iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** XII **Month of publication:** December 2017

DOI:

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor :6.887
Volume 5 Issue XII December 2017- Available at www.ijraset.com

Laboratory Investigation on Sand with Different Grades

Vishnu Kant Malviya[1], K.G. Kirar[2], Ajeet Saxena[3]

Abstract: The density index of a granular cohesion less soil is a superior indicator for identifying its level of compaction i.e. coarser soil put side by sided to relative compaction. It has been also noted that sands are a more desired material for using as filler material in foundation or base, because of its property to be less influenced by pore water pressure as compared to cohesive soils. The cause may be due to their greater size of void, which contains more air than water. Practically it is very complicated to acquire homogeneous sands during various cut and fill actions or other functions of construction. This leads to obtaining sand from diverse sources, which result in heterogeneous (mixed) properties in the sample used.

***Keywords*: density index, granular cohesion less soil, foundation, cohesive soils, water, sand**

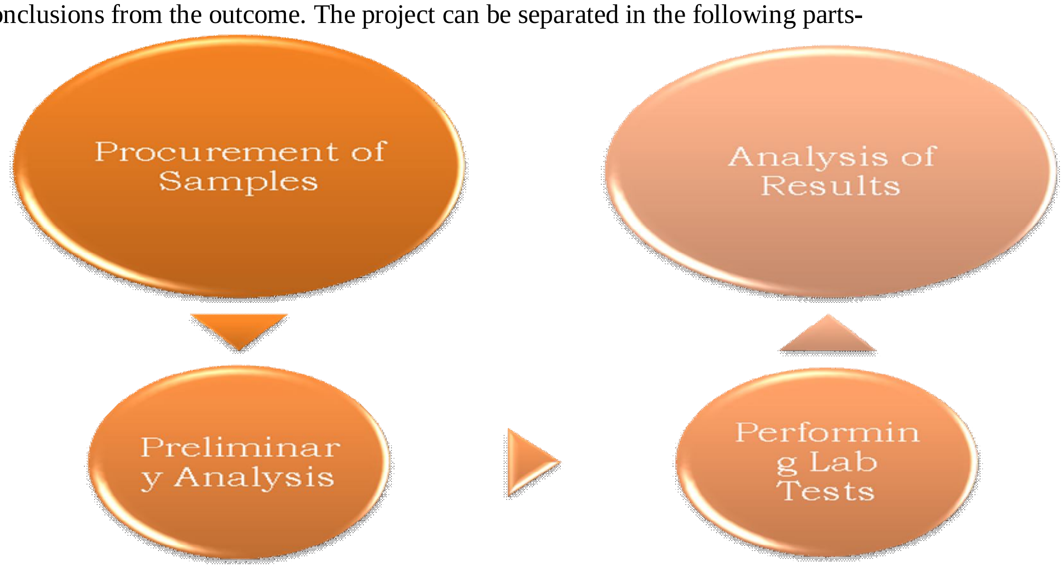
I. INTRODUCTION

Density Index may be defined as the expression used to signify the relative looseness or compactness of cohesion-less granular soil. It is one of the major properties which decide its practice. Density index provides a practical useful assessment of compactness of cohesion less soils, preferably recognized as one of the index properties for sand. The compressible features of cohesion less soils and related characteristics of such soils are reliant on parameters like shape of individual particles and grain size distribution.

Density index is also influenced by these parameters and provides correlation between properties of soils. Numerous soil properties such as compressibility, compaction friction angle, penetration resistance, permeability and California bearing ratio are found to establish simple relations with density index. Thus, for such reason it is essential to find out minimum and maximum density of soil.

II. EXPERIMENTAL INVESTIGATIONS

The project being an experimental effort needs the protocol of accumulating specimens, analyzing them, executing a range of tests and obtaining conclusions from the outcome. The project can be separated in the following parts-



Methodology adopted

A. Analysis of Results

The outcomes of several density index and bearing capacities for dissimilar sand grade fractions achieved were analyzed. Empirical relations have also been set up between gradation, bearing capacity and density index.

