

Suitability of Stabilized Dredged Soil as Pavement Subgrade

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ABSTRACT:In India large quantity of marine sediments is dredged from harbours and seaports for construction of the marine structures and for maintenance of the shipping channels. The dredged soil requires large area for its disposal. It is recognized that the offshore dumping of dredged soil causes disruption to the aquatic environment. The marine dredged soil cannot be used in valuable construction process because it exhibits properties such as low shear strength, high natural water content and high compressibility. This paper aims to reuse the dredged marine soil as a sustainable material which is economical for the construction activities. Attempts were made to stabilize the dredged soil for the different applications such as embankment obstruction, road construction and for landfill. This study investigates the potential reuse of the dredged soil for the road construction. This paper describes a study to solidify the dredged marine sediment using cement. This project made an attempt to evaluate the effectiveness of using cement in modifying the properties of marine sediments, by the means of laboratory tests to assess the compatibility of modifying the marine dredge soil as a construction material for the road construction. In this project, study of properties dredge soil obtained from Vypin, Kerala is done and its suitability as using it as pavement subgrade is checked. Survey is conducted on regions susceptible to weak subgrade and suitability of replacement of the weak soil by stabilized dredge is studied.

KEYWORDS:Dredged soil, cement stabilization, subgrade, pavement.

I. INTRODUCTION

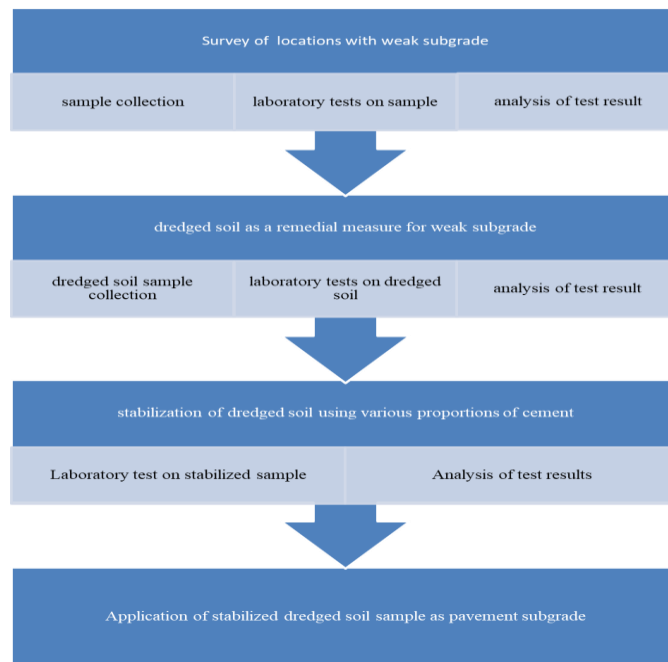
Dredging is an activity of removing the sediments from the bottom portion of the rivers, lakes and sea beds. Dredging process is necessary for the development activities of the coastal region. Dredging is an activity carried out for the purpose of the construction of the port facilities and for the maintenance of existing shipping channels by removing the sediments from the bottom of the sea, lake and river. Due the dredging operation large amount of sediments are generated, which cannot be used for the construction activities because of its poor geophysical properties such as high water content, presence of organic matter and salt. The offshore dumping of the dredged marine soil causes many negative impacts on the marine ecosystem and the environment. Such open dumping also causes the long term damaging pollution due to the contamination of the heavy metals such as hydrocarbons which release the contaminants to the surrounding environment. For the improvement of mechanical and geophysical properties of dredged soil, stabilization technology can be adopted. If the dredged soil is used for any beneficial reuse then the environmental impact due to the open disposal of the dredged soil can be avoided. The typical characteristics of the dredged soil are fine grained soil type and they generally consist of clay and silt sized particles. Due to the properties such as high compressibility and low bearing capacity, it cannot be used for any civil engineering applications such as road construction and back filling activities. So some attempts have been made to the modification of the properties of the dredged marine clay with quarry dust, it seen that it reduces compressibility and increases shear strength. As the treated material has improved strength, it is suitable for used in various civil engineering applications. The focus of this study is to examine the suitability of cement in the stabilization of marine dredge soil. DMS consist mainly of clays, silts, and sands. It is mingled with rocks, debris, large obstacles, and organic matter. Organic matter usually derives from humus, decomposed plant and animal residues and other organic matter such as algae, worms, and amphipods that settle at the bottom of water's body. There are three options in DMS management: sea disposal, land disposal, and beneficial use. Disposal at sea is the most common practice in Malaysia. Land disposal are not applicable due to high cost and requires large area. However, both of these optional give adverse effect to human and environment when expose to contaminated DMS. Instead of treating DMS as a waste, it has been realized that DMS can be used beneficially for a variety of applications such as beach nourishment, habitat restoration and construction material. This paper reviews some of the civil engineering application for DMS where the geo-characteristic of the material are discussed.



