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Clay stabilization using flyash and carbide waste and its effect on the value of unconfined compression test *(Case Study of National Park Ujung Kulon Road in Pandeglang Regency)*

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Abstract.Clay is a type of soil with high pore water characteristics which causes its problem for pavment. Ujung Kulon national Park road in Sumur Subdistrict, Pandeglang Regency is a road with clay soil type, so the road is often demaged. To overcome this its problem it is necessary to add strength and improve its bearing capacity.The water content of the sample taken from the compaction of the original soil standart proctor. The variation of fly ash mixture that used is 0% and 20% and carbide waste with a mixture of 0%, 5%, 10%, 15%, 20% and 25%. Based on the result, the soil which stabilized by fly ash and carbide waste in the variation of 0%, 10%, 15%, and 20% showed the increase of the value of the soil bearing capacity, and decrease the velue of soil plasticity index.the largest of UCT (Unconfined Compression Ssrenght) value result for soil sample mixed with 20% fly ash and 20% carbide waste contain by curing for 28 days in amount of 5,51 kg /cm2.

1. Introduction

Subgrade type of clay is a type of soil with a very high character of pore water which causes problems for civil structures (buildings and pavement). Jalan Ujung Kulon National Park in Kampung Cibayoni, Desa Kertajaya, Kecamatan Sumur, Kabupaten Pandeglang has a CBR value below the standard which results in damage to the road structure above. To overcome this problem, it is necessary to study soil properties so that the strength of road construction is in accordance with the properties of the land that is feasible to use and there needs to be an effort to improve the soil through soil stabilization efforts. There are several steps that can be taken to stabilize the soil, one of which is the stability of the soil with chemicals. In this study the authors plan to stabilize the soil by using added ingredients in the form of fly ash and carbide waste.

In a previous study, by Kusuma [5] regarding the Stabilization of Expansive Clay Soils by Using Fly Ash and Its Effect on the Value of Free Press Strength, it was found that fly ash was able to increase the value of free compressive strength of the soil. And research from Ridwan [10], regarding the Effectiveness Study of the Use of Carbide Waste on Clay Stabilization with CBR and UCT Tests, the results of carbide wastes were able to increase the value of free compressive strength and decrease the value of soil plasticity index. Based on these studies the authors conclude that using fly ash and carbide waste as added material has a considerable influence on efforts to increase the value of free compressive strength so that the authors plan to use added ingredients in the form of fly ash and carbide waste in this study which is expected to improve quality of land on Ujung Kulon National Park Road in Kertajaya Village, Cibayoni Village, Sumur District, Pandeglang Regency.

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Figure 1. Research Location Conditions.

2. Literature Review

The use of fly ash added ingredients in this study is planned as much as 0% and 20%, this refers to research conducted by RI Kusuma [6] where the greatest value of free compressive strength is at a variation of 20% but does not reduce the value of the plasititas index soil. Whereas the use of added material in the form of carbide waste is planned to use variations of 0%, 5%, 10%, 15%, 20%, and 25% where the variations refer to E Mina [8] with the results of research adding 15% carbide waste. By adding the percentage of carbide waste by 20% and 25% the author aims to examine whether by adding a percentage of carbide waste the compressive strength produced will increase or decrease and is expected to reduce the soil plasticity index.

RI Kusuma [5] soil stabilized with fly ash at variations of 0%, 10%, 20%, and 30% showed an increase in the carrying capacity, a plastic limit, and a liquid soil limit as well as a decrease in the value of the specific gravity of the soil. The largest UCT value is found in mixed soil with fly ash content of 20% with ripening for 21 days, amounting to 2.55 kg / cm2

3. Research Methodology

This study is a study of stabilization of clay against the value of free soil compressive strength carried out at one point on Jalan Ujung Kulon National Park in Kampung Cibayoni, Kertajaya Village, District of Sumur, Kabupaten Pandeglang by using added ingredients such as fly ash and carbide waste.

This research was conducted in several stages, first was testing the physical properties of the soil and analysis of grain size to determine the type of soil. Then the soil compaction process is carried out to determine the optimum water content and maximum dry weight of the soil, then mixing the soil with a percentage of 20% mixture of fly ash and variations in the mixture of carbide waste, namely 5%, 10%, 15%, 20% and 25%. After the test object has been made ripening with the curing time of specimens 0 days, 7 days, 14 days, 21 days and 28 days. After curing, UCT (Unconfined Compression Test) is carried out to get the value of soil carrying capacity. In addition to the UCT test, soil physical properties were also tested to determine the effect of fly ash and carbide waste on the physical properties of the soil.

