JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

" USE OF PLASTIC WASTE IN ROAD WAY CONSTRUCTION "

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ABSTRACT

We are focused on the utilization of plastic waste in roadway construction. The research involves an in-depth analysis Aggregate of the physical, properties of plastic waste materials and their compatibility with traditional road construction materials. Plastic increases the life of the Roadway .We can not destroy plastic, so reusing it is the better option. Plastic – bitumen composite road have better wear resistance than standard asphalt concrete roads. Plastic as low density as compared to aggregate. Its low density, strong strength, long life, low cost. Plastic coated aggregate which leads to increased bonding between polymer and bitumen. High density polyethylene use in make bottle. In this research we have used only bisleri plastic bottles.

01.INTRODUCTION

Studies report we can used plastic bottles indicated reduced permanent deformation in form of rutting and reduced low temperature cracking of the pavement surfacing. Plastic is a very versatile material. Several studies have proven the improper disposal of waste plastic bottles. We cannot burn use of plastic but we can reuse the plastic waste. Plastic can be divided into two major categories thermoses & thermoplastic .The various literature indicated that the waste plastic added to hot aggregate will form a fine coated layer of plastic over aggregate. Plastic coated aggregate provided higher strength of roadways. 10% Bitumen replace in plastic We have added plastic bottles in the percentage of 5%-10% and 15% according to the weight of the aggregate.

02 Advantages

Some detailed features and benefits of using waste plastic in road construction:

1. Adding waste plastic to increase strength, stability of roads.
2. Reduce the need of bitumen by around 10 %
3. Increase the strength and better option in road way
4. Plastic-modified roads have lower production temperatures
5. Use higher percentage of plastic waste
6. Waste plastic can be used in various types of roads, including highways, urban roads, and rural roads.

03 Disadvantages

Some detailed disadvantages of using waste plastic in roadways for your project:

1. Quality and consistency issues: Waste plastic materials can vary significantly in terms of quality, composition, and contaminants

2. Durability concerns: While some studies suggest that incorporating waste plastic can enhance the durability and lifespan of roads, long-term performance data is limited.

3. Environmental impact: Although using waste plastic in roadways helps reduce plastic waste in landfills and promotes recycling, there are potential environmental concerns.

04 Project Objectives

Assess the feasibility and effectiveness of incorporating plastic waste in road construction materials.

1. Conduct research and analysis on the properties of plastic waste and its potential applications in road construction.
2. Reduce plastic waste through its utilization in road construction.
3. Reduction in carbon emissions achieved by utilizing plastic waste in road construction.

05 LITERATURE REVIEW

1. Fransis Hveem (1942)

"Optimum quantity of bitumen inroads" who was a project engineer of California Department of Highways, has developed the Hveem stabilometer in 1927. He did not have any previous experience on judging, the required mix of its colour, hence he decided to measure various mixture parameters to find the optimum quantity of bitumen. [Vallerga and Lovering 1985]. He had used the surface area calculation concept, (which was already in use, at that time for the cement concrete mix design), to estimate the quantity of bitumen actually required.

2. Dr. R. Vasudevan (2007)

He stated that the polymer bitumen blend is a better binder compared to plain bitumen. Blend has increased softening point and decreased Penetration value with a suitable ductility.

3. Zahra Niloofar Kalantar (2012)

Many researches on PMA mixture have been conducted for the past two decades. Although addition of virgin polymers to asphalt for the purpose of enhancing the properties of asphalt over a wide temperature range in paving applications was contemplated quite some time ago, recycled polymer added to asphalt have also shown almost the same result in improving the road pavement performance as compared to virgin polymers. In this study, a critical review on the history and benefits of using waste and virgin polymer in asphalt is presented followed by a review of general studies on using polymers in asphalt in order to improve the properties of pavement.

4 . Amit P. Gawande (2012)

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 un aesthetic 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. In conventional road making process bitumen is used as binder. This waste plastic modified bitumen mix show better binding property, stability, density and more resistant to water.

