

“STUDY ON PROPERTIES OF BC MIX BY ADDING CARBON BLACK POWDER AND E- WASTE”

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Abstract – In this study deals with the effective usage of carbon black powder and E-waste as an additive in bitumen grade VG-10, for addition of carbon black powder and E-waste using them bitumen may changes in their properties like softening point, temperature, viscosity and its strength for the effective results we founded the optimum binding content of both carbon black powder and E-waste of 2% and 7% in the bitumen by Marshall stability test and combination of both given a good result regarding its strength.

The aim was to find a way of reusing E-waste in order to reduce their volumes in refuse disposal sites and at the same time carbon black powder is a form of burnt plastic waste like tyres of vehicles, so to reduce plastic waste and reuse E-waste which often to lead to reduce environmental problems this study will be carried out.

Key Words: Effective usage of carbon black powder¹, E-waste², Properties of bitumen³, 2% and 7%⁴, Reusing of E-waste⁵, Reducing land fills⁶.

1. INTRODUCTION

1.1 Background

The growth in different kinds of industries together with population growth has resulted in a huge increase in production of various kinds of waste materials, throughout the world. The creation and disposal of non-decaying waste materials such as Blast Furnace, Slag, Fly-Ash, Steel Slag, Scrap Tyres, Plastics, Electronic Wastes etc. have been posing difficult problems in developed as well as in developing countries. Research works are carried out by various countries for the disposal of some of these waste products and utilization of some other products and there is a lot of published literature dealing with different aspects of these challenging problems. Of these, the efforts to find useful applications of some of the waste products as an additive to modify bitumen have given satisfactory results.

Enabling the use of secondary materials as an additive to bitumen binders and they become as polymer modified bitumen has many potential benefits and the determination of material performance data, will provide a satisfactory frame work for the successful use of these materials in road

works. There are so many uses for environment by use of these secondary materials like decreasing the requirement of disposal of secondary materials to landfill, thus assisting in meeting government recycling targets. Polymer modified bitumen mix mould could also produce stiffer and stronger binder material, than the conventional ones.

1.2 Secondary materials

i. Carbon Black Powder(CBP)

The fine powdery soot or carbon black powder formed by the burning of hydro carbon under oxygen depleted conditions. And also, carbon black is defined as virtually pure elemental carbon in form of colloidal particles that are produced by incomplete combustion or thermal decomposition of gaseous or liquid hydro carbon under controlled conditions. And also Carbon black powder which is produced from source of burnt plastic waste or tyres.



Fig 1: Carbon Black Powder

ii. E-waste

Electronic Waste it is the term used to describe old, expired life electronic appliances such as computers, laptops, TVs, DVD players, smart phones, music players etc. which have been disposed of by their original users. While there is no generally accepted definition of E-waste, in most cases, E-waste has been plays an essential and durable products used for to process the data at various fields like telecommunications or entertainment in private households and businesses. For a fact PC industry is growing at a 25% compounded annual growth rate.



Fig 2: E-waste

2. LITERATURE REVIEW

Dr. Kiran Kumar B V and Saritha N (2015)[1] “A Study on use of Carbon Black Powder in Bituminous Road Construction” they are stated in this research deals with the effective usage of carbon black powder as an additive in bitumen grade VG-10. For identification of basic properties changes in bitumen after addition of carbon black powder in various percentages like 0.25%, 0.5%, 0.75, 1.0%, 1.25%, 1.5%, 1.75% and 2.0% for all the different percentage addition of carbon black to the bitumen, tests were conducted to identify the basic properties changes and optimum addition of carbon black powder for the Marshall mix design to calculate OBC. Here the changes found related to softening point temperature and the viscosity. Also calculated OBC from the Marshall method of mix design and they obtained OBC at 5.75% results also good.

