Review of How to Construct the Model of Road Using Waste Tyres and Study on It

Mr. Sanket Pandharpatte[1] Mr. Kunal Vasudev[2] Mr. Abhishek Kashmire[3] Mr. Shreyans Muke[4] Mr. Mustafa Mujawar[5]

[1,2,3,4,5]Department of Civil Engineering

[1,2,3,4,5]Sharad Institute of Technology, Polytechnic, Yadrav, Ichalkaranji, India

Abstract— The use of four wheeler, two wheeler vehicles etc. is increasing day by day. As a result amount of waste tyres also increasing. Waste tyres in India are categorized as solid or hazardous waste. It is estimated that about 60 per cent of waste tyres are disposed via unknown routes in the urban as well as rural areas. This leads to various environmental problems which include air pollution associated with open burning of tyres (particulates, odor, visual impacts, and other harmful contaminants such as polycyclic aromatic hydrocarbon, dioxin, furans and oxides of nitrogen) and aesthetic pollution. Therefore, it is necessary to utilize the wastes effectively with technical development in each field. The waste tyres can be used as well sized aggregate in the various bituminous mixes if it is cut in the form of aggregate and can be called as rubber aggregate. This not only minimizes the pollution occurred due to waste tyres but also minimizes the use of conventional aggregate which is available in exhaustible quantity.

Keywords: Rubber Aggregate, Flexible Pavements, Crumb Rubber, Modified Bitumen, Quieter Roads

I. INTRODUCTION

Now a days disposal of different waste produced from different industries is a great problem.

These material pose environmental pollution in the nearby locality because many of them are non-biodegradable Traditionally soil, stone aggregate, sand, bitumen, cement etc. are used for road construction. Natural material being exhaustible in nature, its quantity is declining gradually. Also, cost of extracting good quality of nature material is increasing. Concerned about this, the scientists are looking for alternative materials for highway construction, by which the pollution and disposal problems may be partly reduced.

Keeping in mind the need for bulk use of these solid waste in India, it was thought expedient to test these materials and to develop specifications to enhance the use of waste tires in road making in which higher economic returns may be possible.

The possible use of these material should be developed for construction of low volume roads in different parts of our country.

The necessary specifications should be formulated and attempts are to be made to maximize the use of solid waste in different layers of the road pavement. Post construction pavement performance studies are to be done for these waste materials for construction of low volume roads with two major benefits:-

1) It will help clear valuable land of huge dumps wastes.
2) It will also helps to preserve the natural reserves of aggregates, thus protecting the environmental.

Rubber tires are user friendly but not ecofriendly as they are non-biodegradable generally. The practice of disposing waste tires in landfills and open burning is becoming unacceptable because of rapid depletion of available landfill sites and clear environmental respectively.

II. HISTORY

Rubberized bitumen is being used in USA from 1960 currently Arizona, Florida, Texas and California using 2 million tons of rubberized bitumen. Rubberized bitumen is very popular in Australia for chip sealing wearing course sand structural layers. Use of Rubberized bitumen being increase in developing countries of Latin American. In 1960s scrap tyres were processed and used as secondary material in the pavement industry. One application was introduced by two Swedish companies which produced a surface asphalt mixture with addition of small quantity of ground rubber from discarded tyres as a substitute for a part of the mineral aggregate in the mixture, on order to obtain asphalt mixture with improved resistance to studded tyres as well as snow chains, via a process known as “dry process”. In the same period Charles McDonalds, a materials engineer of the city of phoenix in Arizona (USA),was the first to find that after thoroughly mixing crumbs of RTR with bitumen (CRM) and allowing it to react for a period Of 45 min to an hour, this material captured beneficial engineering characteristics of both base ingredient. He called it Asphalt Rubber and the technology is well known as the “wet process”.

By 1975, Crumb Rubber was successfully incorporated into asphalt mixtures and in 1988 a definition for rubberized bitumen was included in the American Socity for Testing and materials (ASTM) D8 And later specified in ASTM D6114- 97. In 1992 the patent of the McDonald’s process expired and the material is now considered a part of the federal law named “Intermodal Surface Transportation efficiency Act” (then rescinded), Mandated its widespread use, the Asphalt-Rubber technology concept started to make a “quiet come back”. Since then, considerable research has related to rubberized asphalt pavements. Nowadays, thes rubberized bitumen materials, obtained through the wet process, have spread worldwide as solution for different quality problems(asphalt binders, pavement, stress absorbing lays and inlayers, roofing materials, etc.) with much different evidence of success demonstrated by roads built in the last 30 years.

III. BENEFITS OF USING WASTE TYRE IN ROAD

The use of four wheeler, two wheeler vehicles etc. is increasing day by day. As a result amount of waste tires also increasing. Waste tires in India are categorized as solid or hazardous waste.

It is estimated that about 60 percent of waste tires are disposed via unknown routes in the urban as well as rural areas.

This leads to various environmental problems which include air pollution associated with open burning of tires and aesthetic pollution. Therefore, it is necessary to utilize the waste effectively with technical development in each field.

The waste tires can be used as well sized aggregate in the various bituminous mixes if is cut in the form of aggregate and can be called as rubber aggregate. This not only minimizes the pollution occurred due to waste tires but also minimizes the use of conventional aggregate which is available in exhaustible quantity.

