

Literature Review on Modified Base Course of a Flexible Pavement to Control Fatigue Cracking

Mudigonda Harish Kumar, C.Freeda Christy

Abstract: *Epdm Rubber is produced excessively worldwide in every year. It cannot be degraded easily as its decomposition takes much time and also causes environmental pollution. One of the mostly used synthetic rubbers is Ethylene propylene diene rubber (EPDM), it is used in cold-room doors seals, electrical insulation etc. This Research shows that Epdm rubber and stone dust are added to base course, after mixing in base course CBR, Plate load and cyclic load test of pavement are investigated and acquired results are compared with regular base course. This paper reviews the use of Epdm and stone dust as supplementary material in base course of a flexible pavement. A detailed literature survey is carried out and presented here.*

Index Terms: *Epdm Rubber, Stone Dust, Fatigue Cracking.*

I. INTRODUCTION

Nowadays different waste delivered from several Industries is an improbable issue. These materials will lead to pollution of the environment; this industrial waste contains a vast number of non-biodegradable substances. As of late, utilization of this industrial waste has been considered in pavement construction with incredible enthusiasm for creating communities. The usage depended on specialized, financial, and living criteria. The absence of conventional pavement materials and the protection of nature make it essential to examine the credible utilization of these materials. Many researchers has carried out their research to control fatigue cracking in flexible pavements by using modified bitumen at binder course but still more research has to be carried. Base course of a pavement have low resistance towards the tensile stresses and dynamic loads which leads to the failure of pavements and maintenance of roads, The major failure in flexible pavements is fatigue cracking This fatigue leads to formation of cracks, pot holes and undulations on the pavements. In flexible pavements load will be distributed into lower layers in decreasing order. EPDM rubber consists of properties like tensile strength, abrasion, resistance to temperature.

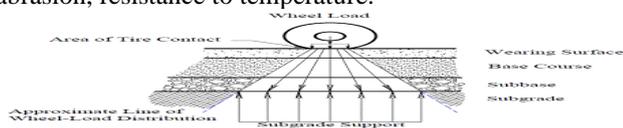


Fig 1. Load distribution in flexible pavement

Manuscript published on 30 March 2019.

*Correspondence Author(s)

Mudigonda Harish Kumar, Research Scholar, Department of Civil Engineering, Karunya Institute of Technology & Science, Coimbatore (Tamil Nadu), India

Dr C. Freeda Christy, Associate Professor, Department of Civil Engineering, Karunya Institute of Technology & Science, Coimbatore (Tamil Nadu), India

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an open access article under the CC-BY-NC-ND license <http://creativecommons.org/licenses/by-nc-nd/4.0/>

II. LITERATURE REVIEW

- Andre L.N. Inacio et al (2017):** Thermoplastic composites reinforced with natural fibers are progressively picking up consideration, for ecological worries, as well as for monetary reasons. Bamboo is a quickly developing lignocellulosic material made out of high quality natural fibers and is a significant commitment to the creation of alternative materials and as reinforcement of matrices.
- Niki D.Beskou et al (2016):** Fatigue crack has been perceived as one of the fundamental structures for damage in asphalt concrete pavements. These additives are Polypropylene (PP), Crumb rubber (CR), Cellulose fiber (CF), Asbestos fiber (AF) and Gilsonite (GS).
- Azza MohamedElleboudy et al (2017):** Performance of geogrid in gravel roads subjected to repeated loads was investigated through laboratory testing. Conducted cyclic plate load test on unpaved roads.
- Iman Mohammadi et al (2014):** Applying water-soaking treatment on CRC asphalts was explored. New and solidified qualities of rubberised-concrete were assessed. water-soaking treatment fundamentally improved mechanical properties of CRC.
- Lei Gao et al(2018):** RAP (reclaimed asphalt pavements)mixtures has low temperature performance when compared to the new mixture, new mixture has a worse indirect tensile resistance than RAP mixture, RAP mixture has worse fatigue performance.
- Suo Zhi et al (2012):** He said that Modified polymer bituminous materials are better than unmodified bituminous materials for crack resistance.
- D. S. V. Prasad et al(2009):** Cyclic load tests are carried out in the laboratory by placing a circular metal plate on the model of flexible pavements
- Mohd Kashif Khan et al (2015):** He finally concluded that the use of stone dust and tyre used for concrete will reduce the pollution and perform as low weight concrete and used in road base

III. MATERIALS

3.1. EPDM RUBBER: A sample of recycled epdm rubber has been collected from the local vendor Alfa polymers in Hyderabad. Epdm rubber is a kind of manufactured rubber, it is an elastomer portrayed by a wide scope of utilizations.

Literature Review On Modified Base Course Of A Flexible Pavement To Control Fatigue Cracking

It is having high content of ethylene it can resist the high temperatures and tensile stress. It has low specific gravity
 3.1.1. Water soaking method: it is a compelling treatment strategy for making a homogeneous blend, that rubber particles are uniformly dispersed [2]



Fig.2.Epdm rubber

3.2. STONE DUST: A sample of stone dust is collected from stone crushing unit at tandur mandal in telangana state. Lot of stone dust is produced from the stone crushing units in tandur region, but the disposal of this stone dust is a major problem in that region. Due to the presence of stone dust and with other pollutants, tandur region stood first position in air pollution region in telangana state.

