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Comparative Study of Stabilization of Sand by using Cement and Emulsion

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Abstract: This study concerned with stabilizing sand with emulsion. Bitumen Emulsions are becoming more popular because of ecological and economic advantages. Emulsions can be mixed easily with sand without heating, which reduces environmental pollution and energy requirement. Emulsions are very small droplets of asphalt in water; to keep these droplets dispersed emulsifying agent is used. This study is focused on stabilizing sand with emulsion for the purpose of maintenance of flexible pavements and as a surface layer of those roadways where the vehicular traffic is not heavy. For this study marshal stability test is done to know the flow value and the stability value of specimen prepared of sand and different percentage of emulsion. In this study it is clear that the specimen made of well graded sand and 8 percent of grade SS2 emulsion give the suitable stability and flow value which proves that the stabilized sand is suitable for flexible pavement repair work. This study concerned about the comparison of stabilization of sand by using cement and emulsion in respect of UCS value and compares the cost for same UCS value.

Keywords: Emulsion, sand, maintenance work, comparison, stabilization

I. INTRODUCTION

This study is carried out in natural river sand is obtained from the Narmada river of Jabalpur region. Asphalt emulsion is the droplets of asphalt which is very popular now days because of no heating before mixing and economical as well. The gravel road in rural areas or in villages is liable to erode because of frost action and rain, this stabilized material can be used to stabilize this kind of road or surfacing in these gravel road. Emulsion is used for sand stabilization because of its cementing and waterproofing quality. The cementation is generally more important for non-cohesive soil and slightly for cohesive soil. Increasing the emulsion content in sand proof increasing the water proofing quality, but it might lower the mixture strength therefore the amount of emulsion to be added in mixture should be adequately find by testing of mixture. The another purpose of this study is to determine the difference between the stabilizing agents, cement and emulsion because of both are cementing material and give different effect on material on different percentage. So at what cost which material is effective and suitable for any work is to be found out in this study. Emulsion is mixed with natural well graded sand and specimen is formed according to Indian standard for finding the marshal stability value and flow value. The specimen are formed for 4%, 6%, 8% and determine the variation in marshal value and optimum emulsion content for which makes material suitable for repair work.

II. MATERIAL AND METHODOLOGY

A. Sand

Granular material used in this study is Narmada river sand of Jabalpur region which is well graded sand according to sieve analysis done in this study.

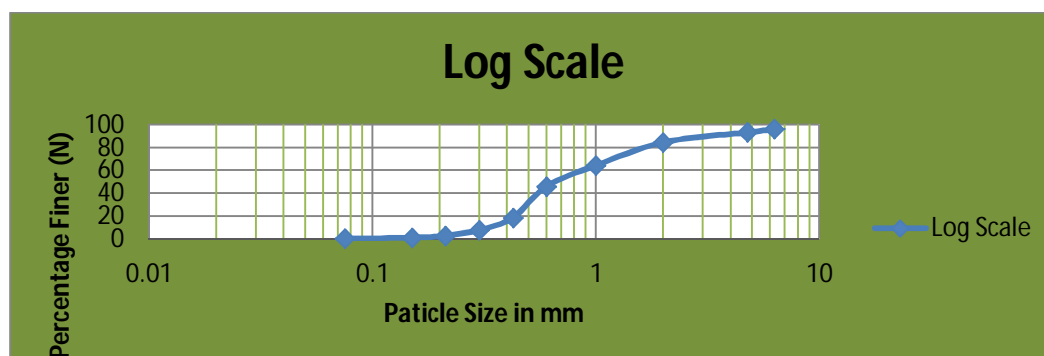


Fig. 1 Sieve analysis of sand

The natural Narmada river sand were used in practical work to prepare the specimen with cement and emulsion as stabilizer individually with different contents of them and conducting the unconfined compressive strength, marshal stability test, modified proctor test and the their properties. The sand were tested for specific gravity, proctor test as per IS code.

B. Tests Results

Table 1: TESTS RESULTS ANALYSIS

TESTS	RESULTS
Marshall stability value	331.61 Kg
Marshall flow value	3.26mm
specific gravity of sand	3.26
UCS of sand +emulsion (10%)	1.59mpa
Specific gravity of cement	3.12
UCS of sand-cement (10%)	2.21mpa

Table 2: Comparative Analysis of UCS of stabilized sand by cement and emulsion

Content of stabilizing agent %	UCS of sand-emulsion MPA	UCS of sand-cement MPA
4	0.1	0.42
6	0.38	0.98
8	0.91	1.71
10	1.59	2.21

