WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Design And Analysis of Automotive Brake Pad For Noise Reduction

Duryodhan Bhusnar[1], Dr. M. J. Shaikh[2]

1. P.G. Student,B.D.C.E. Wardha, M.S. India.
2. Professor, B.D.C.E. Wardha, M.S. India.

A B S T R A C T:

The main objective of this project is to develop traditional or conventional concrete and simultaneously motivate the people about light weight concrete. This focuses on tests such as Compressive test only. The results obtained are interesting and useful to compare the results with that of traditional concrete. The main focus of this concrete is to low density and thermal conductivity, ultimately there Is reduction of dead load, faster building rate in construction and lessen haulage and handling costs. No-fine concrete is produced by using ordinary Portland cement, coarse aggregates, and water. This concrete is tested for its properties, such as slump value, porosity and compressive strength. The results showed that porosity has significant effect on compressive strength of no-fine concrete. The normal concrete has a density of 2500 kg/ m3, the major contributions to the density of concrete is the high specific gravity of coarse aggregate. In the present study, an attempt has been made to partially replaced coarse aggregate and fully replaced fine aggregate by lighter weight material to achieve concrete of lighter density. Coarse aggregate was replaced by blast furnace slag in various trial percentages. This concrete is mix with different ratios of aggregate/cement and it helps find different properties like chemical, physical and mechanical.

Keywords: Lightweight concrete (No fine), blast furnace slag, strength, properties.

Introduction

Automotive braking systems are integral to vehicle safety and performance. However, a persistent issue in the automotive industry is the noise generated during braking, commonly referred to as brake squeal. This project aims to address this problem by focusing on the optimization of automotive brake pad design to reduce noise while maintaining or improving braking efficiency. In the ever-evolving landscape of automotive engineering, vehicle safety and performance remain paramount considerations. Within this intricate matrix of design, materials and functionality, automotive braking systems represent a linchpin that directly impacts both driver safety and driving experience. In the pursuit of enhanced vehicle performance, manufacturers have continually striven to engineer brakes that combine reliability, efficiency, and reduced stopping distances. However, this relentless pursuit of performance has also brought forth an inherent challenge a cacophonous obstacle that has persisted for decades brake noise.

Brake noise, characterized by a cacophony of squeals, squeaks and screeches, has long plagued the automotive industry. Beyond being an auditory nuisance, brake noise concerns related to driver comfort, safety and consumer satisfaction. This seemingly universal phenomenon, often referred toas “brake squeals,” manifests during the application of brakes, diminishing overall driving experience and engendering skepticism about vehicle safety. The consequences of this issue extend far beyond the boundaries of mere inconvenience: brake noise can lead to driver hesitancy, decreased confidence in vehicle safety, and even an adverse impact on the reputation of automotive manufacturers. Recognizing the multifaceted challenges posed by brake noise, the automotive industry has endeavored to explore innovative avenues that mitigate this perennial issue. At the heart of these efforts lies the quest for optimal brake pad design. A design that harmonizes the demands for efficient deceleration, safety and minimal noise generation. Achieving this equilibrium necessitates a holistic approach that delves into the intricacies of material science, structural engineering and aerodynamics.

Fig Automotive Brake Pad

Automotive braking systems are integral to vehicle safety and performance. This project, entitled "Design & Analysis of Automotive Brake Pad for Noise Reduction," embarks on a journey to address the profound challenge of brake noise. Its mission is to delve into the recesses of brake pad design, unearthing the sources of noise generation and crafting innovative solutions that not only silence the dimensions but also enhance overall braking system performance. As we navigate the annals of brake pad design, we will traverse the realms of material science, geometric configurations and computational simulations, unlocking insights that have eluded engineer for years.

