

## Addition Effect of Petrasoil Additive Material on CBR Value of Soil in Swamp Areas

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### Abstract

Some road construction projects use petrasoil additive to increase soil stabilization, one of them is the Improvement of Tabarfane-Hokmar (Chemical Petrasoil) Road Project in Aru Selatan Timur District, Aru Islands. To obtain the influence of petrasoil additive material as soil stabilization in swamp areas, a research is needed. petrasoil additives that powder shape are dissolved in water with 3 variations, namely 500 liters, 750 liters, and 1000 liters of water. Tests which carried out include compaction testing, index properties, and CBR. The results showed that the addition of petrasoil mixture with water without being combined with other added ingredients could lead to increasingly unstable soil conditions where the soil water content increased and the dry weight of the soil diminished, meaning that soil density decreases, and the CBR value of soil decreases.

### Keywords

Petrasoil, CBR Value

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## 1. INTRODUCTION

South Sumatra is one of the provinces in Indonesia that has a fairly large swamp area of around 613,795 hectares consisting of 455,949 hectares of tidal swamps and 157,856 hectares of non tidal swamp (BWS, 2015). Road infrastructure which built on swamp area must pay attention to the existing subgrade conditions because the characteristics of swamp soil are saturated of water and have low carrying capacity soil (Subagyo, 2006). various efforts have been made to improve the existing subgrade conditions including utilizing fly ash as a material for soil stabilization (Indrayani et al., 2018; Indera et al., 2016; Mina et al., 2015). Nowadays several road construction projects add Petrasoil to increase soil stabilization, among others in the Improvement of Tabarfane-Hokmar (Chemical Petrasoil) Road Project in sub district of South East. In this study, the addition of petrasoil to the soil without other materials so was obtain the effect of petrasoil addition in increasing soil stabilization in swamp areas.

## 2. EXPERIMENTAL SECTION

### 2.1 Classification method

Soil samples were taken from swamp soil and then were added petrasoil which had been dissolved in water with 3 size variations so the effect of petrasoil addition on the carrying capacity of the soil was obtained. The location of land extraction in this study was in the Banyuasin District which consisted of a large portion of the swamp area, the topography of the area consisted

of 80% wet lowlands with a slope of 0 - 8%, consisting of tidal swamps, non tidal swamps and coastal. While laboratory tests were carried out at the Sriwijaya State Polytechnic Material Test Laboratory. Petrasoil obtained from suppliers PT. SA. Nusantara - PT. Basuki Rahmanta Putra.

The parameters to be tested include: compaction testing, testing properties index (GS/ specific gravity, moisture content, weight content), sieving analysis, hydrometer, atterberg boundary and CBR testing. Combination of adding petrasoil that dissolved in water in a ratio of 1 kg petrasoil to 500 liters of water; 750 liters of water; and 1000 liters of water.

### 2.2 Analysis method

Samples location which were taken were based on the results of previous studies namely clay soil in the swamp area precisely in the district of Tanjung Lago District. This research is a continuation of previous reseacher on the studied of land in swamp areas, so that the chosen location is one point of 10 sampling points. The location of land sampling can be seen in Figure 1. Laboratory testing guidelines used the SNI, AASHTO and ASTM standards (AASHTO, 1998; ASTM C618, 1994; SNI 0317421989, 1989).

## 3. RESULTS AND DISCUSSION

### 3.1 Index Properties Testing

Specific gravity is the ratio of the weight of soil grains to the volume of soil grains at a certain temperature. Specific gravity testing results can be seen in the Figure 2.

