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# USE OF PLASTIC WASTE IN FLEXIBLE PAVEMENT

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**Abstract: The waste materials is always a problem for the environment, some waste may be disposed easily some cannot. Plastic is also a kind of material whose disposal is always a tedious job. The disposal of waste effected the environment drastically, for minimizing this effect several research in various field is going on to recycle plastic safely. One of its ways is to use the waste plastics in road construction. Plastic road is a need of an hour as they not only consume waste plastic in an eco-friendly way ,but also helpful in increasing the quality of the road. In this review paper we will thoroughly study some of the methods and technique through which plastic is used in the road construction and how these technologies suits in various conditions.**

**Significant environmental and economic problem are created because all forms of plastic like carry bags, wrappers, chocolates, chips, hand bags, cold drink bottles and lids of all bottles. Utilization of waste plastic bags in bituminous mixes has proved that these enhance the properties of mix in addition to solving disposal problems. The processed 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, Plastic roads, is a simple way to make eco-friendly constructions. The innovative technology not only strengthened the road construction but also increased the road life as well as will help to improve the environment. The main objective of this paper is to discuss the significance of plastic in terms of innovative methodology for treatment and disposing and to provide solution to reduce, recycle, reuse by applying it for pavement and road construction.**

**Keywords:** - Aggregate, Bitumen, Plastic Waste Material.

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## I INTRODUCTION

A material that contains one or more organic polymers of large molecular weight, solid in its finished state and at some state while manufacturing or processing into finished articles, can be shaped by its flow, is called as „Plastic". Plastics are durable and degrade very slowly; the chemical bonds that make plastic so durable make it equally resistant to natural processes of degradation. Plastics can be divided in to two major categories: thermoses and thermoplastics. A thermoplastic softens when exposed to heat and returns to original condition at room temperature. Thermoplastics can easily be shaped and molded into products such as milk jugs, floor coverings, credit cards, and carpet fibers. These plastic types are known as phenolic, melamine, unsaturated polyester, epoxy resin, silicone, and polyurethane.

According to recent studies, plastics can stay unchanged for as long as 4500 years on earth with increase in the global population and the rising demand for food and other essentials, there has been a rise in the amount of waste being generated daily by each household. Plastic in different forms is found to be almost 5% in municipal solid waste, which is toxic in nature. Plastic waste is used as modifier of bitumen to improve some of bitumen properties Roads that are constructed using plastic waste are known as Plastic Roads and are found to perform better compared to those constructed with conventional bitumen. Plastic waste is a huge threat to the environment. In 2005, after monsoon rains flooded Mumbai, plastic bags were blamed for clogging the underground drainage system and intensifying the effect of the floods. In areas frequented by tourists, like Goa, heavy consumption of bottled water has resulted in trash on beaches, creating eyes ores and end angering marine life. Even India's cows, considered sacred, have not been spared. After3,000 cows died in Lucknow in 2000, the city investigated and found plastic bags in their stomachs .Apparently the bags had been ingested as the animals grazed at dump sites. With more than 35 tons of plastic waste generated by every Indian state, each day India is confronted with the big question of how to get rid of this non-biodegradable menace.

## II PROBLEM STATEMENT

The average per capita consumption of Plastic in India is about 11 kg, which is considerably low as compared to the Global average of 28 kg. As per the Central Pollution Control Board (CPCB) reports, plastic contributes to 8% of the total solid waste, with Delhi producing the maximum quantity followed by Chennai, Kolkata, Mumbai, and Bangalore.

Indiscriminate Dumping of Plastic Waste on land makes the Land Infertile. Burning of Plastics Generates Toxic Emissions such as Carbon Monoxide, Chlorine, Hydrochloric Acid, Dioxin, Furans, Amines, Nitrides, Styrene, Benzene, 1, 3-Butadiene, CCl4, and Acetaldehyde. Sub- standard Plastic Carry Bags, packaging films (<40µ) etc. pose problem in collection and recycling. Utilization of Plastic Waste in Road Construction.

## III SCOPE OF THE PROJECT WORK

The main scopes of plastic roads are economic in terms of bitumen. The shredded plastic in form of polymer covers the aggregates and thus occupies a larger portion of the road reducing the quantity of bitumen needed. Waste Plastic is a harmful and non-biodegradable waste responsible mainly for land pollution.

Other waste materials like LDPE, HDPE fibers glass powder etc. can be taken for replacing with bitumen. To eradicate potholes, minimize the global warming, The lifespan of the road can be increased & Eco- friendly in nature.

