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Steel Fiber High Performance Concrete: A Review

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ABSTRACT:

High Performance Concrete, has gained popularity recently. The modern concept of HPC has been broadened to include strength and durability. Applications for high-performance concrete (HPC) in civil engineering are quite diverse and include everything from thin pavements to large constructions like bridges and high-rise skyscrapers. In this review many researches based on steel fiber HPC are studied and conclude that The behavior of HRC is better as compare to normal concrete in terms of strength.

I. INTRODUCTION

In recent past there are many applications of High Performance Concrete spread throughout the world ranging from the making of industrial floors, nuclear power projects to high rise infrastructure buildings and water retaining structures. Many research works are still under progress in the field of HPC so as to meet the likely demands of the fast growing construction industry and performance requirements. Today, the definition of HPC has vastly expanded to encompass both durability and strength of the structural components.

II. HIGH PERFORMANCE CONCRETE

"High Performance Concrete is concrete that has been specifically chosen to meet its intended use." It's not mysterious, doesn't require strange substances, and doesn't require the usage of specialized equipment. To create a concrete mix within strictly regulated tolerances, all we need is an awareness of the behavior of the concrete. The use of High Strength concrete is used in the construction of Earth-quake resistant structures, long-span bridges, off-shore structures and other mega structures will result in lighter sections, leading to cost effectiveness of structures.

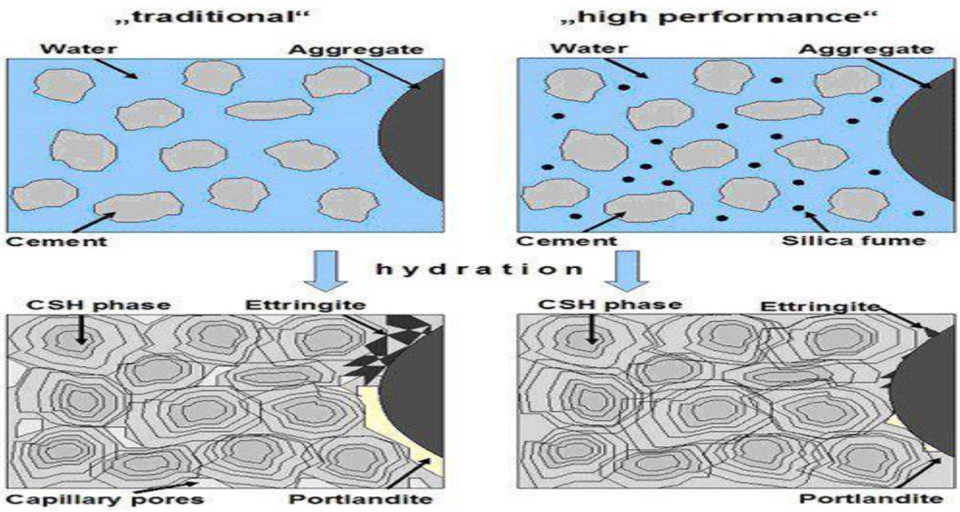

Figure 1 Mechanism of HRC

III. LITERATURE REVIEW

Various works are given on the steel fiber HRC. which summarized are as follows-

V. S. Parameswaran (1999) Early in the 1970s, research and development on fiber-reinforced concrete composites started in India. Fibre concrete technology is being utilised for in situ strengthening and repairs of concrete structures, as well as the fabrication of precast concrete components. It is no longer limited to laboratory research. Applications currently include pipes, manhole covers and frames, flooring and roofing components, precast thin-wall parts, building structures resistant to blasts and currency vaults.

Nguyen Van CHANH (2002) The fiber composite's capacity to absorb energy and endure repeated shock or impact loading would significantly improve if the material underwent a metamorphosis from brittle to ductile. The mechanics, technology, and applications of SFRC are covered in this study.

