

USE OF WASTE POLYCARBONATE IN BITUMEN MIX FOR FLEXIBLE PAVEMENT CONSTRUCTION

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ABSTRACT

In India In a huge quantity of plastic (polycarbonate) waste is generated from various types of sources. In this research paper, the polycarbonate is used in bitumen mix for flexible pavement construction. Some percentage of polycarbonate is mixed with bitumen & various tests are carried. Then finally polycarbonate is mixed with bitumen & construction of road is done.

Keywords: Waste Plastics, Bitumen.

I. INTRODUCTION

On this work, various researches are carried out in the past & available paper & literature review has shown that polycarbonate is extensively use in bitumen for construction of pavement. Nowadays disposal of different waste produce from different industries is a great problem. This material causes environmental pollution in the nearby locality because many of them are non-degradable products. Traditional bitumen & aggregates are used in road pavement. But natural materials exhaustible in natural, the quantity of aggregates is decreasing fast, by various companies for highway/road construction and for many other purposes. In industries various types of plastic waste in generated. This plastic material is used for road construction due to which pollution of nature because of plastic waste is automatically decreased & also the development of construction occurs. Polycarbonate is a waste from various industries and is used with bitumen for construction after various laboratory tests. The cost of construction is decreased & Industrial waste is also reused and reduced. History Polycarbonate polymer was discovered and it was changed in 1928. By E.I. Caruthers of Du. point Company. It was new, resistance of transparent material. In 1952 many scientist become interested in the polycarbonate molecule. In 1959 industrial scale polycarbonate manufactured stored. The objective of this study & Investigation are; to use of polycarbonate in bitumen for construction of road. To prepare this VG-30 Grade bitumen is used. And test are carried out in this 5%, 10%, 15% polycarbonate is replaced with bitumen.

II. LITERATURE REVIEW

1) N. Pramukh, R. L. Prajwal, B. M. Darshan , S. Sunilkumar, C. L. Santhosh . 7 july 2020

As per studies Plastic waste is a common problem nowadays. Plastic is a toxic and perpetual material. Disposal of waste plastic is a menace and become a serious problem globally due to their non-biodegradable and very harmful to human health's since they are not disposed scientifically and then create a ground and water pollution. Looking forward the scenario of current lifestyle a whole prohibition on the use of plastic cannot be put, although the waste plastic in roads construction is gaining importance these days because plastic roads improve better than normal ones and the plastic waste considered to a pollution hazard, can find its use. The use of waste plastic for coating the aggregate of the bituminous mix found to improve its performance characteristics.

2) Pratiksha Singh Rajput, R. K. Yadav. April 2016

The coating of plastics reduces the porosity, absorption of moisture and improves soundness. The polymer coated aggregate bitumen mix forms better material for flexible pavement construction as the mix shows higher Marshall Stability value and suitable Marshall Coefficient. Hence the use of waste plastics for flexible pavement is one of the best methods for easy disposal of waste plastics.

3) Priyanka Toke , Vrushali Mahadik , Bhupendra Patil .February 2020

The durability of a plastic is high and it degrades slowly. And also plastic has high resistant to degradation. Plastic can be divided into two major categories-thermoses & thermoplastics. Thermo sets have high durability and strength because thermo sets solidifies irreversibly when they heated, henceforth can be used primarily in construction application. Plastic is a non-degradable waste, causes greenhouse effect and global warming. The various experimental procedures have been carried out whether the waste plastic material can be reused productively. The various literature shows that the waste plastic material when added to high temperature aggregates will form a thin coat of plastic over the aggregate and such aggregates when mixed with binder material is found to have higher strength, higher resistance and better performance over a period of time. Along with bitumen, use waste plastic material increases its life time and smoothness. It is economical and eco-friendly. Addition of plastic waste material in construction of road pavements reduces the plastic shrinkage and drying shrinkage. The use of waste plastic improves the abrasion value & slip resistance of asphalt material pavement.

