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Soil Stabilization using Scrap Rubber Tyre

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Abstract -Disposal is a big problem links with extremely growing up country like India. The waste rubber tyres is safer disposal has become a biggest challenging job. This thesis work represents the how to safe dispose of the rubber tyres waste to save the environmental and atmosphere of the earth. The dissertation represents how to convert the rubber waste to useful material for construction work in geotechnical engineering and their properties. As we know that india is a growing country and population is increase day by day so this factors need to development and construction of building , roads, etc. because they can easily survive. In india the soil have found in different types. Some were the soil have good bearing capacity and poor also. So we have need to improves this poor bearing capacity of soil to provide the strength hardness, Durability of the structure. The rubber tyre have some good physical and chemical properties to improve the soil strength , bearing capacity , and effect less costly. Rubber tyres are widely used for stabilization of soil in engineering work. The commonly in general application being in construction of highway , roads and airfield pavements. Where the basic objective is stability of soil and to also decrease the maintenance and construction cost effectively by making aggravate use of locally available materials. Stabilization is a basic fundamentally changing the chemical properties of soft soil by adding stabilizers or binders either in dry or wet situation to developed the stiffness and strength of the originally weak soil.

Key words:- Clay. Soil, Sand, Waste rubber tyre crumbs, UCS unconfined compression test,standard proctor test.

1. INTRODUCTION

Finding effective ways in which to lose scrap tyres continues to be a haul throughout the planet. In an exceedingly growing country like Republic of India, disposal problems beside a seamless increase in tyre production have resulted in increase in tyre stockpiles which will harbor environmental issues, vector borne diseases and fireplace hazards. In an attempt to cut back the change of integrity problem, alternatives, like waste reduction, resource recovering, land filling, and usage are being reviewed to cut back the continuing accumulation of scrap tyres. Sadly, every of those alternatives contains technical, economic and environmental limitations that inhibit the choice of an overall resolution. It's for this reason that continuing analysis is being conducted to determine use for scrap tyres within the market that effectively reduces that this limitations encountered by existing alternatives.

Waste tyre stockpiles have reached menacing volumes in several industrial countries, making an acute ought to establish engineering alternatives for the useful apply of discarded tyres. The producing method for tyre combines raw materials into a special kind that yields distinctive properties like flexibility, strength, resilience and high resistance. If tyres are reused as construction material, the distinctive properties of tyres will once more be exploited in an exceedingly useful manner. The advantages of mistreatment scrap tyres are significantly increased if they'll be accustomed replace virgin construction materials made of non-renewable resources. To boot, scrap tyres are show to own vital action capability for organic liquids and vapors. Recent analysis indicates that chopped tyres don't show any change of being a dangerous waste or of getting adverse effects on well water quality. Albeit classified as waste, tyre shreds have distinctive properties for several geotechnical and Geo-Environmental application. Properties of waste tyres are of serious worth for the planning of main road mound. The mixture of tyre shreds with soil for mound construction might not solely give different means that of reusing tyres to handle economic and environmental considerations, however conjointly facilitate solve geotechnical issues related to low soil shear strength. If waste tyres are reused as a Construction material instead of disposed or burned, their distinctive properties will once more be useful in an exceedingly property materials stream. Waste tyres may well be effectively used as substitute to geo-synthetics made of non- renewable resources.

2. EXPERIMENTAL INVESTIGATION

A series of unconfined compressive strength tests were conducted determine shear strength characteristics of untreated clay and clay stabilized with tire scrap to evaluate the effect of tire scrap on shear strength of the soil. These characteristics have been illustrated by establishing the relationships between resulting axial stress and applied axial strain in strain controlled tests. Unconfined compressive strength determined as peak strength value and respective failure strain have been calculated from the observations taken during the tests.
The characteristic of material used in mixes as discussed below.

2.1 Soil used

The soil is classified as medium compressible clay, CI, as per IS: 1498 (1970). The grain size distribution and the physical properties of soil are reported in Table 3.1

2.2 Tire-Scrap

Tire scrap have been divided into two categories on the basis of size for their inclusion in various percentages to the parent soil.The specific gravity of crumb tire scrap varies from 0.9 to 1.10, values as obtained from manufacturer.

