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Study on the effect of fly ash with the expansive soil on different temperatures

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ABSTRACT

Soils which exhibit more volume changes due to variations in moisture contents are defined as expansive soils. These soils exhibit large amount of swell and shrinkage movements due to environmental and seasonal moisture changes. The objective of this research is to gain an understanding of the possible mechanisms responsible for aging effects in the soil in various temperature conditions. In this study an attempt is made to determine the index properties of soil which is been collected from three different places. The effect of temperature on the expansive soil with adding optimum of 12% of fly ash is been executed with different tests to determine their engineering properties. The index properties like liquid limit, plastic limit, shrinkage limit and specific gravity of the problematic soils and the compaction characteristics and unconfined compressive strength and the optimum percentage of the soils without addition of wastes. This study is done to determine the improvement of the shear strength of the soils, to determine the optimum percentage of fly ash in improving the properties of problematic soil, to reduce the swelling potential of the soils. It can be concluded as the temperature increases the atterberg's limit of the soil sample deceases. The various other properties also changes as the temperature increases, with the addition of optimum of 12% of flyash improves the bearing capacity of the expansive soil.

KEY WORDS: Expansive soil, Flyash, Temperature

1. INTRODUCTION

Soils in which exhibit low shear strength, low bearing capacity, high swelling nature, more settlement and having more moisture content potential are termed as expansive soils. The clay content in the soil specimen is more in these kind of soil and silt content is less when compare to the clay content in them. The properties of a natural clay with various percentage of flyash and with that soil samples the test are performed with the mix of blended soil and flyash. Soil samples which are collected and adding 12% of fly in the sample are tested by the following experiments. Liquid Limit test, Plastic Limit test, Shrinkage Limit test, Specific Gravity test, Sieve analysis test, Optimum moisture content test, unconfined compression test, Free Swelling Index.

Bunvaneshwari (2001), has stated that the test carried out with different proportion of fly ash indicates that the workability is high with 25% fly ash and also the dry density observed is high as 25%. The natural soil used for construction shall be dried with moisture content below 7%. Sharma (2004) has observed that the free swelling index of the soil is sates that the ash blended expansive soil with fly ash contents of 0, 5, 10, 15 and 20% on a dry weight basis and they inferred that increase in fly ash content reduces plasticity characteristics and the FSI was reduced by about 50% by the addition of 20% fly ash.

Soil samples: In this study three different soil which is been collected from three different places at various depth. With the collected soil sample wet sieve analysis was done to determine is finer proportion so that the types of the soil can be determined.

Soil-1	Soil -2	Soil -3
Sriperumbudur	Anna nagar, Chennai	Koyambedu, Chennai

The soil samples collected from all the three places are expansive soil in which it is having a liquid limit minimum of 53% and maximum of 72% without addition of the flyash. The flyash used in this study having a high calcium Fly ash in stabilizing fine-grained clayey soils (CL, CH) was investigated in the laboratory. Strength tests in compression, in indirect tension and flexure were carried out on samples to 12 percentage of fly ash and cement had been added.

2. METHODOLOGY

The collected soil samples is been tested with various experiments. To determine the effects of various temperature in the soil samples. The experiments are done in the soil in the virgin soil and then in the heating the sample at a temperature of 100^{o}, 150^{o}, 200^{o}, 250^{o}. The engineering properties of soils are generally measured in the laboratory at the room temperature however seasonal changes modify the thermal environment of the soil in field and therefore a concern as to the type and degree of the soil of influence of the temperature change on the engineering properties of the soils is justifiably expressed in an attempt to assess this influence, laboratory studies were conducted on three clay soils. The standard laboratory tests specimens of soil compacted at their maximum dry density and optimum moisture content and necessity to evaluate very fundamental properties of liquid limit, plastic limit,

unconfined compressive strength and swelling potential consider in three sample of soil and observed in various temperature.

Tests performed on the soil sample collected (Soil 1, Soil 2, Soil 3)							
Liquid Limit	Plastic Limit	Shrinkage Limit	Specific Gravity	Optimum moisture content	Maximum dry density	Unconfined Compression Test	Free swelling index

3. RESULTS AND DISCUSSION

The liquid limit of the soil sample collected from three different places are been derived with a graphical representation show an increase in temperature and the liquid limit of soils as shown in fig.1.

All the soils show decrease in liquid limit as the temperature increases from 0ºC to 250ºC. Soil 2 shows a decrease of maximum liquid limit (11%) when the soil is subjected to temperature variation of 0ºc to 250ºC. Decrease in liquid limit of the soils due to increase in temperature is an improvement in the property of the soil.

