

Use of Recycled Plastic Waste in Road Pavement

Sachin Dilip Patil¹ Gourav Ganesh Mane² Sanyam Vaibhav Upadhye³

^{1,2,3}UG Student

^{1,2,3}Department of Civil Engineering

^{1,2,3}Sharad Institute of Technology Polytechnic Yadrav, Ichalkaranji, India

Abstract— Plastic is global phenomenon and its side effect felt throughout the universe. Plastic waste is non-biodegradable material and researchers found the material can remain on earth for 4500 years without degradation. Plastic waste can be divided in to two categories thermoset & thermoplastic. These plastic are polyimide, polyoxemethylene and polyethylene tetrathate. A thermoplastic can easily be shaped and molded into products India generates 25940 tons of plastic waste every day, but 40% of it remains uncollected causing choking of drainage and river system, littering of the marine ecosystem etc. Open air burning leading to adverse effect on human health and environment. The central pollution control board (C.P.C.B) had conducted a study in major cities of India. Delhi, Chennai, Kolkata Mumbai and Bangalore together generating more than 50% of total contribution from these cities .If reported that these cities every day generate in total 4,059 tons of plastic waste. This increased has turned into major challenges for local authority. Other than plastic, India generates 62 million tons of waste of metal every year, out of which 23% of waste metal can usually be recycled & remaining are exposed to the environment. On this outline of problem of disposal of plastic and metal waste, following proposal is based. It focuses on manufacturing green fencing post made up of 100% waste plastic. This can consume high amount of waste plastic along with reduction of the requirement of material for conventional construction, like cement and sand and aggregate. This will also lead to reduced carbon foot-print. These fencing posts are capable to withstand all quality parameters as per IS 4996-1984.

Keywords: Plastic, Waste

I. INTRODUCTION

Human activities create waste, and it is the way these wastes are handled, stored, collected and disposed of, which can pose risks to the environment and to public health. In urban areas, especially in the rapid urbanizing cities of the developing world, problems and issues of Solid Waste Management (SWM) are of immediate importance. This has been acknowledged by most governments, however rapid population growth over-whelms the capacity of most municipal authorities to provide even the most basic services. Typically one two thirds of the solid waste generated is not collected. As a result, the uncollected waste, which is often also mixed with human and animal excreta, is dumped indiscriminately in the streets and in drains, so contributing to flooding, breeding of insect and rodent vectors and the spread of diseases.

Looking to the global issue by plastic waste, and waste metal research efforts have been focused on consuming the waste on massive scale in efficient and environmental friendly manner. Plastic waste recycling is an excellent environmental friendly way as compared to disposal of waste plastic. On this outline of problem of disposal of plastic and

metal waste, following proposal is based. It focuses on manufacturing green fencing post made up of 100% waste plastic. This can consume high amount of waste plastic along with reduction of the requirement of material for conventional construction, like cement and sand and aggregate. This will also lead to reduced carbon foot-print. These fencing posts are capable to withstand all quality parameters as per IS 4996-1984.

A. Objective

- Literature review related to current to study & its possible application.
- Visit to waste plastic industry existing to understand process of melting plastic bag.
- Collection of plastic waste.
- Comparison of waste plastic with plain bitumen.

The suitability will be assessed using following test.

- Penetration test.
- Flash & fire point test.
- Ductility Test
- Softening point test.
- Viscosity Test.

II. REVIEW OF LITERATURE

For proposed work following are the literature reviewed:

A. Amit Gawande, G. Zamare, V.C. Rengea, Saurabh Tayde, G. Bharsakale, "An Overview On Waste Plastic Utilization In Asphaltting of Roads" *Journal of Engineering Research and Studies* EISSN0976-7916 Vol. III/ Issue II/April June, 2012/01-05:

The quantum of plastic waste in municipal solid waste (MSW) is increasing due to increase in population, urbanization, development activities and changes in life style which leading widespread littering on the landscape. Thus disposal of waste plastic is a menace and become a serious problem globally due to their non-biodegradability and anaesthetic view. Since these are not disposed scientifically & possibility to create ground and water pollution. This waste plastic partially replaced the conventional material to improve desired mechanical characteristics for particular road mix.

B. Miss Apurva J Chavan, " Use of Plastic Waste In Flexible Pavements", *International Journal of Application or Innovation in Engineering & Management (IJAIEM)*, Volume 2, Issue 4, April 2013:

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.

C. Athira R Prasad, Dr Sowmya N J, "Bituminous Modification With Waste Plastic And Crumb Rubber", *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)* ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 12, Issue 3 Ver. II (May - Jun. 2015):

The use of waste materials like plastics and rubber in road construction is being increasingly encouraged so as to reduce environmental impact. Plastics and rubbers are one of them. . The plastic waste quantity in municipal solid waste is increasing due to increase in population and changes in life style. .Similarly most tires, especially those fitted to motor vehicles, are manufactured from synthetic rubber. Disposal of both is a serious problem. At the product the experiments were done by using the waste of polyethylene packages include bottle and food crates in the range of 10% to 80% by volume as a short reinforcement structure.

D. Imran M. Khan, Shahid Kabir, Majed A. Alhussain, Feras F. Almansoor "Asphalt Design Using Recycled Plastic and Crumbrubber Waste For Sustainable Pavement Construction", *Procedia Engineering* 145(2016):

The seasonal change in temperature and loading nature has a significant effect on asphalt behaviour because of its viscoelastic nature. Several types of flexible pavement failure/distress occur due to this behaviour of asphalt binder, among which rutting and environmental factors.

E. Johnson Kwabena Appiah, Victor Nana Berko-Boateng, Trinity Ama Tagbor "Use Of Waste Plastic Materials For Road Construction In Ghana", *Case Studies in Construction Materials* 6 (2017):

This paper forms part of research to solve two main problems in Ghana: firstly, the management of municipal solid waste (MSW), particularly with regards to used plastics which have overwhelmed major cities and towns; secondly, the formation of potholes on roads due to excessive traffic and axle weight.

III. METHODOLOGY

Following test has to carry out in order to point out the property of the pure bitumen and rubberized bitumen:

- Collection of plastic waste from khan industry Parvati industry.
- Penetration test: It is the test to measure the hardness or the softness of bitumen by measuring the depth in millimetre. Also, it is calculated the consistency of bitumen
- Flash and Fire Test: Generally, to focus on the safe mixing and the application of temperature value. The temperature at which spark generate is known as the flash point and the point at which bitumen start to ignite or fire is called as fire point.
- Ductility Test: Ability of material to undergo plastic deformation before the break. It is as important test to measure the elongation of bitumen under the traffic load.
- Viscosity Test: Is it the test to define the fluid property of material i.e. resistance to the flow. When apply the

temperature it greatly influences the strength of resulting paving mixes.

IV. CONCLUSION

From the research carried out, following conclusion is made: Plastic roads can withstand heavy traffic and are durable than flexible pavement roads. The use of plastic mixture reduces the bitumen content by 15% and improves the strength and performance of the road. This new technology is environmental friendly. The field trails have also been successful in pune, Bangalore and Jamshedpur. With combined efforts of contractors and government plastic bitumen roads will be able to curb the biggest waste disposal problem of the country. The plastic roads are also cost efficient and it is said that use of plastic in road constructions would help to resolve the problem in the world up to some extent. The use of plastic mix will reduce the bitumen content by 15% and increases the strength and performance of the road. The comparison study done between various parameters have also explained that utilization of waste plastic is the new savior of mother land

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