Experiment Study on Compound Solidification Materials for Disposing Dredged Sediment of the high water content

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Abstract

Soft solidifying agent for Strengthening Foundation has a strong regional, in order to address the problems resulting from dredger fill quick strengthening of tianjin seashore region, the principle of orthogonal test with four factors and five levels, unconfined compression test are employed to obtain an integrated rapid curing agent directed primarily at cement, coal ash, silicate of soda and lime in tianjin seashore region. Moreover, the paper attempts to develop a relation for strength clay, and discover the stress-strain relationship of unconfined compressive strength. The experimental results show that this rapid curing agent can improve compressive strength.

Keywords

Dredged Sediment, Compound Materials, Solidification.

1. Introduction

In recent years, with the development and construction of coastal cities mass increase, the demand increased of land resources, more and more land is made up with reclaimed soil (Zhang chunlei et al, 2010; Wang Dongxing et al, 2012). A lot of port engineering construction is building to soft soil foundation that reclaimed soil. A lot of river, lake and sea space usually produces a lot of high water content dredged silt in the process of development and construction. Well Point Dewatering or vacuum preloading Program. The processing method cost of construction process is higher and Lack the necessary material resources In the process of method by these methods. Insufficient strength problem that Caused by the construction control still be there. The processing of Solidified Dredged Sediment is frontier topics in the geotechnical engineering research in recent years (Li erhu et al, 2012; Wang Jianping et al, 2013). Reinforce dredger fill with Curing Agent is one of the commonly used method in foundation treatment. Under the condition of land shortage in Tianjin seashore region, it is a rapid, economic foundation reinforcement technology that Make the reclaimed soil from mud state consolidation as soon as possible become a certain bearing capacity of foundation (Yu bing 2011), it will bring huge benefits to reclamation project.

Solidification method has been extensively used as an effective technology for the treatment of the dredged Sediment by many researchers (Bell F G, 1994; A. Vatsala, 2001; G. Rajasekaran, 2005; Jian-Feng Chen et al, 2010; Nilo Cesar Consoli et al, 2011; Suksun Horpibulsuk et al, 2012; R. J. Zhang et al, 2013). Unconfined compressive strength tests and direct shear tests were conducted to cement solidified dredged material and remolded solidified dredged material (Huang yinghao, 2009). The soil curing tests with different ratio of cement and lime in dredger fill of WenZhou were carried out to study the road-used performance of cured dredger fill and obtain an economical and efficient curing agent mix (Li Hailong, 2014). A simple empirical formula and some basic properties of cement stabilized soil are discussed on the basis of a lot of laboratory tests .The compressive strength of cement-stabilized soil depends mainly on cement dosage and secondly on moisture content of intact soil. Based tests of 28 prescriptions (Tang X.Y., 2000). The effectiveness of fly ash use in the stabilization of organic soils and the factors that are likely to affect the degree of stabilization were studied (Erdem O. Tastan et al, 2011).

2. Text

The dredger fill of Selection of Tianjin seashore region as the test soil sample, cement, quick lime, fly ash and water glass as curing materials and study on Tianjin seashore region dredge fill solidification effect by different curing material combination, different initial moisture content and different curing period, by the end, To obtain a reasonable curing agent to Tianjin seashore region by orthogonal test and unconfined compressive strength test.

2.1 Test materials.

The dredger fill of selection of Tianjin seashore region as the test soil sample, cement, quick lime, fly ash and water glass as curing materials, the test soil sample of engineering site is homogeneous and flowing plastic soil and homogeneous. Determination of the physical properties of test soil sample by laboratory test, as following:

Table 1 The Physical properties of the test soil

Sample	water content（%）	specific gravity	void ratio	plastic index	Liquidity index
1	128.0	2.74	3.527	19.3	5.60
2	86.1	2.74	2.445	17.7	3.77

