



MUD UTILIZATION OF LAPINDO AS SOIL STABILIZATION MATERIALS THAT CONTAIN SALT CLAY

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ABSTRACT

Lapindo mud containing silicate (SiO_2) that can function as a filler and lime (CaO) as a binder between the particles. Previous research in the use of these materials, may be used as, a substitute material of cement, to mix concrete manufacture. While in this study, Lapindo mud is used as, a substitute material lime to stabilize clay soils containing salt. Soil samples were taken from the area Sumenep then mixed with mud Lapindo 10%, 20%, 30%, 40%, 50%. Results of this study, up to 50% concentration slurry liquid limit value decreased 16.67 % and plasticity index, 73.73 % decline of the native land. Test compaction up with a mixture of 40%, the solid based on the increase of the value of γ_{dmax} , γ_{dmax} native land at 1.42 kg / cm^3 be 1:56 kg / cm^3 , which means an increase of 11.43%. CBR test up to 30% Lapindo mud mixture, 9.02% CBR value is including the category of value CBR is good enough as a land base and an increase of 44.55 % from the original soil. Direct shear test Lapindo mud up to levels of 40%, the value of the shear stress increased by 40.25% of the original soil. Free press test until the Lapindo mud levels of 40%, the value of free compressive stress 2.03kg / cm^2 very rigid categories and an increase of 39.04% from the original soil. And to test free swelling up to levels of 50% Lapindo mud, with a 24 -hour immersion, the value of development decreased by 63.64%. So in general it can be said that the levels of Lapindo mud more than 50% effective in stabilizing the clay in Sumenep area to reduce the potential for development, while raising the level of Lapindo mud carrying capacity is a maximum of 40%.

Keywords: lapindo mud, stabilization, salt, expands, carrying capacity.

INTRODUCTION

Background

Sidoarjo mud volcano or mud or mud Lapindo Sidoarjo (Lusi), is the emergence of mudflow incident at a drilling location PT. Lapindo Brantas in Renokenongo Village, Porong, Sidoarjo regency, East Java, to be exact location of the mudflow is located in the Porong sub-district in the south of Sidoarjo. Events that occur after the date of May 27, 2006, together with the 5.9 magnitude earthquake that struck Yogyakarta. Mud volcano is still inundated residential areas, agriculture and industry in the three Districts in the vicinity, as well as affect the economic activity in East Java.

Sidoarjo mud in utilization can be used as building materials (ceramic, concrete mix, multipurpose sand, paving blocks, concrete bricks, tiles), road material, foundation. The utilization is still within the limits of the study in order to gain a better mechanical behavior as well as an economical cost.

Based on previous research Aristianto, NGK. Made Anom Wiryasa, I Wayan Sudarsana 2009 Lapindo mud containing chemicals silicate mineral (SiO_2) which is higher than the cement and lime (CaO). The content of silicate can serve as filler material while the content of lime as binder between the particles. Based on the content of the Lapindo mud used as, a cement substitute material, in the manufacture of concrete. Research results Lapindo

mud, can be used as a mixture of materials, manufacturing of solid concrete [1, 2].

According to D. Harjito 2014, more than 640 hectares of productive land have been submerged in Sidoarjo mud eruption volcanic war, but the eruption continues. Mud original shape in a state of semi - crystalline, and is rich in silicon and aluminum oxide, with a total amount of SiO_2 , Al_2O_3 and Fe_2O_3 more than 85 %. Calcination at high temperatures between 600 - 8000C for a period of time, followed by grinding to reduce the particle size of less than 63um, converting sludge into amorphous materials and reactive. Mud is excellent as a pozzolan material, suitable for making pozzolan mortar or concrete and geopolymer precursor materials [3].

Gati research results Sri Utami, Siti Choiriyah 2014 titled land use analysis Sumenep Madura containing salt as a heap and subgrade. 15.03% Sumenep soil containing salts including very high plasticity clay soils that are potentially very easy to expand, the density is good, very ugly category CBR value and voltage value including the consistency of the hard ground. Once added salinity to 20 % including a high plasticity clay soil that expands a potentially easy, good density, CBR value approaching good and bad categories voltage value (stress) including the consistency of the soil, is hard. Sumenep - Madura ground if it will be used as embankment and subgrade, should the value of plasticity, lowered, until the plasticity index < 20% [4, 5].