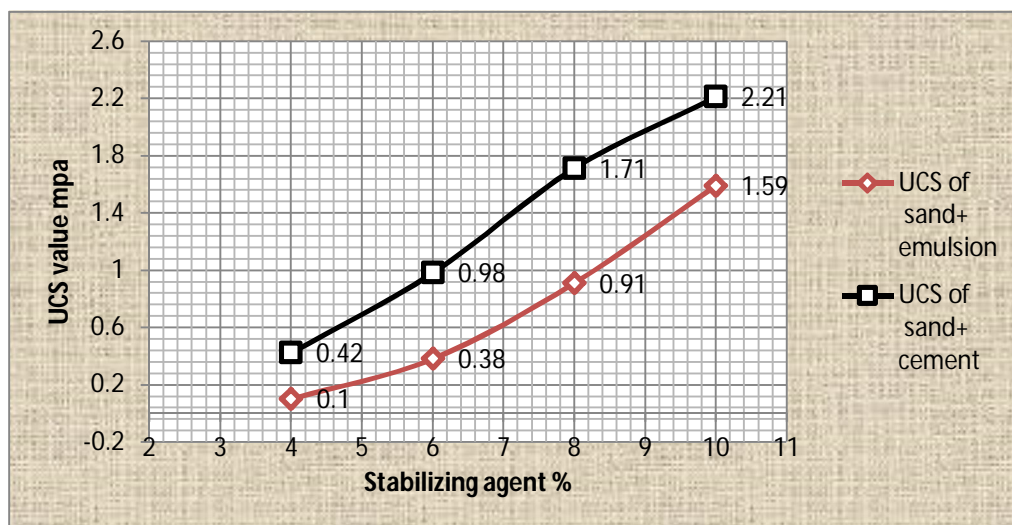


Fig. 2 comparison of UCS value of sand-cement and sand-emulsion mixture

Table 3: Analysis of Marshall Stability on different % of emulsion

Emulsion content %	density gm/cc	Air voids Vv	VFB %	Marshall stability kg	Flow value mm
7	2.87	5.28	42.31	276.67	2.83
8	3.01	6.47	47.72	302.22	2.92
9	3.21	5.92	48.22	331.61	3.26
10	3.34	4.83	50.13	314.33	3.41

