International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES),(UGC APPROVED)
Impact Factor: 5.22 (SJIF-2017),e-ISSN:2455-2585
"A National Conference on Recent Trends in Civil Engineering-II"
Volume 5, Special Issue 03, March-2019.

A STUDY ON UTILIZATION OF BRICK DUST FOR SOIL STABILIZATION

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Abstract-With the expanding population and the decrease of accessible land, to an ever-increasing extent development of building and other structural designing structures must be done on weak and soft soil. The weak soil has low bearing strength and high shrinkage, and swelling an extraordinary decent variety of ground improvement systems such as soil stabilization is done to enhance the properties of soil. To solve the above problem by replacing the clay soil with the additive in different percentage of brick dust 5%,10%,15%,20%,25 %, 30% by weight and the test are performed on plain soil and the additive soil. The tests are liquid limit test, plastic test, proctor test, California bearing ratio test. A comparison of plain clay soil and the soil mixed with burnt brick dust is performed which shows us that burnt brick enhance a property of clay soil. Burnt brick dust is a waste material generated from the brick kiln and the disposal of brick dust is an issue for our environment in this study the disposal of brick waste with its effective use in soil stabilization.

Keywords- soil stablization, brick dust, soil.

I INTRODUCTION

The term soil adjustment implies, upgrades of the stability or bearing intensity of the soil by the use of controlled compaction, proportioning as well as the addition of appropriate admixture or stabilizers. Soil stabilization deals with the physical, Physico-chemical , and chemical methods to ensure that the stabilized soil serves its intended purpose of pavement component material. Adjustment makes soil increasingly stable by decrease in the permeability, compressibility and with increment in shear quality; it makes the soil progressively stable in this manner upgrading bearing limit of soil. Since Foundation of any structure including Roads is a basic part of the structure as far as burden exchange to the earth, it is normally a troublesome issue in structural designing works when the sub-grade is found to be clay soil. Soils having high clay content tend to swell when their dampness content is permitted to increment. The structure needs strong foundation for long durability and proper construction ,if there is a weak subgrade for road construction with the passage of time it compact which result settlement of road . It may cause cracks on the surface of the road .To avoid these problems soil stabilization should be considered

II MATERIAL

- Burnt Brick Dust
- Clay Soil

Burnt brick dust: Brick dust with its segment burnt brick powder is a waste produced from burning of bricks with the dirt covered by surrounding. Because of the burning of soil blocks, it solidified and at the season of explusion the set up an incredible capacity to diminishes the swelling capacity of clay and black soil. The waste produced from brick kiln which can be used as soil stabilizer .The appropriate use of waste products gives the stability and also gives strength to soil. The burnt brick dust is easily available and generally available at very cheaper rate. The Brick dust was taken from Chetak kiln In Luniyawas Which is 17km from Jaipur city.

Clay Soil: The soil sample was collected from Village Ropada which is 19km from Jaipur city. The top surface was removed and the clay was excavated by using excavators. There is approximately 8 bigha land in which clay soil is excavated and supply it to nearest kiln plants @Rs480/tractor where it is used for the manufacture of bricks.the clay soil changes properties with respect to water content as soil shrinks when its dry and swells in wet condition .

III RESULTS & DISCUSSION

Table 1.Properties of soil

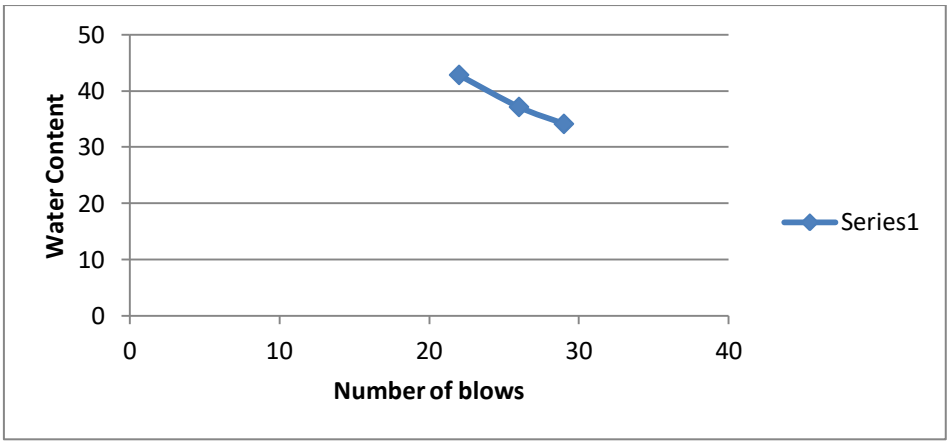
Properties of soil	Values of soil
Liquid limit %	38.16
Plastic limit %	16
Plasticity index %	22.16
Specific gravity	2.67

