



# Use Of Waste Plastic In Bituminous Road

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## Abstract:

The quantum of plastic in solid waste is increasing due to increase in population, urbanization, development activities and changes in life style which is leading to widespread littering on the landscape. The disposal of waste plastic has thus become a serious problem globally due to their non-biodegradability. Many of the wastes produced today will remain in the environment for many years leading to various environmental concerns. Therefore it is necessary to utilize the wastes effectively with technical development in each field. Many by-products are being produced using the plastic wastes. Our present work is helping to take care of these aspects. The main objective of the study was to investigate the performance of the bituminous mix modified with bio-medical plastic waste and to compare it with the normal mix. Medical plastic waste was collected from IMAGE (Indian Medical Association Goes Eco-friendly), Palakkad, Kerala, India. Use of this mix for road construction helps to use plastics waste. Once the plastic waste is separated from municipal solid waste, the organic matter can be converted into manure and used. Our paper will discuss in detail the process and its successful applications.

## Keywords

Landscape, biodegradability, bio-medical plastic.

## 1. Introduction

Any nation's progress is directly dependent on infrastructure. India is on the threshold of a major forward thrust in the field of transportation infrastructure. Now-a-days disposal of different wastes produced from different Industries is a great problem. These materials pose environmental pollution in the nearby locality because many of them are non-biodegradable. Traditionally soil, stone 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 quOver the past two decades, traffic volumes have increased,

demanding from pavement engineers, stronger and long lasting pavements. New methods of pavement design are being developed to improve the performance of roads. New materials are being used to replace the old ones to improve the durability, strength, aesthetics and economy. One of the promising ways is to use plastics in bituminous road construction industry. ality of natural material is increasing. Over the past two decades, traffic volumes have increased, demanding from pavement engineers, stronger and long lasting pavements. New methods of pavement design are being developed to improve the performance of roads. New materials are being used to replace the old ones to improve the durability, strength, aesthetics and economy. Plastic in different forms is found to be almost 5% in municipal solid waste, which is toxic in nature. It is a common sight in both urban and rural areas to find empty plastic bags and other type of plastic packing material littering the roads as well as drains. Disposal of biomedical plastic wastes like plastic syringes and glucose bottles have always been a matter of concern because of the various health hazards and pollution caused by them.

## 2. Methodology

To study the effect of mixing plastic waste in bituminous mixes. the following methodology was adopted. The plastic waste like carry bags, Polythenes etc. was collected and shredded to size passing through 2.36 mm sieve and Retained on 600 micron sieve. The shredded plastic waste was mixed in the hot aggregates. Normal mix specimens were prepared with bitumen contents of 4.5 percent, 5 percent, 5.5 percent and 6 percent. The Optimum Bitumen Content (OBC) was found out using Marshall test. Plastic modified mix specimens with plastic contents of 6%, 8%, 10%, 12%, and 14% by weight of bitumen were prepared through dry process by adding plastic to heated aggregates. Marshall test were conducted on plastic modified mix specimens to study different parameters. The bio-medical syringe plastic waste needed for the work was collected from a private organization, IMAGE (Indian Medical Association Goes Eco-



friendly), Kanjikode, Palakkad. The following tests on aggregates were done:

- Aggregate crushing value test
- Aggregate impact value test
- Specific gravity test
- Water absorption test
- Los Angeles abrasion test

#### a) Wet Process:

Waste plastic bags collect first. Collected plastic waste sorted as required thickness. Normally polyethylene 60 micron or below is used for the further process. Generally less micron plastic is easily mixable in the bitumen at higher temperature (160-170oc) Collected plastic was cut into fine pieces as far as possible. Then sieve it through 4.75mm sieve and retain on 2.36mm sieve was collected. First bitumen heated at about 160-170 c temp. which is melting temperature. Then piece were added into this. At constant temp. mixture was stirred manually for about 20-30min. Polymer bitumen mixture of different composition were prepared & used for carrying out diff. test i e. Penetration test, ductility test, flash point test & fire point test, stripping test, ring & ball test and marshall stability test.

#### b) Dry Process

An alternate method was innovated to find an effective way of using higher percentage of plastic waste in the flexible pavement. The aggregate coated with plastic was used as the raw material. The plastic used were the disposed carry bags, films, and cup etc with a maximum thickness of 60 microns. Plastic waste can be used as a coating over aggregate and this coated stone can be used for road construction. The bitumen was not blended with plastic waste.

### 2.1 Scope Of Study

1. Disposal of waste plastic is a major problem.
2. It is non-biodegradable.
3. It mainly consists of low-density polyethylene.
4. To find its utility in bituminous mixes for road construction.
5. Burning of these waste plastic bags causes environmental pollution.
6. Laboratory performance studies were conducted on bituminous mixes.
7. Studies proved that waste plastic enhances the property of the mix.
8. Improvement in properties of bituminous mix provides the solution for disposal in an useful way.

The quantum of plastic in solid waste is increasing due to increase in population,

urbanization, development activities and changes in life style which is leading to widespread littering on the landscape. Bottles, containers and packing strips etc. is increasing day by day. As a result amount of waste plastic also increases. This leads to various environmental problems. Disposal of waste plastic is a serious problem globally due to their nonbiodegradability and hazardous to human healths, since these are not disposed scientifically and thus, create ground and water pollution.



Fig. 1.



Fig. 2.



Fig. 3.



### 3. Conclusion

Our studies on the performance of plastic tar road conclusively proves that it is good for heavy traffic due to better binding, increased strength and better surface condition for a prolonged period of exposure to variation in climatic changes. Above all, the process helps to dispose waste plastics usefully and easily. Polymer Modified Bitumen is used due to its better performance. Polymer Modified Bitumen is used due to its better performance. But in the case of higher percentage of polymer bitumen blend, the blend is a more polymer dispersion in bitumen, which get separated on cooling. This may affect the properties and quality of the blend and also the Marshall stability value of plastic modified mix was found to be 51 percent more than that for the normal mix which indicates an increase in load carrying capacity.

- It was observed that the aggregate crushing value was reduced by 27 percent on coating the aggregates with plastic. This implies that the crushed fraction will be lower when the plastic coated aggregates are subjected to loads.

- The aggregate impact value showed a percentage reduction of 17.7 on coating. This means that the plastic coated aggregates have better impact resistance.

- Los Angeles abrasion value of plastic coated aggregates was found to reduce by 8 percent indicating that these

aggregates have superior abrasion resistance compared to normal aggregates.

- The permanent strain was reduced by 0.21 percent for plastic modified mix.

- The average tensile stiffness modulus value of plastic modified mix is found to increase by 47.8 percent than the normal mix which indicates an increase in the tensile strength. On the basis of the experimental results obtained, it is found that mixes prepared with biomedical plastic waste has shown better properties compared to the conventional bituminous mixes. Hence, the biomedical plastic waste can be disposed off judiciously by incorporating it in bituminous mixes. ad laid using such blend.

### 4. References

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