Use of Waste Plastic In Road Pavements

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Abstract- *For production of asphalt mix waste plastics both by domestic and industrial sectors can be used Waste plastics are mainly use for packaging are formed of by Polyethylene, Polypropylene and polystyrene. Their softening varies from 110-1400c and they can not produced any toxic gases at heating but the softened plastics going to formed a coat over the aggregates, when it is formed over the hot aggregate at 1600C. The Plastics Coated Aggregates (PCA) is a good raw material for the construction of flexible road pavement. PCA then mixed with hot bitumen of different types and the mixes were used for contruction of road pavement. PCA - Bitumen mix showed better binding and less wetting property. The higher Marshall Stability value in the range of 18-20KN and the load bearing capacity of the road is increased by 100% by sample. The roads are constructed since 2002 using PCA-Bitumen mixes are performing better.. A detailed study on the performances of these roads shows that the constructed with PCA –Bitumen mix are performing better. It is a eco-freindly and economical process.*

Keywords- Waste plastic, Bitumen

I. INTRODUCTION

Plastic is everywhere in today s lifestyle. The main problem is a solution for the plastic waste. This threat of disposal of plastic have no solution itself and certain practical level have to be initiated at the ground level. On the other ha And the road traffic is increases time to time hence there is a need to increase the load bearing capacities of roads. In construction of pavement, hot bitumen is filmed over stone aggregates mixed, laid and rolled. But when the sprinking of water takes place over roads, it creatspotholes by penetratation. Certain anti stripping agents are used but these have limited use and the cost of construction increases Their is improving abrasion, slip resistance and increased the durability and fatigue life by coat of plastic over them. The mix of plastic and bitumen, LDPE replacing 30% of 2.36 - 5mm aggregates showed 250% increase in Marshall stability and the mix density reduced upto 16% and in addition it to the Indirect Tensile Strength (ITS) is improve too. On heating at 100-160'C polythene, polypropylene and polystyrene soften and developed good binding properties, formed it with bitumen results in a mix which is good for road laying. The states including Tamil Nadu, Andhra Pradesh, Karnataka, Pondicherry, Kerala have also laid tests roads which have successfully withstood loads due to heavy traffic, rain and variation in temperature and In Maharashtra 1,500 km of road have been laid by the above mix.

Mostly granular sub base and base bituminous base and wearing courses used in our country. Due to the revolution in industries and its large amount of production in plastic looking to be a economical and effective raw material. 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 and rubber wastes in an eco-friendly way is the thrust area of today's research. Looking forward the scenario of present lifestyle a complete ban on the use of waste plastic cannot be put, the plastic waste taking the face of a devil for the present and the future generation. Allows to obtain values of splitting and by weight of mix, tensile strength satisfied the specified limits while plastic waste content is beyond 30%. Failures will occur when the consistent mixing time and mixing temperature are not provided for bitumen modifier mix, modified bitumen cannot exhibit good performance in situ. So, there is standard mixing period, temperature and modifier content for all the polymers with a trademark. This all procedure taken in account while mixing and placing of roads is to be done using plastic waste. Their are greatest advantages in hot and extremely humid climate durable and eco-friendly plastic roads. This will also help in relieving the earth from all type of plastic waste.

RESEARCH OBJECTIVES

1. To study the properties of plastic.
2. To study the properties of bitumen.
3. Basic aim is to efficiently utilize the plastic waste in the construction so it is better economical to society.
4. To know the limited proportion of plastic waste in addition to bitumen mix for getting proper strength.
5. To compare the experimented results with the conventional pavement details and perform the economic analysis.

II. MATERIALS

This project works deals with experimental program for making of plastic waste road pavement. Materials use in this project are Bitumen, plastic and aggregate. Various test on materials like bitumen and aggregate. It is observing that all

the materials satisfy the relevant provisions of IS code practice.

a. Bitumen: There is use of 60/70 and 80/100 grade bitumen which can be easily mix with and easily bond with bitumen and plastic, at a specific temperature.
b. Aggregate: The aggregate having size more than 4.75mm are called as coarse aggregate. Locally available crushed stones was used as coarse aggregate. Specific gravity of coarse aggregate was 2.75. Particle size use 20mm to10mm.
c. Plastic:Mostly used plastics products are bags, cups, films and foams, made up of polyethylene, polypropylene or polystyrene of thickness 60 micron in shredded form of size 4.75mm to 2.36mm. In percent of 5 to 15 %. The higher use percentage is 15 %.

III. PROCEDURE

Waste plastic bags were collected from roads, garbage trucks, dumpsites and compost plants, rag-pickers, waste-buyers at Rs.5-6 per kg. The collected waste plastic sort at required thickness. Generally, polyethylene of 60 micron or more is used for the further process. Less micron plastic is easily mixable in the bitumen at higher temperature (160°c-170°c).It is clean by de-dusting or washing if required. Collected waste plastic is cut into the fine pieces as possible. The plastic pieces were sieved through 4.75mm sieve and retaining at 2.36mm sieve was collected. Firstly, Bitumen was heated up to the temperature about 160°c-170°c which is its melting temp. Pieces were added slowly to the hot bitumen of temperature around 160-170°c.The mixture was stirred manually for about 20-30 minutes. In that time period temperature was kept constant about 160-170°c. waste plastic mix bitumen can be prepared for the carryout the test i.e. Penetration test, Ductility test, Flash point test & Fire point test, Stripping test, Ring and ball test.so the various process are namely the first is dry process and other is wet process to carry the plastic bags into the bitumen mixes. Field trials have been carried out using wet process and dry process. Hence we use dry process. Dry Process: 1.Collection of plastic waste 2. Cleaning and shredding of waste plastic 3. Mixing of shredded plastic waste, aggregate and bitumen in mixing plant 4. Laying of bituminous mix.

