Review Paper on Properties of Bitumen Using LDPE for Road Construction

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Abstract-In India, bituminous surfaced flexible pavements comprise majority of the roads over rigid pavements. Distress symptoms, such as cracking, rutting and others. are being increasingly caused at earlier stages due to high traffic intensity, over loading of vehicles and significant variations in daily and seasonal temperature of the pavement. Investigations have revealed that modifiers can be used to improve properties of bitumen and bituminous mixes to make it more suitable for road construction. Bituminous-mix design involves mixing various sizes of aggregate and bitumen contents in optimum proportions. The modified bitumen shows better properties desired for road construction. The waste plastic bags for LDPE were heated to 160-180oC and added to the aggregate, for adding to bitumen (60/70) at 120-140oC. The LDPE-aggregate mix was then combined to get the sample for dense bituminous concrete (DBC).

I. INTRODUCTION

On the majority of roads, conventional bitumen performs satisfactorily. However, high traffic intensity, increasing axle load and daily and seasonal variations in temperature of the pavement lead to an early development of distress symptoms like raveling, rutting, undulations, cracking, bleeding, and potholing of bituminous surfaces. Thus the load bearing capacities of the road is to be increased. Flexible pavements (bitumen roads) comprise of the major portion of all surfaced roads. In India, it is estimated that over 33 lack kilometers of road exists and out of which of which around 50% is surfaced. Road transport has acquired dominant position amongst the various modes of transportation system due to its flexibility, door-to-door service, reliability and speed. In India, road transport carries close to 90% of passenger traffic and 70% of freight transport. In India, majority of the pavements are bituminous since they consume lesser initial cost when compared with rigid pavements i.e. cement concrete pavements. Investigations in India and countries abroad have revealed that properties of bitumen and bituminous mixes can be improved to meet requirements of pavement with the incorporation of certain additives or blend of additives. These additives are called “Bitumen Modifiers” and the bitumen premixed with these modifiers is known as modified bitumen. Modified bitumen is expected to give higher life of surfacing (up to 100%) depending upon degree of modification and type of additives and modification process used.

II. LITERATURE SURVEY

This chapter presents the characteristics of SMA with fibers to justify research aim and sets the background for the proposed work.

Bailey and Allen (2009), the convergence of the altered sulfur pellets in the mixture is intended to improve asphalt mixture properties keeping up workability and similarity. The results inferred that the asphalt mixtures holding the changed sulfur pellets were indicated enhanced execution contrasted with the customary asphalt mixtures.

increase in the temperature could affect the properties of bitumen. The appropriate storage of such polymer mixed bitumen is extremely significant. It should be stocked up in a freezer and it has been also referred that it is steady for 6 hrs at a temperature of 1800C.

Sheikna Lebbai et. al. (2011), performed reading recycling of plastic waste and mixing it through bitumen to set roads. The technology is simple but innovative, involving, mixing plastic 8% with bitumen 92% for road surfaces. Torn plastic waste proceeds as a brawny binding means for tar, producing the asphalt which lasts longer by rendering it extra impermeable towards the water. The regular road surface has life 3-4 years and the road constructed with plastic waste last at least 7-8 years.

Sabina et. al. (2012), describes comparative performance of characteristics of bituminous concrete blends including plastic polymer (PP) (8% and 15 % by weight of bitumen) with conventional bituminous concrete blends which has been prepared with 60/70 penetration grid bitumen. Significant improvement in properties like, retained stability, indirect tensile strength, marshal stability and rutting has been observed in pp modified bituminous concrete mixes.

Overall, it can be inferred that the aggregate, when coated with plastics (LDPE) improved its quality with respect to moisture inclusion, voids, and soundness. The covering of plastic reduces the significant property porosity and helps to get enhanced the class of the aggregate and its presentation in the flexible pavement. But, it also induces stiffness. To compensate for the stiffness induce, by the

use of LDPE as modifier, search the literature for other modifier.

