EXPERIMENTAL INVESTIGATIONS ON SOIL STABILIZATION BY USING QUARRY DUST AND WASTE PLASTIC FIBRE AS A SUBGRADE IN FLEXIBLE PAVEMENT

M.Manickam[1],S. Dhivya bharathi[2,*],D.Gowri[3,*], P.Indhra [4,*] ,S,Jaya prabha[5,*]
[1] Assistant Professor, Department of Civil Engineering, Vivekanandha College of Technology For Women.
[2,3,4,5,]UG student, Department of Civil Engineering, Vivekanandha College of Technology For Women.

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ABSTRACT
Red soil and clay soil covers a large portion of land in india.These soils are found in areas with low rainfall and they are not capable of retaining moisture. To improve the engineering and strength properties of these soils,soil stabilization can be carried out by adding some admixtures to these soils.The waste plastic fibres from water bottles are used to stabilizing both clay and red soil. These waste plastic bottles plays an alternative source of waste disposal management. The use of quarry dust collected from Omalur-Dalmia Board,Salem District. This quarry dust is used to improve geophysical properties of the soil and also increasing the stability of the soil. The main aim of the project is to evaluate the effect of addition of various percentages of waste plastic bottle strips like 0.25%,0.50%.0.75%,1.00%&1.25% in the length of 10mm and the quarry dust like 10%,20%,30%,40%&50% in order to enhance the properties of red soil infrastructure flexible pavement are often laid on clay soils. The final conclusion drawn from this investigation is such as that quarry dust and waste plastic fibre can be used as a effective stabilizing agent in stabilization of clayey and red soil for utilizing it in a pavement.

1.INTRODUCTION

The classification of entire soils of the world splits into clay or sandy type of soils. The latter hardly posses any problem due to seepage of water into it, which is mainly rock. Rather the clayey type of soils are formed by chemical weathering which involves chemical reactions constituting hydration, carbonation and leaching. Due to these aspects the clayey soils swell when it comes in contact with water during winter season and shrink when water is lost due to evaporation during summer. A lot of investigation has been carried out by researches in modifying the swelling and shrinkage properties of clayey soils. The last option is sorted in study which is found to be economical in certain aspects when the quantum of soil to be stabilized is larger, especially in the case of laying flexible pavement. Red soil may occur from the soil, often mixed with sand clay or as sediment mixed in suspension with water in rivers and streams and as deposits in the bottom. Red soil has a moderate specific area with a typically, non sticky, plastic feel. Red soil usually has a flowly feel when dry and a slippery feel when wet. In soil material, 80% of the particles range from 2 to 50μm. The particle size fractionation with in this size range allows determination of the main minerals bearers of natural trace elemnent in red soil. This moisture may come from rains, floods, leaking sewer lines, or from the reduction of surface evaporation when an area is covered by a building or pavement. Frequently, these expansive soils cause the cracking and braking up of pavement, railways, highway embankments, road ways, foundations and channel or reservoir linings. the waste plastic fibre and quarry dust can be utilized effectively to improve the index and engineering properties of the soil and the soil is beneficial as it acts as an effective soil stabilizer to provide a solution for the poor settlement of the soil.stabilization of pavement sub grade soils has traditionally reiled on treatment with lime,cement and special additives such as pozzolanic materials. From the experimental investigation the better results are given by these quarry dust and waste plastic fibre.

1.1 OBJECTIVE

- To determine the optimum use of these stabilizing materials and gives us the result of increasing the shear stresses, bearing capacity and durability of the pavement.
- To determine the optimum moisture content of the soil by Standard proctor's compaction test.
- To determine the strength properties of soil with admixture is done by Unconfined compression test and California bearing ratio test.
- By the test results , the addition of admixtures to provide an better geophysical properties of the soil.

1.2 SCOPE

- For any land-based structure, the foundation is very important and has to be strong to support the entire structure. In order for the foundation to be strong, the soil around it plays a very critical role.
- So, to work with soils, we need to have proper knowledge about their properties and factors, which affect their behaviour.
- Soil stabilization is the process which improves the physical properties of soil, such as shear strength, bearing capacity which can be done by use of controlled compaction or addition of suitable admixtures like cement, sand, lime, fly ash, plastics or by providing textiles, geo synthetics .
- To provide alternative solution for the disposal of plastic materials and quarry dust.
- To provide an economical solution for the soil stabilization using these stabilizing materials.

