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A STUDY ON STRENGTH PROPERTIES OF EXPANSIVE SOIL TREATED WITH BURNT MUNICIPAL SOLID WASTE AND POLYPROPYLENE FIBRES

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Abstract:A methodical process, involving experimentation in the laboratory under controlled conditions is done. It is observed form the laboratory studies that maximum improvement in the properties of Expansive soils for Burnt municipal solid waste treatment with polypropylene fibers in this investigation. A methodical process, involving experimentation on Atterberglimits (liquid limit, plastic limit), Differential free swell, Sieve analysis, specific gravity, Proctor compaction test, California Bearing Ratio(CBR), Unconfined Compressive Strength(UCS) tests were conducted by adding 0.5%, 1%, 1.5% & 2% of Polypropylene fiber to the expansive soil by dry weight under controlled conditions in the laboratory. It is observed from the laboratory studies that maximum reduction in properties is observed for stone dust treatment with Polypropylene fiber. Burnt municipal solid waste is a kind of solid waste material that is generated from house hold waste which is abundantly available. The effect of randomly distributed Burnt municipal solid waste on MDD, OMC, UCS and CBR has been discussed in this project. Polypropylene fiber is an orange to brown-black solid. Polypropylene fiber is non-combustible and corrosive in nature. The percentages of Burnt municipal solid waste by dry weight of soil was taken as 5%, 10%, 15% and 20%. The first series of compaction, CBR and UCS tests were conducted on the Expansive soil and the same tests were conducted in the second series on soil samples mixed with Burnt municipal solid waste and similarly tests were conducted in the third series on soil samples mixed with Burnt municipal solid waste and Polypropylene fiber. Laboratory experiments favorably suggest that mixing Burnt municipal solid waste and Polypropylene fiber with soil would be effective in improving soil properties.

Keywords: Expensive soil, UCS, CBR, Burnt municipal solid waste.

1. INTRODUCTION

Expansive soil is one among the risky soils that has a high potential for contracting or swelling because of progress of dampness content. Far reaching soils can be found on practically every one of the landmasses on the Earth. Dangerous outcomes brought about by this kind of soils have been accounted for in numerous nations. In India, huge tracts are secured by extensive soils known as dark cotton soils. The significant zone of their event is the south Vindhyachal range covering nearly the whole Deccan Level. These darts spread a region of around 200,000 square miles and consequently structure about 20% of the complete territory of India. The essential issue that emerges concerning sweeping soils is that distortions are altogether more prominent than the flexible misshapenness and they can't be anticipated by the old style versatile or plastichypothesis. Development is more often than not in an uneven example and of such an extent to make broad harm the structures laying on them. Appropriate healing measures are to be embraced to change the dirt or to decrease its unfavourable impacts if sweeping soils are distinguished in an undertaking. The therapeutic measures can be diverse for arranging and structuring stages and post development stages. Numerous adjustment systems are by and by for improving the extensive soils in which the qualities of the dirts are modified or the risky soils are evacuated and supplanted which can be utilized alone or related to explicit structure choices. Added substances, for example, lime, concrete, calcium chloride, rice husk, fly fiery debris and so forth are likewise used to change the attributes of the broad soils. The qualities that are of worry to the plan designers are piousness, compressibility and solidness. The impact of the

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added substances and the ideal measure of added substances to be utilized are reliant chiefly on the mineralogical arrangement of the dirt's. The paper centres about the different adjustment strategies that are practically speaking for improving the broad soil for diminishing its swelling potential and the constraints of the technique for adjustment there on. In India, the region secured by far reaching soil is almost 20% of the absolute zone. The far reaching soils regularly spread over a profundity of 2 to 20m. In stormy season, they experience hurl and shed pounds. In summer, they psychologist and increase thickness and become hard. This substitute swelling and shrinkage harm the structures harshly. This is increasingly extreme for the light structures. During summer, polygonal breaks are show up at the surface, which may stretch out to a profundity of about 2m demonstrating the dynamic zone wherein volume change happens. The profundity of dynamic zone characterized as the thickness of the dirt beneath the ground surface inside which dampness content varieties and subsequently volume changes dotake place. Sustained endeavours are being made everywhere throughout the world on thruway research field to develop additionally encouraging treatment strategies for appropriate structure and development of asphalts running over broad soil sub grade.