Type of soil as per: ISC	High plastic
Optimum moisture content	17.64
Maximum Dry density	1.74 /cc

Liquid limit test:

S.No	Determinations NO	Notation	I	II	III
01	**Container no**		1	2	3
02	**Weight of container**	W_1 (grams)	25	26	25
03	**Number of blows**		29	26	22
04	**Weight of container + wet soil**	W_2 (grams)	30.5	32	30
05	**Weight of container + dry soil**	W_3 (grams)	29.3	30.2	28
06	**Weight of water**	$W_2 - W_3$ (grams)	1.4	1.8	2
07	**The weight of oven dry soil**	$W_3 - W_1$(grams)	4.1	4.2	3
08	**Water content (%)**	$\left[\frac{W2 - W3}{W3 - W1}\right]$	34.14	37.5	42.85

The mean of three values = $\frac{34.14+37.5+4285}{3}$
=38.16%



Graph: Liquid limit test of soil

Plastic Limit test:

S.No	Determinations NO	Notation	I	II	III
01	**Container no**		1	2	3
02	**Weight of container**	W_1 (grams)	25	26	28
04	**Weight of container + wet soil**	W_2 (grams)	29.5	30	31
05	**Weight of container + dry soil**	W_3 (grams)	29	29.5	30.5
06	**Weight of water**	$W_2 - W_3$ (grams)	0.5	0.5	0.5
07	**The weight of oven dry soil**	$W_3 - W_1$(grams)	4	3.5	2.5
08	**Water content (%)**	$\left[\frac{W2 - W3}{W3 - W1}\right]$	12.5	14.28	20

Therefore the mean of three values = $\frac{12.5+14.28+20}{3}$

=15.76

Which is approximately equal = 16%

Plastic index (I_p) = Liquid limit – plastic limit

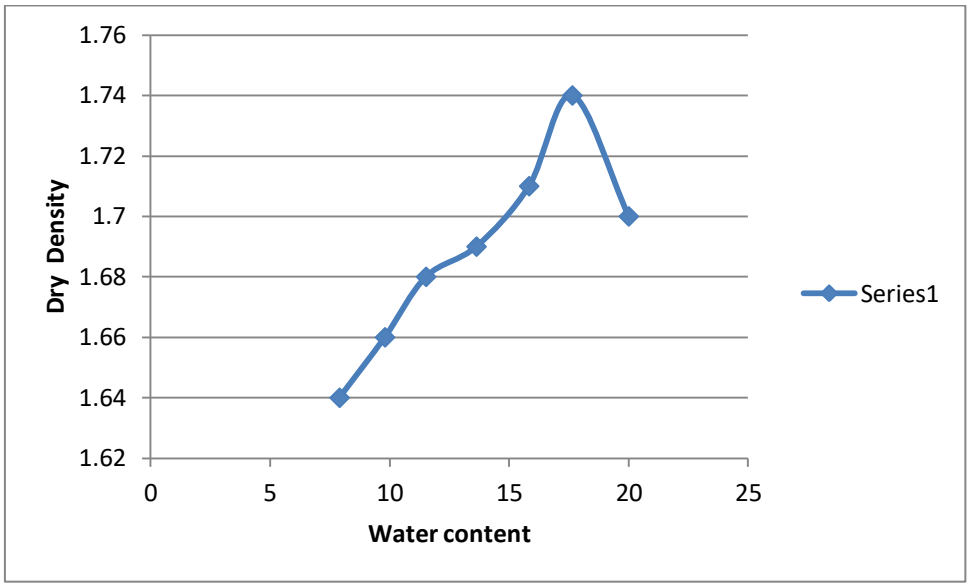
= (38.16-16)

