

Review on Utilization of Waste Rubber Tyre as a Soft Subgrade Reinforcement in Flexible Pavement

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Abstract— This paper focus on the review of the utilization of waste rubber tyre as subgrade reinforcement in flexible pavement. Waste rubber tyres increases because of increase in automobile .As waste rubber tyre is categorize as solid waste and it is manufactured by using synthetic rubber so it is disposal is again big problem. In sundry areas 60 to 70% of waste tyres are disposed in incongruous way. This may leads to various environment problem like land pollution, air pollution etc. This damage can be avoided by utilizing tyre wastes with technical development in different fields like using construction of flexible pavements. Flexible pavement which will enhance properties of flexible pavement and also act as remedial measures for the disposal problem of waste tyre rubber. Tyre can be used in various forms viz; crumb rubber, shred, fine powder and cuts. Feasibility and effectiveness of rubber tyre can be check by various test performance.

Keywords— Solid waste, Automobile, Waste rubber tyre, Flexible pavement, Subgrade,

I. INTRODUCTION

The clay often is weak and has no enough stability in heavy loading. In this regard, it is necessary to reinforce and or stabilize the soil. Stabilization in a broad sense incorporates the various methods employed for modifying the properties of a soil to improve its engineering performance.[1] Stabilization is being used for a variety of engineering works, the most common application being in the construction of road and airfield pavements, where the main objective is to increase the strength or stability of soil and to reduce the construction cost by making best use of locally available materials.[2] Stabilization is process of fundamentally changing the chemical properties of soft soils by adding binders or stabilizers, either in wet or dry conditions to increase the strength and stiffness of the originally weak soils. Soil stabilization is a way of improving the weight bearing capabilities and performance of in situ sub soils, sands, and other waste materials in order to strengthen road surfaces.[3] The prime objective of soil stabilization is to improve the California Bearing Ratio of in situ soils. The other prime objective of soil stabilization is to improve onsite materials to create a solid and strong sub base and base courses. In certain regions of the world, typically developing countries and now more frequently in developed countries, soil stabilization is being used to construct the entire road. It is desirable from an engineering standpoint to build upon a foundation to ideal and consistent density. Thus, the goal of soil stabilization is to provide a solid, stable foundation. [4]Density is the measure of weight by volume of a material and is one of the relied upon measure of the suitability of a material for a construction purposes. The more density a material possesses, the fewer voids are present. Voids are the enemy of the road construction, voids provide a place for moisture to go, and make the material less stable by allowing it to shift under changing pressure, temperature and moisture condition. Improving an in situ soil engineering properties is referred to as either soil modification or soil stabilization. The term modification implies a minor change in the properties of soil, while stabilization means that the that the engineering properties of the soil have been changed enough to allow field construction to take place.[5]

I. LITERATURE REVIEW

Arwan Apriyano, Sumijanto, Dadan Deri Gusmawan [1] demonstrate that in this study, soil reinforcement using woven waste of tires can improve soil bearing capacity significantly. The most recommended distance between each stripe is of 3.5 cm. At that distance, the CBR value will increase by 115.29%over the soil without reinforcement Utilization of waste of tires for soil reinforcement is very beneficial to both of the stability of the road structure and environmental pollution problem. At the end performed experiments using five stripe distance variations of woven tires – i.e. 2, 2.5, 3, 3.5 and 4 cm. Five soft clay samples were made and each was reinforced using each of these woven tires. The California Bearing Ratio (CBR) test was conducted on each sample and the CBR value was determined from the stress on the displacement of 0.10 and 0.20 inch.

AliFirat Cabalar, Zuheir Karabash, Waleed Sulaiman Mustafa [2] research on Stablisation of clay using tyre buffing and lime. In this research California Bearing Ratio (CBR) and Unconfined Compression (UC) tests were conducted on the mixtures prepared with tyre buffings and lime. Tyre buffings and lime contents in the mixtures were 0%, 5%, 10%, and 15%, and 0%, 2%, 4%, and 6%by dry weight of the specimens, respectively. Addition of a small amount of lime to the clay with tyre buffings increases the CBR values of the specimens, and thereby may cause a

substantial decrease in design thickness of a highway pavement. Similar results were also obtained by the UC tests. Consequently, this research suggests using both tyre buffings and lime as an alternative method to improve the performance of clay in an economically and environmentally beneficial way.

Amit Srivastava, Shikha Pandey, Jeeshant Rana [3] derived that Addition of shredded tyre waste in black cotton soil also helps in reducing its swelling and shrinkage characteristics. From the combined observation of compaction tests and UCS test results, it can be noted that addition of 5% shredded tyre waste in black cotton soil will provide a mix having a lighter weight and marginally improved shear strength. Hence, mixing of shredded tyre waste of coarser size can be suggested for the construction of lighter embankments where it is required to be placed over soft or weak foundations. Further, addition of shredded tyre waste increases the consolidation properties that may be attributed to the increased permeability values of the mix. The addition of shredded tyre waste increases the compressibility properties of the mix.

C.E. Piercea, M.C. Blackwell [4] Demonstrate In this study, Experimental results indicate that crumb rubber can be successfully used to produce a lightweight flowable fill (1.2–1.6g/cm³) with excavatable 28-day compressive strengths ranging from 269 to 1194 kPa. Using a lightweight fill reduces the applied stress on underlying soils, thereby reducing the potential for bearing capacity failure and minimizing soil settlement. Based on these results, a crumb rubber-based flowable fill can be used in a substantial number of construction applications, such as bridge abutment fills, trench fills, and foundation support fill.

