ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

APRAISAL OF DEMOLISHED CONCRETE COARSE AND FINES FOR STABILIZATION OF CLAYEY SOIL

Mr Archit Jain*, Mr Arpit Chawda

[*] MTech scholor, Assistant professor Department of civil engineering, RKDF SOE, Indore

DOI: 10.5281/zenodo.155098

ABSTRACT

Road pavements or structure on loose soil needs stabilization. Soil stabilization is mainly done for modifying soil engineering properties to improve the bearing capacity and durability property of weak soil. At the same time the waste material disposal is possessing a lot of problem for disposal. The aim of the study is to appraise the waste material with a review on stabilization of clayey soil using demolished concrete structural fines. Various methods are available for stabilizing clayey soil. These methods include stabilization with chemical additives, soil replacement, compaction control, moisture control and thermal methods. Based on literature reviews and use of demolished waste issues, fines obtained from demolished waste is a low cost and effective soil stabilization method. This dissertation presents the results of a study that investigated the use of demolished concrete in the stabilization of expansive clayey soil.

The demolished waste is crushed into fines and coarse materials and grading of fines is done to know the properties of demolished fines and there suitability as a stabilization material. The soil has been stabilized with 0.5%, 10% and 25% of demolished concrete fines and coarse. The final mixtures were tested: Moisture Content Atterberglimits, Compactionand California Bearing Ratio Unconfined Triaxial test. Results indicates that demolished concrete content increases, maximum dry density decrease while CBR values tend to increase. Thus, demolished concrete could potentially act similar to lime or cement in improving the properties of clayey soils. Finally it is concluded that the specific gravity increases with increase in amount of stabilizer. Plasticity index of soil decrease with increase in amount of stabilizer. The maximum dry density increases, and the optimum moisture content decreases with increasing the concrete content in the mixture.

The CBR values of the mixtures increases with increasing the recycled concrete content in the mixture. Using C&D waste 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.

KEYWORDS: Black Cotton Soil, Sand, Isolated footing, Impact loading and Static loading.

INTRODUCTION

Soil is a 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 in the laboratory.

This mainly emphasizes on stabilization of expansive soil using locally demolished concrete. This infers the following objectives like use of coarse and fines of demolished concrete structures to stabilized soil at different percentage i.e. on 0%, 5%, 10% and 25%. The research also emphasizes on determination of various parameters of soil like moisture content Atterberg limit at different proportion of FDCS.

Construction of pavements in weak soil areas creates a lot of problems for civil engineers because of its low California bearing ratio (CBR) value and alternate swell-shrink behavior when the soil comes in contact with water. This results not only in high cost of construction but also necessitate frequent repairing as cracks of different shapes and varying depth are seen on these soils.Today, crushed concrete is available in large quantities, which results from the demolition of old structures and waste concrete from new structures. The current annual rate of generation of construction waste is 1,183 million tons worldwide.The urgent need for recycling is of global concern and is driven mainly by environmental considerations, due to the increasing scarcity of natural resources and the growing disposal cost into the landfills in many countries.Efforts have been made to utilize these fines as a soil stabilizer for improving the properties of clayey soil as subgrade. Use of excessive production of waste like fly ash, plastics, rice husk ash which is not only hazards but also creating deposition problem. Efficient use of demolished concrete for stabilization of clayey soil may reduce this hazards and effective waste management.

ABOUT MATERIALS
Crushed and graded waste concrete were the materials used in this dissertation and research. Concrete blocks and bricks were separated from demolition waste materials, and were crushed using a sledge and laboratory crusher. Fig. 1 shows the crushed concrete. The gradation recommended by Indian Standards for the stabilized aggregates used in pavement base and sub-base was used in this research. The Atterberg limits tests on the fine fraction of the concrete showed that they are non-plastic. Concrete were mixed in 4 different proportions by volume. The tests were conducted on each mixture stabilized at different cement contents.

Demolished Concrete Waste: When structures made of concrete are demolished or renovated, concrete recycling is an increasingly common method of utilizing the rubble. Concrete was once routinely trucked to landfills for disposal, but recycling has a number of benefits that have made it a more attractive option in this age of greater environmental awareness, more environmental laws, and the desire to keep construction costs down.

Concrete aggregate collected from demolition sites is put through a crushing machine. Crushing facilities accept only uncontaminated concrete, which must be free of trash, wood, paper and other such materials. Metals such as rebar are accepted, since they can be removed with magnets and other sorting devices and melted down for recycling elsewhere. The remaining aggregate chunks are sorted by size. Larger chunks may go through the crusher again. After crushing has taken place, other particulates are filtered out through a variety of methods including hand-picking and water flotation.

METHODOLOGY
In this chapter mainly the methods used to calculate bearing capacity or settlement are to be discussed. However the dissertation is based on suitability of different shapes of foundation as a part of settlement.

EXPERIMENTAL WORK
The tested soil was mixed with 0.5%, `10%, and 25% demolished concrete by dry weight of the soil. The mixtures were then subjected to the following tests:

- i) Moisture Content.
- ii) Atterberg Limits.
  - a) Liquid Limit
  - b) Plastic Limit
- iii) Compaction
  - (a.) Standard proctor test
  - (b.) Modify proctor test
- iv) California Bearing Ratio (CBR).
- (v) Unconfined Triaxial Test.

