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STUDY ON STUMPING PROCESS OF SUBGRADE SOIL STABILIZATION

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Abstract: In india almost 90% of the roads are made flexible type of pavement. The dynamic loads of moving vehicles are considered impact on roads because of relatively short duration. In road pavements loads are transferred from top to other courses and subgrades. Due to this loads and constant vibrations subsiding and horizontal displacement of roadsub base happens. To overcome this we are working on our own process and named as "Stumping Process".

Keywords : Soil stabilization, Stumping process, Soil Subgrade

I. INTRODUCTION

Stumping is a process of subgrade soil stabilization used to improve the bearing capacity and shear strength of weak soil by introducing wooden stakes or piles into the ground. This technique has been used for centuries, with evidence of its use dating back to the Roman Empire. The process involves driving wooden stakes or piles into the soil at regular intervals, usually spaced about 1 to 1.5 meters apart. The stakes or piles are driven into the ground using a heavy hammer or pile driver until they reach a depth where they can provide the necessary support and stability. Once the stakes or piles are in place, a layer of gravel or crushed stone is spread over the top of the soil. This provides a stable base for the construction of roads, buildings, or other structures.

The stumping process was commonly used in the construction of early roads and highways. In the 18th and 19th centuries, wooden stakes were driven into the ground to support the weight of horse-drawn carriages and other vehicles. This technique was also used in the construction of railroad tracks, with wooden ties being driven into the ground to provide a stable base for the tracks. Over time, the stumping process evolved to include other materials, such as concrete and steel. In the early 20th century, concrete piles were introduced as an alternative to wooden stakes. These piles were stronger and more durable, making them better suited for supporting heavy loads.

I.I

Table No: 4.1 Subgrade Soil Properties

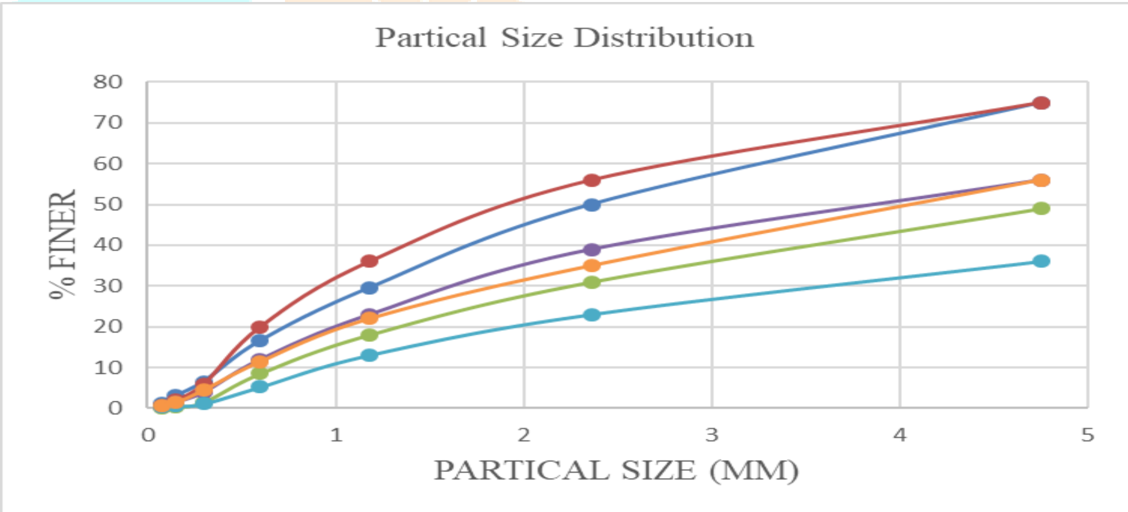
Properties	**Subgrade Soil**
Color	Grayish Black
Specific Gravity	2.43
Free Swell Index (%)	63.33
GRAIN SIZE DISTRIBUTION	
Gravel (%)	0.69
Sand (%)	6.39
Silt / Clay (%)	92.92
IS Classification	CH
ATTERBERG'S LIMIT	
Liquid Limit (%)	64.70
Plastic Limit (%)	33.24
Plasticity Index (%)	31.69
Shrinkage Limit (%)	24.51
COMPACTION CHARACTRISTIC	
Maximum Density (g/cc)	1.32
Optimum Moisture Content (%)	25.84
Unconfined Compressive Strength (Kg/cm^2)	0.550
CALIFORNIA BEARING RATIO (SOAKED)	
2.5mm penetration (%)	2.63
5mm penetration (%)	2.4

4.3 Sieve Analysis of Raw Subgrade Soil

This is method of separation of soils into different fractions on the basis of particles present into soils. This Particle Size Analysis test is performed to determine the percentage of different grain sizes present within a soil sample. It is also shown in graphical form on a particle size distribution curve. This test was performed 5 times and classification for each test is shown in table no.-4.2 and accordingly Grain size distribution curve is drawn.

