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Partial replacement of bitumen by using plastic waste

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Abstract: In 20th century after industrial revolution, we face enormous effects of pollution on environment. And due to advance technology pollution is increasing drastically. plastic waste is one of the serious and large problem in pollution because plastic is not easy to decompose and remains for long period in environment. for cure this issue we use plastic as a binder material for road construction by decreasing some percentage of bitumen. when the plastic waste mixed with bitumen it increases strength and durability. It helps to improve environment condition and road life span.

I. INTRODUCTION

II. Waste plastic produced from different source is the major problem . It leads to hazardous effect on environment . It not only effects human life as well as combine effects of natural resources like soil , water, lake , ponds by burning plastic toxic gas generated it dangerously effects human health . Plastic waste used to improve properties and environmental stability with mixing with bitumen effectively . Bitumen is product of crude oil which remains after incomplete refining. Day by day natural resources are decreasing so this technique saves bitumen for future . By using plastic bitumen mixture construction cost can reduced . It will help to reduced wastage used protect environment. There is increase in cost of natural products which are used in construction and due this cost of construction increasing. Plastic has various types like polystyrene , polyethylene , polypropylene . Waste plastic is melted first then coated over aggregate then mixed with hot bitumen .and this mixture used for road construction . Our study helps to provide low-cost road protect environment and increasing use of waste material .

III. Keyword

Aggregates, Bitumen , Waste Plastic , Bitumen replacement.

IV. Abstract

In 20th century after industrial revolution, we face enormous effects of pollution on environment. And due to advance technology pollution is increasing drastically. plastic waste is one of the serious and large problem in pollution because plastic is not easy to decompose and remains for long period in environment. for cure this issue we use plastic as a binder material for road construction by decreasing some percentage of bitumen. when the plastic waste mixed with bitumen it increases strength and durability. It helps to improve environment condition and road life span.

V. OBJECTIVE

Simple intention is to capably use the waste plastic in productive way so that it can be beneficial to society. Objective of this project work

- 1- To use waste plastic in bituminous.
- 2- To identify the ideal proportion of waste plastic to be added in the bitumen mix for required strength.
- 3- To coat aggregates with the waste plastic materials.
- 4- To find a suitable alternative over conventional material with cost reduction.
- 5- To decrease the use of natural resources.

I. Material Used

A- Bitumen



Fig.5.A.1. Bitumen

Bitumen is largely used for road construction or road surfacing . It is also called as asphalt . Bitumen is produced for lighter crude oil components . Which are removed from distillation . It is naturally occurring form of petroleum product . It contains heavy hydro carbon . it is petroleum-based material and it has good binding properties . Bitumen contains Tar . It is alkaline resistance . It used in various construction . such as water tank , coat fire escape .Bitumen is best core layer in a pavement which contain gravel ,stones and sand . It binds all material together .

B- Plastic



Fig.5.B.1 Plastic bottles

Plastic is a waste material in environment is a long-term usage . It can lead to toxic chemical into air , water , soil which cause health problem to environment . Hence it is necessary to reuse waste plastic to decrease this danger . When plastic waste is molten it acts as a binder as it is used in construction . It increases mechanical properties of road and decrease the construction cost .

C- Aggregate



Fig.5.C.1. Coarse aggregate

Aggregate is used in construction aggregates consist of sand, gravel, crushed stone, etc. They are used to fill voids and drainage. Before used aggregate is used they are tested for strains, stiffness, hardness and water absorption test.

Methodology

1- Test on bitumen

Bitumen works as a binding material for aggregates in bituminous mixes. In India we use mainly grade 60/70. The bitumen starts melting in 140-173°C. All tests conducted on bitumen as per I.S. The simple test properties conducted on bitumen indicate that the use of waste plastic in bitumen decreases the penetration and ductility value, whereas increases in softening point and specific gravity value about 4.36% weight of bitumen.

Table 6.1.1. Physical properties for bitumen test

PHYSICAL PROPERTIES	BITUMEN GRADE 60/70
SPECIFIC GRAVITY	1.002
SOFTENING POINT	58 ^o C
DUCTILITY	63.8mm
PENETRATION -	62

2- Test on aggregates

Aggregates provide street development and other framework improvement exercises. Recognize that aggregate is not recently earth or soil that is sharp accessible from an endless number of areas. IRC recommends two sizes of aggregates: 12mm, 10mm & 6mm.

Table 6.1.2. Physical properties of aggregates used

PROPERTIES	OBSERVATION	MoRTH SPECIFICATION
SPECIFIC GRAVITY	2%	2%
IMPACT VALUE	22.21%	MAX 25%
CRUSHING STRENGTH	5.12%	MAX 45%
ABRASION STRENGTH	13.2%	MAX 50%

3- Plastic

Plastic waste collected from different sources and separated from other wastes like sand, stones, gravels. Plastic waste is cleaned with water and dried in sunlight. They are cut into small sizes between 2.36mm-4.75mm in a shredding machine. Plastics are cut into small pieces. The aggregates are heated at a specified temperature of 150 to 165°C and coated with plastic.

7-Marshall Stability Test



Fig.7.1.1. Marshall stability equipment

The aggregate taken in use has been passed through 12.5 mm sieve . Bitumen tests the grade as 60/70. The bitumen heated in a pan till it melts . The calculated amount of plastic was added in bitumen . It is mixed for 2 min. this mixture mixed up to the aggregate coat with it that mixture take out and placed it of diameter and height in three layer , 50 blows were given after each layer. The sample taken out from it after 6 hr and placed side for 24 hr . After 24 hr these sample takes to conduct marshall stability test , note the reading of each sample and compared with the standard reading of bitumen concrete.

