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COMPARATIVE STUDY FOR FILLING ROAD POTHOLES WITH PLASTIC WASTE MIX BITUMEN AT GALGOTIAS UNIVERSITY SERVICE LANE

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Abstract-

We all are aware of non-degradability of plastics which can harm our planet so badly. In search of solution to protect ourselves by this problem we all have doing something in our field of civil engineering .Plastic mix Bitumen in road construction or pothole repairing will create great impact to dispose plastics in it most scientfic way.However most of research is done on full length road but here we have studied on road pothole .Here we have reported direct positive results in the properties of bitumen and Aggregates by mixing of plastics . We have adopted dry process for our project as it is suggested for small and isolated works .When mixed with plastics ,bitumen's softening point increased from 44° celsius to 65° celsius And Aggregate's Abrasion value has come from 26.6 to 24.This observation suggests that as we increase percentage of plastics in bitumen and Aggregates their properties get enhanced significantly.

INTRODUCTION

Plastic is obtained from fossils beneath earth. It's huge production and use started after World War 2. Plastics transformed human life in every field be it Medicine, Industry, Electrical and electronics, Agriculture, food and beverages, space technology etc. But its disposal became a huge concern today as it is non-biodegradable material. Nearly 10 billion tons of plastic have been produced since 1950 only but only about 10% of them is recycled till now.

Plastic also responsible for climate change. working about new innovations to dispose plastic it's use in road construction had proved boon to world especially for environmentalists and engineers The use of plastic waste in bituminous road has become rapid ignition due to efforts Professor.R.Vaudevan of Thiagrajan college of engineering Madurai.

As we are aware that there are a lot of problems related to environment and environmental change. Like Air Pollution, Water Pollution and solid wastes

Plastic. We use plastics in our daily-to-daily life. Many researchers and scientists have been finding solutions for this problem for a long time. A problem related to environment is the problem for each and every person alive in this planet. Although we have got some solutions like three R's, that are reduce, recycle and re-use. But this thing will not work in future. We must have find some other solutions because finding solutions for such things should be priority for every person and being Civil engineering students we planned to use plastics for filling potholes. Why we chose plastic only rather than any other object, we have already mentioned it but we must tell you some data's that should be known by you. First of all, what will happen if we don't use or we must say we don't re-use plastics. It will take nearly 4500 years to get ending up with itself. So, it is understood that it is non-biodegradable and will harm all the important things for life available on planet like trees, soil, water and air. So, this should be in

use but we are not first to use it in civil engineering projects. Almost One lakh(nearly) KMs road is been constructed using it. Bitumen is the main thing after plastic to make a proper mixture with concrete. We take Bitumen, aggregate and Shredded plastic in an appropriate ratio, get it at enough temperature and heat, mix it and start applying it. Ratio can vary for different quality, quantity, area and strength.

LITERATURE REVIEW

Dr. R Vasudev has initiated this project. Founded that waste plastic can be used in road construction. He then started his experiment in his college premises and got positive results After him, Indian Road Congress has started using it. He performed Marshall Stability tested on standard condition and got it's results higher than the non plastic mix one. Therefore the use of plastic material mixing in road proved to be best way to tackle pollution problem.

Prof. C.EG. Justo is father of highway engineering in India suggested to use 8 percentage of plastic. According to him, One can take desirable ratio but it will be more costly. So, he suggested to be it at 8%.

D.N. Little worked on adding bitumen in the mixture in appropriate ratios. He found that using 8% of waste shredded plastics can reduce 0.4 % of bitumen along with enhanced properties. Since a binding material is one of the most required thing for a mixture which is to be used in construction.

Poweth et. Al. Worked on suitability of plastic waste. In a sentence we can say he suggested us to choose best out of waste plastic. He mixed with samples of different soils and their results were studies. After all he also recommended plastics to be best suitable for road construction.

METHODOLOGY

A. MATERIAL USED- There are mainly 3 types of materials that we have used for filling road potholes that are described below: -

1. Aggregates: - Aggregates are solid materials found naturally and is highly used in construction for providing base. They prevent roads from differential settling. They are key materials for constructing a pavement. In our project we have used aggregates varying between size 1.9cm to 5.1cm. Due to high traffic load and other heavy vehicles wearing occurs on road surface aggregates act as a resistance to wearing action.

Vital Properties of Aggregates are: - (a) Strength

(b) Durability

(c) Toughness

(d) Hardness

Various tests that we have conducted on Aggregates

2. Bitumen: -Bitumen is a semi solid type of petroleum product which is dark and black in color. It is also called as Asphalt and is obtained from crude oil. Prof. R Vasudevan states that polymer coated aggregate bitumen mix forms better material for flexible pavement construction as the mix shows higher Marshall Stability value and suitable Marshall Coefficient. We have used 60/70 grade of bitumen for our project.

Vital properties of Bitumen are: - (a) Adhesion- The adhesiveness binds all components together.

(b)Resistance- It is water resistant material.

(c)Strength- It is very hard material in solid form.

(d)Ductility-Due it's ductile nature it forms good coating.

(e)Economical- It is available at reasonable rates everywhere.

Various tests conducted on Bitumen: -

S.No.	Test	Result
1	Penetration test	75mm
2	Ductility test	65mm
3	Flash point test	193.22 c
4	Fire point test	202 c

3. Plastic waste: - Plastics are one of the biggest environmental concerns today. Scientists have discovered different ways to tackle this problem but one of the most effective methods has been found out by Prof. R Vasudevan also known as "Plastic Man of India" dean at Thiagarajar college of engineering, Madurai. He along with his team had been working on the concept of plastic road since 2001, use of waste plastic in hot bitumen had provided positive results he had constructed a road with use of waste plastics in college premises.

