PLASTIC WASTE MANAGEMENT

SRIKANTH BANDELA
Department of civil engineering
Vishnu Institute Of Technology
Bhimavaram, Andhra Pradesh

P ROHITH
Department of civil engineering
Vishnu Institute Of Technology
Bhimavaram, Andhra Pradesh

B MARY DEVIKA
Department of civil engineering
Vishnu Institute Of Technology
Bhimavaram, Andhra Pradesh

Abstract—**Waste plastic and its disposal pose a significant threat to the environment, resulting in global warming and pollution. In bituminous mixes, the use of plastic waste improves its properties and also its strength. As of 2018, around 380 million tons of plastics are manufactured annually worldwide. Some researchers suggest that by 2050 there could be more plastic than fish in the ocean by weight to overcome this problem we have to use plastic in construction of pavements and in other purposes. In addition, plastic disposal and various pavement defects, such as pot holes, corrugation, ruts, etc., would also be solved. The waste plastic used are poly-ethylene, poly-styrene, poly-propylene. The waste plastic as 0%, 5%, 10%, 15%, 20% is mixed with hot bitumen and is used for pavement construction. The waste plastic is shredded and coated over aggregate and resulted mix is used for pavement construction. This will not only strengthen the pavement and also increases its durability. The plastic pavement is resistant to heavy traffic and durable compared to normal flexible pavements. As a smoke absorbent material that can absorb the smoke from the engines, titanium-di-oxide is used. This revolutionary technology would be ideal for the hot-humid climate of India. It's economical and eco-friendly. In this paper, we have discussed about the pavement design, process of construction of flexible pavements by mixing plastic with bitumen.**

Keywords—*Plastic, Binder, Bitument, Pavement*

I. INTRODUCTION

The disposal of waste plastic is the biggest threat to the environment. The potholes and corrugation are the big issue on the highway. Plastic pavement is a better solution to the problems mentioned above. iA material containing one or more organic polymers of large molecular weight, solid in its finished state, may be formed as "plastic" by its flow. Plastic's durability is high and it degrades very slowly. And also plastic has high resistant to degradation. Plastic can be divided into two major categories- thermoses and thermoplastics. Thermosets have high durability and strength because when heated, it solidifies irreversibly, and can now be used mainly in construction applications. Plastic is a non-degradable waste, causes greenhouse effect and global warming. Whether the waste plastic can be reused productively has been carried out in various studies. The different literature showed that when applied to hot aggregates, the waste plastic would form a fine plastic coat over the aggregate and when combined with binder, such aggregates are found to have higher strength, higher resistance and better performance over a period of time. Using waste plastic, along with bitumen, improves its life and smoothness. It is eco-friendly and economical. In the construction of pavements, the addition of plastic waste decreases plastic shrinkage and drying shrinkage. The use of waste plastic improves the abrasion and slip resistance of asphalt pavement. In India, plastic pavements have the greatest benefit because of the hot and extremely humid climate.

II. SCOPE OF THE PROJECT

SCOPE OF THE PROJECT:

- To eradicate potholes.
- To minimize the global warming,greenhouse,gases and pollution.
- The life span of the roads can be increased.
- Eco –friendly in nature.

ADVANTAGES:

- Reduce the need of bitumen by some extent.
- Develop a technology which is eco-friendly.
- Improvements in fatigue life of roads.
- Increase the strength and better performance of the road.
- Use higher percentage of plastic waste.
- The gases released during traffic conditions are absorbed by smoke absorbent.

III. LITERATURE REVIEW

Dr.R.Vasudevan,(2007)-Stated that compared to plain bitumen, the polymer bitumen blend is a better binder. With suitable ductility, the blend has increased the softening point and decreased penetration value.

Zahra Niloofar Kalantar (2012) - Many researches on PMA mixture have been conducted for the past two decades. Although the addition of virgin polymers to asphalt was considered quite some time ago to improve the properties of asphalt over a wide temperature range in paving applications, In comparison to virgin polymers, recycled polymers added to asphalt have also indicated almost the same result in improving road pavement performance. This is a review of the use of polymers in asphalt pavement. In this article, followed by a review of general studies on the use of asphalt polymers to improve pavement properties, a critical review of the history and benefits of the use of waste and virgin polymers in asphalt is addressed.

