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UTILITY OF PLASTIC WASTE IN CONSTRUCTION OF ROADS

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ABSTRACT

Now a days, two such challenges that countries with large population face are effective disposal of plastic waste and establishing a road network that is economical and durable .But there is a solution that connects the two problems. Proper waste disposal is of great importance in both rural and urban areas. In all of this, plastic waste is most hazardous for our environment, nature and human's health also .So, the utilization of plastic waste is most important thing. No doubt plastic is too good for consumers use as it is more durable but burning releases very harmful toxic carcinogenic gases which cause damage to our environment. In this study, the suitability of plastic waste materials for pavement construction has been discussed. Plastic provides a solution to problem of effective disposal of plastic waste at the same time increases the strength and durability of road. The waste is mixed in different proportions to the soil sample and their influence on geotechnical properties was studied. When quarry dust was added along with soil plastic mix, it maintains the CBR value within the required range.

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. Due to its biodegradability it creates stagnation of water and associated hygiene problems in the area. In order to tackle this problem experiments have been carried out whether this waste plastic can be reused productively in the construction of roads or not.

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.

Key words: Plastic waste, Mechanical characteristics, Bituminous mix, Plastic road.

INTRODUCTION

Now a days the disposal of waste plastic is a major problem .Two such issues are plastic waste disposal and establishing a road network which is both economical and durable. The rate of production of waste has increased tremendously in almost all parts of the world in the past few decades. So, now a days requirement of utilization of plastic waste is necessary. The quantities of these waste that are accumulating, are causing serious disposal problems. Due to population growth, industrialization, consumerism and technological development there has been a tremendous increase in the rate of production of waste. Every year the world produces 275 million tonsof hazardous , non-recycled, non-biodegradable plastic waste. India produces 7.2 million tons of plastic waste per year. Indian government spends about Rs 1600 crore for treatment & disposal of these wastes. In addition to this, industries discharge about 150 million tons of high volume low hazard waste every year, which is mostly dumped on open low lying land areas.

This paper aims at proposing a new method of disposal of plastic waste, quarry dust and type waste by using them in the sub grade soil for pavement. The Main objectives of this study are to find safe and productive disposal of plastic wastes, study of index properties and CBR values of variable mixes of soil and waste and suitability of soil-waste mix in sub grade Plastic use in road construction is not new. Recent studies in this direction have a shown some hope in terms of using plastic waste in road construction. A series of laboratory tests including specific gravity, grain size analysis, Atterberg's limits and CBR test were conducted for this purpose. The results of the tests are presented and discussed herewith.

Now we are going to discuss the utilization of plastic waste in construction of road. Plastic road mainly use plastic carry-bags, disposable cups and plastic bottles that are collected from garbage dumps has an important ingredient of the construction materials. When mixed with hot bitumen, plastic melt to form an oily coat over the aggregate and the mixture is laid on the road surface like a normal tar road.

What is meant by plastic road?

Plastic roads are roads made either entirely of plastic or of composites of plastic with other material. Plastic

road mainly use plastic carry bag's, disposal cup's and plastic bottle's etc. that are collected from garbage

dumping site as an important ingredient of the construction material, when mixed with a hot bitumen, plastic melts to form an oily coat over the aggregate and the mixture is laid on the road surface like a normal tar road. The implementation of plastic in roads also open a new option for recycling post consumer plastics.

TYPES OF PLASTIC:

1. Thermosets
2. Elastomers
3. Thermoplastics

Materials Used

a. Aggregate:

b. Aggregate of 20mm,10mm.
c. Stones Dust and Lime as Filler
d. **Bitumen**:
e. 60/70,80/100grade bitumen.
f. **Waste plastics**:
g. Waste plastic in the shredded form.(PVC Is not Used)

Specification for waste plastic used in construction of road:

The following types of waste plastic can be used in the construction of rural roads :

a. Films of such as carry bags and cups of thickness should be up to 60microns.
b. Hard foams (PS) of any thickness
c. Soft foams (PE and PP) of any thickness
d. Laminates plastics thickness up to 60micron (Aluminum coated also) packing materials used for biscuits, chocolates, etc.