= 22.16%

Compaction Test of soil:

Plain soil:

Trial number	Notation	1	2	3	4	5	6	7
Weight of soil		2.3kg	2.3kg	2.3kg	2.3kg	2.3kg	2.3kg	2.3kg
Weight of mould		3.621	3.621	3.621	3.621	3.621	3.621	3.621
Container No		5	3	1	2	6	9	8
Weight of Container	W_1	28	26	24	28	25	22	27
Weight of container + wet soil	W_2	58	56	54	58	55	52	57
Weight of container + dry soil	W_3	55.8	53.3	50.9	54.4	53.6	47.5	52.00
Weight of water	$W_2 - W_3$	2.2	2.7	3.1	3.6	4.1	4.5	5
Weight of oven dry soil	$W_3 - W_1$	27.8	27.3	26.9	26.4	25.9	25.5	25
Bulk Density	$\frac{M}{V}$	1.78	1.83	1.88	1.93	1.99	2.05	2.04
Water content(%)	$W=\left[\frac{W_2-W_3}{W_3-W_1}\right]$	7.9	9.8	11.52	13.63	15.83	17.64	20
Dry density		1.64	1.66	1.68	1.69	1.71	1.74	1.70

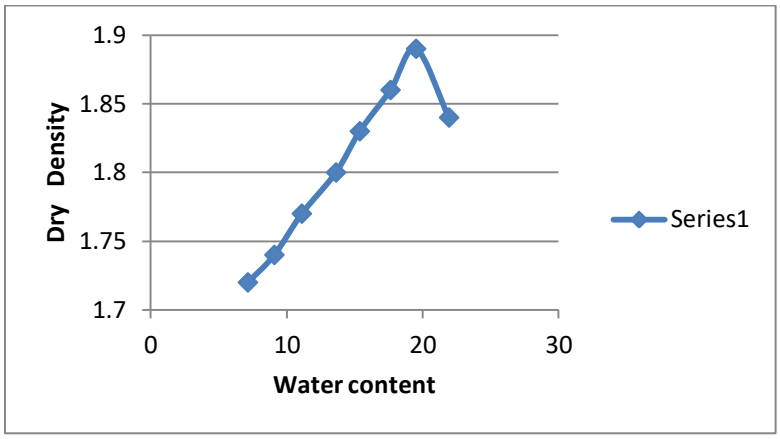


Graph: Standard Proctor test (plain soil)

This is graph of standard proctor test which shows the variation of dry density of clay soil at different water content .The dry density of soil increase from 1.64 g/cc to 1.74 g/cc and then decreases to 1.70 g/cc The water content at maximum dry density is called optimum water content .

Standard proctor test (plain soil + 5% BBD)

Trial number	Notation	1	2	3	4	5	6	7	8
Weight of soil		2.3kg	2.3kg	2.3kg	2.3kg	2.3kg	2.3kg	2.3kg	2.3kg
Weight of mould		3.621kg	3.621kg	3.621kg	3.621kg	3.621kg	3.621kg	3.621kg	3.621kg
Container No		1	2	4	7	5	8	3	9
Weight of Container	W_1	25	26.5	28	25	27	30	25	26
Weight of container + wet soil	W_2	55	56.5	58	55	57	60	55	56
Weight of container + dry soil	W_3	53	54	55	51.4	53	55.5	50	50.6
Weight of water	$W_2 - W_3$	2	2.5	3.0	3.6	4	4.5	4.9	5.4
Weight of oven dry soil	$W_3 - W_1$	28	27.5	27	26.4	26	25.5	25.1	24.6
Bulk Density	$\frac{M}{V}$	1.85	1.90	1.97	2.05	2.12	2.19	2.27	2.25
Water content(%)	$W=\left[\frac{W_2-W_3}{W_3-W_1}\right]$	7.14	9.09	11.11	13.63	15.38	17.64	19.52	21.95
Dry density		1.72	1.74	1.77	1.80	1.83	1.86	1.89	1.84

