Comparative Analysis Of The Behaviour Of Salt Pan Clay And Formal Clay For Construction Work

D.Suganthi
U.G Students, Department of Civil Engineering
Roever Engineering College
Perambalur, India

M.Manjuladevi
U.G Students, Department of Civil Engineering
Roever Engineering College
Perambalur, India

N.Pavithra Bai
U.G Students, Department of Civil Engineering
Roever Engineering College
Perambalur, India

R.Angela clemencia
U.G Students, Department of Civil Engineering
Roever Engineering College
Perambalur, India

R.Akila
Assistant Professor, Department of Civil Engineering
Roever Engineering College
Perambalur, India

***Abstract*—Clay is a type of soil which is a natural material composed primarily of fine grain minerals. Saltpan is a shallow container (or) depression in the ground in which salt water evaporates to leave a deposit of salt. Chemically clays are hydrous, aluminium silicates, ordinary containing impurities potassium, sodium, calcium, magnesium (or) iron in small amount. The SALT PAN CLAY samples are collected in MARAKANAM in VILLUPURAM district and FORMAL CLAY samples are collected in PERAMBALUR. We are tested SALT PAN CLAY and FORMAL CLAY samples in TRICHY for determine the index and engineering properties of samples. The properties of samples are analyzed and compared for the purpose of construction work.**

Keywords—: Formal clay, Salt pan clay, Index properties, Engineering properties

I. INTRODUCTION

In India about one- fifth of the area is covered by clay soil. Soils having low bearing capacity are found in several parts of the world. In Tamilnadu also low bearing capacity soil occur in many parts. The basic problems associated with these types of deposits are low shear strength and high compressibility. Whenever poor soil conditions are at site such as loose sand ,soft clay, highly organic deposit or dumped heterogeneous material are encountered the following are the alternative to overcome the problems. Due to growth of population and scarcity of land, construction of structures in poor soil is unavailable. Saltpan is a basin in a semi-arid region where chemical precipitates (evaporites) are deposited, owing to the concentration by evaporation of natural solutions of salts. The least soluble salts (calcium and magnesium carbonates) are precipitated first on the outside of the pan, followed by sodium and potassium sulphates. The soil behaves like a softsoil under wet/saturated condition. Hard, dry clay for examples may be suitable as a foundation for heavy loads so long as it remains dry, but it may become unstable when wet. The properties of clay plasticity, shrinkage .Individual clay particles are always smaller than 0.004mm. Properties of clay include plasticity, shrinkage under firing and under air draying, fineness of grains, hardness, cohesion and capacity of the surface to take decoration. The following properties are determined in formal clay and salt pan clay such as specific gravity, moisture content, atterberg limits, maximum dry density, optimum moisture content, cohesion, angle of internal friction.

II. EASE OF USE

A. Index Properties

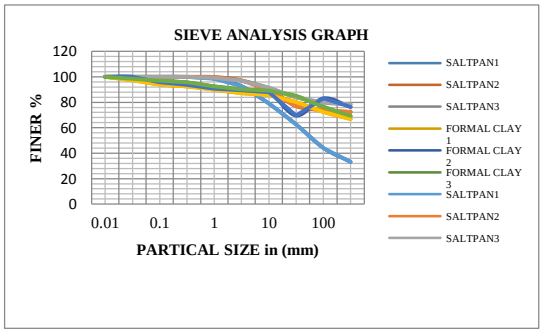
1) Specific Gravity: Specific gravity of soil grains is used in calculating void ratio, porosity and degree of saturation, by knowing moisture content and density. The value of specific gravity helps in identifying and classifying the soil type.

