Addition of Crusher Dust in Clayey Soil as Subgrade Material

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***Abstract*- Flexible pavements are mostly adopted pavements for transportation. To give a better service the subgrade lying underneath the pavement should have good bearing capacity, strength and stability. Subgrade is one of the important components of the pavement which is constructed by the natural soil. It is a compacted layer of soil provide the lateral support to the pavement. If the subgrade is a clayey soil then it affects the performance of the pavement due to lack of sufficient bearing capacity. Stabilisation is a ground improvement technique that improves the properties of the soil. In this project the clayey soil is stabilised by the addition of crusher dust as the stabiliser. Laboratory tests were conducted on clayey soil with various percentage of Quarry Dust. Atterberg limits and compaction tests were carried out on unmodified soil. California bearing ratio (CBR) test, Standard Proctor Test was performed to determine the corresponding characteristics of the Soil–Quarry dust mixtures. The Yield of Higher CBR values of soil-quarry dust mix extent their potential for use as a Subgrade for flexible pavement.**

Keywords: **Clayey soil, Subgrade, Quarry dust, CBR.**

I. INTRODUCTION

Transportation is necessary for the proper functioning and development of economic activities for any country, which involves production, distribution of goods and services from one place to other. The objective of laying a pavement is to support the wheel loads and to transfer the load stresses through wider area on the soil subgrade below. Subgrade is generally made up of locally available natural soils. The strength and performance of a pavement is dependent on load bearing capacity of subgrade soil. The improvement in load bearing capacity of subgrades soil will improve the load bearing capacity of pavement and thus, pavement can sustain more stresses. In case of poor soil in construction site, the poor soil of required depth can be removed or replaced with the soil of high strength. Crusher dust, being a waste product, produced during crushing of gravel and rock suits to be one of the stabilizers which help in increasing the strength of subgrade. The main advantage of crusher dust is, it reduces in cost of construction if availability of quarries is present.

U Arun Kumar, Kiran B. Biradar (2014) identified that quarry dust to the soil reduces the clay content and thus increases in the percentage of coarser particles, It is also identified that addition of (40%) Quarry dust yield high CBR value. Satyanarayana, et al(2013) has studied that the strength characteristics of compacted crusher dust and Crushed Stone mixes through a series of CBR tests by varying the crusher dust. Onyelowe Ken et.al (2012) exposes the qualities and applications of quarry dust as admixture during soil improvement and for a more economic approach. Agrawal and gupta et.al (2011) reported that the potential use of marble dust as stabilizing additive to expansive soil, which involves the determination of the swelling potential of expansive soil in its natural state as well as when mixed with varying proportion of marble dust.

II. MATERIALS

2.1 Soil

Clay soil has been used as base material in this study. The soil sample is collected from shallow depth from the Rajajinagar Colony in Hanamkonda Town.

Table 2.1 Properties of soil sample

Liquid limit (%)	41.04
Plastic limit (%)	26.93
Plasticity index (%)	14.11
Specific gravity	2.7
OMC (%)	10.20
MDD (gm/cc)	2.24
Cohesion(kg/cm^2)	0.6
DFS (%)	14.28

2.2 Crusher Dust

The Crusher dust used was collected from a local quarry at Gudepad (Parkal Road), Warangal (rural), Telangana.

Table 2.2 Properties of Crusher Dust

Liquid limit (%)	NIL
Plastic limit (%)	NIL
Plasticity index (%)	NP
Specific gravity	2.55
OMC (%)	5.88
MDD (gm/cc)	2.44
Cohesion(kg/cm^2)	0
Angle of shearing resistance (^{0})	51^{0}40’

III. RESULTS AND DISCUSSION

The experiments were performed to study the effect of crusher dust to conventional clayey soil in varying percentages.

3.1 Compaction Characteristics

The IS light weight compaction test is performed according to IS 2720-part 7 to determine the optimum moisture content and maximum dry density for the varying percentages of crusher dust to clayey soils.

