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COMPARISON OF DIFFERENT MATERIALS USED IN TRANSPORTATION ENGINEERING

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ABSTRACT

Pavement design, the process of developing the most economical combination of pavement layers, mainly deals with the design of material mixtures and thickness of different pavement layers. Even if highway pavements are well designed and constructed, they may require proper maintenance; and if not, different distresses like fatigue cracking, bleeding, rutting, potholes etc. occur in the pavement which is considered to be complex phenomenon because of several factors involved (like rainfall, traffic etc.). In this study, the observation showed that the most commonly found pavement distresses in the highway were pot holes, alligator cracks followed by raveling and edge failure. All the distresses found have values exceeding maximum limits. The most required probable treatments for surveyed distresses are overlay, patching and shoulder improvement. In this study, the pavement performance can be enhanced by using different innovative materials. The innovative materials are: Self-healing Asphalt, Incorporation of steel fibers, Plastic waste. Comparison can be done with and without using materials.

Keywords: Pavement, Self healing Asphalt, Steel fibres, Plastic waste

1.INTRODUCTION:

Pavement design is the process of developing the most economical combination of pavement layers (in relation to both thickness and type of materials) to suit the soil foundation and the cumulative traffic to be carried during the design life. Design of pavement structure differs from the design of building, bridges due to the fact that the pavement design till today is based on empirical or semiempirical approach and there is no rational method of design.

Pavement design consists of mainly two parts:

The main factors to be considered in the pavement design are: traffic; climate, road, geometry; and position, soil and drainage. Road maintenance is one of the important components of the entire road system.Even if the highways are well designed and constructed, they may require maintenance; the extent of which will depend on several factors including the pavement type. A flexible pavement failure is defined by formation of pot holes, ruts, cracks, localized depressions, settlements, etc. The localized depression normally is followed with heaving in the vicinity. The sequence develops a wavy

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pavement surface. The failure of any one or more components of the pavement structure develops the waves and corrugations on the pavement surface or longitudinal ruts and shoving. Pavement unevenness may itself be considered as a failure when it is excessive. The subject of pavement failure/distress is considered to be complex as several factors contribute to its deterioration and failure. The aging and oxidation of bituminous films lead to the deterioration of flexible pavement.

Detrimental actions in pavement are rapidly increased when excess water is retained in the void spaces of the pavements. A brand-new pavement at the start of its design life is expected to be one without any "distress" or undesirable features. The more the distress, the shorter thepavement's life- and at some point, the distresses are so great in intensity (for example, 75% of the wheel path area in project area has cracks) that the pavement is considered to be "failed"or at the end of its design life.

2. LITERATURE EVIEW:

A. Garcia, S. Salih (2020) Induction heating makes cracks in asphalt disappear. There is an optimum cracking level to apply the induction heating treatment. The air voids get re- configured during loading and induction heating. The reason for the air void reconfigurationis still unclear.

Fang Lan et.al. (2020) Understanding the self-healing of asphalt materials at molecular level will benefit pavements. The evaluation and improvement methods for self-healingefficiency are summarized. The relationship between self-healing ability and fatigue performance is discussed.

Rutticka Kedare (2020) In the paper researcher worked to make bricks from waste plastic and sand. This brick is resistant to oil, water, salts and acids. It can withstand temperature up to 180 degrees Celsius. The same material can be used effectively filling potholes on Indian roads.

Elavarasi.D (**2015**) Studied the Structural behaviour of High Strength Steel Fibre Reinforced Concrete block pavement. In this study an experimental program was carried out to investigate the structural behaviour of High strength steel fibre reinforced block pavements.

Amir Tabakovic and Erik Schlangen (2015) Incorporating self-healing technology into asphalt pavement design presents a solution for some of the difficulties facing asphalt.By using different methods like induction heating,Rejuvenation ,Incorporation of nanoparticles, Ravelling can be reduced with the help of self-healing asphalt. However, the key objective of self-healing technology for asphalt pavement design is the development of a truly smart asphalt pavement system, capable of self-assessment and automatic response.

Rishi Singh Chhabra, Supriya Marik (2014) this review paper states that, different types of originate materials and construction technologies have been invented to show their suitability for design, construction and maintenance of potholes. That rubbers and Plastics can be one of them. Also considering the environmental approach, due to excessive use of polythene in day-to-day business, the pollution to the environment is enormous.

Balazs and Lubloy (2013) Investigated the properties of concrete may be considerably influenced by high temperatures. These properties are

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depending on the maximum temperature and the composition of the concrete.

Haktanir et.al. (2007) investigated the performance of steel fiber significantly increased the split tensile strength with an average of 40%, the modulus of fracture by an average of 42%.Even though adding steel fibers doesn't have a significant effect on the compressive strength of concrete, it has a significant effect on the impact resistance of the concrete.

3. CONSTRUCTION MATERIALS:

1. Dry process

2. Wet process

3.1 Dry process:

The plastic waste is dried and cleaned to remove the impurities. Then cut into 1.18mm- 4.36mm in shreddingmachine. The PVC should be eliminated from the plastic waste in cleaning process. As per HRS specifications the aggregate is heated to 165oC and the bitumenis heated to a extent of 160oC to have good binding property. In mixing chamber the cut plastic is added to hot aggregate to apply coating uniformly over aggregate for 30 to 45 seconds. The plastic coated aggregate is added to bitumen at a temperature between 150oC - 165oC.

3.2 Wet Process:

The plastic is collected 60 micron or below sizes preferred for next step. The reason behind this is that less size of plastic can easily mixable with hot bitumen at temperature between 160oC-170oC.The bitumen is heated to 160oC-170oC which is the melting temperature of plastic. The fine pieces of plastic is added to the hot bitumen. At constant temperature mixture was stirred manually for about 20-30min.

3.3 TESTS:

Test on aggregates

a) Aggregate crushing test
b) Los Angeles abrasion test
c) Impact test
d) Test on bitumen

3.4 Test on bitumen

a) Penetration test
b) Softening point test
c) Viscosity test
d) Marshall Stability test.

4.RESULTS AND DISCUSSION:

Self-healing roads far outperform than conventional roadways. Self-healing pavements canimprove traffic flow, reduce maintenance activity and extend the life of a road up to 40 years. It can reduce co2 emissions and less operational cost compared to conventional roadways.

Addition of waste plastic to the bituminous mix has delayed the early deterioration of roads. The substitution of bitumen with waste plastic will indirectly save on costly bitumen which in turn will make these roads further beneficial. Also, the effective utilization of the waste plastic for the preparation of the modified bitumen will result in a substantial increasein its scrap value, which otherwise is an undesirable waste material that is littered all over the urban areas.

The addition of steel fibres to the pavement increases the properties of pavement i.e. Flexural strength, tensile strength compared to normal pavement. The fibres can work at both micro and macro level. At a micro level,fibres arrest the development of microcracks, leading to higher flexural strength and tensile strength, whereas at a micro level fibres

control crack opening, increases energy absorption of the pavement compared to normal pavement.

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