International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 6 606 – 610

A Study of Swelling Pressure of Soil along Left Bank Canal of BARGI Dam

Rohit Kumar Singh
M.E.(Geotech) Scholar,
Jabalpur Engineering College,Gokalpur,Jabalpur(M.P.)
Email Id:-
singhrohitkumar1989@gmail.com

Rakesh Grover
Associate Prof.,Dept. Of Civil Engineering
Jabalpur Engineering College,Gokalpur,Jabalpur(M.P.)
Email Id:-
rakesh.grover11@gmail.com

A.K. Singhai
Associate Prof. Dept. of Civil Engineering,
Jabalpur Engineering College,Gokalpur, Jabalpur, India
Email id:-
aksgec@gmail.com

Abstract: **-**An expansive soil attracts and accumulates water a pressure known as swelling or expansion pressure builds up in the soil and it is exerted on the overlying materials and structures if they are any. On the other hand, tests to determine index properties are quite simple and less expensive. A correlation for the quick analysis of swell pressure of soil from the graph generated between different soil engineering parameters such as (OMC, MDD, PI, ACTIVITY OF SOIL and RL) and SWELLING PRESSURE[1](inKPa). In this study, an attempt is made to correlate swell pressure with reduced depth of the location along the left bank canal.

Keywords:-*Swelling Pressure[1], Plasticity Index[2],Activity[3]*

*****

I. INTRODUCTION

As canals are having increase in demands for land. Due to this we need to study and analyze the soil engineering parameters on which dams are going to be constructed. We have to check for unsuitable grounds such as soft and expansive soils before any start of a civil project. The swelling pressure of an expansive soil is not a unique property but is influenced by a number of factors such as initial density and water content, a method of compaction, soil structure, availability of water, electrolyte concentration in the water, confining surcharge and specimen size. The higher the initial dry density the greater is the swelling pressure. The drier the soil before the start of expansion the higher will be swelling pressure. Swelling Pressure is necessary for estimation of heave and for safe and economic design of Canal linings. The objective of this study is to assess the degree of association between Swelling Pressure and each of the influencing parameters namely Liquid limit (LL), Plasticity Index (PI) and Maximum Dry Density (MDD), Optimum moisture content (OMC). The basic fact that both Atterberg limits and Engineering properties are dependent upon composition of the soil. The study area is soil of left bank canal of Bargi dam. Test reports data collected from Q/C office of Rani Avanti Bai Lodhi Sagar Pariyojana Bargi Hills, Jabalpur are analyzed for its grain size distribution, Atterberg's limit, Standard Proctor Compaction, swelling pressure can bedetermined by using one-consolidometer test.

II. METHODOLOGY

The relationship between the index properties and swelling characteristic of expansive soils is examined. The earlier studies showed that an increase in dry density and plasticity index of the soil cause an increase in swell pressure, while a decrease in natural moisture content cause an increase in swell pressure. The process of swelling and shrinking is a cyclic behavior and continues for many years. Thus, when the expansive soils are present behind hydraulic structures, traditional lateral earth pressures cannot be used to estimate total pressures acting on the retaining structure. In this study, a new proposed method developed to predict potential swell pressures and to use in the design of canals. A parametric study performed to study the effect of swell pressures on the canals constructed on expansive soils. The parametric study results show that based on the soil propertiesthe expansive soils can significantly affect the design of hydraulic structures. More importantly, ignoring the effect of expansive soils on retaining walls would result in under design and unsafe structures. In addition, it was comparing between the proposed swell pressure method and the constant swell pressure method, the different between those methods, the previous method (constant swell pressure method) did not consider the changing in plasticity index and the moisture content. On the other hand, the proposed method takes in the account the changing in each of plasticity index and the moisture content that play important roles in the swell pressure.So in order to know the swelling pressure (KPa) of the soil adjacent to the L.B.C. of Rani Avanti Bai Lodhi Sagar Pariyojana we need know about various soil parameters and procedure i.e., going to be used.

The various soil parameters used to set relation with swelling pressure are been explained below:

[1] OMC: The Optimum Moisture Content (OMC) is themoisture content that leads to the maximum soil density under the particular test conditions. It is a function of the soil type, and may be determined by the Modified or Standard Proctor density tests.