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

RESULT

Case1: With 0% FDCS in soil

Properties of soil	With 0% FDCS in soil
Natural moisture content	17%
Specific Gravity	2.59
Liquid limit	56.5%
Plastic Limit Plasticity index	29.10% 27.40%
Compaction (OMC)	18.02
Maximum Dry Density (MDD)	1.72 kg/m3
California Bearing Ratio (CBR)	7.4
Percentage Increase	0%
Unconfined compressive strength at OMC	2.69kg/cm2

Case2: With 5% FDCS in soil

Properties of soil	5% FDCS in soil
Natural moisture content	15%
Specific Gravity	2.66
Liquid limit	55.5%
Plastic Limit Plasticity index	28.40% 27.10%
Compaction (OMC)	16
Maximum Dry Density (MDD)	1.8kg/m3
California Bearing Ratio (CBR)	10.11
Percentage Increase	36.6%
Unconfined compressive strength at OMC	3.86kg/cm2

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

Case3: With 10% FDCS in soil

Properties of soil	10% FDCS in soil
Natural moisture content	13%
Specific Gravity	2.68
Liquid limit	54.5%
Plastic Limit Plasticity index	28.20% 26.30%
Compaction (OMC)	16
Maximum Dry Density (MDD)	1.95kg/m3
California Bearing Ratio (CBR)	13.47
Percentage Increase	82%
Unconfined compressive strength at OMC	5.34kg/cm2

Comparative Results of FDCS in Soil

Properties of soil	0% FDCS in soil	5% FDCS in soil	10% FDCS in soil
Natural moisture content	17%	15%	13%
Specific Gravity	2.59	2.66	2.68
Liquid limit	56.5%	55.5%	54.5%
Plastic Limit Plasticity index	29.10% 27.40%	28.40% 27.10%	28.20% 26.30%
Compaction (OMC)	18.02	16	16
Maximum Dry Density (MDD)	1.72 kg/m3	1.8kg/m3	1.95kg/m3
California Bearing Ratio (CBR)	7.4	10.11	13.47
Percentage Increase	0%	36.6%	82%
Unconfined compressive strength at OMC	2.69kg/cm2	3.86kg/cm2	5.34kg/cm2

CONCLUSIONS

The conclusions of this dissertation for appraisal can be summarized as follows.

1. Specific gravity increases with increase in amount of stabilizer.
2. Plasticity index of soil decrease with increase in amount of stabilizer.
3. The maximum dry density increases, and the optimum moisture content decreases with increasing the concrete content in the mixture.

4. The CBR values of the mixtures increases with increasing the recycled concrete content in the mixture.
5. Using C&D waste 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.

REFERENCES

[1] Al-Sharif, M. and Attom, M. (2000).”Use of Burned Sludge as a New Soil Stabilizing Agent.” Environmental and pipeline engineering 2000: pp. 378-388.
[2] Arulrajah, A., Disfani, M.M., Horpibulsuk, S., Suksiripattanapong, C., and Prongmanee, N. (2014).”Physical Properties and Shear Strength Responses of Recycled Construction and Demolition Waste in Unbound Pavement Base/Sub base Application.” Construction and Building materials: pp. 245-257.
[3] Parsons, R. and Kneebone, E. (2004).” Use of Cement Kiln Dust for the Stabilization of Soils.” Geotechnical Engineering for Transportation Projects: pp. 1124-1131
[4] Okagbue, C. (2007).”Stabilization of Clay Using Wood Ash.” Journal of Materials in Civil Engineering: Vol. 19, Geotechnical aspects of Stabilized Materials, pp. 14-18.
[5] IS 2720 part 2, 3, 5, 7, 8, 16
[6] Mechanical behaviour of concrete made with fine recycled concrete aggregates L. Evangelista, J. de Brito
[7] Recycled construction and demolition concrete waste as aggregate for structural concreteAshraf M. Wagiha, Hossam Z. El-Karmotyb, Magda Ebidc, Samir H. Okbad.
[8] Processing and properties of recycled aggregate concrete by H Jeong.
[9] Construction and Demolition Waste used as Recycled Aggregates in Concrete: Solutions for Increasing the Marketability of Recycled Aggregate Concrete Brett Tempest1 ; Tara Cavalline2 ; Janos Gergely3 ; David Weggel.
[10] C. Poon et al., Influence of moisture states of natural and recycled aggregates on the slump and compressive strength of concrete, Cem. Concr. Res. 34 (2004) 31–36.
[11] W. Vivian, C.M. Tam, Crushed aggregate production from centralized combined and individual waste sources in Hong Kong, Constr. Build. Mater. 21 (2006) 879–886.
[12] A.M. Neville, Properties of Concrete, fifth ed., Prentice Hall, USA, 2002.
[13] D.N. Parekh et al., Assessment of recycled aggregate concrete, J. Eng. Res. Stud. 2 (2011)