Investigation of Various Bituminous Mixes Using Plastic Waste

Prof.P.A.Salunkhe[1], Nikam Maya[2], Kande Jayshree[3], Kulkarni Jaywant[4], Jape Shubham[5]
[1, 2, 3, 4]D. V. V. P. College of Engineering, Ahmednagar, Maharashtra, India

Abstract- *This Paper Provides Investigation of Various Bituminous Mixes Using Plastic Waste. The rapid rate of urbanization in India has led to increasing plastic waste generation. This increase has resulted in a large amount of plastic waste, particularly plastic bags and PET bottles, being littered on the landscape of India. In this context, research has been carried out to contribute to the development of efficient policy approaches on plastic waste in India. Few policies have been enforced by the government to address the acute problem of littering in the country. The strengths, weakness and missing links of the existing policies were identified. The analysis has revealed that the existing policies on plastic waste have not been able to address the issue of littering, primarily because these have not attempted to provide a long-term solution to the problem.*

Keywords- Bitumen Pavement plastic waste Aggregates solid waste material. Plastics bag plastic road waste.

I. INTRODUCTION

Most of the paved roads in our country have granular sub base and base; bituminous base and wearing courses. The past practice of providing thin wearing coat of 20 mm premix carpet with seal coat was to allow deformation in granular layers to take place once road is opened to traffic. After the layers get compacted then thick bituminous wearing course was provided. 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. Today, every vital sector of the economy starting from agriculture to packaging, automobile, electronics, electrical, building construction, communication sectors has been virtually revolutionized by the applications of plastics. Plastic is a non-biodegradable material and researchers found that the material can remain on earth for 4500 years without degradation. Several studies have proven the health hazard caused by improper disposal of plastic waste.

II. LITERATURE REVIEW

[1]Johnson Kwabena Appiah976-7916-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. This waste plastic partially replaced the conventional material to improve desired mechanical characteristics for particular road mix. In the present paper developed techniques to use plastic waste for construction purpose of roads and flexible road.

[2] Amit Gawande 0976-7916-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 unaesthetic view.

[3] Imran M. Khan 0976-145- The seasonal change in temperature and loading nature has a significant effect on asphalt behavior because of its viscoelastic nature. Several types of flexible pavement failure/distress occur due to this behavior of asphalt binder, among which rutting and fatigue cracks are very common. In this study, Low Density and High Density. Waste plastic materials can improve desired properties of bituminous mix for repair and construction of flexible pavements.

[4] Utibe J0490-496-: Waste plastic materials including low density polyethylene bags etc. are disposed through landfills. They also showed higher void air, lower bulk density and Marshall flow than the conventional bituminous mix. The results from the proportions of aggregate and quarry dust used in sieve analysis showed ratio 50:50 to be more appropriate for bitumen/plastic blends. This project also proves that waste plastics can be used efficiently for road repairs and construction resulting in more sustainable and better roads with high performance and durability.

[5] ShivrajSarojero Patil 0975-6744-: 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. The aggregate mix is heated and the plastic is

effectively coated over the aggregate. 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.

[6] Miss Apurva J Chavan 0540-551-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

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[7] A.Boomika,M.A.Naveen 09-14-:A nation's development mainly depends on the development of transportation of the country. As flexible pavement is majorly used in India, it is important that steps has to be taken to increase the life of the bituminous pavements. Flexible pavement is often subjected to problems like rutting, cracking, and other failures due to repeated traffic loads.

[8] Athira R Prasad0108-115-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.**y.** In addition, their density was decreased, ductility increased, and the workability improved, which lead to produce lightweight materials.

[9]Ahmad K. Jassim0635 – 642-Disposal of plastic waste in environment is considered to be a big problem due to its very low biodegradability and presence in large quantities. Therefore, finding alternative methods of disposing waste by using friendly methods are becoming a major research issue.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.The results show that there is a possibility to produce plastic from polyethylene waste and by using 60% and 40%, respectively.

[10] R.B.Ahmed-: Most of the highways and roads of Bangladesh are generally constructed as flexible pavement and are generally designed with fresh aggregates and neat bitumen. During road reconstruction and rehabilitation, proper handling of demolished pavement becomes a great problem.

[11] Amit Gawande 0147-157-: 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 unaesthetic view This waste plastic partially replaced the conventional material to improve desired mechanical characteristics for particular road mix.

[12] Imran M. Khan1557 – 1564-: The seasonal change in temperature and loading nature has a significant effect on asphalt behavior because of its viscoelastic nature. Several types of flexible pavement failure/distress occur due to this behavior of asphalt binder, among which rutting and fatigue cracks are very common.

[13]Davide Lo Presti863– 881-: Nowadays, only a small percentage of waste tyres are being land-filled. The Recycled Tyre Rubber is being used in new tyres, in tyre-derived fuel, in civil engineering applications and products, in moulded rubber products, in agricultural uses, recreational and sports applications and in rubber modified asphalt applications.The benefits of using rubber modified asphalts are being more widely experienced and recognized, and the incorporation of tyres into asphalt is likely to increase.

[14] Farag Khodary0307-312-The result shows that crumb rubber/CaCo3nanocom-posite can be used as asphalt modifier and improve both Penetration and softening point for all modified bitumen. from the point of mechanical properties and fracture resistance modified asphalt concrete mixtures with 15% crumb rubber/CaCo3nanocomposite.

[15]Nuha S.Mashaan0166 – 170-: Roadways are considered one of the most important elements of infrastructure and they play an essential role in our daily lives. r in the modification of bitumen binder is considered as a smart solution for sustainable development by reusing waste material.