5 . Rishi Singh Chhabra (2015)

In the highway infrastructure, a large number of originates materials and technologies have been invented to determine their suitability for the design, construction and maintenance of these pavements. Plastics and rubbers are one of them. Also considering the environmental approach, due to excessive use of polythene in day to day business, the pollution to the environment is enormous. The use of plastic materials such as carry bags, cups, etc. is constantly increasing day by day10. Since the polythene are not biodegradable, the need of the current hour is to use the waste polythene in some beneficial purposes. The use of these materials as a road construction proves eco-friendly, economical and use of plastic gives strength in the sub-base course of the pavement.

06. IS codes use in Roadways

In India, the Indian Roads Congress (IRC) provides guidelines

1. Bitumen Roadways:
   - IRC:SP:11-2013: "Guidelines for the Design of Flexible Pavements"
   - IRC:SP:20-2002: "Guidelines for the Design of Bituminous Overlay on

07. Comperative study

Tests

- **Aggregate impact test:**

1) Empty mould W.t (w_1) = 0.805

2) Weight of mould + aggregate (w_2) = 1.195 (Normal aggregate)
= 1.165 (5%)
=1.135 (10%)
=1.115 (15%)

3) Weight of aggregate w3 (w_2 -w_1) = 0.390 (Normal aggregate)

= 0.360 (5%)
= 0.330 (10%)
= 0.310 (15%)

4) Weight of aggregate passing through 2.36mm seive w_4= 65gm (Normal aggregate)
=60gm (5%)
= 52gm (10%)
=44gm. (15%)

5) Normal Aggregate impact value

Formula = $\left(\frac{w4}{w3}\right)$ x 100

= $\left(\frac{65}{0.390}\right)$ x 100

= 25 %

6) Aggregate impact value (5%) of use plastic waste

Formula = $\left(\frac{w4}{w3}\right)$ x 100
= $\left(\frac{60}{0.360}\right)$ x 100 (5%)

=16.66%

7) Aggregate impact value (10%) of use plastic waste

Formula = $\left(\frac{w4}{w3}\right)$ x 100 (10%)

=$\left(\frac{52}{0.330}\right)$ x 100

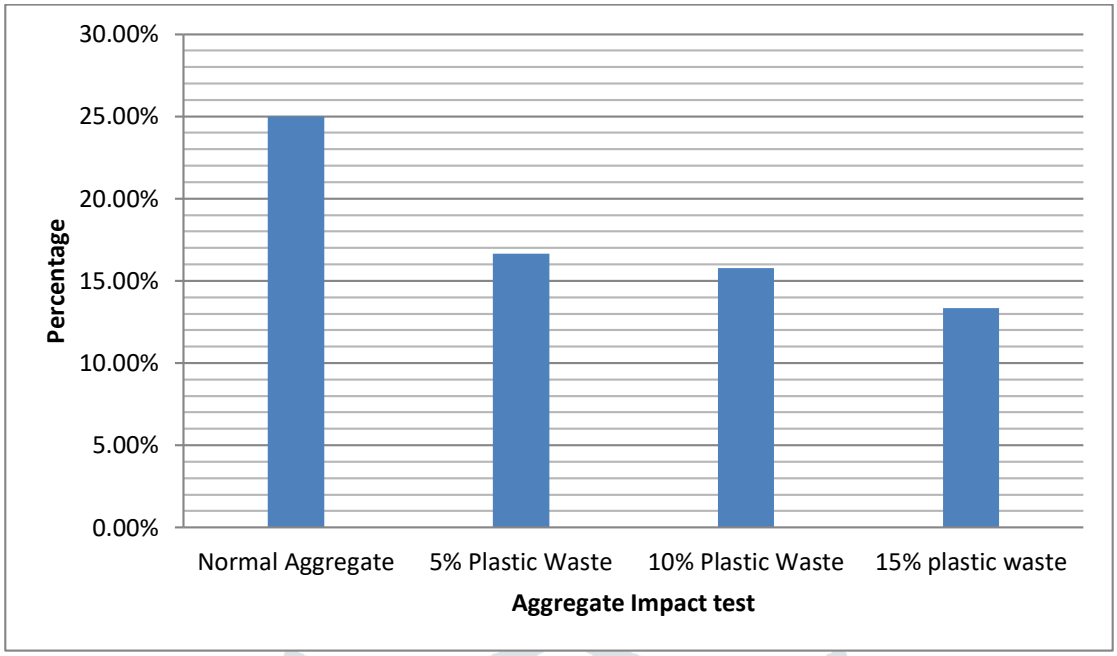
= 15.76%

8) Aggregate impact value (15%) of use plastic waste

Formula = $\left(\frac{w4}{w3}\right)$ x 100 (15%)

