



# Study Of Stress-Strain Behavior Of Cohesion Less Soil Mixed With Granite Dust Under Cbr Test

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**Abstract:** One of the most important characteristics in construction which is widely used in connection with road pavements and foundation is soil stabilization. In order to enhance the engineering properties of the soil, stabilization techniques are required. The addition of waste materials like, fly ash, rice husk ash etc. increases the physical as well as chemical properties of the soil. Some of the expected properties to be improved are shear strength, liquidity index, plasticity index, unconfined compressive strength and bearing capacity. One of the primary objectives of this research is to analyze the effect of granite dust on cohesion less soil. This research studied the application of granite dust material on the geotechnical properties of soil. For the purpose of study, three soil samples at different location were collected and considered. The granite dust was collected from the RCC Quarry site, within in NH06 project Navapur Maharashtra for the stabilization studies. The experimental program were carried out on the samples treated with different percentages of granite dust at 10%, 15%, 20%, 25% and 30%. The research depicts the study carried out to check the improvements in the strength properties of soil stabilization by granite dust in varying percentages. The dry density of the soil increases with addition of granite dust at varying percentages and a corresponding decrease in the moisture content. The test carried out shows that there is an improvement in the strength properties of the soil as a result of an increase in the cell pressure with an increase in the granite dust proportion. It is therefore concluded that granite dust is an effective stabilizer which can be used as additive to improve geotechnical properties of cohesive soil when necessary. However, no assumption should be made that granite dust should be considered as suitable stabilizer for all type of soil until they are tested with the sample.

**Index Terms** - Granite Dust, Soil Stabilization, Stabilizer.

## I. INTRODUCTION

Drainage issues are one problem that a proper contingency plan should cover. Sandy soil is free draining, meaning it does not hold much water. Flooding of a sandy area can cause erosion of the ground making the building foundation weak. This natural characteristic can lead to other issues. Settlement occurs when the soil gets too wet, causing an increase in pore pressure. With no friction between the grains, sand smoothly shifts out of place. This shifting causes structures built on it to settle; and we all know settling foundations do crack. Areas where foundation settling is common often employ piers to correct the problem. Sand has a natural consistency to shift and slide around. While drainage issues and using piers driven down into firmer substrate help, there is always a concern that the soil will freely move under the proper circumstances. If this natural characteristic is not considered, structures built on these sites can sink or fall. Sandy soil is not the best place to build on. However, with proper planning and consideration, completing the perfect project is possible. It is important for you to know what to expect with sand and ways to mitigate problems that may arise.

## II. EXPERIMENTAL PROGRAM

The Sandy soil has been mixed with the different percentages of Granite Dust and compaction characteristics have been determined. Based on the modified proctor test value the optimum mix has been taken as 75%S+25%GD. Furthermore, Atterberg's limit and CBR test have been performed on the optimum mix.

### Materials

### Soil Samples

The soil sample was collected from the National Highway Under Construction Site (NH06). The Soil Samples collected were stored and air-dried in the Geotechnical laboratory of the (J M MHATRE INFRA PVT LTD). The physical properties of soil have given in table no 1.

Table 1: Results For Sandy Soil.

Tests	Characteristics	Values	IS Code
Particle Size Distribution	Gravel (%)	13.40	IS: 2720 (Part-4)
	Sand (%)	67	
	Silt and Clay (%)	19.60	
	Classification of Soil	SM	IS: 1498
Physical Properties	Specific Gravity	2.67	IS: 2720 (Part-3)
	Liquid Limit (%)	31	IS: 2720 (Part-5)
	Plastic Limit (%)	NP	
	Plasticity Index (%)	NILL	
Engineering Properties	Optimum Moisture Content (%)	10.85	IS: 2720 (Part-7)
	Maximum Dry Density (KN/m3)	1.968	
	Free Swell (%)	17	IS: 2720 (Part-40)

