REVIEW ON STABLIZATION OF SOIL USING POLYPROPYLENE AS WASTE FIBRE MATERIAL

Sandeep Chhokar[1], Vinod Kumar Sonthwal[2],

[1]PG Scholar[2] Associate Professor, Department of Civil Engineering,

[1,2,]NITTTR Chandigarh, India, 160019.

ABSTRACT: There is a rapid increase in generation of waste plastics all around the world due to Economic Growth, Changing Consumption and Production Patterns. The world's annual consumption of plastic materials has increased from around 5 million tonnes in the 1950s to nearly 100 million tonnes. Thus, presently 20 times more plastic is produced as compared to 50 years ago. In Asia and the Pacific, as well as many other developing regions, plastic consumption has increased much more than the world's average due to rapid urbanization and economic development. So, with this, more and more resources are being used to meet the increased demand of plastics, which results in higher generation of plastic waste. After food waste and paper waste, plastic waste is the third major constitute at municipal and industrial waste in cities. Even the cities with low economic growth have started producing more plastic waste due to increased use of plastic packaging, plastic shopping bags, PET bottles and other goods/appliances using plastic as the major component. This situation gets worsened due to the fact that they are not even aware of the ill-effects of plastic waste to environment.

Due to extremely long periods required for natural decomposition, waste plastic is often the most visible component in waste dumps and open landfills. Plastic waste recycling can provide an opportunity to collect and dispose off, plastic waste in the most environmental friendly way and conversely, it can be converted into a resource. Due to growing concern about the disposal off plastic waste, and the panic in the current environmentalist, the object of this thesis was chosen as "Soil Stabilisation Using Polypropylene as Waste Fibre Material" which is one of the type of the plastic waste.

KEYWORDS: Soil Stabilisation, Fibres of Waste Plastics, Reinforcement, Polypropylene, Maximum Dry Density, Optimum Moisture Content, Direct Shear Strength Parameters, Unconfined Compressive Strength.

.

INTRODUCTION

Soil is highly complex, heterogeneous and unpredictable material whichhas been subjected to vagaries of nature, without any control. The properties of soil change not only from one place to other but also at the place with depth and with a change in the environmental, loading and drainage conditions. The properties of a soil depend not only on its type but also on the conditions under which it exists. In comparison to other construction materials such as concrete or steel, it is not economically feasible to transport the soils from one place to other, because a huge quantity of soil is involved and it is not opened to inspect at greater depth for foundations of different structures.

Sometimes**,** civil Engineers are forced to construct a structure on the site selected for reasons other than soil conditions. Therefore, it is more and more important for the engineer to know the degree to which the engineering properties of the soil may improve or other choices that can be thought of for the construction of the intended structure at the specified site. If unsuitable soil conditions are encountered at the site of a proposed structure, unsuitable soil can be bypassed by means of deep foundation extended to a suitable bearing material, poor material can be removed and replaced by a suitable material or soil in-place can be treated by using any suitable ground improvement methods (soil stabilisation) to improve its engineering properties. Thus, to puzzle out at the selected site, we necessitate having proper knowledge about their attributes and ingredients which affect their conduct. Hence, from the commencement of construction employment, the necessity of raising the soil properties has come to the light and the process of soil stabilisation helps us to accomplish the required attributes in a soil needed for the building work.

In India, the modern era of soil stabilisation began in early 1970 with a universal shortfall of petroleum and aggregates; it became necessary- for the technologists to look at means to improve soil other than replacing the poor soil at the construction site. Soil stabilisation was used, but due to the use of obsolete methods and also due to the absence of proper technique, soil stabilisation lost favor. In recent limes, with the growth in the demand for infrastructure, sensitive materials and fuel, soil stabilisation has begun to call for a fresh form. With the availability of better research, materials and equipment, it is emerging as a popular and cost-effective method for land improvement. Site feasibility studies for geotechnical projects are of far most beneficial before a task can bring off. Site survey usually takes place before the design process commences in order to infer the characteristics of subsoil upon which the decision on placement of the project can be built. The following geotechnical design criteria have to be considered during the site selection:

i) Design load and function of the structure.

ii) Type of foundation to be utilised.
iii) Carrying capacity of the subsoil.

