A REVIEW STUDY ON THE STEEL FIBER REINFORCED CONCRETE PAVEMENT

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***Abstract*: Concrete pavement is a key structure of highway pavement in India due to its increase in ride superiority, minimum maintenance, and extended design life. These rigid pavements may sometimes experience pavement distress that results in premature failure. This research studies the application of fibers in concrete due to its enhancement resistance to cracking. Now–a-days steel fibers in concrete increase intensively as an engineering demand. From the present scenario it is not only essential to provide safe, efficient and economical design, but it also provide as balanced base for future application. The energy consumption and cost associated with concrete pavements can be reduced through the use of recycled materials with more effective construction techniques. In many developed countries like India, anxiety over resource conservation, reduced material cost and waste production have paying attention on recycling of materials. This recycling of materials from industrial wastes either helps to conserve natural resources or propose environmental profits. Steel fiber reinforced concrete (SFRC) is composite material made of hydraulic cements containing fine and coarse aggregate and using discontinuous discrete steel fibers as raw material. Concrete have poor tensile strength propagate micro-cracks and leading concrete to the brittle fracture. This paper presents a review study to utilization of steel scrap in the rigid pavement.**

***Keywords*: Steel scrap, compressive strength, Concrete, Optimum percentage of steel scrap, Compressive strength.**

1.0 INTRODUCTION

Concrete is the most suitable material which is used in construction worldwide. Generally, concrete is made by mixing cement, sand and aggregate together and water as lubricant. Also, some admixtures and chemicals used in concrete making to improve properties of concrete. Along with the development of technology, the research conducted to improve the properties of concrete, among others, with the addition of fiber. Nowadays, different wastes such as fly ash, blast furnace slag, quarry dust, brick bats, broken glass waste and its powder, Steel waste, Coconut shells, E-waste, Plastic waste, Marble dust powder, Paper and pulp mill waste, Sugar cane industry waste etc. can be used in many developed countries. As per rapid Industrialization, steel producing industries increasing year and year. These industries produced steel waste and gases which are very harmful to the environment. In India steel waste generated from steel industry is very high. This waste may be dumped in to the barren land and other disposal places. Recycling of steel waste reduces the steel waste but recycling steel has low quality and recycling cost is high. However recycled steel is not used in construction, so we are using steel scrap waste in concrete which reduces the consumption of reinforcement and cost of structure. At present day Reinforced concrete structures are very popular worldwide. R.C.C. structure has good load bearing capacity. Also it has very good resistant against wind and earthquake forces. R.C.C. structures are made from concrete and steel. Concrete has good compressive strength and steel has good tension strength. So, structure remains stable against various forces.

1.1 ROLE OF STEEL FIBRES IN PAVMENTS

Plain concrete pavements have low tensile strength and strain capacity, however these structural features are improved by fibre summation, allowing simplification of the pavement layer thickness. This performance can be more and depends on fibre feature and dosage. The most substantial act of fibre reinforcement is to retard and control the tensile cracking of concrete. Therefore it is found to have more affect on the pavement cost due to decreased thickness essentials, low maintenance costs and longer useful life. Comparing with the life cycle of an asphalt road, SFRC pavements have been described to last twice as long.

- **Social Development**

The modern conception of the project is the use of reused steel wire as concrete fibre reinforcement, which provides extra environmental profits for tyre reprocessing over land filling. In order to measure the economic and environmental picture of the manifestation pavement, life cycle cost analysis (LCCA) and life cycle assessment (LCA) studies.

- **Economic development**

Utilization of steel filaments influences critical changes in flexure, to effect and weariness quality of cement. It has been utilized as a part of different sorts of structures. Development of recycled steel tyre cord (RTC) fibre reinforcement as an economical alternative to industrially produced steel fibres, used normally in SFRC construction.

- **Strategic Need**

Steel fibers have been needed for a large time in construction of roads and also in floorings, especially where more wear and tear is come into picture. Specifications and nomenclature are crucial for a material to be utilized as the tenders are invited based on specifications and nomenclature of the items. In a place where steel fiber reinforced concrete was applied for overlays like flooring, adopting nomenclature can be taking up for concreting of small thickness.

2.2 LITERATURE REVIEW ON STEEL SCRAP

Elavarasi.D et al studied the Structural behaviour of High Strength Steel Fibre Reinforced Concrete (HS-SFRC) block pavement. In this study an experimental program was carried out to investigate the structural behaviour of High strength steel fibre reinforced (HS-SFRC) block pavements. High strength plain cement concrete blocks (HSC) were also casted for comparison purpose. Three different fibre contents (0.5%, 0.75% & 1.0% by volume fraction) were considered. The results obtained have shown that the addition of the steel fibres has increased the compressive strength, flexural strength, tensile strength and abrasion resistance and the deflection of beam and pavement block was decreased at the age of 28 days. It is observed that strength properties of HS-SFRC 1.0% are high compared to 0.5% & 0.75% of fibre content. It is clearly shown that the increase in strength is due to the increase in fibre content. The test results were compared with High strength concrete (HSC – control mix).

