

"Study Of Bituminous Concrete Using Polymers And Varoious Types Of Additives "

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Abstract - India boasts of the third largest highway network in the world. To keep up with the nonstop structure development, new roads are existing constructed. The ever adding population has further raised the vehicular viscosity due to increased passenger business and freight transport over the last many decades. India and numerous other countries have further than 90 percent of roads which are constructed with flexible pavements or bituminous courses. So, to achieve the conditions, parcels of asphalt binder and bituminous composites are to be bettered by using colorful complements. For a pavement section distinct types of complements are used similar as Polymers, Crumb Rubber and other waste accoutrements like waste plastic, discarded tyre tubes etc which increases the life of the pavement depending upon the degree of revision and type of complements used. Due to increase in population, the vehicular business viscosity is also adding . Due to this, the wear and tear and gash of tyres from these vehicles is undoubted due to which a big number of scrap tyres are being generated. A large number of waste and worn out tyres are formerly in actuality and with an periodic production rate of 15- 20 each time. These tyres are discarded indiscriminately or squirreled . The used tyres had a great trouble to mortal health and terrain, since it's non-biodegradable so it's having disposal problems also. also, consumption of waste plastic is adding day by day. further than 50 of the plastic is used as a packaging material. As plastic is anon-biodegradable waste so it doesn't undergoes corruption. In this, we projected to study the use of the waste tyre rubber andwaste plastic as a blending material in bitumen, which is further used for road construction. If waste plastic and used tyre rubber can be added in bitumen for perfecting the parcels of bituminous composites.

Key Words: Bitumen, Aggregate, Polymers, Binders etc

1. INTRODUCTION

This document For evolving countries like India an effective road mesh is prerequisite for public integration, country's development and for socio- profitable development. From the last many times, the use of vehicles has increased, which has further increased the vehicular viscosity on roads. Due to increase in vehicular business, there's a huge importunity for bettered pavement sections which can repel the adding vehicular loads. A trace pavement is a structure conforming of

different layers of set accoutrements above the natural soil subgrade. The primary function of these layers is to disperse the applied vehicle cargo to the subgrade. The pavement face should give the respectable riding quality, competent descent resistance i.e. adequately smooth. The main end is toinsure that stresses conveyed due to wheel loads are adequately reduced, so that they won't go beyond the bearing capacity of the soil subgrade. There are substantially two types of pavements which are primarily honored as Flexible pavements and Rigid pavements. Flexible Pavement is contrived with the bituminous treated top face course and its pavement structure is composed of several layers. Flexible pavements are those which have low or nearly negligible flexural strength. Flexible pavements conveys wheel cargo stresses to the lower layers of the pavement by grain- to-grain patches by the contact of the total through the grainy patches of the structure. The bitumen used for Bituminous Concrete subcaste is a paving bitumen of distant density grade(VG10, VG20, VG30, VG40) following the IS specification for " Paving Bitumen "

- Bituminous Concrete

When colorful complements are used in the bituminous composites, these are comprehended as bitumen modifiers. The complements like polymers, rubber or the mix of the two or further should be named in such a way that they should have the following parcels. Complements should be compatible with the bitumen. They Should be able of being reused or recycled by ordinary or conventional mixing ,And Should maintain parcels like penetration, rigidity, density etc during operation, in-service and storehouse. They've to bear needed coating density at operation temperature. Use of polythene in bituminous pavements isn't new. These days it's obligatory to use waste polythene in the construction of bituminous pavements. Waste plastic or polythene is added to hot blend asphalt admixture and the process of depositing admixture on the face of road is analogous to a normal navigator road. Plastic roads consists substantially of waste plastic carry bags, water bottles, soft drink bottles, and disposal mugs