Sunil J. Kulkarni (2015) - Waste material minimization is an important feature of modern initiatives for growth and development. In various

domestic and industrial applications, plastic is used. It is very popular to make use of plastic bags and bottles. Owing to the non-biodegradable nature of plastics, the handling of plastic waste is a major issue. The plastic can be used as feedstock for ethanol like materials. It can be used for road construction and other activities connected with construction.

IV. MATERIALS USED

PLASTIC: A plastic material consisting of a wide variety of organic polymers, such as polyethylene, PVC, nylon, etc., which can be gently moulded and then rigidly or slightly elastically placed.

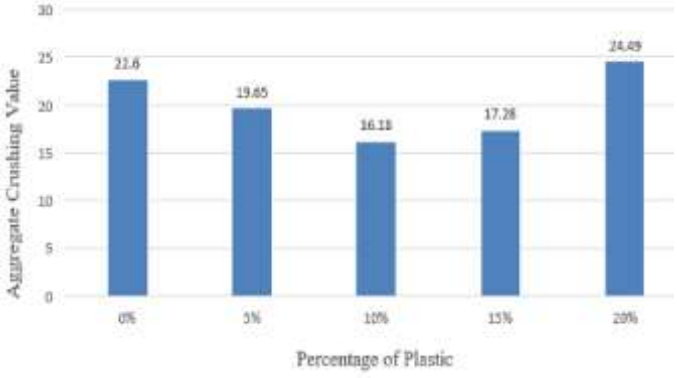
BITUMEN: A black viscous hydrocarbon blend obtained naturally or as a residue from the distillation of petroleum. It is used for surfacing and roofing the roads.

AGGREGATE: Construction aggregate, including sand, gravel, crushed stone, slag, recycled concrete, and geo-synthetic aggregates, is a type of coarse to medium grain particulate matter used in construction.. Aggregates are the world's most commonly mined materials.

V. RESULTS AND DISCUSSION

% of Plastic	Aggregate Crushing value (%)
0	22.6
5	19.65
10	16.18
15	17.28
20	24.49

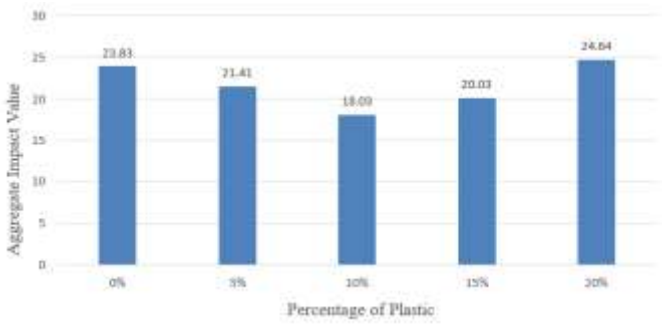
Table 5.1: Final Aggregate Crushing Values



Graph 5.1: Bar Chart For Aggregate Crushing Values

% of Plastic	Aggregate Impact value (%)
0	23.83
5	21.41
10	18.03
15	20.03
20	24.64

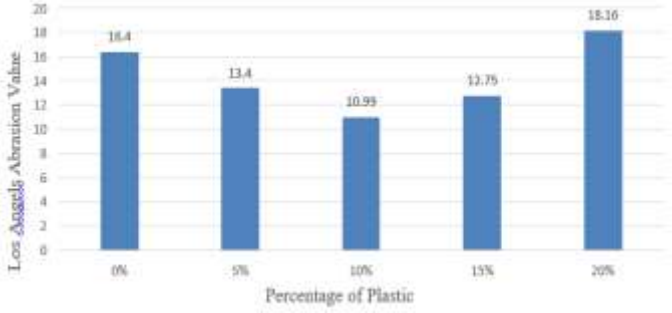
Table 5.2: Aggregate Impact Values



Graph 5.2: Bar Chart For Aggregate Impact Values

% of Plastic	Los Angeles Abrasion values (%)
0	16.4%
5	13.4%
10	10.99%
15	12.75%
20	18.16%