2. REVIEW OFLITERATURES

R.Thirumalai(2017) It represents the recent trends in stabilization of expansive soil using industrial waste (granite and Burnt municipal solid waste , cement kiln dust, silica fume , rice husk ash) as stabilizers for decreasing the environmental hazards.

A.Dinesh(2017) has concluded that the soil stabilization by using various minerals like Bagasse ash ,sawdust, copper dust, and flyash were most commonly used.

Aditya Chansoria (2016) has presents the effect of Bagasse ash on engineering characteristics of blackcotton soil. Black cotton soil samples blended with 10%,20%,30% and 40% of Bagasse ash were prepared and series of laboratory experiments have been performed. The test results showthat the CBR value increases from 1.75% to 7.05% and OMC has been reduced from 21.12 % to 12% and MDD increased from 1.6 to 1.72 g/cc. In this experimental study it can be concluded that the expansive soil behavior of black cotton soil is reduced to a considerable extent with utilization of Bagasse ash.

P.Indiramma (2016) A study is carried out to check the improvement in the properties of expansive soil with addition of Bagasse ash in different percentages .The test results for as atterbergs limits , compaction characteristic ,DFS,UCS obtained from the tests on expansive soil mixed with different proportions of Bagasse ash as an admixture.

3. Materials

EXPANSIVESOIL: The Expansive soil was collected from "TUMMALAPALLI" village near Amalapuram, East Godavari District in India.

Figure: 1 Black cotton soil

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Burnt municipal solid waste: Drainage system in many parts of Warangal city are still continue to operate on conventional open drainage system and they are in the process of up gradation to underground system. Also it has been observed that due to inadequacy of the dust bins the solid wastes are often spilling on to the ground and the street sweeping are added to the waste. Also whenever the drains cleaned, silt is collected from the open drains are also added to the waste. Periodic maintenance of drains results in collection of waste along with silt. The collected waste from street sweepings, silt from drains being added to the dust-bins contain significant portion of silt and soils and are finally transported to the dumping yards. Thus the accumulated waste at the dumping yards contain considerable amount of soil-sand-silt. Waste collected from the dumping yards is set for natural burning for 24 hours on open yard to ensure complete burning of organic matter and all combustible matter like plastics, rubber paper, thermo coal etc

Figure: 2 **Burnt municipal solid waste**

Polypropylene fibers:

Polymer such as polypropylene (PP) reinforcement in the form of discrete fiber is a popular and well established method of soil reinforcement. PP fibers are used to increase shear strength, to minimize volumetric shrinkage and swelling of soil.

Figure: 3 Polypropylene fibers

3. Results

3.1 Plastic limit and Liquid limit values of untreated expansive soil and expansive soil treated with Burnt municipal solid waste

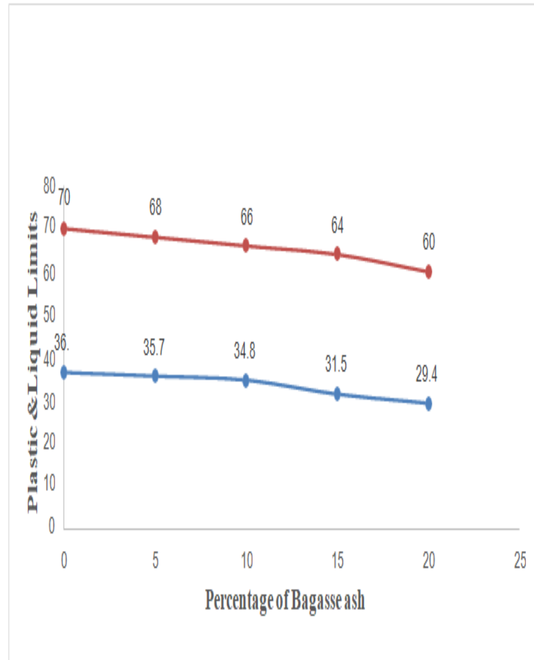

Figure: 4 Represents the Plastic limit and Liquid limit values of untreated expansive soil and expansive soil treated with Burnt municipal solid waste

3.2 OMC and MDD Values of Untreated Expansive soil and Treated Expansive soil with Percentage variations of Burnt municipal solid waste

