IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Use Of Waste Plastic In Flexible Pavement In Various Elements

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Abstract: Plastics are non-biodegradable materials and it is durable and resistant to degradation, making them nearly impossible for nature do break down. Plastics are not fully compared only recycled. Plastic only break into small pieces. Waste Plastic pollution is a global Problem. Every year 19-23 million tonnes of plastic waste leaks into aquatic ecosystems. Plastic Pollutes lakes, river and seas. The two types of plastic in wed in construction, thermosets & thermoplastics, thermoset plastic has good strength and durability. If we use in waste plastic in flexible pavement than it is economical and great for the environment and helps in increasing the quality of roads. Many environmental problems arise due to plastic like Cary bags, wrappers, battles of cold drinks, Chips and hand bags. we can solve the problem of disposal of waste plastic. It mines with bituminous missives added to that aggregate, gives higher strength, durability higher resistance to water and better performance a long period of time. Plastic Road is very good in terms of Climate condition of India because there all types of weather condition. We in the environment. The main objective of this paper into understand about the use of plastic waste and its use can make us stronger and sustainable and when we add aggregate to plastic, it reduces the air voids and binds the plastic in a better way, gives us strength and Stability.

Index Terms – Non biodegradable, Ecosystem, Durability, Sustainable, Environment, Thermoplastics etc.

I. INTRODUCTION

There are a lot of problems for plastic waste disposal in India and plastic in very harmful for human and Animal health. Between 1.1 and 8.8 million ton of plastic waste enters the ocean each year.Plastic is not expensive and durable, mort plastics do not biodegrade Bo they stay in the environment for a Long time. In 2019, 368 million tons of plastic were produced each year, with 51% of that in Asia. Plastic in A Synthetic material made from organic polymers that can be molded into various shapes. There are Durable and degradable in the soil. There are two types of plastics. Thermoplastics and thermoset plastics. Thermoplastics and thermoset soften when heated and harden when cooled, allowing them to be remolded And recycled. Thermoset plastics harden permanently once molded. Plastic in the mixture of organic polymers, carbon, oxygen, Nitrogen and Sulphur. No maintenance is Required in waste plastic Road for years as the surface remains without any Cracking or potholes. Most of The plastic available today is of single use and throw. Plastic waste is durable and non- biodegradable Materials. Main component of plastic in the form of polyethylene is used which Can be assumed in form Pet Battles, Disposable Cups, Plastic Carry bags, packet of Polyethylene which we get from garbage. The Polymer Coating works to improve air voids and makes the road surface Smooth and moisturizer free,Resulting in reduced pitting and roughness in the surface.

We use Plastic waste in road construction which Increases the life of our roads and it is also economical and environment friendly for us. By mixing plastic Waste in hot aggregate the amount of bitumen com be reduced, which saves our bitumen and our waste Plastic is also destroyed. So we can get rid of waste plastic after a long time.Road made from plastic are called Plastic roads.Plastic roads are better than bituminous road, plastic

roads do not get damaged when exposed to water and Also reduce the Shrinkage and cracking of roads. If we increase the percentage of waste plastic then we Decrease the bitumen by 10%. It also improves the performance of road. The method of making roads using Plastic in not new. We have come to the conclusion that by coating plastic on aggregate we can improve the Strength and performance of the road.

Scope of plastic waste road-

- Enhancing the Stability and Performance of bituminous roads.
- Protect it from rain water damage and increase itslife span.
- Reducing environmental impact and making it eco- friendly
- Reducing greenhouse gasses effect, potholes on roads and global warming.

LITERATURE REVIEW

Plastic has been used in the manufacture of flexible Pavements in India for many years. A lot of inventions Have been done in this area to we plastic waste in bituminous road construction. Plastic waste Can be wed in Flexible pavements by enhancing the bitumen properties and Strength.

(1)
Dr. R. Vasudevan (2007), is an indian scientist who has worked in waste management. He Developed an innovative method to reuse plastic waste to construct better, more durable and very cost Effective roads. He is also called as the 'Plastic Man of India' who has found a way to reuse plastic waste And make durable roads. Plastic roads were first developed by Rajgopalan Vasudevan in 2001 counting of An asphalt mix.

2)

R Manju, Sathyas (2017), A lot of experiments have been done to manufacture waste Plastic to see if waste plastic can be reused or not. When waste plastic aggregate will form fine coat of plastic Over the hat aggregates when mixed with binders provide high Strength and high resistance and durable Performance over a long period of time. Apart from bitumen, by using waste plastic we can increase the life Of the road and the smoothness and it is very economical and eco- friendly.

