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An Experimental Study on the Effect of Use of Waste Plastic in Flexible Pavement

Sachin[1] and Jaswant Singh[2]

**[1]M. Tech. Scholar, Department of Civil Engineering,
CBS Group of Institutions, Jhajjar, Haryana (India)
[2]Assistant Professor, Department of Civil Engineering,
CBS Group of Institutions, Jhajjar, Haryana (India)**

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Abstract

Solid waste management is the thrust area. Of this various waste materials, plastic waste, tyre waste and municipal solid waste are of great concern. On the other side, the road traffic is increasing. The traffic intensity is increasing. The load bearing capacities of the road are to be increased. Our present work is helping to take care of both these aspects. Plastic waste, consisting of carry bags, cups and thermocoles can be used as a coating over aggregate and this coated stone can be used for road construction. By this process a road of 1 Km length and 3.375M width of single lane can consumes 10, 00000 carry bags and the road strength is increased by 100% and there is no pot hole formation. Secondly the waste tyres are powdered and the powder is blended with bitumen and this blend is used along with plastic coated aggregate. The mix polymer coated aggregate and tyre modified bitumen have shown higher strength. Use of this mix for road construction helps to use both plastics waste and tyre waste. Once the plastic waste is separated from municipal solid waste, the organic matter can be converted into manure and used. Our project will discuss in detail the process and its successful applications. 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 is a menace and become a serious problem globally due to their non-biodegradability and unaesthetic view. Since these are not disposed scientifically & possibility to create ground and water pollution. This waste plastic partially replaced the conventional material to improve desired mechanical characteristics for particular road mix. In the present project developed techniques to use plastic waste for construction purpose of roads and flexible pavements has reviewed. In conventional road making process bitumen is used as binder. Such bitumen can be modified with waste plastic pieces and bitumen mix is made, which can be used as a top layer coat of flexible pavement. This waste plastic modified bitumen mix show better binding property, stability, density and more water resistance.

Keywords: *Waste Plastic, Pavement, mix polymer coated aggregate.*

Introduction

The threat of disposal of plastic will not solve until the practical steps are not initiated at the ground level. It is possible to improve the performance of bituminous mixed used in the surfacing course of roads. Studies reported in the used of re-cycled plastic, mainly polyethylene, in the manufacture of blended indicated reduced permanent deformation in the form of rutting and reduced low – temperature cracking of the pavement surfacing. The field tests withstood the stress and proved that plastic wastes used after proper processing as an additive would enhance the life of the roads and also solve environmental problems. Plastic is a very versatile material. Due to the industrial revolution, and its large scale production plastic seemed to be a cheaper and effective raw material. Today, every vital sector of the economy starting from agriculture to packaging, automobile, electronics, electrical, building construction, communication sectors has been virtually revolutionized by the applications of plastics. Plastic is a non-biodegradable material and researchers found that the material can remain on earth for 4500 years without degradation. Several studies have proven the health hazard caused by improper disposal of plastic waste. The health hazard includes reproductive problems in human and animal, genital abnormalities etc., Looking forward the scenario of present life style a complete ban on the use of plastic cannot be put, although the waste plastic

taking the face of devil for the present and future generation. We cannot ban use of plastic but we can reuse the plastic waste. Plastics waste scenario in the world, of the various waste materials, plastics and municipal solid waste are great concern. Finding proper use for the disposed plastics waste is the need of the hour. On the other side, the road traffic is increasing, hence the need to increase the load bearing capacities of the roads. The use of plastics (be consistent in the use of polymer or plastic, since the focus is on plastic waste) coated aggregate for asphalt pavement allows the reuse of plastics waste. Plastics, are versatile packing materials and commonly used by man but they become problem to the environment.

Results

S. No.	Details	Trial No.			Average
		1	2	3	
1	Total wt. of aggregate sample filling the cylindrical measure = w_1g	600	600	600	600
2	Wt. of agg. Passing 2.36 mm sieve after the test = w_2g	60	56	61	59
3	Wt. of agg. Retained on 2.36 mm sieve after the test = w_3g	510	502	507	506.33.
4	Difference in weight = w_1- (w_2 + w_3) g	40	42	32	38
5	Agg. Impact value = percent fines = (w_2/ w_1) x 100	11.76	9.33	10.17	10.42
Therefore aggregate impact value = 10.42%					

Los Angles Abrasion Value Test (IS: 2386 – Part – 4)

Specifications for conducting Los Angeles test:

Grading	Weight of test sample in grams for different grading in the size range, mm (passing and retained on aggregate test sieves)										Abrasive charge	
	80-63	63-50	50-40	40-25	25-20	20-12.5	12.5-10	10-6.3	6.3-4.75	4.75-2.36	No. of spheres	Weight of charge in grams
A	-	-	-	1250	1250	1250	1250	-	-	-	12	5000±25
B	-	-	-	-	-	2500	2500	-	-	-	11	4584±25
C	-	-	-	-	-	-	-	2500	2500	-	8	3330±20
D	-	-	-	-	-	-	-	-	-	5000	6	2500±25
E	2500*	2500*	5000*	-	-	-	-	-	-	-	12	5000±25
F	-	-	5000*	5000*	-	-	-	-	-	-	12	5000±25
G	-	-	-	5000*	5000*	-	-	-	-	-	12	5000±25

*** Tolerance of ±2% is permitted**

Results

1- Type aggregate = Crushed angular aggregates

2- Grading = C

3- No of spheres used = 8

4- Weight of charge = 400gm

Table 0.1: Test values and calculation

Sr. No.	Test values and calculation	Test no			Average
		1	2	3	
1	Weight of specimen	5000	5000	5000	5000
2	Weight of specimen after abrasion test retained on 1.70mm test sieve, w2gm	3900	3700	3600	3733.33
3	Los Angeles abrasion value = Percentage wear = $(w_1-w_2)/w_1$	22	26	28	25.33

Conclusions

1. Use higher percentage of plastics waste.
2. Reduce the need of bitumen by around 10%.
3. Increase the strength and performance of the road.
4. Avoid the use of anti stripping agents.
5. Carry the process in situ.
6. Avoid industrial involvement.
7. Avoid disposal of plastics waste by incineration and land filling.
8. Generate jobs for rag pickers.
9. Add value to plastics waste.
10. Develop a technology which is eco-friendly.

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