## IV OBJECTIVES

1. To study the reuse of waste plastic for flexible pavement from literatures.

2. Experimental Analysis of aggregate and bitumen mix.

3. Experimental Analysis of optimum plastic content & optimum bitumen content.

## V LITERATURE REVIEW

Yash Menaria, RupalSankhla,[1](2016),It is made up of various chemical elements and is regarded as a highly pestilent material which does not easily degrade in the natural environment after its usage. Waste plastics are made up of Polyethylene, Polystyrene and Polypropylene. Temperature varying between 120˚C - 160˚C gives the softening point of these plastics.

R.Manju,SathyaS[2](2017)The various experiments have been carried out whether the waste plastic can be reused productively. The various literature indicated that the waste plastic when added to hot aggregates will form a fine coat of plastic over the aggregate and such aggregates when mixed with binder is found to have higher strength, higher resistance and better performance over a period of time. Along with bitumen, use waste plastic increases its life and smoothness. It is economical and eco-friendly.

Snehalkarle,Mrs.MirShah.[3](2016),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. Past studies on the use of recycled material in bituminous mixes and their effects on properties of roads have been thoroughly studied and the best suited combination of recycled waste and binder to environment is proposed.

Kaushinder, Rakesh.et.al[4](2018),According to recent studies, plastics can stay unchanged for as long as 4500 years on earth with increase in the global population and the rising demand for food and other essentials, there has been a rise in the amount of waste being generated daily by each household. 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.

Prof. Anuradha Deshmukh, Prof. Priyanka Chandure.*et.al* [5] (2017), Utilization of waste plastic bags in bituminous mixes has proved that these enhance the properties of mix in addition to solving disposal problems. The processed 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.

Manoj Sharma,Dr. Ashutosh S. Trivedi.et.al[6](2012 )The disposal of waste effected the environment drastically, for minimizing this effect several research in various field is going on to recycle plastic safely. One of its ways is to uses

The waste plastics in road construction. Plastic road is a need of an hour as they not only consume waste plastic in an eco-friendly way, but also helpful in increasing the quality of the road.

Mohammed Jalaluddin [7] (2014), the project elucidates about the use of plastic in civil construction. The components used include everything from plastic screws and hangers to bigger plastic parts that are used in decoration, electric wiring, flooring, wall covering and water proofing plastic roads.

Imran Ali, Rupesh Kumar, Uttam Kumar Mev*et.al.*[8] (2018),In this paper presentation, the study of plastic waste such as plastic bags, bottles, cans, etc. which are a huge problem for the society that can be reuse by certain processes. The waste can be used in the construction of road. The road formation with the plastic waste response a high tensile strength which is more necessary in the construction of road.

Rishi Singh Chhabra ,Supriya Marik[9] (2014),Worldwide, sustainability is the pressing need of the hour in the construction industry and towards this end use of waste material in road construction is being increasingly.

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Encouraged so as to reduce environmental impact. In the highway infrastructure, a large number of originate materials and technologies have been invented to determine their suitability for the design, construction and maintenance of these pavements.

Mr. Mahesh M Barad[10] ( 2015 ),It is necessary to utilize waste effectively with technical development in each field. Many by-products are being produced using the plastic wastes. Plastic waste, consisting of carry bags, cups and other utilized plastic can be used as a coating Cover aggregate and this coated stone can be used for road construction. The mix polymer coated aggregate and tire 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.