Hamid Behbahani (2011) While the idea of using fibres to reinforce brittle materials is not new, the use of fibres in concrete in the current era dates back to the early 1960s. Over the past thirty years, more research and development on fiber reinforced concrete (FRC) has been undertaken in recognition of the enhanced qualities of the products made of FRC. An overview of the benefits, uses, and mechanical characteristics of steel fibre reinforced concrete (SFRC) is provided in this study.

A.M. Shende (2012) In order to investigate the compressive strength, flexural strength, and split tensile strength of steel fibre reinforced concrete (SFRC), which contains fibres with a volume fraction of 0%, 1%, 2%, and 3% of hook tain, a critical investigation was conducted for M-40 grade concrete with a mix proportion of 1:1.43:3.04 and a water cement ratio of 0.35. Aspect ratios of 50, 60, and 67 steel fibres were employed. The collected result data has been examined and contrasted with a control sample that contains no fibre. A graphic representation of the link between aspect ratio and split tensile strength, flexural strength, and compressive strength. The outcome data indicates a definite percentage increase in 28 days. Compressive, flexural, and split tensile strengths for concrete in the M-40 grade.

Patil Shweta (2014) According to the applicable IS standards, compressive strength and flexural strength are the different strength parameters that were investigated. The experimental findings show that the flexural strength of concrete is greatly increased by the addition of steel fibre. Additionally, it shows that by raising the aspect ratio of fibre from 40 to 70, flexural strength rose from 36.7% to 58.65% while maintaining a constant amount of 1.5% of fibre. The study suggests that steel fibre reinforced concrete can be utilised to create curved forms because of these characteristics.

Tomasz (2015) While witness concrete destruction is a three-stage process, compression of fiber-reinforced concrete is a two-stage procedure. It may be concluded that the σ-ε relationship for concrete in compression is affected by the addition of steel fibres, and that the height of the number of steelfibres added to the concrete mixture increases the level of critical stresses (σcr). Crack propagation in concrete is influenced by the presence of distributed reinforcing during compression.

Ahmad Bazgir (2016) The purpose of this study is to explore and analyse the structural behaviour of concrete reinforced with steel fibres at varying fibre volume fractions. This study uses experimental methods to gather data on the behaviour of SFRC. Concrete is being tested in three different states: tension, compression, and flexure.

Avinash Joshi (2016) Steel fibres serve as a bridge to slow the spread of cracks and enhance a number of the concrete's qualities. It is well known that fibres have a major impact on how workable concrete is. In this study, the variable was the percentage of steel fibre volume fraction (0, 0.5, 1.0, and 1.5), and the aspect ratio (50). For the hardened properties of the concrete, its flexural strength, splitting tensile strength, and compressive strength were measured. Their primary goal is to make the material more resilient and capable of absorbing energy. However, the main goal is frequently to raise the tensile and flexural strength as well. There was a little increase in the final strength. The ductility was much improved by the fibre addition.

Y. Gündüz (2016) In four different volume fractions, three distinct hookedended steel fibres were introduced to a high-performance concrete. Flexural tensile strength tests were used to determine the mechanical strengths and fracture energy of concretes. The findings of the tests indicated that the types of hooked ends had a significant impact on the fracture energy and post-cracking behaviour of high performance steel fibre reinforced concretes (HPSFRCs).

Mohd. Gulfam Pathan (2017) Because it is easily worked and can be shaped into any shape, concrete is a material that is widely utilised in the construction sector. Ordinary cement concrete has extremely little resistance to cracking, very little ductility, and very poor tensile strength. The primary cause of the brittle failure of concrete is internal microcracks, which are caused by the concrete's brittle nature and inability to withstand tensile pressure. This essay explains the various uses of SFRC and how they can be applied to boost strength and generate better crack resistance.

Satyashiva prasad nannuta (2017) High strength concrete has found more uses in many parts of the world in recent years. The demand for high strength concrete and recent technological advancements have made this rise possible. Using high strength concrete in building construction has various benefits. For example, reducing the size of the members, lowering their own weight, and removing the formwork early.