S.NO	SOIL SAMPLES	SPECIFIC GRAVITY	WATER CONTENT
1	FORMAL CLAY 1	1.97	73.3
2	FORMAL CLAY 2	2.1	72.2
3	FORMAL CLAY 3	2.2	72.3
4	SALT PAN CLAY 1	2.1	38.9
5	SALT PAN CLAY 2	1.02	32.3
6	SALT PAN CLAY 3	1.4	94.8

2) Grainsieve Analysis: Grain size analysis is used in the engineering classification of soil .Particularly coarse grained soils .Part of suitability criteria of soils for road, airfield,

levee, dam and other embankment construction is based on the grain size analysis .Information obtained from the grain size analysis can be used to predict soil water movement. Soils are broadly classified as coarse grained soils and fine grained soils. Further classification of coarse grained soils depends mainly on grain size distribution and the fine grained soils are further classified based on their plasticity properties . The grain size distribution of coarse grained soil is studied by conducting sieve analysis.

GRAIN SIZE	FINER %					
	Salt pan			Formal clay		
	Sample 1	Sample 2	Sample 3	Sample 1	Sample2	Sample3
				100		
				97.	100	
	100			32	100	
	100		100	93.	95.	
	100		100	98	72	
	99.8		100	92.	93.	
	6		100	46	82	
	98.5		99.	89.	90.	
	4		28	98	68	
20	92.6	100	96.	87.	89.	100
10	6	100	98	14	52	98.58
4.75	79.0	100	91.	85.	87.	97.04
2.36	2	100	34	66	98	95.6
1.18	62.6	99.84	83.	80.	69.	92.52
600	2	97.12	98	18	66	90.24
425	44.1	89.7	79.	72.	83.	89.06
300	2	77	84	42	04	84.96
150	33.1	73.78	78.	66.	76.	76.46
75	6	72.44	32	94	36	69.24



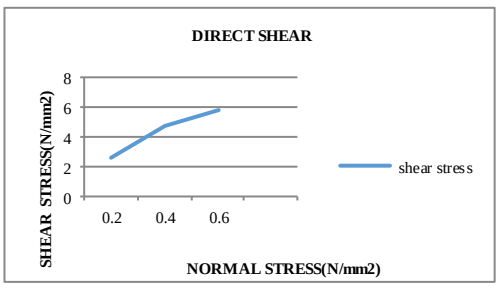
3) Atterberg Limits Of Soil: The values of liquid limit and plastic limit are directly used for classifying the fine grained soils. Once the soil is classified it helps in understanding the behaviour of soils and selecting the suitable method of design construction and maintenance of the structures made-up or and resting on soils.

ATTERBERG LIMITS	SALT PAN			FORMAL CLAY		
	SAMPLE1	SAMPLE 2	SAMPLE 3	SAMPLE 1	SAMPLE2	SAMPLE3
LIQUID LIMIT %	56	30	48	35	42	29
PLASTIC INDEX %	38.6	2.25	9.1	24.9	34.3	11
FLOW INDEX %	14.1	17.2	60	51.5	88	9.6
SHRINKAGE INDEX %	4.93	5.97	14.8	16.5	6.6	50.6

B. Engineering Properties

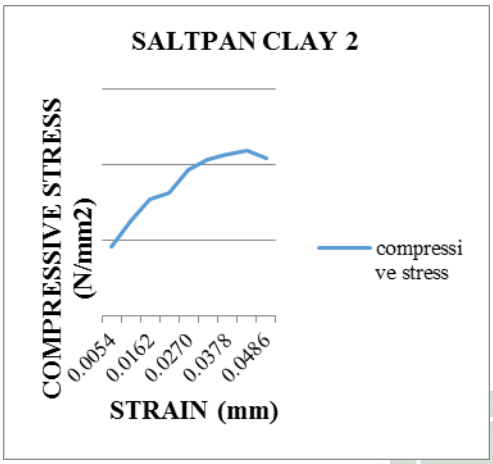
1) Direct Shear Test: Shear parameters are used in the design of earthen dams and embankments. The stability of the failure wedges depends on the shear resistance of the soil along the failure plane. The strength parameters C and φ are used in calculating the bearing capacity of soil foundation systems. Further shear parameters help in estimating the earth pressures behind the retaining walls.