## VI SYSTEM ANALYSIS

**Methodology:**

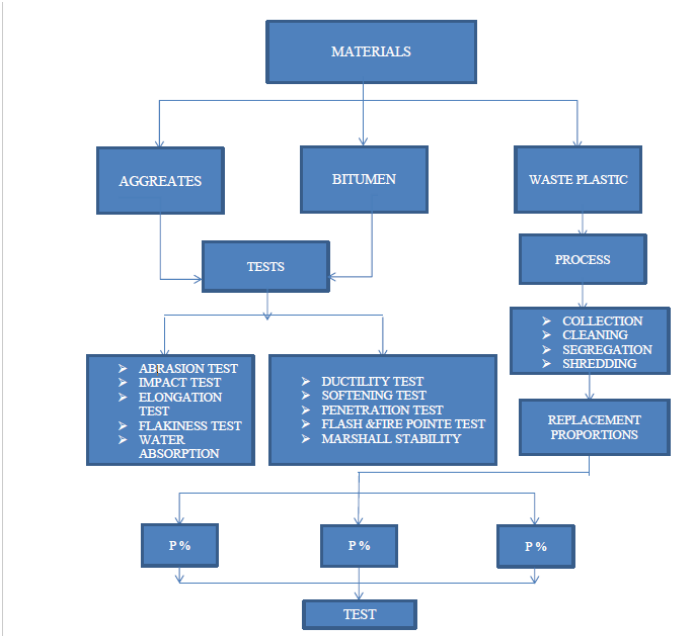



**Fig. Methodology**

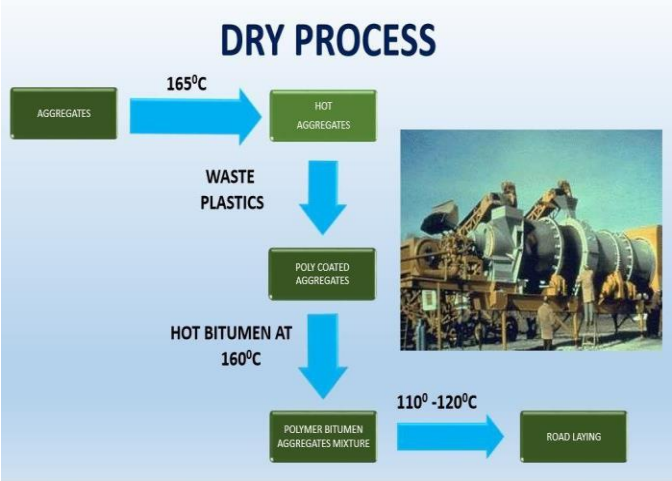
**Dry process:**

First the plastic waste is collected, segregated and stored. The segregation is done because certain kinds of plastic like polyvinyl chloride (PVC) and flux sheets cannot be used due to safety concerns. The next step involves the cleaning of the plastic. This is necessary because most of the plastic waste collected has been used for packaging (55% in India) and hence is likely to contain residual substances such as little bit so food which must be removed. After this the plastic coating goes through the process of shredding which reduces it to the correct thickness, 2-4mm. The aggregate is heated to around 1600C-1700C and then the plastic is added and after 30-40s a uniform is observed.

**MATERIAL USED**

**1. Aggregate:-**

Aggregates form the major portion of pavement structure and they form the prime materials used in pavement construction. Aggregates have to bear stresses occurring due to the wheel loads on the pavement and on the surface course. They also have to resist wear due to abrasive action of traffic. These are used in pavement construction in cement concrete, bituminous concrete and other bituminous constructions and also as granular base course underlying the superior pavement layers. Therefore the properties of the aggregates are of considerable significance to the highway engineer. Some of the desired properties of these aggregates are strength, durability, toughness, hardness etc.




**2. Bitumen:-**

Bituminous materials used in highway construction are broadly classified into bitumen and tar. Bitumen may further be divided into petroleum asphalt or bitumen and native asphalt. There are different forms in which native asphalts are available. These are those which occur in a pure or nearly pure state in nature. The viscosity of bitumen is sometimes reduced by a volatile diluents; this material is called cutback. When bitumen is suspended in a finely divided condition in an aqueous medium and stabilized with an emulsifier, the material is known as emulsion. Tar is the viscous liquid obtained when natural organic materials such as wood and coal are carbonized or destructively distilled in the absence of air. Bitumen is available in various grades and types. To judge the suitability of these binders various physical tests have been specified by agencies like ASTM, Asphalt Institute, British Standards Institution and the ISI. These tests include penetration tests, ductility tests, softening test, flash and fire point tests, viscosity tests, etc.

**3. Waste Plastic:-**

Plastic are generally used to enhance the properties of bituminous concrete mixes by reducing the air void present between the aggregates and also to bind them together so that no bleeding of bitumen will occur. For the present study plastic waste such as carry bags, water bottles, milk packets, glasses, cups etc. will be used as a modifier. The plastic waste such as carry bags, cups, disposables, etc. are shredded in the shredding machine and then sprayed in different percentages over the hot aggregates.

## VII CONCLUSION

Based on the study and experimental data for waste plastic modified bituminous concrete mix compared with conventional bituminous concrete mix, the following conclusions can be drawn- The results showed that waste plastic can be conveniently used as a modifier for bituminous concrete mix as it gets coated over the aggregates of the mixture and reduces porosity, absorption of moisture and improves binding property of the mix. The Optimum Bitumen Content (OBC) wasfoundtobe5.43%byweightofaggregates.TheOptimumPlasticContent(OPC)tobeadded as a modifier of bituminous concrete mix was found to be 9.73% weight of Optimum Bitumen Content (OBC) of bituminous concrete mix. Bituminous concrete mix modified with waste plastic coated aggregates.

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