

WASTE POLYMERIC PACKAGING MATERIAL USE IN BITUMINOUS ROADS

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Abstract: The quantum of plastic waste in municipal solid waste (MSW) is increasing due to increase in population, urbanization, development activities and changes in life style which leading widespread littering on the landscape. Thus, disposal of waste plastic is a menace and become a serious problem globally due to their non-biodegradability and anaesthetic view. Since these are not disposed scientifically & possibility to create ground and water pollution. Rutting is caused by accumulation of permanent deformations caused by repeated applications of traffic loads and it is a stress controlled cyclic loading phenomenon. The process of deformation of bituminous surfacing is accelerated by increase of pavement temperature, reduction in stiffness of mix and increase in traffic loads. The aim of this project is to report findings of study on increase in stiffness modulus of bituminous mixes by incorporation of waste polymeric packaging material (WPPM) to enhance pavement performance as well as to protect environment.



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INTRODUCTION

Any nation's progress is directly dependent on infrastructure. India is on the threshold of a major forward thrust in the transportation infrastructure. Now-a-days disposal of different waste produced from different industries is a great problem. These materials cause environmentally pollution in the nearby locality because many of them are nonbiodegradable. Traditionally soil, aggregates, sand, bitumen, cement, etc. are used for road construction. Natural materials being exhaustible in nature, its quantity is declining gradually. Also, cost of extracting good quality of natural material is increasing. Concerned about this, the scientists are looking for alternative materials for highway construction, and industrial wastes product is one such category. If these materials can be suitably utilized in construction, the pollution and disposal problems may be partly reduced. In the absence of other outlets, these solid wastes have occupied several acres of land around plants throughout the country. Keeping in mind the need for bulk use of these solid wastes in India, it was thought expedient to test these materials and to develop specifications to enhance the use of these industrial wastes in construction, in which higher economic returns may be possible. The possible use of these materials should be developed for low volume of construction and different parts of our country. The necessary specifications should be formulated and attempts are to be made to maximize the use of solid wastes in different levels. Bituminous binders are widely used by paving industry. In general pavements are categorized into two groups, i.e. flexible and rigid pavement

LITURATURE SURVEY

1. Naveen and Pardeep (2019) studied how Bituminous Concrete (BC) is a composite material mostly used in construction projects like road surfacing, airports, parking lots etc. It consists of bitumen (used as a binder) or asphalt and mineral aggregate which are mixed together & laid down in layers then compacted. Over the last few decades increasing awareness of human being about environment protection and preservation guides some new techniques. Now a days, the steady increment in high traffic intensity in terms of commercial vehicles, and the significant variation in daily and seasonal temperature put us in a demanding situation to

think of some alternatives for the improvisation of the pavement characteristics and quality by applying some necessary modifications which shall satisfy both the strength as well as economical aspect.

2. Priyanshi Bhargava and Tapas Singh (2018) indicated that Bituminous mixes are most typically used everywhere the world in flexible pavement construction. It consists of asphalt or bitumen (used as a binder) and mineral combination that is mixed along, set down in layers and so compacted. Under traditional circumstances, standard bituminous pavements if designed and executed properly perform quite satisfactorily; however, the performance of bituminous mixes is extremely poor under varied situations. Today's asphaltic concrete pavements are expected to perform higher as they're experiencing the increased volume of traffic, accrued loads and increased variations in daily or seasonal temperature over what has been experienced within the past. Additionally, the performance of bituminous pavements is found to be terribly poor in wet induced situations. Considering this plenty of labour has been done on the utilization of additives in bituminous mixtures and as well as on modification of bitumen. Plastics are everywhere in today's lifestyle and are growing rapidly throughout particularly in a developing country like India. As these are non-biodegradable there is a major problem posed to the society with regard to the management of these solid wastes. Low density polyethylene (LDPE) has been found to be a good modifier of bitumen. Even, the reclaimed polyethylene originally made of LDPE has been observed to modify bitumen..

3. Kalpana and D. Surendaran (2018) gave a review that Disposal of waste materials together with waste plastic baggage has become a significant drawback and waste plastics 10 area unit burnt for apparent disposal that cause environmental pollution. Utilization of waste plastic baggage in hydrocarbon combines has tested that these enhance the properties of mix additionally to determination disposal issues. Plastic waste that is cleansed is remove a size specified it passes through 2-3mm sieve victimisation shredding machine. The aggregate mix is heated and also the plastic is effectively coated over the combination. This plastic waste coated mixture is combined with hot hydrocarbon and also the resulted mix is employed for construction. the utilization of the innovative technology won't solely strengthen the construction however conjointly increase the road life yet as can facilitate to boost the surroundings. Plastic roads would be a boon for India's hot and very wet climate, wherever temperatures oft cross 50°C and torrential rains produce disturbance, departure most of the roads with massive potholes.

