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Enhancing the Index and Engineering Properties of Virgin Soil by the Addition of Saw Dust

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ABSTRACT

As we know that soil subgrade has great effect on quality and life of pavement. But the concern lies in construction industry when flexible pavements are constructed on weak subgrade and on such soils whose CBR ratio is very low. In those cases, where such circumstances arise thickness of subgrade as well as strength of subgrade should be given due consideration. Taking the economic aspects of civil engineering projects there should be a look for the economic and effective methods either for the replacement of poor construction material or for the effective reinforcement on subgrade soils.On the basis of test results following conclusions were drawn: -It is concluded that for improving the properties of soil, waste Saw Dust is found to be useful.As the Saw Dust material is locally available and is also cheaply available it is found to be useful in economic solutions.Usage of Saw Dust in soil stabilization helps in the reduction of environmental effects.It is seen from the results that with the increase in the percentage of Saw Dust liquid limit decreases, which will help in improving the subgrade.It is seen from the results that with the increase in the percentage of Saw Dust plastic limit decreases, which will help in improving the subgrade.It is seen from the results that with the increase in the percentage of Saw Dust plasticity index decreases, which will help in improving the subgrade.It is seen from the results that with the increase in the percentage of Saw Dust CBR increases, maximum value was found to be 21.93% and 11.45% respectively.It is seen from the results that with the increase in the percentage of Saw Dust UCS increase Up to 8.5%, and after that it decreases. UCS increases from 63.54 KN/m2 to 133.12 KN/m2 and decreases to 119.74 after that.From the results it is seen that optimum percentage of Saw Dust is 8.5%.

Introduction

As we know that soil subgrade has great effect on quality and life of pavement. But the concern lies in construction industry when flexible pavements are constructed on weak subgrade and on such soils whose CBR ratio is very low. In those cases, where such circumstances arise thickness of subgrade as well as strength of subgrade should be given due consideration. Taking the economic aspects of civil engineering projects there should be a look for the economic and effective methods either for the replacement of poor construction material or for the effective reinforcement on subgrade soils. This dissertation work will carry out the study on soil subgrade located at Qazigund area of Jammu and Kashmir under PMGSY. In this study a significant improvement will be developed between the CBR values of native soil both in soaked as well as unsoaked condition and correlation will be developed between various percentages of Saw Dust.

The study of this dissertation will be primarily based on the enhancement of poor soil subgrade by taking the various percentages of Saw Dust along with various soil samples. The area which we choose for our dissertation work is having a steep soil profile and is on the banks of River Jehlum, means it can possess a good quantity of silt ratio, based on this a Saw Dust will be added to the soil in varying percentages.

The various objectives of this study are below: -

To study the properties of virgin soil samples and soil mixed with saw dust.

To find out the characteristic compressive strength of virgin soil and soil mixed with saw dust

To correlate various engineering properties like OMC, MDD, LL, PL and PI of virgin soil and soil mixed with saw dust.

To correlate soaked as well as unsoaked CBR values of virgin soil and soil mixed with saw dust.

To compare and to evaluate the graphical interpretation of the tests performed on virgin soil and soil mixed with saw dust.

Methodology

The various tests which will be conducted are listed below: -

- Liquid limit test.
- Plastic limit test.
- Grain Size Distribution.
- Specific Gravity test

