USE OF WASTE PLASTIC AND WASTE TYRE IN BITUMINOUS ROAD CONSTRUCTION

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Abstract : The disposal of plastic waste and exhausted tyres of two-wheeler, four-wheeler vehicles is increasing day by day. They study focuses on evaluating performnace of mixing with combinationin waste plastic and tyre in terms strength,ductility and other key properties.Waste tyres and wasteplastics in India are categorized as solid and hazardous waste. It is assessed that about 60% of disposed tyres and plastic wastes are through indefinite ways in the rural and urban zones. This leads to various environmental problems which include air pollution associated with open burningof tyres and plastics (particulates, odour, visual impacts and other harmful contaminants such as polycyclic aromatic hydrocarbon. Therefore, it is necessary to minimize the plastic and rubber wastes effectively in each field. To increase the mechanical characteristics of the conventional road by bitumen, bitumen was partly substituted with the waste materials of rubber and plastics and tyre. Then it is observed that the mechanical characteristics are improved for the road mix. Utilization of waste tyres and plastics to minimizes the use of conventional aggregate which is available in exhaustible quantity.

Keywords: Waste plastic, waste Tyre , strength,ductility.

I. INTRODUCTION

With the rapid growth of the world economy and the surge in population as well as the increase in urbanization, which leads to a corresponding growth in the demand for many infrastructures such as housing and transportation. As everyone knows, the natural aggregates in concrete mainly originate from crushed gravel and sand . However, the lack of virgin aggregates and the ongoing exploitation of natural resources by people lead to a serious ecological threat . Hence, there is an urgent need for new alternative materials to meet the requirement of concrete to be more sustainable in the construction industry . In this context, different forms of solid wastes such as waste plastics, tyre rubber waste, waste glass, steel slag, and steel fibers are applied as materials investigated in the field of civil engineering . Plastic have become an integral part in our daily life and so the millions of tons amount of plastic waste is generated annually today. Due to its low cost, easy manufacturing and impervious to water, plastics are used in an excessive and manufacturing wide range of products.

OBJECTIVES:

- To reduce the bitumen content by the addition of waste plastic in the hot bituminous mix.
- To know the stability of the modified bituminous pavement by conducting MarshallStability test
- To minimize the cost of construction of the flexible pavement.
- To reduce the environmental impacts, that arises during the disposal of waste tire.

II. LITERATURE SURVEY

Johnson Kwabena Appiah ,Victor Nana Berko-Boateng ,Trinity Ama Tagbor (2017). This paper forms pat of research to solve two main problems in ghana: firstly ,the management of municipal solid waste (MSW),particularly 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 study examines the effect of blending waste thermoplastics polymers , namely high density polypropylene (pp) in conventional AC-20 graded bitumen, at various plastic compositions. The plastics were shredded and blended with the bitumen 'in situ' with the shear mixer at a temperature range of 160-170 degree c. Basic rheological parameters such as penetration, ring and ball softening point and viscosity tests were employed to determine the resulting changes from base bitumen. FTIR spectroscopy was also

employed to study the chemical functionalities present in the bitumen composite. The properties of the unmodified bitumen were found to be enhanced with the changes recorded in the archaeological properties of the polymer modified bitumen (PMB).It was observed that polypropylene polymer, showed profound effect on homogeneity and compatibility with slight linear increment in the viscosity ,softening and penetration values as against relatively high changes for HDPE modified bitumen.

Amit Gawande ,G .Zamare, .C .Rengea, Saurabh Tyde, G. Bharsakale 'The quantum of plastic waste in municipal solid (MSW)IN increasing due to increase in population ,urbanization, development activities and changes in life style which leading widespread littering on the landscape .thus non- biodegradability and unaesthrtic view .since are not disposed. International journal of pure and applied mathematics special issue 1145 scientifically and possibility to create ground and water pollution. 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 pavements has reviewd with waste plastic pieces and bitumen mix is made which can be used as a top layer coat of flexible pavement. This waste plastic modified bitumen mix is made which can be binding property, stability, density ,and more resistant to waste.