1.1 LITERATURE AND REVIEW

- Bhargav and Gautam(2013), tried to find the optimum temperature by which the bituminous blend temperature was reduced by the warm blend asphalt technology. Rediset organic cumulative was used as an tenacious with the bitumen binder VG- 30. There was significant.
- Kazmi and Rao(2015) delved the use of waste plastic material(Polyethylene Bags)(LDPE) in the shredded form which is used as a chaining agent in the construction of Flexible Pavements. In this study, polyethylene was used as a binding agent with bitumen VG- 30 grade as a relief of bitumen with different proportions 5, 7, 9 and 11 and parcels of blend is carried out. There was mainly an increase in the stability value of amalgamated material in comparison to normal VG- 30 asphalt binder. The results displayed that the waste plastic accoutrements can be incorporated as a binding agent for the construction of flexible pavements. Addition of 9 LDPE was set up to be the optimum binder proportion. Marshal stability with addition of 9 of LDPE comes out to be1590.2 kg and it was32.5 lesser than the standard value of a minimal 1200 kg. The inflow range of2.9-3.0 was also well within the required range.
- Akinpelu et al(2013) applied Polyethylene as a binder modifier. In this six different proportions of waste plastic by weight of optimum binder content was named i.e.2.5,5.0,7.5,10.0,12.5 and 15. The waste plastic was incorporated using a wet process as a relief and colorful parcels were tested like Bulk Density, Stability and Flow. The results showed the increased stability value, reduced viscosity and slightly reduced inflow value for all probabilities. The optimum balance of modifiers was attained at12.5 by the weight of optimum binder content(OBC). The enhancement in stability value of the modified asphalt binder using polyethylene is substantially due to an increase in adhesion and cohesion parcels of the asphalt binder which will enhance the advanced fatigue resistance value and reduce thermal cracking and rutting.
- King et al., 1986). The density helps to limit the deviation while the elastic reclamation reduces the residual distortion. The elastic face subcaste islands the cracks from unmodified layers under, therefore, maintains the water-tight nature of the asphalt and protects the beginning structure.
- King et al.(1986) also ferried out a test for testing the rutting resistance and it was set up that the PMB was suitable to repel 4- 10 times further lading cycles before routines of colorful specified depths.
- Terrel and Walter(1986) have showed that polymers give considerable enhancement in the physical parcels of binder – aggregate combinations. still, the bettered parcels of the PMB should be made use of in order to have increased service life and the consistence shouldn't be degraded on the rationale of using PMB.
- Valkcring et al.(1990) reported that the mileage of the dynamic creep test for better vaticination of the strain rate in polymer modified bituminous composites. The pattern depths were calculated under the revolution lading in the laboratory test track tests.
- Collins et al.(1991) reported that selection of applicable asphalt is essential to gain a mix with optimal parcels. bettered comity leads to numerous advantages. Further, it has been proved that the effectiveness of the added polymer in terms of elastic recovery desisted from a soft to a hard binder.
- Lenoble and Nahas(1994) showed that the addition of polymer not only increases the operation temperature range of asphaltic binders but also increases the business resistance. Further, it was also bandied that the thermal cracking resistance of a pavement is controlled by the temperature at which the binder reaches a modulus close to its glassy modulus.
- Oliver and Tredrea(1997) presented test results of dynamic shear rheometer on PMB. It was set up that long- term laboratory exposure at a temperature below the outside encountered in pavement service redounded in large changes in the rheological geste of the PMB and these changes were likely to reduce the advantages which fresh PMBs have over unmodified bitumen in service. Airey and Brown(1998) delved chemical changes and the rheological of polymer modified bitumen under short- term and long term growing condition
- Molenaar and Nirmal(1998) carried out tests(flexible modulus, tensile strength and fracture durability of composites) with conventional bitumen and polymer modified bitumen.
- Khattak and Baladi(2001) showed that rheological and engineering parcels of polymer mixed binders fusions largely depend on the polymer type and content. The blend design of the

conventional bitumen and polymer mixed bituminous fusions were conducted using the Marshall blend- design procedures. At the optimum polymer content, the strengths of the polymer modified fusions were roughly 1.45 times advanced than the fusions made with bitumen binder subordinated to the same processing conditions. Further, empirical relations for prognosticating fatigue life of polymer modified bituminous blend were also developed considering different polymer content, plastic distortion, density and circular tensile strength.

- Khattak and Baladi(2001) also showed the enhancement in the resistance to plastic distortion with polymer revision. It's shown that the needed number of cargo cycles to accumulate any value of plastic distortion increases as the polymer content is increased until 5 optimum polymer content is reached.
- Kumar et al.(2004) carried out study for the parcels of polymer modified binder and it has been shown that Styrene Butadiene Styrene(SBS) polymer modified binder has better elastic recovery as compared to Linear Low Density Polyethylene(LLDPE) binder.

