

Stabilization of Clayey Soil by using Stone Dust and Plastic Bottle Strips in Subgrades

Rahul Phonsa, Harpreet Singh

Abstract: The intention of this study is to enquire the utilization of waste materials like stone dust and plastic bottle fiber as a strips in the stabilization of clayey soil in the sub grade and to appraise the effects of stone dust and plastic fiber on geotechnical properties of soil. The stabilization of soil is to improve the engineering properties of fragile soil by adding stabilizer like wooden husk, stone dust, cement, fly ash, rice husk ash, lime, allcofine and plastic fiber etc. in this study the stone dust and plastic fiber are used as a stabilizer. The stone dust is a variety of solid waste material which are easily available from stone crusher and Plastic bottle are also solid waste material which are day by day increasing and not in environmental friendly hence they have to be recycled and to be used for soil stabilization. In this study, The various percentage of stone dust is taken as 2%,4%,6%,7%,8%,10%,12%,16%,20%. After performing work on these percentages the optimum value obtained is 7% and further test like Standard Proctor and CBR is to be conducted on this optimum value. The plastic was taken 0.4%,0.8%,1.2%,1.6%,2.0%. these percentage mixed with soil sample as to explore the effects of mixing on the OMC, MDD, and CBR properties of soil.

Keywords: clay soil stabilization, stone dust, plastic fiber, OMC, MDD, CBR

I. INTRODUCTION

In the construction of highways soil is good and comfortable material. Before use in any kind of construction process it is very important to know about the properties and feasibilities of soil. In this study clayey soil are used. The clayey soil is inanimate clay of intermediate to high compressibility. The clay soil is high shrinking and puffiness properties. The clay soil is hard when it dry but loses in wet condition.

The process of stabilization of soil is the modification of soil to raise their physical properties. The stabilization of soil can better the engineering properties of soil and makes it stable. The main intention of soil stabilization can increase the shear strength and control the shrink swell properties of soil and thus improving the load bearing capacity of a sub grade to support pavement and foundations. It mainly to low its construction cost. By using waste materials for stabilization of soil like plastic bottle strips is a conventional method for the strength of earth embankment. Plastic are durable and degrade very slowly. The waste plastic normally include polyethylene terephthalate (PET), high density polyethylene

(HDPE), low density polyethylene (LDPE), poly vinyl chloride (PVC), poly propylene (PP) and polystyrene (PS). In this study the use of waste plastic bottle strips (PET) to improve the engineering properties of soil.

Similarly, the stone dust due to high necessitates of aggregates and wreckage for construction process, rubble quarries and aggregates are common. Stone dust improves the engineering properties of clay to make it suitable. In the site of crusher, stone dust is one which is produced in large quantity about 15% – 25% of the total manufacture in each crusher unit is left out as the waste materials.

With the help of soil stabilization, waterproofs of the soil, increase the strength of soil, decrease soil volume due to temperature or humidity, improves soil workability, improves durability and reduce cost.

II. MATERIALS AND METHODS

The materials which are to be used in this study as follows:

- A. Soil : The clay soil used for the study was collected from the village kurali District Rupnagar (Pb). The clay soil is inanimate clays which is medium to high compressibility and from major soil grouping of India. Laboratory test were carried out on the plain soil is given in the table no 1 as below.

Table no 1. Properties of soil

| S.NO | LABORATORY TEST | RESULT |
|------|-----------------------|-----------|
| 1 | Atterberg | |
| | Plastic limit | 48% |
| | Liquid limit | 58.66% |
| | Plasticity index | 10.66% |
| 2 | SP. Gravity | 2.77 |
| 3 | Modified proctor test | |
| | OMC | 21% |
| | MDD | 1.63gm/cc |
| 4 | CBR | 2.35% |

Revised Manuscript Received on May 10, 2019

Rahul Phonsa, Post Graduate Student, Department of Civil Engineering, Chandigarh University, Gharuan, Punjab, India

Er. Harpreet Singh, Asst. Professor, Department of Civil Engineering,, Chandigarh University, Gharuan, Punjab, India.



Stabilization Of Clayey Soil By Using Stone Dust And Plastic Bottle Strips In Subgrades

B. Stone dust : In this study the stone dust was collected the Ashoka project plant(kharar-ludhiana highway) kharar. The stone dust is used in soil which were passing 150 micron IS sieve. Index properties of stone dust was determined as per IS codes. It was randomly mixed with soil sample in 2%,4%,6%,7%,8%,10%,12%,16%,20%. Of the dry weight of the soil. After performing work on these percentages the optimum value obtained is 7% and further test like Standard Proctor and CBR is to be conducted on this optimum value.