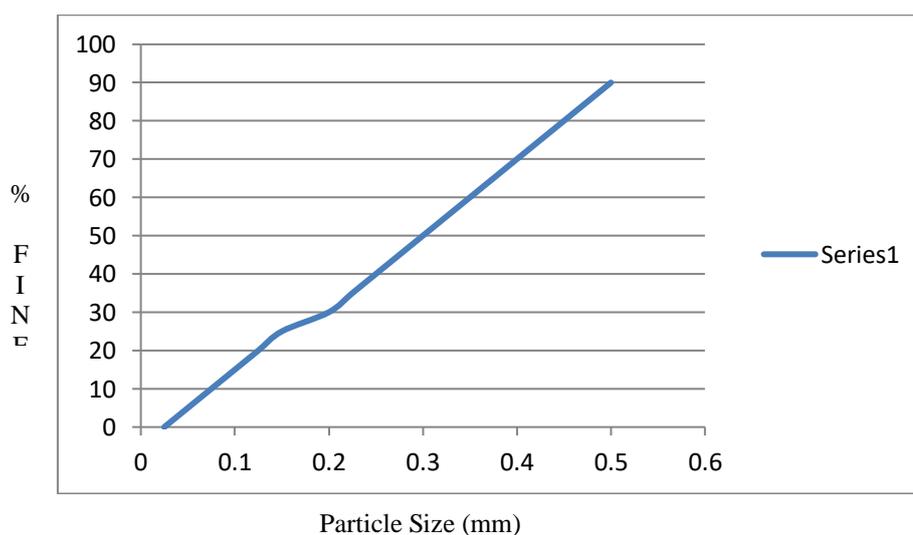


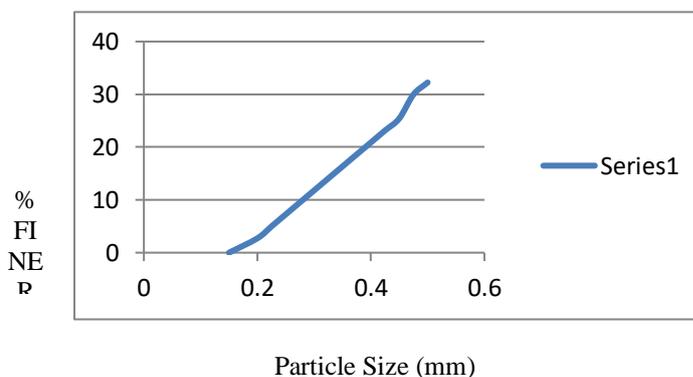
Fig 1 Grain size distribution curve for Murrum(soil)

**Granite Dust**

Granite Dust is fine powder of granite stone (IGNEOUS ROCK) which is available on market (Price: -200 KG) and I get this from nearby quarry.

Table 2: Characteristics of Granite Dust

Characteristics	Values
Specific Gravity	2.70
Color	Greyish
Natural Moisture Content	0.26%



**Fig 2 Grain size distribution curve for granite dust.**

**Mix Proportion**

In this study common symbols have been adopted in which first term S stands for Soil and second term GD stands for Granite Dust.

Designation	% Soil (MURUM)	% Granite dust
100%S	100%	0%
90%S+10%GD	90%	10%
85%S+15%GD	85%	15%
80%S+20%GD	80%	20%
75%S+25%GD	75%	25%
70%S+30%GD	70%	30%

Table 3: Mix Proportion for optimizing granite dust content.

## RESULT AND DISCUSSION

### Atterberg's Limit

The Liquid Limit of An Optimum Mix is 27.5% The Plastic Limit for An Optimum Mix Is Non-Plastic Plasticity Index Is Null for An Optimum Mix.

### Modified Proctor Test

Further Figure 3 shows the variation of optimum moisture content with granite dust content and it has been observed that as the percentage of granite dust increases OMC decreases up to 20%. The decrease in the OMC could be due to hydrophobic nature of the granite dust and as the addition of granite dust content in the soil-granite dust mixes always got accompanied by the reduction of fineness content in the mix, and consequently, water-holding capacity of the mix got diminished and therefore such results were observed.