Literature Survey

De Gruyter (2020) had studied brakes are one of the most important components of vehicle. Brakes are one of the most important components of vehicle. The brake system must be reliable and display unchanging action throughout its use, as it guards the health and life of many people. Properly matched friction pair, a disc and brake pad (in disc brakes), have a great impact on these factors. In most cases, the disc is made of grey cast iron. The brake pads are far more complex components. New technologies make it possible to develop materials with various compositions and different proportions, and connect them permanently in fully controllable processes. This elaboration shows that all these factors have a greater or lesser impact on the coefficient of friction, resistance to friction wear and high temperature, and brake pad's operating life. This review collects the most important, the most interesting, and the most unconventional materials used in production of brake pads, and characterizes their impact on the tribological properties of pads. [1]

Vipul Matariya and Prof. Hiren Patel (2019) Carried out automobile disk brake is an essential mechanical system used to slow down and stop the vehicle. During the operation of the brake, a high amount of kinetic energy will generate a high amount of heat energy and forces. The generated heat increases the rotor temperature, which leads to disk brake rotor deformation due to the combined effect of mechanical forces and temperature. During the study, a disk brake rotor will be investigated for frictional forces acting on it and heat generated due to friction between calliper pads and rotor surface. Brake rotor dimensions can be optimized for strength with a reduction in weight using advance topology optimization method. Topological optimization was done on ANSYS 18.1 for disk brake rotor having materials of grey cast iron. Grey cast iron has a weight of 4.42 kg which may be replaced by a ceramic composite material for disk brake having a weight of 1.51 kg materials. [2]

Shahabaj Bagwan & Prof. S. R. Shelge (2015) Carried out Brake squeal noise has been under investigation by automotive manufactures for many years due to consistent customer complaints and high warranty costs. Disc brake squeal remains a complex problem in the automotive industry, since the early 20th century, many researchers have examined the problem with experimental, analytical and computational techniques. Although brake squeal do not affect braking performance, still it is not acceptable. So brake noise issues have led vehicle manufacturers, brake and friction material suppliers to investigate various ways of improving their processes in order to reduce vehicle noise and increasing passenger comfort. In this study various parameters affecting disc brake squeal are studied. Effect of increasing braking pressure leads to increase in disc brake squeal. It is found that lower rotational velocities have more probability to occur disc brake squeal. Higher coefficient of friction increase squeal propensity. Increase in damping reduces disc brake squeal. [3]

Mohamad Arman, *et al.* (2018) Carried out Studying about different materials for brake pads is necessary as the asbestos brake pads causing the harmful effects and these should be phased out. There are many alternatives for asbestos are investigated from different journals. In this review paper some of the most suitable environment friendly and best performed compositions are presented. Fibres made of agricultural wastes like banana peels, palm wastes, aramid fibres, flax fibres etc. are studied. By using bio source raw materials like condensed tannins and furfural alcohol a bio sourced thermo set resin was developed and used and tested for a new application: as a resin matrix of automotive brake pads. The manufacturing procedure developed is particularly easy. Automotive brake pads based on this green resin were characterized and showed better braking properties and wear resistance when used under real car, full scale test conditions. [4]

Mr. V. S. Chavan, *et al.* (2017) had carried out Braking system is the very important part of automobiles. Brake pad is made up of composite materials, different types of materials are available for brake pads. Brake pad material is made up of different compositions. In order to study the performance of brake pads it is necessary to study its two properties viz. [5]

Anudeep Kumar Kankanala & Dr. Mayukh Sarkar (2020) had carried out Brake pads are the most significant element in the automobile, which helps to retard the vehicle and bringing to rest position. The needs enhanced on the mechanical and tribological properties of the material for brake pads. Studying various materials for the brake friction materials for replacement of asbestos, which causes harmful effects to the environment and the wear indication of the brake pads with various methods. Natural composite material plays a major role in friction coefficient and environment-friendly. Non asbestos containing friction materials like those that palm kernel shell, bagasse, coconut shell, rice husk, banana peel, periwinkle shell, etc. are studied. Filler materials like copper powder, calcium carbonate, etc. are used. Different binders like phenolic resin and epoxy resin used to manufacture ecological brake pads. In this review, studied various agricultural wastes and metals as an alternative for asbestos brake pads and the wear indication. [6]

Shoaib Munir Mulani, *et al.* (2022) had carried out the brake pad-disc system undergoes severe abrasive and adhesive wear mechanism in the production of wear debris. Because of the constant abrasion, this procedure produces fine particle debris, which certainly harm the environment. Brake pad material is made up of different compositions. In order to study the performance of brake pads it is necessary to study its two properties viz. Researcher have also looked at its negative impact on the eco-system. The review articles analysis the outcome of brake pads with made different formulations. [7]

Swapnil Thigale and Chinmay Shah (2017) had carried out to design a lighter brake disc than the existing models used in general two wheelers is the main objective of this paper. Topology optimization was performed on disc by determining the constraints in the design and appropriate boundary conditions to reduce its weight. The new disc is 26.68 % lighter than the previous disc.By using this knowledge of topology optimization with engineering aspect an optimized brake disc design can be made in short time. [8]

Problem Identification

The problem of noise generated by automotive brake pads during is a well-documented and persistent issue that has long plagued the automotive industry. Identifying the specific problems associated with brake pad noise crucial to developing effective solutions. There are some key problem area related to brake pad noise in context of optimizing brake pad design are Brake Squeal, Safety concern, Consumer satisfaction.

Brake Squeal is one of the most prevalent and bothersome issue. It is characterized by high-pitched, continuous noise concerns about the overall safety and perceived quality of the vehicle. It can lead to driver discomfort and dissatisfaction.

From safety concern key point brake noise, particularly squeal cam impact driver confidence and perception of vehicle safety. The noise might make drivers hesitant to apply the brakes in critical situations, potentially increasing the risk of accidents.

Brake noise often results in customer complaints and dissatisfaction. This can have a detrimental effect on an automotive manufacture's reputation and lead to reduced customer loyalty and sales.

Methodology

- Study of existing design, working and operation.
- Data accumulation
- Design Calculations
- Modification in existing design
- Result discussion
- Validation of result

REFERENCES

1. De Gruyter, "Review of Conventional and Non-Conventional materials are used in production of brake pads" Science and Engineering of Composites of Materials, November 2020 P-SECM: 2020-0041
2. Vipul Matariya and Prof. Hiren Patel, "Topological Optimization of Automobile Rotor Disk Brake,", SSRG International Research Journal of Engineering, Vol.6, Issue 4, April 2019, ISSN: 2348-8360.
3. Shahabaj Bagwan & Prof. S. R. Shelge, "Review on Study and Analysis of Disc Brake to Reduce Disc Brake Squeal,", International Journal of Innovative Science, Engineering and Technology (IJISET), Vol.2, Issue: 4, April- 2015, e-ISSN: 2348-7968.
4. Mohamad Arman, Shubham Singhal, Pankaj Chopra, Mayuk Sarkar, "A review on material and wear analysis of automotive Brake pad", Materials Today Proceedings, Volume 5, Issue14, Part 2, December 2018, Pages 28305-28312.
5. Mr. V. S. Chavan, Prof. S. D. Kachave, Prof. H. P. Deshmukh, "A REVIEW ON WEAR ANALYSIS OF BRAKE PAD", International Journal of Advance Engineering and Research Development, Volume: 05, Issue: 12, Dec - 2017, e-ISSN: 2348-4470, p-ISSN: 2348-6406.
6. Anudeep Kumar Kankanala & Dr. Mayukh Sarkar, "A review on Material, Wear Indication and Wear Analysis of automotive Brake pad", International Research Journal of Engineering and Technology, Volume 7, Issue 8, Part 2, August 2020, e-ISSN: 2395-0056, p-ISSN: 2395-0072.
7. Shoaib Munir Mulani, Ashwin Kumar, Haris Naiyer E Azam Shaikh, Pravin Kumar Singh, Piyush Chandra Verma, "A review on recent development and challenges in automotive brake -pad disc system.", Materials Today Proceedings, Volume 56, Part 1, February 2022, Pages 447-454.
8. Swapnil Thigale and Chinmay Shah, "WEIGHT REDUCTION IN BRAKE DISC USING TOPOLOGY OPTIMIZATION.", International Journal of Research In Engineering and Technology, Volume 5, Issue 10, Oct-2016, e-ISSN: 2319-1163, p-ISSN: 2321-7308.