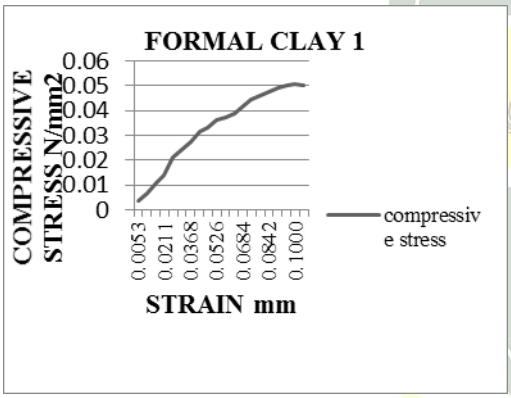
S.NO	NORMAL STRESS	SHEAR STRESS
1	0.2	2.639
2	0.4	4.722
3	0.6	5.806



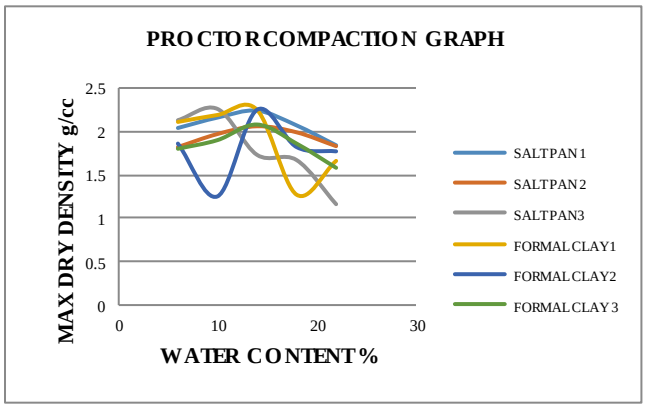
2) Unconfined Compressive Test: It is not always possible to conduct the bearing capacity test in field .Sometimes it is cheaper to the undistributed soil sample and test its strength

laboratory. Also to choose the best material for the embankment ,one has to conduct strength tests on the sample selected .Under the condition it is easy to perform the unconfined compressive test on distributed and remolded soil sample. Now we will investigate experimentally the strength of a given soil sample.





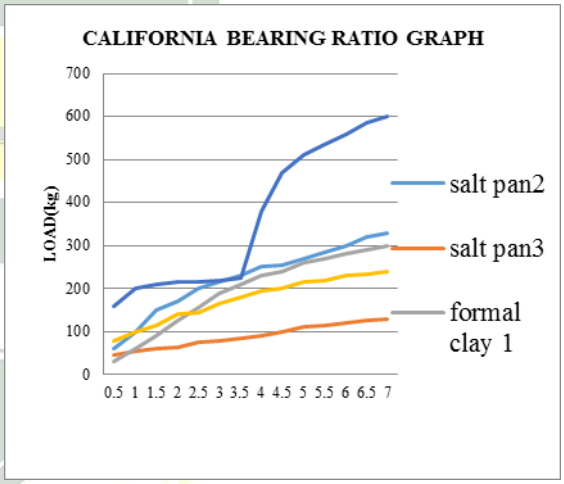
3) Standard Proctor Compacting Test: The degree of compaction of a soil is measured in terms of its dry density. The degree of compaction mainly depends upon its moisture content during compaction, compaction energy and the type of soil. For a given compaction energy , every soil attains the maximum dry density at a particular water content which is known as optimum moisture content (OMC).



		DRY DENSITY g/cc				
		TRAIL 1	TRAIL 2	TRAIL 3	TRAIL 4	TRAIL 5
w%		6	10	14	18	22
SALT PAN CLAY	1	2.04	2.16	2.24	2.07	1.84
	2	1.82	1.97	2.06	1.99	1.83
	3	2.13	2.26	1.73	1.67	1.16
FOR MAL CLAY	1	2.11	2.19	2.25	1.27	1.06
	2	1.86	1.95	2.25	1.82	1.77
	3	1.8	1.9	2.08	1.86	1.56

C. California Bearing Ratio Test

The California bearing ratio (CBR) is a penetration test for evaluation of the mechanical strength of natural ground, subgrades and base course beneath new carriage way construction. The CBR test is described in ASTM standards D188305 (for laboratory prepared samples. The CBR rating is developed for measuring the load bearing capacity of soils used for building works.