3)

Mr. Chabbi Lal Singh, Prashant Singh, Abhishek Kumar, Shushant Singh, Rajeev Rajput. (2020) Use of plas6tic waste win flexible pavement – green highways. This topic deals with the using of waste Plastic. The plastic waste is used is poly-ethylene, poly-styrene, Poly propylene, the temperature varying b/w 12°C-160°c gives the "Softening point of plastic. This type of road reduce the air voids with plastics and Binds with aggregate to provide stability. Plastic is a non – degradable waste and hence the greenhouse
Effect of global warming in severe.

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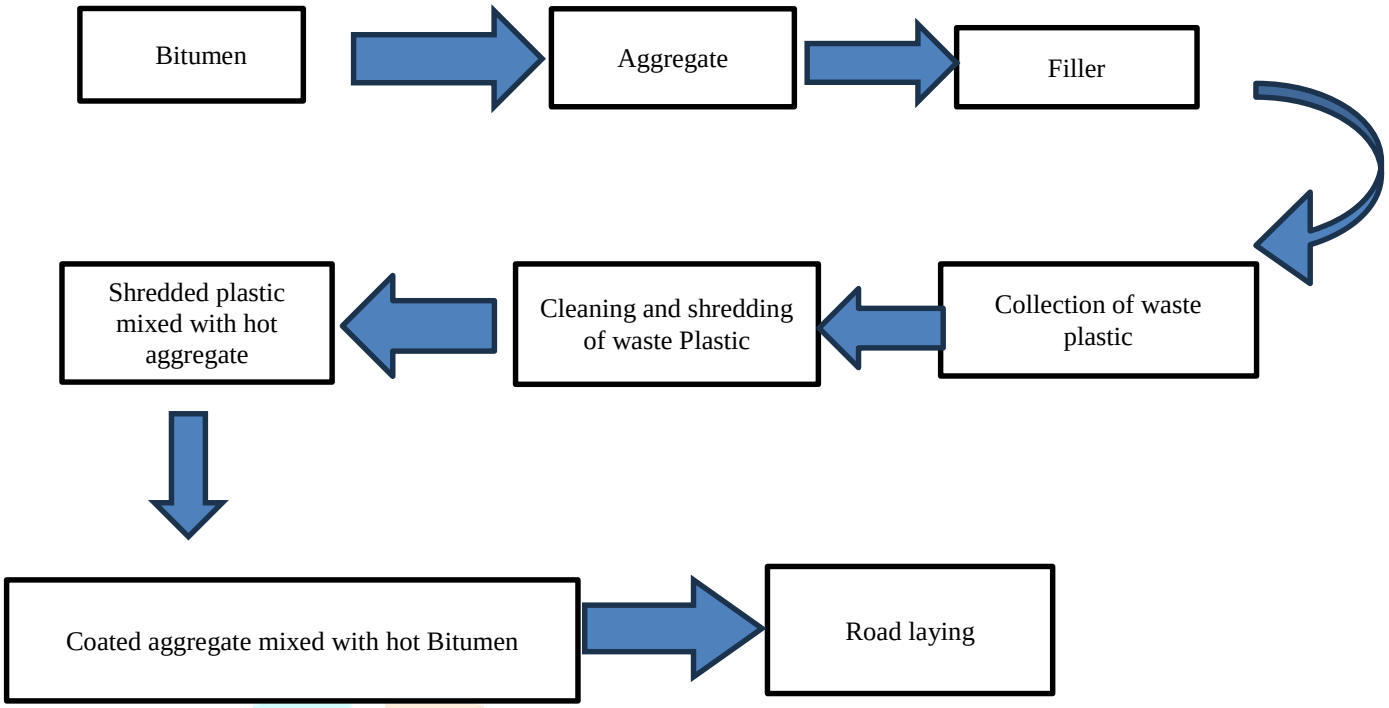
P. Vijaya Lakshmi Kanthi, Ch. Rohitha, K. Rakesh, D. Hema, V. Hemanth, B. Jayaram-(202.3) waste plastic and its disposal is the Biggest Cause of environmental pollution and global warming. Marshall method is used to determine the optimum bitumen Content. Guidelines issued by railway ministry For we of Plastic waste in road construction for bituminous concrete 6 to 8% of the weight of bitumen in used as waste plastic.

Methodology



THE FOLLOWING MATERIALS ARE USED TO CREATE WASTE PLASTIC FLEXIBLE PAVEMENT.

Use of material:-

- **Bitumen**- It works as a binder in between which Keeps all the ingredient's together in the Mixture. Different grades of bitumen are used on the basis of Strength. Excellent quality of bitumen, it Becomes Soft when heated. The guidelines for selection of grades for viscosity graded paving bitumen will Be as under IRC 111-2009.

Bitumen

- **Aggregate**:- Aggregate is a very important material in the Construction of flexible Pavement. Two types of aggregate are used course & fine aggregate [20mm and 10mm].