Scrap tyre different properties given as below

Table -1: classification of waste tire according to particle size

Material	Size
Cuts	<300mm
Shred	50-300mm
Scrap	10-50mm
Granulate	1-10mm
Powder	<1mm
Fine Powder	<0.5mm
Buffinq's	0-40mm
Reclaim	Depend on input
Devulcanisate	Depend on powder
Pyroliticchar	<10mm
Arbon products	<0.5mm

Table -2: chemical compositiopn of waste tires

Constituents	Percentage %
Rubber (natural and synthetic)	38
Fillers (carbon black, silica, carbon chalk	30
Reinforcing materials (steel, rayon, nylon)	16
Plasticizers (oil and resins)	10
Chemical for vulcanization (sulphur, zinc oxide)	4
Chemical as antioxidants to counter ozone effects	1
Miscellaneous	1

Table-3: index properties of materials

<table>
<tr><th colspan="2" rowspan="2">PHYSICAL PROPERTIES</th><th colspan="3">MATERIAL</th></tr>
<tr><th>PARENT CLAY</th><th colspan="2">RUBBER TIRE SCRAP</th></tr>
<tr><td rowspan="3">GRAIN SIZE DISTRIBUTION DATA</td><td>GRAVEL (%)</td><td>0</td><td rowspan="3">SYMBOL</td><td rowspan="3">SIZE DETAIL</td></tr>
<tr><td>SAND (%)</td><td>4</td></tr>
<tr><td>CLAY + SILT (%)</td><td>96</td></tr>
<tr><td colspan="2">SPECIFIC GRAVITY</td><td>2.59</td><td rowspan="3">R-425 µ</td><td rowspan="3">Passing from 600 µ sieve and retained on 425 µ sieve</td></tr>
<tr><td colspan="2">LIQUID LIMIT</td><td>41</td></tr>
<tr><td colspan="2">PLASTIC LIMIT</td><td>25</td></tr>
<tr><td colspan="2">PLASTICITY INDEX</td><td>16</td><td rowspan="4">R-150 µ</td><td rowspan="4">Passing from 425 µ sieve and retained on 150 µ sieve</td></tr>
<tr><td colspan="2">IS CLASSIFICATION</td><td>CI</td></tr>
<tr><td colspan="2">OMC (%)</td><td>24</td></tr>
<tr><td colspan="2">MDD (G/CC)</td><td>1.60</td></tr>
</table>

3. Sample Preparation

3.1 Composition of specimens

Specimens of parent soil and treated with 5, 10, 15 and 20% by weight of rubber tire scrap of various sizes were prepared at maximum dry density and optimum moisture content as per IS: 2770 (Par 7) (1974).

3.2 Mixing

Oven dry soil was dry mixed with various percentages of additives. Sufficient quantity of distilled water was then added to bring the moisture content to the desired level. The mixture was then manually mixed thoroughly with a spatula. All the specimens were kept in polythene bags for maturing for three days.

4. CASTING AND TESTING

A total of 10 specimens mix of parent clay and clay stabilized with 5, 10, 15 and 20% of rubber tire scrap of various sizes.

Table-4: compaction characteristics of clay stabilized with tire scrap

SAMPLE DESCRIPTION	COMPACTION PROPERTIES	PERCENTAGE OF STABILIZER (TIRE SCRAP)				
		0%	5%	10 %	15 %	20 %
PARENT CLAY+ TIRE SCRAP (R-425μ)	OMC (%)	24	23.6	22.8	21.6	20.4
	MDD (g/cc)	1.60	1.575	1.562	1.495	1.465
PARENT CLAY + TIRE SCRAP (R-150μ)	OMC (%)	24	23.1	22.7	21.2	20.7
	MDD (g/cc)	1.60	1.585	1.540	1.490	1.475

4.1 COMPARISON CURVE

Standard proctor test

Standard Increase in proportion of scrap rubber tyre addition with soil decreases the maximum dry density of the prepared soil. Soil is treated with increasing proportions of scrap rubber tyre.it effect the optimum moisture content of soil.

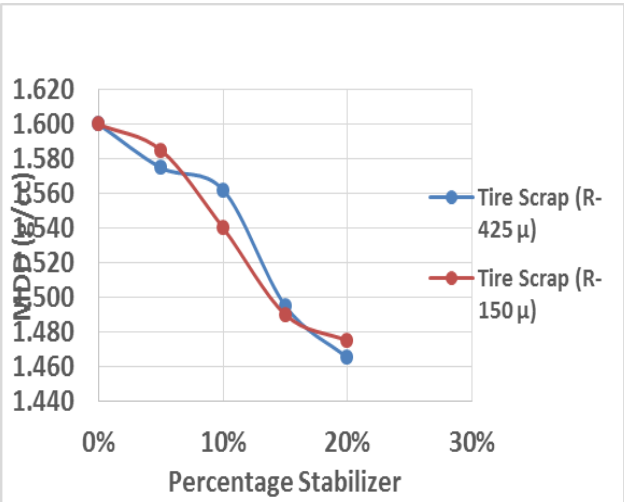

Chart-1: comparison of mdd values of clay stabilized with various percentages of tire scrap

