# Investigation of Geotech Specification of Sand Dunes Soil-A Case Study of Barmer Dist

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***Abstract:-*** **Soil background concentrations of heavy metals are important criterion for the assessment of soil environmental quality. The background concentrations of soil heavy metals, As, Cd, Cr, Cu, Ni, Pb and Zn, were investigated based on an extensive investigation conducted in the whole area of Beijing. About 120 soil samples taken from the area without pollution of heavy metals were selected from the total 803 soil samples. After analyzing the samples with strict quality assure and quality control (QA/QC) procedures, the heavy metal concentrations in the soils were calculated using statistical method. The revised background concentrations of the soils in Beijing are proposed to be 7.09 mg/kg for As, 0.119 mg/kg for Cd, 29.8 mg/kg for Cr, 18.7 mg/kg for Cu, 26.8 mg/kg for Ni, 24.6 mg/kg for Pb, 57.5 mg/kg for Zn, respectively. Compared with the concentrations suggested by China National Environmental Monitoring Center (CNEMC) in 1990, the Cd background concentration suggested in present study is about 125% higher than that of CNEMC, and the As, Cr, Cu, Zn concentrations are 19%-55% lower than those of CNEMC, while the concentrations of Pb and Ni are not obviously different from those of CNEMC. Soils have many different properties, including texture, structure or architecture, water holding capacity and pH (whether the soils are acid or alkaline). These properties combine to make soils useful for a wide range of purposes. Soil properties govern what types of plants grow in a soil or what particular crops grow in a region. Here are some of the main soil properties that are important several workers have investigated the nutrient status of soil as a factor which control the growth of plants and the composition in coastal sand dune system.**

***Keywords— CNEMC, concentrations, pH, composition***

## I. INTRODUCTION

Barmer is located in the western part of the state forming a part of the Thar Desert. The district borders, Jaisalmer district in the north, Jalore
district in the south, Pali district and Jodhpur district in the east, and Pakistan in the west.

The total area of the district is 28,387 square kilometres (10,960 sq mi).[1] The district is located between 24,58' to 26, 32'N Latitudes and 70, 05' to 72, 52' E Longitudes.

The longest river in the district is the Luni. It is 480 km in length and drain into the Gulf of Kutch passing through Jalore. The variation in temperature in various seasons is quite high. In summers the temperature soars to 46 °C to 51 °C. In winters it drops to 0 °C (41 °F). Primarily Barmer district is a desert where average rainfall in a year is 277 mm. However, extreme rainfall of 549 mm rain between 16 and 25 August 2006 left many dead and huge losses due to flood in a nearby town Kawas and whole town submerged. As many as twenty new lakes formed, with six covering an area of over 10 km².

Poorly planned and rapid urbanisation has increased Barmer's vulnerability to flash flooding. The local ecology and soil type is not equipped to deal with sudden or excessive water accumulation, which causes short- and long-term damage. Other areas suffer the gradual effects of 'invisible disasters', which also threaten the lives and livelihoods of the locals

A considerable part of western Rajasthan is covered with sand dunes mainly the west central trough. In general, most of the area of Bikaner, Jaisalmer, Barmer, Churu and Jodhpur etc. districts of Rajasthan covered by sand dunes., In the Rajasthan desert, there are two major and one minor zones of the sand dunes to the east of this zone another zone of medium to this high and very high dune run through Barmer, Churu, and Rajgarh. The third small dune zone into discontinuous patches passes through Sanchor, Siker, and Jhunjhunu. These three dune zone include the dune of different types and origin in the certain part of Rajasthan desert some investigation of sand dune have been carried pandey (1964), Singh (1977) in the present article an include made to discuss the origin and different types of sand dune in Barmer.

Study of soil properties is very important for any type of construction. As soil provide base layer for construction so behaviour of soil play a significant role in construction. In this study Barmer district is selected as there will huge construction in future due to development of petroleum refinery in that area.