In the yesteryear, the third criteria played a major role in decision making on site selection. In one case the bearing capability of the soil was poor, the following were options:
i) Change the design to suit site condition.
ii) Remove and replace the in-situ soil.
iii) Abandon the site.

Abandoned sites due to undesirable soil bearing capacities dramatically increased, and the result of this was the scarcity of land and increased need for natural resources affected areas include those which were susceptible to liquefaction and those crossed with soft mud and organic stains. Other regions were those in a landslide and contaminated soil. Nevertheless, in most geotechnical projects, it is not possible to obtain a construction site that will meet the design requirements without ground modification. The current exercise is to modify the engineering properties of the native problematic soils to meet the plan specs. Nowadays, soils such as, soft clays and organic soils can be amended to the civil engineering requirements. This province of the art review focuses on soil stabilisation methods which is one of the various methods of soil improvement.

In this research work, soil stabilisation is to be carried out with waste fibre material -polypropylene (randomly distributed) obtained from the Supreme Industries, Village - Sersini (Lalru), Ambala - Chandigarh Highway, Distt- S.A.S,Nagar Punjab; producing a number of plastic items which are globally used for the different works.

PURPOSE OF REVIEW

The intention of this assess is to bring in and summaries journalism pertaining to the application of waste polypropylene fibres as fortification in the soil by examining the performance of experimental soil test samples. The inspection is restricted to published research reports, journal articles, and conference proceedings.

This reviewis structured to illustrate the value added to foundations by the use of geosynthetic reinforcement. In especial, the review is designed to illustrate the benefits derived from waste polypropylene fiber reinforcement, the conditions under which reinforcement is good, the polypropylene properties that are most influential for this application, and the mechanisms responsible for reinforcement. The ends of this unit are used subsequently to evaluate existing design procedures, to comment on developing application specifications. All work reviewed in this division is taken at face-value, implying that **t**he study has not been reviewed in the process of inspection. Every effort has been constituted to describe the details and conclusions as contained in the original references.

STUDIES ON STABILISATION OF SOIL USING WASTE MATERIALS

GhatgeSandeepHambirao et al; (Feb-2014), "**Soil stabilisation using waste shredded rubber tyre clips."** Construction of engineering structures on weak or soft soil is considered as unsafe. Improvement of load bearing capacity of the ground may be contracted by a variety of ground improvement techniques. In the present investigation, shredded rubber from waste has been taken as the reinforcement material and cement as binding agent which was randomly included in the soil at three different portions of fiber content, i.e. 5% 10% and 15% by weight of soil. The probe has been concentrated along the strength behavior of soil reinforced with randomly included shredded rubber lire. The samples were subjected to California bearing ratio and unconfined compression tests. The trials have clearly demonstrated a substantial advance in the shear strength and bearing capacityparameters of the studied soil.

IJTARME(Jan-2014),"Study on heave characteristics of black cotton soils using copper slag with cement as admixture." Black cotton soil is one of the major regional soil deposits in India, spreading over an expanse of approximately 3.0 lakh sq.km. Black cotton soils or the expansive soils in India are extremely debatable, as they swell on absorption of water and shrink on evaporation thereof, because of this alternate swell and shrinkage; distress is caused to the bases of structures laid on such grounds.

Copper slag, which is produced during hydrometallurgical production of copper from copper or es, contains materials like iron, aluminum oxide, calcium oxide, silica, etc. For every metric ton of metal production, approximately 2.2 tons of slags are generated. Dumping and disposal of such vast amounts of slag causes environmental and space problems. Therefore, we apply the industrial waste - Copper Slag to reduce the swelling of expansive grounds.

The present paper elucidates about the works being carried out using copper slag as a cushioning material. Developments of cohesive bonds in a cement-stabilized copper slag cushion, when stabilized with cement, are expected to consequent arrest heave. The outcomes of the survey indicate a novel solution to the problem heave of expansive soil. It also resolves the problem of copper slag mi Hellion and disposal to some extent.