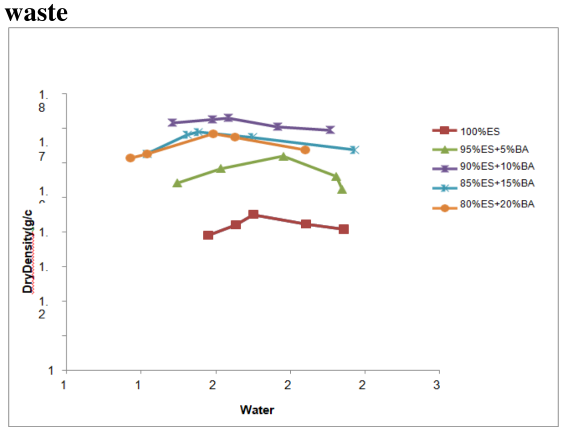

Figure: 5 Represents the OMC & MDD values of Expansive Soil Treated with % Variations of Burnt municipal solid waste

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3.3 **CBR values of Untreated and Treated Expansive soil with percentage variations of Burnt municipal solid waste**

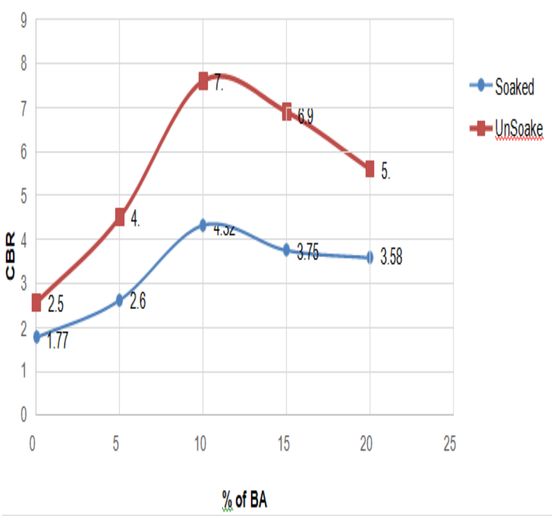

Figure:6 Represents the CBR values of Untreated and Treated Expansive soil with percentage variations of Burnt municipal solid waste

3.4 Optimum moisture Content and Maximum Dry Density of 10% Burnt municipal solid waste Treated Expansive Soil with percentage Variation of Polypropylene fibre

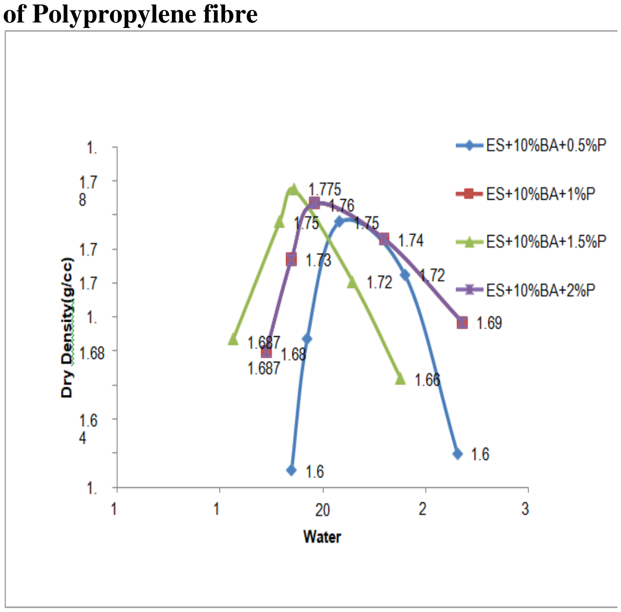

Figure: 7 Optimum moisture Content and Maximum Dry Density of 10% Burnt municipal solid waste Treated Expansive Soil with percentage Variation of Polypropylene fibre

3.5 CBR values of treated expansive soil with 10 % Burnt municipal solid waste with various percentages of Polypropylene fibre