1. Collection of plastic waste:Plastic waste collected from various sources must be separated from other waste. Thickness of plastic is 60 microns or more.

Fig. No.1 Collection of plastic waste

2. Cleaning and shredding of waste plastic:Mix together some baking soda with water to make a thin paste. By use of cloth rub the paste over the textured plastic surface. Make a solution of diluted white vinegar using one-part vinegar and two parts waste.

Fig.No. 2. Cleaning and shredding of waste

3. Mixing of shredded waste plastic, aggregate and bitumen in central mixing plant: Plastic materials. Due to its structure, components and characteristics, plastic is a very unique material that is mainly used in industrial production. The plastic waste can be recycled by shredding and washing the material, before producing a reusable, recycled granulate.

Fig.No. 3. Mixing of shredded waste plastic.

4. Laying of bituminous mix: The aggregate are heated to around 1700C; the plastic waste shredded to the size varying between 2.36mm and 4.75mm. This shredded plastic waste is added over hot aggregate with constant mixing to give a uniform distribution. The plastic get softened and coated over the aggregate covered by plastic when it get soft. The hot waste plastic filmed aggregate are mixed with hot bitumen 60/70 or 80/100 grade (1600C). For shredding of solid plastic waste of poly-propylene 'scrap grinding machine' is used. In this process, a solid plastic Waste are shredded with the help of with two rotating and one fixed blades. This whole process gives output in per hour rate. Following are the Specifications of Scrap Grinder.

IV. TETING ON MATERIALS AND RESULTS

4.1 Test on Aggregate: Various tests are conducted to study the stability of bitumen for various condition. These tests are conducted as present specification.this specificationare supposed to bear relationship with those properties which directly govern performance of mixes and bituminous pavement. various lab test are conducted on plastic mix aggregate are following.

1. Aggregate Impact Value:

Sr. No.	Stone Aggregate	Plastic Content %	Aggregate Impact Value
1	Without plastic	0	10.31
2	With plastic	5 10	8.14 6.51

2. Los Angles Abrasion Value :

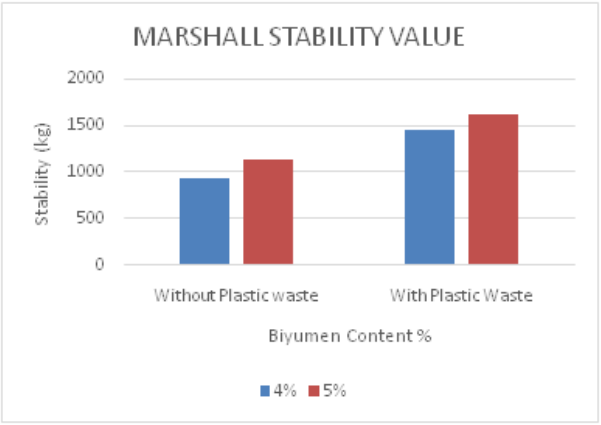
Sr. No.	Stone Aggregate	Plastic Content %	Abrasion Value
1	Without plastic	0	12.50
2	With plastic	5 10	11.35 10.15

4.2Test on Bitumen : Various test are conducted to study the stability of bitumen for various conditions. These test are conducted as present specification. These specifications are supposed to bear relationship with those properties which directly govern performance of mixes and bituminous pavement. The softening point of bituminous material or tar is temperature at which the substance attains a particular degree of softening. The ductility test gives a measure property of bitumen and ability to stretch, in flexible pavement design. It is necessary that binder should form a ductile film around the aggregate so that the physical properties of aggregate is improved. Following test are carried out on aggregate.

Sr. No.	Test	Results	Range
1.	Penetration Value	85 mm	80-100 mm
2.	Ductility Test	71.50 cm	Minimum 40 cm
3.	Softening point	45.25^{0}C	45^{0}C-60^{0}C

a. Marshall Stability Test :

Sr. No.	Bitumen Content (%)	Plastic Content (%)	Marshall Stability (Kg)
1.	4	00	935
2.	5	00	1125
3.	4	05	1455
4.	5	10	1615



V. CONCLUSION

This study will have a positive impact on the environment as it will reduce the quantity of waste plastic to be disposed of by incineration and land filling. It will not only add value to plastic waste but will develop a technology.

This project intended to find the effective ways to reutilize the hard plastic waste in bitumen modifier for flexible pavements. The use of waste plastic in road construction represents a important outlet for such materials. Waste Plastics can be improved the melting point of the bitumen. The use of the modern technology strengthened the road construction as well as increased the road life and road quality, In addition to the improvement of the quality of the road. these technology

has helped to use the waste plastics obtained from domestic and industrial packing materials. The process is ecofriendly and socially highly relevant and hence one of the best methods for easy disposal of Waste plastics.

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