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SOLID WASTE MANAGEMENT

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ABSTRACT: The use of plastic and related materials is increasing exponentially due to tremendous growth in population, urbanization and changed life style leads to widespread littering of plastic 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. 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.

Plastic waste, consisting of carry bags, cups and other utilized plastic can be used as a coating over 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. 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.

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. Plastic waste which is cleaned is cut into a size such that it passes through 2-3mm sieve using shredding machine. The aggregate mix is heated and the plastic is effectively coated over the aggregate. This plastic waste coated aggregate is mixed with hot bitumen and the resulted mix is used for road construction.

I. INTRODUCTION

The rate of production of waste has increased tremendously in almost all parts of the world in the past few decades. The quantities of these waste that are accumulating, are causing serious disposal problems. The conventional methods of disposal are found to be inadequate. Due to population growth, industrialization, consumerism and technological development there has been a tremendous increase in the rate of production of waste. Every year, 7.2 million tons of hazardous waste is produced and its disposal is becoming a major issue and about one km² of additional landfill area is needed every 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. In this scenario, the conventional waste disposal methods are found to be inadequate. Through this project, a small attempt has been made at deducing a new method of waste disposal.

This paper aims at proposing a new method of disposal of plastic, quarry dust and tire waste by using them in the sub grade soil of pavement. The Main objective of this study are safe and productive disposal of wastes - plastic, quarry dust and tire, study of index properties and CBR values of variable mixes of soil and waste and suitability of soil-waste mix in sub grade. This paper aims at proposing a new method of disposal of plastic, quarry dust and tire waste by using them in the sub grade of pavements. 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 in this paper.

Plastic is everywhere in today's lifestyle. It is used for packaging, protecting, serving, and even disposing of all kinds of consumer goods. With the industrial revolution, mass production of goods started and plastic seemed to be a cheaper and effective raw material. Today, every vital sector of the economy starting from agriculture to packaging,



automobile, building construction, been virtually revolutionized by the applications of communication or InfoTech has plastics. Plastic in different form is found, which is toxic in nature. It is commonly collected both urban and rural areas. It creates stagnation of water and associated hygiene problems. Plastic waste hazard to the environment Plastic waste can be reused productively in the construction of road 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 quality of natural material is increasing Concerned about this, the scientists are looking for alternative materials for highway construction, and industrial wastes product is one such category. If these materials can be suitably utilized in highway construction, the pollution and disposal problems may be partly reduced. In the absence of other outlets, these solid wastes have occupied several acres of land around plants throughout the country.

Keeping in mind the need for bulk use of these solid wastes in India, it was thought expedient to test these materials and to develop specifications to enhance the use of these industrial wastes in road making, in which higher economic returns may be possible. The possible use of these materials should be developed for construction of low volume roads in different parts of our country. The necessary specifications should be formulated and attempts are to be made to maximize the use of solid wastes in different layers of the road pavement. Post construction pavement performance studies are to be done for these waste materials for construction of low volume roads with two-fold benefits: (a) it will help clear valuable land of huge dumps of wastes; (b) it will also help to preserve the natural reserves of aggregates, thus protecting the environment.

WHAT IS PLASTIC?

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'. Plastic is boon for humans. As it has cheap cost, easy to transport, can be use for different purpose. For Packaging purpose mainly we use jute bags, paper bags, cloth bags which is heavy and not economical for transport. So for overcoming it we prefer plastic bags or carry bags. In a Survey it was found that a plastic can be long lasting more than 4000 years. It was good to know that life of plastic is more than any other packaging material. Plastics, are versatile packing materials and commonly used by man but they become problem to the environment.

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: thermosets and thermoplastics. A thermoset solidifies or "sets" irreversibly when heated. They are useful for their durability and strength, and are therefore used primarily in automobiles and construction applications. These plastics are polyethylene, polypropylene, polyamide, polyoxymethylene, polytetrafluorethylene, and polyethylene terephthalate. 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. The threat of disposal of plastic will not solve until the practical steps are not initiated at the ground level. It is possible to improve the performance of bituminous mixed used in the surface course of roads. Studies reported in the use of recycled plastic, mainly polyethylene, in the manufacture of blend indicated reduced permanent deformation in the form of rutting and reduced cracking and crazing of the pavement surface. The field tests withstood the stress and proved that plastic wastes used after proper processing as an additive would enhance the life of the roads and also solve environmental problems. 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.

