

# A REVIEW STUDY OF USING PLASTIC WASTE IN THE CONSTRUCTION OF BITUMINOUS PAVEMENTS

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**Abstract:** Waste plastic materials such as cups, polythene bags, is increasing day by day leading to the serious environmental hazards as the plastic is non- biodegradable. Thus, this waste needs to be removed from the environment or utilized effectively. It has been seen that the waste plastic materials can improve the desired properties of bituminous mix for repairs and construction of bituminous pavements. The molten plastic can be used to coat the aggregates and also as a partial replacement of bitumen in the bituminous mix. The mix polymer coated aggregate and modified bitumen have shown higher strength. Use of this mix for road construction helps to use plastic waste effectively. Now a day's waste plastic is used in bituminous road construction. This technology is not a new concept but rather not practiced widely.

**Key Words:** Plastic Waste, Bitumen, Aggregates, Plastic coated aggregates, Plastic modified bitumen.

## I. INTRODUCTION

Plastic is a non-biodegradable material, and it has been found by researchers to keep going for around 4500 years without decay which implies that it plastic waste poses a great danger to the environment [1]. The mechanical upheaval of plastics has brought about an expanded plastics creation and lessening in cost of plastics. Today as watched, each key part of the economy worldwide from horticulture to the correspondence divisions, manage the utilization of plastics in every one of their field of work. Besides, specialists have completed extensive investigations that have demonstrated the perils behind the ill-advised dumping of this plastic waste [2]. These risks result into medical issues, for example, conceptive issues experienced by people and creatures. It is comprehended that if plastic waste can't be totally restricted, the techniques for using it for ecological beneficiation by and for the future age must be derived. Administration of waste materials is one of the intense advancements that are as of late completed. To decrease the high rate of plastic waste collection everywhere, there are approaches to reuse them in road construction [3].

The use of plastic coated aggregates has been proposed for disposing plastic wastes. Studies have demonstrated that utilizing reused plastics can be utilized for enhancing the mechanical qualities of flexible pavement and some of the advantages include better binding property, stability, density, and high resistance to water and cracks [4]. The field results show that theses plastic coated aggregates can withstand stress and increase the life of the roads and reduce the environmental problems at the same time.

## II. LITERATURE REVIEW

**Prof.C.E.G. Justo** states that addition of 8.0 % by weight of processed plastic for the preparation of modified bitumen results in a saving of 0.4 % bitumen by weight of the mix or about 9.6 kg bitumen per cubic meter (m<sup>3</sup>) of BC mix.[5] Modified Bitumen improves the stability or strength, life and other desirable properties of bituminous concrete mix.

**V.S. Punith (2001)**, states there is possibility to improve the performance of bituminous mixes of road pavements. Waste plastics (polythene carry bags, etc.) on heating soften at around 130°C. Softened plastics have a binding property. Hence, it can be used as a binder for road construction.

**Dr. R. Vasudevan (2007)** investigated that the coating of plastics reduces the porosity, absorption of moisture and improves soundness. He stated that the polymer bitumen blend is a better binder compared to plain bitumen [6]. Blend has increased softening point and decreased Penetration value with a suitable ductility. When it used for road construction it can withstand higher temperature and load. The coating of plastics reduces the porosity, absorption of moisture and improves soundness. The polymer coated aggregate bitumen mix forms better material for flexible pavement construction as the mix shows higher Marshall Stability value and suitable Marshall Coefficient. Hence the use of waste plastics for flexible pavement is one of the best methods for easy disposal of waste plastics. Use of plastic bags in road help in many ways like Easy disposal of waste, better road and prevention of pollution and so on.

**S.Rajasekaran et al (2013)** explains that by coating the aggregate with the polymer has many advantages and which ultimately helps in improving the flexible pavement quality not only it improve the pavement quality but also improve the aggregate quality. This technology also helps in the disposal of waste plastic obtained from the domestic and industrial packing materials. The dry process is more valuable as it dispose the 80 % of waste polymer in eco-friendly way. And use of polymer reduces the equivalent bitumen quantity and therefore reducing the construction cost of road.