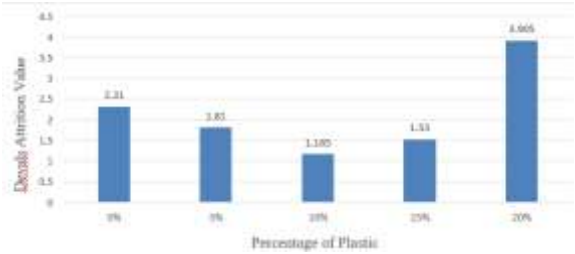
Table 5.3: Los Angels Abrasion Values



Graph 5.3: Bar Chart For Los Angels Abrasion Values

% Of Plastic	Devals Attrition Values (%)
0	2.31%
5	1.81%
10	1.165%
15	1.53%
20	3.905%

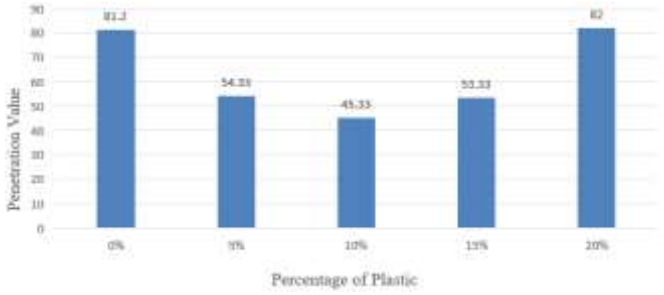
Table 5.4: Devals Attrition Values



Graph 5.4: Bar Chart For Devals Attrition Values

% of Plastic	Penetration Values (%)
0	81.2
5	54.33
10	45.33
15	53.33
20	82

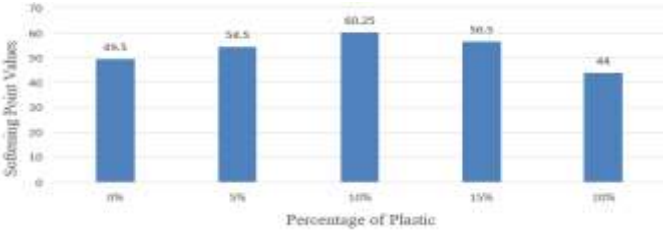
Table 5.5: Penetration Values Of Bitumen



Graph 5.5: Bar Chart For Penetration Values Of Bitumen

% of Plastic	Softening point (°C)
0	49.5
5	54.5
10	60.25
15	56.5
20	44

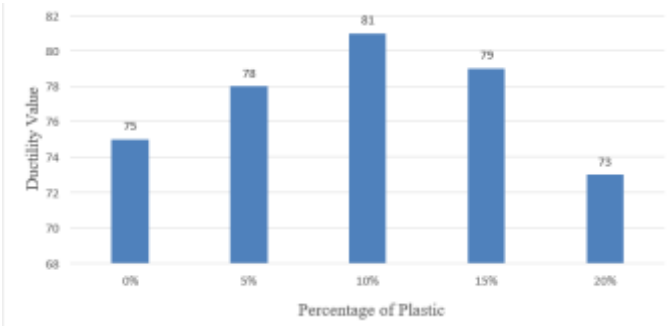
Table 5.6: Softening Point Values Of Bitumen



Graph 5.6: Barchart For Softening Point Values Of Bitumen

% of Plastic	**Ductility values (cm)**
0	75
5	78
10	81
15	79
20	73

Table 5.7: Ductility Values Of Bitumen



Graph 5.7: Bar Chart For Ductility Values Of Bitumen

Conclusion:

