



## “EXPERIMENTAL ANALYSIS BY UTILIZATION OF SHREDDED PLASTIC IN BITUMEN”

<sup>1</sup>Anurag Wahane, <sup>2</sup>Aditya Singh Bhuwal, <sup>3</sup>Nikhil Parganiha, <sup>4</sup>Sanjay Bansor

<sup>1</sup>Assistant Professor, <sup>2,3,4</sup>UG Student

<sup>1</sup>Department of Civil Engineering

<sup>1</sup>SSIPMT, Raipur, India

**Abstract:** Plastics are non-biodegradable materials and then a way to degrade our surroundings. Plastic wastes have established to be a supply of risk because it is toxicant in nature. Plastic waste could be a massive drawback in today's world. So, this plastic waste ought to be reused to eliminate the threat to the environment. One such employ will be within the construction of flexible pavements. Plastic coated aggregates have established to supply higher resistance to abrasion and wear and tear. Furthermore, the bond between these plastic-coated aggregates and therefore the bitumen is additionally too strong to enhanced contact space between plastic (polymers) and bitumen. Such roads show higher performance and have enhanced life spans. Plastic use in roads isn't new. the durability of the roads set out with shredded plastic waste is way additional compared with roads with asphalt with the standard combine. the utilization of the innovative technology not solely reinforced the building however additionally enhanced the road life further as will facilitate to enhance the atmosphere and additionally making a supply of financial gain.

Keywords- Plastic waste, aggregates, bitumen.

### 1. INTRODUCTION

Due to the rise in population, day by day use of plastic is additionally increasing so, plastic consumption is increasing day by day. Plastics are non-biodegradable and not ecofriendly however it's user friendly. these days more than 14 million tons of plastics waste are generated in India. The overuse of plastic results in produce a haul like disposal of waste plastic and management of disposal waste. Plastic waste is nondegradable material, it takes virtually one hundred years to two hundred years to decompose the waste plastic material. There are many ways to dispose the waste plastic material like disposing the waste materials into beneath water in oceans, however thanks to this fauna get disturbed by their life by swallowing the plastics. Waste plastic is used as the additives within the construction of flexible pavement, by this waste is used and also the issues is solved like management of pollution by burning the waste plastic. It has been recognized that the deficiencies of bitumen is overcome by the addition of polymers for rising viscos-elastic behavior besides maintaining its own benefits. except finding the matter of waste disposal, addition of waste plastics in bitumen combines leads to reduction in consumption of bitumen thereby leading to overall value reduction



Fig1. Plastic Mix Bitumen Road

### 2. LITERATURE SURVEY

**Dr.R.Vasudevan(2007)** stated that the plastic bitumen blend is a better binder compared to plain bitumen. Blend has results in increase in softening point and decrease in Penetration value with a suitable ductility.

**Zahra Niloofar Kalantar(2012)** Studied that many studies on PMA mixture have been conducted in the resent 2 decades. Although addition of plastics to asphalt for the purpose of increasing the properties of asphalt over a wide temperature range in paving applications was thought quite some time ago, recycled plastic added to asphalt have shown nearly the same result in improving the road pavement performance as compared to virgin polymers. This paper is a review of the use of plastics in asphalt pavement.

**Amit Gawande (2012)** Stated that 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 has become a serious problem globally due to their toxic nature. Since these are not disposed scientifically & chance to create ground and water pollution. This waste plastic partially replaced the conventional material to improve desired mechanical behavior for particular road mix. In regular road making process bitumen is used as binder. Such bitumen can be modified with addition of waste plastic pieces and bitumen mix is made which can be used as a top layer coating of flexible pavement. This waste plastic modified bitumen mix shows better resistant property, stability, density.

**Sunil J. Kulkarni (2015)** Stated that minimization of waste material is important aspect of the modern growth and development capabilities. Plastics are used in various domestic as well as industrial applications. Use of plastic bags and bottles are very common. The disposal of plastic waste is major problem due to toxic nature of plastic. The plastic can be used as fuel for ethanol like products. It can be used for road construction and other construction related projects. The current review summarizes the research of use of waste plastic.

**Rishi Singh Chhabra (2014)** examined that within the route infrastructure, an oversized variety of originates materials and technologies are made-up to see their suitability for the planning, construction and maintenance of those pavements. Plastics and rubbers square measure one among them. additionally considering the environmental approach, because of excessive use of synthetic resin in day-to-day business, the pollution to the surroundings is big. The use of plastic materials like carry luggage, cups, etc. is continually increasing day by day. Since the synthetic resin don't seem to be perishable, the requirement of the present hour is to use the waste synthetic resin in some useful functions. the employment of those materials as a building proves eco-friendly, economical and use of plastic offers strength within the sub-base course of the pavement.

### 3. MATERIALS AND METHODOLOGY

In plastic roads (composites of plastic with other materials) construction generally following materials are used such as Aggregates (of size 20mm, 10mm and stone dust / lime as filler), Bitumen for binder (different grades of bitumen 60/70 or 80/100 can be opted), Plastic Waste collected from various garbage dumps in the shredded form is used (PVC is not used because of the high toxicity).