**Sasane Neha .B et al (2015)** investigated application of waste plastic as an effective construction material in flexible pavement. [8] They explained that the addition of plastic is the innovative technology which strengthen the road construction and also increases the life of road. As the plastic content increase the property of bitumen and aggregate also increases compared to conventional flexible pavement the flexible pavement with the added plastic has good results. According to marshal stability test the optimum use of plastic is up to 10%.

**Sabina (2001)** studied the comparative performance of properties of bituminous mixes containing plastic/polymer (PP) (8% and 15% by weight of bitumen) with conventional bituminous concrete mix (prepared with 60/70 penetration grade bitumen). Improvement in properties like Marshall Stability, retained stability, indirect tensile strength and rutting was observed in Plastic modified bituminous concrete mixes.

**Woyal and Wagle** carried out research on use of waste plastic and waste rubber in aggregate and bitumen for road materials.[9] In their research they used polymer and crumbed rubber as a binder with respect to aggregate and bitumen. They tested the material for crushing value, impact value, abrasion value, and specific gravity, bitumen penetration value, ductility, softening point. They found that the use of waste plastics and rubber tyres in the form of powder for flexible pavement material is one of the best methods for easy disposal of wastes.

### III. CONCLUSION

Following are the conclusions drawn after studying the various researches:

1. The properties of aggregates get enhanced after they are coated with a layer of plastic.
2. By adding waste plastic to the bitumen the properties of bitumen has been optimized.
3. Addition of plastic to the bituminous mix increases its Marshall stability Value, thus making it more stable.
4. Thus, the use of waste plastic ultimately improves the performance and quality of flexible pavement.
5. As plastic is non-biodegradable and also harmful to environment thus, disposal of plastic is a matter of great concern. Therefore, use of waste plastic in the road construction is an effective way of disposal of waste plastic.

### REFERENCES

- [1]. Vamshi, *J. Eng.* 2(2013) 123-128.
- [2]. W. Butu and S.S Mshelia, *British J. Environ. Sci.* 2 (2014) 10-26.
- [3]. A.J. Chavan, *Int. Innovation Eng. Manage.* 2 (2013) 1-13.
- [4]. V. S. Punith, A. Veeraragavan, *Laboratory fatigue studied on bituminous concrete mixes utilizing waste shredded plastic modifier*, Proceeding of the 21<sup>st</sup> ARRB and 11<sup>th</sup> REAAA Conference, Australia 2003.
- [5]. Justo, C.E.G. and Veeraragavan, A. (2002) *Utilization of Waste Plastic Bags in Bituminous Mix for Improved Performance of Roads*. Banglore University, Bengaluru.
- [6]. Vasudevan R,(2006) “*Utilization of waste plastics for flexible pavement*”, Indian Highways (Indian Road Congress), vol. 34, no.7, pp 105-111.
- [7]. Vasudevan.R, S.K. Nigam, R. Velkennedy, A. Ramalinga Chandra Sekar I and B. Sundarakannan (2007), “Utilization of Waste Polymers for Flexible Pavement and Easy Disposal of Waste Polymers”, Proceedings of the International Conference on Sustainable Solid Waste Management, September, pp 105-111.
- [8]. Sasane Neha .B., Gaikwad.Harish, Dr. J R Patil And Dr. S D Khandekar, Application Of Waste Plastic As An Effective Construction Material In Flexible Pavement, International Research Journal Of Engineering And Technology,2015, 2(3),1943-1948.
- [9]. Dr. Abhaykumar S Woyal, Mudassir. D. Wagle, Use Of Waste Plastic And Waste Rubber In Aggregate And Bitumen For Road Materials, International Journal Of Emerging Technology And Advanced Engineering, 2013, 3(7),301-306.