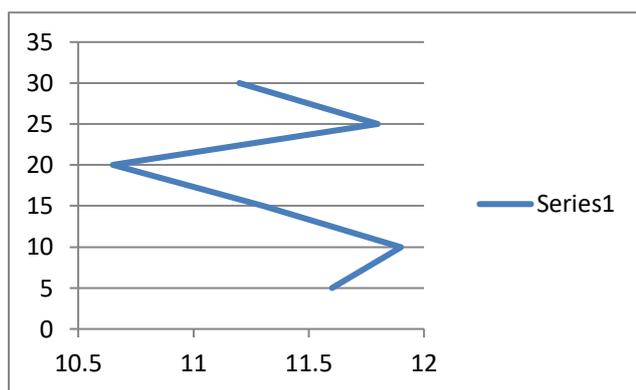


Fig 3 Variation of OMC with granite dust Content.

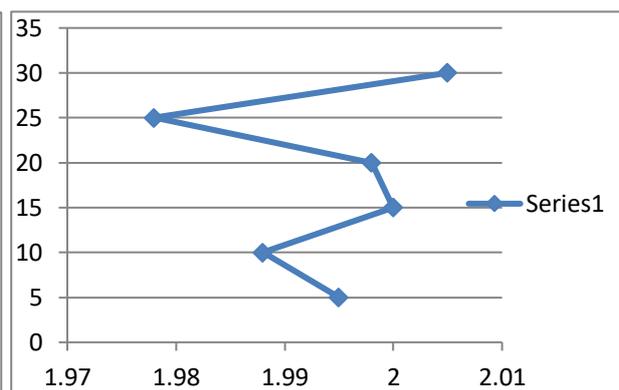


Fig 4 Variation of MDD with granite dust Content.

Figure 4 shows the variation of maximum dry density with granite dust content and it has been seen that as the percentage of granite dust increases MDD also increases. The increase in the MDD is because of the specific gravity of the granite dust which is more than that of the Murrum(soil).

### California Bearing Ratio

It can be seen that unsoaked CBR value of the optimum mix has been 57% higher than that of the clayey soil. While 17.19% increase in soaked CBR value of optimum mix has been seen than that of the sandy soil. This increase in the CBR value is as a result of cementing property of the Granite dust Granite dust fines may possess some of the cementitious properties of ordinary Portland cement but the difference is that they are slow hydrating and slow strength developing.

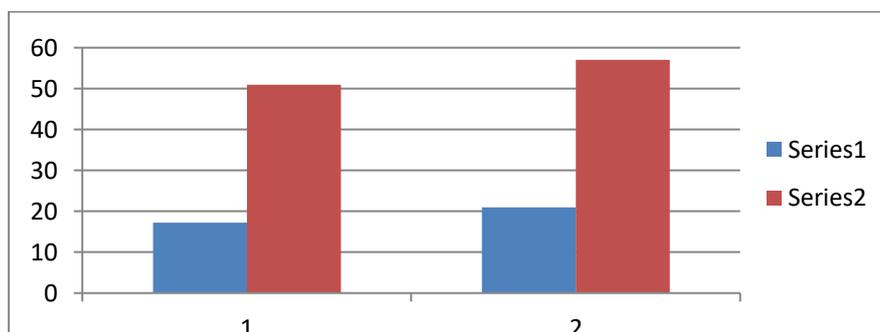


Fig 5 Variation of CBR value for the Unsoaked and Soaked condition.

## CONCLUSIONS

1. The liquid limit, plastic limit and plasticity index decrease to 18%, 22% and 13% than that of Murrum(soil) and the shrinkage limit has been increased to 38%.
2. The CBR value for the unsoaked and soaked sample of optimum mix has been increased to 64% and 15% than that of Murrum(soil).

The result of the presented study reflects that the granite dust can be used as a stabilizer for the Murrum(soil) as addition of ash improves the geotechnical properties of the mix. But granite dust alone cannot counteract the expansive nature to much extent.

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