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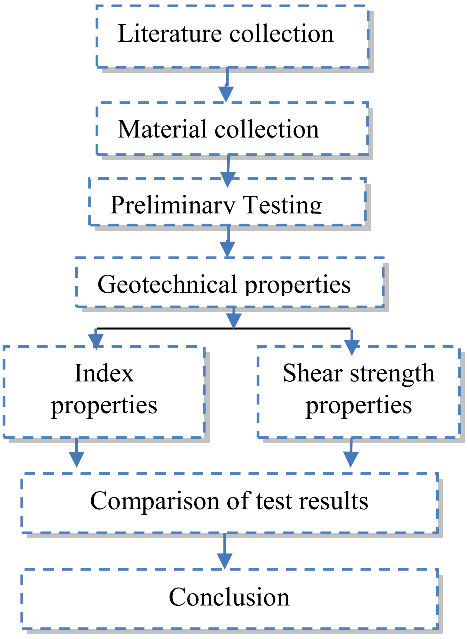
2.METHODOLOGY



3.MATERIALS

3.1Clay soil

Clay soil is one of the major regional deposits in india, covering an area of about 3.0 lakh sq.km. They tends to have low shear strength and to loss its shear strength on wetting or other physical disturbances. They can be plastic and compressible in nature.

Figure 1.CLAY SOIL

3.2Red soil:

Red soil is a group of soil that develop in warm temperature, moist climate under lying or mixed forest and that have thin organic and organic mineral layers over lying a yellowish- brown leached layer resting on an alluvial red layer.these are generally derived from crystalline rock.red soil denote the second largest soil group of india covering an area of about 6.1 lakh sq.km

Figure 2.RED SOIL

3.3 Quarry dust

It is byproduct of the crushing process which is a concentrated material use as aggregates for concreting purpose,especially as fine aggregates.in quarrying activities, the rock has been crushedinto various sizes, during the priocess the dust generated is called quarry dust and it is formed as waste. These waste quarry dust having the shear strength quality and acting like a admixture. That are generally termed as a stabilizing agent in soil stabilization process.

Figure 3.QUARRY DUST

3.4 waste plastic fibre

The plastic fibres from waste water bottles arecutted into small strips like 10 mm size and mixed wit both red and clay soil as a stabilizing agent.

Figure 4. PLASTIC FIBRE

4.RESULTS AND DISCUSSION

A.SIEVE ANALYSIS

This is used to determine the proportion of different grain sizes contained within soil. The sample was sieved using a mechanical sieve shaker to find the finer sand. Then the cumulative percentage of soilretained on each sieve was found out and grain size distribution curve was plotted.