III. CONCLUSION

The results showed that waste plastic can be conveniently used as a modifier for bituminous mix as it gets coated over the aggregates of the mixture and reduces porosity, absorption of moisture and improves binding property. There was a slight decrease in air voids of dry mix as compared to wet mix but the changes are within the permissible range. Flow value (mm) in mix decreases with

increase in percentage of plastic waste and bituminous percentage. Highest flow value is observed when 15% plastic is added in the mix with bitumen percentage 5.75%.From above conclusions and observations we can deduct that bituminous mix with 12.5% plastic waste used as additive with optimum bitumen content 5.5% is a optimal mix proportion and can be used to achieve better results.

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REFERENCES

[1] Johnson KwabenaAppiah, Victor Nana Berko Boateng, Trinity Ama Tag bor"USE OF WASTE PLASTIC MATERIALS FOR ROAD CONSTRUCTION IN GHANA", Case Studies in Construction Materials 6 (2017) PP1-7

[2] Amit Gawande, G. Zamare, V.C. Rengea, Saurabh Tayde , G. Bharsakale, "AN OVERVIEW ON WASTE PLASTIC UTILIZATION IN ASPHALTING OF ROADS" Journal of Engineering Research and StudiesE-ISSN0976-7916Vol. III/ Issue II/April-June,2012/01-05

[3] 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)

[4] Utibe J. Nkanga, Johnson A. Joseph, Feyisayo V. Adams, Obioma U. Uche "CHARACTERIZATION OF BITUMEN/PLASTIC BLENDS FOR FLEXIBLE PAVEMENT APPLICATION"Procedia Manufacturing 7(2017)PP 490-496.

[5] ShivrajSarojero Patil, "EXPERIMENTAL STUDY ON BITUMEN WITH SYNTHETIC FIBER", Journal of Information, Knowledge and Research in Civil Engineering, ISSN: 0975 – 6744| Nov 14 to Oct 15 | Volume 3, Issue 2 pp213-216

[6] 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 PP 540-551

[7] A. Boo mika, M.A.Naveen, J. Daniel Richard, A. Mythili, R.Vetturayasudharsan,"EXPERIME NTAL STUDY ON PARTIAL REPLACEMENT OF BITUMEN WITH LIGNIN AND PLASTIC", SSRG International Journal of Civil Engineering Special Issue-April 2017 PP 9-14

[8] Athira R Prasad, Dr Sowmya N J, "BITUMINOUS MODIFICATION WITH WASTE PLASTIC AND CRUMB RUBBER", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e ISSN: 2278-1684,pISSN: 2320-334X, Volume 12, Issue 3 Ver. II (May - Jun. 2015), PP 108-1159.Ahmad K. Jassim, "Recycling of Polyethylene Waste to Produce Plastic Cement", Procedia Manufacturing 8 (2017)pp 635 – 642 International Journal of Pure and Applied Mathematics Special Issue 1154

[9] Ahmad K. Jassim, "RECYCLING OF POLYETHYLENE WASTE TO PRODUCE PLASTIC CEMENT", Procedia Manufacturing 8 (2017)pp 635 – 642

[10] R.B. Ahmed, A.Rahman, K. Islam, J. Amin , S. K. Palit, "RECYCLING OF RECLAIMED BITUMINOUS PAVEMENT MATERIALS", International Conference on Research and Innovation in Civil Engineering (ICRICE 2018)

[11] Amit Gawande, G. S. Zamre, V. C. Renge, G. R. Bharsakale, Saurabh Tayde, "UTILIZATION OF WASTE PLASTIC IN ASPHALTING OF ROADS", Sci. Revs. Chem. Commun.: 2(2), 2012, PP147-157

[12] Imran M. Khan, Shahid Kabir, Majed A. Alhussain,FerasF.Almansoor, "ASPHALT DESIGN USING RECYCLED PLASTIC AND CRUMB-RUBBER WASTE FOR SUSTAINABLE PAVEMENT CONSTRUCTION", Procedia Engineering 145 (2016) 1557 – 1564

[13] Davide Lo Presti, "RECYCLED TYRE RUBBER MODIFIED BITUMENS FOR ROAD ASPHALT MIXTURES: A LITERATURE REVIEW", Construction and Building Materials 49 (2013)PP 863– 881

[14] Farag Khodary, Y. Mohammed, A. Wazeri, "DAMAGE ANALYSIS OF ASPHALT CONCRETE MIXTURES MODIFIED WITH CRUMB RUBBER/CACO3NANOCOMPOSITE",International Journal of Scientific &Engineering Research, Volume 6, Issue 3, MARCH-2015 PP307- 312

[15] Nuha SMashaan, Asim Hassan Ali, Mohamed RehanKarim,Mahrez Abdelaziz, "AN OVERVIEW OF CRUMB RUBBER MODIFIED ASPHALT", International Journal of the Physical Sciences Vol. 7(2), pp. 166 - 170, 9 January, 2012

[16] Textbook of Highway Engineering by V. K. Kumawat

[17] Reference book Highway Material Testing & Quality Control by G. Venkatappa Rao & K Ramachandra Rao.

[18] Textbook of Highway & Traffic Engineering by Subhash C Saxena. [6] Guidelines of NHAI for Construction of Flexible Pavement (http://nhai.gov.in).

[19] Guidelines of PWD Maharashtra for Construction of Flexible Pavement (www.mahapwd.com). [8] Miss

Apurva J Chavan - Use of plastic waste in flexible Pavements -ISSN 23