B. Sieve Analysis

Data sets of the specimens accumulated for Sieve Analysis

Sample	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Coefficient Of Uniformity (Cu)	Coefficient of Curvature (Cc)
1	10	62	28	0.16	0.46	0.77	1	6.25	1.32
2	5	69	26	0.19	0.48	0.8	1.2	6.32	1.01
3	0	88	12	0.13	0.64	0.7	0.8	6.15	3.94
4	14	76	10	0.5	0.8	1.1	1.4	2.8	0.91

C. Specific Gravity

Specific Gravity results of obtained specimens.

SAMPLE	1			2			3			4		
	I	II	III	I	II	III	I	II	III	I	II	III
Wt. of Pycnometer (gm)	100	100	100	100	100	100	100	100	100	100	100	100
Wt. of Pycnometer + Sand (gm)	150	150	150	150	150	150	150	150	150	150	150	150

Wt. of Dry Sand W1 (gm)	50	50	50	50	50	50	50	50	50	50	50	50
Wt. of Pycnometer + Water W2 (gm)	343	351	351	347	351	349	347	349	341	347	344	346
Wt. of Pycnometer + Water + Sand W3 (gm)	374	382	382	378	382	380	378	380	371	378	375	377
Gs	2.65	2.63	2.66	2.58	2.63	2.60	2.57	2.59	2.54	2.63	2.65	2.66
Average Gs		2.64			2.60			2.57			2.65	

D. Vibration Table Test

The density index for the 17 prepared specimens.

Mass of Mould	(M1) = 10.631 kg
Height	(H) = 17 cm
Diameter	(D) = 15 cm
Area of Cross-section	(A) = 0.018 m^2
Volume	(V) = 0.003 m^3
Unit Weight of water	(ϒw) = 1000 kg/m^3

E. Direct Shear Test

1) Specimen 1

Natural Gradation: Coarse-10% Medium-60% Fine-30%

Specimen No	Coarse (%)	Medium (%)	Fine (%)	D50 (mm)	Normal Stress (kg/cm^2)	Proving Ring Reading (a)	Shear Force = (a)*3.0672N (b)	Shear Stress = (b) / 36 (kg/cm^2)	Angle Of Internal Friction (ϕ) (°)	Unit Weight (ϒ) (gm/cc)	Bearing Capacity Factor Nϒ	Ultimate Bearing Capacity (kN/m^2)
1.	10	50	40	0.6	4.91	54	165.60	4.60	43.14	1.96	211.37	2071.38
2.	20	50	30	0.82	4.91	50	152.64	4.24	40.86	2.04	137.33	1400.81
3.	30	50	20	1.12	4.91	47	142.92	3.97	38.96	2.12	84.37	894.29

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor :6.887
Volume 5 Issue XII December 2017- Available at www.ijraset.com

4.	10	60	30	0.76	4.91	52	160.92	4.47	42.31	2.03	184.42	1871.82
5.	20	60	20	0.99	4.91	47	143.28	3.98	39.03	2.09	97.50	1018.90
6.	30	60	10	1.34	4.91	42	129.60	3.60	36.30	2.15	76.26	819.85
7.	10	70	20	0.9	4.91	48	148.32	4.12	40.01	2.06	109.73	1130.27
8.	20	70	10	1.08	4.91	44	133.92	3.72	37.16	2.10	74.55	782.73

