

Rubberized Concrete for Noise Control: A Review

¹Md. Sameer, ²Satish Parihar, ³Amir Rehman

¹M. Tech Student, ²Professor, ³M. Tech Student

¹Civil Engineering Department,

¹Rama University, Kanpur, India.

Abstract : With the rapid growth in India's economy and population and worldwide in recent years, noise pollution and scrap tyre rubber disposal are becoming a major environmental issue and affecting human and life of animals. A analysis of previous work is done in this paper to minimize and control noise transmission through the use of life ended tyre as a coarse aggregate in concrete at the specified percentage. As a result, concrete supplemented with rubber can be used for noise insulation and has attractive strengths. Benefits of noise reduction with rubber waste replacement in any area briefly outlined in this article. In addition, our work history on rubberised concrete reduction in noise is also discussed in depth.

IndexTerms – Rubberized Concrete, Insulation, environmental issue, noise pollution.

I. INTRODUCTION

In the recent decades India's urban areas have been densely populated. It has risen 31.8% recently. This has contributed to certain environmental and health related issues which also involve emissions from the atmosphere. Those factors are inevitable and need to be addressed in the construction activities.

Therefore, they can not be stopped entirely. Yet it is important to take such preventive steps to monitor and mitigate the severity of it.

According to the 1981 Pollution Prevention and Control Act, noise is referred to as a 'air-pollutant.' It is the irritating, distracting and unwanted sound that should be avoided due to its lack of sleep and loss of concentration. The person gets irritated because of the constant uncomfot they inflict.

The noise in that room should be no more than 30dBA for a sound sleep, according to the WHO guidelines. It does not surpass 35dBA for holding focus in any classroom.

On a continuous basis, noise levels above these thresholds will affect both mental and physical health on a short-term and long-term basis. Rubber waste, especially waste from scrap tires, is one of the most unmanageable. A very urgent ecological issue today is its management and utilization. Vast quantities of scrap tires are stored in dumps, where they pose great fire hazard. Poisonous smoke is emitted during these fires, and the fires are difficult to extinguish. This triggers numerous environmental issues and pressures in the area of handling, using and recycling scrap tires to constantly look for new possibilities and directions.

The management of rubber waste can be subdivided into three main stages: waste recovery, waste incineration or storage in specially built dumps. The environmentalists aim to ban the incineration of rubber waste and its disposal in solid waste facilities through various legislative actions. The goal of this work is to analyze the possibilities for the use of different particle scrap-tyre rubber waste in noise control to tackle two priority environmental problems with one solution , i.e. "Management of noise pollution with reuse of end-of - life tyre in construction"

II. NOISE CAUSES AND EFFECTS

Noise pollution occurs by default when there is either an unnecessary amount of noise or an unwanted sound that usually causes disturbance of the ecological cycle.

III. SOUND ABSORBING MATERIALS

Owing to their high efficiency and low cost, porous materials Synthetic fibers can be used for thermal insulation and sound absorption and rubber can be a good alternative for noise cancellation A majority of various sustainable materials for noise control can be divided into three main categories:

Natural Materials, Composite Materials and Recycled Materials

There is a great variety of natural fibers which can be used for thermal and acoustical applications. These are widely available in the context of coconut, kenaf, hemp and mineralised wood fibers. Rubber particles or end-of-life tyre seems good solution for passive noise control.

There is a large number of natural fibers that can be used in acoustic and thermal implementations. They are generally available in the form of coconut, husk, hemp, mineralised wood fibers. Particulate rubber or end-of - life tyre seems like a safe option for passive noise reduction.

IV. TECHNIQUES TO CONTROL NOISE

Humans have taken different steps to reduce the noise levels. Sound is a mechanical wave and thus reflects, refracts, diffracts, absorbs, etc. The in-depth understanding of these phenomena will aid in noise reduction. Several types of noise reduction systems are in operation, the two are:

4.1Passive Noise Control

Passive noise - reducing approach led to those measures which aim to beat down the noise by controlling the near source environment. Because in these methods no input power is needed, this method is sometimes cheaper than active control, but output is limited to mid- and elevated-frequencies. Effective noise system primarily monitors low frequency signals and functions well.