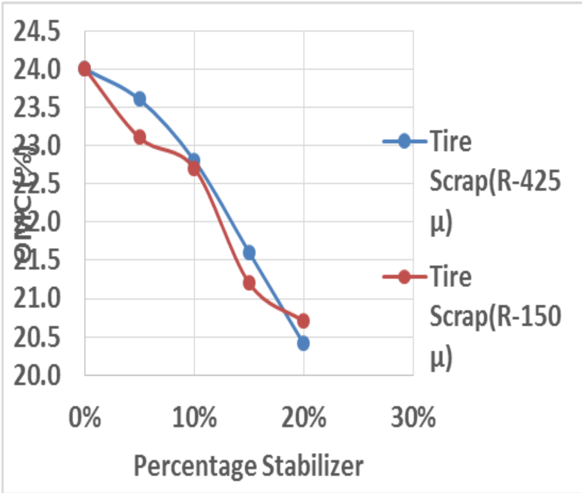

Chart-2: Comparison of OMC values of clay stabilized with various Percentages of tire scrap

UNCONFINED COMPRESSION TEST

Experiments reveal mixing of scrap rubber tyre with soil. Increases the strength of soil and no effect on strain.

Table-5: unconfined compressive strength of stabilized clay

SAMPLE DESCRIPTION	STRENGTH PROPERTIES	PERCENTAGE OF STABILIZER (TIRE SCRAP)				
		0%	5%	10 %	15 %	20%
PARENT CLAY + TIRE SCRAP (R-425 μ)	UNCONFINED COMPRESSIVE STRENGTH (kg/cm²)	1	1.20	1.45	1.67	1.75
	FAILURE STRAIN	0.082	0.026	0.035	0.048	0.055
PARENT CLAY + TIRE SCRAP (R-150 μ)	UNCONFINED COMPRESSIVE STRENGTH (kg/cm²)	1	1.17	1.28	1.39	1.55
	FAILURE STRAIN	0.082	0.032	0.039	0.048	0.053

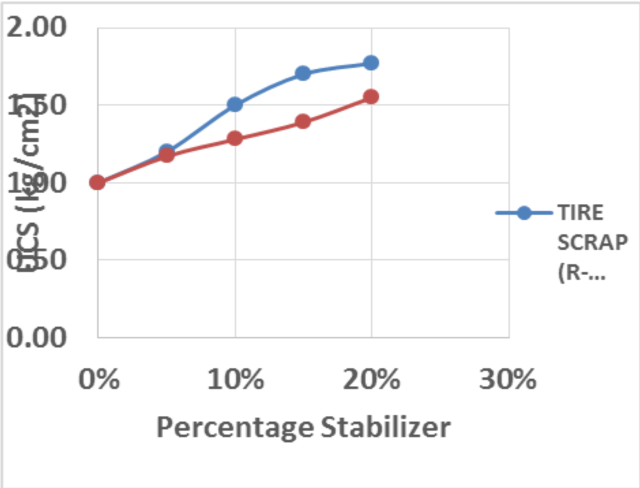

Chart-3: comparison of ucs values of clay stabilized with various percentages of tire scrap

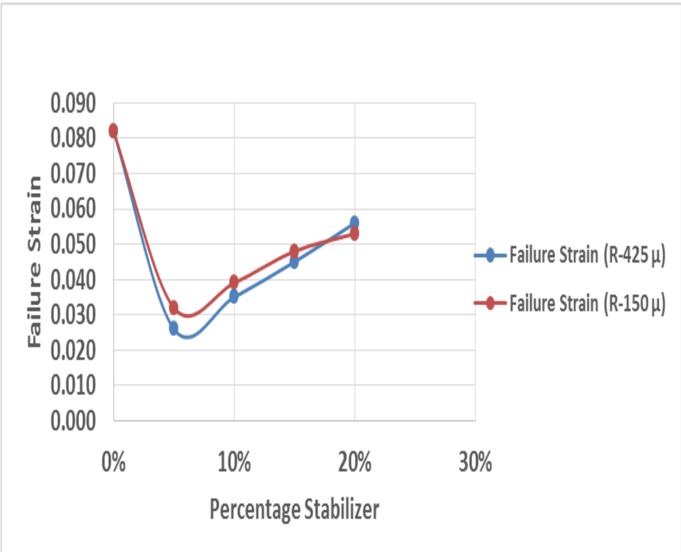

Chart-4: Comparison of failure strain of clay stabilized with various Percentages of tire scrap

5. CONCLUSIONS

Largely, there is an increase in the value of unconfined compressive strength due to increase in percentage of tyre scrap of various sizes indicting strength improvement of soil. By and large, for rubber tyre scrap treated soil, the value of UCS is greater in comparison to that of parent soil. For soil treated with 18% of tyre-scrap (R-425µ – tyre-scrap passing 600µ and retained on 425µ IS sieve), highest UCS value of 1.75kg/ cm^2 has been observed.

There is no significant variation in the values of strain at failure, but normally there is a decrease in the values due to increase in percentage of tyre scrap of various size. The decrease may be attributed to granular nature of tyre scrap.

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