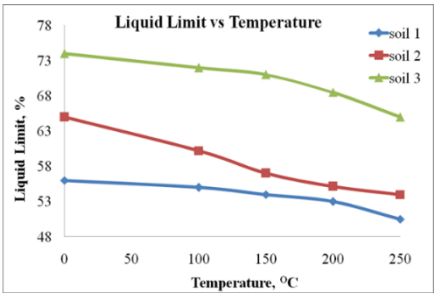

Figure.1. Liquid limit of three different soil sample from the temperature variation of 0 to 250º c

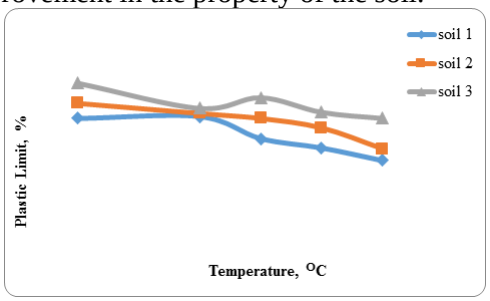

Figure.2. Plastic limit of three different soil sample from the temperature variation of 0 to 250º c

Fig. 2 terms the effect of the different temperature variation (from 0ºc to 250ºc) on the expansive soil which is collected from three different places. From the graph it can be stated that the soil three i.e. soil sample collected from Koyembedu shows an increase in the plastic limit when comparing to the soil1 and soil 2. As the temperature increases the index properties of the soil sample varies.

The Plasticity Index of the soil sample is determined by the difference between the Liquid Limit and Plastic Limit of the soil. The plasticity of the three sample shows a decrease in their properties as the temperature variation is more. Plasticity of the soil 1 shows a drastic decrease as the temperature increases. In the case of soil 2 terms an increment in the plasticity as the temperature increases. Fig 3 refers the soil 3 show an increment in the plasticity index when comparing with the other two soil sample.

The shrinkage limit of the soil sample collected from three different places are been derived with a graphical representation show an increase in temperature and the shrinkage limit of soils as shown in fig 4. All the soils show decrease in liquid limit as the temperature increases from 0ºC to 250ºC. Soil 2 shows a decrease of maximum Shrinkage limit (5%) when the soil is subjected to temperature variation of 0ºc to 250ºC. Decrease in shrinking limit of the soils due to increase in temperature is an improvement in the property of the soil.

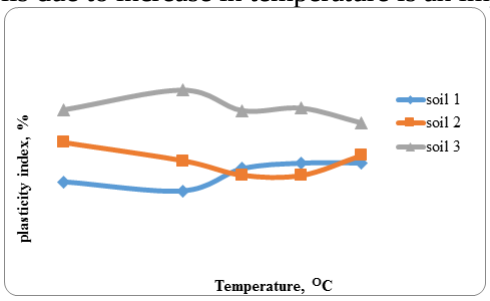

Figure.3.Plasticity index of three different soil sample from the temperature variation of 0 to 250o c

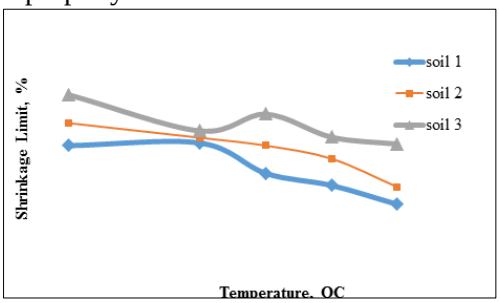

Figure.4.Shrinkage limit of three different soil sample from the temperature variation of 0 to 250o c

Fig.5, shows the effect of the different temperature variation (from 0ºc to 250ºc) on the expansive soil which is collected from three different places. From the graph it can be stated that the optimum moisture content of the soil sample shows a variation in there moisture content from two to three percentage from the soil three i.e. soil sample collected from koyembedu shows an increase in the plastic limit when comparing to the soil1 and soil 2.