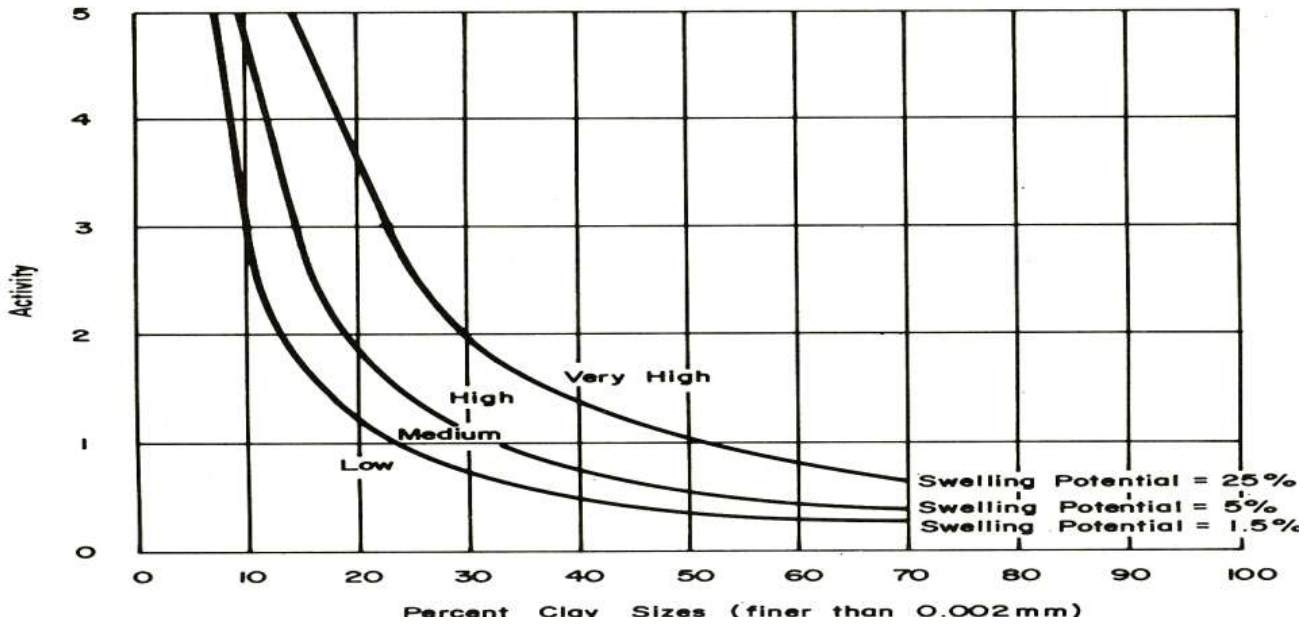
[2] PI: The plasticity index (PI) is a measure of the plasticity of a soil. The plasticity **index** is the size of the range of water contents where the soil exhibits plastic properties. The PI is the difference between the liquid limit and the plastic limit (PI = LL-PL).

Classification	Plasticity index (%)	Liquid limit (%)
Non-expansive	0-6	0-25
Low	< 25	25-50
Marginal	25-35	50-60
High	> 35	> 60

LL : The liquid limit is the water content at which a soil is practically in liquid state but has infinitesimal resistance against flow which can be measured by any standardized procedure. With reference to one such standard procedure the liquid limit is defined as the water content at which a groove cut in a pat of soil by a grooving tool of standard dimensions will flow together for a distance of13 mm under the impact of 25 blows in a standard liquid limit device.

[3]MDD: The Proctor compaction test is a laboratory method of experimentally determining the optimal moisture content at which a given soil type will become most dense and achieve its maximum dry density.

[4]ACTIVITY: The amount of retained water or state of water in soil mass depends upon available clay mineral in soil. Activity of a soil assesses capacity of soil to hold water. Obviously this term is applicable for clayey soil.



$$\text{Activity} = \frac{P.I}{C-10}$$

Where
P.I = plasticity index (%)
C = the percentage clay size finer than 0.002 mm

[5] RL: TheReduced Level in surveying refers to equating elevations of survey points with reference to a common assumed datum. It is a vertical distance between survey point and adopted datum plane. Thus it is considered as the base elevation which is used as reference to reckon heights or depths of other important places.