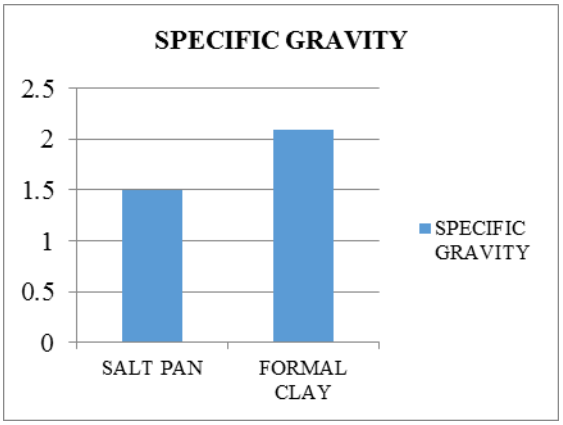


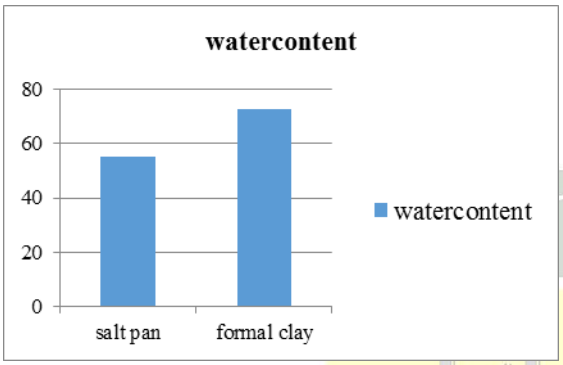
SAMPLE	CBR VALUE	
	FOR 2.5 PENETRATION	FOR 5.0 PENETRATION
SALT PAN2	0.145	0.138
SALT PAN3	0.05	0.05
FORMAL CLAY1	0.113	0.126
FORMAL CLAY2	0.105	0.107
FORMAL CLAY2	0.156	0.206

III. RESULT AND DISCUSSION

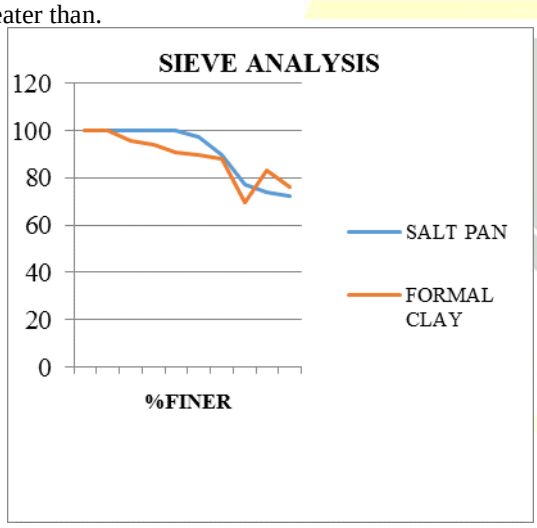
A. Index Properties

1) Pycnometr Method: The specific gravity results of formal clay are greater than salt pan.