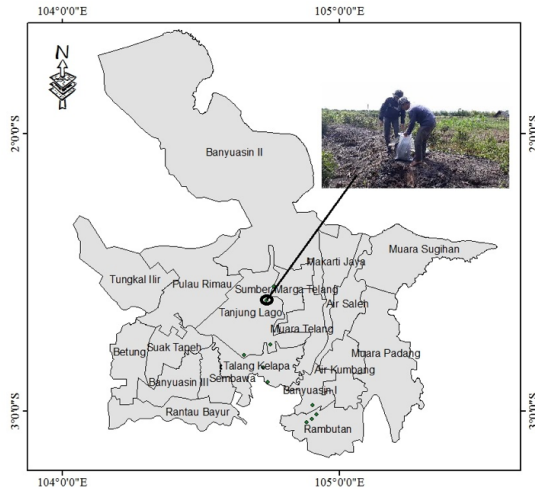


Figure 1. Samples Location

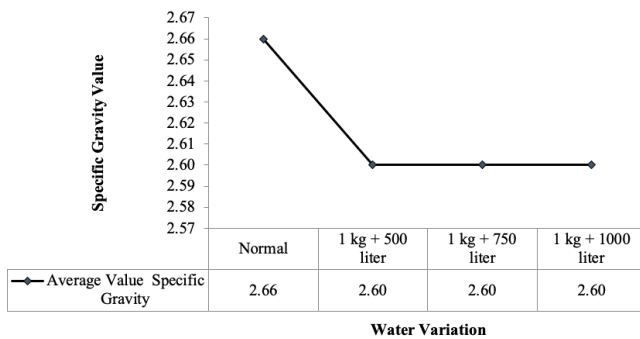


Figure 2. The Average Test Results of Specific Gravity

Specific Gravity test results show that the value of density is decreased by 0.06 (from 2.66 to 2.60) with petrosoil addition with a mixture of water, this means that the addition of petrosoil without other added ingredients can cause a decrease in soil specific gravity.

Testing atterberg boundaries is done to get the liquid limit, plastic limit, and soil plasticity index. The average test results of atterberg boundaries can be seen in Figure 3.

The results of the liquid limit test indicate that the addition of petrosoil causes the liquid limit to increase from 36.87% to 57.60% by a water variation of 500 liters; 57.64% by a water variation of 750 liters ; and 56.83% by a water variation of 1,000 liters. The higher the liquid limit on the soil cause the soil to become more unstable, because water is very influential on soil stability. While the results of the plasticity index test show that the soil plasticity index has increased with the addition of petrosoil whereas the higher the plasticity index will showed that the soil conditions increasingly not conducive to the civil construction. Petrosoil addition to soil without other added ingredients can cause an increase in soil consistency limits. From the test results it can be seen that the highest increase in the plasticity index is the addition of 750 liters of water but

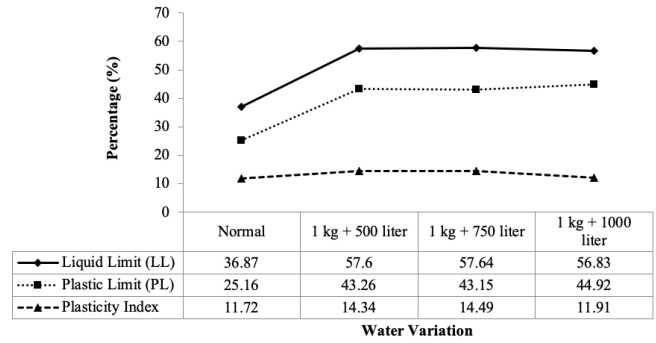


Figure 3. The Average Test Results of Atterberg Boundary

in the addition of 1000 liters of water, there is a decrease in the liquid limit and the plasticity index. For this reason, it is necessary to carry out further research on water variations of more than 1000 liters.

Grading test is done to get the size of the grain before and after added petrosoil, the average test results of gradations can be seen in Figure 4.

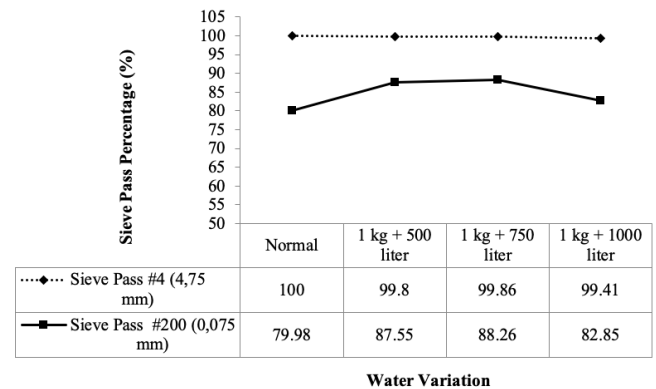


Figure 4. The Average Test Results of Gradations

The gradation test results showed that the soil with petrosoil additions which passed the 0.075 mm sieve had increased because the soil grains become smoother.

### 3.2 Compaction Testing

Compaction testing is carried out to determine the optimum water content and maximum soil density. The average results of testing the optimum moisture content can be seen in Figure 5. The graph in figure 5 shows that with the addition of petrosoil mixed with water resulting in an increase in soil water content, from 15.26% to 19.73% on a variation of 500 liters of water, and 22.57% on a variation of 750 liters of water, and 23.48 % on a variation of 1000 liters of water. The more addition of the mixture of petrosoil and water will cause an optimum increase in water content. This means that the addition of petrosoil without other added ingredients is not recommended for soil improvement because the higher the water content the