WHAT IS PLASTIC ROAD?

The roads constructed using plastic waste, popularly known as plastic roads. Plastic roads are found to better performance as compare to those roads which constructed with conventional bitumen, The Indian Centre for Plastics in Environment (ICPE) has been promoting the use of plastic waste to construct asphalt roads. A few trial roads have been paved successfully by combining plastic waste with bitumen. Plastic roads mainly use plastic carry bags, disposable



cups, and bottles that are collected from garbage dumps as an essential ingredient of the construction material. Plastic use in road construction is not new. It is already in use as PVC or HDPE pipe mat crossings built by cabling together PVC (polyvinyl chloride) or HDPE (high density poly-ethylene) pipes to form plastic mats. The plastic roads include transition mats to ease the passage of tyres up to and down from the crossing. Both options help protect wetland haul roads from rutting by distributing the load across the surface. But the use of plastic-waste has been a concern for scientists and engineers for a quite long time.

Recent studies in this direction have shown some hope in terms of using plastic-waste in road construction i.e., Plastic roads. A Bangalore-based firm and a team of engineers from R. V. College of Engineering, Bangalore, have developed a way of using plastic waste for road construction. An initial study was conducted in 1997 by the team to test for strength and durability. Plastic roads mainly use plastic carry-bags, disposable cups and PET bottles that are collected from garbage dumps as an important ingredient of the construction material. When mixed with hot bitumen, plastics melt to form an oily coat over the aggregate and the mixture is laid on the road surface like a normal tar road 1.4

OBJECTIVES

1. To study what is plastic road.
2. To understand properties of plastic road.
3. To study of material used in construction of plastic road.
4. To understand methods of plastic road construction.
- 5: To study of benefits/advantages of plastic road over road.
6. To understand the concept of plastic road.

II. LITERATURE REVIEW

The director of the Central Road Research Institute (CRRI) said that bitumen mixed with plastic or rubber improves the quality and life of roads. The deputy director of the CRRI said that polymers mixed with bitumen increased the construction cost up to six per cent, but increased the longevity of roads manifold. The performance studies carried out on the roads constructed in Tamil Nadu indicated satisfactory performance with good skid resistance, good texture value, stronger and less amount of progressive unevenness over a period of time. The experimentation carried out by CRRI also indicated better stability value, indicating higher strength, less flow and more air voids. Al-Hadidy AL, Yi-qiu Tan (2009), "Effect of polyethylene on life of flexible pavements",

The laboratory studies conducted by CRRI in utilization of waste plastic bags in bituminous concrete mixes have proved that these enhance the properties of mix in addition to solving disposal problems. The results indicated that there was an improvement in strength properties when compared to a conventional mix. Therefore, the life of pavement surfacing using the waste plastic is expected to increase substantially in comparison to the use of conventional bituminous mix

Ms. Apurva Chavan (2013) says that using plastic waste in mix will help reduction in need of bitumen by around 10%, increase the strength and performance of road, avoid use of anti stripping agent, avoid disposal of plastic waste by incineration and land filling and ultimately develop a technology, which is eco friendly.

Dr. R. Vasudevan states that the polymer bitumen blend is a better binder compared to plain bitumen Blend has increased Softening point and decreased Penetration value with a suitable ductility. When it used for road construction it can withstand higher temperature and load. The coating of plastics reduces the porosity, absorption of moisture and improves soundness. The polymer coated aggregate bitumen mix forms better material for flexible pavement construction as the mix shows higher Marshall Stability value and suitable Marshall Coefficient. Hence the use of waste plastics for flexible pavement is one of the best methods for easy disposal of waste plastics. Use of plastic bags in road help in many ways like Easy disposal of waste, better road and prevention of pollution and so on. Dr. R. Vasudevan and S. Rajasekaran, (2007) stated that the polymer bitumen blend is a



better binder compared to plain bitumen Blend has increased Softening point and decreased Penetration value with suitable ductility. The concept of using plastic in flexible pavement has been done since several years ago in India. The concept of utilization of waste plastic in construction of flexible pavement has been done since 2000 in India. The properties of this modified bitumen were compared to that of ordinary bitumen. It was noted that penetration and ductility values of modified bitumen was decreasing with the increase in proportion of the plastic additive, up to 12 % by Weight. The results indicated that there was an improvement in strength properties when compared to a conventional mix.

