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A Study Of Swelling Pressure Of Soil Along Right Bank Canal Of Bargi Dam

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Abstract-When 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 PRESSURE² (in KPa). In this study, an attempt is made to correlate swell pressure with reduced depth of the location along the left bank canal.

KEYWORDS-SWELLING PRESSURE¹ , EXPANSIVE² , CORRELATION³

I. INTRODUCTION

As dams and reservoirs 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 on 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 is determined 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 retaining walls, 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 retaining walls. A parametric study performed to study the effect of swell pressures on the design of anchored sheet pile walls constructed in expansive soils. The parametric study results show that, based on the soil properties and wall geometry, the expansive soils can significantly affect the design of retaining 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 difference 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 R.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 the moisture content that leads to the maximum soil density under the

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particular test conditions. It is a function of the soil type, and may be determined by the Modified or Standard Proctor density tests.

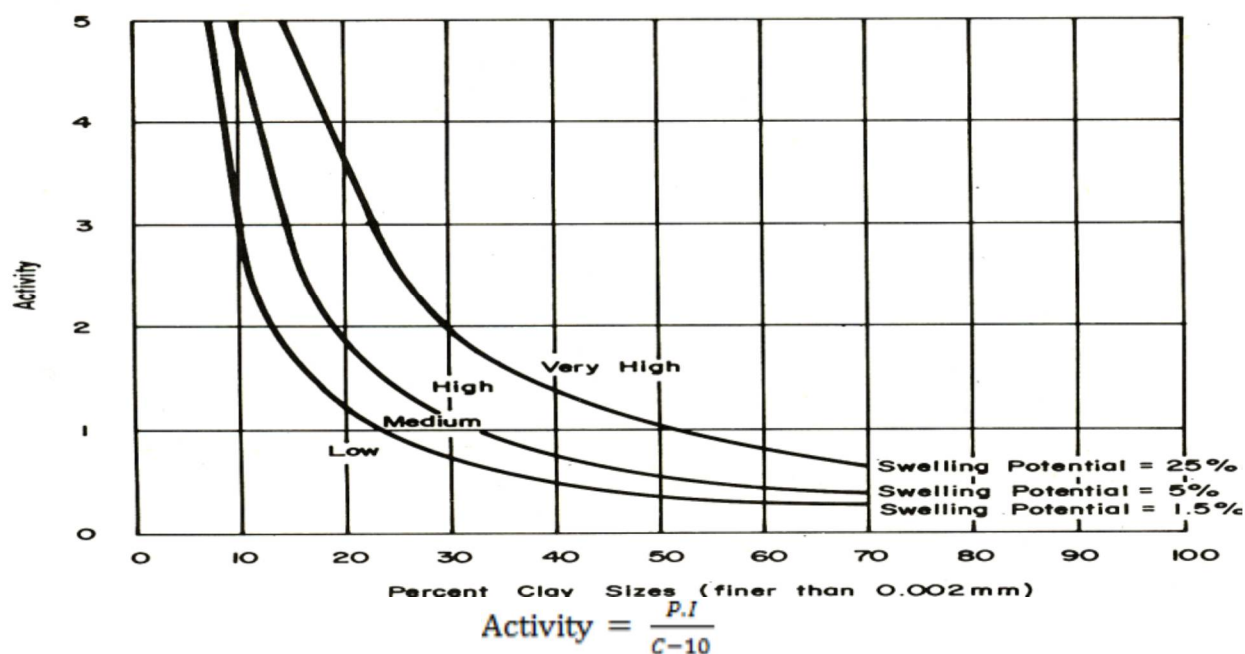
[2] **PI** : The plasticity index (PI) is a measure of the plasticity of a soil. The plasticity **index** is the size of the range of water contents where the soil exhibits plastic properties. The PI is the difference between the liquid limit and the plastic limit ($PI = LL - PL$).

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 of 13 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.



where

P.I = plasticity index (%)

C = the percentage clay size finer than 0.002 mm

[5] **RL** : The Reduced 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.

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III. RESULT

The relationships and equations with different soil parameters(OMC , PI , MDD , ACTIVITY & RL).