Tun Hussein on Malaysia, M B S alfergani and abdalla Ab sinusi saiah (2013) [2] presented international journal of civil engineering and advanced technology (IJEAT) ISSN:2249-8958, VOLUME-2, ISSUE-3 February 2013 on topic “pavement performance with carbon black and natural rubber (latex)”, from the journal it is concluded that the use of carbon black in that research project was identified to have the potential to becoming a modifier in HMA mixes due to elastic behavior and in reducing the rutting potential. This study presents the viability of carbon black as an additive in bitumen as binder and hot mix asphalt concrete with different ratios of 10, 15, 20% CB blended with each other. It was observed that the creep values are also lowest with 10% addition of carbon black powder. Thus, this shows carbon black may contribute towards better flexible roads in the future.

Vikram J. Patel, Hemraj R. Kumavat, Ganesh V. Tapkire [3] “An Experimental Study of Bituminous Pavement adding Electronic-Waste to Increase the Strength Economical” they stated When Waste products are collected from each resident in the city, the waste should be sorted, Segregated Electronic waste should be crushed and use that material for plinth filling purpose, In this way all the electronic waste in the city

will get dispose of in the same city and they also said that to investigate the use of recycled plastic components of E-waste in construction applications. This is an alternative solution to administer the growing quantity of the E-waste. Several studies have verified that plastic can also be used in experimental works related to flexible pavements, bitumen and bituminous mixes are modified in order to improve the performance of bituminous concrete mixtures. The bitumen of 40/60 penetration grade is used as binder in present work and the physical properties of bitumen. All tests conducted on bitumen were in accordance with procedure laid down in Indian standards. The basic test properties on bitumen and modified bitumen indicates that the replacement of bitumen by waste plastic increases the penetration and reduces ductility values, whereas increases in softening point when about 5% and 10% by weight of bitumen content is replaced by waste plastic. If the Procedure of this research comes into existence, then the Environment issues with Electronic Waste can be resolved.

Veena Narasimhan (2003) [4], “Polymer modified bitumen” stated that problem related to the issue of disposing Printed Circuit Boards (PCB) and plastics. And it can be used as an additive in the bitumen by recycling PCB and plastics and they have acted as a partial replacement of filler or as an additive to bitumen binder. At last with a result and concluded that several tests are obtained a good positive result and the material also reusable, and it may partially replace filler so it saves cost.

3. OBJECTIVES

- i. To study the basic properties of aggregates and bitumen.
- ii. To investigate the viability of using carbon black and E The principle objective of this study was to find a means of useful disposal of materials like E-waste by modifying bitumen and check the effects of modification on the bitumen.
- iii. E-waste as Partial replacement for coarse aggregates.
- iv. To Produce combination of aggregate into asphalt mixture which will result in the better performance.
- v. Addition of carbon black powder and E-waste increases the resistance against rutting and cracking and make bitumen stiffer.