= $\left(\frac{44}{0.310}\right)$ x 100

= 13.33%



Reference of IS Codes
1) < 10% Exceptionally strong
2) 10 – 20 Strong
3) 20 – 30 Satisfactory for load surfacing
4) >35% Weak for road

- **Aggregate crushing test:**

Calculations:

Aggregate crushing value = $\frac{w3}{w1-w2}$ x 100

Where,

W_1= Weight of mould + aggregate = 6.133
$W_{2=}$ Weight of empty + mould= 3.241
W_3= Weight of Aggregate remaining in 2.36mm sieve= 0.489

$$= \frac{0.489}{6.233-3.241} \text{ x } 100$$

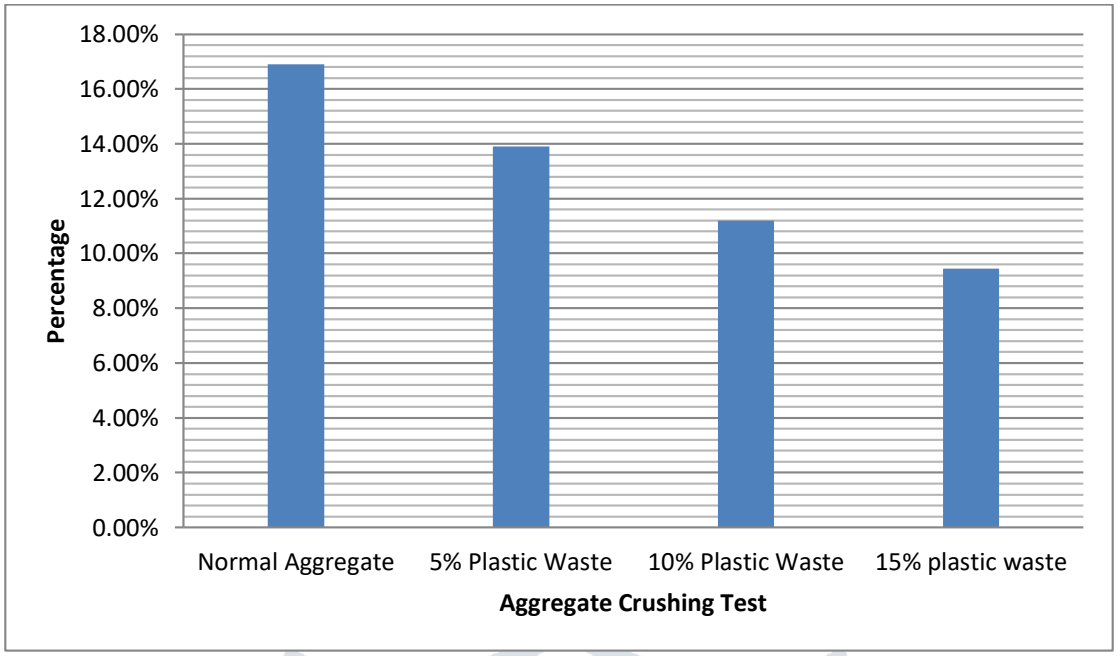
$$= \frac{0.489}{2.892} \text{ x } 100$$

= 16.90 % (Normal aggregate)