Table No: 4.2 Sieve Analysis Results for Subgrade Soil

Particle Size Distribution						
I.S Sieve(mm)	**% Finer Bag 1**	**Bag 2**	**Bag 3**	**Bag 4**	**Bag 5**	**Bag 6**
4.75	75	75	49	56	36	56
2.36	50	56	31	39	23	35
1.18	29.5	36	18	23	13	22
0.6	16.5	20	8.5	12	5.2	11.5
0.3	6.5	6	1.5	4	1.1	4.5
0.15	3	2	0.3	1.5	0.53	1.4
0.075	1.2	0.6	0.15	0.3	0.47	0.6
Receiver/Pan	0	0	0	0	0	0



Graph No.1 Particle Size Distribution

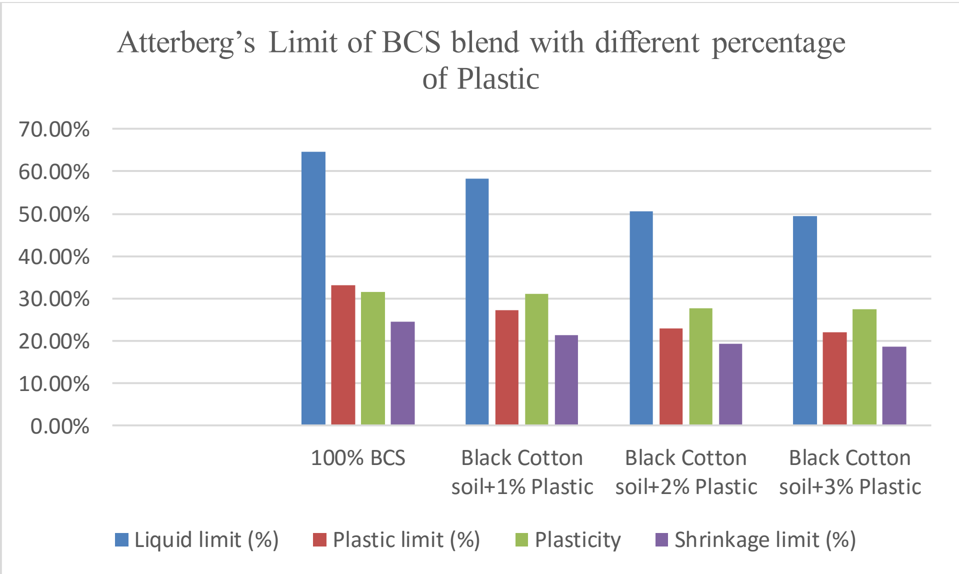
4.4 Tests on Plastic Added Subgrade Soil

4.4.1. Atterberg's Limit test result for different percentage of Plastic

The liquid limit, plastic limit and shrinkage limit test were conducted for Subgrade Soil (BCS) and mix specimen of different percentage of lime.

Table No.4.3 Atterberg's Limit of BCS blend with different percentage of Plastic

Sr. No.	**Soil composition**	**Liquid limit (%)**	**Plastic limit (%)**	**Plasticity Index (%)**	**Shrinkage limit (%)**
1	100% BCS	64.70%	33.24%	31.68%	24.51%
2	Subgrade Soil+1% Plastic	58.36%	27.32%	31.03%	21.41%
3	Subgrade Soil+2% Plastic	50.66%	22.95%	27.70%	19.31%
4	Subgrade Soil+3% Plastic	49.49%	22.01%	27.48%	18.73%



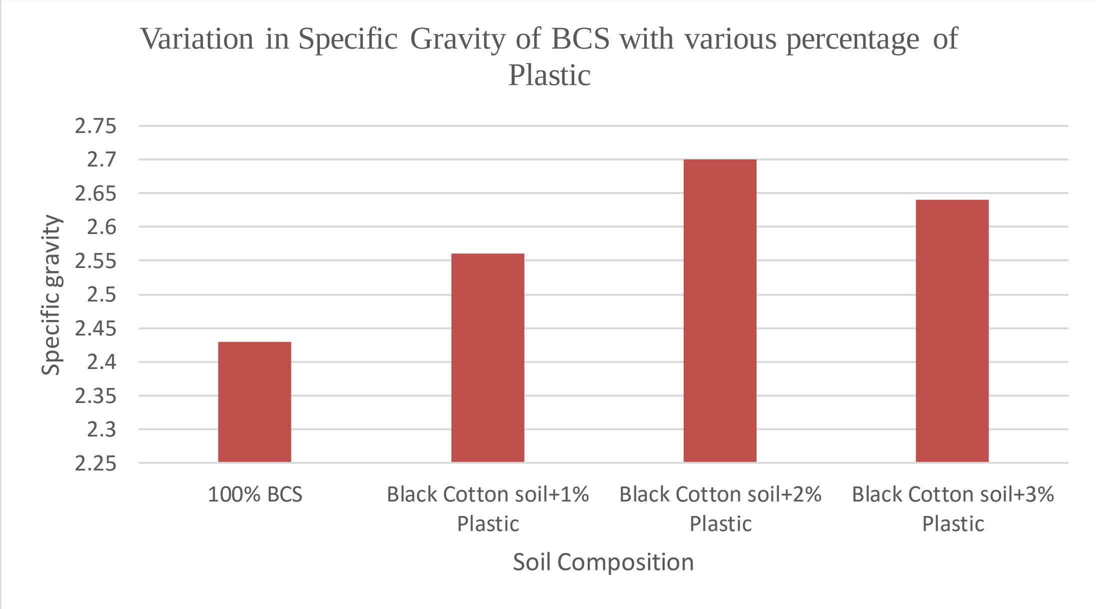
Graph No.2 Atterberg's Limit of BCS blend with different percentage of Plastic

