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A REVIEW ON EXPERIMENTAL STUDY OF E WASTE IN VIRGIN BITUMINOUS MIXES

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Abstract: Bituminous mixes are most commonly used all over the world in flexible pavement construction. It consists of asphalt or bitumen (used as a binder) and mineral aggregate which are mixed together, laid down in layers and then compacted. Under normal circumstances, conventional bituminous pavements if designed and executed properly perform quite satisfactorily but the performance of bituminous mixes is very poor under various situations. Today's asphaltic concrete pavements are expected to perform better as they are experiencing increased volume of traffic, increased loads and increased variations in daily or seasonal temperature over what has been experienced in the past. In addition, the performance of bituminous pavements is found to be very poor in moisture induced situations. Considering this a lot of work has been done on use of additives in bituminous mixtures and as well as on modification of bitumen. Research has indicated that the addition of mobile chips and waste LPDE plastic to asphalt binders helps to increase the interfacial cohesiveness of the bond between the aggregate and the binder which can enhance many properties of the asphalt pavements to help meet these increased demands. However, the additive that is to be used for modification of mix or binder should satisfy both the strength requirements as well as economical aspects.

In this review paper detailed study is carried out to find the best suitable and stable replacement of bitumen in construction industry.

I. INTRODUCTION

Plastics are everywhere in today's lifestyle and are growing rapidly throughout particularly in a developing country like India. As these are non-biodegradable there is a major problem posed to the society with regard to the management of these solid wastes. Low density polyethylene (LDPE) has been found to be a good modifier of bitumen. Even, the reclaimed polyethylene originally made of LDPE has been observed to modify bitumen. Latest innovations in the field of science and technology have changed the very lifestyle of common man. Much electronic equipment that was beyond reached earlier is now available at affordable prices. On one hand this development has made life easy for all but on the other hand it has encouraged use and throws mentality. Nowadays people prefer to buy a new appliance rather than taking the pains to get the older one repaired. Such a trend not only leads to increase in volume of electrical and Mobile waste but also poses serious threat to public health and environment. E-waste is growing exponentially in recent years because the markets for these products are also growing rapidly. The US-EPA has estimated an increase of 5 to 10% in the generation of e-waste each year globally of which only 5% is being recovered. Thereby the amount of e- waste that needs to be disposed off in an environmental friendly manner is increasing day by day. The fraction including iron, copper, aluminium, gold and other metals in e-waste is over 60%, while plastics account for about 30% and the hazardous pollutants comprise only about 2.70%. The e- waste inventory based on this obsolescence rate and installed base in India for the year 2005 has been estimated to be 146180.00 tones. In India, e-waste is mostly generated in large cities like Delhi, Mumbai and Bangalore. In these cities a complex e-waste handling infrastructure has developed mainly based on a long tradition of waste recycling. Sixty five cities in India generate more than 60% of the total e waste generated in India. Ten states generate 70%of the total e-waste generated in India. Maharashtra ranks first followed by Tamil Nadu, Andhra of e-waste generating states in India. Among top ten cities generating e-waste, Mumbai ranks first followed by Delhi, Bangalore, Chennai, Kolkata, Ahmadabad, Hyderabad, Pune, Surat and Nagpur. There are two small WEEE/E-waste dismantling facilities are functioning in Chennai and Bangalore. There is no large scale organized e-waste recycling facility in India and the entire recycling exists in unorganized sector.

Figure 1 Mobile waste

II. LITERATURE REVIEW

Stone Matrix Asphalt was first developed by ZICHNER, 1960 STRAUBAG- BAU, AG central laboratory, Germany. It is extended to Europe, US in very less time period due to its properties like durability, rutting resistance, skid resistance, elongated service life, more resistance to fatigue, cracking and wear.

Later on many researchers work on it to enhance the quality and strength of SMA among which by Brown and Cooley, 1997 assessed various properties by using three major

stabilizing additives. These are by cellulose fibre, polymers and mineral fibre.
WALLENBERGER, 2002 worked on finding various properties of wood and natural fibre in polymer reinforcement.
ZAFAR, 2005 a material specialist from NESPAK saw into possible application of penetration grade asphalt binder in SMA for large traffic roads and highways, studying many pavement failures.
Cooley Jr., and Hurley, 2004 assessed potentials of SMA in MISSISIPPI, for rut resistant based on the laboratory tests and analyses.