1) The Crushing value reduces from 22.6% to 16.18% when 10% of plastic is added to bitumen and increases from 16.18% to 24.49% when 20% of plastic is added to bitumen which is more than initial value. For good flexible pavements crushing value of aggregates should be minimum. So the value at 10% is considered.
2) The Impact value reduces from 23.83% to 18.03% when 10% of plastic is added to bitumen and increases from 18.03% to 24.64% when 20% of plastic is added to bitumen which is more than initial value. For good flexible pavements impact value of aggregates should be minimum. So the value at 10% is considered.
3) The Abrasion value reduces from 16.4% to 10.99% when 10% of plastic is added to bitumen and increases from 10.99% to 18.16% when 20% of plastic is added to bitumen which is more than initial value. For good flexible pavements abrasion value of aggregates should be minimum. So the value at 10% is considered.
4) The Attrition value reduces from 2.31% to 1.165% when 10% of plastic is added to bitumen and increases from 1.165% to 3.905% when 20% of plastic is added to bitumen which is more than initial value. For good flexible pavements attrition value of aggregates should be minimum. So the value at 10% is considered.
5) The Penetration value reduces from 81.2mm to 45.33mm when 10% of plastic is added to bitumen and increases from 45.33mm to 82mm when 20% of plastic is added to bitumen which is more than initial value. For good flexible pavements penetration value of bitumen should be minimum. So the value at 10% is considered.
6) The Softening point value increases from 49.5°C to 60.25°C when 10% of plastic is added to bitumen

and decreases from 60.25°C to 44°C when 20% of plastic is added to bitumen which is less than initial value. For good flexible pavements softening point value of bitumen should be maximum. So the value at 10% is considered.

7) The Ductility value increases from 75cm to 81cm when 10% of plastic is added to bitumen and decreases from 81cm to 73cm when 20% of plastic is added to bitumen which is less than initial value. For good flexible pavements ductility value of bitumen should be maximum. So the value at 10% is considered.

8) From the above conclusions we can conclude that by adding 10% of plastic to bitumen all the above tests are within their standard limits and we can get good flexible pavements. For the improved performance of the roads, plastic mixed with bitumen and aggregates is used.

9) The plastic pavement can withstand heavy traffic and are durable than normal flexible pavements.

10) Finally the use of plastic mix will reduce the bitumen content by 10% and increases the strength and performance of the road. This new technology is Eco-friendly.

REFERENCES

[1] Indian roads congress IRC: 37-2012 - Guidelines for the design of flexible pavements- August 2012.

[2] R. Vasudevan, (2011), "A technique to dispose waste plastics in an ecofriendly way – Application in construction of flexible pavements" Construction and Building Materials vol. 28 Department of Chemistry, Thiagarajar College of Engineering, Madurai, Tamil Nadu, India, PP 311–320.

[3] Miss Apurva j Chavan (2013) - Use of plastic waste in flexible pavements -ISSN 2319– 4847, Volume 2, Issue 4, April 2013.

[4] S.S.Verma - Roads from plastic waste (2008) - The Indian Concrete Journal - November 2008.

[5] Vinoth.N - Use of plastic wastes in road construction – Central Institutes of Plastic Engineering and Technology.

[6] Aravind k. , Das Animesh, (2007) "Pavement design with central plant hot-mix recycled asphalt mixes", Construction and Building Materials, vol. 21, Dept. of Civil Engg., Indian Institute of Technology, Kanpur, India, pp 928–936.

[7] Dhodapkar A N., (Dec. 2008), - "Use of waste plastic in road construction", Indian Highways, Technical paper, journal, P No.31-32.

[8] Al-Hadidy A.I., Yi-qiu Jan (2009), "Effect of polyethylene on life of flexible pavements", Construction and Building Materials, vol. 23.

[9] Rishi Singh Chhabra, Supriya Marik (2014) - A Review Literature on The Use Of Waste Plastics And Waste Rubber Tyres In Pavement – International Journal Of Core Engineering & Management (IJCEM) - Volume 1, Issue 1, April 2014.

[10] Zahra NiloofarKalantar , Mohamed RehanKarim, AbdelazizMahrez (2012) -A review of using waste and virgin polymer in pavement - Construction and Building Materials 33 (2012) 55–62.

[11] AmitGawande, G. Zamare, V.C. Renge, SaurabhTayde, G. Bharsakale (2012) - An overview on waste plastic utilization in asphalting of roads - Journal of Engineering Research and Studies volume 3,2012/01-05.