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# Study of Improving Soil Using Permit, Corn Ash and Sodium Silicate

W Erwanto *, R. R Parea. , A Ermitha.

The Christian University of Indonesia Toraja, Rantepao, Indonesia

*Corresponding author: erwanto.wal@gmail.com

**Abstract.** Soil that has low bearing capacity has a bad impact on the construction that is built on it as a result of which the building is easily damaged such as lifting the foundation on the building and causing cracks and shifting on the road. This research uses experimental laboratory methods. Soil samples used were taken from Lembang Tondon Siba'ta, Tondon District. Corn cobs were taken from Sa'dan Marante, Sodium silicate is obtained from chemical figures and palm fiber taken from Buntu Tagari and then tested for soil physical characteristics and soil bearing capacity in soil samples with a mixture of sodium silicate, corncob ash, palm fiber and soil without mixture. The results of the research on stabilized soil by adding 0.2% palm fiber, 2% corncob ash and 3% sodium silicate obtained an increase in soil bearing capacity of 9.73% from the original soil and the addition of 0.2% palm fiber, 4% corncob ash and 3% sodium silicate.

## 1. Introduction

Land is the initial foundation for the construction of both roads and buildings. Therefore, soil that has low bearing capacity can have a negative impact on the existing construction on it. One way to increase the bearing capacity of the soil is stabilization, to increase the carrying capacity of the soil and increase in strength which will be taken into account in the design process of pavement thickness. In general, soil stabilization is mixing the soil with certain materials, in order to improve the technical properties of the soil, or it can also be soil stabilization is an attempt to change or improve the technical properties of the soil to meet certain technical requirements. The purpose of this study was todetermine the bearing capacity of soil which was stabilized using corncob ash, palm fiber and sodium silicate?

## 2. Literature

### *2.1. Soil, Palm Fiber, Corn Weevil Ash*

Soil is defined as a material consisting of aggregates (grains) of solid minerals that are not cemented (chemically bonded) to each other and of decayed organic matter (which has solid particles) accompanied by liquids and gases that fill the empty space between these solid particles [1]. In addition, soil in the view of civil engineering is a collection of minerals, organic matter and relatively loose deposits that lie above the bedrock. The process of crushing in the formation of soil from rock occurs physically or chemically. Physical processes include erosion due to wind, erosion by water and glaciers, or splitting due to freezing and melting of ice in the rock while chemical processes result in changes in the mineral composition of the rock from which it originates. One of the causes is water containing alkaline acids, oxygen and carbon dioxide.

Palm fibers are natural fibers produced from palm trees that have many features, namely they are durable for hundreds or even thousands of years, are resistant to acids and sea water salts, and prevent the penetration of subterranean termites. Fiber is a material that has been used to produce several products such as rope, nets, cordage, water hoses and containers since ancient times. Plant and animal fibers are still widely used for felts, paper, brushes or thick fabrics. In addition, fiber or fiber is also the most important element, because the fiber will determine the mechanical properties of the composite such as stiffness, ductility, strength and so on. The main functions of fiber are:

1. As a load carrier that is in a composite structure 70% -90% of the load is carried by the fiber.
2. Provides stiffness, strength, heat stability and other properties in composites.
3. Provides electrical insulation (conductivity) to composites, but this depends on the fiber used.

### *2.2. Soil Stabilization*

Soil stabilization is a process to improve soil properties by adding something to the soil, in order to increase soil strength and maintain shear strength [2]. The purpose of soil stabilization is to bind and unify the existing material aggregates. Soil properties that can be improved by means of stabilization can include: volume stability, strength or bearing capacity, permeability, andconservation or durability. According to Bowles [3-6] some of the actions taken to stabilize the soil are as follows:

1. Increase soil density.
2. Adding to inactive material thereby increasing cohesion.
3. Adding material to cause chemical and / or physical changes to the soil.
4. Lowering the ground water level (soil drainage).
5. Replacing bad soil.