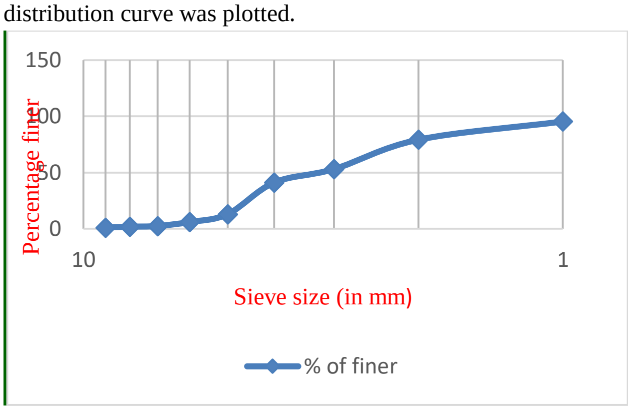


Figure 4.1 Partical size distribution using sieve analysis for clay soil

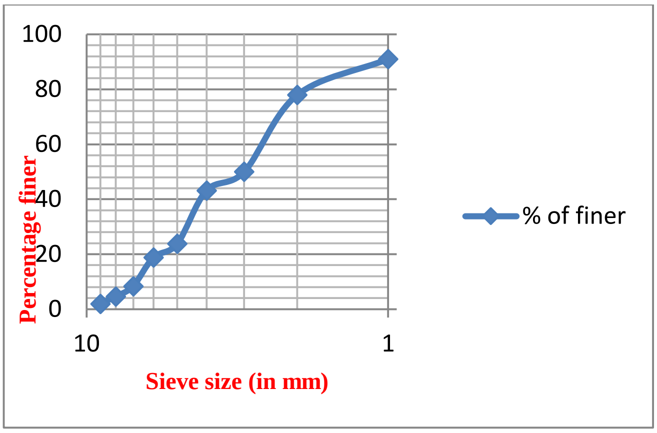


Figure 4.3 Partical size distribution using sieve analysis for red soil

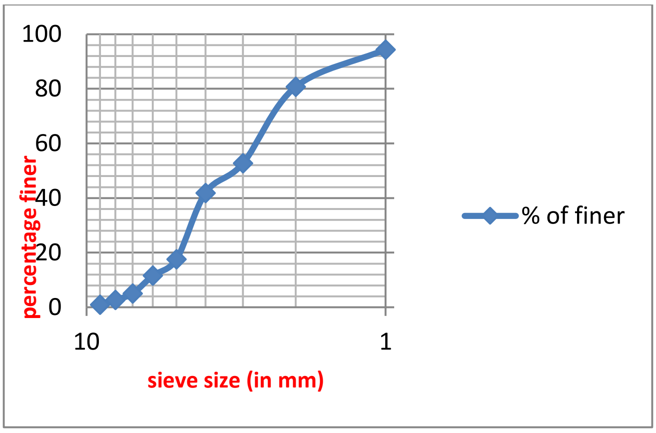


Figure 4.4 Partical size distribution using sieve analysis for both clay& red soil

From the graphical representation,the fine particles of the soil retained on the sieve that indicates the size of D10 and obtaining less than 2 value.

B.COMPACTION TEST:

To determine the effect of reinforcing fibres and quarry on the moisture density relationships, standard compaction tests were conducted as per Bureau of Indian Standard specification on clay and red soils with quarry dust and waste plastic fibre mixtures.quarry du st percentages like 10%, 20%, 30%, 40% & 50% and waste plastic fibre percentages like 0.25%, 0.50%, 0.75%, 1.00% & 1.25%.