Sample No.	Sample name	Bitumen plastic% and	Bitumen content (gm)	Plastic Content (gm)
1	A0	4.5	45	0
2	A1	4.5	41.72	2.17
3	A2	4.5	40.2	4.3
4	A3	4.5	37.6	6.23
5	A4	4.5	35	8.79

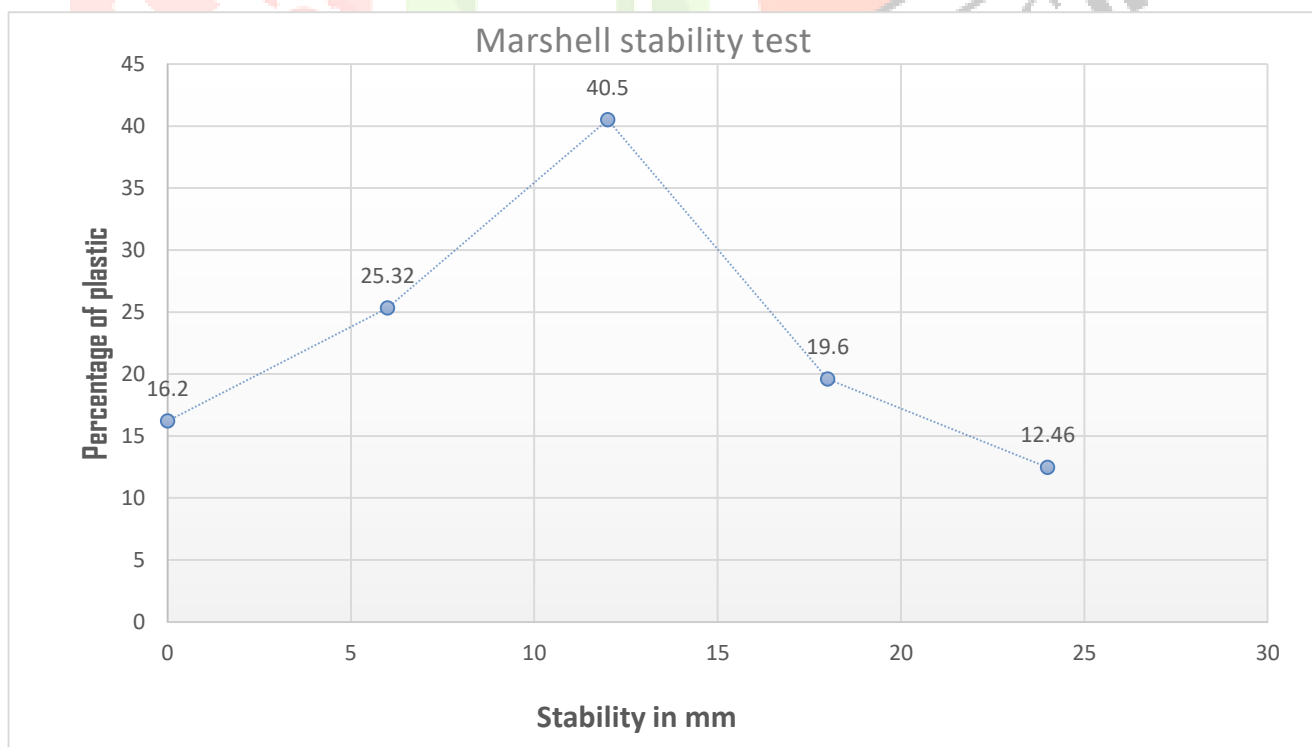
Table 7.1.1. Recorded Samples

Where ,

- A0- sample contain no plastic
- A1- sample contain plastic 6%
- A2- sample contain plastic 12 %
- A3- sample contain plastic 18 %
- A4- sample contain plastic 24%

Bitumen	Percentage of plastic	Stability (mm)
Pure Bitumen	0	16.2
With plastic	6	25.32
With plastic	12	40.5
With plastic	18	19.6
With plastic	24	12.46

Table -7.2.1. Marshall stability results



8-Conclusion

- 1- Bitumen is a non-renewable source which should be efficiently used where these replacements of plastic carries main role.
- 2- Usage of plastic more efficient than the traditional method of road construction .
- 3- Result shows that with increase of waste plastic in bitumen increases the stability between the aggregates and bitumen.
- 4- The Marshall stability test shows that the maximum use of 12- 16 % of plastic in the bitumen gives the good and effective results than using of plastic more than 20 %.
- 5- The use of waste plastic in construction of roads gives suitable strength . they give better compaction and reduce air voids because of better binding between bitumen and plastic .

9-Reference

- 1- IS: 1203-1973 for penetration test on bitumen grade 60/70.
- 2- Indian Road Congress IRC: 37-2018 - Guidelines for the design of flexible pavements.
- 3- Textbook of Highway Engineering by V. K. Kumawat.
- 4- Guidelines of PWD Maharashtra for Construction of Flexible Pavement (www.mahapwd.com).
- 5- Guidelines of NHAI for Construction of Flexible Pavement (<http://nhai.gov.in>).
- 6- Miss Apurva J Chavan (2013), "Use of plastic waste in flexible pavement" ISSN 2319 - 4847, Volume 2, Issue 4, International Journal of Application or Innovation in Engineering & Management.
- 7- T Subramani "Experimental Investigations On Coir Fibre Reinforced Bituminous Mixes" International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 2, Issue 3, May-Jun 2012, pp.1794-1804.