## 3. Results and Discussion

### *3.1. Original Soil Physyical Characteristics Testing*

Based on the results of tests carried out in the laboratory on the soil samples used, the density, soil plasticity index, plastic limit, and CBR values were obtained as shown in Table 1.

**Table 1.** Combination of Baseline Soil Data

| No. | Type of testing | Complications of native soil data |
|---|---|---|
| | | Result |
| 1 | Specific gravity | 2.45 Gr / $cm^3$ |
| 2 | Water content | 14% |
| 3 | liquid limit | 58.98% |
| 4 | plastic limit | 46.61% |
| 5 | Plastic index | 12.57% |
| 6 | Filter analysis | A-2-7 |
| 7 | Dry fill weight | 1.293 Gr / $cm^3$ |
| 8 | CBR | 7.90% |

The sieve analysis test on soil samples was also carried out with the intention of knowing the grain size distribution and grain composition (gradation) of the soil samples, based on the AASTHO classification where Table 3 obtained data on the percentage of soil that passed through sieve no 200 of 1.32% of the soil including silty or loamy and sandy gravel (Max 35%). The liquid limit of 58.98% can be classified in A-2. Plastic index 12.57% for group A-2, PI included in group A-2-7.

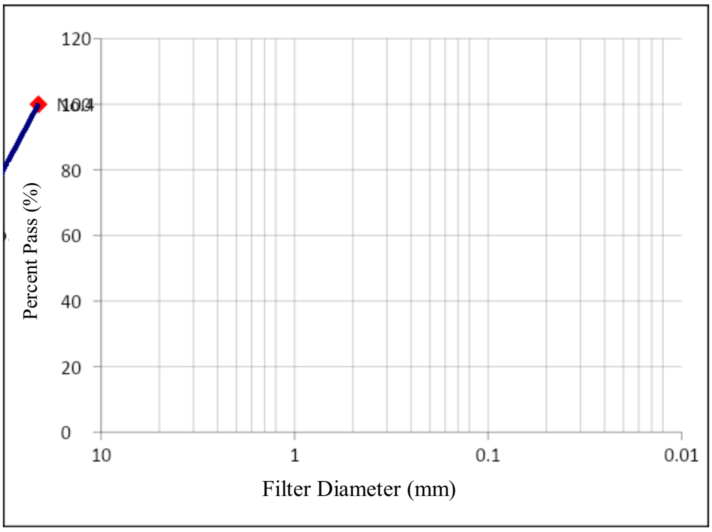


**Figure 1.** Distribution of Soil Grains

*3.2. CBR Testing (California Bearing Ratio)*

The CBR (California Bearing Ratio) laboratory test uses this modified proctor to determine the CBR value of soil material samples, aggregates or a mixture of soil and aggregates compacted in the laboratory at the specified moisture content.

*3.2.1. Original Soil CBR Testing Tests*

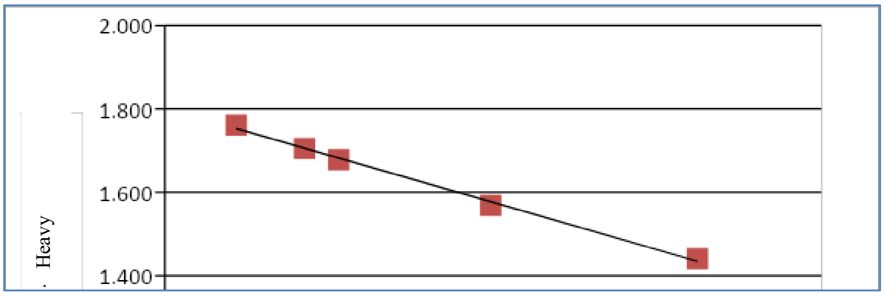


**Figure 2.** Original Soil Compaction Test Results

The graph above shows the relationship between the moisture content and the dry bulk density of the soil, where the more the water content contained in the soil, the greater the value of the dry bulk density, but if the water content continues to increase, the weight of the soil will decrease. In the figure, it can be seen that the optimum moisture content is 23.4% and the optimum dry weight is 1.279 gr / $cm^3$.