4. Discussion

4.1. Soil properties

The soil sample was tested for properties parameter and then the results were summarized. The following are the results in Table 1 of soil properties such as grain size analysis, liquid limit, plastic limit, and specific gravity without mixtureof material additive:

Table 1. Soil properties

No.	Characteristic	Value
1	% fine grain	55.88 %
2	Soil density	2.622
3	Liquid limit	68.335 %
4	Plastic limit	34.63 %
5	Plasticity index	33.7 %
6	Optimum water content	29 %
7	Dry unit weight	1.27 gr/cm^3

4.2. Soil classification

Classification of soil can be determined through analysis of grain size distribution results in Table 2, liquid limit and plastic limit test and USCS soil classification system table. From the results of analysis using USCS System classification it can be concluded that the soil was classified as OH soil, which is Organic clay with medium to high plasticity properties.

Table 2. Classification of soil based on USCS System

Classification procedure		Symbol	Type
Fine-grained soil (more than 50% passes sieve No.200	Clayly Silt with liquid limit of less than 50%	ML	Non organic Silt with a small amount of fine sand, gravel or clayly fine sand with low plasticity
		CL	Clayly silt non organic with low to moderate plasticity, silt mixed with clayly fine sand
		OL	Organic silt or organic clayly silt with low to medium plasticity
	Silty Clay with liquid limit of more than 50%	MH	Non organic clay, clay mixed with fine sand
		CH	Non-organic clay with high plasticity, fat clay
		OH	Organic clay with medium to high plasticity
		PT	Peat and high organic soil

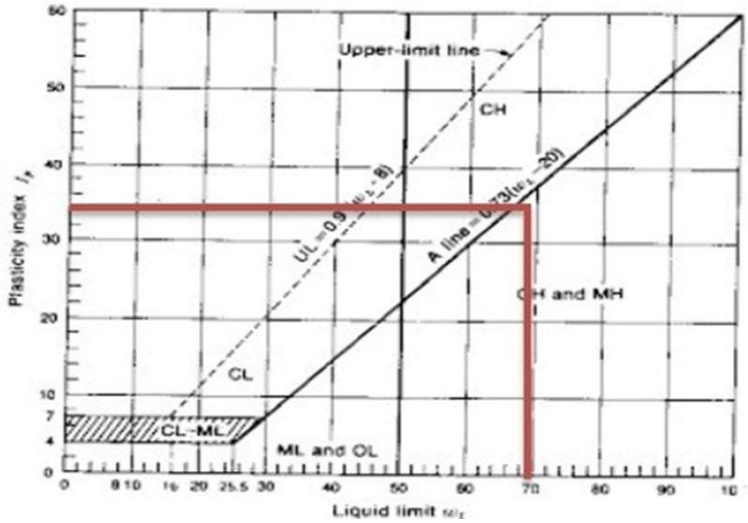

Figure 2. Graph of correlation between Liquid Limit dan Plasticity Index.

4.3. UCT (unconfined compression test) test results

The free compressive strength test (UCS / Unconfined Compression Test) was obtained from laboratory soil compaction tests sampled

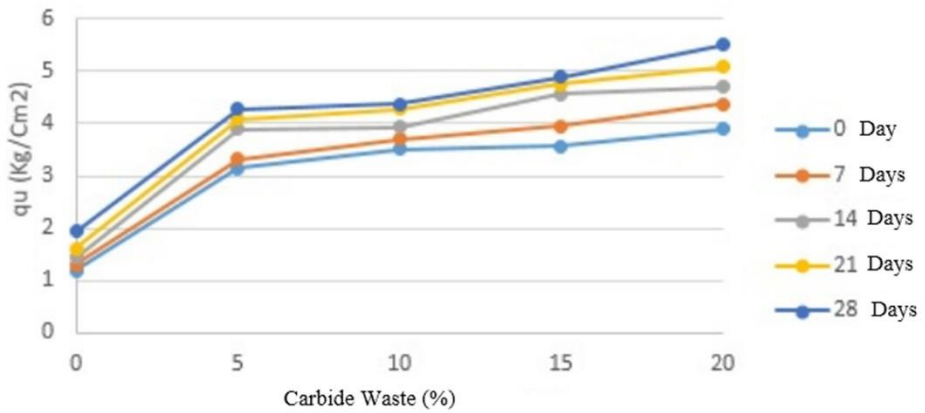

Figure 3. Graph of relation between qu value and percentage of additive Materials.

In Figure 3 the graph above is the result of testing the qu value based on the percentage of ingredients added. Figure 5 above can be seen that for all curing times with the addition of percentages of fly ash and the addition of carbide waste gradually can increase the value of qu, the highest qu value is obtained by the percentage of 20% fly ash and 20% carbide waste. At the percentage of 20% fly ash and 25% carbide waste there is no data that can be obtained at any length of ripening because the resulting test object is very dry so that damage to the test object occurs when removed from the mold.