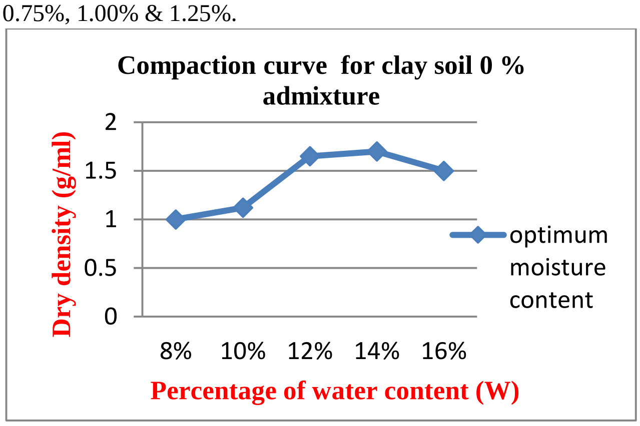


Figure 4.5 Compaction curve for clay soil

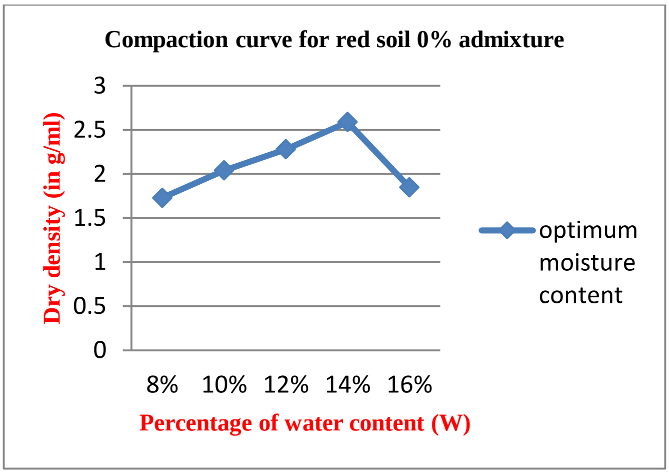


Figure 4.5 Compaction curve for red soil

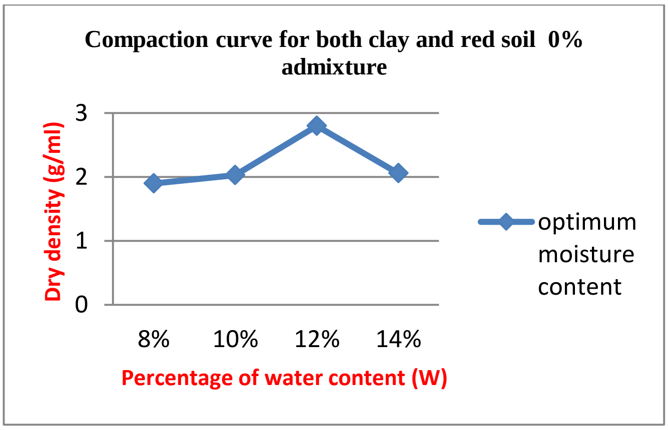


Figure 4.6 Compaction curve for both clay and red soil

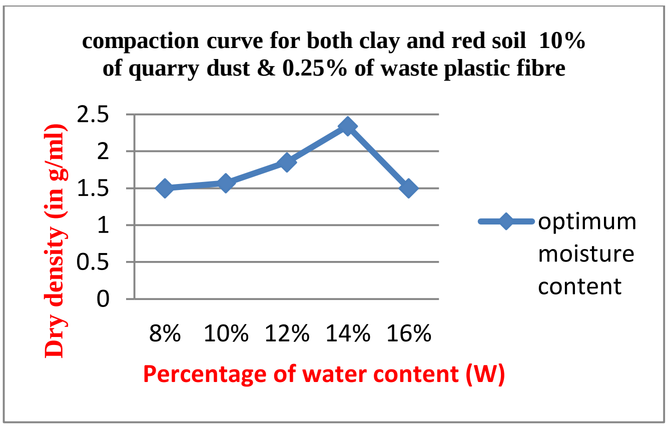


Figure 4.7 Compaction curve for both clay and red soil with 10% quarry dust and 0.25% waste plastic fibre

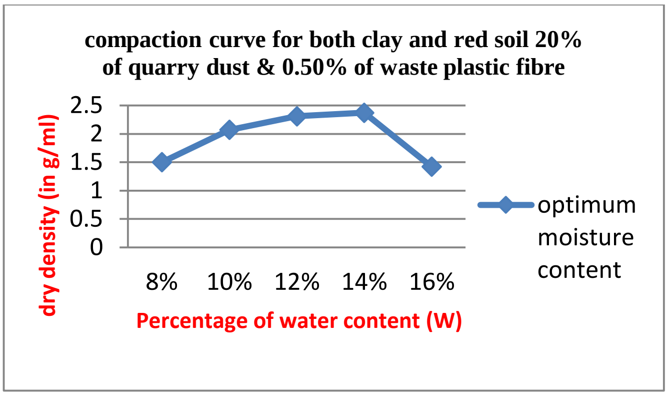


Figure 4.8 Compaction curve for both clay and red soil with 20% of quarry dust and 0.50% of waste plastic fibre

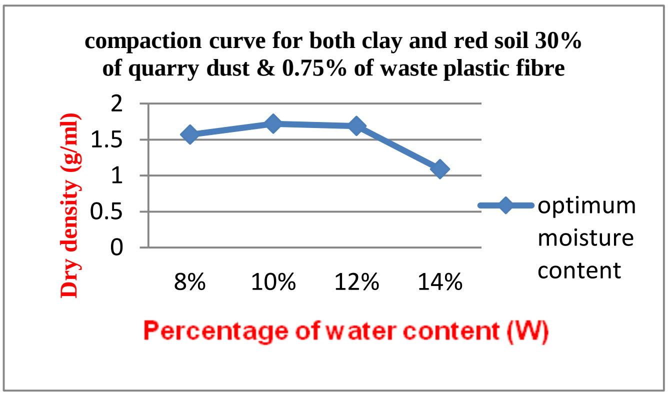


Figure 4.9 Compaction curve for both clay and red soil with 30% quarry dust and 0.75% waste plastic fibre