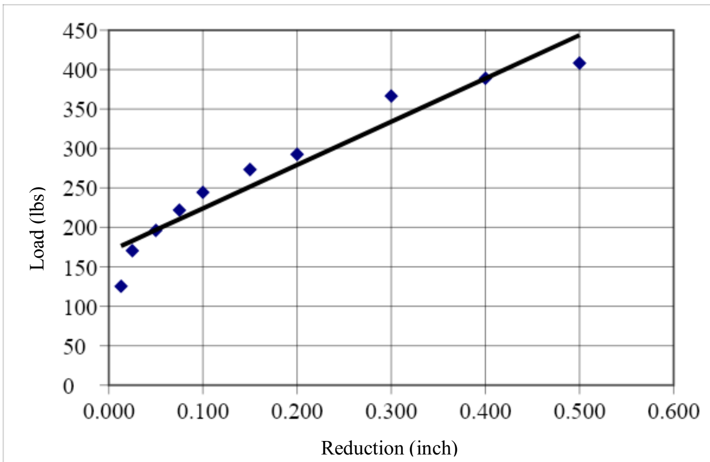


**Figure 3.** Relation of Load Reduction in CBR Testing of Original Soil

**Table 2** Results of Original Soil CBR Value

| Drop, x (inch) | Load, y = 779773ln (x) +442.2090 (lbs) | CBR (%) |
|---|---|---|
| 0.1 | 262,660 | = 262,660/3 ×1000 ×100% = 8.76 |
| 0.2 | 316,709 | = 316,709/3 ×1500 ×100% = 7.04 |

Based on Table 2, the minimum CBR value is 12.22% and the maximum CBR is 11.26% and can be illustrated in the graph of land subsidence above which is related to the load and penetration pressure. It is obtained that the CBR value of the original soil is 8.76, so the DDT value is 5.75.

*3.2.2. Tests for Soil CBR Testing with the addition of 0.2% palm fiber, 2% corncob ash and 3% sodium silicate*

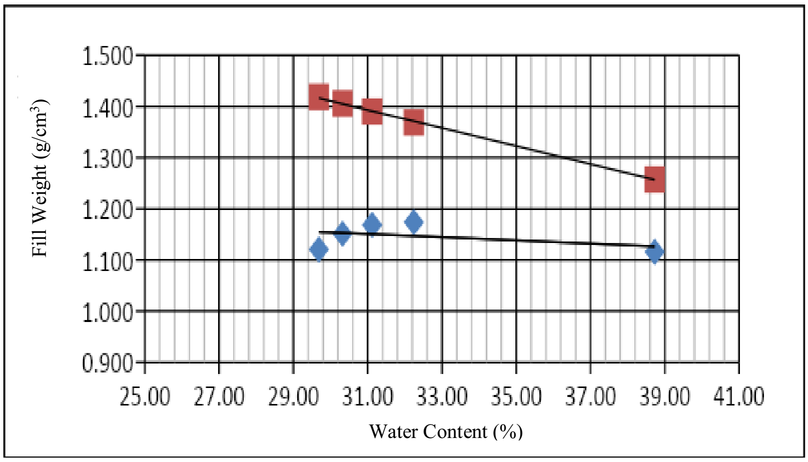


**Figure 4.** Compaction Test Results Soil with the addition of 0.2% fibers, 2% Corn Cob Ash and 3% Sodium Silicate

The graph above shows the relationship between water content and soil dry weight, where the more water content is contained in the soil, the greater the weight value, but if the water content continues to increase, the weight of the contents will decrease. Optimum 33.9% and optimum content weight 1.1823 gr / $cm^3$.