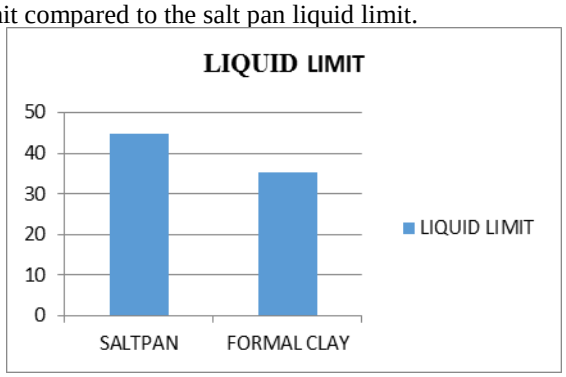




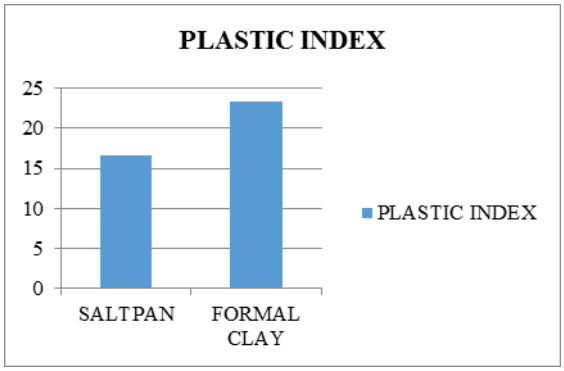
2) Sieve Analysis: The sieve analysis result of salt pan s greater than.



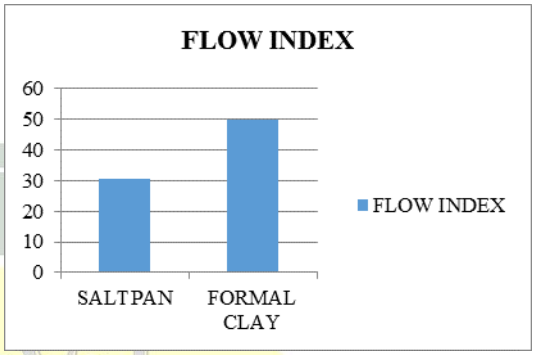
3) Atterberg Limits: The formal clay have lowest liquid limit compared to the salt pan liquid limit.



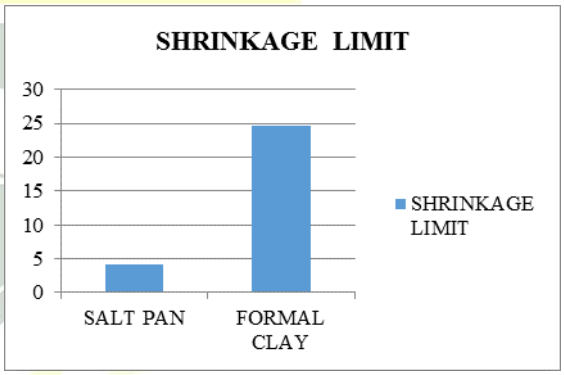
The formal clay have highest plastic index value compared to the salt pan.



The salt pan have lowest flow index compared to the formal clay flow index.

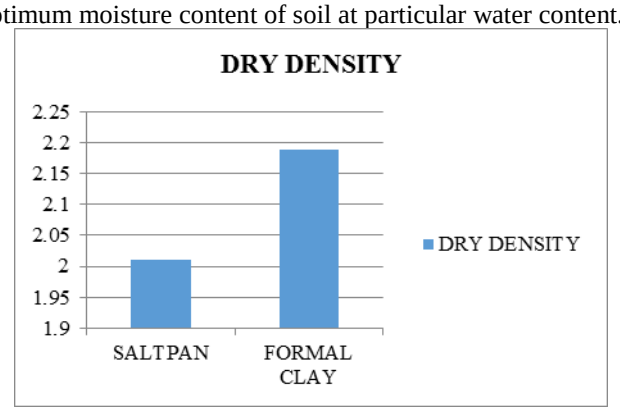


The shrinkage limit of salt pan very lower than formal clay.



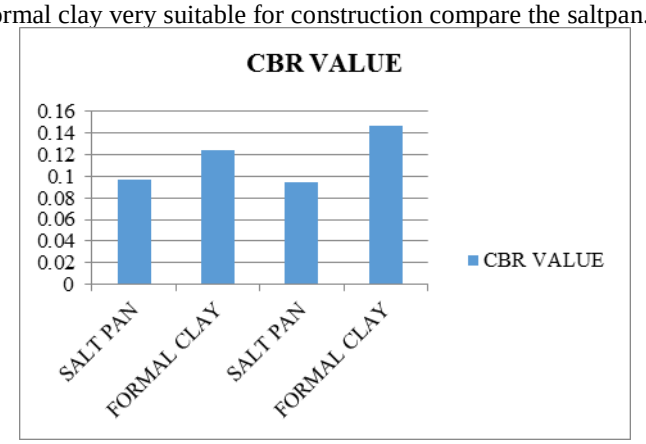
B. Engineering Properties

1) Standard Proctor Test: The formal clay has highest dry density value compare than the salt pan. In this result also give optimum moisture content of soil at particular water content.