As shown in above graph, The outcome of graph on Subgrade Soil treated with different proportions of Plastic is showing that with raise in the proportion of Plastic, the liquid limit goes reducing from 64.70 % to 49.49 % of Plastic proportion increasing from 0 to 3 % whereas the plastic limit raises beginning 33.24 % and 22.01 % for 11% but slightly decreased to 31.68% for 7% of Plastic and shrinkage limit goes decreasing from 24.51% to 18.73% while plastic proportion increasing from 7 to 11 % respectively as shown in graph-02.

4.4.2. Specific Gravity

Table No.-4.3 Variation in Specific Gravity of BCS with various percentage of Plastic

Sr. No.	**Soil Composition**	**Specific Gravity**
1	100% BCS	2.43
2	Subgrade Soil+1% Plastic	2.56
3	Subgrade Soil+2% Plastic	2.70
4	Subgrade Soil+3% Plastic	2.64



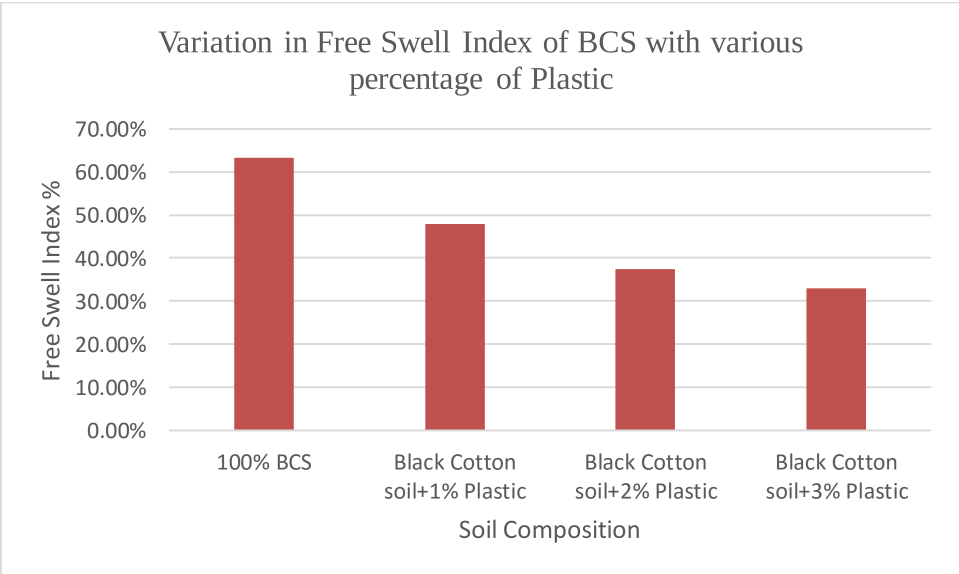
Graph No.3 Specific Gravity of BCS with various percentage of Plastic

As shown in above figure, comparison of specific gravity of virgin BC soil with BC soil mixed with 1%, 2%, and 3% brick powder. 100% Back cotton soil value is 2.43. as well as Subgrade Soil + 1% Plastic value is 2.56. Subgrade Soil + 2% plastic value is 2.7. and Subgrade Soil + 3% Plastic value is 2.64. Whenever Subgrade Soil add with 1% Plastic it is good result.

4.4.3. Free Swell Index:

Table No.4.4 Variation in Free Swell Index of BCS with various percentage of Plastic

Sr. No.	Soil Composition	Free Swell Index %
1	100% BCS	63.33%
2	Subgrade Soil+1% Plastic	48%
3	Subgrade Soil+2% Plastic	37.33%
4	Subgrade Soil+3% Plastic	33%



Graph No.4 Free Swell Index of BCS with various percentage of Plastic

As shown in above figure, it has been observed that the free swell index value continuously decreases with increase of Plastic content from 1% to 3%. Free swell index minimum value 33% for 3% Plastic.