5 % Waste plastic bottles = 13 .90%

10 % Waste plastic bottles = 11.20%

15 % Waste plastic bottles = 9.45 %



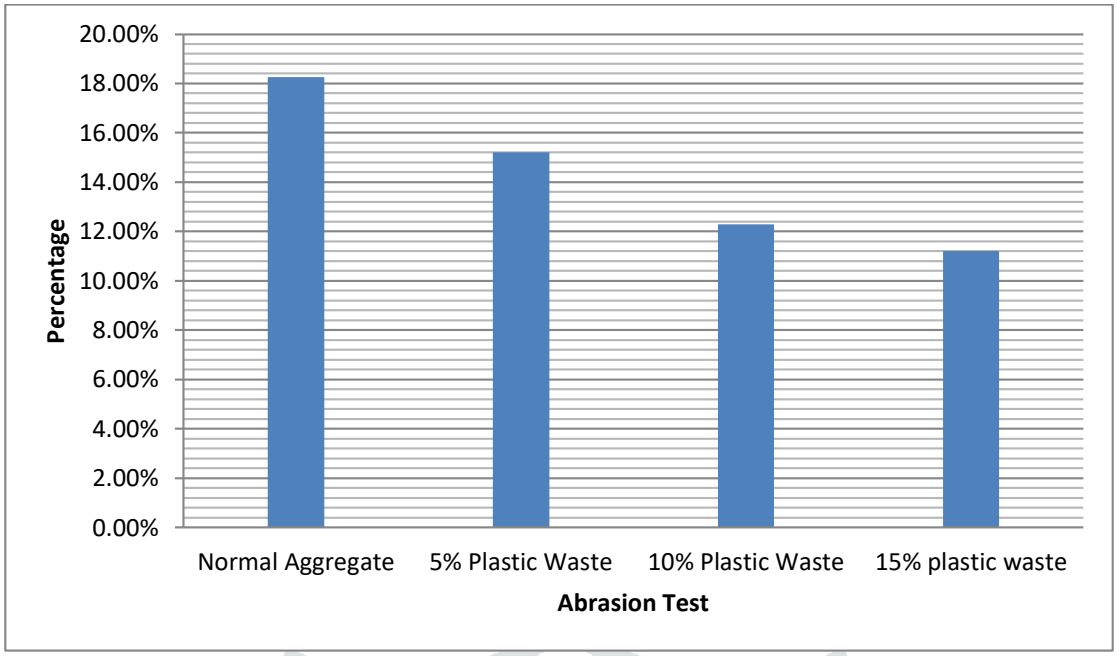
IS Code comparison
1) <10% exceptionally strong
2) 10-20% -> Strong
3) 20-30% -> satisfactory for road surveying
> 35% -> weak for road

- **Abrasion Tests**

Calculations

Loss Angles abrasion values = different in weight/weight of sample × 100
Weight of sample=5000gm.

Weight after test (wash &oven Dry) = then: Abrasion value = (500-4087)
Abrasion value= 913/500×100
Abrasion value = 18.26% (Normal aggregate)



5 % Waste plastic bottles = 15.12%

10 % Waste plastic bottles = 12.30%

15 % Waste plastic bottles = 11.20 %

The strength of coarse aggregate find with help of aggregate crushing test

Test of bitumen

- **Penetration Test**

  70 Is the penetration value of bitumen

Bitumen grade	Gradation value
5-35	30 to 40
5-45	40 to 50
5-55	50 to 60
5-65	60 to 70
5-90	80 to 100
5-200	175 to 225

* Low penetration value show hardness of Bitumen
* High penetration value show softness of Bitumen
*Hard Bitumen use in high traffic area
*Soft Bitumen use in low traffic area

- **Ductility Test**

Sr. No.	Details of samples	1	2	3
1	Initial Reading= w1 cm	0	0	0
2	Final Reading= w2 cm	85	75	73
3	Ductility=(w2-w1)cm		75	73
4	Mean Value	77.66		

08. Results

2. Test of Bitumin

Sr. No.	Test	Test Result	Specification Requirement	Standards
1	Penetration Test	70	65-90	IS : 1203-1978
2	Ductility Test	78	Min 75	IS : 1208-1978

3) Test aggregate result Add in table of chat Result.

Stone Aggregate	Plastic Content	Aggregate Impact value	Los Angeles abrasion value	Crushing Test	Water Absorbtion
Without Plastic	0	25%	16.90%	18.26%	4.2%
With Plastic	5 %	16.66%	13.90%	15.20%	3.1%
With Plastic	10%	15.76%	11.20%	12.30%	1.5%
With Plastic	15%	13.33%	9.45%	11.20%	1.0%

09. conclusion

From the study of the behaviour of plastic waste bottles we can conclude that increases plastic content decrease the value of Aggregate impact test, crushing test & abrasion test. Plastic caoted aggregate is more through as compared to normal Aggregate. This study have positive impact on environment to reuse plastic bottles.

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