Based on previous research mentioned above we do research on the utilization of Lapindo mud as, stabilization material, clay containing salt. In the previous study, Lapindo mud is used as a substitute for cement in the concrete mix, whereas this study Lapindo mud is used as a substitute for lime stabilization of clay mixture that contains salt [4, 5, 6].

Research problem

- How the potential development of clay containing salt after stabilized with a mixture of Lapindo mud.
- What is the value of the levels of Lapindo mud mixture that can be used as a stabilization material so obtained carrying capacity include density, CBR, shear stress, and free compressive strength that is optimum.

The aim of the research

- Knowing the potential development of clay containing salt after stabilized with a mixture of Lapindo mud.
- Lapindo mud content value that can be used as a stabilization material mixture thus obtained carrying capacity include density, CBR, shear stress, and the optimum of free compressive strength.

Advantages of research

Research on the utilization of the Lapindo mud as the stabilization material clay containing salt are:

- Adding the benefits of Lapindo mud whose volume increases at any time.
- Clay from Sumenep area which is mined salt can be used as a subgrade or embankment after stabilization with a mixture of Lapindo mud.

RESEARCH METHODOLOGY

Preparation works

Soil sampling in Sumenep, Madura, soil samples were taken in a disturbed state and the procurement of Lapindo mud

Tests in laboratory

Tests conducted in the laboratory Institut Teknologi Adhi Tama Surabaya (ITATS), include, and manufacture test object, the native land and a mixture, ground + Lapindo mud, 10 %, 20 %, 30 %, 40 %, 50 %. Laboratory tests namely Atterberg limits, standard density test (protoc test), direct shear, CBR testing laboratory, swelling and unconfined compression.

Next is the analysis of the data, which classifies data into each group according to the percentage of sludge that is used. Calculation of the data, laboratory test results, and then analyzes the results of the calculation. Based on the analysis of the results of calculations it can be concluded.

RESULTS AND DISCUSSIONS

a. Atterberg limit test

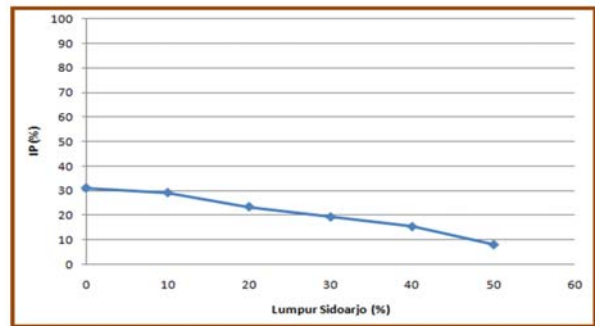


Figure-1. The relationships between LL with the percentage of Sidoarjo mud.

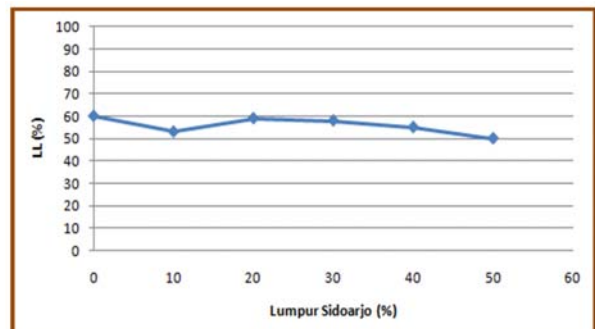


Figure-2. The relationship between IP with percentage Sidoarjo mud.

