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Study of Plastic Wastes by Utilizing in Road Construction

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Abstract: Management of plastic wastes is a challenging problem worldwide. The waste is being managed in many ways like land filling, recycling and burning. In construction fields it can also be used as aggregates with concrete. This study deals about the study of utilization of waste plastic materials like bottles, containers, plastic covers, etc. in combination with bituminous concrete in road construction. Stability of bituminous concrete after the addition of waste plastic powders is tested and analyzed for safety and sustainability of road.

Key words: Reusing plastic wastes, plastic waste management, bitumen, concrete, safety, road

INTRODUCTION

In our daily life plastic products are playing main role. Plastic are become used as a replacement for various materials like wood, steel and silver based products that were used before. They are available everywhere around us from wrapping materials, packaging materials, garbage bags, shopping bags, containers, toys, household items to industrial products. In parallel to this, plastic wastes also become increasing in another side. Plastics will not be degraded and if we recycle, then it is harmful to the environment. Further, the recycling of a virgin plastic material can be done 2-3 times only because after every recycling, the strength of plastic material is reduced due to thermal degradation.

Management of plastic wastes is a challenging problem worldwide. By Benson and Khire (1994) by adding strips of reclaimed High-Density Polyethylene (HDPE) with portage sand, the test have been done, to determine, California Bearing Ratio (CBR), secant modulus, resilient modulus and shear strength. Test results of this study showing that there is increase in resistance to deformation and strength while reinforcing sand with reclaimed HDPE strips. By Rao and Dutta (1997), it has been found that sand with waste plastic mixtures improve the bearing capacity of granular trench and consequently the bearing capacity ratios for all cases.

The possibility of re-cycling plastic bag waste materials is explored by Ghernouti *et al.* (2014). Here, plastic bag waste material is added in concrete mixture by replacing various percentages of sand (10-40%). The concretes are tested in fresh and hardened states. The results showed that the use of PBW improves the workability, density and reduces the compressive strength of concrete containing 10 and 20% of waste which have a mechanical strength acceptable for lightweight materials, remains always close to reference concrete (made without PBW).

Changes of shear strength and bearing capacity have been tested by Chebet and Kalumba (2014) for the locally sourced sand by randomly including strips of high density polyethylene material from plastic shopping bags. Laboratory results obtained favorably suggest that inclusion of this material in sandy soils would be effective for soil reinforcement in geotechnical engineering.

By Ismail and Al-Hashmi (2008), many tests and experiments were been performed to determine the efficiency of reusing waste plastic in the production of concrete. Various percentages of sand are replaced with waste plastic to determine fresh density, dry density, compressive strength, flexural strength and toughness indices. This study insures that reusing waste plastic as a sand-substitution aggregate in concrete gives a good approach to reduce the cost of materials and solve some of the solid waste problems posed by plastics.

MATERIALS AND METHODS

Proposed method: Bitumen is a material which is a by product of petroleum refining process as shown in Fig. 1. It is a highly viscous at temperature above 100°C and is solid at room temperature. For the present investigation 80/100 is employed bituminous materials or asphalts are extensively used for roadway construction,

Fig. 1: Bitumen

Table 1: Property of plastic wastes

Properties	Results
Specific gravity	1.04
Melting point	250-260

primarily because of their excellent binding characteristics and water prolongs properties and relatively low cost.

This method exhibits the utilization of plastic waste in hot bituminous blends to upgrade asphalt execution, secure condition and give ease streets. Polymer and plastic altered bitumen, regularly abridged as changed bitumen is acquired with the joining of chose thermoplastics and destroyed plastic from disposed of waste, common plastic or some other reasonable elastomers in bitumen. The property of waste plastic is shown in Table 1. The waste plastic is added to the bitumen in various percentages (10-35%) and tests were performed to determine bending and compressive strength.

RESULTS AND DISCUSSION

Table 2 shows the bending and compressive strength of concrete prepared by replacing various percentages of bitumen with plastic wastes. The 35% of polymer bitumen blend is a better binder compared to plain bitumen. The blend has increased softening point for 35% and decreased penetration value with a suitable ductility. More than 35% of polymer leads to decrease in the stability. When this polymer bitumen blend used for road construction it can with stand higher temperature. Hence, it is suitable for tropical regions. Hence, its load carrying capacity is increased maximum at 35% (Fig. 2).

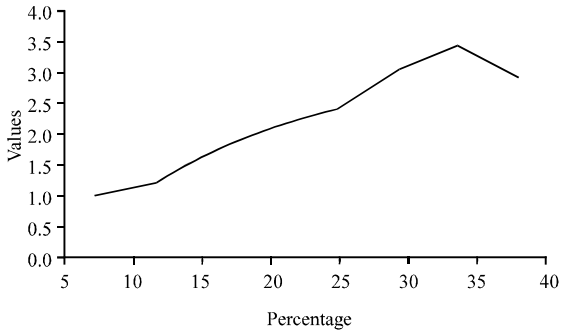

Fig. 2: Result on stability check

Table 2: Bending and compressive strength

Plastic over aggregate (%)	Bending strength	Compressive strength
10	324	250
20	332	272
30	348	291
35	392	318

CONCLUSION

The expansion of waste plastic adjusts the properties of bitumen. The adjusted bitumen demonstrates great outcome when contrasted with standard outcomes. The plastic has the stability on the 30-40%. The issues like draining are lessen in hot temperature locale. Plastic has property of retaining sound which like wise helps in decreasing the sound contamination of overwhelming activity. Total material cost of the venture is decreased by 7.99%.

REFERENCES

Benson, C.H. and M.U. Khire, 1994. Reinforcing sand with strips of reclaimed high-density polyethylene. J. Geotech. Eng., 120: 838-855.

Chebet, F.C. and D. Kalumba, 2014. Laboratory investigation on re-using polyethylene (Plastic) bag waste material for soil reinforcement in Geotechnical Engineering. Civil Eng. Urban Plann. Intl. J., 1: 67-82.

Ghernouti, Y., B. Rabehi, B. Safi and R. Chaid, 2014. Use of recycled plastic bag waste in the concrete. J. Intl. Scientific Pub., 8: 480-487.

Ismail, Z.Z. and E.A. Al-Hashmi, 2008. Use of waste plastic in concrete mixture as aggregate replacement. Waste Manage., 28: 2041-2047.

Rao, G.V. and Dutta, R.K., 1997. Ground improvement with waste plastic. Master Thesis, Missouri University of Science and Technology, Rolla, Missouri.