2.2 Test scheme.

The water content of soil sample is 80%,the cement content is 7%,11%,15%,17% and 19%, the maintenance cycle is 7d and 28d, then unconfined compressive strength test and Test the strength of the solidified soil ;

The principle of orthogonal test with four factors and five levels, the water content of soil sample is 80% ,the cement content is 7%,11%,15%, 17%,19%, maintenance cycle is 7d, the quick lime dosage is 1% to 5%, ,then unconfined compressive strength test and Test the strength of the solidified soil ; the dosage of fly ash is 1%,3%,5%,7%,9%; the dosage of glass water is 1% to 5%, then unconfined compressive strength test and test the strength of the solidified soil.

3. Results analysis

The cement mixing (curing agent) ratio is the weight ratio of cement and soil. the test results as follows:

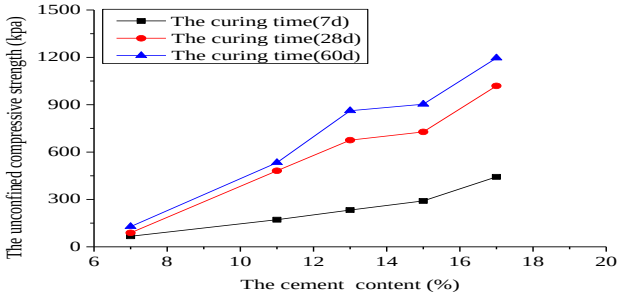

Fig. 1 the relationship of Cement content and soil curing strength

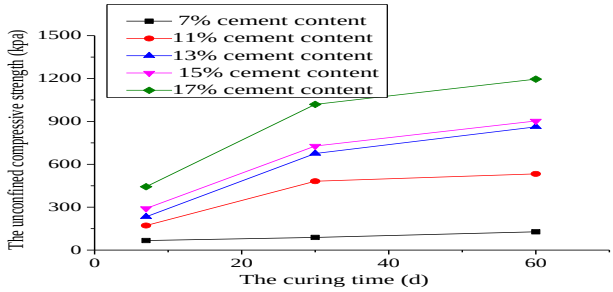

Fig. 2 the relationship of the curing time and soil curing strength

Fig. 1 is the relationship of cement content and silt soil curing strength, figure 1 shows that the strength of the cement stabilized soil increase with the increase of cement mixing ratio, it should

select the appropriate dosage of cement in order to save engineering budget funds under the premise of guarantee the project quality in the practical engineering.

The fig. 2 is the relationship of soil curing strength and curing time, figure 1 shows that that the strength of the cement stabilized soil increase with the increase of curing time, Reinforcement of soil strength about 2-3 times that of the original strength after 7d of maintenance, Reinforcement of soil strength about 1-2 times that of the 7d after 30d of maintenance.

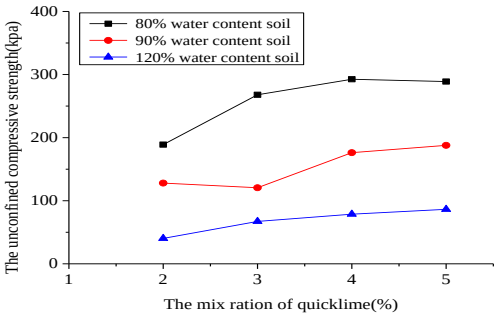

Fig. 3-1 the relationship of Quick lime content and soil curing strength under the condition of 10% cement content

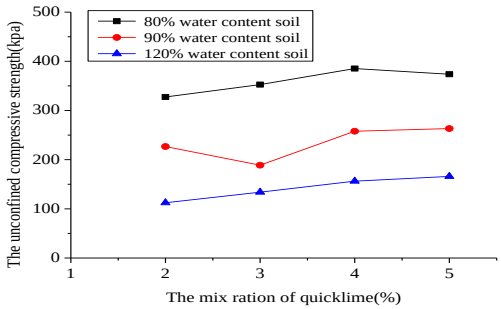

Fig. 3-2 the relationship of Quick lime content and soil curing strength under the condition of 15% cement content