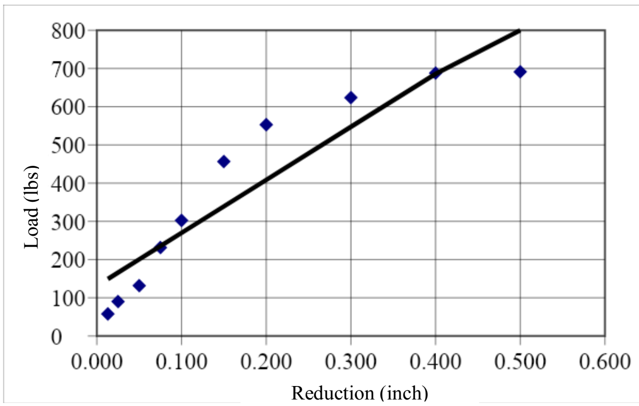


**Figure 5.** Relationship between Decrease and Expense at Land With Addition Fiber 0.2%, 2% Corn Cob Ash and 3% Sodium Silicate

**Table 3** Results of CBR Value with the addition of 0.2% palm fiber, 2% corncob ash and Sodium Silicate 3%.

| Drop (inches) | Load, y=202.2141ln (x)+ 832.3306 (lbs) | CBR (%) |
|---|---|---|
| 0.1 | 366,715 | (366,715/3 ×1000) ×100% = 8.76 |
| 0.2 | 506,879 | (506,879/3 ×1500) ×100% = 7.04 |

Based on Table 4.3, it is obtained that the minimum CBR value is 12.22% and the maximum CBR is 11.26% and can be described in the graph of land subsidence above which is related to the load and penetration pressure. It is obtained that the CBR value of the original soil is 12.22, so the DDT value is 6.37.

*3.2.3. Soil Compaction and CBR Testing with the addition of 0.2% palm fiber, 4% corncob ash and 3% sodium silicate*

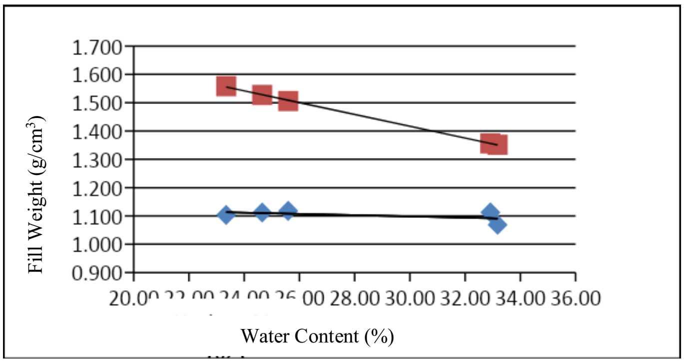


**Figure 6.** Compaction Testing with the Addition of 0.2% Palm Oil, 4% Corn Cob Ash and 3%Sodium Silicate.

The graph above shows the relationship between water content and soil dry weight, where the more water content is contained in the soil, the greater the weight value, but if the water content continues to increase, the wet weight will decrease. In the picture, it is known that the optimum water content is 27% and the optimum weight content is 1.101 gr / cm$^3$.