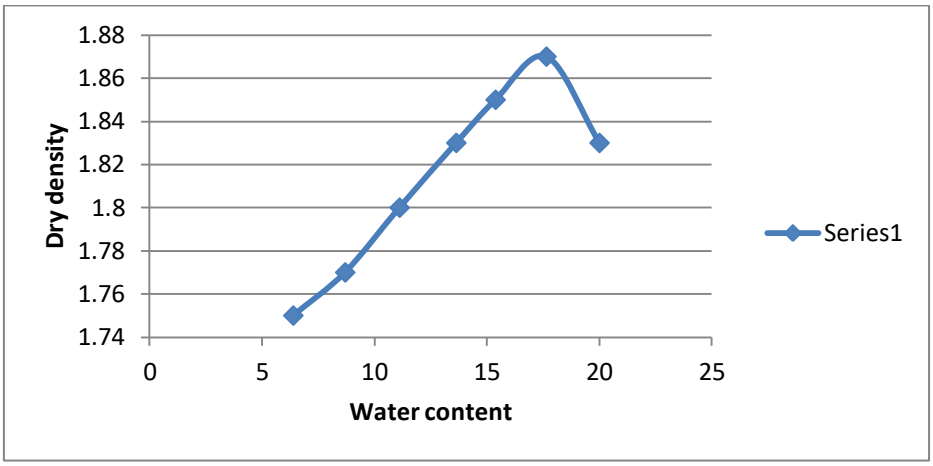


Graph : Standard proctor test (soil +5% BBD

The graph shows the variation of dry density at different water content of soil with 5 % of brick dust from the graph the dry density increase from 1.72 g/cc to 1.89 g/cc and the optimum water content is 19.52 %.

Table Standard proctor test (plain soil +10%BBD)

Trial number	Notation	1	2	3	4	5	6	7
Weight of soil		2.3kg	2.3kg	2.3kg	2.3kg	2.3kg	2.3kg	2.3kg
Weight of mould		3.621kg	3.621kg	3.621kg	3.621kg	3.621kg	3.621kg	3.621kg
Container No		6	11	13	15	16	14	12
Weight of Container	w_1	25	26.5	28	27	29.5	30	27
Weight of container + wet soil	W_2	55	56.5	58	57	59.5	60	57
Weight of container + dry soil	W_3	53.2	54.10	55	53.4	55.5	55	52
Weight of water	$W_2 - W_3$	1.8	2.4	3	3.6	4	4.5	5
Weight of oven dry soil	$W_3 - W_1$	28.2	27.6	27	26.4	26	25.5	25
Bulk Density	$\frac{M}{V}$	1.87	1.93	2.00	2.08	2.14	2.21	2.20
Water content(%)	$W=\left[\frac{W2-W3}{W3-W1}\right]$	6.38	8.69	11.11	13.63	15.38	17.64	20
Dry density		1.75	1.77	1.80	1.83	1.85	1.87	1.83



Graph: Standard proctor test (soil + 10% BBD)

The graph shows the variation of dry density of soil with 10% brick dust at different water content the maximum dry density is 1.87 g/cc and optimum moisture content is 17.64

Standard proctor test values proportion of soil and burnt brick dust (BBD)

Content	Clay soil	Clay soil +5%BBD	Clay soil+10%BBD
Maximum dry density g/cc	1.74	1.89	1.87
Optimum moisture continent %	17.64	19.52	17.64

IV CONCLUSIONS

From the test results the following conclusion have been made:

- The stabilization of clay soil with burnt brick dust is very effective
- The brick dust is easily available and are available free of cost from neighbour kiln
- Elimination of buffer layer of pavement which reduces thickness of pavement [1]
- From the above test result it is concluded that the maximum dry density of soil increases and moisture content decrease which is effective .

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