Angle of internal friction (ϕ) and Bearing capacity of Specimen 1

2) *Specimen 2:* Natural Gradation: Coarse-5% Medium-70% Fine-25%

Angle of internal friction (ϕ) and Bearing capacity of Specimen 2

Specimen No	Coarse (%)	Medium (%)	Fine (%)	D50 (mm)	Normal Stress (kg/cm^2)	Proving Ring Reading (a)	Shear Force = (a)*3.0672N (b)	Shear Stress = (b) / 36 (kg/cm^2)	Angle of Internal Friction (ϕ) (°)	Unit Weight (gm/cc)	Bearing Capacity Factor Nϒ	Ultimate Bearing Capacity (kN/m^2)
1.	5	65	30	0.72	4.91	54	166.68	4.63	43.31	2.02	216.89	2190.55
2.	5	70	25	0.8	4.91	47	144.72	4.02	39.34	2.03	101.31	1028.27
3.	5	75	20	0.96	4.91	43	133.20	3.70	37.01	2.06	72.70	748.86
4.	10	65	25	0.82	4.91	53	163.80	4.55	42.86	2.04	202.27	2063.20
5.	10	70	20	0.92	4.91	47	145.44	4.04	39.46	2.06	91.73	944.85
6.	10	75	15	0.94	4.91	45	137.52	3.82	37.92	2.08	71.60	744.64
7.	15	65	20	0.92	4.91	50	154.44	4.29	41.16	2.08	147.08	1529.58
8.	15	70	15	1	4.91	48	147.24	4.09	39.80	2.09	82.65	863.67
9.	15	75	10	1.04	4.91	45	137.88	3.83	37.98	2.10	60.06	630.64

III.CONCLUSION

On the basis of experimental study, following conclusions are drawn-

1) Well graded samples i.e. sample whose uniformity coefficient is more than 6 (Cu >6) and coefficient of curvature is between 1 to 3 (1< Cc <3) for sand are appeared to be denser than the other samples i.e. they have higher density index around greater than 70%, which is classified as ‘dense sand

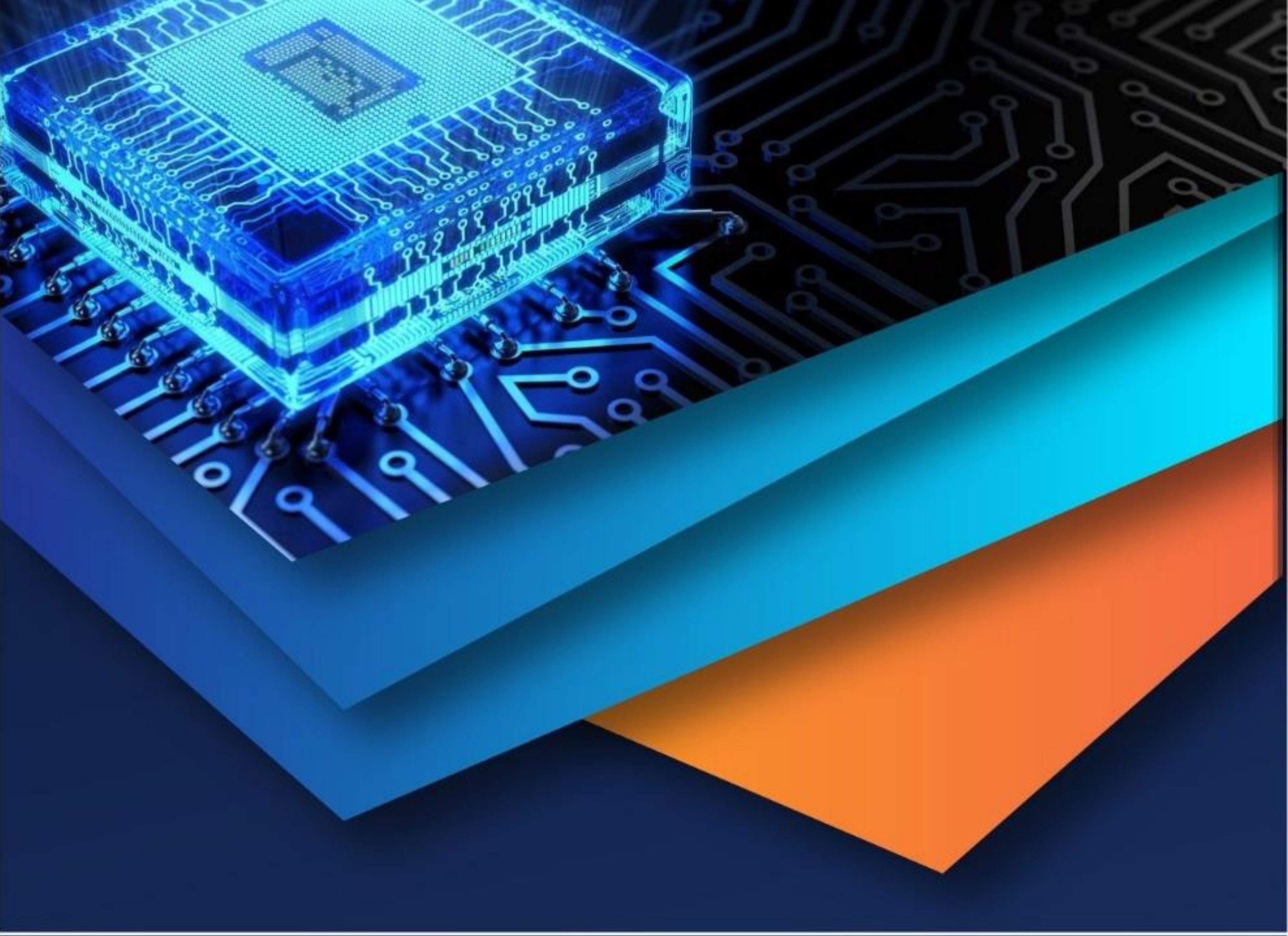
2) Density index, Bearing Capacity and angle of internal friction are found to vary inversely to the mean particle size.
3) The density index and angle of internal friction conform with the empirical relation given by Meyerhof (1956), positioned between the range of +/- 5% error.
4) The mean particle size is found to be most important parameter in affecting the index property i.e. density index for cohesion-less soils taken. Thus an empirical relation is suggested from the present experimental work as