- C.B.R. test.
- UCS Test

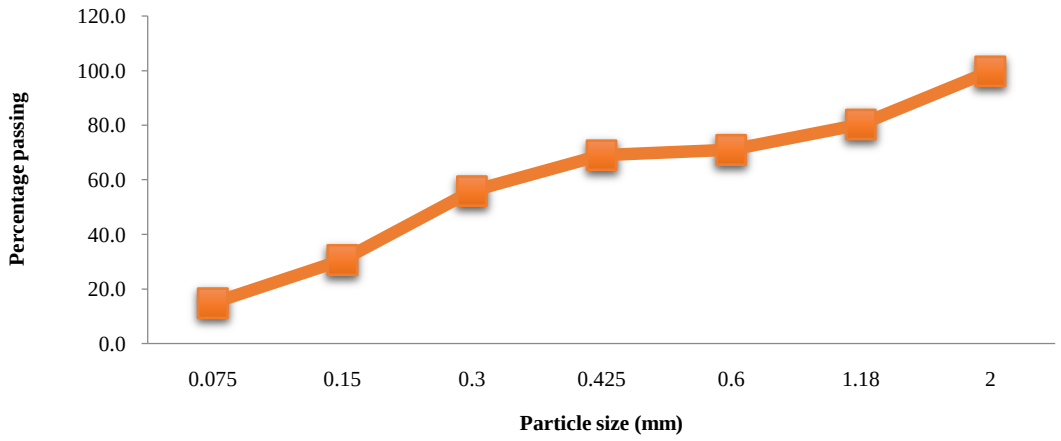
The Saw Dust will be purchased from a plywood factory located at Rangreth Srinagar. The Saw Dust will be brought from the factory and will be examined in the laboratory. Same Material will be pulverized Up to a certain degree of fines as discussed in the previous sections. A planed site of soil subgrade located at Qazigund area of Jammu and Kashmir under PMGSY has been chosen for the dissertation. Soil samples will be prepared with varying percentage of Saw Dust and Also of the Virgin soil. After that testing will be carried out. The test results obtained will be noted down and after that test results will be plotted and conclusions will be drawn from that.

Results

Sieve Analysis

Data of Sieve Analysis

S. No	Sieve (mm)	Weight of sample retained on sieve	Cumulative weight retaining on sieve	Percentage of soil retained on sieve	Percentage of soil passed on sieve
1	2.360	2.82	2.82	0.28	99.72
2	1.180	194.44	197.25	19.73	80.27
3	0.600	93.18	290.43	29.04	70.96
4	0.425	19.56	309.99	31.00	69.00
5	0.300	131.12	441.11	44.11	55.89
6	0.150	253.06	694.17	69.42	30.58
7	0.075	157.66	851.83	85.18	14.82
8	Pan	148.17	1000.00	100.00	0.00



Particle size distribution curve

Values of Coefficient of Curvature and Coefficient of Uniformity;

D10 = 0.06

D30 = 15

D60 =0.3625

From the particle size distribution curve, we have the values of D10, D30, D60 are (0.06,0.15, 0.3625).

Coefficient of Uniformity;

$$(Cu) = D60 / D10$$

$$= 0.3625/0.06 = 6.041$$

Coefficient of Curvature

$$(Cc) = (D30) /D60 \times D10$$

$$= 0.150 /0.3625 \times 0.06 = 1.03$$

Therefore, according to IS 2720 PART 4, the soil is well graded clayey soil.

Specific Gravity Test

Specific Gravity of parent soil

Container Number	I
Weight of empty pycnometer (M_1)	38.14
Mass of pycnometer + mass of dry soil (M_2)	64.52
Mass of pycnometer + soil + distilled water (M_3)	154.61
Mass of pycnometer + fill with water only (M_4)	138.2
Specific gravity G	2.64

Calculations

$$G = \frac{M_2 - M_1}{(M_2 - M_1) - (M_3 - M_4)}$$

$$= \frac{64.52-38.14}{(64.52-38.14)-(154.61-138.2)}$$

$$= \frac{26.38}{26.38-16.41}$$

$$= \frac{26.38}{9.97}$$

$$= 2.64$$

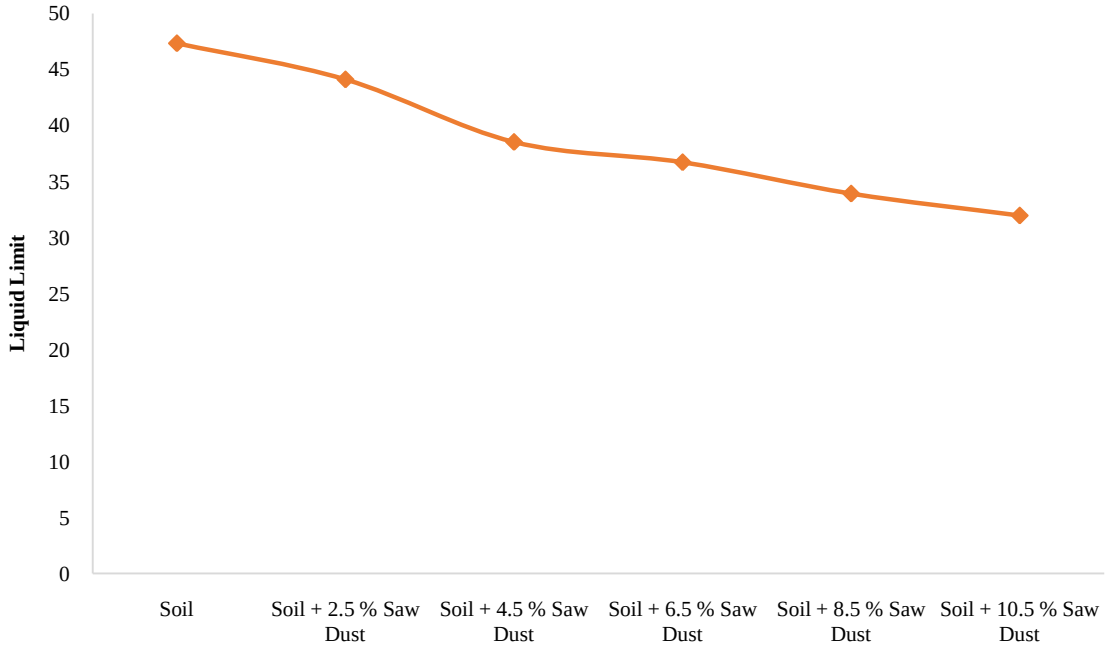
Therefore, specific gravity of parent soil = 2.64

Liquid Limit Test Results

Liquid Limit Test was conducted on virgin soil as well as on soil samples mixed with varying percentages of Saw Dust. Test procedure is already discussed in the previous section. The liquid limit of virgin soil as well as of soil samples mixed with varying percentages of Saw Dust is Tabulated and shown in Figure.

Liquid Limit Results

S. No	Mix	Liquid Limit (%)
1	Soil	47.34
2	Soil + 2.5 % Saw Dust	44.11
3	Soil + 4.5 % Saw Dust	38.52
4	Soil + 6.5 % Saw Dust	36.71
5	Soil + 8.5 % Saw Dust	33.91
6	Soil + 10.5 % Saw Dust	31.95

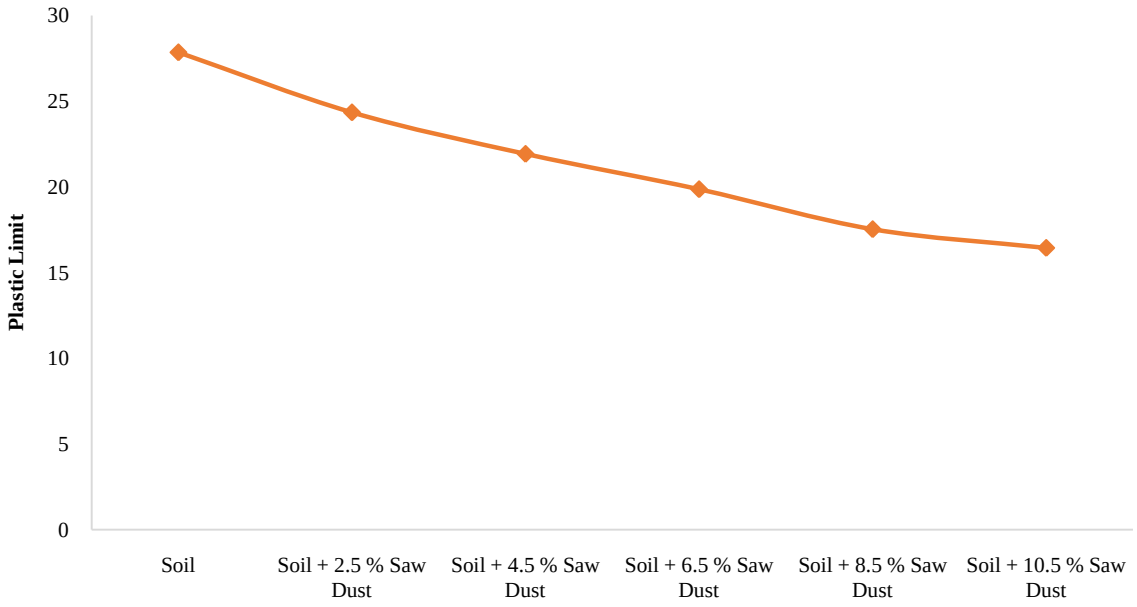


Plastic Limit Test Results

Plastic Limit Test was conducted on virgin soil as well as on soil samples mixed with varying percentages of Saw Dust. Test procedure is already discussed in the previous section. The plastic limit of virgin soil as well as of soil samples mixed with varying percentages of Saw Dust is Tabulated and shown in Figure

Plastic Limit Results

S. No	Mix	Plastic Limit (%)
1	Soil	27.84
2	Soil + 2.5 % Saw Dust	24.34
3	Soil + 4.5 % Saw Dust	21.92
4	Soil + 6.5 % Saw Dust	19.86
5	Soil + 8.5 % Saw Dust	17.53
6	Soil + 10.5 % Saw Dust	16.44

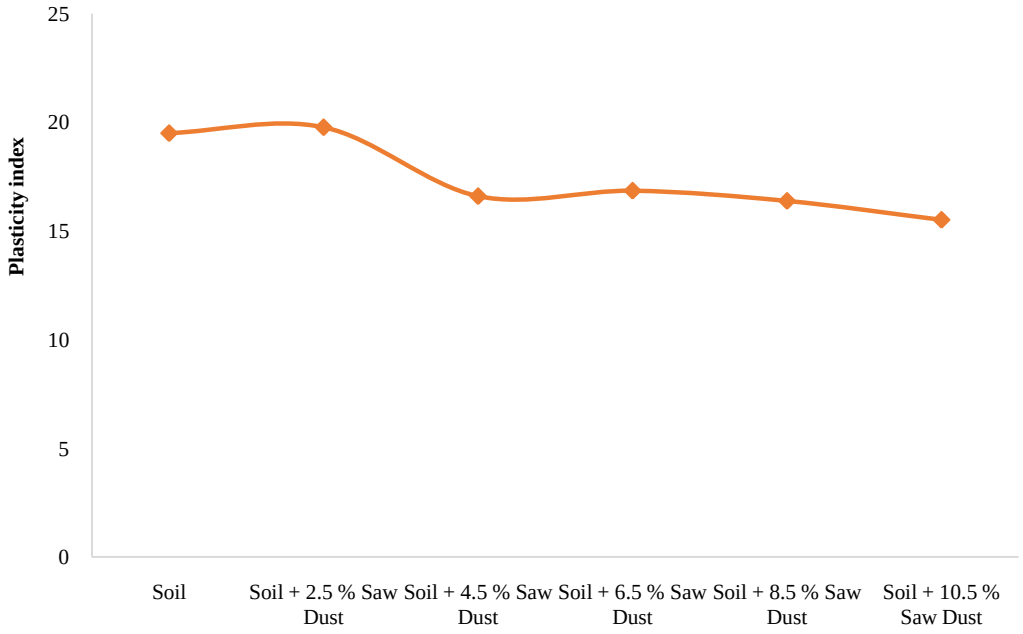


Plasticity Index Test Results

The plasticity Index of virgin soil as well as of soil samples mixed with varying percentages of Saw Dust is Tabulated and shown in Figure.

PlasticityIndex Results

S. No	Mix	PlasticityIndex (%)
1	Soil	19.5
2	Soil + 2.5 % Saw Dust	19.77
3	Soil + 4.5 % Saw Dust	16.6
4	Soil + 6.5 % Saw Dust	16.85
5	Soil + 8.5 % Saw Dust	16.38
6	Soil + 10.5 % Saw Dust	15.51