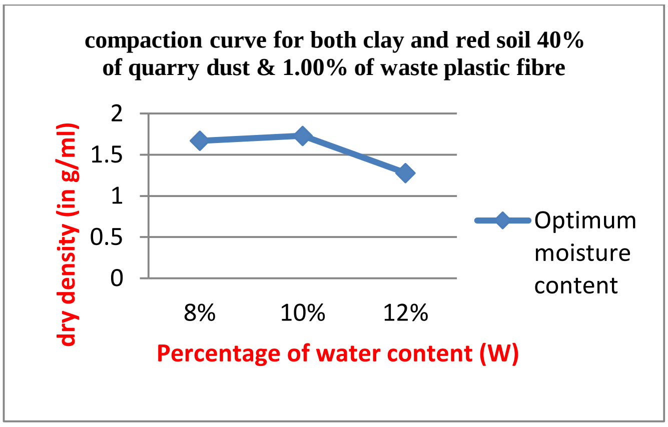


Figure 4.10 Compaction curve for both clay and red soil with 40% quarry dust and 1.00% waste plastic fibre

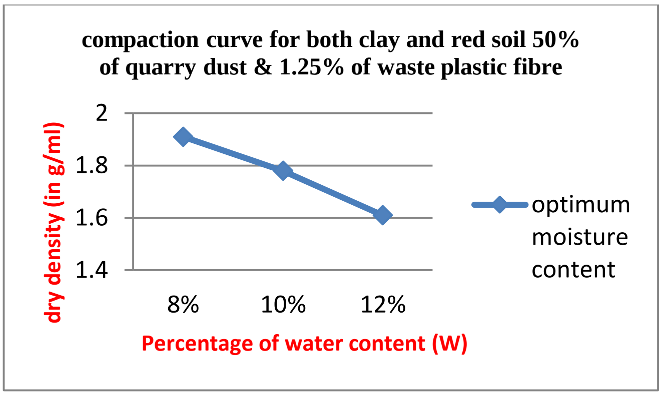


Figure 4.11 Compaction curve for both clay and red soil with 50% of quarry dust and 1.25% of waste plastic fibre

From the above graph shows the maximum optimumcontent that obtained from increasing percentages of both quarry dust and waste plastic fibre. That gives the results in 8% & 10% of OMC in the addition of admixture percentage like 40% & 50%.

TABLE 1: variation of omc and mmd for various % of quarry dust and waste plastic fibre

% of quarry dust & waste plastic fibre	OMC %	MDD g/ml
0%	12	2.80
10% & 0.25%	14	2.34
20% & 0.50%	14	2.37
30% & 0.75%	10	1.72
40% &1.00%	10	1.73
50% & 1.25%	8	1.91

C.UNCONFINED COMPRESSIVE STRENGTH

The unconfined compressive strength test was conducted in various percentages of quarry like 10%,20%,30%,40% & 50% and waste plastic fibre like 0.25%,0.50%,0.75%,1.00% & 1.25% with the combination red and clay soil.

