Modifying Bituminous Mix by Use of Plastic

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Abstract **- The disposal of the waste plastic is one of the main issues to the environment which causes pollution and global warming. This plastic waste can be used with the bituminous mix. It increases the strength and properties of the pavement. This process will simultaneously help to dispose plastic waste and reduce potholes and increase life of pavement. Polyethylene, polystyrene, and polypropylene are the types of plastic which are shredded, coated on the aggregate, and mixed with hot bitumen which is used for filling the potholes and also for road construction. It will increase the life span of the pavement. Also, a smoke absorbing material Titanium Dioxide is used which absorbs the smoke emitted from the vehicles. This method of pavement construction is eco-friendly as well as economical.**

I.INTRODUCTION

The disposal of plastic waste is a major threat to the environment. The proper mixing of waste plastic with bituminous mix gives strength and increases the properties. Additionally, it will also help to fill up the potholes, ruts, etc. The waste plastic is destroyed and covered over total and blended in with hot bitumen and came about blend is utilized for asphalt development. It will build the life expectancy of the pavement. A smoke retaining material Titanium Dioxide is utilized which ingests the smoke radiated from the vehicles. This technique for pavement development is eco-friendly just as efficient.

II. OBJECTIVE

- To study type of plastic to use in mix.
- To give layer of plastic on aggregate.
- To design asphalt pavement with aggregate-plastic-bitumen mix.
- To coat the aggregate with plastic and take impact test and compare values of impact with plain aggregate.
- To test the plain bitumen mix and modified bitumen mix with Marshall stability test.

III. LITERATURE REVIEW

R Manju Anand (2017): - Stated that plastic is a major hazard to environment. Using of plastic waste in bitumen mix increase properties of mix and use of chemical TiO2 absorbs smoke from vehicles.

Sunil J Kulkarni (2015): - Less use of waste material is important for modern growth and development. Plastic is used in our day-to-day life in various fields. Getting rid of plastic waste is not easy. Plastic can be used for making ethanol type products.

Prince Ghalayan (2017): - Using plastic waste in bituminous mix increases properties of mix plastic waste can be effectively coated on aggregate. Plastic aggregate will increase road durability but also give strength to mix.

Bhadne Rupesh Umarao (2019): - using waste plastic and crumbed rubber in mix with percentage 5%, 7.5%, 10% coat on aggregate. The strength is increased by 62% compared to normal aggregate.

Vatsal Patel (2014): - Due to regular use of plastic its quantity is increasing day by day. Using plastic waste by powdering, blending and coat over aggregate can be effective for ecofriendly environment.

IV. METHODOLOGY

Potholes occurs due to deterioration of bituminous pavements due to external environment agencies, due to vehicular loads, uneven surface, uneven compaction, lack of design and use of substandard material etc. It mostly affects the vehicular users. They

mainly lead to the traffic accidents causing major human health hazards. Plastic is non disposable material, and we use plastic in many day-by-day activities, so its presence is abundance. That is why there is need to balance the environmental effects of plastic.

V. STUDY OF MATERIAL

Aggregate: - It is one of the key constituents of bituminous mix. Well gradation of aggregate is essential for stability of mix. 2.36mm, 4.75mm, 10mm aggregate sizes are used for preparation of mix. Good aggregate has ability to resist impact, so it is widely used in road construction.

Plastic: - It is mostly used material due to its cheap cost; it is used for domestic household purposes and industrial purposes. PVC is largely produced plastic. It is dense and have high impact resistance. It resists salinity, chemicals, and alkalis.

Bitumen 60/70 grade: - Most commonly used bitumen grade in road construction. 60/70 means penetration vary between 60 to 70 at common check. This is mostly used for roads in mild regions.

Outline of proposed work: -

5.1 Comparative study:

Mixing plant- The shredded plastic and aggregate is added into the hot cylinder. The aggregate gets a coat of plastic, then bitumen is added, and coat of bitumen is given to the aggregate. Mixing plant has a better control over the temperature and comparative study can be done by adding normal aggregate and plastic-coated aggregate. 10% of bitumen is replaced by plastic. The test carried out for the comparative study are:

Test on aggregate- Impact Test

Test on Bitumen- Marshall Stability Test

VI. DESIGN OF PAVEMENT

Material preparation

- Collection of raw material and equipment's required.
- 1st heat the aggregate up to 100 ℃.
- After heating temperature reaches 100℃ add shredded plastic (PVC) grade gradually 20% of bitumen. Plastic start melting about 120-130℃
- Add 160℃ bitumen is fully melted and mix is ready.