4. Maaz Allah Khan et al., (2017) studied Plastic found in different forms is almost 5% amongst municipal solid waste, which can prove to be toxic in nature. It is a common sight in both urban and rural areas to find empty plastic bags and another type of plastic packing material littering the roads as well as drains. Due to its biodegradability, it creates stagnation of water and associated hygiene problems. In order to contain this problem experiments have been carried out whether this waste plastic can be reused productively in the construction of roads. The experimentation at several institutes indicated that the waste plastic, when added to hot aggregate will form a fine coat of plastic over the aggregate and such aggregate, when mixed with the binder is found to give higher strength, higher resistance to water and better performance over a period of time. Therefore, it is proposed that we may use waste plastic in the construction of Rural Roads.

5. Huda Shafiq and Ansar Humid (2016) stated that Plastics are the non-biodegradable materials and so a means to degrade our environment. Plastic wastes have proved to be a source of health hazard as it is toxic in nature. Plastic waste is a big nuisance in today's world. So, this plastic waste should be reused to eliminate the threat to the surroundings. One such reuse can be in the construction of flexible pavements. Plastic coated aggregates have proved to offer better resistance to abrasion and wear and tear. Moreover, the bond between these plastic-coated aggregates and the bitumen is also very strong due to increased contact area between plastic (polymers) and bitumen. Such roads show better performance and have increased life spans.

6. Sunil J Kulkarni (2016) stated that the disposal of biodegradable waste can be carried out in open dumping, sanitary landfill or composting methods. Incineration can also be used for solid waste treatment. Pre-treatment of agricultural waste and vermicomposting are 11 effective ways to convert solid waste into manure and combustible gases. Critical problem of solid waste minimization lies with non-biodegradable waste. Use of plastic in construction material is becoming more and more acceptable due to the improved properties of materials. The optimum quantity of the waste plastic in bitumen was reported to be 10 percent in most of the investigations. With increase in plastic share, the strength and flow property increase. Most of the investigators have advocated use of waste plastic up to 10 percent. The cost of construction materials also decreases considerably due to use of waste plastic

OBJECTIVES

- Plastic is coated over stones-improving surface property of aggregates.
- Coating is easy and temperature required is same as road laying temperature.
- Use of waste plastic more than 15% is possible.
- Flexible films of all types of plastics can be used.
- Doubles the binding property of aggregates.
- No new equipment is required.
- Bitumen bonding is strong than normal.
- The coated aggregates show increased strength.
- As replacing bitumen to 15% higher cost efficiency is possible.
- No degradation of roads even after 5-6 years after construction.
- Can be practiced in all type of climatic conditions.
- No evolution of any toxic gases as maximum temperature is 180°C.

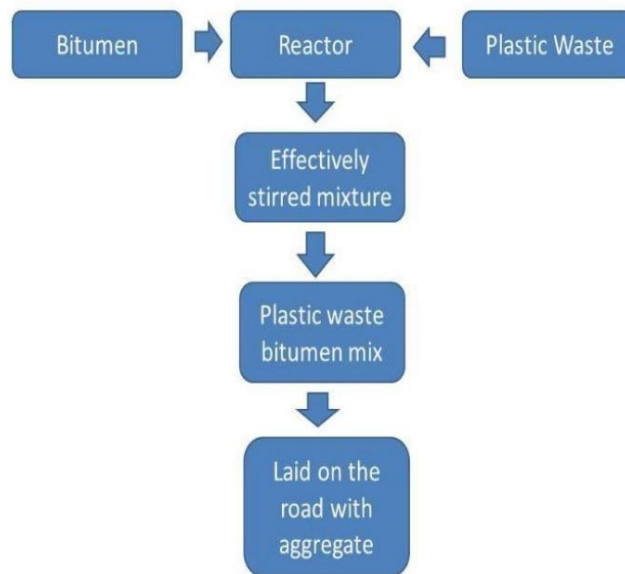
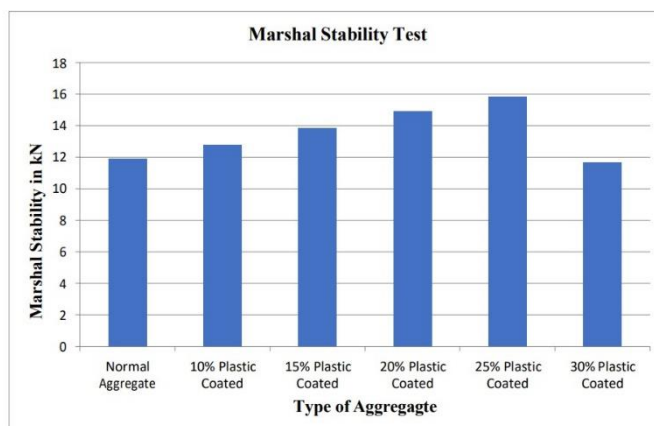
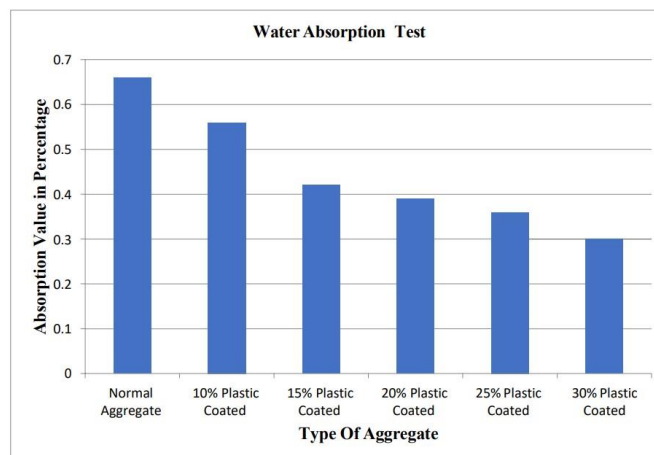