In recent BAZEJOVSKI, 2010 has providing the detailing of the material mixes of filler, aggregates, binder and stabilizers which has been used in practical examples.

Bamboo Fibre is introduced here which is naturally and readily available fiber. It is economical comparing to other conventional fibres. Based on the study by JAIN et al., 1992 on mechanical behavior of Bamboo and it's composite,it has high strength in fibre direction, greater tensile, flexural and impact strength.

DAS, 2002 has found that Bamboo fiber has good durability,stability and he also found this fiber has thinness degree of fiber which can be used as stabilizer in SMA Mix. Based on the test result providing on the data sheet after testing TopcelCellulose,this has been inferred in binding of SMA as high resistance base course.

Ilangovan (2000), Ilangovan and Nagamani (2002), Ilangovan et al (2008) studied that natural sand with quarry powder as full replacement in concrete is possible with appropriate treatment of quarry dust before utilization and also found so as to the compressive, split tensile strengths, flexural, and durability characteristics of concrete made of quarry rock dust are nearly 10% more than the traditional concrete.

Ahn et al (2001) studied that the mortar compressive quality was diminished as the MBV moved forward. Mortar drying shrinkage demonstrated a comparative pattern for connection in the midst of test comes about as compressive quality and what's more it is expanded as ingestion limit expanded. It was affirmed that top notch cement can be finished with produced fines substance up to 17% with no utilizing admixtures. Contrasted and cement made of regular sand, high fines concrete for the most part had higher unit weight, higher flexural quality, unrivaled scraped area resistance, and lesser penetrability.

Sahu et al (2003) Stated that the solid made with the substitution of waterway sand by pounded stone powder waste can accomplish the same compressive quality, equivalent rigidity and modulus of burst as the control of cement. Concrete made with this substitution can accomplish bring down level of shrinkage as that of control concrete.

Shukla et al (2000) Established that the substitution of sand by stone tidy diminishes the workability of the solid, while the compressive quality and split rigidity of cement blends increment up to 40% substitution of sand by stone tidy.

Topçu et al (2003) Developed that the compressive quality and flexural quality were enhanced when supplanting the sand by limestone of under 2mm grain estimate. The toughness properties, for example, penetrability, retention and porosity were diminished when the filler was 7 to 10%. In overabundance of this, no progressions or adverse impacts were watched.

Mark James Krinke (2004) considered the impact of admixtures in concrete containing made sand. He found that the expansion of superplasticizer into a solid blend enhances the workability and quality of the solid blend. At the point when a lot of plasticizer are included, the quality enhanced by around 30 percent on the blend without plasticizer. Be that as it may, the rate of quality pick up of the solid blend is brought down extensively when the plasticizer is included. With a specific end goal to keep up the manufactuSilicafumemix as less expensive than the common sand solid blend, the measure of the super plasticizer added should not surpass 1.5 percent

Lamb (2005) affirmed that the Sandstone Quarry Sand (SQS) canbe utilized as a concrete substitute, subject to the end client necessities and material's accessibility. The leachate comes about demonstrated a huge increment in lime, when SQS was added to the mortar, which may cause blooming on solid items. Despite the fact that the pozzolanicity comes about were sure, it was discovered that this material contains a high insoluble buildup, which confines its utilization in concrete just as filler.

Pedro Quiroga et al (2006) explored the solid blends with high microfines and found that solid was stiffer and less workable than concrete with regular sand. At the point when microfines are > 15%, the stream diminishes by 60%, additionally requires high range water lessening admixtures. Subsequently microfines ought to be constrained to 15% and to build the stream, appropriate reviewing, plasticizers or fly powder (as substitution of bond) should be utilized. They found that solid with MFA brought about higher compressive and flexural qualities. They additionally found that solid with MFA brought about higher imperviousness to scraped spot and chloride entrance.