Minimizing potholes:

- First melt the raw bitumen.
- Clean the potholes by using broom.
- Spray the melted bitumen over the potholes evenly.
- Add the mix and fill it in potholes.
- Resurface the potholes using available road any equipment.
- Take gas cylinder and apply water on its surface.
- Roll over the potholes by applying pneumatic pressure until the material is fully compacted.
- Repeat these steps for other potholes.

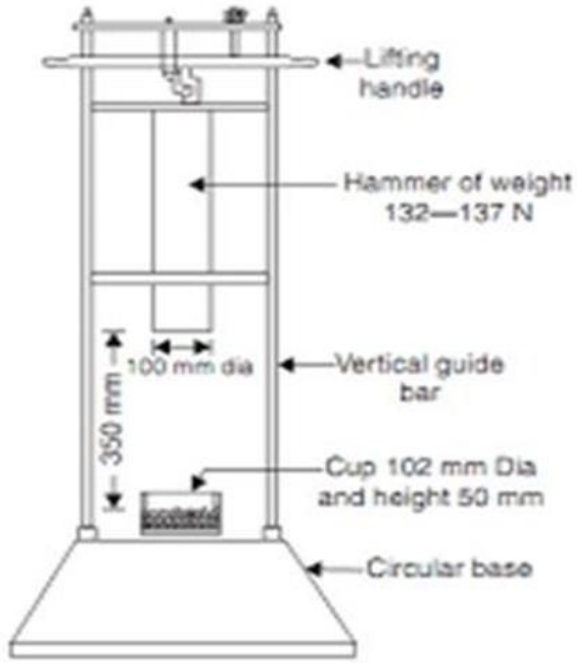
VII. TEST ON MATERIAL

1) Marshall Stability Test-

- Marshall stability test is performed to get the load carrying capacity of the specimen with plastic coat on aggregate.
- bitumen and plastic are heated with aggregate and mixed properly.
- 70 blows are given to the material on both the sides and mould is prepared.
- The sample is kept for cooling for 24 hours.
- The sample is kept on testing machine. The flow meter is adjusted to zero.
- The load is applied at a rate of 50mm per minute until the load reading is obtained.
- The reading is obtained in Newton.

2)Impact Value Test-

- Impact test is carried out to obtain aggregate impact value.
- Sample which passes from 12mm and retained on 10mm is taken. Dust particles over the aggregate are removed using a cloth.
- The aggregate is filled in three layers in calibration container using tamping rod of 10mm.
- The weight of the aggregate is determined and considered as W1 and remaining aggregate is filled in the impact mould in three layers using tamping rod.



- The impact mould is placed in impact machine and 15 blows are given and then remove the impact mould.
- The sample is sieved in 2.36mm sieve and the passing sample is weighed as W2.
- Using to the formula, w_2/w_1 ×100 we can get the impact value of the sample.
- According to the Indian standard, the impact value percentage should not exceed more than 45%.

	Sample 1 (Plane aggregate)	Sample 2 (Plastic with aggregate)
Total Wt. of dry sample=W1	336	332
Wt. of portion passing 2.36mm sieve=W2	61.1	63.0
A.I. V=$\frac{w_2}{w_1}$ × 100%	18.2%	19.0%

VIII. FACILITY REQUIRED

- College central library for reference journals and books.
- Computer facility is required for online journals and research papers through interior for collection of required literature.

IX. CONCLUSION

By performing the project and taking the tests on material we successfully come to know that by using plastic waste in bituminous pavement as additive enhances the durability of pavement.

X. FUTURE SCOPE

1. By spraying Titanium Dioxide on packed potholes one can test the carbon dioxide absorption capacity by conducting smoke test.
2. HDPE (High Density Polyethylene) can also be used instead of PVC it has high strength to density ratio.
3. Silica gel can also apply on packed potholes for better pollution absorption.

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