We had complied with RDSO Guidelines for use of waste plastic in filling of potholes that are as follows: -

(a)Waste plastic shall conform to be passing through 2.36mm sieve and should retain on 600micron sieve.

(b)Dust and impurities should not be more than 1%.

(c)Plastic waste should be shredded properly into small sizes between 2.36mm to 4.75mm.

B. PROCESS- There are two processes that can be used for filling potholes one is dry process and other is wet process. In dry process shredded plastic is added in hot aggregates on other hand in wet process waste plastic is used in powder form and is added to hot bitumen. For small and isolated works dry process is preferred where Mini Hot Mix Plant is prepared. First, we have cleaned all the shredded waste with clean water and let it dry in normal air. Secondly, we burn small countryside furnace in which we burn aggregates at temperature of 160 degree Celsius. During that time plastic got dried up after 30 minutes we mix dried plastic with aggregate. we spray waste plastic over aggregate slowly so that plastic particles get sticked to aggregates after that it forms oily coating. Amount of plastic is 8% of bitumen we can understand it in easy way that in 10kg of bitumen 0.8kg of waste plastic is added.

SITE WORK- Project work was carried on the Galgotias University parking service lane.

HEATING OF AGGREGATE -

As plastic gets fully coated on aggregates Similarly with, we heat up solid bitumen in open container it is heated until bitumen melts down to viscous form. Stone dust and fine sand are used as a filler in potholes

Note-Temperatures should be measured regularly using IR Thermometer.

Temperature is very prime factor as it gives good binding of materials.

Viscous bitumen and plastic filmed aggregates are mixed up in a separate puddler and mixed up with help of long iron rod. Now we slowly pour the mix over potholes. The road laying temperature is 110 degrees Celsius approx. accordingly, after they are filled use road roller of any specified capacity on potholes for 5 to 8 times so that materials get compacted properly and also get molded in shape of potholes. By using above techniques, we have filled 2 road potholes that were present in Galgotias University service parking service lane.

BITUMEN IN SEMI SOLID FORM-

FILLED UP POTHOLE-

Characteristic Features of Process we followed: -

(a)No new machinery used.

(b)Simple process and easy working

(c)In situ process

(d)Safe and eco friendly

(e)Use of comparatively less bitumen as it is obtained from crude oil it is non-renewable resource.

(f) No evolution of toxic gases during the process

(g)No leaching of plastics in future

(h)Comparatively, High water resistance

(i)Enhanced load withstanding property.

(j)The pothole life period is increased practicably.

(k)Very low chances of rutting and raveling.

RESULT-For comparative study of filling road potholes with plastic waste different types

of tests are performed on plastic coated aggregates with varying percentage of plastic so that we can get comparative data analysis.

*Analysis of test on bitumen modified with different percentages of waste plastic

First Test Softening point test: - Different types of bitumen are available depending upon their origin. Different kinds of construction needs different bitumen, But some of the characteristics are necessary for all kinds of bitumen like temperature susceptibility ,viscosity ,affinity ,adhesion .The softening point of bitumen means temperature at which it starts softening under particular degree of heat. Softening point of bitumen is having no definite melting point but it starts to become mobile when used as then it is exposed to varying harsh conditions.

S.NO.	Bitumen %	Plastic %	Softening point ©
1	1OO	0	44
2	95	5	55
3	92	8	65

Second test is the Ductility test: -- Ductility is the property of elongation of material without breaking or cracking here material is a bitumen. It gives adhesiveness and stretching ability it is measured in cm or mm

S.NO.	Bitumen %	Plastic %	Ductility mm
1	100	0	64mm
2	95	5	50mm
3	92	8	45mm

The third test is the penetration test: - Penetration refers to the hardness of bitumen it is measured in mm by measuring this we can find out various grades of bitumen used for different purposes. There are different types of grades like 60/70 and 80/100 etc. Low penetration grade is used in hot climate areas to avoid softening and high penetration grade for cold climate areas as to get rid of excessive brittleness.

S.NO.	Bitumen %	Plastic %	Penetration mm
1	100	0	73mm
2	95	5	60mm
3	92	8	50mm

*Analysis of test on aggregate coated with different percentages of plastic

First test Aggregate Impact Value Test: -Aggregates, when subjected to heavy traffic, have a chance to get into smaller pieces so it is very compulsory for aggregates to have high resistance to an external load and it is measured as aggregate impact value.

S.NO.	Plastic %	Aggregate Impact value %
1	0	11
2	5	10.88
3	8	10

Second test Los Angeles Test: - Toughness and crushing of aggregates are measured. Aggregates should have resistance towards wearing and tearing of surface. It gives us abrasion value in percentage.

S.NO	Plastic %	Los Angeles Abrasion Value %
1	0	26.6
2	5	25.2
3	8	24

CONCLUSION: - The experiments we have conducted and the studies that was done by our seniors give a path for upcoming generations to handle such a serious problem. Also there is a continuous need of examining previous works and formulating for new research so that light of innovation keeps on glowing. Plastic mix bitumen has provided us with all the desired results Using plastics in road construction and pothole filling is best suitable technique to dispose of plastic wastes in an ecologically friendly way. We hope to spread this awareness at levels so that we can make the best possible use of this innovation.

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