IV. OBJECTIVES

- Exploring the most recyclable materials in the road field. Understanding benefits and drawbacks of utilizing some of these materials in comparison to the others.
- Identifying some knowledge gaps related to any of the explored materials
- Tentative research plan for my PhD studies at u ottawa.

V. LITERATURE REVIEW

1) S.B. Patil & A.A. Lole, e.t.a.l. in 2016, they have studied that on road pavement. They said that, this section deals with rubberized bitumen, a binder in hot mix asphalt and chip seal applications that results from the proper addition of crumb rubber to hot bitumen and then left in heated state to react.

   Rubberized bitumen is ued extensively in California, Arizona and Texas in the USA, in several countries of western Europe, and in south Africa. It is also used to lesser extent in parts of Canada and in a dozen more statein USA.

   The benefits are many, including reduced long – term road maintenance and expense, significant noise reductions, improved traction and reduced accident rates in wet road condition. Addition of waste tyres as rubbers aggregate modifies the flexibility of surface layer.

   Optimum content of waste rubber tyres to be used is between the range of 5% to 20%.

   Problem like thermal cracking and permanent deformation are reduce in hot temperature region.

   Rubber has property of absorbing sound, which also help in reducing sound pollution of heavy traffic roads.

   The author believes that the widespread use of the RTR-MBs technologies within the road pavement industry is advisable. In fact the several benefits provided to the asphalt pavement performance, and to the overall sustainability of the infrastructure, are soevident that it is strongly advised to consider RTR-MBs technologies as a first option to the binders currently used in road pavements. Companies, road authorities, etc. have to evaluate if it is convenient to use the high viscosity wet process technology, which proved widely to provide several benefits, in particular it allows highway designers to reduce pavement layer thickness due to the proven properties of rubberized bitumen, but presents some challenges as: the need for suitable blending and mixing equipment, the cost of such equipment and the degree of difficulty in preparing asphalt mix design. The other option is to choose the wet process-No-Agitation technology which solves several issues but leads to asphalts pavement with, so far, uncertain long term performance. In both cases the implementation of these technologies still presents issues as: the lack of availability of suitable RTR processing facilities in the vicinity and the cost of such facilities, the lack of rubberized bitumen binder and mix standards, the uncertainty on the environmental personnel particularly for accurate laboratory analyses, of raw materials and training are indeed another key aspect for a successful application of RTR-MBs in road asphalt mixtures also because new procedures are being developed to perform an enhanced laboratory design of these technologies as well as reducing limitations to their applicability in the field. Examples are given by the increasing number of rubberized asphalt applications with additives able to reduce paving temperatures (i.e. warm mix technologies) but also from the invention of a new form of important aspect to clarify is the cost of technology: it is true that initial costs are still an issue but the rapid cost increase of bitumen and results of lifecycle cost analysis indicate that RTR-MBs are in may cases an economically convenient option.

   Several issues indicated within this manuscript. A proof of this statement is given by the state of California (USA)Increasing adoption of these technologies in asphalt Mixtures and form the January (2013) the usage of rubberized asphalt 35% of the total weight of asphalt paving materials produced in the country. The main reason of this mandate is the prediction of substantial saving in the long term.

   At last, there is evidence that closer involvement of local and RTR industries and the major investments on training and research could definitely help to decrease the costs of implementing RTR-MB technologies as well as solving the

2) Nitish Kumar k, Dr. H N Rajakumara in 2016,The basic property that we tested for VG-30 bitumen is in permissible limit. By Adding 0-4% Crumb rubber in bitumen specific gravity, softening point, flash & fire point are increasing and ductility, penetration are decreasing. But up to 1% addition of crumb rubber obtain value are within the limit. Stability and flow of bitumen mix are within the limit up to 1% of crumb rubber. By replacing 5% aggregate of size passing 19mm & retained on 13.2mm by rubber aggregate obtained Marshall Stability and flow value are within optimum limit.
3) Deshmukh Nitu .H, Kshirsagar D. Y in 2017, they said that,1. Penetration value test result shows that Penetration value decreased with the increased amount of the rubber waste added. Lower penetration value making a harder grade of asphalt, giving additional strength to the road and reduces water damage. Lower Penetration thereby making a harder grade of asphalt, giving additional strength to the road and reduces water damage. 2. Softening point test shows that Softening Point increased with the increased amount of the rubber waste added. This showed that the bitumen becomes less susceptible to temperature changes as the content of rubber waste increased. Increase of Softening Point, thereby giving it protection against hot climatic conditions. 3. Ductility test result shows that the rubber

waste added will harden the bitumen. The bitumen becomes more viscous and harden, which would be useful to obtain stiffer bitumen asphalt. 4. The biggest advantage of using rubberized bitumen is that the road life increases in comparison to the normal bitumen whereas the cost increase on the road. 5. Improved adhesion aggregates and binder thereby giving better strength, stability and longer life.

VI. SCOPE OF WORK

Picking up a research topic plan based on literature/recommendations Commencing research process over the next 40 months

Despite all researches on potential use of recycled material in road structure, yet there is mounds of concerns and knowledge gaps that require intensive investigation and assessment to the interest to the interest of building better roads and preserving natural resources.

VII. CONCLUSION

Despite all researches on potential use of recycled material in road structure, yet there is mounds of concerns and knowledge gaps that require intensive investigation and assessment better roads and preserving natural resources.

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