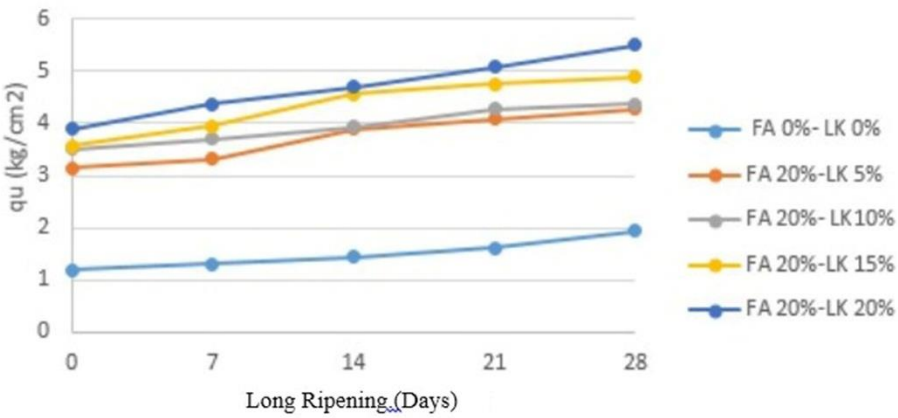

Figure 4. Graph of relation between qu values to ripening day long.

In figure 4, the graph above, overall the qu value increases along with the increasing length of ripening except for the percentage of 20% fly ash and 25% carbide percentage. Seen in the picture above the highest qu value is found in the percentage of 20% fly ash and 20% percentage with 28 days curing time.

From all the data from the results of testing the percentage of qu value above, it can be concluded that both curing time and the percentage of fly ash and carbide waste given to the test material will affect the percentage of qu value. The effect is in the form of increasing the value of qu (soil strength) obtained by adding curing time and increasing the percentage of fly ash and carbide waste gradually on the test material. Evidenced by the length of curing 28 days and the amount of mixed material by 20% both fly ash and carbide waste produced a qu value of 5.51 kg / cm2. The value of qu on the percentage of 20% fly ash and 20% carbide waste with a length of curing 28 days has a percentage increase of 360.32% of the value of qu on the percentage of fly ash and 0% carbide waste with a length of 0 days. In the percentage of fly ash 20 and 25% carbide waste, the addition of excessive percentage of carbide waste can reduce the water content of the sample so that the sample cannot be formed. So that no data can be obtained.

4.4 Plasticity Index

After obtaining liquid boundary and plastic boundary data on the soil with a mixture of added ingredients of fly ash and carbide waste, the soil plasticity index (PI / Plasticity Index) is obtained. Comparison of the plasticity index value, namely the percentage of fly ash and carbide waste. The results of soil plasticity index on mixed soil are as shown in the table 3 below.

Table 3. Plasticity index value of soil with precentage of admixtures

***Fly ash* (%)**	**Carbide Waste (%)**	**Liquid Limit (%)**	**Plastic Limit (%)**	**Plasticity Index (%)**	**Category**
0	0	68.34	34.63	33.71	High Plasticity
20	5	60.34	36.1	24.24	High Plasticity
20	10	58.02	37.67	20.35	High Plasticity
20	15	53.87	39.65	14.22	High Plasticity
20	20	49.41	40.62	8.79	Moderate Plasticity

Index value of soil materiality without added material is 33.71% and categorized as OH soil, soil with high plasticity. From the picture above it can be concluded that the addition of fly ash and carbide waste to clay plasticity index values decreased from 33.71% to 8.79% .

5. Conclusion and Suggestion

5.1 Conclusion

Based on the results of research and testing, it can be concluded that stabilization using fly ash and carbide waste on clay soil at Ujung Kulon National Park Road, Cibayoni Village, Kertajaya Village, Sumur District, Pandeglang Regency are as follows, in the free compressive strength test the following results are obtained Fly Ash and carbide waste can increase the value of free soil compressive strength, the highest compressive strength value is found in the percentage of 20% fly ash and 20% carbide waste with 28 days curing time of 5.51 kg / cm2 which increases from 1,178 kg / cm2 on soil without a mixture of fly ash and carbide waste, with a percentage increase of 35.61%. But at the percentage of 20% fly ash and 25% percentage of carbide waste the test object cannot be formed because the sample is too dry so there is no data that can be obtained.

In this study, fly ash and carbide waste can affect the physical properties of clay. This is indicated by the decrease in soil plasticity index value from 33.71% to 8.79% or the percentage decrease in soil IP by 73.91% after the soil is mixed with 20% fly ash and 20% carbide waste. With the decrease in soil plasticity index the potential for land development will be smaller. The soil in this study can be used as subgrade if the soil is in optimum dry state or not saturated with water.

In testing the physical properties of native soil, the soil at that location according to the classification system of USCS soil is included in the OH classification with a plasticity index value of 33.71%, namely organic clay. Because the soil is included in the clay category and high plasticity, the soil needs to be repaired. In testing the physical properties of the original soil also obtained the value of density of 2.622; liquid limit value is 68.335%; and the plastic limit value is 34.63%..

5.2 Suggestion

Research on stabilization of this land is still not completely perfect, because it is expected for further research, each subgrade in each region has different physical properties, and therefore it is necessary to test the physical properties of the soil. There are several other added ingredients for soil stabilization, and chemical literature that can be used for land stabilization can be found.

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