Table.1. Index properties of stone dust [5]

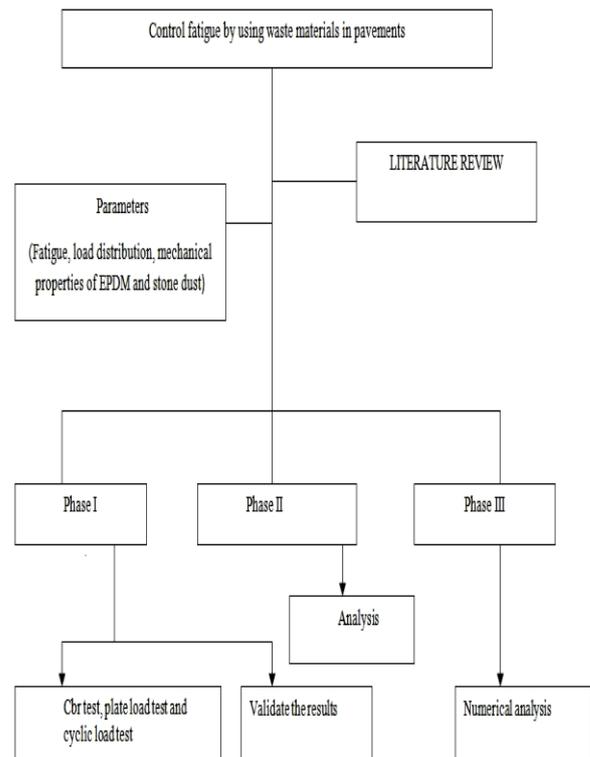
Property	Value
moisture content (%)	9.11
Particle Size distribution	
Sand (%)	97.1
Silt (%)	2.9
Specific gravity	2.76
OMC (%)	11.5
MDD (g/cm ³)	1.97
CBR soaked (%)	11.5

IV. RELATED WORKS

Apart from finding the OMC, MDD of EPDM rubber and stone dust some related works has to be carried out to find the strength of EPDM rubber and stone dust as reinforcement material in base course of flexible pavement for that CBR test, plate load test and cyclic load test has to be carried out and the obtained results has to be compared with conventional base course.

V. RESEARCH APPROACH

The research approach of evaluating the fatigue failure of flexible pavement is based on both laboratory and field studies .The below flow chart shows the research approach towards the control of fatigue failure in flexible pavements by adding epdm and stone dust in base course layer of flexible pavement.



VI. CONCLUSION

Epdm rubber is non degradable material and the dumping of epdm rubber occupies more land area at the same time dust produced from quarries or from crushing units of rocks will produce fine material in the form of dust, this stone dust is lighter material and it occupies more area for storage and causes air pollution which is a major issue these days..To overcome issues like shortage of space to dump and air pollution those materials can be replaced in base course layers of pavement because flexible pavements will often encounter with fatigue cracking, this can be eliminated by adding Epdm and stone dust in base course layer ,this will act as reinforcement material.

REFERENCES

1. Lei Gao, Hua Li, Jianguang Xie, Zengbing Yu, Stephane Charnot. Evaluation of pavement performance for reclaimed asphalt materials in different layers, CONSTRUCTION AND BUILDING MATERIALS, (2018) 561–566.
2. Iman Mohammadi, Hadi Khabbaz, Kirk Vessalas. In-depth assessment of Crumb Rubber Concrete (CRC) prepared by water-soaking method for rigid pavements, CONSTRUCTION AND BUILDING MATERIALS, (2014) 456–471.
3. Suo Zhi, Wong Wing Gun , Luo Xiao Hui , Tian Bo. Evaluation of fatigue crack behavior in asphalt concrete pavements with different polymer modifiers, CONSTRUCTION AND BUILDING MATERIALS, (2012) 117–125.
4. Naman Agarwal, Ajit Kumar. Design of stone dust stabilized road, International Journal of Civil Engineering and Technology (IJCIET), Volume 6, Issue 5, May (2015), pp. 28–33.



5. Niki D.Beskou, Stephanos V.Tsinopoulos, GeorgeD.Hatzigeorgiou. Fatigue cracking failure criterion for flexible pavements under moving vehicles, SOIL DYNAMICS AND EARTH QUAKE ENGINEERING, (2016)476–479.
6. Azza MohamedElleboudy, Asser MoslehSaleh, Amany GoudaSalama. Assessment of geogrids in gravel roads under cyclic loading, Alexandria engineering journal (2017), Pages 319-326.
7. Mohd Kashif Khan, Bhanu Pratap Singh. Used Of Recycled Tyre/Rubber as Course Aggregate and Stone Dust As Fine Aggregate in Cement Concrete Works, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) (Sep. - Oct. 2015), PP 101-107.
8. D. S. V. Prasad and G. V. R. Prasada Raju. Performance of waste tyre rubber on model flexible pavement, ARPN Journal of Engineering and Applied Sciences VOL. 4, NO. 6, AUGUST 2009.
9. Yash Pandey, Dr. Sangita and Dr. Vandana Tare. "Utilization of Coal Mixed Waste Aggregates available at Thermal Power Plants for GSB and Asphalt Mixtures", Advances in Transportation Geotechnics 3 . The 3rd International Conference on Transportation Geotechnics (ICTG 2016), Procedia Engineering Volume 143, 2016, Pages 170–177.
10. Cristina Cazan, Mihaela Cosnita and Anca Duta. "Effect of PET functionalization in composites of rubber–PET–HDPE type". Arabian Journal of Chemistry.2015.
11. G.H. Shafabakhsh, M. Sadeghnejad, Y. Sajed."Case study of rutting performance of HMA modified with waste rubber powder", Case Studies in Construction Materials, (2014) 69–76.

AUTHORS PROFILE



Mudigonda Harish Kumar, Research Scholar,
Department of Civil Engineering, Karunya
Institute of Technology & Science



Dr C.Freeda Christy, Associate Professor,
Department Of civil Engineering, Karunya
Institute of Technology & Science. Published
over 20 international and National Journal
Papers, Guided 3 Phd Scholars.