RELATED WORK

[1].Soil sample collection of weak soil and dredged soil [2].Laboratory tests of the collected samples [3]. Stabilization of dredged soil using cement [4]. Tests on stabilized soil.[5] Application as pavement subgrade
The dredged soil was collected from Vypin, Kochi, Ernakulam, Kerala. Weak soil is collected from Chelad,Ernakulam.The soil is tested in laboratory for strength determination and stabilized using cement.The tests conducted on the samples are Specific gravity test, water content test, standard proctor test, CBR test.

II. METHODOLOGY



III. EXPERIMENTAL RESULTS

The tests conducted in order to determine the strength of both the soil samples are (a).specific gravity test (b).water content test (c).standard proctor test (d).CBR test.

Sieve analysis was conducted on both the soil sample and it was found that;

- 1.The weak soil sample collected is of clayey nature
- 2.The dredged soil sample consists of marine clay along with sand particles.

The test results of the weak soil sample is as follows.

Experiment	Trial 1	Trial 2	Trial 3	Trial 4
1.Water Content	5%	5%	-	-
2.Specific Gravity	2.56	2.56	-	-
3.Std. Proctor Test				
Dry density (g/cc)	1.34	1.43	1.48	1.39
Water content (%)	14.24	15.28	20	26.31
Opt. Moisture Content (%)				18.01%
4.CBR	1.63			

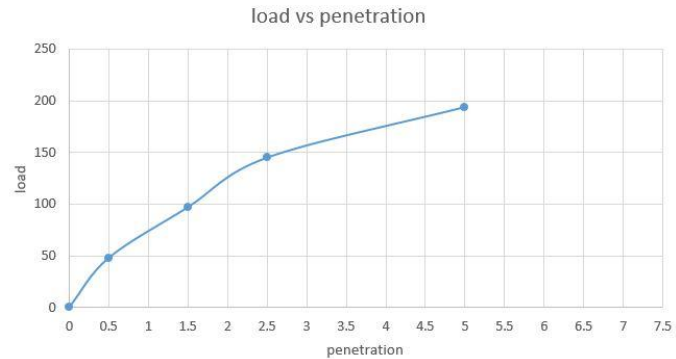
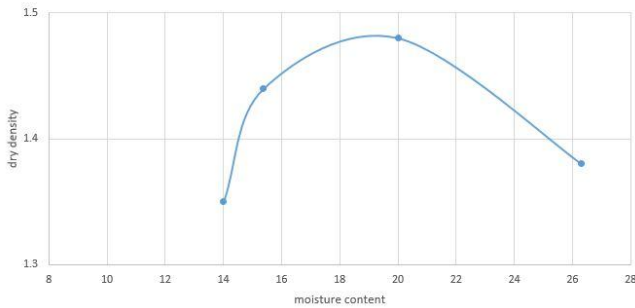
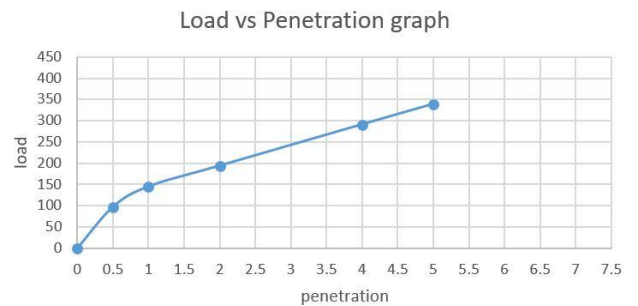
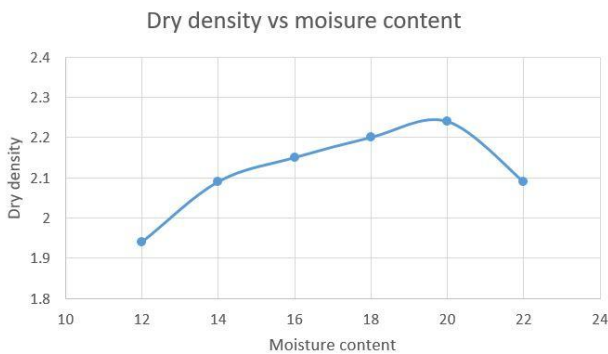