4.2 Active Noise Control

Through this technique we are called active noise management by manipulating and suspending sound field by electro-acoustic methods. There are 2 active control methods. First, by using actuators as an acoustic material to generate out-of-phase vibrations to remove disturbances, and second, by using flexible and vibro-elastic components to radiate an audio signal that interferes with disturbances and decrease overall intensity.

V. RUBBERIZED CONCRETE

Several researchers and scientists are trying to develop alternative building material which is environmentally friendly and contributes to sustainable growth. Enormous amount of rubber tyres waste is created day by day which causes the impression of disposal and has many environmental problems. End-of - life tyre can not be quickly discharged in the natural area, as its decomposition takes a long time and often adds contamination to the atmosphere. When standard traditional concrete materials are replaced by rubber or rubber waste the word is called rubberized concrete.

VI. LITERATURE REVIEW

1) Savale P. A et al paper discusses the causes, consequences and recommendations for unnecessary noise controls. It appears that cars, factories, highway transport, airports, railways, and public address systems are significant sources of sound pollution. Many of our day-to-day practices lead to sound emissions by consciously or unknowingly both citizens. Often ignored, sound pollution adversely affects the person contributing to discomfort, attention loss, hearing loss. Efforts shall be made to establish the causes of sound pollution and hence the reasons for that noise levels. Efforts must be made to reduce the unnecessary noise levels from sources that produce noise[1].

2) Hj Zulkepli. Et al . conducted a research on noise pollution in the school environment and consideration was given to three schools having distinct ambiances. Increasing industrial, traffic and other activities around the schools has been found to contribute to increased noise emissions in the school area. The study explores the detrimental impacts on performance of teachers and pupils in the vicinity of the school campus due to noise emissions from traffic, industrial, and other activities. The results were made in two groups, i.e. by noise rate calculation and by questionnaire. The collection of physical data is done by sound level meter for 8 hours with 5 seconds interval at several points within the school. A graph of Sound Pressure Level (Decibel) versus Time was presented and the noise level range was obtained with min. and mod. For case1, case2 and case3, the noise range (in Decibel) was found to be (56-77), (53-72), and (42-59), respectively. The measured Max of SPL (in Decibel) is 77, 72 and 59. SPL mods (in Decibel) are 68, 62 and 45. After evaluating and comparing the measured data with the acceptable range (35-45), it is found that in case1 and case2 the noise issue does exist. The case 3 was found to be appropriate for the classrooms. The questionnaire survey was conducted for case1 because it has low sound quality and the findings showed that a noise issue certainly exists with 95 percent of respondents agreeing to it. It is also reported that 41 percent of the noise came from the students themselves, 30 percent from traffic, 12 percent from building, 12 percent from people walking by, 3 percent from various sources including animal noise and 2 percent from shopping. Various negative effects observed include study / teaching disturbance, classroom hearing problem, mental stress, discussion difficulty, one needs to speak louder. And safety problems, including headache. It was concluded after the final analysis that only those schools are exposed to noise pollution, in which there are commercial and traffic activities around them. This has also proposed the construction of schools away from Shops and Highways [2].

3) M.H.F. De Salisa et al investigated various strategies for noise control in naturally ventilated buildings, including reduced costs, simpler and manageable environmental conditions and reduced use of mechanical ventilation systems. Constructed buildings should be designed to minimize the need for mechanical devices. Trickle filters and wide openings do the tricks offered. To drain air from buildings, the well built ventilation systems must have a pressure difference of 10Pa available. The location of the ventilation openings should be distant from the direct noise paths and the screens used should consist of barriers including fences, mounds of earth etc. Apertures, inlets, and outlets can be treated using the acoustic louvre and linings. Hybrid solutions for window inlets and in general, induct treatment and different components have been designed to incorporate the best attributes of more than one form of noise reduction treatment. A variety of hybrid treatments and techniques can also be applied if the problem source of noise has strong tonal components. Reduction of network noise such as road traffic noise, quality of integral barriers used in popular frequency bands often increases the sound reduction of outside walls. [3].