III. RESULT

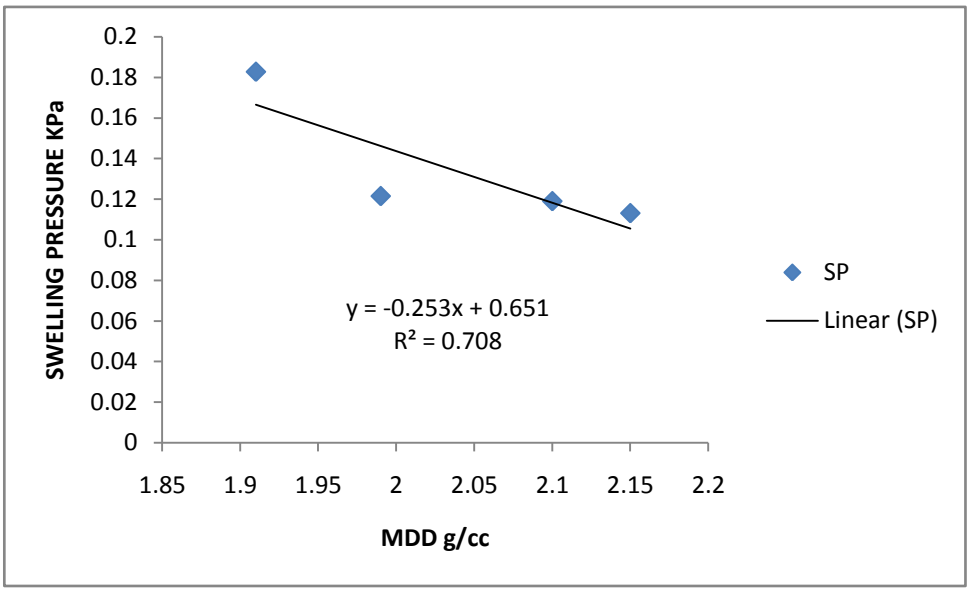
Relations and equationsbetweenswelling pressure and various soil engineering properties (such as RL,MDD,ACTIVITY,P.I. and OMC).

In the first step we set up a relationshipbetween swelling pressures (Kpa) vs reduced level (KM).

Equation generated is given as

$y = 0.0203x-7.7195$, where y = swelling pressure

$R^2=0.1624$ R^2= coefficient of correlation



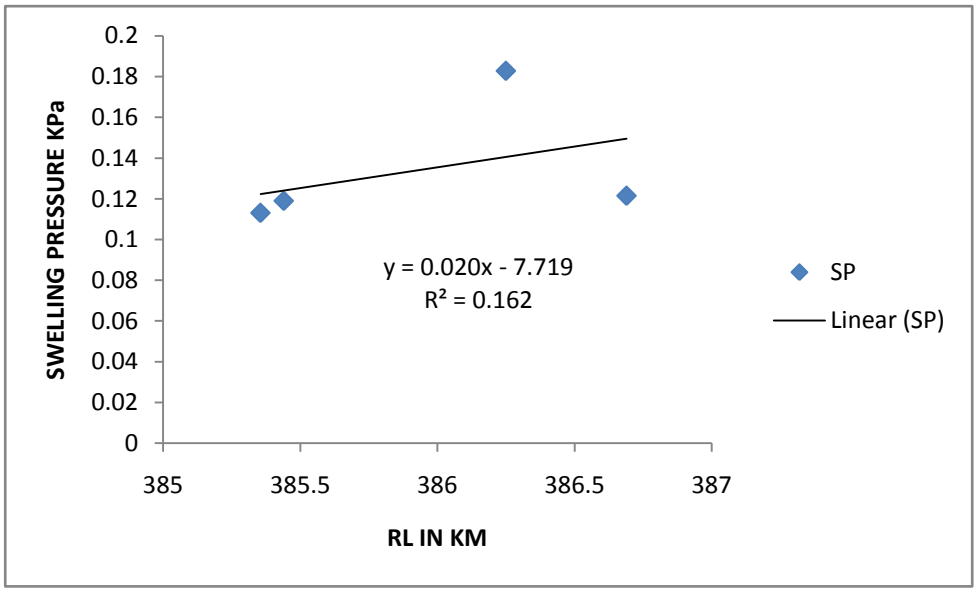
In the above equation we can get thedifferent values of y i.e., swelling pressure in Kpa by for different values of x.

In the second step we will set up relationship between swelling pressure and maximum dry density(g/cc).

Equation generated is given as

$y=-0.2539x+0.6513$ where y= swelling pressure

$R^2=0.7087$ R^2=coefficient of correlation



From the above equation we can find different values of swelling pressure for different values of x.