In this project, find out the property of the sand dune soil as it is important to assess before any type of construction. In the Barmer district there are large amount of sand dune and that covered most of the area of district. A sand dune is a hill of sand built by both wind flow and water flow. Sand dunes occur in different forms and sizes, formed by interaction with the flow of air or water. Most kinds of sand dunes are longer on the windward side where the sand is pushed up the dune. In general there are several types of dune such as linear, star, barchans, parabolic.

## II. STUDY AREAS

In Barmer, the huge construction work will take place in future as government planned to establish petroleum refinery. Soil study will become very significant for future development in that area. As we know that most of the part of the Barmer is covered by sand dunes therefore it is very important to understand their behavior sand dunes and soil properties. Sandy soils have a wide range of limiting factors for agricultural production, which include nutrient deficiencies, acidity, low water holding capacity and on the dune sands, susceptibility to wind erosion. The soil physical and chemical properties of sandy soils are summarized in generally, sandy soils are strongly acidic but in particular cases of sandy marine soils that contain carbonate fragments, of Vietnam sandy soil may exceed 6.0. The Coarse texture of sandy soils together with low organic matter often leads to a low water holding capacity and high infiltration rate which represent major challenges for agriculture production .

As construction will take place at large scale and it will continuously progress next 8-10 years. Therefore it is very important to find out the property of the sand dune soil for construction and stabilization of sand dune soil as per requirement of construction.

*California Bearing Ratio (CBR)*

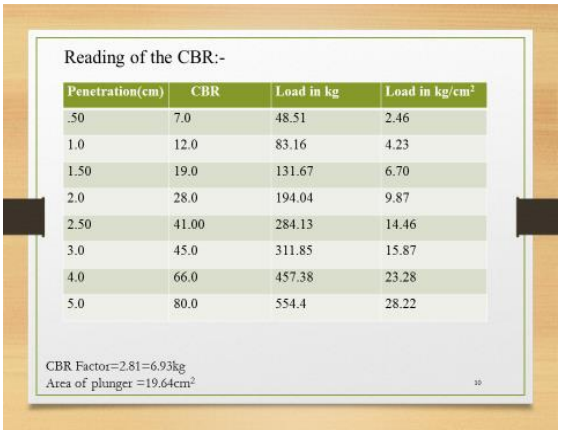
It is the ratio of force per unit area required to penetrate a soil mass with standard circular piston at the rate of 1.25 mm/min. to that required for the corresponding penetration of a standard material.

- The California bearing ratio test is penetration test meant for the evaluation of subgrade strength of roads and pavements.
- The results obtained by these tests are used with the empirical curves to determine the thickness of pavement and its component layers.
- This is the most widely used method for the design of flexible pavement for road.

- The CBR rating was developed for measuring the load-bearing capacity of soils used for building roads. The CBR can also be used for measuring the load-bearing capacity of unimproved airstrips or for soils under paved airstrips. The harder the surface, the higher the CBR rating. A CBR of 3 equates to tilled

farmland, a CBR of 4.75 equates to turf or moist clay, while moist sand may have a CBR of 10. High quality crushed rock has a CBR over 80. The standard material for this test is crushed California limestone which has a value of 100.

$$CBR = \frac{p}{p_s} \cdot 100$$


Reading of the CBR:-

| Penetration(cm) | CBR | Load in kg | Load in kg/cm² |
|---|---|---|---|
| .50 | 7.0 | 48.51 | 2.46 |
| 1.0 | 12.0 | 83.16 | 4.23 |
| 1.50 | 19.0 | 131.67 | 6.70 |
| 2.0 | 28.0 | 194.04 | 9.87 |
| 2.50 | 41.00 | 284.13 | 14.46 |
| 3.0 | 45.0 | 311.85 | 15.87 |
| 4.0 | 66.0 | 457.38 | 23.28 |
| 5.0 | 80.0 | 554.4 | 28.22 |

