movement the ground according to hutchinsons (1968, in hansen,1984) consists of creep and avalanche for again in the slide, flow, fall and slip. The definition of an avalanche of (landslide) according to sharpe (1938, in hansen, 1984), is luge or sliding or falling of mass of rock / land or mix to both (table 1).

**Table 1 . Classifications avalanche (source : *Stewart Shape 1938, in Hansen, 1984)***




There are some things that can cause the landslide. According to hary christady hardiyatmo (2003 ), landslide at the slope happened because of some factors follows:

- Adding a burden on the slopes .Additional burden on the can be a new building , additional burdens by water enters to the ground and pooled on the surface and dynamic loads by plants in the wind and other.
- An excavation or cutting ground at the foot of the slope.
- Soil excavation sharpen slope.
- A change of position the great waters in a rapid draw down ) on the dam , river and other.
- A rise of land lateral by water (water fill cracks will encourage the ground into a lateral direction).
- Earth quake
- The decline in custody sliding forming the ground as a result of water levels , rising water pressure the , pressure seepage by water puddle in the ground , the ground at the slope containing loam , and expands and shrinking others.

Basically, a wear to make the that stable divided into 2 of the (wesley and pranyoto, 2010) :

A. Reduce style or moment borer propulsion by means remodel slope concerned. As:
   - Change slope become more flat or reduce the angle of inclination of
   - Reduce slope.
   - Change slope being slope decker ( multi slope ).
B. Increase forces of fight against or moment :

- By wearing  counterweight, that is home to the foot of the slope heap.
- By reducing water pressure pore in deep slope.
- By mechanical means, namely by placing pole or making a wall land retaining.

**Safety Factor.**

Generally security factor is defined as ( anderson and richards, 1987 ).

$$F = \frac{Shear\ strength\ available}{Shear\ stremgth\ required\ for\ stability}$$

Or also definition or also a definition that used to of the safety of the comparison between style retaining landslide in the style of the cause landslide.

$$F = \frac{Anchoring\ style\ landslide}{Style\ cause\ landslide}$$

Value stability a slope can be shown as follows:

- F >1.5 : The land at the slope stable.
- F < 1.5 : The land at the slope not stable.
- F = 1.5 : Land on the slopes is risky landslide.

**Data Testing Laboratory**

- Spesific Gravity

| Berat Picno + Aquadest (gr) | Berat Picno + Sampel (gr) | Berat Picno + Sampel + Aquadest (gr) | T1 (◦C) | T2 (◦C) |
|---|---|---|---|---|
| 80.6 | 48.732 | 91.6 | 30 | 30 |
| 73.87 | 53.41 | 86.42 | 30 | 31 |
| 76.85 | 53.35 | 86.85 | 30 | 30 |
| 77.7 | 55.18 | 87.7 | 30 | 31 |

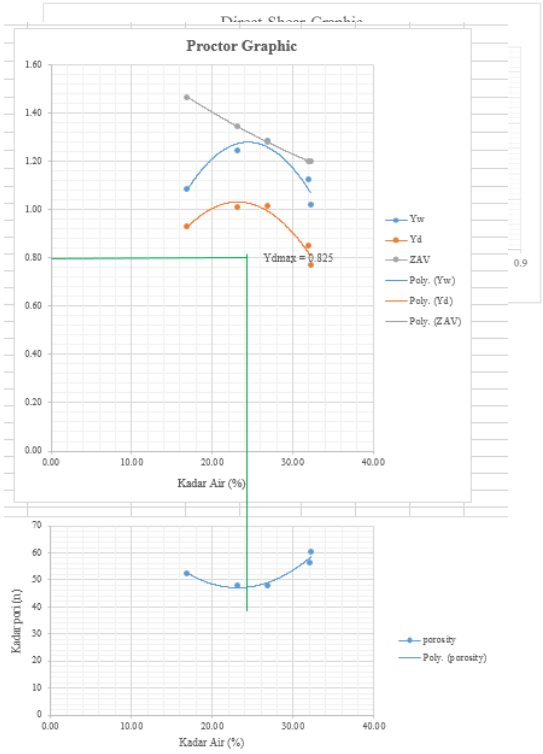
| t1 | t2 | HAP | Gs | Gs Rata - Rata |
|---|---|---|---|---|
| 1.00374 | 1.00374 | 52.142 | 2.203 | 1.952 |
| 1.00374 | 1.00374 | 44.777 | 2.074 | |
| 1.00374 | 1.00374 | 46.824 | 1.754 | |
| 1.00374 | 1.00374 | 45.469 | 1.776 | |