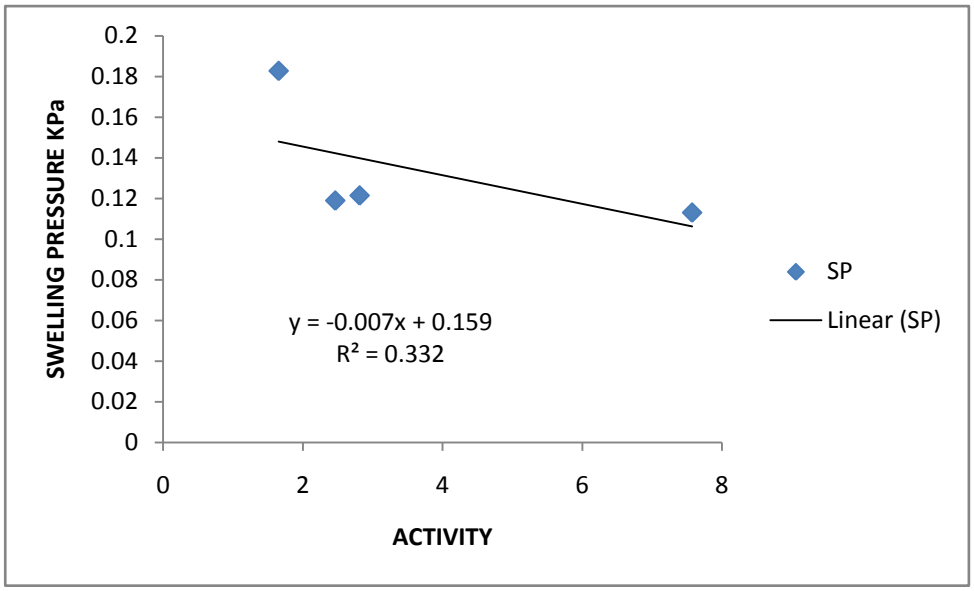
In the third step we will set up a relationship between swellingpressure vs activity of soil.

Equation generated is given as

$y= -0.007x+0.1595$ where y= swelling pressure

 ISSN: 2321-8169
606 – 610

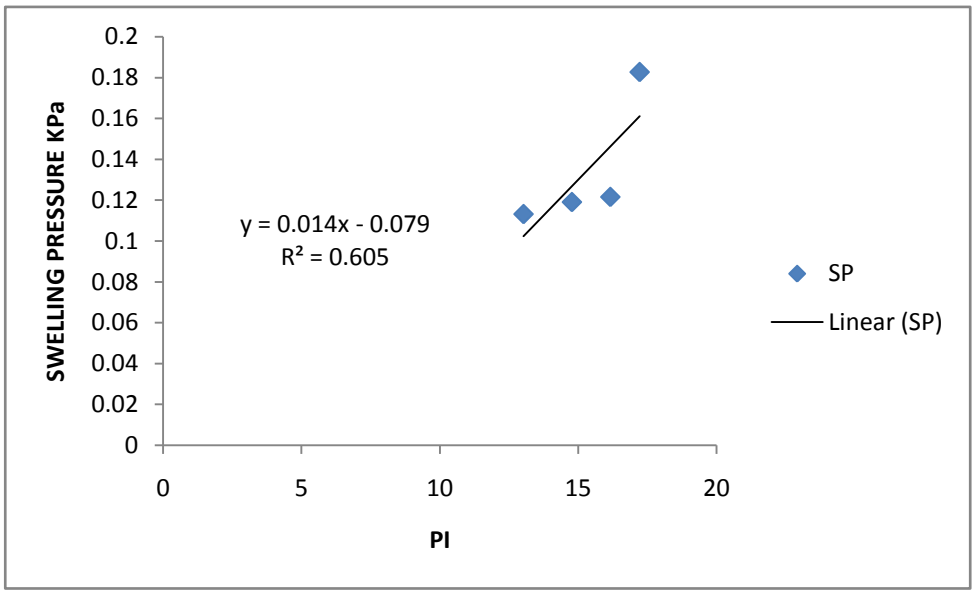
R^2=0.3326 R^2=coefficient of correlation



From the above relationship we can find different values of swelling pressure for different values of x.
We can also comment that as the plasticity index increases swelling pressure increases.