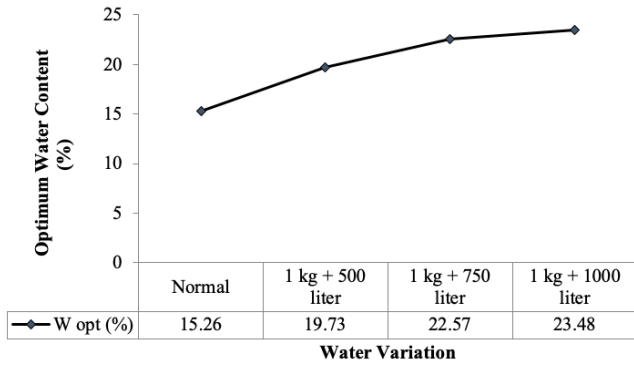


Figure 5. The Average Test Results of Optimum Water Content

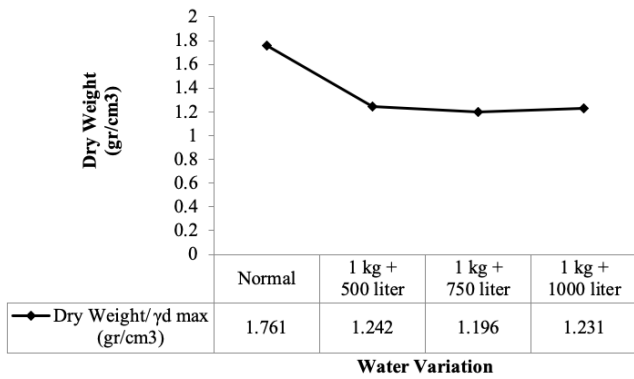


Figure 6. The Average Test Results of Dry Weight

soil conditions will become more unstable.

While the average test results of dry weight can be seen in Figure 6.

Figure 6 shows that occur a decrease of the dry weight of the soil by additions a mixture of petrasoil and water, ie on the variation of 500 liters of water from the weight of 1.761 gr/cm<sup>3</sup> to 1.242 gr/cm<sup>3</sup>, on the variation of 750 liters of water to 1.196 gr/cm<sup>3</sup>, and at the variation of 1000 liters of water to 1,231 gr/cm<sup>3</sup>. This shows that the addition of petrasoil without other added material mixtures can cause a decrease in the dry weight of the soil so this means that the soil density decreases, with reduced soil density will cause the soil conditions to be unstable for construction buildings, so the petrasoil mixture cannot be used for soil repairs without other added ingredients.

### 3.3 Testing of CBR Value

The average results of testing the CBR value of the original soil and CBR with additional of petrasoil at variations in water can be seen in Figure 7.

### 3.4 Discussion

Mechanical, physical and chemical soil stabilization carried out at this time aims to improve soil conditions. Petrasoil

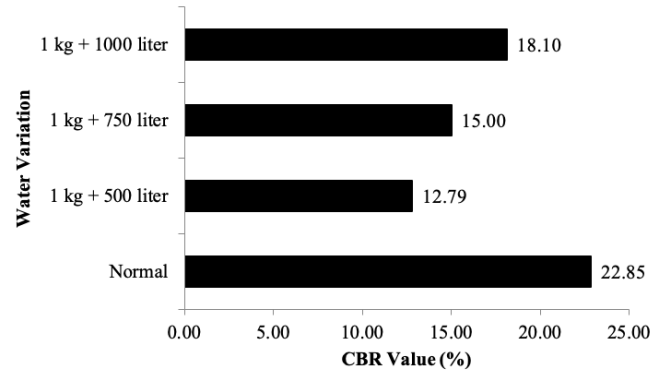


Figure 7. Result of CBR Value

use in some road constructions is always combined with other materials such as cement or lime. From this results of this study was obtained that the addition of petrasoil dissolved in water without being combined with other added ingredients can cause the soil conditions to become more unstable where the soil water content is higher, while the soil with high water content is not good for road construction, besides that causing dry soil weight diminishing means that the soil density is getting lower so that the land becomes unstable, as well as the CBR value was decreasing, it is means that the carrying capacity of the land is getting lower. Petrasoil content as stabilizing material on the soil must be considered, and the use of petrasoil as a supplement to added material in the soil improvement effort must also be taken into account so that further research is needed on the petrasoil itself and the effect of adding petrasoil as an added material to the soil.

## 4. CONCLUSIONS

There was a decrease in CBR value in the addition of petrasoil with 500 liters of water ie was from 22.85% to 12.79%, while the CBR value increased in petrasoil addition with 750 liters of water and 1000 liters but the increase in CBR value was still below the CBR value under normal conditions . The results showed that the addition of petrasoil without being combined with other added ingredients could lead to increasingly unstable soil conditions where the soil water content increased and the dry weight of the soil diminished, meaning that soil density decreases and the CBR value of the soil decreases.

## 5. ACKNOWLEDGEMENT

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