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ijirset@gmail.com



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Appraisal in Properties of Soil Using Scrapped Concrete Material

S P Dhotre¹, S D Redekar², S S Mohite³, S U Dhayarkar⁴, A A Gole⁵

U. G Student, Department of Civil Engineering, Zeal College of Engineering, Pune, India¹.

Assistant Professor, Department of Civil Engineering, Zeal College of Engineering, Pune, India².

U. G Student, Department of Civil Engineering, Zeal College of Engineering, Pune, India³.

U. G Student, Department of Civil Engineering, Zeal College of Engineering, Pune, India⁴.

U. G Student, Department of Civil Engineering, Zeal College of Engineering, Pune, India⁵.

ABSTRACT: Soil stabilization is a process in which the physical properties of soil are transformed to give high strength gains. Stabilization is done by the increment in shear strength and the bearing capacity of soil. This study is to improve the stabilization of black cotton soil using demolished concrete waste material. There are many methods that are available for stabilization of black cotton soil. These methods are chemical biological and physical. All these methods may have the disadvantages of being ineffective and expensive. Considering the literatures fine material obtained from demolished waste is a low cost and effective soil stabilization method.

KEYWORDS: stabilization, black cotton soil, Demolition waste.

I. INTRODUCTION

Soil is the loose surface material that covers most land. It consists of inorganic particles and organic matter soil is derived naturally by disintegration of rocks. Soil can be excavated using earth moving equipment's on site or can be disintegrated by lighter mechanical means in testing laboratories. In civil engineering, sub grade is the soil material below the constructed road, pavement or railway track. It can also be called as the formation level. Undisturbed soil beneath the pavement is called natural sub grade. In civil engineering, compaction of soil is the process in which stress is applied to the soil that causes densification which makes air to displace from the pores between the soil grains. Pavement failures usually occur due to the intrusion of subgrade soils into the granular base, which results in the inadequate drainage and reduced stability which may lead to structural failures. The common improvement techniques include improved soil gradation, depletion in plasticity index, and increment in durability and shear strength. Soil stabilization can also be used to improve soil workability, provide a weather resistance for work platforms, also help to reduce swelling of expansive materials, and relieve problems associated with poor strength in case of black cotton soil.

II. RELATED WORK

Black cotton soil shows very low bearing capacity and high swelling and shrinkage characteristics. As a result of such characteristics, this soil forms a poor foundation material for road construction, and replacing such soil prior to construction activity can bring economic challenges. [1] moisture content of the soil sample lowers after first week and one month, and it was observed that addition of brick dust shows positive results. [2] the study shows that the soil properties tend to increase after addition of brick dust by 50% of dry weight, it also helps to reduce swelling and shrinkage of soil. [3] after addition of cement dust into the soil sample it imparts substantial and durable properties when added as a stabilizer. [4] the engineering properties of soil can be improved substantially by replacing nearly half of its dry weight by the brick dust which in return gives improved soil bearing properties. [5] the values of bearing capacity can be increased by increment in sand content and attain a desirable CBR value for the sub grade pavement. [6] after addition of desired quantity of lime into the black cotton soil the treated soil can be accepted as base material, which helps to curtail certain thickness of the upper crust of road. [7] the MDD and OMC shows a decrement with the addition of stabilizer content, which results in the increasing bearing capacity of soil. [8] the strength of subgrade can be increased with help of concrete demolished waste, reduction of nearly 2 inch was obtained in thickness of base and courses. [9] the thickness of pavement was found to be reducing after addition of concrete waste the maximum layer thickness that reduced was nearly 11%. [10] the

serious threat that can be caused due to landfills can be countered by using concrete waste in soil stabilization, work should be done in order to utilize the fine particles as soil stabilizing agents for improved soil properties in case of expansive soils.

III. METHODOLOGY

• Material Collection

- 1) Black cotton soil is collected from the farm of Palus village in Sangli district. The fine soil passing through the IS sieve of 425 micron is taken as test specimen. The properties of the raw untreated black cotton are found before the admixture was mixed & these properties are as follows,

Property	Value
Specific gravity	3.58
Liquid limit	53.9
Plastic limit	34.8

- 2) Concrete demolition waste is collected from a dump site near sect-35 Khargar of Navi Mumbai city. The concrete demolition waste was in the form of large blocks which isn't suitable for mixing with the Raw black cotton soil, as a result the blocks were hammered, and broken to small boulders and then into fine powder by the use of hammer, later the concreted fine powder passing through IS sieve 425 micron is considered for mixing into the raw soil sample as an admixture.

The Concrete aggregate waste collected from the demolition site is hammered for crushing. It is made finer by crushing, particles of waste sample passing through IS sieve 425 microns shall be taken for mixing it into the soil sample.

Later the crushed Concrete will be mixed with 3 different proportions. The test will be conducted on each mixture being stabilized at different cement contents and by percentage volume.

Raw black cotton soil that is being tested for initial tests is then mixed with 5%, 10%, and 15% of demolished concrete by moisture less weight of the soil. This mixture is then subjected to these tests:

1. Specific gravity test.
2. The Atterberg's Limits.
 - Liquid limit
 - Plastic limit
3. Compaction test
 - Modified proctor test.
4. California bearing test. (CBR)

IV. EXPERIMENTAL RESULTS

1. Specific Gravity Test

The specific gravity test can be termed as the ratio of the given volume of soil particles at a room temperature to weight of equal volume of water at room temperature.

Results: The results for the test on each specimen are given below,

1. 0% Concrete Demolition waste (Raw soil) = 3.58

2. 5% Concrete Demolition waste = **3.65**
3. 10% Concrete Demolition waste = **3.68**
4. 15% Concrete Demolition waste = **3.70**

Conclusion: The specific gravity is found to be increasing when concrete demolition waste is added to the soil.

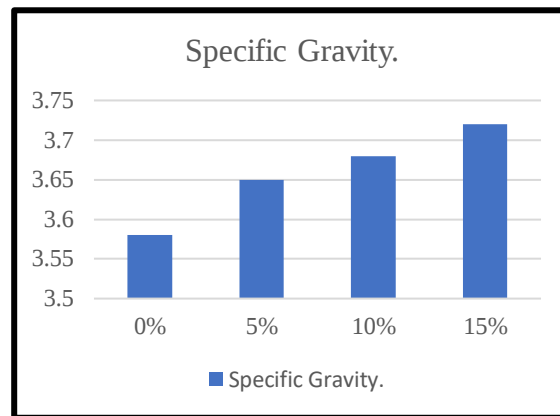


Fig. 1: Specific Gravity

2. Altenburg Limits

(a) Liquid limit test -

Liquid Limit (LL) is the water percentage at which the soil starts to changes from plastic state to liquid state when the soil specimen is just fluid enough for a groove to close when bisected in a specified manner.

Results:

The results for the Liquid limit test on each specimen are given below,

- 1) Black cotton soil + 0% (Raw black cotton soil) = **53.9**
- 2) Black cotton soil + 5% = **51.11**
- 3) Black cotton soil + 10% = **46.5**
- 4) Black cotton soil + 15% = **43.69**

(b) Plastic limit test -

Plastic Limit (PL) is the water percentage at which the soil sample changes from plastic state to semi-solid state. Plastic limit test includes repeated rolling of the soil sample into a thick thread up to it reaches a desired point where it crumbles.