Majid Jaral, (2018) Material recycling has received attention in many developed nations, including India, due to concerns about waste creation, lower material costs, and resource conservation. The recycling of materials from industrial wastes either suggests environmental benefits or aids in the preservation of natural resources. Steel fibre reinforced concrete (SFRC) is a composite material composed of discrete steel fibres that are discontinuous and used as a raw material in hydraulic cements including fine and coarse aggregate. Due of its low tensile strength, concrete can fracture brittlely by causing microcracks to spread. A review research on the use of steel scrap in stiff pavement is presented in this publication.

Nithin Dsouza (2018), The experimental results for M25 Grade concrete with hooked end steel fibre dosages of 0.5%, 1%, and 1.5% by weight of concrete having an aspect ratio of 60 are discussed in this study together with the plain concrete and SFRC results. The findings demonstrate that, as compared to conventional concrete, the strength and durability qualities of SFRC with different steel fibre doses improved.

Shashank Shubham (2020), For a theoretical discussion on the topic of steel fibre reinforced concrete, see this paper. Here, we talk about using language and behavioural models that aim to explain material performance without getting into specifics of mathematics. Here, we demonstrate that the flexural strength of concrete reinforced with steel fibres is directly correlated with its steel fibre content and negatively correlated with its water-to-cement ratio. The purpose of the various allusions from classic and early writers is to connect the topic chronologically. In order to provide context for the current understanding of steel fibre reinforced concrete, a historical review was conducted.

Arivalagan S (2022) The stress-strain relationship, fibre length, and orientation all have a significant impact on post-cracking resistance. Below a certain length, the spacing between reinforcements doesn't seem to have much of an impact on the spread of cracks. Compression and split tensile tests are performed on M20 grade concrete in this project. The cubes and cylinders are cured in a casting for 7, 14, and 28 days. This project uses steel fibres with three distinct volume percentages of fibres: 0.50 percent, 0.75 percent, and 1.0%. The addition of fibre shown an increase in both tensile and compression strength.

Inayat Ullah Khan (2022) The dose effect of steel fibre in various ratios on the compressive, splitting, tensile, and flexural strengths of concrete is assessed in this experimental setup. It is also looked into how flexure and compressive strength relate to the amount of steel fibre used. By using steel fibre, compressive and flexural strengths were shown to be significantly increased. Additionally, the impact of steel fibre length on the mechanical characteristics of concrete is examined. In compression and flexure, a 2% dosage of steel fibre with a 300 length performed admirably.

Muhammad Nasir Amin (2022) In order to determine the essential components of steel fiber-reinforced concrete (SFRC), this study conducted a scientometric analysis of the literature. The ability of standard review papers to connect various sections of the literature in a structured and methodical way is restricted. The co-occurrence, co-citation, and knowledge mapping components of current research are the most difficult. The data needed to fulfil the study's objectives was found and obtained using the Scopus search engine.

Relevant publication sources, keyword analysis, prolific authors based on publications and citations, top papers based on citations received, and regions actively involved in SFRC investigations were identified during the data evaluation process.

ÖzerZeybek (2022) The purpose of this study was to investigate the impact of fibre content on the concrete's fresh and hardened states through an experimental investigation. In order to accomplish this, tests for compression, splitting tensile, and flexure were conducted to monitor the performance of concrete containing recycled steel tyres at ratios of 1%, 2%, and 3%. As the volume percentage of steel fibre in concrete increases, the material's mechanical qualities improve. However, adding 2% steel fibres resulted in a noticeable decrease in workability.

IV. CONCLUSION

It has been discovered that adding steel fiber to concrete improves its strength and toughness in comparison to untreated concrete. Improved abrasion resistance, flexural strength, impact resistance, high flexural and fatigue flexural durability are all achieved with steel fiber reinforced concrete. These days, steel fiber reinforced concrete is a relatively affordable architectural option. The ductility of concrete is increased by the addition of steel fibres.

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