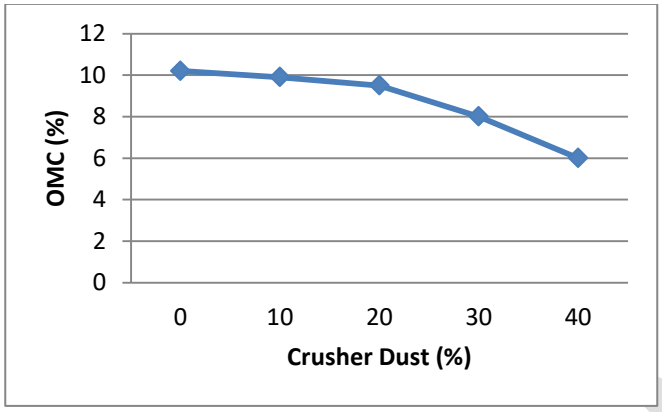

Fig 1 variation of Soil + Crusher Dust Mixes on OMC

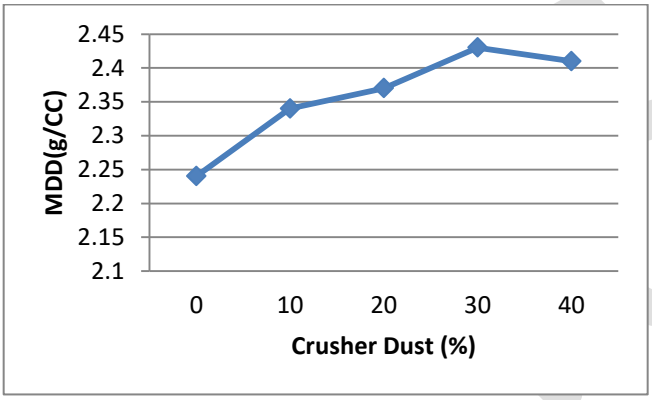

Fig 2 variation of Soil + Crusher Dust Mixes on MDD

Table 3.1 Variations of OMC and MDD for Crusher Dust Mixes

Percentage Crusher dust added (%)	OMC (%)	MDD (g/cc)
0	10.2	2.24
10	9.9	2.34
20	9.5	2.36
30	8	2.43
40	6	2.41

The addition of crusher dust to the soil reduces OMC and increases MDD of soil sample upto 30% addition and further reduces the MDD value as percentage of crusher dust increases.

3.2 California Bearing Ratio (C.B.R)

CBR tests were performed to determine the CBR Value on samples according to IS 2720 (Part-16)-1987 which are compacted to optimum moisture content obtained from the standard proctor test.

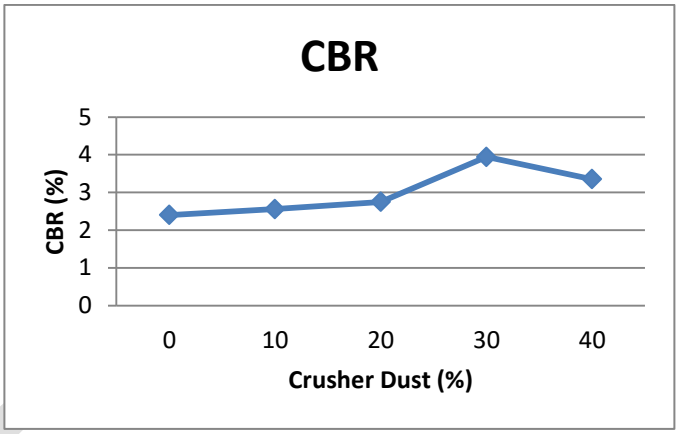

Fig 3 variation of Soil + Crusher Dust Mixes on CBR

Table 3.1 Variations of CBR for Crusher Dust Mixes

Percentage Crusher dust added (%)	C.B.R (%)
0	2.4
10	2.56
20	2.75
30	3.94
40	3.35

CBR value of Soil sample increases as percentage of Crusher dust increases upto 30%, furthermore increase in Crusher dust reduces the CBR value.

IV. CONCLUSIONS

The experiment conducted to study the effect of Crusher dust addition on soil sample reveals the following:

1. The addition of crusher dust to the soil reduces the clay content and thus increases in the percentage of coarser particles.
2. The addition of crusher dust to the soil reduces OMC of soil to 27.5% with increase in percentage of crusher dust.
3. The addition of crusher dust to the soil increases MDD of soil to 8% with increase in percentage of crusher dust.
4. The value of CBR increased by 64.17% with addition of 30% crusher dust.

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