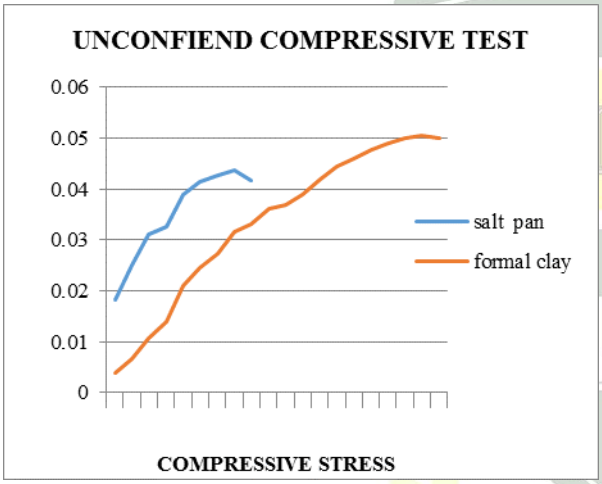


2) California Bearing Ratio Test: The CBR test is penetration test for evaluation of the mechanical strength of

natural ground and subgrade. CBR results formal clay has a higher mechanical strength compare than the salt pan. So formal clay very suitable for construction compare the saltpan.



3) Unconfined Compressive Test: Ucc test give the bearing capacity of soil. In this test results the formal clay having high bearing capacity compare than the salt pan.



CONCLUSION

The following conclusions are drawn based on the laboratory studies carried out on this study.

- The study explains about the knowledge about the salt pan clay and formal clay connection with engineering characteristics. It is noticed that the collected samples of salt pan clay is blackish in colour ,less sluggish, highly plastic and silty clay and formal clay is blackish in colour, less sluggish and highly plastic.
- It is observed that the specific gravity and water content were of formal clay values are high compared to salt pan clay.
- It is observed that the sieve analysis results are more are than equal. The salt pan sample one is high silty compared to other five samples.
- It is observed that liquid limit results are very high compared to the formal clay sample. The plastic index results of formal clay are very high compared to salt pan clay. The flow index of the formal clay is very high.
- It is observed from sieve analysis results the salt pan clay sample 1 is very silty due to this result the shear strength of sample is observed by direct shear test. The value is of shear strength1.2NM/mm2 and angle of internal friction is 88˚30′.
- It is observed the dry density and OMC of formal clay samples are very high compared to the salt pan clay samples.
- It is observed that the result of salt pan clay U.C.C is very high compared to formal clay samples.
- The result of formal clay samples of C.B.R for 2.5 and 5 penetration is high compared to salt pan clay samples.

In this paper concludes that the formal clay samples are good for construction work compared to salt pan clay sample.

REFERENCES

[1] Basack (2009)" Engineering properties of marine clays from the eastern coast of India".

[2] Bipul Sen (2014)" Index properties of soil collected from different locations and correlation of parameter".

[3] Zohib shalizad janjua (2016) "Correlation of CBR with index properties of soil".

[4] Vishal chandrasakar (2016) "Study of correlation of CBR value with engineering properties and index clay properties of coarse grained soil.

[5] Koteswaran Rao (2009)" Laboratory studies on the properties of stabilized marine clay from Kakinada sea coast, India".

[6] Saklecha P.P (2011) "Spatial correlation of mechanical properties of subgrade soil for foundation characterization".

[7] Dr. B.C punmia Text book "Soil mechanics and foundation engineering".