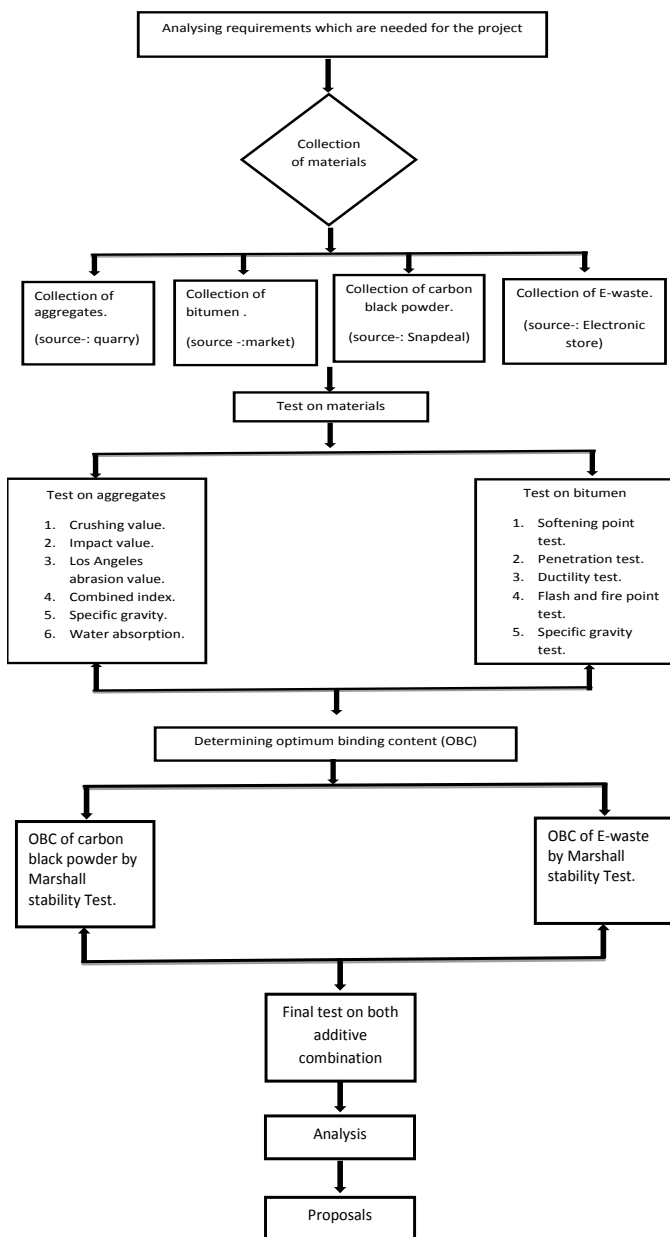
4. Scope

- i. Finding the stability and properties of bitumen course using an additive of carbon black powder and E-waste to partial replacement for coarse aggregates .
- ii. Based on results Proposals should be prefer for which part of transportation should be used.

- iii. Implementation to transportation system using bitumen course as an additive of carbon black powder and E-waste based on results obtained through the tests conducted.
- iv. One aspect of the strategy to reduce landfills in our environment which reduces pollution due to usage of carbon black powder and E-waste.

5. Methodology

Study methodology has following steps:



6. Detailed Methodology

Tests on Aggregate

- 1) **Impact Value of Aggregate test :**(IS-2386-part4-1963) - This test is conducted to determine the toughness of stone aggregate due to impact. The aggregate impact value is lesser indicates the material is tough.
- 2) **Los Angeles Abrasion test :**(IS-2386-part4-1963) - This test was conducted to determine the hardness of aggregate. The aggregate used for road construction should be hard enough to resist the wear and tear due to moving wheel loads. Lesser abrasion value indicates the harder material.
- 3) **Aggregate Crushing value test:** (IS-2386-part4-1963) - This test was conducted to check whether the aggregate is strong enough to resist crushing under rollers during compaction as well as due to heavy traffic wheel loads lesser aggregate crushing value indicates that the aggregate is strong.
- 4) **Specific gravity and water absorption test:** (IS-2386-part3-1963) - The specific gravity test is conducted to check the quality of material and stones' having a greater number of water absorption rates is more porous. The higher specific gravity and lower water absorption are desirable.
- 5) **Shape test :**(IS-2386-part1-1963) - These tests are conducted to check the flaky and elongated particles percentage in the aggregate. The presence of elongated and flaky particles will affect the strength of the mix.

Tests on Bitumen

- 1) **Penetration test:**(IS73-2006)
This test is conducted to determine the grade of the bitumen in terms of hardness.
- 2) **Ductility and Elastic recovery test:**(IS73-2006)
In this test to find the distance in cm at which a standard briquette of bitumen can be extended before the thread breaks. Elastic recovery test is conducted to determine the ability of bitumen to undergo reversal of strain.
- 3) **Softening point test:**(IS73-2006)
The softening point test is conduct to find temperature at which the bitumen material get softens. The softening point of bitumen should be higher than the

maximum temperature in that particular region where the bitumen is to be used.

4) Specific gravity test:(IS73-2006)

This test is conducted for bitumen to check the presence or absence of impurities.

5) Flash and Fire point test: (IS73-2006)

This test is conducted to determine the temperature at which the volatile constituents of the bitumen are likely to catch fire and cause hazards. The temperature during mixing should be well below the flash point of the material being used.

6) Viscosity test:

The viscosity test was conducted to check resistance to flow of bituminous material.