$$Dr = 73\ D50^{-0.07}$$

5) Density index (Dr) and Ultimate Bearing Capacity (qd) of soil were found to be directly proportional.

REFERENCES

[1] White, H. E., Walton, S. F. (1937). “Particle Packing and Particle Shape”, Journal ofthe American Ceramic Society, Vol. 20, Issue 4, pp. 155-166.
[2] Burmister, D. M. (1948), “The Importance and Practical Use of Relative Density in Soil Mechanics,” ASTM Proceedings, Presented at the Meeting of Committee D-18 on Soils for Engineering Purposes held during the Fifty-first Annual Meeting, Detroit, Michigan, Vol. 48, pp.1249–1268.
[3] Wasti, Y. and Alyanak, I, "KilMuhtevasınınZemininDavranışınaTesiri .İnşaatMühendisleriOdası", TürkiyeİnşaatMühendisliği 4. Teknik Kongresi. Ankara 1968.
[4] Novais-Ferreira, H, "The Clay Content and the Shear Strength in Sand-Clay Mixtures". Proc. 5th African Reg. Conf. Soil Mech. Found. Engrng. Luanda,1971, Vol1 , pp.3-9, Theme 3.
[5] Lee, J., Salgodo, R. (1972). “Estimation of Bearing Capacity of Circular Footings on Sands Based on Cone Penetration Test”, Journal of Geotechnical and Geo environmental Engineering, 131:4, pp. 442-452.
[6] Holubec, I, D'Appolonia, E. (1973). “Effect of Particle Shape on the Engineering Properties of Granular Soils”, ASTM, Digital Library / STP / STP523-EB / STP37879S
[7] Johnston, M. (1973). “Laboratory Studies of Maximum and Minimum Dry Densities of Cohesion less Soils”, ASTM, Digital Library / STP / STP523-EB / STP37869S.
[8] Youd, T.L. (1973). “Factors Controlling Maximum and Minimum Densities of Sands”, ASTM, Digital Library / STP / STP523-EB / STP37866S



10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL
IMPACT FACTOR:
7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY