EXPERIMENTAL INVESTIGATION ON SOIL STABILIZATION WITH DEMOLISHED CONCRETE

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ABSTRACT

Soil serves as engineering media for the construction and preserve or destroy artifacts of human endeavors. This step of construction process bears such a great importance because it can cause foundation failure due to the insufficient bearing capacity of the soil. Stabilizing of soil in an economical way is complicated task,by this project we are going to increase the soil strength for the foundation by adding demolished concrete. As demolished concrete waste handling and management is the new primary challenging issue faced by the world and a hectic problem in upcoming days. To make this material to be eco-friendly, we are going to satisfy the environment and economical point of view. To tackle it in an indigenous manner, it is desirable to completely recycle demolished concrete waste in order to protect natural resources, to reduce environmental pollution, to reduce construction cost and resolving housing problems faced by low income communities of the world.

The concept of using demolished concrete is to know the stabilization of soil when mixed with the debrismaterial coming from construction when demolished andto improve and enhancethe strength and properties of soil when mixed with the demolished concrete. This identification is done by using various tests in laboratory experiments of specific gravity, Atterberg's limits, direct shear test and California bearing ratio. Hence by using the demolished concrete for stabilizing the soil, it could be shifted from "Construction and Demolition(C&D) Waste Material to Resource material".

Key words: Soil Stabilization, Construction and Demolished Concrete.

INTRODUCTION

Soil is a mixture of organic matter,minerals, gases, liquids, and organisms

that together support life. The Earth's body of soil is the pedosphere, which has four important

functions: it is a medium for plant growth; it is a means of water storage, supply and purification; it is a modifier of Earth's atmosphere; it is a habitat for organisms; all of which, in turn, modify the soil.

Soil formation, or paedogenesis, is the combined effect of physical, chemical, biological and anthropogenic processes working on soil parent material. Soil is said to be formed when organic matter has accumulated and colloids are washed downward, leaving deposits of clay, humus, iron oxide, carbonate, and gypsum, producing a distinct layer.

The term 'soil' has different meanings in different scientific fields. It has originated from the Latin word Solum. To an agriculture scientist, it means "the loose material on the earth's crust consisting of disintegrated rock with an admixture of organic matter, which supports plant life". To a geologist, it means the disintegrated rock material which has not been transported from the place of origin. But, to a Civil Engineer, the term 'soil' means, “the loose unconsolidated inorganic material on the earth's crust produced by the disintegration of rocks, over lying Hard Rock with or without organic matter”.

1.SOIL-FORMING FACTORS

How soil formation proceeds are influenced by at least five classic factors that are intertwined in the evolution of a soil. They are: parent material, climate, topography (relief), organisms, and time. When reordered to climate, relief, organisms, parent material, and time, they form the acronym CROPT.

1.1 PHYSICAL PROPERTIES OF SOIL

The physical properties of soils, in order of decreasing importance for ecosystem services such as crop production, are texture, structure, bulk density, porosity, consistency, temperature, colour and resistivity. Soil texture is determined by the relative proportion of the three kinds of soil mineral particles, called soil separates: sand, silt, and clay.For any soil to be stabilized, it has to be improved their properties and develop its strength.

2. SOIL STABILIZATION:

Soil stabilization is the process which is used to improve the engineering properties of the soil and thus making it more stable. Soil stabilization is required when the soil available for construction is not suitable for the intended purpose. It includes compaction, reconsolidation, drainage and many other such processes.

In some areas it is not possible to find the good foundation soils which can support the new infrastructures. The land scarity problem and creation of green environment push the civil engineers to the alternatives to utilize the available sites. Stabilizing soil not only requires for soft soils. It can be performed to to enhance strength in order to reduce the cost of entire project.

2.1 PRINCIPLES OF SOIL STABILISATION:

• Evaluating the soil properties of the area under consideration.

• Deciding the property of soil which needs to be altered to get the design value and choose the effective and economical method for stabilization.

• Designing the Stabilized soil mix sample and testing it in the lab for intended stability and durability values.

2.2 NEEDS &ADVANTAGES :

Soil properties vary a great deal and construction of structures depends a lot on the bearing capacity of the soil, hence, we need to stabilize the soil which makes it easier to predict the load bearing capacity of the soil and even improve the load bearing capacity. The gradation of the soil is also a very important property to keep in mind while working with soils. The soils may be well-graded which is desirable as it has less number of voids or uniformly graded which though sounds stable but has more voids. Thus, it is better to mix different types of soils together to improve the soil strength properties. It is very expensive to replace the inferior soil entirely soil and hence, soil stabilization is the thing to look for in these cases.

2.3 ADVANTAGES OF SOIL STABILIZATION

It is used for many purposes. It increases different soil properties as listed below.

1. Soil stabilization is used to reduce the permeability and compressibility of the soil mass in earth structures and to increase its shear strength.
2. It is used to increase the bearing capacity of foundation soils.
3. It is used to improve the natural soils for the construction of highway and airfields.
4. It is also used to make an area trafficable within a short period of time for emergency purposes.
5. Soil stabilization is used to increase the unit weight of the soil.
6. It helps to decrease the void ratio of the soil.
7. Stabilization of soil increases the shear strength of soil.

2.4 METHODS OF SOIL STABILISATION

2.4.1MECHANICALMETHOD OF STABILISATION

In this procedure, soils of different gradations are mixed together to obtain the desired property in the soil. This may be done at the site or at some other place from where it can be transported easily. The final mixture is then compacted by the usual methods to get the required density.

2.4.2 ADDITIVE METHOD OF STABILISATION

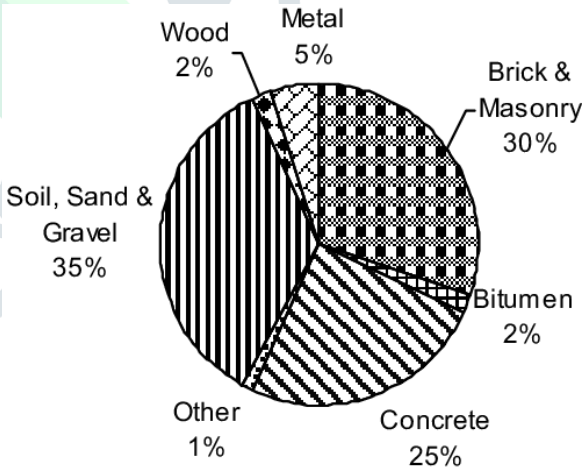
It refers to the addition of manufactured products into the soil, which in proper quantities enhances the quality of the soil. Materials such as cement, lime, bitumen, Demolished concrete, glass pieces, fly ash etc. are used as chemical additives. Sometimes different fibers are also used as reinforcements in the soil. Different soil stabilization techniques are used all over the world.Different soil stabilization techniques are used all over the world.

3. DEMOLISHED CONCRETE

the construction industry is the availability of soil. So getting soil is really expensive nowadays as its availability is very limited. So more importance is given nowadays for replacement .

In our project we are trying to replace soil with crushed used (demolished) concrete. The concrete created with this aggregate shows the strength of concrete with natural soil. This is not only much cheaper, but also helps to decrease the disposal of construction wastes, which environmentalists say degrades the land. So in the end use of this crushed concrete is beneficial not only to the utilizer but also to our environment. This is an experimental study to see the feasibility of C&D wastes as stabilizer in concrete.

As per studies the C&D waste produced in India and the quantity of various constituents generating as per year are shown in the table.



Different constituents of C&D waste.

constituent	million tonnes/yr.
Soil, Sand and gravel	4.20 to 5.14
Bricks and masonry	3.60 to 4.40

Concrete	2.40 to 3.67
Metals	0.60 to 0.73
Bitumen and wood	0.25 to 0.30
Others	Others 0.10 to 0.15

Quantity of various constituents generated as peryear.

To reduce this the soil is being stabilized by demolished concrete.

4. MATERIALS USED:

4.1 SOIL:

Soil is the three-phase system and also an accumulation or deposit of earthy material, derived naturally from disintegration of rocks or decay of vegetation that can be excavated readily with power equipment in the field or disintegrated by gentle mechanical means.

The soil used in this project was collected at a depth of 1 m at the building construction site near Sathavahana university of Telangana, vidhyanagar,Karimnagar, Telangana.

The disturbed soil sample were collected randomly and brought to soil mechanics laboratory for testing.

4.2 DEMOLISHED CONRETE:

The waste that result from the destruction of old buildings,pavements known as demolished wastes mostly comprise of concrete,brick and steel wastes and are being dumped in open space.Dumping solid wastes is of concern in different Countries. Considerations must be oriented to the protecting environment by suggesting the alternative of using recycled waste material in civil engineering applications rather than dumping them.

The demolished concrete waste materials were obtained in this project from a demolishing site i.e., at an area where demolishing of pavements was done for the construction of water treatment effluent plant at that particular area at Vidhyanagar, Karimnagar,Telangana. This demolished concrete waste consists of only cement, fine aggreagate, coarse aggreagate.

The demolition is done by anmechanical device at the site and brought to soil mechanics laboratory and is grounded to produce powder and the sieve of 2.36mm is used to obtain the fine powder of demolished concrete and which is ready to use as soil stabilizer.

5. EXPERIMENTS DONE:

The soil has been tested for its natural properties and is then mixed with 5% and 10% demolished concrete and the tests done are:

I. Specific gravity
II. Moisture content
III. Grade analysis
IV. Atterberg limits
   i) Liquid limit
   ii) Plastic limit
V. Standard proctor test
VI. Direct shear test
VII. California bearing ratio

As the soil is in dry state and due to weather effect, the moisture content obtained for soil is 0%. The OMC obtained for soil is 12% atdry density 1.97g/cm³.

The grade of soil obtained is well graded soil. Though the soil is good to use for construction improving its properties and reducing the size of footing and cost plays a major role.

Experimental results:

Properties of soil	For soil	For soil with 5% demolished concrete in soil	For soil with 10% demolished concrete in soil
Specific gravity	2.78	2.80	2.85
Liquid limit	54%	48%	34%
Plastic limit Plasticity index	30.88% 23.12%	26.23% 21.77%	10.51% 17.49%
Dry density(γ) g/cm³	1.82	2.17	2.61
Direct shear test			
1. Cohesion	0.05	0.03	0
2. Angle of internal friction(ø)	50˚	67˚	75˚
California bearing ratio(CBR)	1.55	1.625	1.874
Percentage increase	0%	4.8%	15.3%

6. CONCLUSIONS

The conclusions of this project can be summarized as:

1. Specific gravity increases with increase in amount of stabilizer.
2. Liquid limit decrease with increase in amount of stabilizer.

3. Plastic limit decrease with increase in amount of stabilizer.
4. Plasticity index of soil decrease with increase in amount of stabilizer.
5. The cohesive nature and angle of internal friction decreases with increase in amount of stabilizer.
6. The CBR values of the mixtures increases with increasing the amount of demolished concrete waste content in the mixture.

Using Construction and Demolition waste(C&D) in soil stabilization helps to reduce the hazardous environmental Impacts of the waste and improves the engineering properties of soil which ultimately reduces the cost of construction and increases the life of the structure built on stabilized soil.

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