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STUDY OF MECHANICAL PROPERTIES OF POROUS AND NON-POROUS AGGREGATE BY USING LOW DENSITY POLYETHYLENE (LDPE) AND ITS COST ANALYSIS

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ABSTRACT

With the increase in the pollution through plastic waste we will take a step to resolve this problem somehow. As we all know that plastic waste are non biodegradable substance and burning these plastic will also prove to be harmful as it produces harmful gases. That's why we will use plastic in such a way that it will become environment friendly. Our way of utilization is in road construction. In this paper we will go to show how we can use plastic waste in road construction. We will use mixture of plastic waste and bitumen in some ratio in road construction. We will use plastic at hot mix plant. This method will not only prove to be helpful in solving the dumping problem of plastic waste but also increases the life of a road and simultaneously it is very economical. For implementing our idea we will do several tests which will be further discuss in detail in our paper. The tests that we will do are - water absorption test, aggregate impact value test, aggregate density test, Ductility test, and penetration test. Through these entire tests we will find the strength of road.

Key Words: **Porous aggregate, Waste plastic, Bitumen, Road.**

1. INTRODUCTION

In ancient cities of Harappa and Mohenjo-Daro of Indus Valley civilization during 2800 B.C, the road development has been first introduced in Indian subcontinent. In 1540-45, Sher Shah Suri had built The Grand Trunk Road which connects Sonargaon near Dhaka in Bangladesh with Peshawar in modern day Pakistan. During 1947 and 1988, Indian roads are poorly maintained. Most of the roads are single lane and are unpaved. In 15 June 1989 NHAI (National Highway Authority of India) came into existence, but it has not achieved so much in road construction. Since 1995 the authority has privatized road network development in India and by May2014,the state wise length became 92851 kilometer of National highway of which 22,757 kilometer are 4-lane or 6-lane modern highway. For Indian economy, Road transport is very important. Indian road network carries over 65% of its freight and about 85% of passenger traffic.

In general, primary India have bitumen based macadamized roads and a few have concrete roads. In 1990s, concrete roads were less popular due to less availability of cement, but with increase in supply of cement in country, concrete roads have gained popularity. These roads need less maintenance compared to bituminous road. With the

enhancement of population, civilization and industrialization the roads needed to me more strong, durable and eco-friendly.

Simultaneously with the rise in the population and industrialization, pollution is also increasing. One of the main reason of pollution is the harmful waste & dumping of these waste is a major concern as the conventional method of disposal is not adequate[1].so why not we should go for utilization of these plastic waste in road construction in this way the issue of longevity of road and dumping of waste gets resolved. In this paper we aims to use the mixture of bitumen and plastic for better environment and better road which will minimizes the construction cost of road.

Figure 1:waste plastic at Bhanpur bridge ,Bhopal

The figure 1 shows waste plastic dump at Bhanpur bridge of Bhopal.

Plastic wastes are seen to be tremendously used in today's world for packaging, serving etc. Its use is increasing as it is found to be very cheap and is a very effective raw material [2]. it is a non biodegradable product so its dumping is a bigger problem. These plastic waste are usually dump in our nearby areas like in ponds, rivers, drainage system etc and because of this the drainage system gets block and further create issue of several type of disease. Diseases like breast cancer, reproductive problem genetic abnormalities are the serious threat of plastic waste. We cannot control on the use of plastic to a greater extent, but through its utilization harmful effects of plastic waste can be controlled and the best way of utilizing it, is in road construction.

2. LITERATURE REVIEW

The use of the non biodegradable product (plastic waste) is growing immensely to enhance the stability, durability of road and minimizing the road cost by replacing few percentage of bitumen with waste plastic. In our paper we are concerning on the use and reuse of plastic waste. Central road research (CRRI)'director concluded that bitumen mixed with plastic improves the road life and road quality. Many of the researchers have founded different things concerning the plastic waste use in road constructions like Prof. C.E.G Just conveys that plastic addition in bitumen increases the strength and properties of bitumen [3].

Rema Devi et al, says that waste plastic waste use in road construction shows better resistance to water which decreases the stripping of bitumen from aggregate [4].

S.S .Verma highlighted in his research about the development of plastic waste use to make plastic road. A industry in banglore [5]

FHWA,1997,Using plastic waste in road construction in India has been practice since 2000.In bituminous road construction; bitumen is used as a binder which is coated over the aggregate. This increases the life of road, but it has a problem that its resistance to water is poor. This resistance issue can be resolved by improving its properties using blending of plastic waste and bitumen. The blending of recycled LDPE to asphalt mixture requires no change to present plant facilities.[6].