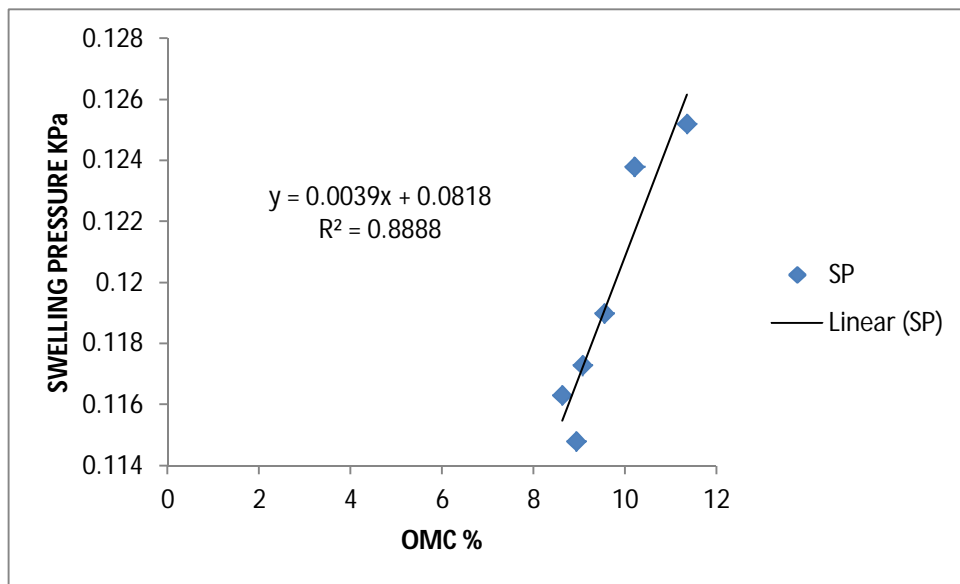
In the first step a relationship between swelling pressure and optimum moisture content.

The equation generated is

$$y = 0.0039x + 0.0818$$

$$R^2 = 0.8888$$

where y=swelling pressure(KPa)
& R^2 =coefficient of correlation³



In the above equation we can get different values of y (swelling pressure) for different values of x.

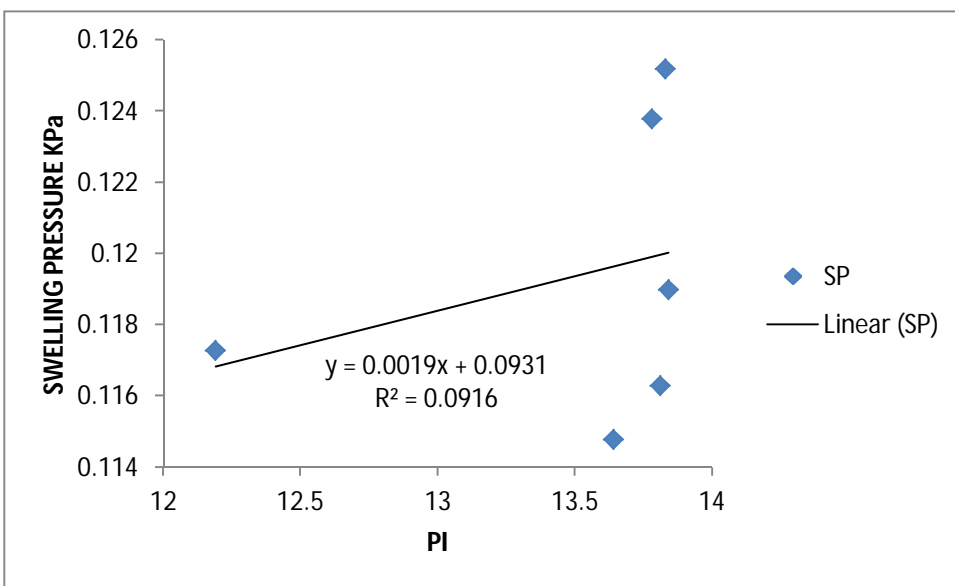
In the second step we will set up a relationship between swelling pressure(KPa) and plasticity index.

The equation is given as

$$y = 0.0019x + 0.0931$$

$$R^2 = 0.0916$$

where y=swelling pressure KPa.
 R^2 =coefficient of correlation.



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

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

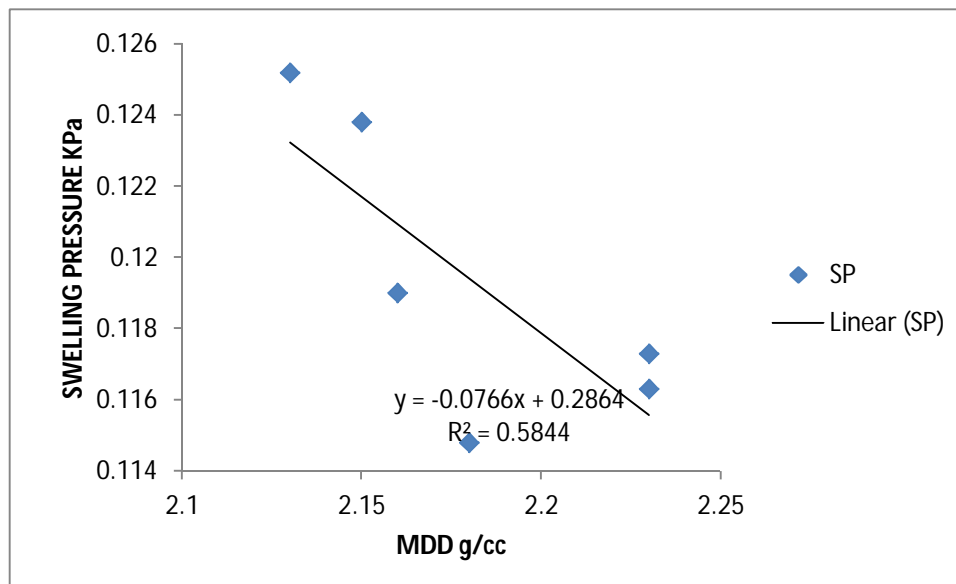
The equation is given as

$$y = -0.0766x + 0.2864$$

$$R^2 = 0.5844$$

where y=swelling pressure KPa.

