

A Review of Waste Plastic Use in Road Construction

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Abstract: *Disposal of waste materials including waste plastic bags has become a serious problem and waste plastics are burnt for apparent disposal which cause environmental pollution. Utilization of waste plastic bags in bituminous mixes has proved that these enhance the properties of mix in addition to solving disposal problems. The use of the innovative technology will not only strengthen the road construction but also increase the road life as well as will help to improve the environment. Plastic roads would be a boon for India's hot and extremely humid climate, where temperatures frequently cross 50°C and torrential rains create havoc, leaving most of the roads with big potholes. In my paper I summarise the research work which is carried out to utilise plastic bags in road construction.*

Keywords: Plastic Bags, Road construction, Environment, Bituminous.

Introduction: Most of the paved roads in our country have granular sub base and base; bituminous base and wearing courses. The past practice of providing thin wearing coat of 20 mm premix carpet with seal coat was to allow deformation in granular layers to take place once road is opened to traffic. After the layers get compacted then thick bituminous wearing course was provided. Plastic is a very versatile material. Due to the industrial revolution, and its large scale production plastic seemed to be a cheaper and effective raw material. Today, every vital sector of the economy starting from agriculture to packaging, automobile, electronics, electrical, building construction, communication sectors has been virtually revolutionized by the applications of plastics. Plastic is a non-biodegradable material and researchers found that the material can remain on earth

for 4500 years without degradation. Several studies have proven the health hazard caused by improper disposal of plastic waste. Plastics, a versatile material and a friend to common man become a problem to the environment after its use. Disposal of a variety of plastic & rubber wastes in an eco-friendly way is the thrust area of today's research. Looking forward the scenario of present life style a complete ban on the use of waste plastic cannot be put, although the waste plastic taking the face of a devil for the present and the future generation. But the use of waste plastics in road construction is gaining importance these days because plastic roads perform better than ordinary ones and the plastic waste considered to be a pollution menace, can find its use. The use of waste plastic for coating the aggregates of the bituminous mix found to improve its performance characteristics.

Recycled polythene carry bags were shredded into small sizes and is coated on aggregates of the mix at specified temperature. Bituminous mixes were prepared with 60/70 bitumen and plastic coated aggregates/ordinary aggregates with cement as a filler material. The uses of plastic waste helps in substantially improving the abrasion and slip resistance of flexible pavement and also allows to obtain values of splitting tensile strength satisfied the specified limits while plastic waste content is beyond 30% by weight of mix. If the consistent mixing time and mixing temperature are not provided for bitumen– modifier mix, modified bitumen cannot exhibit good performance in situ, thus premature failures will occur. Therefore, there are certain recommended mixing time, mixing temperature and modifier content for all the polymers with a trademark. This all should be taken in mind while mixing and lying of roads is to be done using plastic waste. Plastic road would be a boon for India. In hot and extremely humid climate durable and eco-friendly plastic roads are of greatest advantages. This will also help in relieving the earth from all type of plastic waste.

NECESSITY OF WORK

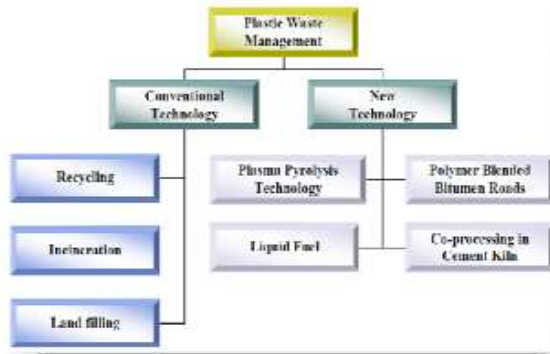
1. Plastic mainly consists of low-density polyethylene and more durability than regular bitumen roads.
2. Eco-friendly recycling of plastic wastes so plastic waste management will be done up to certain extent. And Eco-friendly process.

3. This will provide more stable and durable mix for the flexible pavements. The serviceability and resistance to moisture will also be better when compared to the conventional method of construction.
4. The polymer modified bitumen show better properties for road construction and plastics waste which otherwise are considered to be a pollution menace.
5. Improvement in properties of bituminous mix provides the solution for disposal in a useful way.
6. Poor locally available aggregates can make into use by coating them with waste plastic which will ultimately reduce the haulage cost & improves the physical properties of aggregates.
7. Stone aggregate is coated with the molten plastic waste. The coating of plastics reduces the porosity, absorption of moisture & improves stripping value.