Imran M. Khan, Shahid Kabir, Majed'' AImansoor.(2016)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 behaviour of asphalt binder, among which rutting and fatigue cracks are very common .in this study ,Low density and High Density Polyethylene and crumb rubber were used as additions to base bitumen. Complex modulus (G*) And phase angle (delta) obtained from Dynamic shear rheometer (DSR) are the basic perimeters used to evaluate the behavior of the binder in respect to rutting and fatigue cracking .it was concluded that LOW DENSITY POLYTHEYLENE(LDPE),High Density polyethylene (HDPE)and crumb rubber (CR) modified binder showed significant improvement in Rheological properties of the binder. Furthermore ,recycling these municipal wastes will contributeto solving environmental problems in the kingdom of Saudi arabia caused by the piling up of these wastes in dumps.

R.S L Khodakarami (year2013) The present study shows the combination of GIS ,Boolean Logic Overlay Model and multi criteria evaluation techniques and identifiying solid waste landfill waste landfill site suitability and selection .the gained results from expected opinions shows that among physical criteria ,surface water ,groundwater among socio economic sub criteria and residential areas ,land use ,are important in order respectively.

Zhen Leng et. al.:studied that the addition of waste plastic materials such as Polyethylene Merthiolate (PET) or their functionality additives into asphalt pavement may improve the durability of pavement and also help decrease the environmental problem s caused by plastic. The main objective of this study is to investigate the feasibility of using the additives, derived from waste PET through an avitaminosis process, to improve the performance of bituminous mixtures containing RAP, by characterizing the binder properties. The results indicated that the samples containing RAP and PET derived additives provided better overall per performance compared to the conventional binder, increasing the rutting resistance by at least 15% and fatigue cracking resistance by up to 60%. Usage of such waste PET based additives as an additive for RAP mixtures represents an approach to deal with a relevant recycling problem while simultaneously recovering two value-added materials. Overall, this study has successfully demonstrated an innovative approach to deal with two waste difficulties:

Sabina et al (2001) studied the comparative performance of properties of bituminous mixes containing plastic/polymer (PP) (8% and 15% by wt of bitumen) with conventional bituminous concrete mix (prepared with 60/70 penetration grade bitumen). Improvement in properties like Marshall Stability, retained stability, indirect tensile strength and rutting was observed in Plastic modified bituminous concrete mixes. 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. 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..

III. METHODOLOGY

3.1 Methodology

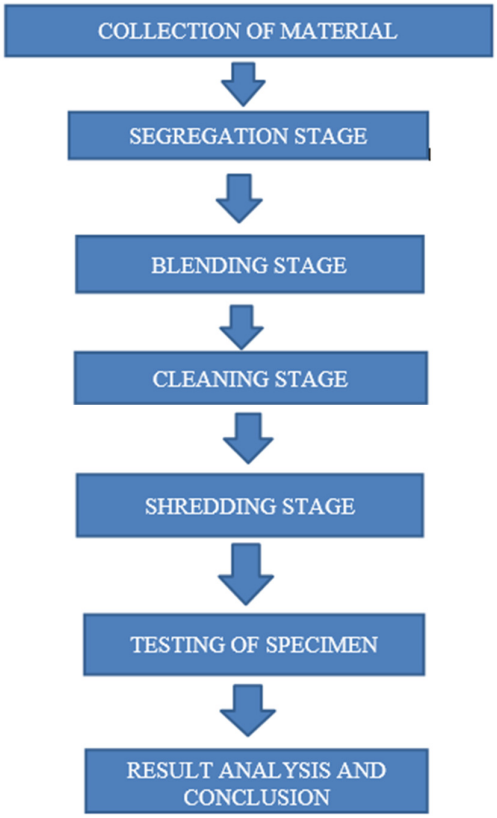

Fig. 1 Schematic representation of methodology

3.2 Test On BITUMAN

The varrious test on performed as project are given below

1. PENETRATION TEST:

2. DUCTILITY TEST:

3. MARSHALL STABILITY TEST:

IV. RESULTS

4.1 Without Mixing Test Result

4.1.1 Penetration Test:

Table no:1 .1 penetration test value result

Sr.No	Description	Sample 1	Sample 2	Sample 3
1	Penetration Initial reading	0	0	0
2	Final	64	66	69
3	Average penetration value	66.33		

Result: The penetration value is 66.33mm.

