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Research Article

STUDY ON PAVEMENTS USING MARINE CLAY SUB GRADES WITH FRC

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ABSTRACT

This paper research and experimental work is defined that evaluation studies of pavement on marine clays using FRC (Fiber Reinforced Concrete). According to view mainly marine clay is generally quite weak and expansive. The experimental background is distinguishing the design of pavement on marine clay bed. Due to expansive soils it contains less shear strength and more compressibility for pavements, to improve such soft soils using techniques such as lime, cement and fiber reinforced concrete for sub grade soil. However fiber reinforced concrete is used for as an alternate material for sub grade. The major contribution of fiber increases the strength and accessibility of sub grade soil.

INTRODUCTION

The development of our country depends upon the transportation and projects constructed. Marine soil properties like wet soil and dry soil contains microcrystalline nature and clay contains minerals like montmorillonite, chlorite, and kaolinite, illite which exist in the soil. It is broadly used in transportation and projects construction which helps to develop the nation. Foundation basement must be strong to generate better soil properties. The various additives are applied in structural components for stabilizing marine clays with lime, cement, and Fiber Reinforce Concrete. Now-a-days the construction on clayey soil reflects the cracking and breakup of pavements, railway structure, highway alignments, building foundations and irrigation works. Clay soil attains aggressive nature to reflect the uneconomical damage estimate, which runs over the marine clay sub grades (Misba, *et al*., 2014; Ravichandran, *et al*., 2009; Jawaid and Shukla, 1996; Anandarajah and Chu, 1997).

Based on the review of fracture observed the amount of work pertaining the determination of consolidation, deformation and strength characteristics of marine clays has been carried out worldwide since last 50 years. Come to Fiber Reinforce Concrete it describes as a composite material constituted mixture of cement mortar with suitable fiber. Mostly the fibers are described by a convenient parameter is called "Aspect Ratio". The aspect ratio of the fiber is the ratio of its length to its diameter. Typical aspect ratio ranges from 30 to 150.

Fiber Reinforce Concrete is concrete continuing fibrous material which increases its structural integrity. FRC is mostly used for ground floors and pavements, but it can be considered a wide range constructions. Here, compressive strength test were carried out to study the properties of hardened concrete. As well as we are using the lime, cement, and concrete to conduct the California Bearing Ratio test. Both of cylinder specimen with a diameter of 150 mm × 300 mm.

In this study we evaluate the performance of marine clay to stabilize the clay by using additive slight lime and cement by doing CBR test and additionally FRC also conducted. The Compressive Testing Machine test conducted to compare the test result which gives the better strength to marine clays. Compressive strength is the capacity of a material of structure to withstand loads tending to reduce size. Compressive

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strength will performed on CTM with loading capacity of 3000 KN. Under a load regime with a loading rate of 4.5 KN/s for cubes specimens of size 150 mm × 150 mm × 150 mm as per IS standards. An attempt to generate the complete stress- strain curve for fiber reinforced concrete (Bansal, *et al*., 1996).

MATERIALS USED

In this experimental study cement, fine aggregate, coarse aggregate, steel fiber, lime and cement were used (Mathiraja, 2013).

Cement

Portland Slag based cement (Brand- Nagarjuna Cement) conforming to IS 455: 1989. Test results on cement are given in Table 1.

Fine Aggregate

Clean and dry river silica grained sand locally available was used. Sand passing through IS 4.75 mm sieve [IS: 383:1970] was used as specimens. The test result on FA is presented in Table 2.

Coarse Aggregate

Locally available crushed granite stone of 12 mm is used. Test results on coarse aggregate are given in Table 3.

Steel Fiber

A specimen containing polypropylene fiber can increase the flexural strength by up to 13% and reduce growth crack up to 70%. Polypropylene purchased from Navi, Mumbai. One of the important properties of steel fiber reinforced concrete (SFRC) is the superior for crack propagation. It is carried out post cracking and ductility of the concrete. Properties of polypropylene fiber are presented in Tables 4 and 5.

Lime

Lime is added to clayey soil. Commercial grade of lime mainly consists of 61.05% of Cao and 7.9% silica used in the experimental work.

Water

Portable drinking water used for mixing and curing.

Table 1. Properties of cement

Properties	Value
Fineness (%)	6.0
Sp. Gravity	3.2
Soundness (mm)	2
Consistency (%)	32
Initial setting Time (Minute)	35
Final setting Time (Minute)	150

Table 2. Properties of FA

Properties	Value
Sp. Gravity	2.65
FM	3.45
Zone	III

Table 3. Properties of CA

Properties	Value
Sp. Gravity	2.93
FM	6.98
Bulk density (grm/cm$^{3)}$	1.7
Impact strength (%)	25.3

Table 4. Properties of polypropylene fiber

Properties	Value
Length (mm)	20
Diameter (mm)	12
Density g/cm^3	0.92
Water absorption	Nil

Table 5. Properties of steel fiber

Properties	Value
Length (mm)	50
Diameter (mm)	1
Tensile strength (Mpa)	1000 -1050
Water absorption	Nil

MIX DESIGN

A design mix has been adopted as per IS10262:2009 for M25 grade concrete. Mix proportion is in Table 6. Material consumption details are shown in Table 7.

EXPERIMENTAL METHODOLOGY

Compressive Testing Machine

It is carried out that in compression testing machine as specified IS 516-1959. Cylinder of 150 mm × 300 mm are uniformly rated compressive load 3000 KN under load programme. The test results are in Table 8.

California Bearing Ratio

CBR test was conducted for different sample by using lime, cement with different combination to stabilize the soil. The CBR test conducted as per IS Code [IS: 2720 (Part XVI – 1979)]. CBR test was observed that the mixture of marine clay plus 8% of lime, Marine clay plus 2% were given a value of 6% which is desirable for road pavement and sub grade as per IRC specifications. The material composition explained in the below Table 9.

CONCLUSION

The maximum compressive strength reaches in the S-3 that is 75% polypropylene and 25% steel fiber

Table 6. Mix proportion

Particulars	Value
Cement (Kg) per Cum	340
FA (Kg) per Cum	830
CA (Kg) per Cum	1120
Water (Lit) per Cum	180
w/c	0.5%
Ratio (C:FA:CA)	1:2:25:3

Table 7. Quantity of fiber use

Mix	Marking	Polypropylene	Steel
CM	S-0	-	-
PC 20	S-1	0.96	2.39
SC 80			
SC 75	S-2	2.81	1.80
PC 25			
PC 75	S-3	2.39	0.97
SC 25			

Table 8. Compressive strength results

Marking	Compressive Strength 28 days (Mpa)
S- 0	30.90
S- 1	34.93
S-2	36.82
S-3	41.97

Table 9. Quantity of marine clay with different mix proportions

S. No	Type of Sub grade Material	Admixture	Different Percentage of Stabilization
1	Marine Clay	Lime	0, 2, 4, 6, 8, 10
2	Marine Clay	Cement	0, 0.5, 1.0, 1.5, 2.0

of weight of cement. Observed that cracks occur in microstructure due to axial load and fiber controls the growth of the cracks. As well as the CBR test also treated that compressive strength of pavements and sub grade. The virgin soil treated as 8% lime then improvement of CBR is 81% and treated with 2% of the improvement was increased to 84%. It was notice from the laboratory the CTM test results that the load carrying capacity of treated clay has been increases compare to untreated clay used for pavements.

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