Therefore, the life of pavement surfacing using the waste plastic is expected to increase substantially in comparison to the use of conventional bituminous mix. Hence the use of waste plastics for flexible pavement is one of the best methods for easy disposal of waste plastics. This technology not only strengthened the road construction but also increased the road life.

MATERIALS

For construction of plastic road different type materials are used. The material should be easily available near site: it should be strong, durable and economical. Availability of material and quality of material greatly affect on economy and durability of road. The cost of material directly affects on cost of road project and quality of material directly affect on strength and durability of road.

The materials required for plastic road construction are as following:

3.1 Soil 3.2 Aggregates

3.3 Bitumen

3.4 Waste Plastic

3.1 Soil

The unconsolidated mineral material of earth crust is known as soil. Soil is also defined as "sediments or consolidated accumulations of solid particles, physical and chemical disintegration of rock, which may not contain organic matter"

EXPERIMENT ON MATERIAL

TEST ON SOIL

Following test are perform on soil during construction of flexible road.

1. Grain size distribution
2. Consistency limit
3. Mineralogical properties of soil grain
4. Shrinkage and swelling
5. Shear strength of soil
6. CBR test

Generally CBR test is conduct on soil to construct flexible road and WBM road. CBR test is useful for designing the thickness of flexible road

TESTS ON AGGREGATE

Following tests are performing on aggregate during construction of flexible road.

1. Los angel abrasion test
2. Aggregate impact test
3. Aggregate shape test

Flakiness Index

A) Elongation Index

B) Angularity Number test

1. Los Angle Abrasion Test:

This is a very popular test for measuring the abrasion resistance of aggregates. A material, which is highly abrasion resistant, has a long life. The test has been

standardized in India (IS 2386-part-4)

III. METHEDOLOGY USED IN WASTE PLASTIC ROAD CONSTRUCTION

The experimentation at several institutes indicated that 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 water and better performance over a period of time.

Basic process:

Segregation process



Cleaning process





Shredding process



Collection process



OBSERVATION, RESULTS & DISCUSSION

OBSERVATIONS

Aggregate characterization

SR NO	TEST	PERMISSIBLE VALUE
1	Los angel abrasion test	35%
2	Aggregate impact test	30%
3	Elongation index	25%
4	Flakiness index	35%
5	Angularity Number test	30%
6	Angularity Number test	25%

Aggregate: Aggregate of 20mm, 10 mm, Stone Dust and Lime as Filler.

IV. RESULTS AND DISCUSSIONS

On the basis of above methodology, various aspects regarding the Polymer coated Aggregates are being discussed below: 1 Aggregate Impact Value The coating of plastics improves Aggregate Impact Value, thus improving the quality of the aggregate. Moreover a poor quality of aggregate can be made useful by coating with pomers. It helps to improve the quality of flexible pavement. This shows that the toughness of be aggregate to face the impacts. Its range should be less than 10%

Aggregate Crushing Value



The aggregate with lower crushing value indicate a lower crushed fraction under load and would give a longer service life to the road. The results show that the aggregates are within the range according to ISS. Its range should be less than 30-35%

V. CONCLUSION

On the basis of study we conclude that the generation of waste plastic is increasing day by day. The major polymers, namely polyethylene, polypropylene, and polystyrene show abesion property in their molten state. Plastics will increase the melting point of the bitumen. Hence, the use of waste plastics for pavement is one of the best methods for easy disposal of

waste plastics Plastic coating on aggregates is used for the better performance of roads. This helps to have a better binding of bitumen with plastic wasted coated aggregate due to increased bonding and increased area of contact between polymers and bitumen. The polymer coating also reduces the voids. This prevents the moisture absorption and oxidation of bitumen by entrapped air. This has resulted in reducing rutting, raveling and there is no pothole formation. The roads can withstand heavy traffic and show better durability.

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