Basic Processes :

1. Segregation
2. Cleaning process
3. Shredding
4. Collection process

1.SEGREGATION: Plastics waste collected from various sources must be separated from other waste Maximum thickness of 60 microns

2. CLEANING PROCESS:

a. Plastic waste get cleaned and dried.

3.SHREDDING PROCESS:

a. Plastic waste will be shredded or cut into small pieces .
b. In this process ,the different types of plastic waste are mixed together.

4.COLLECTION PROCESS :

a. The plastic waste retaining in 2.36 mm is collected

METHODS OF MIXING:

1. Dry process
2. Wet process

1.DRY PROCESS

a. First of all the plastic waste is collected. Plastic waste like plastic bags, bottles etc .are cut into a size between 2.36 mm and 4.75 mm using shredding machine.
b. The segregation is done because a certain kind of plastic like Polyvinyl Chloride and flux sheets cannot be used due the safety concerns
c. Most of the plastic waste collected has been used for packaging and hence is likely to contain residual substances such as little bits of food which must be removed so it is necessary to clean the plastic waste properly
d. Now the aggregate is heated to 170°C in the mini hot mix plant
e. Then plastic is added in equal proportion. And after 30 - 40sec a uniform coating is observed. This coating gives it an oily look.
f. Similarly the bitumen is to be heated up to a maximum of 160°C and then added.
g. Now the mixture is ready for the construction of road. Then the mixture is transferred to the road and the road is laid. Up to four layers of mixture is laid rolled and cleaned with the coated aggregate
h. The final layer is added and rolled before being left to rest.

Significant features of process:

1. Durability:

The normal bitumen roads in India tend to break down very quickly. So, the durability of plastic roads than the bitumen road is good. And it is proved by binding test, moisture absorption test, soundness test aggregate impact test and los angles abrasion test.

2. Environmental advantage:

The environmental advantages of plastic roads arises from the fact that it uses plastics that would otherwise be disposed through environmentally harmful means

3. Economic advantage:

The cost of construction of road decreases considerably with the use of plastic. Since 10%-15% of bitumen is replaced by plastic, the cost benefit is sizeable

a. In this process, the waste plastic is directly mixed with hot bitumen at the temperature of 160 °C.
b. This mixture is then mixed using mechanical stirrer.
c. This mixture also contains additional stabilizers and requires proper cooling.
d. This process is not popular, because it requires a lot of investment, larger plants and equipment than the dry process.
e. This process has not commonly used.

ADVANTAGES OF PLASTIC ROAD :

a. Use of higher percentage of plastic waste. Plastic is a good binder material. It make the strong road with increased Marshall Stability Value.
b. This reduces the need of bitumen by around 10%.
c. Reduction in pores in aggregate and hence less rutting and raveling.
d. Increase in the strength and performance of the road. The strength of the road is increased by 100%.
e. The cost of road construction road is also decreased.
f. It develop a technology, which is eco-friendly.
g. The use of waste plastics on the road has helped to provide the better place for buring plastic waste without causing disposal problem.
h. Better resistance towards rain water and cold weather.
i. No stripping and potholes.
j. The maintenance cost of the road is almost nil.

CONCLUSION:

Plastic will increase the melting point of the bitumen. use of the innovative technology not only strengthened the road construction but also increased the road life. Help to improve the environment. Plastic road would be a boon for India's hot and extremely humid climate where durable and eco-friendly roads which will relive the earth from all type of plastic waste. This is an absolutely innovative new method of not only recycling plastics, but also to save money and resources spent on the construction of roads in rural areas.Maybe, there would be various other ways in which this method can be improved. All of my doubts whether plastic can actually be recycled in a useful way for the people also are cleared.

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