PHOTO GALLERY





CONCLUSION

1. It was found from study of behaviour of polymeric packaging material with improvement of modified mix possesses Marshall Characteristics as mentioned It is found that increase of Marshall Stability Value with polymeric polyethylene content up to 4% and after that it decreases. If the addition of polymeric material increases then the Marshall Value decreases.
2. Using polymeric packaging material in road construction will help reduction in need of bitumen by around 10%, increases the strength and performance of road as well as its durability.
3. Polymeric material also improves the strength of bitumen mixes with their binding properties.
4. This technique also helps to avoid general disposal technique of waste plastics like land filling and incineration, which are certainly burden on environment or ecology.
5. In Impact value test of aggregate, it is found that the plastic coated aggregate shows less impact than non-plastic coated aggregate. But excessive coating of plastic to aggregate also leads to rise in impact value of aggregate.
6. In Abrasion value test, the value gets reduced as coating percentage increases but at specific point the increase in coating may leads to high abrasion value. Thus, to obtain good results coating of aggregate should be in proper proportion.
7. In Moisture absorption test, it is found that the increase in percentage of coating of plastic to aggregate may leads to minimum percentage of moisture absorption by aggregate as compared to normal aggregate or non-coated aggregate. Due to polymeric material coating of aggregates the voids present in aggregate are completely filled by plastic so there is less number of voids and thus as coating percentage increases the moisture absorption of aggregate gets decreases.
8. For Marshall stability test, the value of load also increases with increase in coating percentage but higher coating percentage may lead to failure of sample. Therefore, to minimize this failure plastic coating should be in proper parameters.
9. Hence from all test results we conclude that the 20% plastic coated aggregate will perform the excellent role as construction material in bituminous road construction.

REFERENCES

- [1] Naveen and Pardeep, "Experimental analysis on bituminous concrete mix roads under the uses of dissipation poly (methylene)", International Journal of All Research Education and Scientific Methods (IJARESM)., Vol7, Issue 6, June 2019
- [2] Priyanshi Bhargava and Tapas Singh, "Use of waste polythene in modification of bituminous mix for DBC", International Journal of Engineering Sciences & Research Technology, January 2018
- [3] Mrs. Kalpana et al., "Utilisation of waste plastic in Bituminous roads", International Journal of Pure and Applied Mathematics, Vol 119, No.17, 2018 [4] Maaz Allah Khan et al., "A Study on the Plastic Waste Treatment Methods for Road Construction", International Journal of Advance Research, Ideas and Innovations in Technology, Vol 3, Issue 6, 2017
- [5] Huda Shafiq and Anzar Hamid, "Plastic Roads: A Recent Advancement in Waste Management", Vol 5, Issue 09, September 2016
- [6] Sunil Jayant Kulkarni, "Use of Plastic in Road Construction Material: Towards Solid Waste Minimization", International Journal of Recent Trends in Engineering and Research, 2016
- [7] Yash Menaria and Rupal Sankhala, "Use of Waste Plastic in Flexible Pavements – Green Roads", Open Journal of Civil Engineering, 2015 [8] Amit Gawande et al., "An Overview on Waste Plastic Utilization in Asphaltting of Roads", Journal of Engineering Research and Studies, Vol 3, Issue 2, June 2012
- [9] Ashok Pareek et al., "Performance of Polymer Modified Bitumen for Flexible Pavements", International Journal of Structural and Civil Engineering Research, Vol 1, No. 1, November 2012
- [10] Taher Baghaee et al., "Utilization of Waste Plastic Bottles in Asphalt Mixture", Journal of Engineering Science and Technology, Vol 8, No.3, 2013
- [11] Sangita et al., "A Novel Approach to Improve Road Quality By Utilizing Plastic Waste in Road Construction", Journal of Environmental Research And Development, Vol 5, No.4, June 2011
- [12] P K Jain, "Mitigation of rutting in bituminous roads by use of waste polymeric packaging material". Indian Journal of Engineering and Material Sciences, Vol 18, June 2011