Table no 2. properties of stone dust

| S.no | Laboratory test | Results | | | |
|------|-----------------|---------------|--|--|--|
| 1 | Sp. Gravity | 2.5 | | | |
| 2 | OMC | 16% | | | |
| 3 | MDD | 1.59gm/c c | | | |



Fig 1. Stone Dust

C. Plastic bottle strips : Plastic are the waste material which can cause the environmental pollution. Plastic can recycled or reuse to make the useful products. Plastic cold drink bottles can be used as PET strips collected from the junk dealer, kharar Mohali . After cleaning and drying , the plastic bottle are used in this study were cutting into the strips of length 10mm and width 3mm.



Fig 2. Pet strips (10 X 3)mm

I. EXPERIMENTAL PROGRAM

In this study the various percentages of stone dust is taken as 2%,4%,6%,7%,8%,10% 12%,16%,20%.After performing

work on these percentages. The optimum percentage of stone dust 7% and different percentage of plastic strips (0.4%, 0.8%, 1.2%,1.6%,2.0%) to the dry weight of soil further test like, Standard proctor test , California bearing ratio test are conducted to determine the OMC, MDD and CBR value of soil. Mixing of plastic strips and stone dust in soil have be done carefully. The addition is by hand and proper care is taken to make a homogenous combination.

3.1. Standard proctor test

In this study the optimum moisture content (OMC) and the max. Dry density (MDD) of the soil samples with 7% of stone dust and various percentages of plastic strips (0.4%,0.8%,1.2%,1.6%,2.0%) were determined by performing the standard proctor test. The dry density was dictated and plotted adjacent to the consequent of water content to find the optimum moisture content and the consequent maximum dry density. The test were conducted as per is 2720 part vii-1980. The values of OMC and MDD of various percentages of stone dust and plastic strips are given below in tabular form.

TABLE NO.3 SUMMARY RESULTS OF STANDARD PROCTOR TEST

| S.NO | Sample | Dry density (gm/cc) | Water content (%) |
|------|------------------------------|---------------------|-------------------|
| 1 | Normal soil sample | 1.63 | 21 |
| 2 | 7% stone dust + 0.4% plastic | 1.76 | 13 |
| 3 | 7% stone dust + 0.8% plastic | 1.73 | 15 |
| 4 | 7% stone dust + 1.2% plastic | 1.72 | 15 |
| 5 | 7% stone dust + 1.6% plastic | 1.71 | 15 |
| 6 | 7% stone dust + 2.0% plastic | 1.68 | 17 |

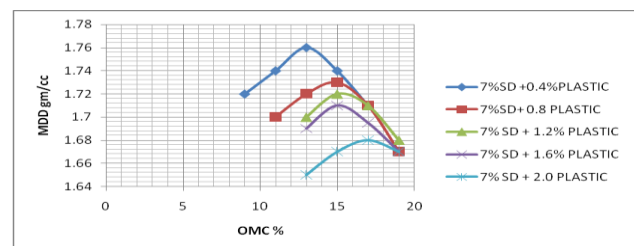


Fig.3. difference of OMC &MDD of soil mixing with stone dust & plastic strips

3.2. California bearing ratio (CBR)

The experiment test was conduct to find the cbr value on the sample with 7% of stone dust which were pass through 150 micron and plastic bottle strips are added to the clay soil in percentages of 0.4%,0.8%,1.2%,1.6%,2.0%. Respectively .The test were conducted as per IS: 2720- Part 16-1987, the result obtained are presented in the table no. 4 below.



Table no. 4: Summary result of CBR test

| Material | CBR value % | | |
|-----------------------------|-------------|--|--|
| Plain soil | 2.35 | | |
| Soil + 7% SD + 0.4% PLASTIC | 3.05 | | |
| Soil + 7% SD + 0.8% PLASTIC | 3.47 | | |
| Soil + 7% SD + 1.2% PLASTIC | 4.15 | | |
| Soil + 7% SD + 1.6% PLASTIC | 5.40 | | |
| Soil + 7% SD + 2.0% PLASTIC | 6.7 | | |

