Strength Behavior of Modified Soils

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Abstract Since soil is used as a construction material in numerous applications, it is important to investigate methods to enhance its properties. In this study the relationship between soil properties (strength and unit weight), and several stabilizers (cement, lime, bentonite and class-C fly ash) 80% sand and 20% kaolinite clay. The samples were prepared using the Harvard miniature compaching method. Soil was stabilized with 6% of each stabilizer and the specimens were tested after 28 days of curing. The highest compressive strength was observed with 6% cement treatment, which showed an improvement of more than 10 times compared to the untreated soil. The soil treated with bentonite, fly ash, and lime also showed improvement.

1. Introduction

Historically, earth has been the most widely known and used as a material in construction and probably has been the most important of all building materials (Legget, 1960). Earth as a construction material is available everywhere and is economically the most efficient means to construct dams, ,roads, embankments and even house the greatest number of people with the least demand of resources. Many additives ranging from industrial materials to waste products have been used in attempts to improve soil properties. According to Middendorf (2001) recorded cases of the use of earth bricks dates back to Mesopotamia “around 8000 BC”. Earth as a construction material is available everywhere and exists in many different compositions.

2. Objectives

The overall objective was to investigate the effect of various stabilizers on the compressive strength of stabilized soils additives such as lime, bentonite, cement and Class C fly ash.

3. Material and methods

A laboratory mixture of 80% sand (S) and 20% kaolinite (K) soils was selected as a base material and treated with various stabilizing materials near the optimum moisture contents. The compacted soils (Harvard miniature method) specimens were cured at room condition.

4. Testing and results

The soil samples (80% sand and 20% kaolinite) were prepared with 6% of cement (C), fly ash (FL), lime (L) and bentonite (B). The results are summarized in Table 1. The highest compressive strength in treated soil was achieved with 6% cement showed an improvement of more than ten times compared to the control soil. Soil treated with 6% bentonite had the lowest increase in compressive strength of 2.56 times the value of the untreated soil. Soils treated with 6% fly ash and 6% lime gave similar enhancement of 2.82 times.

Table 1: Summary of the results

Sample Configuration	Strength (psi)	Strain (%)	Optimum Water Content (%)	Dry density (g/cm^3)	Remarks
S80K20	65	1.96	8.99	2.28	Control Soil
S80K20C3B3%	152	1.91	8.25	2.37	Highest Density
S80K20B6%	167	2.01	10.36	2.23	Highest O M C
S80K20C6%	680	1.09	7.52	2.35	Highest Strength & Lowest Strain
S80K20L6%	184	1.9	8.73	2.15	Same Strength as Fly ash
S80K20FA6%	184	1.9	7.42	2.27	Same Strength as Lime

5. Conclusions

Cement treated soils showed the highest strength and lowest plasticity. Dry density increased compared to the untreated soil. The optimum water content decreased in all mixtures except for the sample treated with bentonite.

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7. References

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