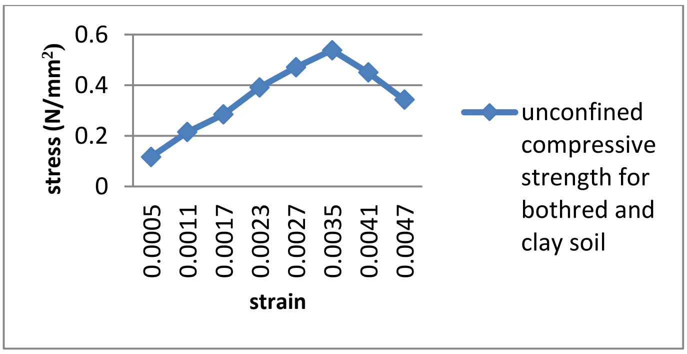


Figure 4.12 UCS test for red and clay soil

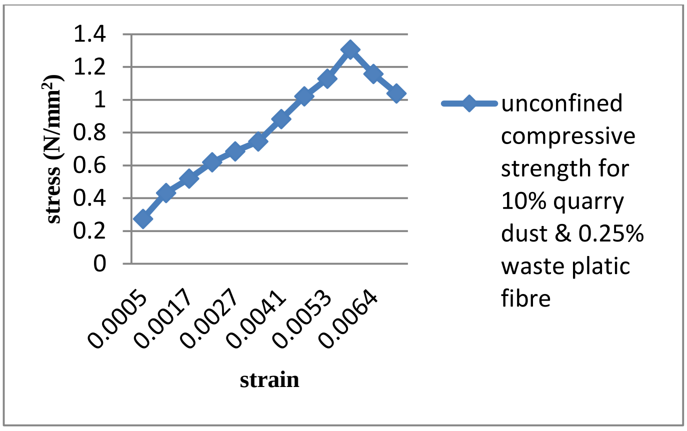


Figure 4.13 UCS test for red and clay soilwith 10% quarry dust & 0.25% of waste plastic fibre

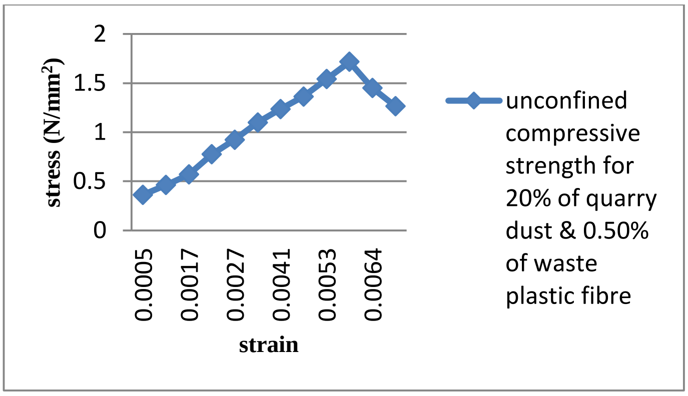


Figure 4.14 UCS test for red and clay soilwith 20% quarry dust & 0.50% of waste plastic fibre

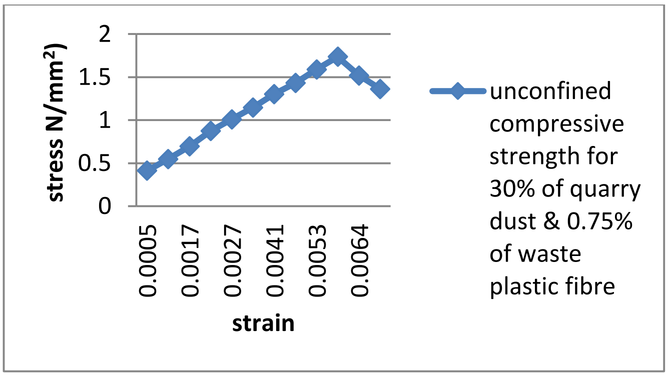


Figure4.15 UCS test for red and clay soilwith 30% quarry dust & 0.75% of waste plastic fibre

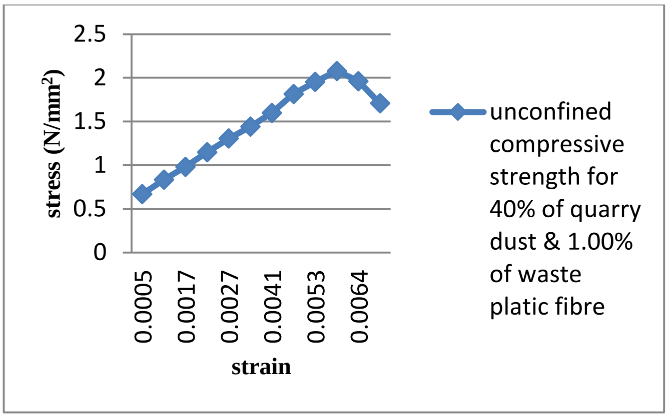


Figure 4.16 UCS test for red and clay soilwith 40% quarry dust & 1.00 % of waste plastic fibre