CBR Factor=2.81=6.93kg
Area of plunger =19.64cm²

Figure-1 California Bearing Ratio (CBR)

*Penetration Test*

The standard penetration test (SPT) is an in-situ dynamic penetration test designed to provide information on the geotechnical engineering properties of soil. The main purpose of the test is to provide an indication of the relative density of granular deposits, such as sands and gravels from which it is virtually impossible to obtain
undisturbed samples. The great merit of the test and the main reason for its widespread use is that it is simple and inexpensive. The soil strength parameters which can be inferred are approximate, but may give a useful guide in ground conditions where it may not be possible to obtain borehole samples of adequate quality like gravels, sands, silts, clay containing sand or gravel and weak rock. The model standard penetration tests were performed in a steel tank,0.85m in diameter and 1.30m deep. The sand was deposited in dry state at various densities and was tested under over burden pressure of 0, 20, 40, 60, 80, kPa. The overburden pressure was applied through a system of loaded springs and plates. Experimentally obtained average curves for dunes sand correlating the no. of blows for overburden pressure in the SPT and the density index are shown in fig. 2.for the overburden pressure from 0 to100 kPa. This is in the maximum value of the pressure used in the tests.

## III. SUGGESTED REMEDIES FOR SWELLING SOIL

The swelling soil causes due to its expansive nature with water cracks are formed in buildings,
canal lining etc. various suggestions to overcome the problem is as under: Provide CNS layer. Detailed study of CNS depth, layer thickness properties of CNS are carried out and published by Dr. Katti (1972, 1979). It is a great problem now a day to locate the CNS material at nearby site and hence it is very costly some times to transport the natural CNS material. Some percentage of clay, sand and the existing swelling soil may be used as CNS material. Provide under-reamed piled foundation. Provide slotted footing so that this may reduce the swelling pressure. Addition of gypsum will reduce the swelling pressure. Limit the foundation depth if swelling soil is at some depth so that distance between foundation and swelling soil will be more and as the distance is more there are less chances

of cracks in building. Take effective measures to maintain moisture equilibrium in foundation soil. Add dune sand in the existing swelling soil.

## IV. CONCLUSIONS

Swelling soils are present in various parts of Rajasthan. Swelling pressures, liquid limit plastic limit, shrinkage limit etc. are different at each site and there is no correlation of properties of each site. Swelling pressure increases with increase in dry density and decreases with increase in molding water content. Swelling pressure also decreases due to addition of gypsum and dune sand. Various remedial measures are presented in the paper to overcome the problem of swelling pressure.

## V. REFERENCES

[1] Chan R.H. (1975)"Foundation on Expansive Soil,"2ndedition. Elsevier Scientific Publishing Company, New York.
[2] 2.Chen, F.H. (1988) "The Basic Physical Properties of Expansive Soils", Proc. 3`d Int. Conf. on Expansive Soils, Haifa, Israel.
[3] Jones, D.E J., and Holtz, W.G. (1973) "Expansive Soils –The hidden Disaster, "Civil Engineering, Vol.43, Nov. 8.
[4] Katti, R.K. (1972)"Mechanics of Swelling Soil Media –A Discrete Practical Approach" Keynote address symposium on strength and deformation behavior of soil, Indian Geotechnical Society, Mysore Centre, Bangalore.
[5] Katti, R.K. (1979) "Search for Solutions to Problems in Black Cotton Soils". Indian Geotechnical Journal, LG.S. Vol.9, No. 1
[6] Mathur,A.K. (1995) "Study of Gypsum on the Swelling Pressure Characteristics of Bentonite,"M.E. Thesis, J. N.V. University, Jodhpur
[7] Panday,R.K. (1997)"A Study of Effect of Addition of Dune Sand on the Swelling Characteristics of expansive clay,"M.E. Thesis, J. N. V. University, Jodhpur.