

PARAMETRIC STUDY OF USING PLASTIC WASTE IN ASPHALT MIX AS A PARTIAL REPLACEMENT OF COARSE AGGREGATE IN AIRFIELD PAVEMENT –GREEN ROAD

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Abstract:In India 5.6 million tons of wastes are being produced by domestic and industrial sectors every year. Untreated solid wastes are dumped to atmosphere. There visibility has been perceived as a serious problem and made plastic a target in the management of solid waste. Plastics are user friendly but not eco-friendly as they are non-biodegradable, generally it is disposed in land filling or incineration. The best way of disposal of waste plastic is changing 3R principle to 5R principle (Reduce, Recycle, Reuse, Research and Remodeling). This 5R principle can be achieved by utilizing in road construction, this in turn result in the reduction of pollution problems to a large extent. This paper presents the results of an experimental investigation carried out to study the effects of using the plastic waste (PE, PET and PP) contained 6%, 8%, 10% and 12% (by weight) are used as a partial replacement of coarse of the flexible pavement of airfield. Since the binding property of plastics is good, it a best method of safe disposal is by using them in airfield pavement. Hence our project has one steps forwards towards the sustainable in level of construction and green environment.

1. INTRODUCTION

Plastic disposal is one of the major problems for developing countries like India, at a same time India needs a large network of transportation for its smooth economic and social development. Since the economic development of the nation links its direct benefits with the efficient system of transportation mainly with airways. Under this circumference, an alternate use for the waste plastics is also the needed. The waste plastic can be used effectively used as a better binder in the process of construction of airfield pavement.

Fundamentally, India is large country where there are many cities with no access to rail and road. So, India is naturally suited for air travel. Hence, this plastic wastes can be effectively utilized in flexible pavement of airport. The plastic waste can be used upto 12% in airfield pavement. It will help to improve the strength and slip resistance of the airfield pavement.

Use of waste plastic in pavement construction is one of emerging advanced technology getting famous now

days, which not only solve problem of waste plastics but also cost effective and save the environment.

OBJECTIVES

- ❖ This will provide more stable and durable mix for the flexible pavements. The serviceability and resistance to moisture will also be better
- ❖ Waste plastic in roads increases the stability value and durability to a great extent.
- ❖ Eco-friendly recycling of plastic wastes
- ❖ Reduces the cost of construction significantly & Then its future maintenance cost will be saved too.

2. MATERIAL PROPERTIES

CLASSIFICATION OF PLASTIC WASTE

Plastics can be classified by their physical properties as thermoplastic and thermosetting materials.

ASPHALT

Asphalt is defined as any of various dark-colored, solid, bituminous substance. It is the by-product of petroleum cracking operation. Asphalt consists of highly condensed aromatic compounds of high molecular weight.

AGGREGATE

The aggregate are transfer into plastic melted and spread over the aggregate giving a thin coating at the surface. The aggregate, when coated with plastics improved its quality with respect to voids, moisture absorption and soundness which result in improvement of quality of the aggregate.

3. RESEARCH METHODOLOGY

The research methodology for present study has adopted various tests to investigate the results on plastic aggregate, bitumen and aggregate-bitumen-plastic mix.