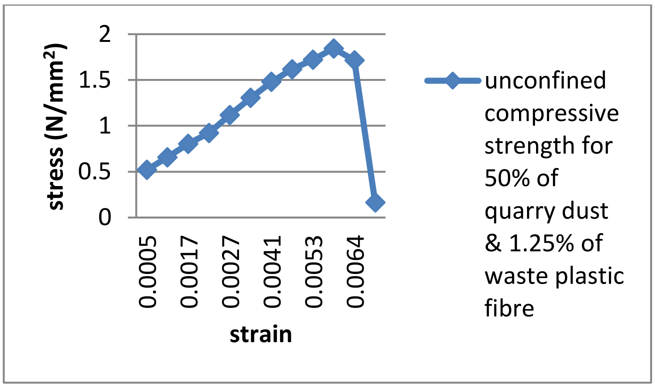


Figure 4.17 UCS test for red and clay soilwith 50% quarry dust & 1.25% of waste plastic fibre

From the above graphical representation,the maximum strain stress value may obtained from 40% &50% of quarry dust and 1.00% & 1.25% of waste plastic fibre.

D.CALIFORNIA BEARING RATIO:

The California bearing ratio test was conducted for various percentages of quarry dust like 10%,20%,30%,40% & 50% and waste plastic fibre like 0.25%, 0.50%,0.75%,1.00% &1.25% in the soil mixture to obtain the California bearing ratio value(CBR). In X-axis, the division in plotted and Y-axis, the load is plotted.

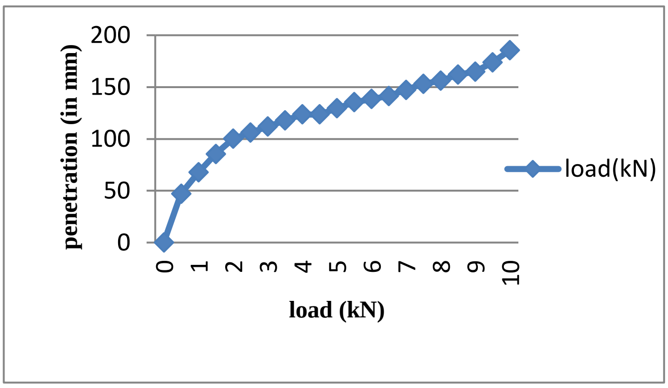


Figure 4.18 CBR test for both red and clay soil

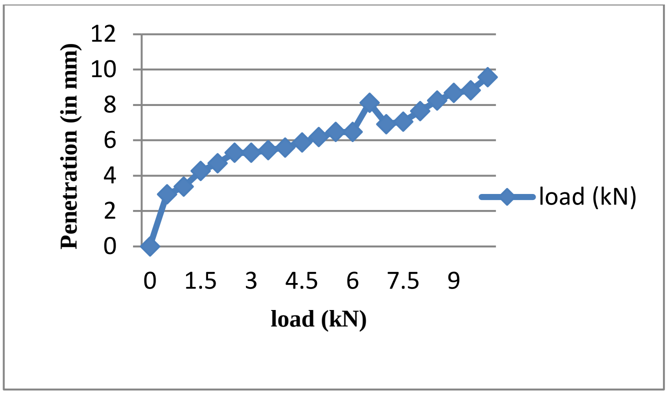


Figure 4.19 CBR test for red and clay soil with 10% quarry dust & 0.25% of waste plastic fibre

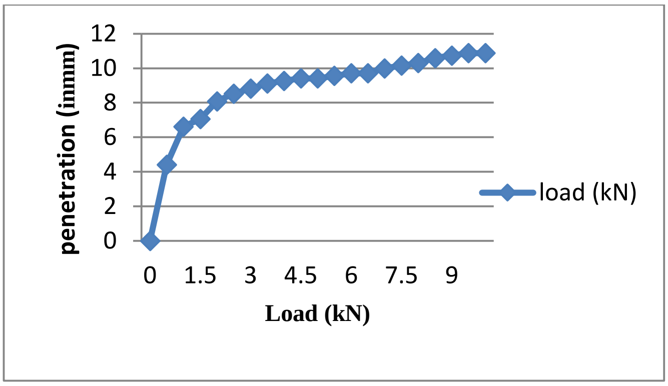


Figure 4.20 CBR test for red and clay soil with 20% quarry dust & 0.50% of waste plastic fibre