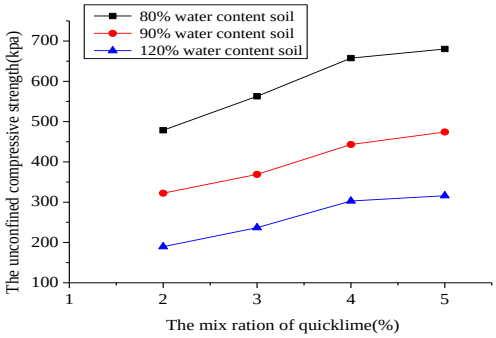

Fig. 3-3 the relationship of Quick lime content and soil curing strength under the condition of 20% cement content

Fig. 3-1 to 3-3 is the relationship of Quick lime content and soil curing strength under the different cement content, It shows the soil curing strength increases with the increase of quick lime content, It to provide reference for the selection of curing material consumption.

3.1 The Orthogonal test

The principle of orthogonal test with four factors and five levels, the water content of soil sample is 80% ,the cement content is 7%,11%,15%, 17%,19%, maintenance cycle is 7d, the quick lime dosage is 1% to 5%, ,then Unconfined compressive strength test and Test the strength of the solidified soil ; the dosage of fly ash is 1%,3%,5%,7%,9%; the dosage of glass water is 1% to 5% , then unconfined compressive strength test and test the strength of the solidified soil. The test results are as follows:

Table 2 the orthogonal test results of the soil curing

Test	Cement content (%)	fly ash content (%)	Quick lime content (%)	Water glass content (%)	7d Curing strength (kpa)
1	7	1	1	1	114.41
2	7	3	2	2	133.50
3	7	5	3	3	187.21
4	7	7	4	4	215.93
5	7	9	5	5	178.68
6	11	1	2	3	286.36
7	11	3	3	4	375.21
8	11	5	4	5	427.84
9	11	7	5	1	455.70
10	11	9	1	2	486.96
11	15	1	3	5	365.73
12	15	3	4	1	426.48
13	15	5	5	2	565.51
14	15	7	1	3	613.22
15	15	9	2	4	632.73
16	17	1	4	2	336.59
17	17	3	5	3	418.50
18	17	5	1	4	461.23
19	17	7	2	4	558.34
20	17	9	3	1	615.12
21	19	1	5	4	362.28
22	19	3	1	5	447.83
23	19	5	2	1	537.41
24	19	7	3	2	613.67
25	19	9	4	3	634.38
mean value1	172.8	282.6	424.2	429.4	
mean value2	405.8	359.8	429.2	426.6	
mean value3	520.2	442.8	438.4	427.6	
mean value4	477.6	490.8	407.6	409	
mean value5	518.6	509	395.6	395	
Range	347.4	116.4	42.8	40	
best solution	3	5	3	1	

Table 2 is the orthogonal test results of The soil curing, table 2 shows the optimum mixture ratio of the curing agent: the cement is 15%, the fly ash is 9%, the quick lime is 3%, water glass is 1% under 80% soil water content. Through the analysis of range "R" in the table, it can draw that the "R" of the

cement is the biggest in all Curing materials, so the cement play dominant role In the process of reclaimed soil reinforcement.

4. Conclusion

The following conclusions could be drawn through the theoretical and text analyses in this paper:

The strength of the cement stabilized soil increase with the increase of cement mixing ratio, it should select the appropriate dosage of cement in order to save engineering budget funds under the premise of guarantee the project quality in the practical engineering.

The optimum mixture ratio of the curing agent :the cement is 15%, the fly ash is 9%, the quick lime is 3%, water glass is 1% under 80% soil water content and the cement play dominant role In the process of reclaimed soil reinforcement.

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