S.S. Kadam et al studied the Effect of different aspect ratio of steel fiber on mechanical properties of high strength concrete. In this study, the effects of different aspect ratio (65 and 80) of steel fiber on mechanical properties of high strength concrete are addressed. Mechanical properties of high strength concrete investigated by varying positions of steel fiber in concrete cubes and beams. Percentage of steel fiber by volume was 0.5%, 1.0% and 1.5%. A series of 78 specimens (39 cubes and 39 beams) of different aspect ratio and varying positions of steel fibers were cast. And it was observed that as percentage of fiber increases workability reduces. The reduction in workability is due to more water required to lubricate more amount of fiber. As amount of fiber increases less space is available for movement of fiber. Experimental findings addressed that as volume of fiber increases; there will be increase in flexural strength. More flexural strength was observed at aspect ratio 80. In flexural strength test more displacement was observed at one third depth than randomly reinforced fibers. Steel fiber reinforced concrete can be used for construction of pavement, industrial floors, bridge deck slabs satisfactorily. For aspect ratio 80 it was found that compressive strength increases in both positions of steel fiber. Empirical equations for predicting basic strength properties of concrete were presented based on regression analysis.

Sajad Ahmad Mir Et Al experimentally investigated about scrap steel reinforced with m20 concrete. The objective of this kind of work is to study the properties of concrete ,when it is reinforced with the scrap steel fibers generated from the lathes . In this technology age these scrap material can be added to concrete ,it improves the workability and mechanical properties of concrete .this scrap material when is added to concrete it is called steel fiber reinforced concrete .various research work has taken place on this type of concrete .in this experimental investigation , scrap steel of diameter 0.5mm and length of 40mm was used with aspect ratio of 80mm and the fibers was used in varying percentages as 0%,0.4% ,0.8%,1.2% ,1.6% ,2% & 2.4% by the weight of concrete on m20 grade of mix (1:1:6:2.99) with water cement ratio 0.42. as for the experimental work is concerned following tests are performed like flexural strength test compressive strength and split tensile test. the flexural strength were tested after 7 days and 28 days and the compressive strength was conducted on the cubes .the specimens were placed under the apparatus .the split tensile strength of concrete mixtures was calculated after 7 days & 28 days aci-544,2r-89,refer splitting test for the fiber content concrete. from the result it clearly showed that the split tensile strength increases with the scrap steel reinforced with concrete .and result also showed that the mechanical properties of scrap steel increases up to 1.6% fiber contents on further increasing, it decreases strength aci also recommend use of fiber content up to 2 % more, it needs further investigation

Aquib Sultan Mir et al studied on Strength Properties of Rigid Pavement Concrete with Use of Steel Fibers and Marble Dust. Materials used in this study are cement, coarse aggregates, fine aggregates, and super-plasticizer, in addition to marble dust and steel fibres. These materials were read in terms of various Indian practices. This paper depicts ongoing researches about the study of rigid pavement concrete strength using steel fibre and Marble dust. Many analysis pertaining to steel fibre reinforced concrete and Marble dust were studied, and their effects were also laid down to a particular conclusion. The conclusion that was drawn out of these studies was that the compressive strength showed an immense increase on use of steel fibre and Marble dust in the rigid pavement concrete, where in marble dust was used as a partial replacement for cement. Also changes were found out in various cases of cube strength, split tensile strength and the flexural strength. It also showed the effect of use of a waste material in the form of waste marble dust being used as a partial replacement material for any cementious compound and ultimately acquiring a strength in particular more than that of a nominal mix.

CONCLUSION

The major conclusions drawn from this research are presented below:

1. Compressive strength and split tensile strength were slightly increased due to the increased percentage of fibre content.
2. The Experimental work also showed that the workability of SFRC gets reduced as we increased the fiber amount.
3. Flexural strength was also increased by the addition of steel fibres.
4. As percentage of fiber increases flexural strength also increases in both the position that is at randomly reinforced fiber concrete and fibers reinforced at 1/3rd depth from top of the surface.
5. SFRC is a sustainable improvement inside the present technology.
6. The studies additionally establish that the residences of hardened SFRC, consisting of flexural electricity, are remarkably higher than those of conventional RCC. Thus, the use of metal fibre for powerful pavement construction can be cautioned undoubtedly.
7. Addition of metallic fibres reduces the workability of concrete; hence it becomes important to utilize top notch plasticizers. And those SFRC is used for foremost, high budget tasks only because Steel fibres are value effective.

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