4.1.2 Ductility Test:

Table no:.1.2 Ductility test value result

Sr.no	Description	Sample:1	Sample:2	Sample:3
1	Initial Reading(x)	0	0	0
2	Final Reading(y)	83	80	84
3	Ductility=(y-x)	83	80	84
4	Avg ductility value in cm	82.33		

Result: Ductility Value is 82.33cm/min

WITHOUT MIXING PENETRATION AND DUCTILITY TEST:

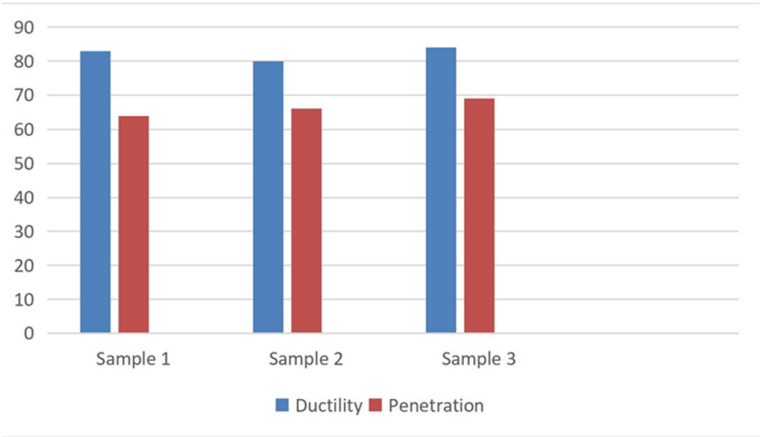

Chart no:1 without mixing penetration and ductility test value

Average of Penetration = 66.33 mm
Average of Ductility = 82.33 cm

4.1.3 Softening point of bitumen:

Table no:1.3 softening point test

Description	Sample :1	Sample:2
Temperature when ball touch bottom	64	65
Avg. Softening pointof bitumen 0C	64.5	

Result: The Softening Point value of given sample is 64.5

4.2 With Mixing Test Result
4.2.1 Plastic Mixing
Penetration Test:

SR.NO	Observation	Bitumen %		
		Sample1(25%)	Sample.2(30%)	Sample3(35%)
1	Penetration di alreading initial	0	0	0
2	Final	60	63	66
3	Avg Final readings	63mm		

Result:The penetration value is 63mm.

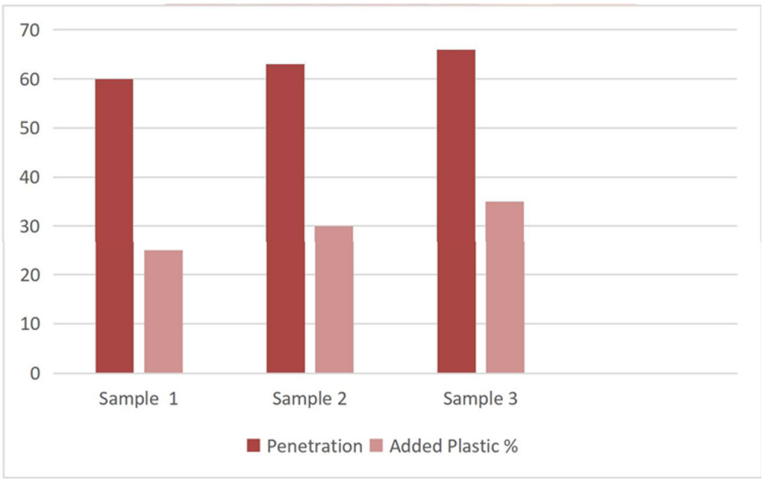

Chart no:2 mixing of plastic waste in penetration value test

4.2.2 Ductility Test:

Table no:2.2 mixing of plastic in ductility test

Sr.no	Description	Sample 1 (25%)	Sample 2 (30%)	Sample 3 (35%)
1	Initial Reading(x)	0	0	0
2	Final Reading(y)	76	78.11	80
3	Ductility=(y-x)	76	78.11	80
4	Avg ductility value in cm	78.03 cm		