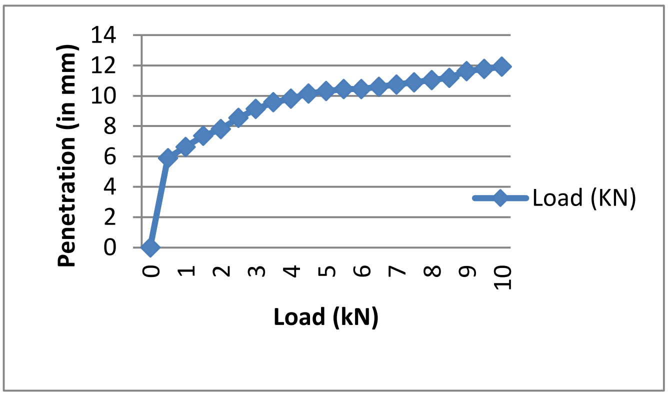


Fig 4.21 CBR test for red and clay soil with 30% quarry dust & 0.75% of waste plastic fibre

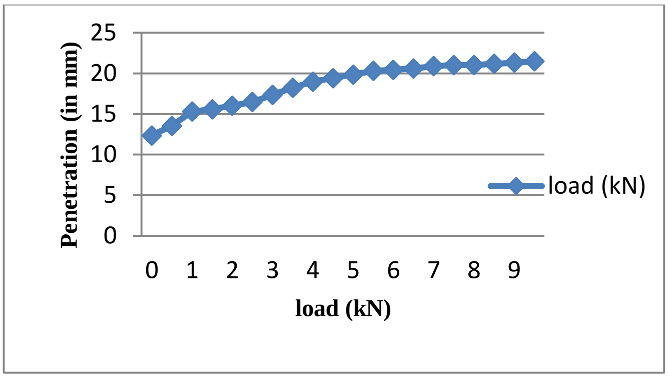


Figure 4.22 CBR test for red and clay soil with 40% quarry dust & 1.00% of waste plastic fibre

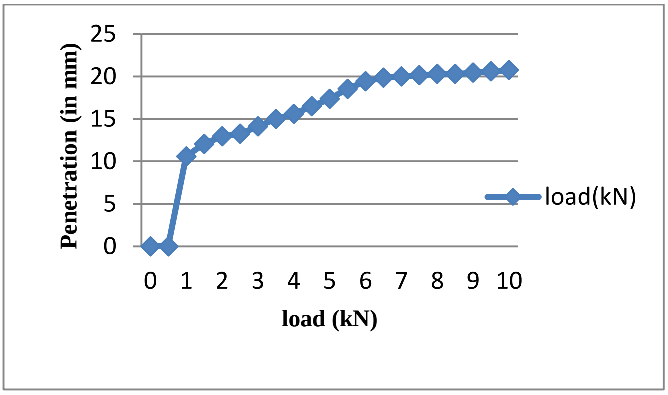


Fig 4.23 CBR test for red and clay soil with 50% quarry dust & 1.25 % of waste plastic fibre

From the above graphical representation,addition of quarry dust and waste plastic fibre in the percentage of 40% and 1.00% gives an result of increasing strength proper

5.CONCLUSION

From the experimental results of geotechnical properties of both clay and red soil sample, the strength is gradually increased by adding the admixture such as quarry dust and waste plastic fibre.

Addition of 40% of quarry and waste plastic fibre to the clay and red soil, the result of strength is increased in the unconfined compressive strength and California bearing ratio test.

The quarry dust and waste plastic fibre enhanced in the compressive strength and the inclusion of the plastic fibres played a significant role in the increasing strength of stabilized soil.

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Gmail-gce.manickam@gmail.com
Gmail-indhuprabhaharan@gmail.com