1.2 DISCUSSION

The entire document should be in cambria font. Type 3 fonts must Marshall Mix design method is a design methodology which is adopted worldwide for determining the strength and flow characteristics of the bituminous paving mixes. It is generally used for design of bituminous mixes which can withstand with heavy traffic loads even under adverse climatic conditions by fulfilling the requirements of the pavement surface characteristics. Flow value, VMA, VFB, Unit Weight in a mixture etc The resulting mix should satisfy the following conditions:

1. Sufficient binder should be used to ensure a strong and tough pavement by providing a water proofing coating on the surface of aggregate particles & binding them together under the suitable compaction.
2. Provide sufficient stability for resistance to deformation under repeated loads. This resistance in the mixture is obtained from aggregates. Sufficient flexibility should be provided to withstand deflection and the bending without cracking. So, to obtain desired flexibility, it is necessary to have proper grade of bitumen
3. An oven for heating the bituminous mixture & specimen mould assembly at a certain required temperature.

4. Hot plates for heating compaction hammer having circular plate at bottom, spoon and spatula.
5. A flat steel spatula is required with blade having size 25 mm wide and should be of length 150 mm and stiff enough to penetrate the entire bituminous mixture.
6. Thermometer is essentially required for determining the temperature of the hot bituminous mixtures. It should preferably be a dial type having a temperature range of 10 to 200°C.
7. A balance or weighing machine for measuring the weight of the mix. The sensitivity of the balance should be at least one gram.
8. Trowels for making the bituminous mix and for placing the bituminous mix in the mould assembly.

A specimen extractor suitably fitted with a jack or compression machine, for extruding the compacted specimen from the mould. Testing head consists of upper & lower cylindrical segments of test head with an inside radius of 51 mm. The lower segment is mounted on the base having two vertical guide rods which facilitates insertion in the holes of the upper test head.

- Sieve analysis test was carried out for determining the gradation of aggregates preparation of the Marshall specimen. Through this sieve analysis test, the proportioning of aggregates such as coarse aggregates, fine aggregate and stone dust is determined by ensuring the proper blending of aggregates to satisfy the gradation limit as specified in MORTH for BC Grade 1.

To decide the optimum binder content (OBC), Marshall Mix samples were prepared by varying the percentage of 60/70 asphalt binder without using any additive or modifier. Stability-Flow laboratory analysis and Volumetric analysis were performed for the Marshall mix samples with bitumen content varying from 4.5% to 5.5%. The test values were obtained.

3. CONCLUSIONS

The major conclusions drawn from the study carried out on stability-flow analysis of BC mix (Grade-1) by using different additives are as follows:

- Initially, normal asphalt binder VG-30 is tested at different percentages for the BC mix grade -1 and optimum binder content (OBC) is calculated .The OBC occurs at 5% and flow values are in the limits specified as per MORTH.

- The stability values for the BC grade-1 mix increase with the replacement of OBC up to 8% of waste plastic but it decreases further with the addition of waste plastic. This waste plastic only indicates that this percentage is the only suited level of replacement.
- For the summation of waste tyre tubes, the stability values for the BC grade-1 mix increase 12 % with the replacement of OBC (5%)
- The OBC of PMB used in BC Grade-1 is 5.2%. Out of the various materials used, replacement of OBC by 12% discarded tyre tube has the highest stability value.

Recommendations

Characterisation tests have been shown to be a good dimension of polymer donation to binder performance. The conventional dimension ways are inconsistent in ranking many- polymer modified HMA performance and may only measure whether or not a modifier is present in an asphalt instance but not its donation to the asphalt's performance. thus this exploration work recommends the following

There's a need for further exploration on performance tests and modelling of the outgrowth to ensure harmonious response(affair) for the input variables using the optimization process.

A study needs to be done to establish the relations between the bitumen binder, LDPE and scruple rubber that impact the physical and rheological parcels of the asphalt concrete blend during processing, storehouse and operation of the modified asphalt concrete.

Polymer qualified binders have proven successful in the laboratory. sweats should be made to develop a correlation between results from laboratory tests and field performance by large scale modelling and testing

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