Figure (1) Dry density vs moisture content Figure (2) Load vs penetration

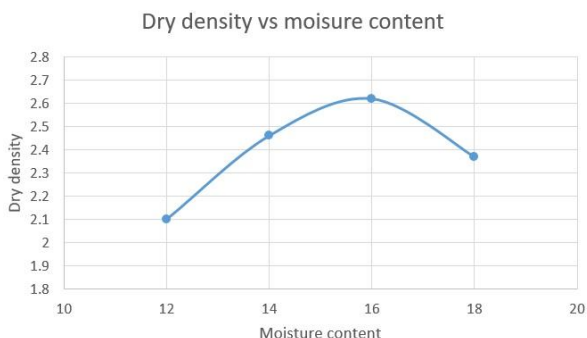
The test results of the dredged soil is as follows,

TESTS	Trial 1	Trial 2	Trial 3	Trial 4
1. Water Content	1%	1%	-	-
2. Specific Gravity	2.6	2.6	-	-
3. Standard proctor test				
Dry density (g/cc)	1.92	2.15	2.26	2.09
Moisture content (%)	13	16.78	20.2	22.64
Opt. Moisture Content (%)				19.85%
4. CBR	1.05			

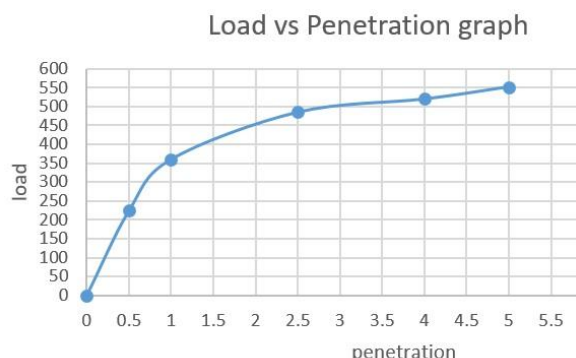


The test results of stabilized dredged soil with 6 % cement replacement is as follows.

TESTS	Trial 1	Trial 2	Trial 3	Trial 4
1. Water content (%)	1	1	-	-
2. Specific gravity	2.78	2.78	-	-
3. Standard proctor test				
Dry density (g/cc)	2.1	2.46	3.24	2.37
Water content (%)	12.21	14.30	16.81	18.18
Optimum moisture content				15.98
4. CBR	3.54			



(5)



(6)

Figure (5) Dry density vs moisture content Figure (6) Load vs penetration

The tests indicate both the soil sample to be weak. In order to use the dredged soil sample as pavement subgrade, its strength should be improved using stabilization. Here we opt Cement as the stabilizing material as it is of cheap cost and abundant in availability. Results show that maximum strength is obtained at 6% replacement of soil by cement stabilizer. The CBR value obtained after stabilizing the dredged soil is 3.54 which indicates the soil is of fair condition and hence can be used for pavement subgrade.

IV. CONCLUSION

This project was to study the suitability of using dredged soil as pavement subgrade. Dredged soil when disposed off is a material of no use and results in loss of land, pollution etc. Due to the varying content, it is hard to predict the properties of dredged soil. If tested and studied properly and utilize the dredged soil for any purpose, it will pave way out problems caused due to the deposition of dredged soil. After tests, it has been found that the dredged soil is weak in engineering characteristics, hence to use it for engineering purposes, it should be stabilized. Cement is a common stabilizer used for improving engineering properties. Here we used cement as the stabilizer and the variations in strength is studied. If dredged soil can be economically and properly stabilized, its characteristics can be enhanced and be used as pavement subgrade. Hence it is an effective way of disposing off the dredged soil.

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