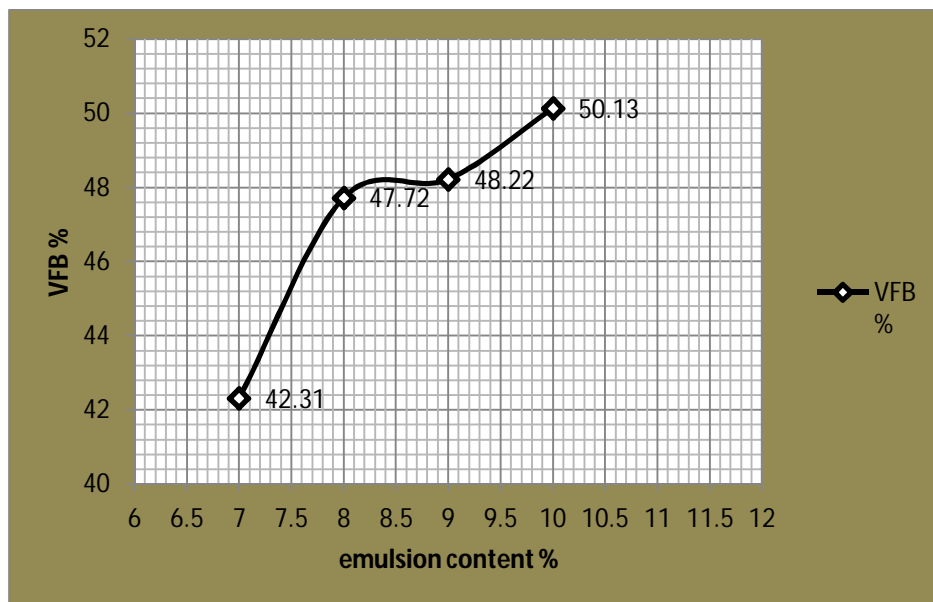


Fig. 3: variation of VFB with emulsion content

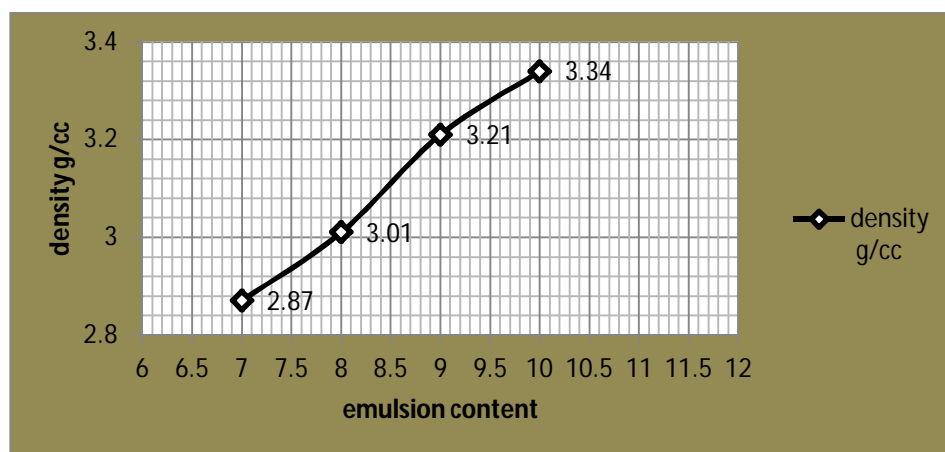


Fig. 4: variation of density with emulsion content

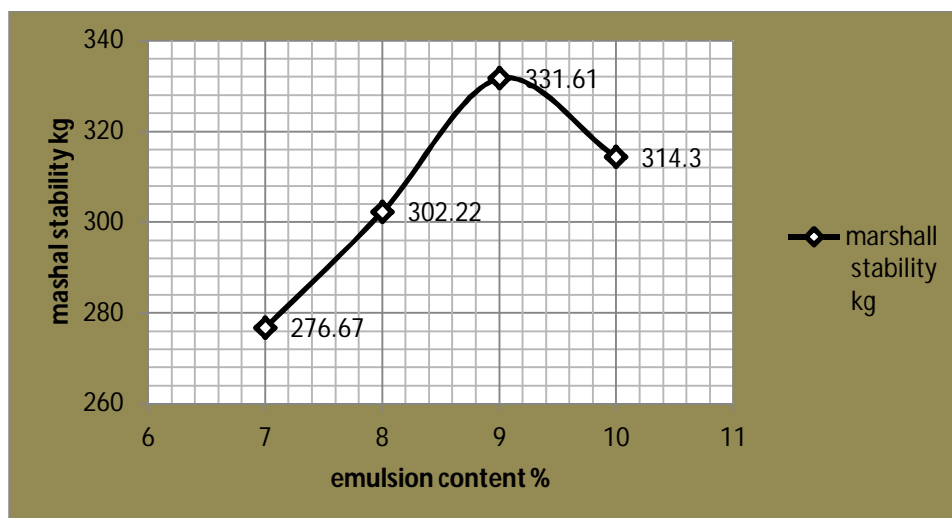


Fig. 5 Variation of marshall stability with emulsion content

III. DISCUSSION

A. Effect of emulsion on sand

- 1) Increase in percentage of emulsion cause the increase in marshal stability value of sand-emulsion mixture up to 9% and the maximum stability value at this percent is 331.61 than it decrease.
- 2) According to this study the density of sand and emulsion mixture increases up to 10% of emulsion in sand-emulsion mixture.
- 3) Unconfined compressive strength of sand-emulsion mixture increases with increase in % of emulsion.
- 4) Voids filled with bitumen in marshal test increases with increase the emulsion content.

B. Effect of cement on Sand

- 1) UCS value of sand-cement mixture increases with increasing cement content in mixture and the maximum value of UCS is 2.21mpa at 10% of cement content.
- 2) Maximum dry density of sand-cement mixture increases with increasing cement percentage.
- 3) Cement combines the sand particles and gives it strength.

Comparison of stabilization of sand by two stabilizing agent cement and emulsion is carried out on the basis of unconfined compression test because the (UCS) test is done on sand by mixing both cement and emulsion individually and analyzes the effect of both agents. Also the cost of both material for same UCS value and making same quantity of material is also find out.

IV. CONCLUSION

From the above experimental study following conclusion are found out.

- A. From the marshal stability test the maximum stability found out is 331.61kg for optimum emulsion content 9%, density 3.21gm/cc, Vv is 5.92%, VFB is 48.22% and flow value 3.26mm.
- B. From the unconfined compressive test the maximum compressive strength is found out 1.59mpa by using emulsion as stabilizer corresponding to 10% of emulsion.
- C. By using cement as stabilizer the maximum compressive strength determined is 2.21mpa for cement content 10% from unconfined compressive test.

On comparison of stabilization of sand by using cement and emulsion the conclusion found that the cement-sand mixture give the compressive strength of 1.71mpa on 8% content and sand-emulsion mixture give 1.59mpa on 10% content so that cement is more suitable for increasing compressive strength of sand and the cost of cement is less than emulsion. So the use of cement for increasing compressive strength is economical and effective. And the result is found out that the marshal stability at 9% emulsion give the suitable stability for surface layer in low traffic road and maintenance work of road surface.

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