4) Rajneesh Kumar, Maaz Allah Khan 2020

During recent researches it has been inferred that waste plastic when mixed up with hot aggregate will form a fine plastic coat over it and when mixed up with the binder gives it a higher strength, high water resistance and enhanced performance over a period of time. Waste materials usually constitutes of plastic bags, laminated pouches, disposable cups etc. The use of plastic with bitumen in construction of flexible pavements not only increases its smoothness and life but helps in reducing the cost of project and also contributes into an ecofriendly environment. The plastic roads are found to give better results and performance compared to the conventional bitumen roads. The use of bitumen was reduced to 10% on introduction of plastic waste as filler materials. It also enhances the strength and performance of the roads. Plastic filling increases the melting point of the bitumen.

III. ADVANTAGE OF POLYCARBONATE IN BITUMEN

- 1) The economic cost of constructing road is low compared to traditional road method.
- 2) Stronger than regular roads.
- 3) Environmentally friendly.
- 4) Save pollution like air & water.
- 5) Road surface smooth.

IV. MATERIAL USED FOR MODIFYING

- 1) Polycarbonate

Most of the packing material used are made us of polycarbonate. These material are useful for their thickness, and Softening properties & this is used for modification of bituminuous properties.

Material	Nature of Polycarbonate	thickness	Softening point
Cup	P.E.	150	100-120
Carry bag	P.E.	10	100-120
Water bottle	P.E.T.	210	170-180
Chocolate caver	P.E.T.	210	170-180
Milk pouch	L.P.E.	60	100-120



Fig.1 Shredded Polycarbonates



Fig.2 Bitumen

1) Experimental Details:

The bitumen is heated to a temperature of 121 C to 138 C at reused amount. Bitumen after mixing the material, preheated aggregate (To remove voids) then cleaned polycarbonate & bitumen is taken in pan. After that mixture is heated again in marshall mould with a collar & base placed on mould with in the marshall compaction pedestal. Compact the material with 70-75 blows, after that inverted mould with collar on bottom. Removed the waste & extracted the sample by pushing the extractor after 24 hours.



Fig.3 Marshall Stability test

V. RESULT

Table: 1 Marshall Stability value for Conventional Bitumen

Mould No.	Percentage of Bitumen	Marshall value (KN)	Flow Value (mm)
1	4.6	14.97	3.43
2	4.6	12.04	3.21
3	4.6	16.63	3.15
		AVG=14.55	AVG=3.26

Table: 2 Marshall Stability value for 10 percent Polycarbonate

Mould No.	Percentage of Bitumen	Percentage of Polycarbonate w.r.t. wt. of Bitumen	Marshall Value (KN)	Flow Value (mm)
1	4.14	0.46	14.55	3.25
2	4.14	0.46	15.40	3.32
3	4.14	0.46	14.85	3.29
			AVG =14.93	AVG 3.28

Table: 3 Marshall Stability value e for 15 percent Polycarbonate

Mould No.	Percentage of Bitumen	Percentage of Polycarbonate w.r.t. wt. of Bitumen	Marshall V(KN)	Flow Value (mm)
1	3.91	0.69	17.48	3.51
2	3.91	0.69	12.64	3.42
3	3.91	0.69	14.76	3.37
			AVG= 14.96	AVG=3.43

Table: 4 Marshall Stability value for 20 percent Polycarbonate

Mould No.	Percentage of Bitumen	Percentage of Polycarbonate w.r.t. wt. of Bitumen	Marshall Value (KN)	Flow Value (mm)
1	3.68	0.92	14.90	3.27
2	3.68	0.92	14.36	2.92
3	3.68	0.92	15.38	3.32
			AVG=14.88	AVG=3.50

Table: 5 Penetration Value (mm)

Penetration dial reading	0% plastic	5% plastic	10% plastic	15% plastic
Initial reading	0	0	0	0
final reading	50	62.1	57	48
Penetration Value (mm)	50	62.1	57	48

Table: 6 Bitumen ductility value (cm)

Ductility reading	0% plastic	5% plastic	10% plastic	15% plastic
Initial reading	0	0	0	0
final reading	80	92	75	61
Ductility Value (cm)	80	92	75	61

Table: 7 Bitumen Softening point value

Softening Point Reading	0% plastic	5% plastic	10% plastic	15% plastic
Temperature When the ball touches bottom (°C)	54.35	55.5	57	58

VI. CONCLUSION

- 1) In addition of replacement the quantity of road is improved.
- 2) By this technical experiment carry bag, Sheet, cups are used for road laying & reduce environmental Hazard.
- 3) The cost of construction in reduced due to use of waste material.

VII. REFERENCES

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