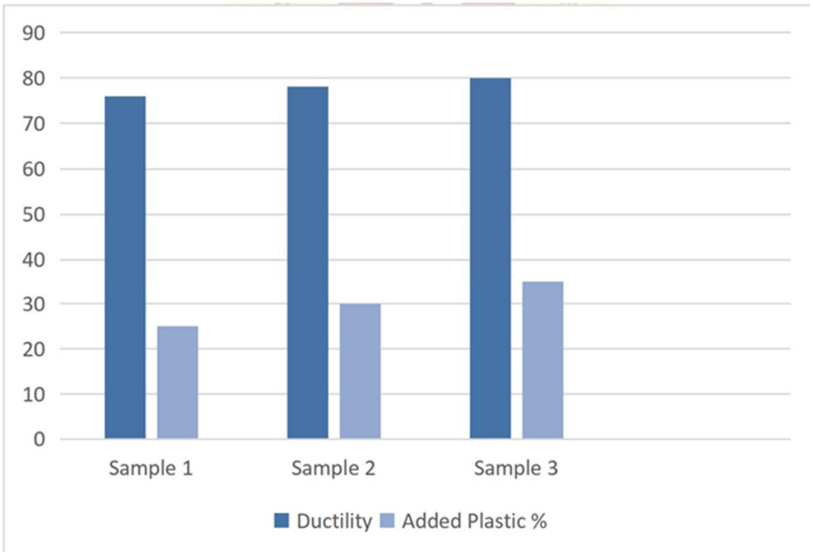

Chart no:3 Mixing of plastic in ductility test

4.3 Marshall stability test:
Observation table for density and voids:

Table no:5.1 marshall stability test value

Sr.no	Description	Sample 1	Sample2	Sample3
1.	%of bitumen	25%	30%	35%
2.	Ht of specimen(mm)	64.5	64.25	64.25
3.	Weight of specimen in air (gm)	1200	1215	1230
4.	Weight of specimen inwater (gm)	462.5	460.3	466
5.	Weight of specimen in SSD(gm)	945	957.8	960

Comparison between the combination of plastic & rubber mix bituminous construction road and ordinary road

Sr.no	properties	Combination	Ordinary road
1	Marshall stability test	More	Less
2	Binding property	Better	Good
3	Softening point	Less	More
4	Penetration test	More	Less
5	Ductility test	More	Less
6	Durability of road	Better	Good

V. CONCLUSION

1. The expansion of plastic and rubber waste adjust the properties of bitumen.
2. The utilization of plastic waste as in development of roads draws out a superior execution. Since, there is better authoritative bitumen with rubber and plastics.
3. The recurrence of purge spaces is likewise diminished because of expanded holding and contact territory between plastic, rubber and aggregates or bitumen.
4. This eventually helps in lessening the absorption of moisture and oxidation of bitumen by entangled air. Henceforth, the roads can hold up under substantial activity, in this way expanding their toughness.
5. Softening point values expanded with the expansion in rate of rubber and plastic waste however subsequent to achieving the idea level, the quality began diminishing. So, it is fitting to utilize adjustedbitumen pavement development to limit. Issues like, Rutting and spading of vehicles amid hot
6. atmosphere conditions.
7. By and large increment in softening point value demonstrates bring down temperaturedefenselessness and is predominantly favored in hot atmospheres.
8. The adjustment in the softening fine qualities might be because of the chemical nature of plasticand rubber wastes included.
9. The reason changes in particular gravity qualities are high surface thickness without any adjustments in its weight. Likewise, notwithstanding easing the natural issues of these substances, bitumen and different materials will be additionally devoured less (thickness of different layers can be
10. lessened through expanding thickness of pavement) Thus the utilization of waste rubber and plastics for pavement is one of the best techniques for simple transfer of waste rubber and plastics.
11. For example, if every one of the asphalts in India are changed over into plastic and rubber roads, allthe rubber and plastic wastes accessible will be utilized as a part of the development of street and waste plastics and rubber transfer will never again be an issue.

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