- Direct Shear

| | | | | | | |
|---|---|---|---|---|---|---|
| Berat Ring = | 25.4 | gr | 0.0254 | kg | | |
| Ø Ring = | 6.31 | cm | | | | |
| F = | 31.256 | cm2 | | | | |

| Percobaan | Beban (kg) | Koreksi Beban (kg) | Pembacaan Dial | Waktu (detik) | σn | σs |
|---|---|---|---|---|---|---|
| 1 | 8 | 7.96 | 42 | 22.53 | 0.255 | 0.504 |
| 2 | 16 | 16.35 | 50 | 35.11 | 0.523 | 0.600 |
| 3 | 24 | 24.31 | 61 | 35.29 | 0.778 | 0.732 |

- Proctor



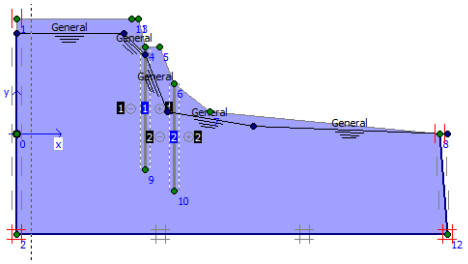

| | | |
|---|---|---|
| $\gamma sat = \frac{(Gs+e)\gamma w}{1+e}$ | | |
| | 1.923 | g/cm3 |
| | 18.854 | kN/m3 |
| $\gamma unsat = \frac{(Gs+e)\gamma d}{1+e}$ | | |
| | 1.516 | g/cm3 |
| | 14.866 | kN/m3 |

- Sieve Analysis

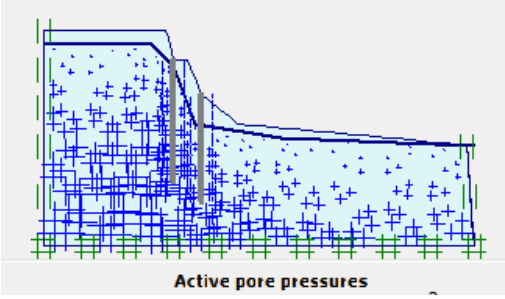
| | | |
|---|---|---|
| Sand = | 47.05 | % |
| Silt = | 2.90 | % |
| Clay = | 50.05 | % |
| Total = | 100.00 | % |

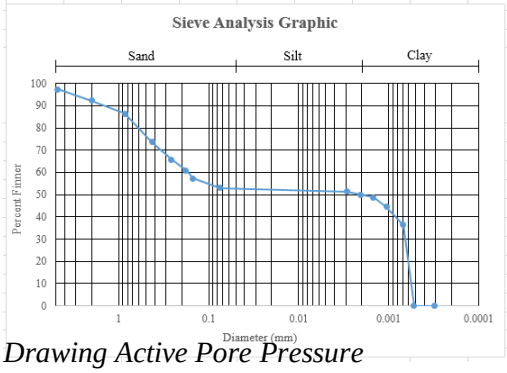
## 4. Analysis Using Plaxis

After getting land data from the lab , then the next step is to analyze the strength of a slope of the natural condition , get a load , and after in boost terucuk with bamboo.