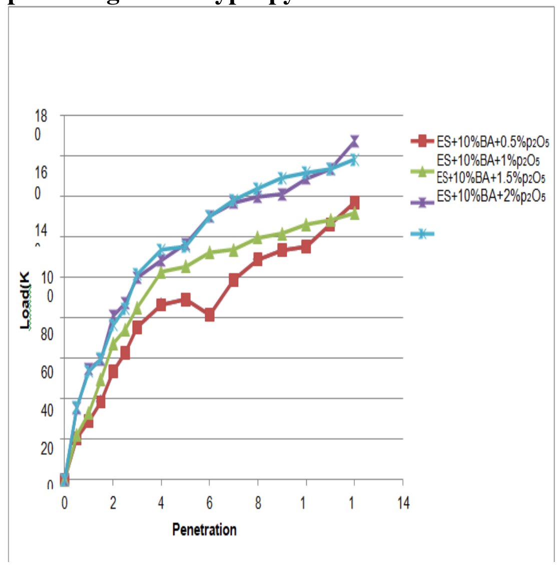

Figure: 8Represents the CBR values of treated expansive soil with 10 % Burnt municipal solid waste with various percentages of Polypropylene fibre

3.6 UCS values of treated expansive soil with 10 % BMSW with various percentages of PP

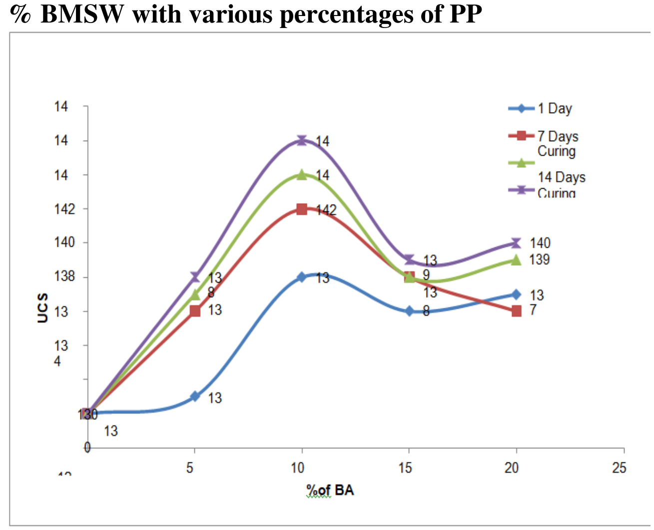

Figure: 9 UCS values of treated expansive soil with 10 % BMSW with various percentages of P_P

4. Conclusions

1. It is noticed from the laboratory investigations that the liquid limit of the expansive soil has been decreased by 6.06% on addition of 10% Bagasse ash and further the liquid limit of Phosphorous pentoxide treated expansive soil has

been decreased by 12.9% with the addition of 1.5 % Phosphorous pentoxide as an optimum when compared with untreated expansivesoil

2. It is observed from the laboratory investigations that the plastic limit of the expansive soil has been improved by 2.75% on addition of 10% Burnt municipal solid waste and further the plastic limit of Polypropylene treated with expansive soil has been improved by 13.29% with the addition of 1.5% Polypropylene as an optimum when compared with untreated expansive soil.

3. It is observed from the laboratory investigations that the plasticity index of the expansive soil has been improved by 9.75 % on addition of 10% Burnt municipal solid waste and further the plasticity index of Polypropylene treated expansive soil has been improved by 12.49% with the addition of 1.5% Polypropylene as an optimum when compared with untreated expansive soil

It is found from the laboratory investigations that the optimum moisture content of the expansive soil has been decreased by 4.65% on addition of 10% Burnt municipal solid waste andfurthertheoptimummoisturecontentofPolypropylenetreatedexpansivesoilhas been decreased by 20.96% with the addition of 1.5% Polypropylene as an optimum when compared with untreated expansive soil

4. It is found from the laboratory investigations that the maximum dry density of the expansive soil has been improved by 18.9% on addition of 10% Burnt municipal solid waste and further the maximum dry density of Polypropylene treated expansive soil has been improved by 21.99% with the addition of 1.5% Polypropylene as an optimum when compared with untreated expansive soil.

5. It is observed from the laboratory investigations that the C.B.R. value of the expansive soil has been improved by 111.86% on addition of 10% Burnt municipal solid waste as an optimum and further the C.B.R value of Polypropylene treated with expansive soil has been improved by 258.75% with the addition of 1.5% Polypropylene as an optimum when compared with untreated expansivesoil.

7. The soaked CBR values of expansive soil on stabilizing treated with Polypropylene is found to be 4.58% and it is satisfying standard specifications. So finally it is concluded from the above results that the Polypropylene can potentially stabilize the expansivesoil.

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