. Aggregate

- **Filler**:- Filler materials are used to improve workability and fill voids. 6mm Store dust of lime used or Filler. Filler are mixes with grade IRC 111-2009.

- **Waste plastic**:- waste plastic can be used in flexible pavement roads in a number of ways, including, Waste plastic can be used to modify the binder in a bituminous mix. Adding 5-10% waste plastic by weight of Bitumen can improve the mix's strength Stability, fatigue life and other properties. Waste plastic can be Sprayed over Using aggregate to create an oily coating. Using waste plastic in road construction can help with pollution, as most plastic waste is made of polymers. Some types of waste Plastic that can be used include, carry bags, disposable Cups, laminated pouches, Aluminium foil, packaging material for biscuits, chocolates, milk, and supermarket items.

Waste plastic

There are two methods of making flexible pavement-

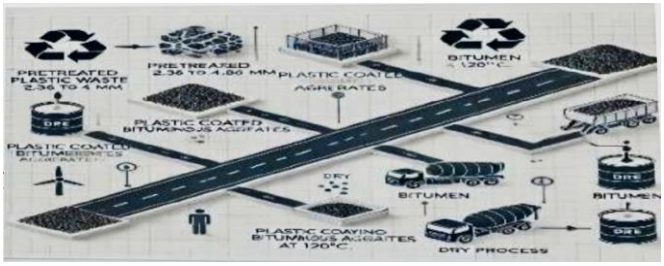
(a) Dry process
(b) Wet process

DRY PROCESS:

The dry process in the method for making flexible pavement roads that involves incorporating Plastic waste into hot aggregates to create Plastic-coated aggregates.

Steps for dry process: -

- Mix plastic waste and Coarse Aggregate at 180°C until the plastic coats the aggregates.
- Mixing fine aggregates with mixers.
- Compacting asphalt mixture using Marshall hammer.
- The plastic coating improves the workability of aggregates and enhances their performance and stability by Reducing porosity.



. Dry process

(b)**Wet process**:

In the wet process, waste plastic powder is mixed into hot bitumen. Waste Plastic powder Should be mixed directly bitumen the aggregates before mixing them.

Steps for wet process :-

- Collection of waste plastic from roads, garbage trucks, dumpsites -or compost plants.
- Cleaning and Shredding waste plastic and it necessary, washing it.
- The Plastic waste which we have cleaned should be cut into the size of 2.36mm and 600 microns, using a Shredding machine.
- Mixing of raw waste plastic with aggregate and bitumen in the central mixing plant and heating it at 135°C To 170°C. the Plastics waste coated aggregate is mixed with hot bitumen for 15 secs and the mix transported for Road construction.
- For laying the waste plastic bituminous mix on the rood the temperature should be from 110°C to 120°C

And the roller should be of any specified capacity.
Shredding machine.

Central mixing plant

RESULTS AND DISCUSSION:-

Test for aggregate –
Crushing Test-

The aggregate crossing value provides are relative measure of resistance to crushing under gradually applied crushing load aggregate crushing value of the course aggregate used for cement concrete surface should not exceed 30%.

S .No.	Observation	Readings
1.	Total weight of dry sample(W1)in gram	2855
2.	Weight of fine passing through 2.36mm sieve (W2) in gram	720
3.	Aggregate crossing value= W2/W1*100	25.21

Crushing value of aggregate is **25.21** it is suitable for manufacturing of the road.

Impact Test:- The ability of aggregates that resist sudden impact or shock load on it.

S.No.	Observation	Readings
1.	Total weight of aggregate sample filling cylindrical measure (W1)	0.40 kg
2.	Weight of aggregate passing through 2.36 mm IS sieve (W2)	0.03 kg
3.	Aggregate impact value = W2/W1*100	9.5

Aggregate impact value is **less than 10 it is exceptionally strong** for flexible pavement

- **10-20% : Strong**
- **20-30% : Satisfactory for road surfacing**
- **More than 35% : Not suitable for road surfacing**

Aggregate impact value test done by project member

Abrasion Test :

Abrasion test is carried out to test the hardness property of aggregate.

S.No.	Observation	Readings
1.	Original weight of aggregate (W1) in gram	5000
2.	Weight of sample retained on 1.7 mm IS sieve (W2) in gram	4005
3.	Loss in weight due to wear (W1-W2) gram	995
4.	Abrasion value= (W2-W1)/W1*100	**19.90%**

Aggregate abrasion value find by abrasion Testing Machine

The lost Angel aberration value for aggregates in between us roads can be affected by the addiction of plastic waste while the specific value various depending on the type and amount of plastic waste used research suggest that incorporating plastic was particularly polythene can qualitative reduce the abrasion value indicating improved resistance to wear.