Figures 1 and 2 shows more plus a percentage of Lapindo mud, it will reduce the value of liquid limit and plasticity index values. This means fixing the evolving nature of clay shrinkage, a decrease of 16.67 % and 73.73 % of the original soil. The addition of 50 % Lapindo mud with IP = 8.14 % shows, the value of plasticity index, which in this case a low development potential [6, 7, 8].



b. Proctor test

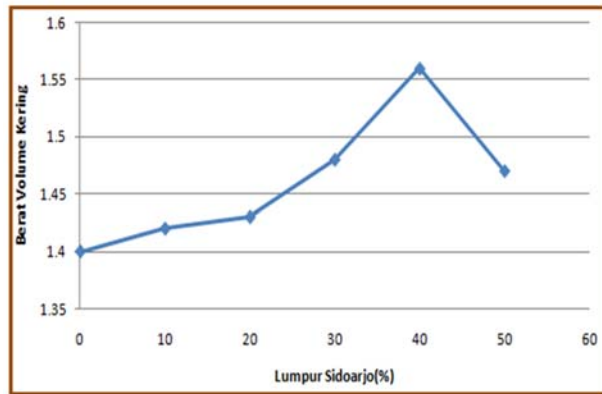


Figure-3. The relationship between the weights of dry volume with the percentage of Sidoarjo mud.

Figure-3 shows the content of the Lapindo mud 10 %, 20 %, 30 % and 40 %. The weight of the dry volume increased from the original soil. While at 50 % by weight of the dry volume has decreased, meaning that the addition of sludge levels of up to 40 % will increase the density of the soil. At levels of 40 % value of the volume of dry weight is 1.56gr / cm³ which include solid category [6, 7, 8].

c. C.B.R test in the laboratory

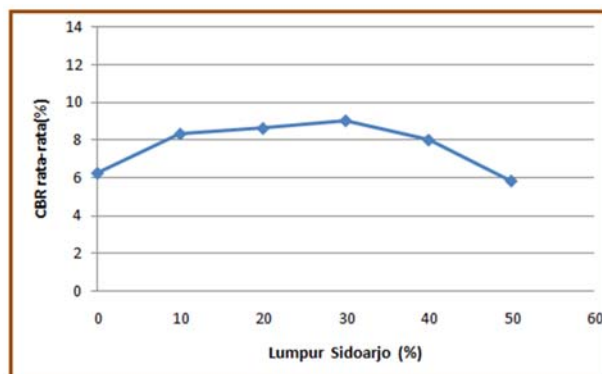


Figure-4. Relationship value of CBR Average, with a percentage of Sidoarjo Mud.

Figure-4 shows the levels of Lapindo mud 10 %, 20 %, 30 % CBR value increased from the original soil, while the levels of 40 % and a 50 % decline. The addition of Lapindo mud by 30 %, the value of CBR = 9.02 % which includes the category of CBR value, within the limits pretty well as a land base [6, 9].

d. Direct shear test

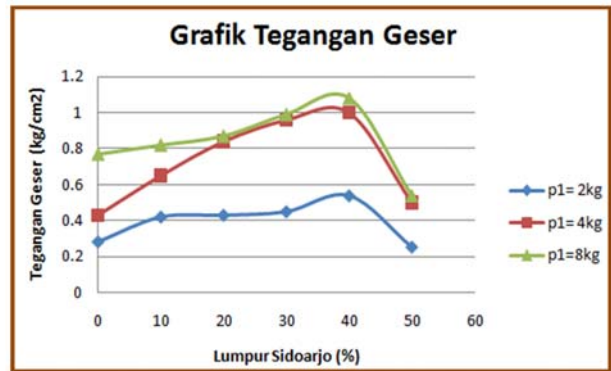


Figure-5. The relationship between shear stress and Percentage Sidoarjo mud.

Figure-5 shows the addition of 10 %, 20 %, 30 % and 40 values of shear stress has increased from the original soil, while the addition of 50 % will experience a decrease in shear stress for all loads.

e. Free compression test

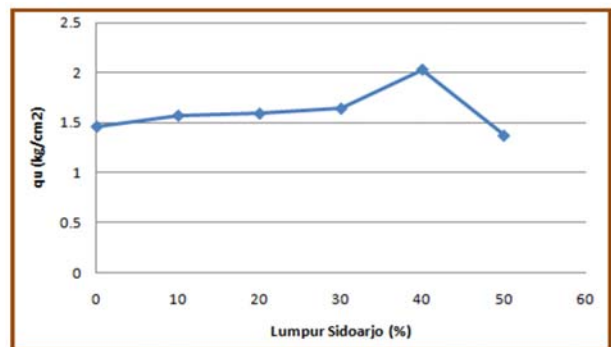


Figure-6. The relationship between stress and percentage Sidoarjo mud.