VaishaliSahu (Dec-2013), "Sustainable reuse of stabilized and **fiber reinforced flv ash-lime sludge (FALS) as pavement sub-base material."**In the road construction sector, the world is facing a major problem of scarcity of conventional building materials. On the other hand, in that respect are many spin-offs from various manufactures, which are lying as waste. In the present study, a composite material made up of fly ash and lime sludge (FALS) was tried as sub-base material in the paving. Stabilization of FALS with commercially available lime and gypsum was carried out and further theeffect of adding polypropylene fibers to stabilized FALS

was studied. A series of unconfined compression tests **were done** on specimens of fiber-reinforced fly ash-lime sludge composite (FRFALS) to assess the influence of fiber inclusion on the durability and ductility characteristics of the composite. The consequence of fiber reinforcement on the California Bearing Ratio (CBR) and shear strength parameters, cohesion (c) and internal friction angle (ϕ) is also talked about. Based on the **results,** it has been reasoned out that the addition **of** low amounts of polypropylene fiber (0.1 %) increases the durability and ductility of the FRFALS for the different curing period. The CBR value of FALS increased by 54% with fiber addition and the shear parameters c and ϕ also increases. Hence the FALS composite is suitable in sub-base layers of flexible pavement, if it is reinforced with polypropylene fiber.

Miss Apurva J Chavan (Apr-2013), "Use of plastic waste in flexible pavements." Disposal of waste materials, including waste plastic bags has become a grave trouble and waste plastics arc burnt for apparent disposal which cause environmental contamination. Use of waste plastic bags in bituminous mixes has proved that these enhance the properties of mixtures in addition to solving disposal problems. Plastic waste which is cleaned is cut into a size such that it fades through 2-3mm sieve using shredding machine. The aggregate mix is heated and the plastic is effectively coated over die aggregate. This plastic waste coated aggregate is mixed with hot bitumen and the resulted mi x is used lor road construction. The use of the innovative- technology will not only strengthen the road construction but also increase the road life as well as will help to improve the environment, Plastic roads would be a boon for India's hot and extremely humid climate, where temperatures frequently cross 50°C and torrential rains create havoc, leaving most of the roads with big potholes,

R.N.Nibudey et al.; (Feb-2013), "Strength Prediction of plastic fiber reinforced concrete (M30)."Now a day we are facing environment protection problems Many things which are formulated for our luxurious life are responsible for polluting environment due to improper waste management technique. One of them is a plastic which holds lo be discarded or recycled properly to preserve the beauty of our nature. To address this issue the fibers from used plastics were added in various parts in the M_{30} grade concrete. This paper identifies the performance of plastic fiber reinforced concrete (M_{30}). An experimental study has been taken out on the specimens like cubes and cylinders which were cast in the laboratory and their behavior under the test was observed. The plastic fibers were added from 0.0 % to 3.0 %. The compressive and split tensile strengths of concrete were found after 28 days curing period.

Sanjay J. Shah (Nov-2002), "Stabilization of fuel oil contaminated soil - a case study"Fuel oil contamination brings adverse eflect on basic geogphnical properties of foundation soil. The present study pertains to one such case, from the petrochemical complex near Vadodara City in Gujarat State, India. In this study, fuel oil contamination caused deleterious effects to the basic geotechnical properties of the CL type of soils. Oil contaminated soil when heated with different stabilization agents like lime, fly ash and cement either independently or as an admixture showed an improvement in the geotechnical properties. This improvement can be attributed to dispersion of oil, cation exchange, agglomeration, and pozzollanic actions of additives namely lime, fly ash and cement. Best results were observed when soil was treated with a combination of 10% lime, 5% cement and 5% fly ash. In the process of stabilization fuel oil might have formed a stable complex with metals. Increase in the strength of the soil can be attributed to reformation of compounds like CSH, CSH-1, that coat and bridge soil grains.

AsokanPappu, "Solid waste generation in India and their recycling potential in building materials."To safeguard the environment, efforts are being made for recycling different wastes and utilize them in value added applications. In this paper, present status on generation and utilization of both non-hazardous and hazardous solid wastes in India, their recycling potentials and environmental implication are reported and discussed in details

In society to maximize the utilization of alternative building materials developed for different cases of solid wastes and increase the output capacity of lab scale processes, technology-enabling centers are asked to be set-up to facilitate entrepreneurs for effective commercialization. Durability and performance of the newer products and public exposure of technologies, emphasizing cost-benefits analyses and life cycle assessment report will significantly lead to successful commercialization of modem operations. The fresh and alternative building construction materials developed using agro-industrial wastes have ample scope for bringing out new construction elements that will dilute to

an extent the prices of construction fabrics. The attempt, therefore, needs to be to encourage entrepreneurs and

construction agencies to grow novel products and operations using all these wastes as raw materials for setting upsecondary industries and contributing to the reduction of greenhouse gases and global healing.