4) T.S.S Jayawaradana et al reported that noise creates a noise level of up to 95dB in a textile factory fitted with heavy machinery, while the National Institute of Occupational Safety and Health recommended that the volume and duration to which the worker should be subjected be 85dB and 8 hours respectively. His analysis used mathematically node and spectrum for viewing applications. [4].

5) Azmi M et al Observed that many recycled products, such as waste rubber, metal shavings, plastic, textile agglomerates can be used at public housing sites under extreme noise effects. Mixing different recycled materials of different grain sizes can be useful to obtain the necessary output [5].

6) Zhao et al Recorded timber / utilized tire rubber composite sheet (WRCP) soundproofing properties. The findings showed that an improvement in the use of reusable tire rubber crumbs and the quantity of PMDI adherent may dramatically increase WRCP's sound proofing properties. [6].

7) Sarawut et al. torsional stiffness, break elongation and abrasion tolerance of the silane-filled master batch compound at 20 percent of silica were preferable to that of silane-filled traditional composites mostly during test. The master batch composite materials, in the case of Si-69, provided similar damping characteristics to those of traditional composites throughout all silica loadings. [7].

8) Zhou et al, using recycled crumb rubber with strong attenuation properties, recorded the novel sound insulator. Results indicated contributions of synthetic materials to the absorption of lower frequencies sound is verified. Although more research is required to confirm the effect of various rubber particles and fabrication method, the results may lead to a new kind of high-performance noise reduction materials. [8].

9) Krzysztof et al described floor tire rubber (GTR) implementation as a possible future butyl rubber composite. The microstructural assessment of a 30 phr GTR sample showed high interactions between both the butyl polymer matrices and GTR [9].

10) Fotini Kehagia and Sofia Mavridou mentioned that rubberized bitumen mixtures might be a perfect option for resurfacing the certain street in bad condition as it not only decreases noise generation and also offers more durable roads that are less vulnerable to temperature effects whilst also maintaining noise removal even after eight months of work. Subsequently, it is strongly recommended that the use of EOL Tires in pavement layers be promoted effectively by national legislation, as the entire quantity of stockpiled EOL Tires could be managed in a technically and environmentally sustainable manner. The inclusion of tyre-rubber particles in bituminous binder eliminates bituminous noise by up to 3dB [10].

VII. CONCLUSION

The focus of this paper is to evaluate the effects of end-of - life tyres on rubberized concrete noise removal. This paper is a first in series of papers to examine rubberized concrete's sound absorbing behavior when natural aggregate replaces rubber in chipped form with scrap tyre. Depending on analysis of the literature and all subsequent reviews have been conducted.

A. There are different approaches available that can be used under passive noise management to reduce the noise emissions. There are also plenty of best materials which is used to reduce the risk of transmission of noise.

B. First from research paper it was found the use of chipped form waste rubber as a coarse aggregate had already been made only by a few researchers.

C. This is further revealed that no literature is available on the calculation of sound and vibration of the same type of composites. So the vibration and sound analysis of rubberised concrete should have a wide variety.

D. Our work aims to manufacture concrete covered by rubber by using recycled tyre rubber and this improved concrete would have sound absorption properties.

E. Studies concentrate mainly on the study of mechanical and physical properties of rubber substituted concrete mixture in which modified concrete has desirable physical and mechanical characteristics. Rubber scrap tire is either used as an alternative to natural aggregates, or as an additive.

F. Noise propagation can be avoided by using standard concrete rubber aggregates.

G. Waste tyre rubber has been researched to have properties for application of sound insulation. The waste tyre's isolation properties were greatly influenced by the amount of material as an aggregate and its interfaces within the products.

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