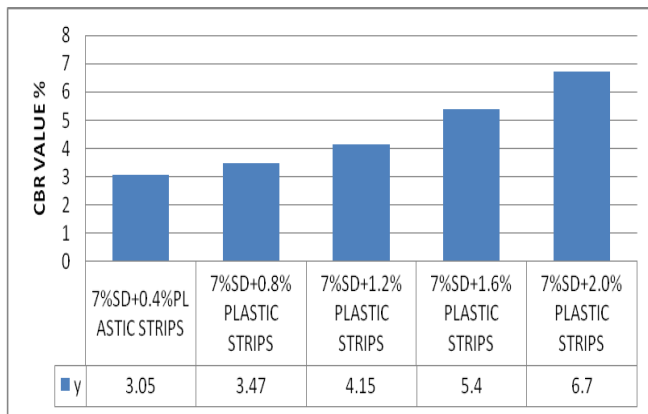


Fig.4. variation of CBR value of soil mixing with stone dust & plastic strips

III. CONCLUSIONS

Based upon the experimental investigate for OMC, MDD and CBR value, the following observation are drawn.

1. The maximum dry density of soil is increasing with adding together of stone dust and plastic strips with soil and the optimum moisture content is decreasing with addition of stone dust and plastic strips
2. Based on standard proctor test. The maximum dry density is 1.76gm/cc and optimum moisture content is 13% at 7% of stone dust and 0.4% of plastic strips. Keeping constant 7% stone dust and varying different percentage of plastic strips the MDD is decreasing and OMC is increasing.
3. The adding of stone dust and PET strips, as a waste materials, are increases the CBR value.
4. From the above graph, it is observed that the CBR value goes on increasing up to 7% of stone dust and 2.0% of plastic strips content in the soil and there on it increases with increases the percentage of plastic strips content.

REFERENCES

1. Abeer Sabri Bshara, Er. Y.K. Bind, Prabhat Kumar Sinha, " Effect Of Stone Dust On Geotechnical Properties Of Poor Soil "International Journal Of Civil Engineering And Technology, Volume 5, Issue 4, Pp.37-47, April(2014)
2. Naman Agaral, "Design Of Stone Dust Stabilized Road ", International Journal Of Civil Engineering And Technology , Volume 6, Issue 5, May (2015).
3. Sabat ,A.K (2012) " A Study On Some Geotechnical Properties Of Lime Stabilized Expansive Soil Quarry Dust Mixes .International Journal Of Engineering Trends In Engineering And Development ,Vol.1,Issue 2, 42-49.
4. Y. Ramakrishna Reddy, T. Ram Prasanna Reddy, "Stabilization Of Soil By Using Waste Fiber Materials " International Journal Of Advanced Technology And Innovative Research , Vol 8, Issue 15,October-2016.
5. Soosan, TG And Sridharam, A and Jose, Bt Abd Abharam, BM (2005) Utilization Of Quarry Dust To Improve Geotechnical Properties Of Soils In Highways Construction Geotechnical Testing Journal, 28(4). Pp. 391-400.
6. Jaswinder Singh, Vinod Kumar Sonthwal, Jasvir S Rattan, " Review On Improvement Of Engineering Properties Of Soil Using Waste Plastic Bottles Strips (Polyethylene Terephthalate)" ,International Jopurnal Of Emerging Technologies, Volume8, Issue Date 01/04/2017.
7. Devashish Kushwah, Mukesh Pandey , Rakesh Gupta, "Review Study Of Soil Behavior Mix With Waste Plastic." " International Journal Of Engineering Research And Application,Vol 7,Issue 9(Part-3)September 2017.
8. Satyam Tiwari, Nisheet Tiwari – " Soil Stabilization Using Waste Fiber Materials" International Journal Of Innovative Technology And Research Volume No 4,Issue No3 ,April- May 2016,2927-2930.
9. Choudhary, A.K, Jha J.N And Gill,K.S, "A Study On CBR Behavior Of Waste Plastic Strips Reinforced Soil". Emirates Journal For Engg. Res., Vol.15, Issue No 1, Pp.51 57 ,(2010).
10. IS: 2720- Part 3-1980, Bureau Of Indian Standards New Delhi, Feb (1981). Determination Of Specific Gravity Of Soil Solids.
11. IS: 2720- Part 16-1987, Bureau Of Indian Standards New Delhi, May (1988). Laboratory Determination Of CBR Value.
12. IS: 2720- Part 7-1980, Bureau Of Indian Standards New Delhi, dec (1980).laboratory method for standard proctor test.