G. Venkatappa rao, R.K. Dutta [5] Observe that Scrap tyres can be shredded into chips and can easily be mixed with granular soils. To assess the behaviour of the admixtures, compressibility and triaxial compression tests were carried out by varying chip size and chip content. The results demonstrated that sand–tyre chip mixtures up to 20% could be a potential material for highway construction and embankment construction up to around 10 m height.

Jie Hana, Jitendra K. Thakurb Dhivya, H[6] Demonstrate that 100% RAP and 100% RCA have been used with geosynthetic rein-force meat as base course materials for sustainable roadway construction. 100% RB has been used with geosynthetic reinforcement (woven geotextile, geogrid, and geogrid and non-woven geo-textile composite) as a load bearing layer in railway track construction

M.S.Mashiria, J.S.Vinoda, M.NeazSheikhan Hing-HoTsangb George Lu, Y. Y. [7] shows that the shear strength and dilatancy behavior of STCh mixtures have been investigated. A series of monotonic triaxial tests has been carried out on sand mixed with various proportions of tyre chips. It has been found that tyre chips significantly influence the shear strength and the dilatancy behavior of STCh mixtures. The effects of confinement and relative density on the shear strength; dilatancy and initial tangent modulus of the STCh mixtures have also been investigated. Moreover, a dilatancy model for STCh mixtures has been proposed and validated with the experimental results

Munnoli P M, Suhail Sheikh, Taqudas Mir, Vijay Kesavan, Rohit Jha [8] the paper presents the study carried out with crumb rubber tyre used in strengthening the subgrade. The Standard Proctor test carried out on black cotton soil showed moisture content and dry density as 18% and 2.43 respectively. The CBR test has shown the range of values from 1.16 to 1.54. Therefore it is suggested that the waste crumbed tyres can be safely used in the sub grade as a soil binder which will effectively hold the soil with increased strength values.

N. Hataf, M.M. Rahimi [9] in this study, five shred contents of 10%, 20%, 30%, 40% and 50% by volume were selected. Addition of tire shreds to sand increases BCR (bearing capacity ratio) from 1.17 to 3.9 with respect to shred content and shreds aspect ratio. The maximum BCR is attained at shred content of 40% and dimensions of 3x12 cm. However, an optimum value for shred content is observed after that increasing shreds led to decrease in BCR.

Satishsajja, V. K. Chakravati [10] this paper discusses the performance of stabilized soft clayey soil for suitability as subgrade using two types of admixtures Robo sand and fly ash. Dynamic cone penetration test out in lab and field on composite soil with varying admixture content and the results are presented. It is observed that there is a considerable improvement with admixture in both index & engineering properties. A reduction in plasticity and improvement in soaked CBR with admixture is observed. Results indicated a relatively high performance of robo sand admixture over fly ash.

SuatAkbulut, SeracettinArasan, EkremKalkan [11] from this study conclude that, both lengths and contents of the rubber fibers played an important role in the development of the UCS of the reinforced samples. In general, the UCS values increased with increasing tire rubber fiber contents up to 2% and then decreased. Both the length and the content of synthetic fibers improved the UCS values. The polyethylene and polypropylene fibers increased the UCS values for all contents with a maximum at 0.2%.

Unnam Rajesh, Satish Sajja, V K Chakravarthi [12] in the present study an attempt has been made to study the engineering performance (CBR) for different types of soil subgrades reinforced with geogrids. Tests are conducted on soil in lab and field and CBR value is determined. Studies are carried out and influence of parameters soil plasticity, geogrid tensile capacity, soaking and unsoaking on CBR property is examined. Enforced With geogrids and the performance of geogrids in soaked condition both lab & field are studied and the performance is quantified. The results obtained have shown the influence of plasticity & fines (%) and possible usage of geogrid in improving soaked CBR performance which in the absence of grid is very poor.

Yeo Won Yoona, Sung Han Cheonb, Dae Seong Kang [13] Demonstrate the sand reinforced by waste tires had more than twice the bearing capacity of loose sand. The improvement in bearing capacity due to the tires decreased with Increase of the density. The settlement reduction due to tire reinforcement with combination of treads and sidewalls was as much as about 70% for loose sand and 34% for dense sand. The bearing capacity increased with a decrease of embedded depth, and the tire mat should be reinforced within the depth of $z=B \frac{1}{4} 0:8$ to improve bearing capacity or to reduce settlements.

II. CONCLUSION

It has been concluded from literature review overall strength is governed by the subgrade layer. It is mandatory to increase subgrade strength in areas having soft soil. Various papers reveals that soil properties can be increased by adding various material and is also reveals that many waste material are also enhancing the properties of subgrade soil which is economical way of improving subgrade strength using crumb rubber, shred and rubber cut performing proctor compaction test ,lab C.B.R, field C.B.R ,plate load test. Generally, using different percentage of tyre waste C.B.R value increases in the range of 10 to 14%.Using tyre waste C.B.R value of subgrade layer has improved, so it helps in reducing waste material and pavement thickness.

III. REFERENCES

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