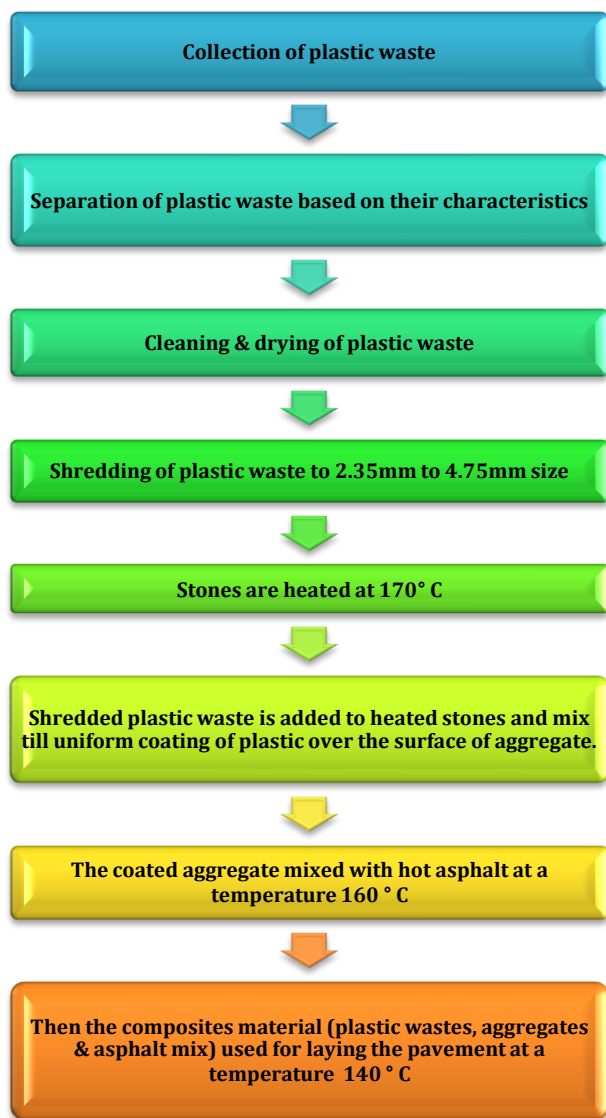


Fig 1: Schematic flow chart of dry process

AGGREGATE

Aggregate of 20mm, 10 mm, Stone Dust and Lime as Filler. For mixing the ingredients for airfield pavement mix, dry process was adopted.

4. LABORATORY EXPERIMENT OF AGGREGATE

SPECIFIC GRAVITY & WATER ABSORPTION TEST

The specific gravity and water absorption of aggregates are important properties. Usually ranges from 2.5 to 3.5

Water absorption: Water absorption values ranges from 0.1 to about 2.0 percent for aggregates normally used in pavement.

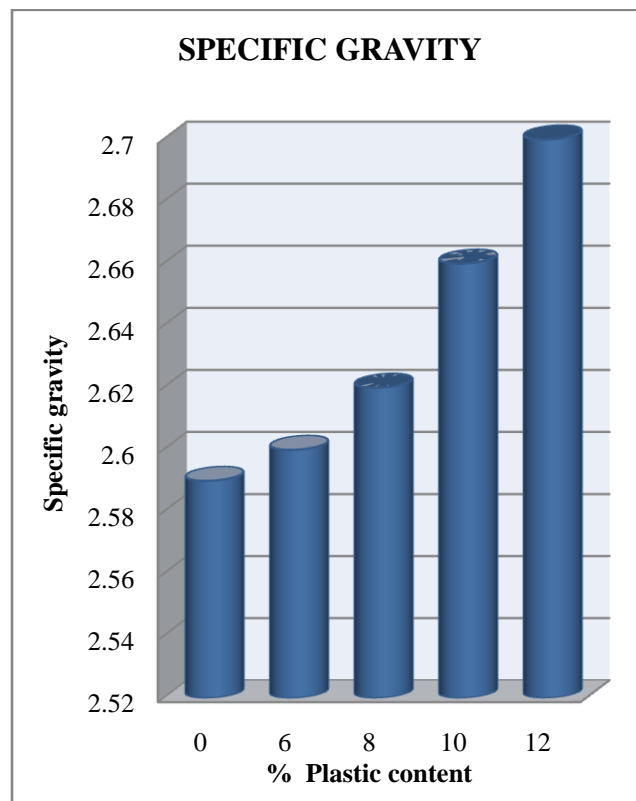


Fig 2: Variation in Specific gravity value of Aggregate with increase in percentage of plastic

AGGREGATE IMPACT VALUE TEST

The aggregate impact test is carried out to evaluate the resistance to impact of aggregates.

Table 1: Observations for aggregate impact test

STONE AGGREGATE	% OF PLASTIC	AGGREGATE IMPACT VALUE
With plastic coating	6	25.69%
	8	22.15 %
	10	17.09 %
	12	15.32 %

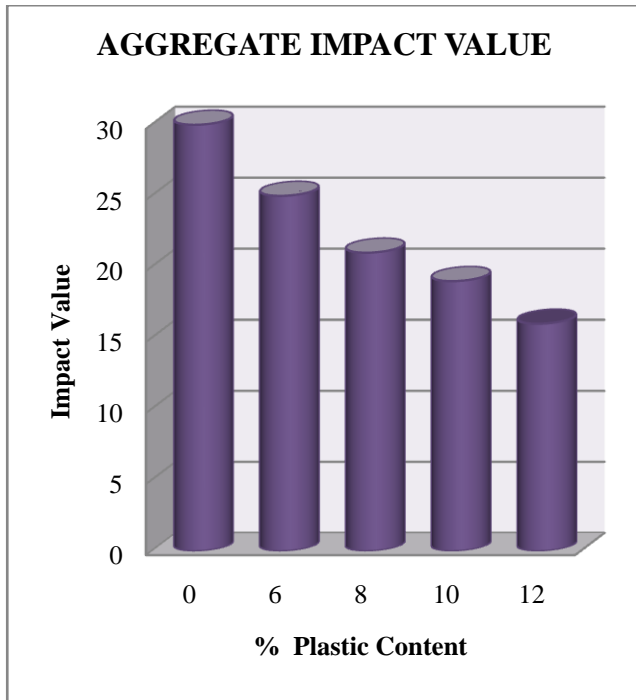


Figure 3: Variation in impact value of aggregate with increase in percentage of plastic