Aggregate Test Result -

Designation	Test Result	Permissible limit (Morth Specification)	Test Method
Aggregate impact value test	9.5	Upto 30%	IS:2386 Part IV 1963
Aggregate abrasion test	19.90	30%	IS:2386 Part IV
Crushing value test	25.21	Not >30	IS:2386 Part IV
Specific gravity of aggregate	2.71		IS:2386 Part III
Water absorption test	0.40	Max 2%	IS :2386 Part III

Bitumen Test Result –

Designation	Test Result	Permissible limit	Test Method
Softening point of Bitumen	56.45°C	47°C (min)	IS:1205 -1978
Penetration Test	54 mm	45 (mm)	IS:1203 - 1978
Ductility Test	95 cm	100	IS:1208 - 1978

Results of the tests conducted on Bitumen modified with different percentages of plastic :-

S.No.	% of Bitumen	% of plastic	Softening point °C	Penetration value (mm)	Ductility (mm)
1.	100	0	43	73	63
2.	98	2	45	58	58
3.	96	4	57	55	54
4	94	6	61	53	50
5.	92	8	63	50	47
6.	90	10	66	46	44
7.	92	12	60	41	40

Aggregate impact value is less than 10% it is exceptionally strong for flexible pavement .
Our impact test value is 9.5 it is very good for flexible pavement.
Aggregate crushing value should not exceed 30% our crushing values is 25.21 it is suitable for laying of road.
Aggregate abrasion value should not exceed 30% our abrasion value is 19.9 it is suitable for flexible pavement.
Specific gravity of aggregate lies between 2.4 to 2.9.our specific gravity value is 2.71.
Water absorption of aggregate maximum 2% but our value is 0.40 it is good for road laying.
Permissible limit of softening point of Bitumen minimum 47 °C but our value is 66°C.
Minimum permissible limit of Penetration value is 45 our Penetration value is 46.
Minimum Ductility value for bitumen is generally 50 cm. And heavier road it's value is 100 cm.

Marshall Stability Test Results :-

The marshall stability test is performed to access a low carrying capacity and resistance to deformation of a asphalt mixtures .it measures the maximum load a compacted asphalt specimen can withstand before failure. The minimum marshall stability value for bituminous mixes as specified by morth (Ministry of Road

transport and Highway ,India) is 340 kg. This value is crucial parameter in marshall mix design, ensuring the durability and stability of a asphalt pavement.

Marshall stability Testing Machine

S.No.	Plastic added	Stability
1.	3	1575.8
2.	3.5	1662.6
3.	4	1672.1
4.	4.5	1633.2

Validation in stability

Test Property	Specified value	Obtained value
Marshall stability (kg) minimum	340	3351
Low value 0.25m units	8-17	4
Percent air voice in the mix	3-5	3.65
Voids field with Bitumen	75-85	75.13

All obtained value found in specified value. All the Test is done and find all value is good comparison ordinary road.

CONCLUSIONS: -

(i)Recycled plastic along with aggregates is used for better performance of roads.Usage of waste plastic in the bituminous concrete increased the stability so that the load carrying capacity of the road will also get increased.

(ii)The use of waste plastic in flexible pavements Shows good results when compared with normal road pavement.

(iii)By using this technology we can reduce the bitumen content up to 10% and increase the performance, and strength of the road

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(iv)When waste plastic is mixed with hot bituminous it acts as a good binder . and reduces the permeability

(v)By using roads made of waste plastic, Potholes caused by rain can be avoided.

REFERENCES:-

1) Prashant Singh, Abhishek Kumar, Shushant Singh, Rajeev Rajput. Use of Plastic Waste in Flexible Pavement – Green Highway. International Journal of Engineering Research & Technology, ISSN: 2278-0181 val. 9 issue 09, September 2020

.

2)Kshirsagar Yuvraj B, Suryawanshi Rohannkumar. P. Bhare Vishal S. Kotkar Pritam.M, Use of plastic waste in Flexible pavement International journal of advance scientific research & engineering Trends. Volume 5 Issue 12 May 2021, ISSN (online) 2496- 0774.

3)SVN Anil Vamsi, Y. Gopi, SK Abdul Raheem, V. Narasimha Reddy, Y. Manoj Kumar, T. Hanumanth Rao, and B. Sricharan Reddy Behaviour of Flexible Pavements by the addition of Plastic waste, international journal of innovative Research in Engineering & Management. ISSN- 2350-0557.volume 9, issue 4 , August 2022.

4)V. Rushendra reddy and T. Surendra, B. Rahul, Use of waste Plastic in Flexible pavements, International Journal of Civil Engineering and technology Volume 8, Issue 5 May 2017.