N. Z Habit have done some experiments on properties of bitumen which is customized by thermo plastic and interacted through eighty penetration index bitumen. As we are already aware that customization of bitumen along with

polymer increases the performance but simultaneously it affects bitumen's properties. Penetration, softening point and viscosity test are some of the methods used for the study of polymer modified bitumen. After all these procedure it was concluded that on penetration, plastic polymers have intense effect. Fewer than 3% concentration of polymer the best outcome was so obtained. [7]

Apurva chavan, april 2013, using waste plastic can reduce the percentage of bitumen to 10% and can enhance the strength and performance of road[8]

Dr.Vasudevan the binding property of bitumen increases using plastic when compared to untreated bitumen .It will enhance the bitumen property which results in increase in softening point and reduce penetration value as a result of which durability gets improved.

A consistent research is going still to achieve the optimality and many have stated to use the plastic in road construction [9].

Salter RJ, Rafati ,The hot bitumen is coated over the hot stone aggregate in flexible pavement construction and rolled. Bitumen is a binder. Yet when water is stagnated, on road it penetrates and result in pot hole, which is a defective spot in the pavement. There are limited use of anti stripping agents and the process also increases the road laying cost [10].

Guiquing Wu, Triboelectrostatic separation is a promising process for granular plastic waste because of its mechanical simplicity, Low cost, high separation efficiency and ability to process wide range of size of particle than other separation system.[11]

Suroso, T.Wn (2004) states that for increasing the softening point of asphalt plastic should be added into the bitumen and the results shows that with the increase in softening point there is a decrease in the penetration value. Thus it is not easily affected by temperature differences, here as the stability value and Marshall Quotient also increases. Suroso also points out that 3% ,3.5% and 4% plastic content can improve the plastic asphalt admixture quality[12].

3. CONCLUSIONS

Through the earlier research we have concluded that method of using plastic waste is prove to be environment friendly and the longevity of road also increases. This shows that in this way the dumping problem of plastic, diseases caused by plastic and toxic gases produced by it can get controlled and in other hand we can have a good strength road also. It prove to be very economical also as we will use overall 8% plastic which will decreases the value of 8% bitumen. we will use waste plastic with porous and non-porous aggregate in different % of plastic for testing A.I.V and W.A of aggregate.

4. ACKNOWLEDGEMENT

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5. REFERENCES

[1] Mercy Joseph Poweth, March 2013"study on use of plastic waste in road construction",ISSN:2319-8753,IJRSET,vol2,Issue3,

[2] Shirish N.Nemade, Dec, 2013."Utilization of polymer waste for modification o bitumen in road construction", SRCC, ISSN: 2277-2669,

[3] Justo. C.E.G and veeraragavan,A(2002)."Utilization of waste plastic bags in bituminous mix for improved performance of roads", Banglore University,Bengaluru.

[4] "Devi R. M, Stephen L, Mini.I.M",(2013)"Reduction of optimum bitumen content in bituminous mixes using plastic coated aggregate". International journal of innovative Research in Science, Engineering and Technology vol, 2, issue3,March 2013.

[5] S. S. Verma, Department of Physics, S. L. I. E. T. Longowal, Dist Sangrur (Punjab) – 148106 Roads

[6] FHWA, (1997). User Guidelines for Waste and by Product Materials in Pavement Construction

[7] N. Z. Habib, I. Kamruddin, M. Napiah and I. Mohd, (2010)," Tan Rheological Properties of Polythylene and Polypropylene Modified Bitumen", World Academy of Science Engg. Tech., **72**.

[8] Apurva J. Chavan, April2013,"Use of plastic waste in flexible pavement",IJAIEM,Vol2,Issue4, ISSN:2319-4847

[9] VasudevanRNigam,S.K,Velkennedy,R,Ramalinga,A,Sekar, CandSundarakannan,B.(2007)"utilization of waste polymer for flexible pavement and easy disposal of waste polymer". Proceeding of international conference on Sustainable solid waste management,Chennai,5-7 september 2007,105-111.

[10] Salter RJ,Rafati-Afshar.F.Effect of additives on bituminous highway pavement materials evaluated by indirect tensile test.Transportaion Research report 1115;1987.p.183-95

[11] Guiquing Wu, Jia LI*, Zhenming Xu, 28 nov,2012,"Triboelectrostatic separation for granular plastic waste recycling "china.

[12] Suroso,T.Wn(2004).Pengaruh Penambahan plastic cara basah dan cara kering terhadap kinerja campuran beraspal,PuslitbangJalan dan Jembatan,BandungJalan dan Jembatan,diakses 9 october 2008.

[13] Yash Maneria, sep2015,"Use of waste plastic in flexible pavement-Green roads

[14] S,M.Al-Salem, July 2009,"Recycling and recovery routes of plastic solid waste",

[15] Y. P. Gupta, S. Tiwan and J. K. Pandey, March (2010)," Utilization of Plastic Waste in Construction of Bituminous Roads", NBM & CW, p. 92.