Test conducted on Bituminous Concrete

Marshall Stability Test:-

Marshall test is extensively used in routine test programs for the paving jobs. The stability of the mix is defined as a maximum load carried by a compacted specimen at a standard test temperature of 60 °C. The flow is measured as the deformation in units of 0.25 mm between no load and maximum load carried by the specimen during stability test (flow value may also be measured by deformation units of 0.1 mm). This test attempts to get the optimum binder content for the aggregate mix type and traffic intensity. This is the test which helps us to draw Marshall Stability vs. % bitumen.

Indirect Tensile Strength Test:-

The Indirect Tensile Strength test was conducted as per ASTM D6931-12 to decide the tensile properties of the asphalt mixture which can further be identified with the cracking properties of pavement. Low temperature cracking, fatigue and rutting are the 3 major distress mechanisms. A higher tensile strength relates to stronger cracking resistance.

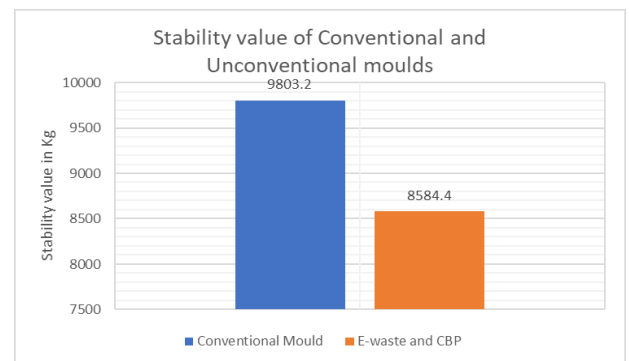
The tensile feature of asphalt mixture are find by loading the Marshall specimen along the diametric plane with a compressive load at uniform rate acts parallel along the vertical diametrical plane of the specimen through two opposite loading strips. The

loading rate of 51 mm/min the load is applied until the specimen cracks along vertical diametric plane.

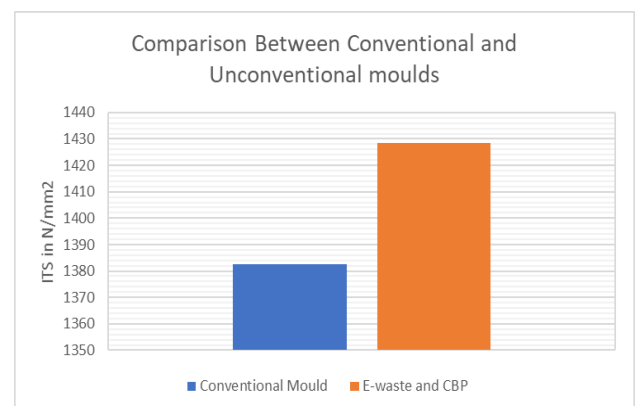
The test specimens were prepared at the optimum binder content along with various percentage of crumb rubber. The specimen height and diameter were measured and note down. The prepared specimen was immersed in water bath at 60⁰c for a period of 24hrs and the specimen are taken out from the water bath and kept it in oven at a temperature of 25°C for a period of 2hrs (conditioned specimen) and then tested in the Marshall testing machine to find the compressive load at which the specimen cracks along vertical plane.

7. Results

a. comparison between conventional and unconventional mould (Compression strength)



b. Comparison between conventional and unconventional mould(Tensile strength)



8. CONCLUSIONS

- i. The addition of e-waste and carbon black powder generally improves mechanical / desirable properties of bituminous mix.
- ii. The addition of e-waste and carbon black powder improves tensile strength of bitumen and hence it reduces low temperature cracking rutting.
- iii. The addition of e-waste and carbon black powder improves stiffer property of bitumen and hence it reduces ductility and creep value.
- iv. The addition of E-waste and CBP eliminates voids in bituminous mix by usage of carbon black powder which acts as a filler.
- v. Also the marshal stability strength and tensile strength ratio have increased with addition of carbon black powder.
- vi. Usage of e-waste and carbon black powder which solve the problem of landfilling.

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