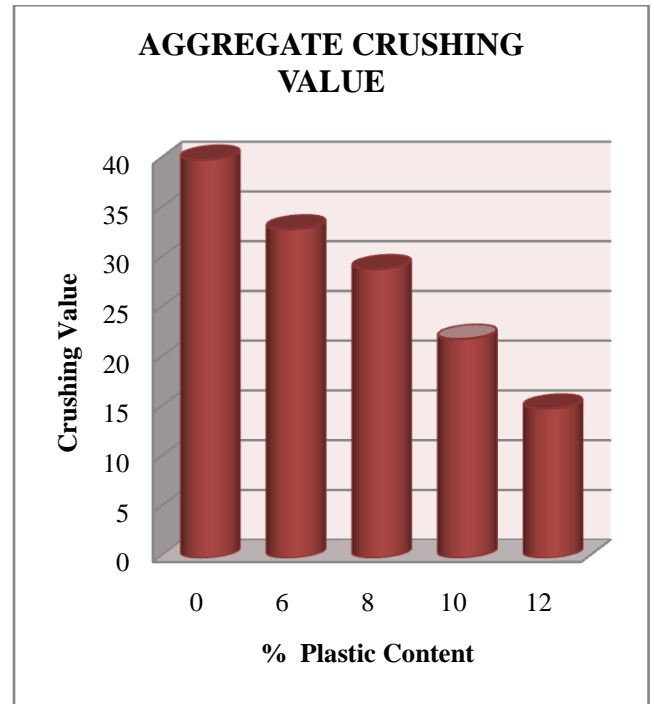


Figure 4: Variation in crushing value of aggregate with increase in percentage of plastic

AGGREGATE CRUSHING VALUE

Table 2: Observations for aggregate crushing test

STONE AGGREGATE	% OF PLASTIC	AGGREGATE CRUSHING VALUE
With plastic coating	6	37.7%
	8	26.21 %
	10	20.67 %
	12	13.45 %

LOS ANGELES ABRASION VALUE

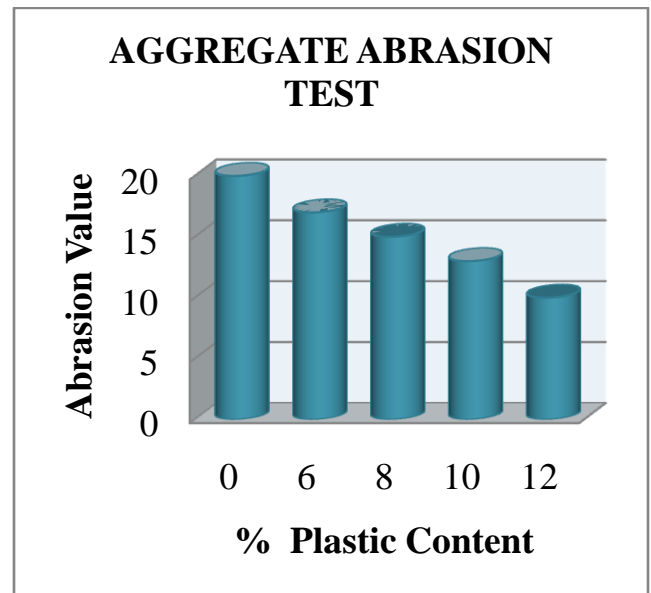


Figure 5: Variation in abrasion value of aggregate with increase in percentage of plastic

Table 3: Observations for Los Angel Abrasion test

STONE AGGREGATE	% OF PLASTIC	AGGREGATE ABRASION VALUE
With plastic coating	8	15.08 %
	10	13.49 %
	12	10.76 %

LABORATORY TESTS FOR ASPHALT

SOFTENING POINT TEST:

GRADE PROPERTY: 80/100

This test is conducted using Ring and ball apparatus. **Table 4:** Observations for tests on Softening point of asphalt

