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Case Study - Concrete Mixer's Power Consumption and Wear Resistance on Mixing Blade

Monika R Setty
Post Graduation Student, Department of Civil Engineering, Dayananda Sagar College of Engineering, Bangalore, India[1]

Abstract: ***Concrete mixers play a pivotal position in the construction industry, facilitating the efficient blending of cement, aggregates, water, and admixtures to create the fundamental building material of our modern world. However, the process of mixing concrete is energy-intensive and exerts significant wear and tear on the mixing blades, leading to maintenance costs and environmental concerns. This abstract explores strategies and innovations aimed at reducing power consumption and minimizing wear on mixing blades in concrete mixers, contributing to sustainability in construction practices. To address power consumption, advancements in motor efficiency, coupled with variable frequency drives (VFDs), have emerged as effective tools for optimizing energy use. In terms of blade wear, engineering developments in blade materials have been instrumental in enhancing durability. Hardened steel alloys and innovative composite materials have been introduced to mitigate wear and prolong blade lifespan.***

Keywords: Power consumption and wear on mixing blades.

I. INTRODUCTION

Concrete, a fundamental building material, relies on the efficient mixing of its components for optimal performance. Concrete mixers, such as drum mixers and batch mixers, are widely used in the construction industry to ensure the homogenous combination of cement, aggregates, water, and admixtures. While concrete production is indispensable, it is imperative to consider the energy consumption and equipment wear associated with the mixing process, especially in the context of modern construction practices, which often incorporate various admixtures and aggregates. The energy consumption of concrete mixers is a critical factor in evaluating their environmental impact. The inclusion of admixtures, which enhance concrete properties, can affect energy requirements. This paper investigates how the addition of admixtures influences energy consumption during mixing. Moreover, it explores strategies for optimizing energy efficiency, such as mixer design improvements and control systems. Concrete mixers are subjected to considerable wear and tear due to the abrasive nature of aggregates and the chemical interactions with admixtures. Wear of mixing blades can lead to reduced mixing efficiency, increased maintenance costs, and shorter equipment lifespans. This study analyses wear patterns, causes, and effects on mixer performance. It also proposes preventive measures and innovative materials to mitigate wear and prolong equipment lifespan. Aggregates are a fundamental component of concrete, and their characteristics can significantly affect the mixing process. This paper investigates how different types of aggregates impact energy consumption and wear in concrete mixers. It delves into the particle size distribution, shape, and surface texture of aggregates, and their interaction with admixtures during mixing.

II. LITERATURE REVIEW

The literature review paper related to concrete mixer to reduce power consumption by changing the admixture quantity and effect of aggregate on the wear of mixing blades.

Veerabadrasamy Arularasi[1] The alteration in power usage primarily stems from the diverse materials incorporated into the concrete mixture. Mineral admixtures employed in concrete exhibit distinct chemical and physical characteristics, causing each material to behave differently. The identification of materials capable of minimizing energy consumption and their integration into concrete production can result in a reduction in the energy required for the manufacturing process. The ultimate objective is energy optimization across all aspects, serving as a crucial step in safeguarding our natural resources. It is evident from the aforementioned findings that maximizing the utilization of powder content has a notable impact on energy consumption, ultimately contributing to the uniformity of the concrete during the mixing phase. Nevertheless, the following conclusions can be deduced from the primary findings of this study.

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An upper limit of 22% for fly ash content increases power consumption by 19.27–20.28%. Conversely, a lower limit of 16–18% for fly ash content decreases power consumption by 1.3–9.83%. Moreover, it was observed that variations in water content can also result in corresponding increases or decreases in power consumption.

Adrian Nita[2] Increasing the angle of inclination reduces the relative contribution of frictional forces to the total load on the mixing blade, suggesting a potential decrease in wear and mechanical stresses on the mixer components. Furthermore, this effect becomes more pronounced when the sliding frictional coefficient between the aggregate material and the mixing blade is higher, underscoring the importance of taking material properties and surface interactions into account when designing and operating mixers. In summary, these findings underscore the advantages of optimizing the angle of inclination in mixer blade design to minimize frictional forces and enhance the durability and performance of mixers when handling aggregate materials with varying frictional characteristics. In industrial applications related to cement concrete production, it is recommended to use cast iron with either 25% Cr or 4% Cr, as the choice of the 9% Cr intermediate grade is not justified due to its higher cost and inferior performance compared to the 4% Cr version.