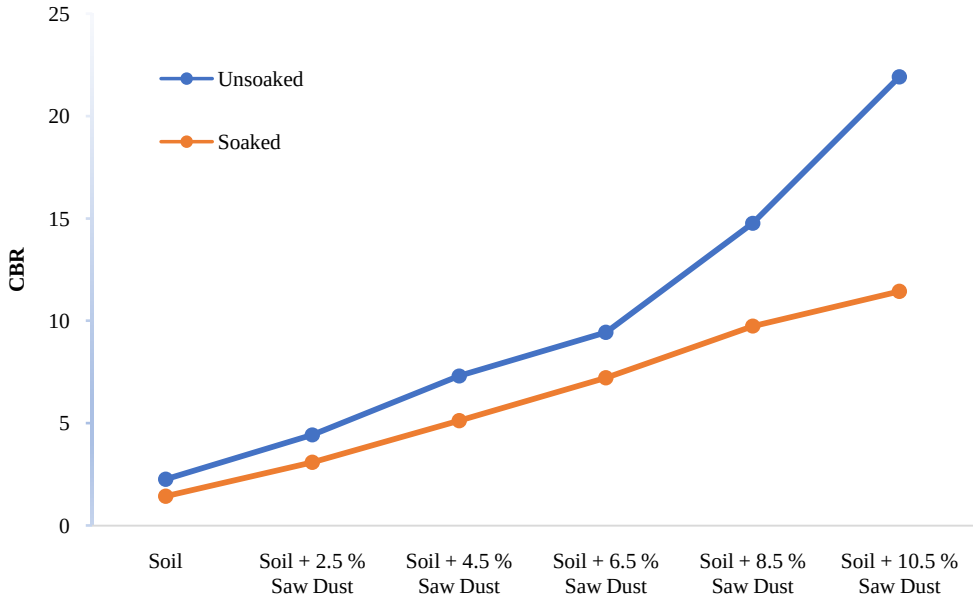


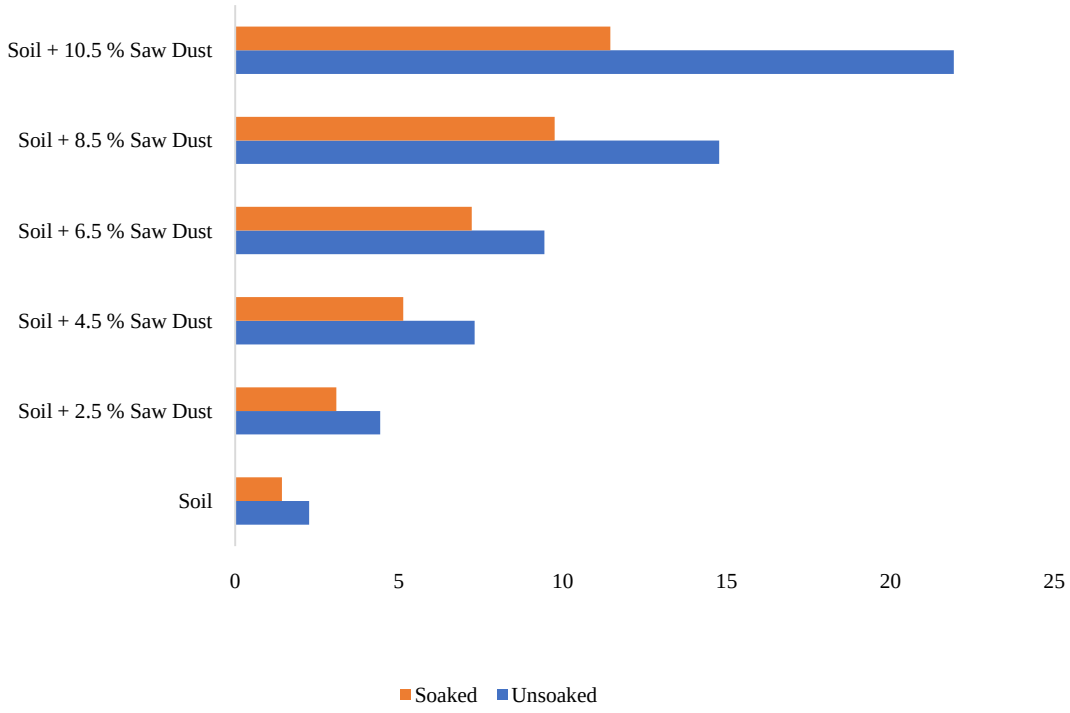
California Bearing Ratio Test Results

California Bearing Ratio Testsare carried out on soil admixed with Saw Dust at various percentages ranging from 0% to 10.5 % by weight of the soil in increment of 2 %.The California Bearing Ratio Testresults of virgin soil as well as of soil samples mixed with varying percentages of Saw Dust is Tabulated in Table and shown in Figure.