In the fourth step we will set up a relationship between swelling pressure vs plasticity index.
Equation generated is given as

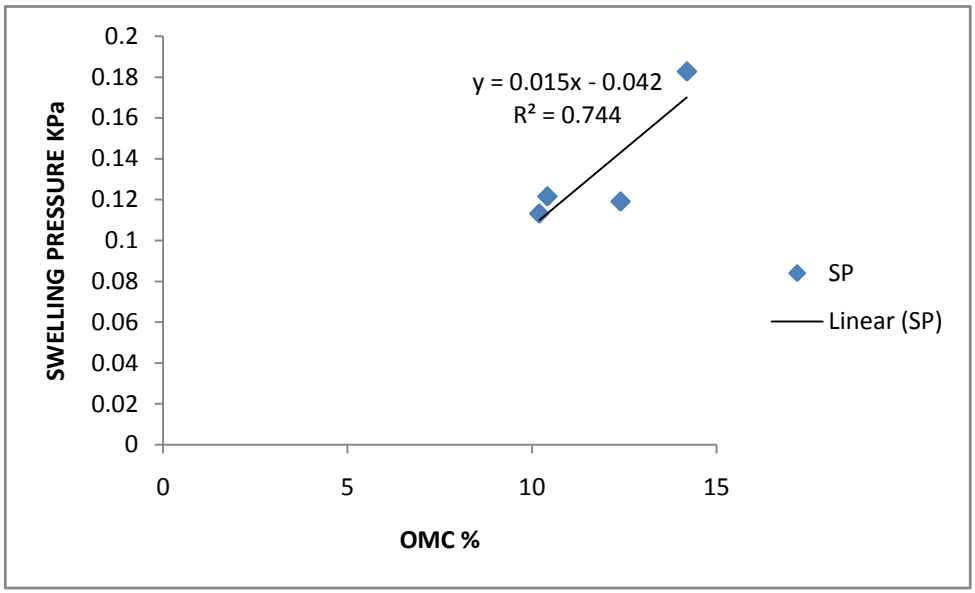
y=0.014x-0.0797 where y= swelling pressure
R^2=0.6059 R^2=coefficient of correlation



From the above equation we can find different values of swelling pressure for different values of x.
We can also comment that as the plasticity index increases swelling pressure increases.

In the fifth step we will set up a relationship between swelling pressure andoptimum moisture content.
Equation is given as

y=0.015x-0.0428 where y= swelling pressure
R^2=0.7448 R^2=coefficient of correlation



From the above equation we get different values of swelling pressure for different values of x.

We can also say that as omc increases swelling pressure also increases.

IV. CONCLUSION

The above relationships between SWELLING PRESSURE vs various soil engineering properties (such as RL,MDD,PI,ACTIVITY and OMC). It will help us to find out the swelling pressure against various values of x .Equations are generated for different values of y with help of graphs and coefficient of correlation i.e., R^2 is also generated. Above relation will be used to calculate swelling pressure along L.B.C. of Rani AvantiBai Lodhi Sagar Pariyojana. Graphsshowing the variation of swelling pressure with respect to various soil engineering properties.

REFRENCES

[1] Chen, F. H; 1975. Foundation on swelling soils, Development on Geotechnical Engineering Elsevier Scientific Co, Amsterdam, 150-158.

[2] Das Braja Mohan; Principles of Geotechnical Engineering: 7edition: Cengage Learning Publishers.

[3] Ene and Okagbuea; 2009. Some basic geotechnical properties of expansive soil modified using pyroclastic dust, Engineering Geology Journal, 107, 61-65.

[4] Ferber, V., Auriol, J.C., Cui, Y. J. and Magnan, J. P; 2009. On the swelling potential of compacted high plasticity clays, Engineering Geology Journal, 104-3, 200–210.

[5] Holtz, W. G. and Gibbs, H. J; 1956. Engineering properties of swelling clays, Transaction ASCE, 121, 641–677.

[6] Huang and Wu; 2007. Stability analysis of unsaturated expansive soil slope, Earth ScienceFrontiers 14-6, 129–133.

[7] Murthy V.N.S.; Soil Mechanics and Foundation Engineering: CBS Publication.

[8] Okagbue; 1990. Expansive soils in Engineering Construction: a review of practices, Mining andGeology Journal, 2, 123–129.

[9] Punmia B.C.; Soil Mechanics and Fondation Engineering: Laxmi Publications.

[10] Sridharan, A., Gurtug, Y; 2003. Swelling behaviour of compacted fine-grained soils, Engineering Geology Journal, 72, 9-18.

[11] Shi, B., Jiang, H., Liu, Z., and Fang, H.Y; 2002.Engineering and geological characteristics of swelling soils in China, Engineering Geology Journal, Volume 67, 63–71.

[12] Singh Alam; Modern Geotechnical Engineering: 3rd edition: CBS Publication.

[13] Singh Alam; Soil Engineering:Theory & Practice vol1:Fundamental and General Principles,4e:CBS Publication.

[14] Xu, Yongfu. "Bearing Capacity of Unsaturated Expansive Soils". Geotechnical and Geological Engineering 22:611-625, (2004).