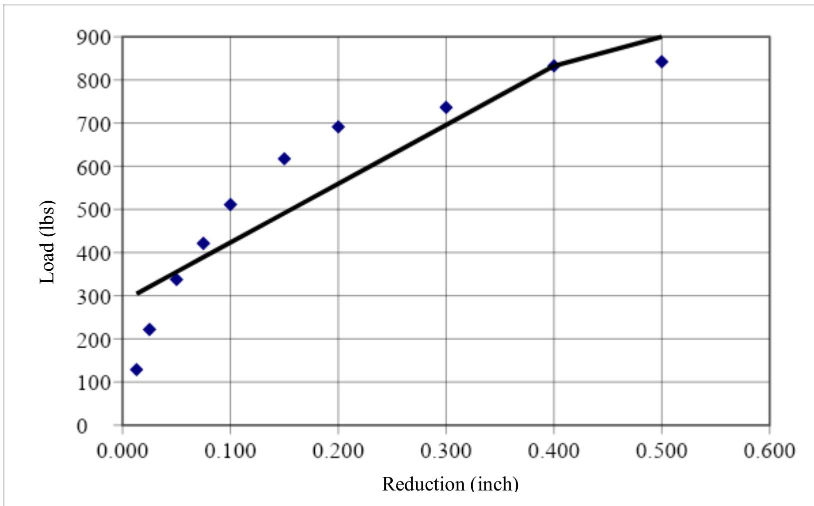


**Figure 7.** Relation of Drop and Expense on Land with Addition Fiber 0.2%, 4% Corn Weevil Ash And 3% Sodium Silicate

**Table 4.** Results of CBR values (palm fiber 0.2%, ABJ 4% and waterglass 3%)

| Drop, x (inch) | Load, y = 208.7927n (x) + 998.3946 (lbs) | CBR (%) |
|---|---|---|
| 0.1 | 517,632 | = 517.632 3 ×1000 ×100% = 17.25 |
| 0.2 | 662,356 | = 662.356 3 ×1500 ×100% = 14.75 |

Based on Table 4, it is obtained that the minimum CBR value is 14.75% and the maximum CBR is 17.25% and can be illustrated in the graph of land subsidence above which is related to load and penetration pressure. After knowing the CBR value, the increase in the value of the soil bearing capacity is calculated. It is obtained that the CBR value of the original soil is 17.25, so the DDT value is 7.018.

*3.2.4. Tests of Soil CBR Testing with the addition of 0.2% palm fiber, 6% Corn Weevil Ash and 3% Sodium Silicate*

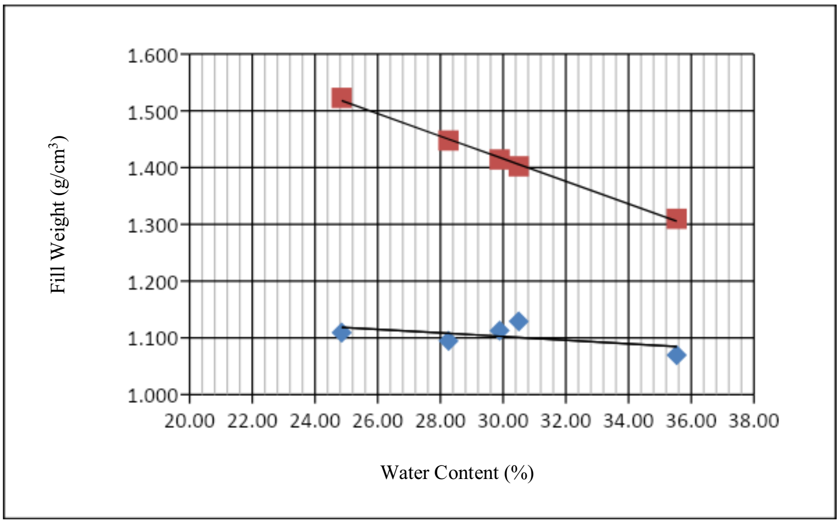


**Figure 8.** Compaction Test Results Soil with the addition of 0.2% fibers, 6% Corn Cob Ash And 3% Sodium Silicate

The graph above shows the relationship between the water content and the dry bulk density of the soil, where the more water content is contained in the soil, the greater the value of the dry bulk density, but if the water content continues to increase, the weight of the content will decrease. Optimum 29.8% and optimum dry weight of 1.148 gr / $cm^3$.