Results:

The results of the Plastic limit test on each specimen are given below,

- 1) Black cotton soil + 0% (Raw black cotton soil) = **34.80**
- 2) Black cotton soil + 5% = **33.69**
- 3) Black cotton soil + 10% = **32.09**

4) Black cotton soil + 15% = 31.45

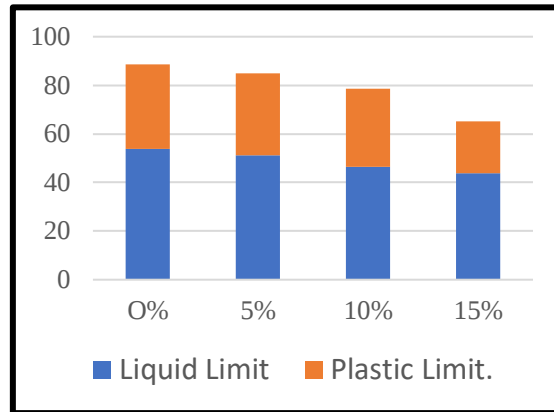


Fig 2: Liquid limit and Plastic limit

3. Compaction Test –

Modified Proctor Test

Modified Proctor Test is determination of the compaction of various types of soil and the properties of soil with a change in moisture content; Also, the relationship between Dry Density and Moisture Content.

Results: The results for the Modified proctor test on each specimen are given below

% Of Admixture	MDD	OMC
0%	2.79	13.5
5%	2.82	12
10%	2.86	11
15%	2.94	10

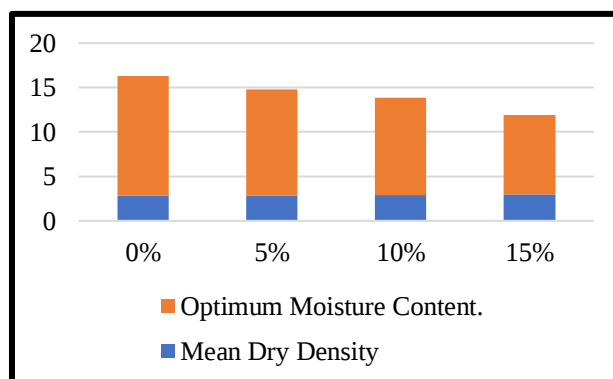


Fig. 3: Mean dry density and Optimum moisture content

4. California Bearing Ratio (CBR).

The California Bearing Ratio (CBR) test is a penetration test used to evaluate the subgrade strength of roads and pavements. The results of these tests are used with the curves to determine the thickness of pavement and its component layers. This is the most widely used method for the design of flexible pavement.

Results: The results for the Modified proctor test on each specimen are given below,

- 1) Black cotton soil + 0% (Raw black cotton soil) = **8.4**
- 2) Black cotton soil + 5% = **9.75**
- 3) Black cotton soil + 10% = **11.56**
- 4) Black cotton soil + 15% = **12.95**

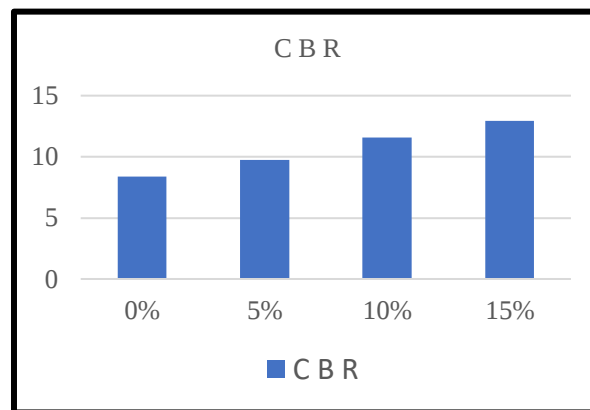


Fig.4: C B R (California Rearing Ratio)

V. CONCLUSION

From above study it has been concluded that the specific gravity shows an increment with increase in amount of stabilizer added. The plastic limit and liquid limit of soil decrease with increase in amount of stabilizer. The maximum dry density increases, and the optimum moisture content show decrement with increasing percentage of the concrete content in the mixture. The CBR values of the tested soil samples increases with addition of the recycled concrete content in the mixture. Usage of concrete and demolished wastes in soil stabilization can help to reduce the hazardous environmental impacts and also improve the engineering properties of soil which indirectly reduce the cost of construction and help to increase the life of the structure built on stabilized soil and also reduces the thickness of pavement which helps in lower construction costs.

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