Plastic waste management

Disposal of plastic waste is a serious concern in India. New technologies have been developed to minimize their adverse effect on the environment. Currently worldwide accepted technology used for the plastic disposal is incineration. However, the incinerators designed poorly, releases extremely toxic compounds (chlorinated dioxins and furans) therefore, facing strong opposition from various non-government organizations. In India to introduce a safer disposal technology

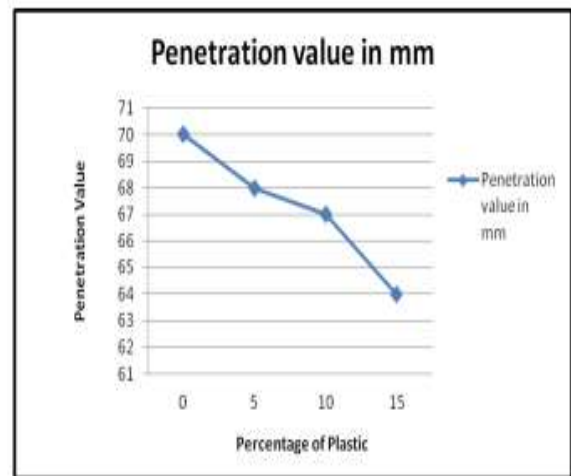
various new technologies were experienced shown in fig



Experimental Tests

1. **Penetration Tests** The penetration test is carried out to know the hardness or softness of bitumen used in road construction by measuring the distance to which the needle penetrates. Samples having different percentage of plastic waste in bitumen is prepared and their penetration values are determined as per IS code .The penetration values of the blends are decreasing depending upon the percentage of polymer added. As per IRC recommendation the penetration values of Bitumen is from 20-225 mm

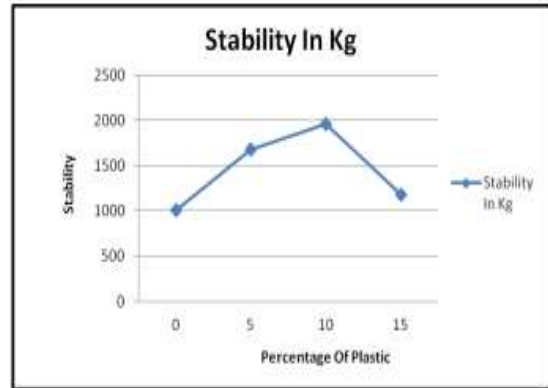
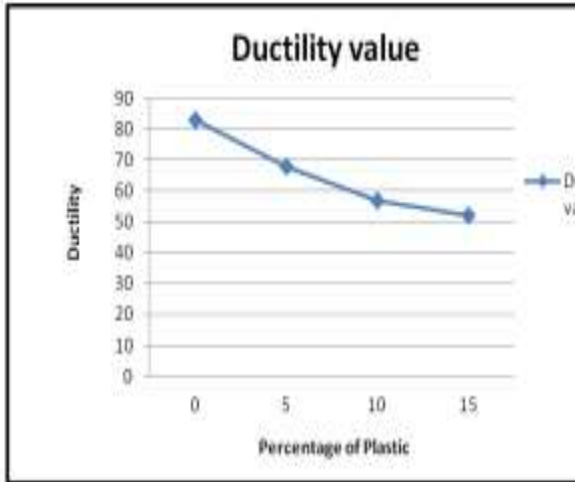
% of bitumen	% of polymer	Penetration value in mm
100	0	70
95	5	68
90	10	67
85	15	64



2. **DUCTILITY TEST (IS: 1208-1978)**

This test is done to determine the ductility of bitumen. The principle of this test is that: the ductility of a bituminous material is measured by distance in cm to which it will elongate before breaking.

% of bitumen	% of polymer	Ductility value
100	0	83
95	5	68
90	10	57
85	15	52



3. Marshal Stability Test In marshal stability test, the deformation of specimen of bituminous mixture is measured when the same load is applied. This test procedure is used in designing and evaluating bituminous paving mixes. The marshal stability of mix is defined as a maximum load carried by a compacted specimen.

Conclusion

1. Plastic will increase the melting point of bitumen.
2. Use of the innovative technology will not only strengthen the road construction but also increase the road life.
3. Help to improve the environment.

References

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Sr No	Plastic Added (%)	Stability (kg)
1	0	1010
2	5	1680
3	10	1957
4	15	1181.23