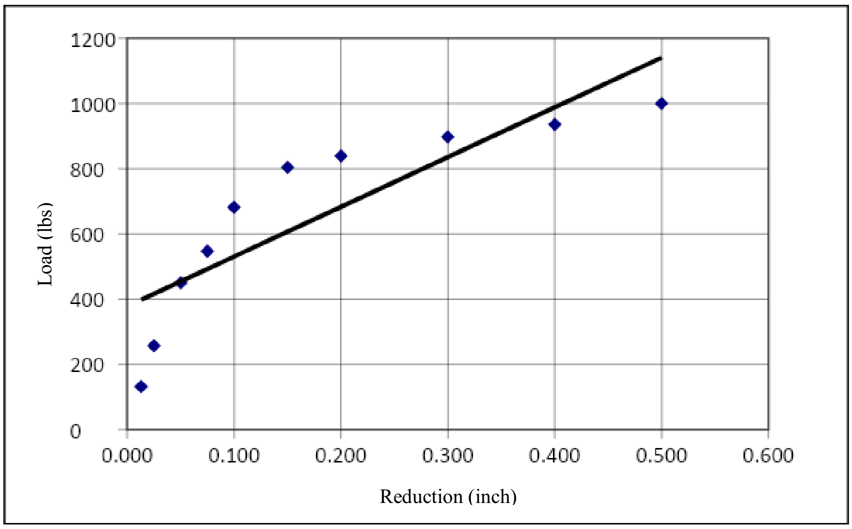


**Figure 9.** Relation of Dropand Expense on Land with Addition Fiber 0.2%, 4% Corn Weevil Ash And 3% Sodium Silicate

**Table 5.** Results of CBR Value (palm fiber 0.2% ABJ 6% and sodium silicate 3%)

| Drop, x (inch) | Load, y = 246,383.ln (x) +1.202.2434 (lbs) | CBR (%) |
|---|---|---|
| 0.1 | 634,925 | = 634.925 3 ×1000 ×100%<br>= 21.16 |
| 0.2 | 805,705 | = 805.705 3 ×1500 ×100%<br>= 17.90 |

Based on Table 5, it is obtained that the minimum CBR value is 17.90% and the maximum CBR is 21.16% and can be illustrated in the graph of land subsidence above which is related to load and penetration pressure. After knowing the CBR value, the increase in the value of the soil bearing capacity is calculated. It is obtained that the CBR value of the original soil is 21.16%, then the DDT value is 7.40.

## 4. Conclusion

The results of the research on stabilized soil by adding 0.2% palm fiber, 2% corncob ash and 3% sodium silicate obtained an increase in soil bearing capacity of 9.73% from the original soil and the addition of 0.2% palm fiber, 4% corncob ash and 3% sodium silicate. Experienced an increase in soil bearing capacity of 19.91% from the original land. The addition of 0.2% palm fiber, 6% corncob ash and 3% sodium silicate increased the carrying capacity of the soil by 22.30% from the original soil, thus the content of added material recommended for field work was the highest added content which was found at 6% corncob content.

## References

[1] Hardianto H 2020 Analysis of the Carrying Capacity of Clay from a Mix of Nickel Slag and Waterglass. Essay. Rantepao: Faculty of Engineering, Christian University of Indonesia Toraja.
[2] Hardiyantmo H C 2010 Soil Stabilization for Road Pavement. Yogyakarta: Gadja Madah University Press
[3] Marthen M T 2020 Study of the Supporting Capacity of Laterite Soil Zeolite Stabilization With Water Glass Activation as the Foundation for Geogrid Reinforcement Nlok. Graduate program. Makassar: Hasanuddin University
[4] Rani A S 2016 Study on the Use of Palm Oil as Slope Stabilization Materials. Essay. Rantepao: Faculty of Engineering, Christian University of Indonesia Toraja.
[5] Hepiyanto, R & Firdaus M A 2019 The Effect of Addition of Corn Weevil Ash on the

Compressive Strength of K-200 Concrete. Journal. Lamongan: Faculty of Engineering, Islamic University of Lamongan
[6] Sadikin U & Stella M 2004 Analysis of Addition of Palm Oil as Reinforcement and Lime as a Stabilizer in Clay Soil for Road Subgrade. Essay. Yogyakarta, Indonesian Islamic University

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