CBR Results

S. No	Mix	California Bearing Ratio	
		Un-Soaked	Soaked
1	Soil	2.26	1.43
2	Soil + 2.5 % Saw Dust	4.43	3.09
3	Soil + 4.5 % Saw Dust	7.31	5.13
4	Soil + 6.5 % Saw Dust	9.44	7.22
5	Soil + 8.5 % Saw Dust	14.77	9.75
6	Soil + 10.5 % Saw Dust	21.93	11.45



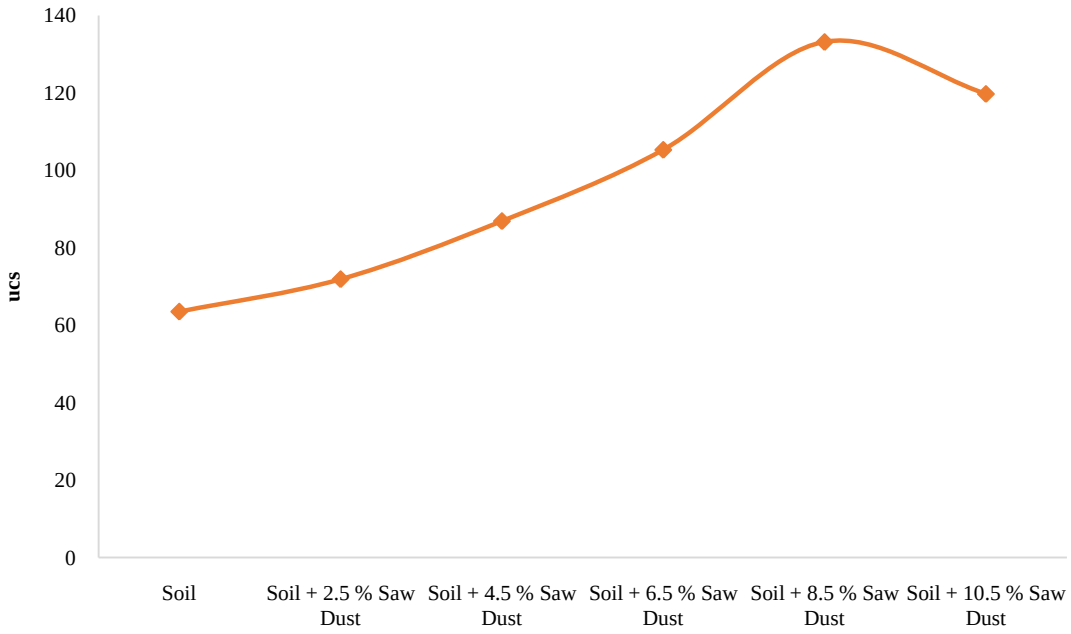


Unconfined Compressive Strength Test Results

Unconfined Compressive Strength Test are carried out on soil admixed with Saw Dust at various percentages ranging from 0% to 10.5 % by weight of the soil in increment of 2 %.The Unconfined Compressive Strength Test results of virgin soil as well as of soil samples mixed with varying percentages of Saw Dust is Tabulated in Table and shown in Figure.

UCS Test Results

S. No	Mix	UCS (KN/m^2)
1	Soil	63.54
2	Soil + 2.5 % Saw Dust	71.91
3	Soil + 4.5 % Saw Dust	86.91
4	Soil + 6.5 % Saw Dust	105.31
5	Soil + 8.5 % Saw Dust	133.15
6	Soil + 10.5 % Saw Dust	119.74



Conclusion

On the basis of test results following conclusions are drawn: -

1. It is concluded that for improving the properties of soil, waste Saw Dust is found to be useful.
2. As the Saw Dust material is locally available and is also cheaply available it is found to be useful in economic solutions.
3. Usage of Saw Dust in soil stabilization helps in the reduction of environmental effects.
4. It is seen from the results that with the increase in the percentage of Saw Dust liquid limit decreases, which will help in improving the subgrade.
5. It is seen from the results that with the increase in the percentage of Saw Dust plastic limit decreases, which will help in improving the subgrade.
6. It is seen from the results that with the increase in the percentage of Saw Dust plasticity index decreases, which will help in improving the subgrade.
7. It is seen from the results that with the increase in the percentage of Saw Dust CBR increases, maximum value was found to be 21.93% and 11.45% respectively.
8. It is seen from the results that with the increase in the percentage of Saw Dust UCS increase Up to 8.5%, and after that it decreases. UCS increases from 63.54 KN/m^2 to 133.12 KN/m^2 and decreases to 119.74 after that.
9. From the results it is seen that optimum percentage of Saw Dust is 8.5%.

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