Mohammad T. Awwad et. al. (2013), presented that polyethylene as one sort of polymers is used to investigate the potential prospects to enhance asphalt mixture properties. The objectives also include determining the best type of polyethylene to be used and its proportion. Two types of polyethylene were added to coat the aggregate [High Density Polyethylene (HDPE) and Low Density Polyethylene (LDPE)]. The polymers were introduced to the mixture in two states (Grinded and not Grinded). Marshall mix design was used, first to determine the optimum bitumen binder content and then further to test the modified mixture properties. The results indicated that grinded HDPE polyethylene modifier provides better engineering properties. The recommended proportion of the modifier is 12% by the weight of bitumen content. It is found to increase the stability, reduce the density and slightly increase the air voids and the voids of mineral aggregate. The tests include the determination of bulk density, stability and flow. Marshall mix design requires the determination of the percentages of air voids and air voids of mineral aggregate. However, it is noteworthy that LDPE could be derived from disposed waste material. Thus, we can infer that LDPE is more easily available as well as promotes waste material utilization.

Vasudevan et. al. (2014), presented a study on the preparation of plastics waste – bitumen blend and its properties to find the suitability of the blend for road construction, was carried out. A modified technique was developed and the stone aggregate was coated with molten plastics and the plastics waste coated aggregate (PCA) was used as the raw material for flexible construction. PCA showed better binding property. It had less wetting property. Its voids were much less. The sample showed higher Marshall Stability value. The roads laid using PCA are performing well. A detailed studied is presented.

Vasudevan et. al. (2015), also observed that the polymer blended bitumen has better properties regarding Softening point, Penetration point, Ductility, Stripping Value and Marshall Stability value. Hence the blend can be used for laying flexible pavement. In this study both dry and wet processes were employed to prepare modified bituminous mixes. In the wet process, the blending was carried out by directly mixing the shredded polymer with hot bitumen at 160 deg. C. In the dry process, a novel technique was employed to use higher percentage of waste plastics in road construction and using this technique an alternate method was employed. In this method, the waste polymer was added on the hot aggregate (170deg.C). The polymer was coated over the aggregate. Here the spreading was easy. The hot aggregate was coated with polymer uniformly. Then the Bitumen was added. The mixing of bitumen with polymer was taking place at the surface of the aggregate. The temperature was around 155 –163 C. Both the polymer and bitumen were in the liquid state.

Vasudevan et. al. (2017), presented that 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. Penetration was reduced to a very low value and similarly the ductility. It has been inferred that the use of higher percentage (more than 3%) of plastics in polymer modified bitumen is not favorable. The paper also studies use of crumb rubber waste as bitumen modifier. Waste tires are powdered and the powder is blended with bitumen (80/100) heated to 100-120oC and stirred at speed of 3000 rpm for 2-3 hours. This blend is used along with plastic coated aggregate. The mix polymer coated aggregate and tire modified bitumen have shown higher strength. The percentage of crumb rubber modifier in the mix varies from 1% to 5%.

III. PROBLEM IDENTIFICATION

The growth in various types of industries together with population growth has resulted in enormous increase in economic activities world-wide.

It is very much desirable that lives of roads be long and requires minimum maintenance due to the over loading of the vehicles.

Due to the temperature varying of different conditions of the bitumen road.

Due to over raining swelling of roads in hilly area.

Environments are affected too much due to waste materials.

Plastic products waste is not recycled fully.

Among various modifiers, polyethylene (e.g. LDPE) based modifiers are widely used as they are easily available, as well as significantly improve road quality.

IV. OBJECTIVES

Feasibility of using LDPE and bitumen mixed for road construction.

To find out the strength of LDPE with bitumen roads as compare to DBM.

V. CONCLUSION

Marshal Stability values and flow value of Dense Bituminous Mix (DBM) increase due to addition of LDPE.

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