FINDINGS FROM LITRATURE REVIEW
(GAPS IDENTIFIED)

Following observations have been pulled out from the broad overview of the literature presented in this chapter:

i) Extensive research work is reported on use of oriented and randomly oriented fibre reinforcements using laboratory testing, while this brought out the positive improvement of geotechnical behaviour of soils. Yet little work reports on the usage of waste fiber polypropylene materials.

ii) The majority of works carried out in the area of sub-base or base improvements of the diverse types of pavements using coir geotextiles to control erosion and watershed management. Just a few works have been reported involving the utilisation of polypropylene for the the advance of engineering properties of land. Consequently, a scope of systematic research study in this field is lacking.

NEED FOR PRESENT STUDY

The review of literature shows that polypropylene is a versatile material with attractive characteristics and advantages, as a result of this polypropylene is now being used abundantly all over the world. Waste fibres or plastics have high strength, less cost, long life and also they are non-biodegradable, therefore, may be used for the enhancement of engineering properties of soil (stabilisation of soil) and may also be used for control of seepage. The use of waste fibres or plastics will results in decreasing the requirement of valuable land for the disposal of wastes and it will also reduce the environmental impacts. Therefore, in this work an attempt had bee n made for utilisation of waste fibre material produced from polypropylene for the enhancement of engineering properties of soil.

CONCLUSION

From the above discussion it can be concluded that there is a need to utilize the waste fibres of polypropylene obtained from the various industries across the country for the stabilisation of the soil, which will directly help in decreasing the requirement of the valuable land for their disposal and also decline the hazardous environmental impacts.

REFRENCES

1 Akinmushuru,J.O. and Akinbolade, "Stability of loaded footings on reinforced soil" Journal, Geo Tech Engg. Div., ASCE, Vol. 107, No– 6, pp819-827, 1981.

2 Ayyar T.S.R., Joseph J., and Beena K. S., "Bearing Capacity of Sand Reinforced with Coir Rope", First Indian Geotextile Conference onReinforced soils and Geotextiles, Bombay, All - Al6, 1988.

3 Banerjee, P.K., "Development of new geosynthetic products through blends of natural fibers," Proceedings of the International Seminar and Technomeet on Environment Geotechnology with geosynthetics, New Delhi, 1966.

4 Cammack, "A role for coir fiber geofabrics in soil stabilization and erosion control", Proceedings of the 11th workshop on coir geogrids andgeofabrics in Civil Engineering Practice, Coimbatore, India, pp 28 -31, 1988.

5 Central Pollution Control Board, "Assessment of plastic waste and its management at airport and railway stations in Delhi" PariveshBhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi-110032, India, 2009.

6 Chaosheng Tang, Bin Shi, Wei Gao, Fengjun Chen, Yi Cai, "Strength and mechanical behaviour of short polypropylene fibre reinforced and cement stabilized clayey soil" Geotextiles and Geomembranes, pp 194 – 202, 2006.

7 Consoli, N.C., Prietto, P.D.M. and Ulbrich, L.A., "The behaviour of fibre- renforced cemented soil" Ground Improvement, London, 3(1), pp 21-30, 1999.

8 Giroud, J.P. and Noiray, L., "Geotextile reinforced unpaved road design", Journal of Geotechnical Engineering Division, ASCE:107, pp 1233 - 1254, 1981.

9 International Journal on Theoretical and Applied Research in Mechanical Engineering ISSN (Print): 2319-3182, Volume-3, Issue-1, "Study on heave characteristics of black cotton soils using copper slag with cement as admixture" pp 1-70, 2014.

10 Kumar, A. Wallia, B.S., and Bajaj, A., "Influence of fly ash, lime and polyester fibers on compaction and strength properties of expansive soil," Journal of Materials in Civil Engineering, ASCE, Vol.19, No.3, pp 242-248, 2007.

11 Miss Apurva J Chavan, "Use of plastic waste in Flexible pavements" International Journal of Application or Innovation in Engineering &Management (IJAIEM.) Volume 2, Issue 4, ISSN 2319 – 4847, pp 540-552, 2013.