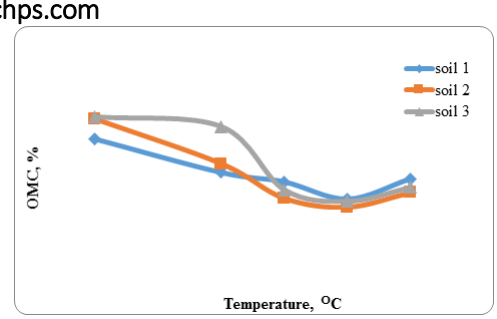

Figure.5.Optimum Moisture Content of three different soil sample from the temperature variation of 0 to 250o c

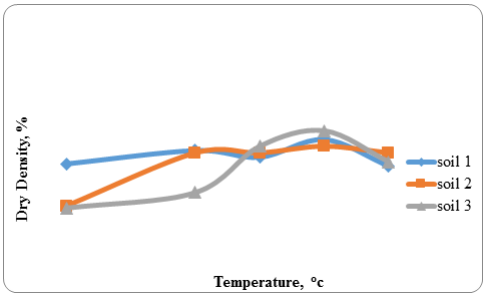

Figure.6.Max Dry Density of three different soil sample from the temperature variation of 0 to 250o c

Maximum dry density of the soil sample is shown in the fig 6 with the soil sample collected from three different places are been derived with a graphical representation show an increase in temperature and the dry density of soils as shown in fig 6. All the soils show a equivalent amount of increase in the dry density as the temperature increases from 0°C to 250°C.

Fig.7, shows the effect of the different temperature variation (from 0°c to 250°c) on the expansive soil which is collected from three different places. From the graph it can be stated that the unconfined compressive strength of the soil sample shows a variation in there moisture content from 10 to 30% from the soil three i.e. soil sample collected from koyembedu shows an increase in the compressive strength when comparing to the soil1 and soil 2.

The free swelling index of the soil sample which is collected in threes different places is shown in Fig.8 which indicates the swelling nature of the soil sample and it also terms as a expansive soil. The effect of the different temperature variation (from 0°c to 250°c) on the expansive soil is shown in the graph. From the graph it can be stated that the swelling index of the soil sample shows a variation of increment around 40 to 50% from comparing with the soil 1 to soil 3.

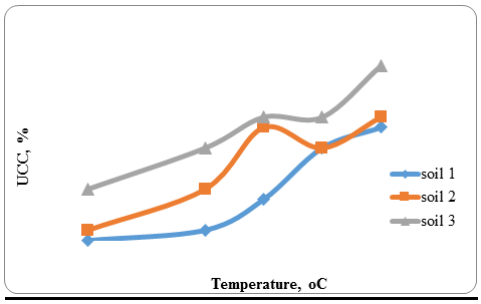

Fig.7.Unconfined compressive strength of three different soil sample from the temperature variation of 0 to 250° c

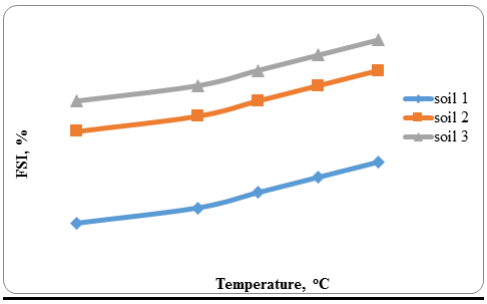

Fig.8.Free swelling Index of three different soil sample from the temperature variation of 0 to 250° c

Fig.9 shows the effect of the different temperature variation (from 0°c to 250°c) on the expansive soil which is collected from three different places. From the graph it can be stated that the specific gravity of the soil sample shows a variation from 0.2 to 0.4% from the soil one i.e. soil sample collected from koyembedu shows an increase in the compressive strength when comparing to the soil 2 and soil 3.

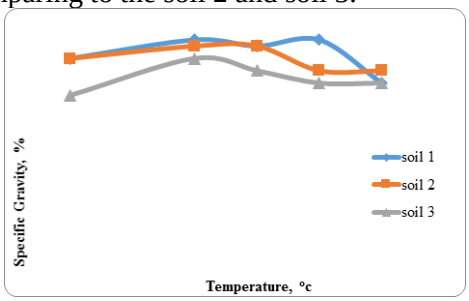

Fig.9.Specfic gravity of three different soil sample from the temperature variation of 0 to 250o c

4. CONCLUSION

From this investigation it can be concluded that the expansive soil can be improved and prepared as a normal one to lay the foundation by using the treatment with the flyash for an optimum of 12%. From this study it can be stated that the soil used in this case is problematic soil such in case of above 50% of liquid limit with the addition of flyash. As the temperature increase the Atterberg's limit of the soil decreases. It shows an increment in the compressive strength as the temperature increase from 0 to 250°c. The swelling nature of the soil shows decrement in the free swelling index as the temperature increases. The plasticity index of the soil varies from each of them as

the temperature increases. The Optimum moisture content of the soil decreases as the temperature variation takes place in the soil. The Specific gravity varies as the temperature increase. The dry density of the soil increase gradually as the temperature increases from 0 to 250^{o}c.

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