R²=coefficient of correlation.



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

In the fourth step we will set up a relationship between swelling pressure (KPa) and activity.

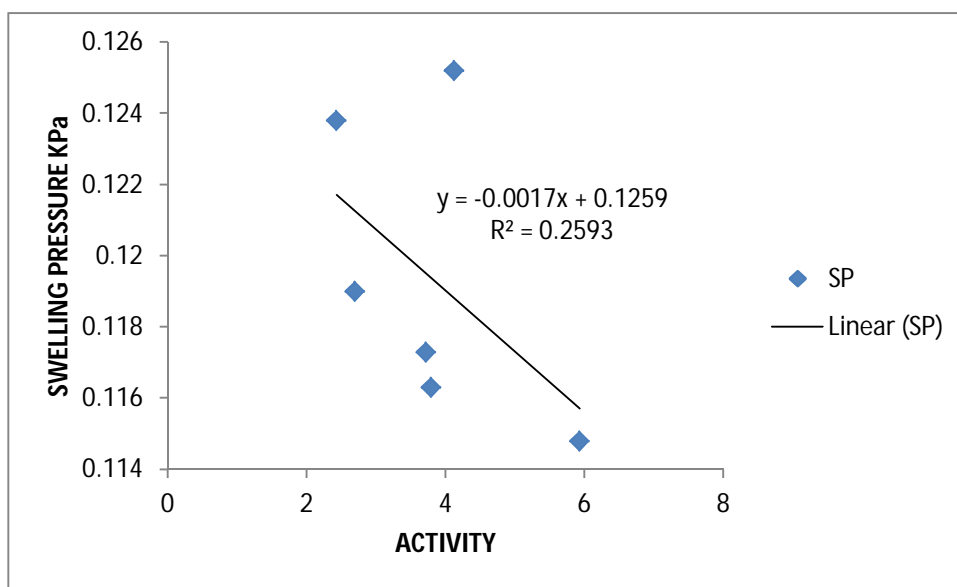
The equation is given as

$$y = -0.0017x + 0.1259$$

$$R^2 = 0.2593$$

where y=swelling pressure KPa.

R²=coefficient of correlation.



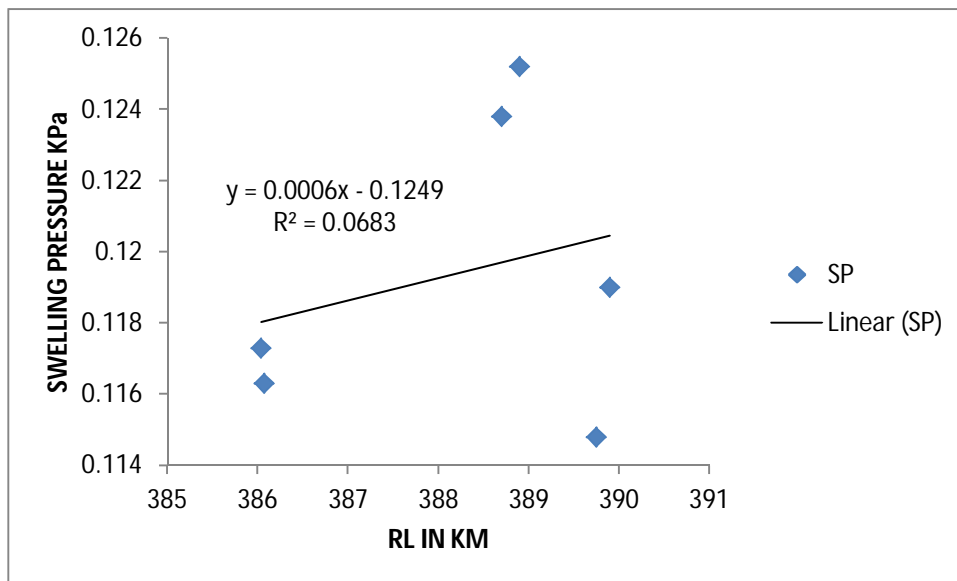
In the above equation we can get different values of y i.e., swelling pressure for different values of x.

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In the fifth step we will set up a relationship between swelling pressure (KPa) and reduced level(KM).
The equation is given as

$$y = 0.0006x - 0.1249$$
$$R^2 = 0.0683$$

where y = swelling pressure.
 R^2 = coefficient of correlation.



In the equation we can get different values of y i.e., swelling pressure for different values of x .

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 R.B.C. of Rani Avanti Bai Lodhi Sagar Pariyojana. Graphs also showing the variation of swelling pressure with respect to various soil engineering properties.

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