III. CONCLUSION

1) For more powder content more water is required for homogeneity of the concrete mix. Hence there is increase in the power consumption.

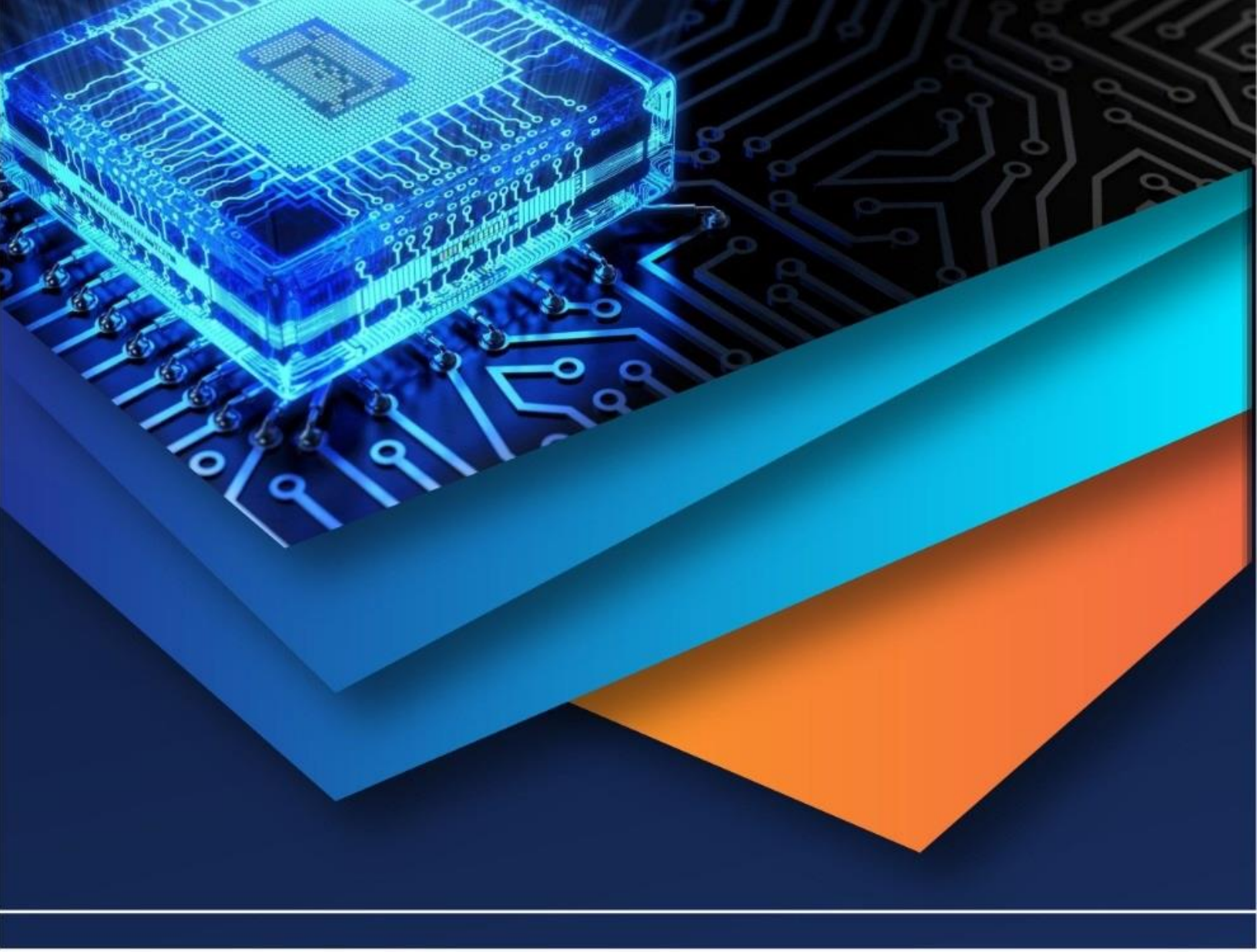
2) With the increase in the angle of inclination there is decrease in the frictional force in turn decrease the wear of the mixing blade.

3) In the production of the mixing blade it is recommended to use 26% Cr to reduce the wear of the mixing blade.

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