% OF BLINDER	% OF PLASTIC	SOFTENING POINT VALUE
94	6	54
92	8	60
90	10	62
88	12	66

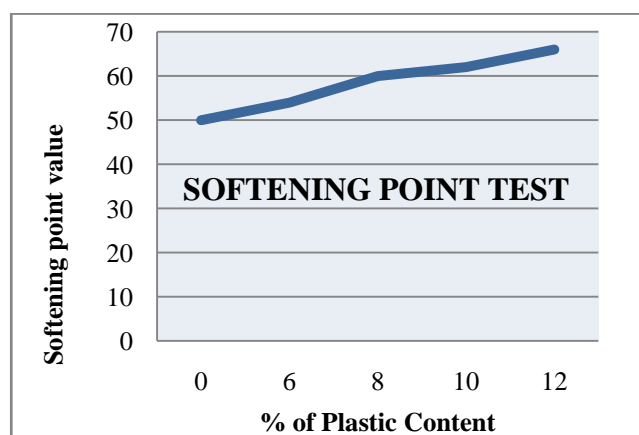


Figure 6: Variations in Softening Point increasing with plastic content

PENETRATION INDEX TEST

It is measured using Penetrometer.

Table 5: Observation for the penetration test

% OF BLINDER	% OF PLASTIC	PENETRATION VALUE
94	6	76
92	8	82
90	10	88
88	12	94

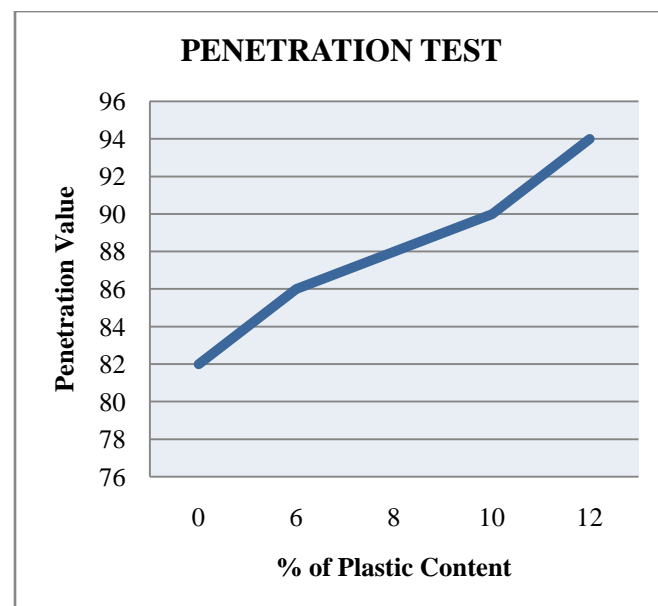


Figure 7: Variations in Penetration Value with increase in percentage of plastic

DUCTILITY INDEX TEST

The ductility of a bituminous material is measured by the distance in cm to which it will elongate before breaking point.

Table 6: Observation for the ductility test

% OF BLINDER	% OF PLASTIC	DUCTILITY VALUE
94	6	90
92	8	88
90	10	85
88	12	83

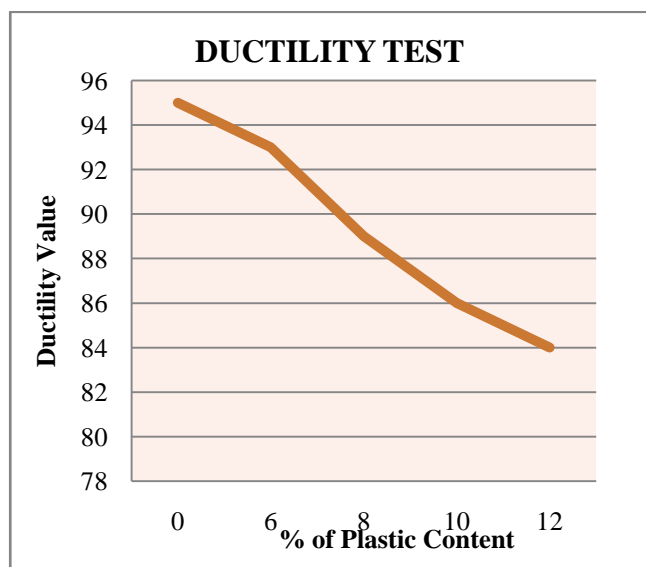


Figure 8: Variation in Ductility of Bitumen with increase in percentage of plastic

5. CONCLUSION

Plastic coating on aggregates has better performance of pavement. This improves a binding of asphalt with plastic wasted coated aggregate due to increased bonding between polymers and bitumen. The plastic coating prevents the moisture absorption and oxidation of bitumen. The roads can withstand heavy traffic and show better durability. This plastic waste can be effectively utilized upto 12% with increases in strength. It is cost effective and reduces the impact on environment.

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