

USE OF PLASTIC WASTE IN ROAD CONSTRUCTION

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ABSTRACT

Process Step 1: Plastics waste(bags, cups, thermocole) made out of PE, PP and PS cut into a size between 2.36mm and 4.75mm using shredding machine, (PVC waste should be eliminated). → Poly Vinyl Chloride (PVC) sheets or Flux sheets should not be used in any case. • Laminated Plastics thickness up to 60 micron (Aluminium coated also) packing materials used for biscuits, chocolates, etc., • Soft Foams (PE and PP) any thickness. • Hard foams (PS) any thickness • Films (Carry Bags, Cups) thickness up to 60 micron (PE, PP and PS) • 1. Paper presentation for Plastic in road construction By: Niranjana K. Sonune Plastic Wastes used in road laying process The following types of waste plastic can be used in the construction of rural roads:

2. Process Step 3: At the mixing chamber, the shredded plastics waste is to be added. It gets coated uniformly over the aggregate within 30 to 60 seconds, giving an oily look. → Process Step 2 b: Similarly the bitumen is to be heated up to a maximum of 160°C (HRS Specification) to have good binding and to prevent weak bonding. (Monitoring the temperature is very important). → Process Step 2 a: The aggregate mix is heated to 165°C (as per the HRS specification) and transferred to mixing chamber. →

3. Overall Process: Process Step 4: The plastics waste coated aggregate is mixed with hot bitumen and the resulted mix is used for road construction. The road laying temperature is between 110°C to 120°C. The roller used is 8-ton capacity. →

4. Fly ash can also be used to give a better performance ♣ No evolution of any toxic gases like dioxin ♣ Use of 60/70 and 80/90 bitumen is possible ♣ Only aggregate is polymer coated and bitumen is not modified ♣ Both Mini Hot Mix Plant and Central Mixing Plant can be used ♣ Use of plastics waste for a safe and eco-friendly process ♣ Use of lesser % of bitumen and thus savings on bitumen resource ♣ In situ process ♣ Simple process without any industry involvement ♣ Easy process without any new machinery ♣ Characteristics of the process: →

1. 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 into 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

polyethyleneterephthalate. A thermoplastic softens when exposed to heat and returns to original condition at room temperature. Thermoplastics can easily be shaped and moulded into products such as milk jugs, floor coverings, credit cards, and carpet fibres. 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. 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 order to contain this problem experiments have been carried out whether this waste plastic can be reused productively. 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 to water and better performance over a period of time. Waste plastic such as carry bags, disposable cups and laminated pouches like chips, pan masala, aluminum foil and packaging material used for biscuits, chocolates, milk and grocery items can be used for surfacing roads.

Use of plastic along with the bitumen in construction of roads not only increases its life and smoothness but also makes it economically sound and environment friendly. 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. Further it has been found that such roads were not subjected to stripping when come in contact with water. Use of higher percentage of plastic waste reduces the need of bitumen by 10%. It also increases the strength and performance of the road. Plastic increases the melting point of bitumen and hence missing can be done in more better and easier way. According to Dr. R. Vasudevan, Dean ECA and Professor, Department of Chemistry, Thiagarajar College of Engineering, Madurai, plastic waste replaces 10% to 15% of bitumen, and thereby saves approximately Rs.35000 to Rs.45000 per kilometer of a road stretch. Inclusion of plastic waste in road construction eliminates the plastic shrinkage cracking of road surface and reduces the drying shrinkage to some extent.

II.LITERATURE REVIEW

The Use of plastic waste in flexible pavements would open up a solution for the disposal issues regarding plastic wastes. Many research works have been done in the area of use of plastic waste in bituminous road construction.

Bhageerathy et al.(2014) investigated the use of biomedical plastic waste in bituminous road construction. They concluded that the Marshall stability value of plastic modified mix was found to be 51 percent more than that for the normal mix which indicates an increase in load carrying capacity.

Dr. R. Vasudevan (2007) investigated that 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.

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 a suitable ductility.

Gawande et al. (2012), Summarized an overview on waste plastic utilization in asphaltting of roads. They reviewed techniques to use plastic waste for construction purpose of roads and flexible pavements.

Raji et al. (2007) investigated the “utilization of marginal materials as an ingredient in bituminous mixes. They concluded that when plastic wastes can be used as additives on bituminous pavements. Hence in their study, the properties of bituminous mix when modified with shredded syringe plastic waste were investigated. The work was carried out by mixing shredded autoclaved plastic syringes with heated aggregates by dry process.

Sultana et al. (2012) investigated the utilization of waste plastic as a strength modifier in surface course of flexible and rigid pavements. They concluded that the potential use of waste plastic as a modifier for asphalt concrete and cement concrete pavement.

III.OBJECTIVES

Basic intention is to efficiently utilize the waste plastic in constructive way so that it can be beneficial to society however main objectives of current project work are:

- To coat the aggregates with the waste plastic materials.
- To check the properties of bituminous mix specimen.
- To check the properties of bituminous mix specimen due to coating of waste plastic materials to compare the properties of bituminous mix specimen with the properties of coated aggregates.
- To identify the optimum proportion of waste plastic to be added in the bitumen mix for getting the required strength.
- To compare the experimented results with the conventional pavement details and perform the economic analysis.
- To prepare statistical model for optimum utilisation of plastic waste.

IV.CONCLUSION

Polymer Modified Bitumen is used due to its better performance. But in the case of higher percentage of polymer bitumen blend, the blend is a more polymer dispersion in bitumen, which get separated on cooling.

This may affect the properties and quality of the blend and also the road laid using such blend.

In the modified process (dry process) plastics-waste is coated over aggregate. This helps to have better binding of bitumen with the plastic-waste coated aggregate due to increased bonding and increased area of contact between polymer 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 reduced rutting, ravelling, and there is not pothole formation. The road can withstand heavy traffic and show better durability.

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