PrachoomKhamput (2006) contemplated the properties of solid utilizing quarry tidy as fine total and blending with admixture sort E". The admixture sort E is included for expanding the workability of cement. The admixture will alter the electric charges of electron on the molecule surface into a similar sort such that the particles will push each other. This outcomes in diminishing the thickness of the bond glue and expanding the droop of cement. The aftereffects of compressive quality of cement at 28 days are

about the same as that of customary cement and the expansion of admixture sort E builds the compressive quality. In view of polymer in the admixture, the w/c proportion is diminished. Other than the impact of polymer, the impact of calcium in the admixture, drives quickly to build up the compressive quality at an early stage.

Justin Norvell (2007) contemplated the impact of muds and dirt estimated particles on solid execution. They found that non-earth ultra-fine particles are not hurtful to the workability, compressive quality and drying shrinkage of the solid and in this way they require not be limited being used with standard cement. Kaolinite and illite dirt minerals just insignificantly influence the execution. Smectite ought to be recognized in totals and restricted. At the point when the rejection of mud minerals in totals is impractical, it might be attainable to moderate their belongings, by methods for a concoction admixture intended to maintain a strategic distance from the response of earth.
Jain et al. (2011) studied mitigation of rutting in bituminous roads by use of waste polymeric packaging materials and concluded that rutting of bituminous mix can be reduced to 3.6 mm from a value of 16.2 mm after application of 20,000 cycles, by adding optimum quantity of polyethylene in bituminous mix for road construction, ultimately improves pavement performance, besides alleviating disposal problems of WPPM for clean and safe environment.

Firoozifar et al. (2010) investigated the novel methods to improve the storage stability and low temperature susceptibility of polythene modified bitumen. They used Kerosene, Oleic Acid, Aromatic oil, B-oil etc for increasing stability of polythene modified bitumen and a fluorescent microscope to observe the homogeneity of the samples.

Aslam and Rahman (2009) studied both dry and wet mix and concluded that the dry process is more economical and beneficial for construction of flexible pavements. Because in case of higher percentage of polythene in wet process they get separate out from bitumen on cooling, so it needs some additives.

Moghaddam and Karim (2012) reported that the utilization of waste material in asphalt pavement would be beneficial in order to find an alternative solution to increase service life of asphalt pavement and reduce environmental pollution as well. Form their study it is concluded that Polyethylene Terephthalate (PET) reinforced mixtures possess higher stability value, flow, fatigue life in comparison with the mixtures without PET.

Pareek et al. (2012) carried out experimental study on conventional bitumen and polymer modified binder and observed a significant improvement in case of rutting resistance, indirect tensile strength and resilient modulus of the bituminous concrete mix with polymer modified bitumen. They also concluded that Polymer modified bitumen results a high elastic recovery (79%) and better age resistance properties (The loss in weight on heating in thin film oven is 6 times higher as compared to conventional bitumen of 60/70).

Sangita et al. (2011) suggested a novel approach to improve road quality by utilizing plastic waste in road construction. According to them India spends Rs 35,000 crores a year on road construction and repairs, including Rs 100,000 crores a year just on maintenance and roads by bitumen modification lasts 2-3 times longer, which will save us Rs 33,000 crores a year in repairs, plus reduced vehicle wear and tear.

Dragomir et al. (2021)The feasibility of using PCB waste in the asphalt pavement industry is analysed in a series of laboratory investigations conducted on asphalt concrete BA16 rul 50/70 (AC16)

Shishir K (2020)The use of natural aggregates in concrete will be decreased if different types of by-product is used in concrete as a substitute material. And it is more important to renovate the waste material. It has been found that strength development pattern of E-waste concrete is analogous to that of conventional concrete. E-waste are the potential viable material can be used as fine aggregate to produce durable concrete as well as coarse aggregate.

Kiran (2020) study magnifies the scenario of application of electronic wastes in different forms i.e., plastic, metal etc. in bituminous and concrete based mixtures. A critical review has been carried the effects of electronic wastes in concrete and bituminous mixes and findings confirm the praxis of electronic wastes is possible within certain limits

III. CONCLUSION

It is concluded from the above discussion that Research has indicated that the addition of mobile chips and waste LPDE plastic to asphalt binders helps to increase the interfacial cohesiveness of the bond between the aggregate and the binder which can enhance many properties of the asphalt pavements to help meet these increased demands. Literature discussed in the present paper has given an overview of utilization of waste material in asphalt pavement would be beneficial in order to find an alternative solution to increase service life of asphalt pavement and reduce environmental pollution as well.

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