#### Utilization of Plastic for Flexible Road Construction

The basic procedure for road construction using plastic waste includes following steps-

**a. Plastic Waste Collection:** In first step, various plastic wastes as distinguished in above specifications are collected from various sources.



**Fig.2 Plastic Waste Collection**

**b. Segregation:** Plastic waste collected from various origin must be separated from other waste. Maximum thickness is 60 microns.

**c. Cleaning and drying:** the separated waste is to be cleaned properly and dried.

**d. Shredding:** After segregation and cleaning-drying step the waste collected is broken and is graded into a size of 2.36 mm to 4.75 mm IS sieve using a shredding machine.



**Fig.3 Shredding Plastic Waste**

**e. Heating Process:** Before transferring to the mixing chamber the aggregate mix is heated to 165oC to 170oC and for preventing weak bonding the bitumen is heated up to the temperature of 160oC.

**f. Surface Coating:** At the mixing chamber, the shredded plastic waste gets coated thoroughly over the surface of the aggregates and shows an oily look within approximately one minute of time.



**Fig.4 Mixing**

**g. Construction:** The aggregates after mixing with the combined fusion of the plastic waste and the bitumen are used for laying the road between the temperature of 110oC to 120oC.



**Fig. 5 Plastic Mix Road Block**

## 4. RESULT AND DISCUSSION

### 4.1 Test Conducted on Aggregates

The Aggregate are tested for different parameters such as **Los Angeles Abrasion value test** as per IS: 2386 (Part IV) 1963, **Crushing value test** as per IS: 2386 (Part IV) 1963, **Impact value test** as per IS: 2386 (Part IV) 1963, **Flakiness Index Shape test** as per IS: 2386 (Part I) 1963, **Elongation Index Shape test** as per IS: 2386 (Part I) 1963

**Table 1 Test Report on Aggregates**

MIX	Test	Property Determined	Results
Mix1	Los Angeles test	Abrasion	27%
Mix2	Crushing test	Crushing strength	21%
Mix3	Impact test	Toughness	11%
Mix4	Shape test	Flakiness index	13%
Mix5	Shape test	Elongation index	12%



**Table 2 Test Report on Aggregates Coated With Different Percentages Of Plastic**

MIX	%Age of plastic	Aggregate Impact value	Los Angeles abrasion value
Mix1	0	11%	26.8%
Mix2	2	10.92%	25.93%
Mix3	4	10.84%	25.69%
Mix4	6	10.76%	25.57%
Mix5	8	10.52%	25.51%
Mix6	10	10.33%	25.36%

#### 4.2 Test Conducted on Bitumen

The Bitumen is tested for different parameters such as **Penetration test** as per IS: 1203-1978, **Softening point test** as per IS: 1205-1978, **Ductility test** as per IS: 1208-1978, **Flash point test** as per IS: 1209-1978, **Fire point test** as per IS: 1209-1978.

**Table 3 Test report on Bitumen**

MIX	TEST	RESULT
Mix1	Penetration Test	73 mm
Mix2	Softening point test	43oC
Mix3	Ductility test	63 mm
Mix4	Flash point test	192oC
Mix5	Fire point test	201oC

**Table 4 Test Report on Bitumen Mixed with Different Percentages Of Plastic**

MIX	%Age of bitumen	%Age of plastic	Softening point (oC)	Penetration (mm)	Ductility (mm)
Mix1	100	0	43	73	63
Mix2	98	2	48	58	58

Mix3	96	4	57	55	54
Mix4	94	6	61	53	50
Mix5	92	8	63	50	47
Mix6	90	10	66	46	44

## 5. CONCLUSIONS

- 1.The maximum value for Los Angeles Abrasion test is shown by Mix1 and the least value for Los Angeles Abrasion test is shown by Mix6 (as per table 2).
- 2.Mix6 which has maximum no. of plastics is showing very much similar result w.r.t Mix1 in terms of Abrasion value and Impact value.
- 3.The Mix1 case is showing maximum ductility which is approximately 30% more than Mix6.
- 4.The Softening point result is very much similar in case of Mix4, Mix5 and Mix6.
- 5.After several investigation it has been observed that the percentage of plastic from 6% to 10% is showing very much similar result. Hence, there is no need of increasing shredded plastic after 6% in bitumen.

## 6. REFERENCES

1. Vasudevan, R, Saravanavel, S, Rajsekarana, S, and Thirunakarasa, D (2006) "Utilization of Waste nPlastics in Construction of Flexible Pavements", Indian Highways, Vol. 34 No.7 IRC, pp 5-20.
2. Sridhar, R Bose, S Kumar, G and Sharma G, (2004) "Performance Characteristics of Bituminous Mixes Modified by Waste Plastic Bags" Highway Research Bulletin, No 71, IRC pp 1-10.
3. IRC:48-1972, "Tentative Specifications for Bituminous Surface Dressing Using Pre-Coated Aggregate", Indian Roads Congress.
4. Utilization of Waste plastic Bags in Bituminous Mixes (November 2002), CRRRI Report submitted to M/s KK Plastic Waste Management Ltd. (Bangalore).
5. ISI, "Indian Standards Specifications for Roads Tar", IS:215, Indian standard Institution.
6. Ministry of Road Transport and Highways, Manual for construction and supervision of Bituminous works, New Delhi, November 2001.