Figure-6 shows the addition of Lapindo mud 10 %, 20 %, 30 % and 40 %, it is obtained, the value of the free press, of the soil increased, while the level of 50 % has decreased. Sidoarjo mud addition of 40% of the obtained $qu = 2.03 \text{ kg / cm}^2$ where the value is included in the category of very stiff consistency, the consistency of the rigidity values are between $qu (2.0-4.0)$ [7, 8].



f. Free swelling test

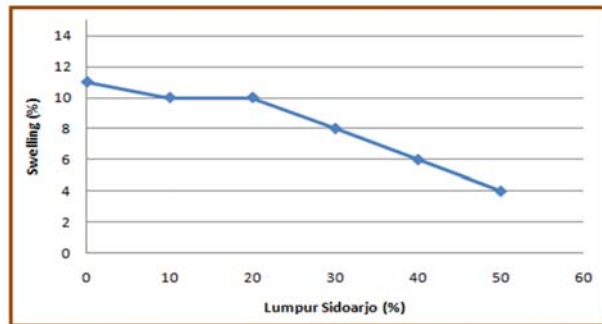


Figure-7. The relationship between swelling and percentage Sidoarjo mud.

Figure-7 shows that the potential value of developing decreased with the addition of Lapindo mud percentage. The value of the potential, developing, is the largest when the decline occurred in Sidoarjo mud of 50 % (swelling = 4 %) including swell of moderate between 1.5 - 5 % [6, 7].

Based on the results of the analysis, with calculation of overall laboratory test can be concluded in general that the Sidoarjo mud can be used as ingredients in the stabilization of clay, which contains gara. Where this can alter the physical and mechanical character of clay to be better than the original. The addition is effective to use, as additional material for stabilizing the clay soil in the area of Sumenep is the addition of more than 50 %. Where it is to reduce swell properties. As for the nature of the increase in carrying capacity is equal to the addition of 40 %.

CONSLUSIONS

Based on the analysis of the results of this study concluded:

- From test, Atterberg limits, the native land acquired liquid limit value of 60 %, 29.02 % plastic limit, and plasticity index of 30.09 %. As for the land, which is mixed with mud Lapindo 10 %, 20 %, 30 %, 40 % and 50 % indicate that the liquid limit value decreased by 16.67 % and plasticity index decline by 73.73 % with increasing levels of Lapindo mud.

- Compaction test, up to 40 % Lapindo mud levels, based on the value γ_{dmax} , then the mixture if compacted soil becomes more dense will raise the value of γ_{dmax} of 11.43 % of the original value of the land γ_{dmax} i.e. from 1.42 kg /cm³ was increased to 1.56 kg / cm³.

- CBR test up to 30 % silt levels, then the value of CBR 9.02 % including the category good enough

to use as a subgrade. In this research, the CBR value increased from 6.24 % to 9.02 % or an increase of 44.55 % from the original soil.

- Direct shear test, the value of shear stress levels of mud 10 %, 20 %, 30 % and 40 % increase, while the 50 % decrease. Shear stress, with mud 40 % is equal to 1.08kg /cm², or an increase of 40.25 % from the original soil.

- Unconfined test at levels of 40 % Lapindo mud, then we obtain maximum free compressive strength is equal to 2.03kg /cm², which includes the category of land, which is very rigid, or in other words an increase of 39.04 % from the original soil.

- Test of free swelling, Lapindo mud mixture of 10 %, 20 %, 30 %, 40 %, and 50 % by soaking 24 hours, then the value of swell has declined. At levels of 50% of the value of swell is 4% as moderate or ground potential. It is not high anymore and decreased 63.64 % of the original soil.

- So in general it can be said Lapindo mud effective for use as a clay soil stabilization, especially in the area of Sumenep with the addition of Lapindo mud by 50 % to reduce the potential for swell and the addition of 40 % Lapindo mud to increase carrying capacity.

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