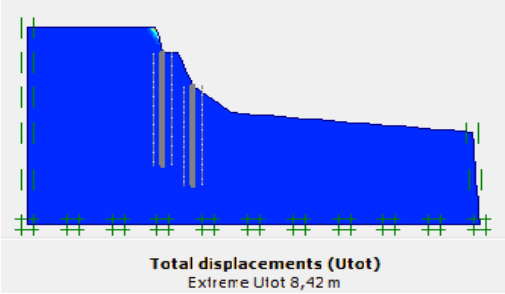



*Drawing Position Advance Ground Water*




*Drawing Active Pore Pressure*




*Drawing Total Displacement The Natural Condition*

**Table 2. Comparison Of The Safety Bracing Of Slope**

| Identifikasi | Plaxis v.8 | Geostudio *(Slope/W)* |
|---|---|---|
| Lereng pada kondisi alami | 1.4866 | 1.337 |
| Lereng pada saat dibebani | 1.4201 | 1.225 |
| Lereng setelah diperkuat dengan terucuk bambu tali | 1.8312 | 1.728 |
| Lereng setelah diperkuat dengan terucuk bambu petung | 1.8339 | 1.728 |
| Turap beton K-175 | 1.7430 | 1.728 |

From the table above shows the number of security ( safety of ) on the natural condition and the condition of having in give the burden of the land became not safe, and after in boost by using terucuk bamboo petung the land of which were not safe to safe.

## 5. Budget Plan The Results Of The Cost

**Table 3. Companies Budget Plan**

| Jenis Material | Konfigurasi | Rencana Anggaran Biaya |
|---|---|---|
| Bambu tali | 1 | Rp 30.750.500,- |
| Bambu Betung | 1 | Rp 41.574.500,- |
| Turap Beton | 1 | Rp134,425,000.00 |

## 6. Closing

### Conclusion

Based on the research done who writers do taken conclusion as follows :

- Test of a series of land in doing in the laboratory of engineering faculty islamic university of sultan agung , produce numbers in the form of c = 37.265 kn/$m^2$, φ = 13º, γsat = 18.854 kn/$m^3$, γunsat = 14.866 kn/$m^3$ And the land is the type of land sandy clay.
- Terucuk bamboo ropes and bamboo petung can be in use as bracing of a slope with the analysis result in natural condition of the land ∑SF : 1.4866, After burdened ∑SF : 1.4201. And after in give bracing of with the bamboo Tali ∑SF : 1.8312 While bracing of with the bamboo petung ∑SF : 1.8339. So can be concluded bracing slope by bamboo rope and bamboo petung can use.

- Bracing of slope in the Road Of Grogol Urban Village Pudak Payung The City Of Semarang by using terucuk bamboo petung , bamboo ropes and pile concrete k-175 uk .25 x25, If in review of the budget for the bamboo a rope needs funding rp 30.750.500, bamboo petung needs funding 41.574.500, and the sheet pile of concrete needs funding 134,425,000.00. Can be concluded that bamboo a rope are considered to be more cheaper than bracing of using bamboo petung and the sheet pile of concrete.

**Suggestion**

After he did analysis stability slope on soft ground in the study, writer can provide some suggestions or the alternative solution of them :

- Prior to bracing of with the bamboo then the planner have to analyze land conditions locations will be in give bracing of with the bamboo first.
- In the condition of land as sandy clay the use of terucuk bamboo as a bracing of slope considered safe.But in the use of bamboo as bracing of slopes on the type of land that other we need to hold further analysis.
- Compared with the sheet pile of concrete the use of bamboo terucuk feed on a lower cost , and easily in can be found in various regions of Indonesia.

## 7. List Of Literature

Anderson And Richards, Safety Factors (1987).
Hary Christady Hardiyatmo, Definition Is An Avalanche (2003) .
Hutchinsons, Major Groups Movement The Ground (1968, In Hansen, 1984).
Purbohadiwidjodjo, In Pangular, Definition Is An Avalanche (1985) .
Sharpe, Definition Is An Avalanche (1938, In Hansen, 1984).
Wesley & Pranyoto, How Make Slope Stable (2010).