Publication URL: https://ijrdo.org/index.php/mce/article/view/3007

Experimental Investigations on Cement Concrete by Using Different Steel Waste as a Fibre to Strengthen the M40 Concrete

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Abstract: As the human going to grow in technology enhances not only human comforts but also damages the environment. Use of metals as containers has become popular and safe now, especially to carry the liquids. Inspite of the inherent advantages and disadvantages existent in its disposal. Today the construction industry is in need of finding cost effective materials for increasing the strength of concrete structures. Hence an attempt has been made in the present investigations to study the influence of addition of waste materials like lathe waste, soft drink bottle caps, empty waste tin, waste steel powder from workshop at a dosage of approximate 0 To 1.6% of total weight of concrete as a fiber. The lathe waste, empty tins, soft drink bottle cops were deformed into the rectangular strips of 15mm to 25mm in size. Green building is an increasingly important global concern and a critical way to conserve natural resources and reduce the amount of materials going to our landfills. Large quantities of metal waste are generated from empty metal cans and bottle caps of juices and soft drinks. This is an environmental issue as metal waste is difficult to biodegrade and involves processes either to recycle or reuse. In this investigation, a comparison have been made between plain cement concrete and the fiber reinforced concrete containing lathe scrap (steel scrap)in various proportions by weight. The fiber used is irregular in shape and with varying aspect ratio. The 28 days strength of WSFRC for compressive strength, tensile strength and flexural strength is found to be increased when compared with the 28 days strength of plain cement concrete. Experimental investigation has been done by using M40 mix and tests has carried out as per recommended procedure by with conventional concrete has been gain more tensile strength as well as compressive strength .concrete is weak in tensile strength and strong in compression so while we improve the tensile strength.

Key Words: Fibre, Steel waste, lathe waste, bottle caps, cans, Compressive Strength, Split tensile Strength, flexural Strength

INTRODUCTION

Today, the world is facing the construction of very challenging and difficult civil engineering structures. Concrete, being the most important and widely used material, is called upon to possess very high strength and sufficient workability properties and efforts are made in the field of concrete technology to develop the properties of concrete by using fibres and other admixture in the concrete up to certain proportions. In the view of the global sustainable developments, it is imperative that Waste Steel Fiber Reinforced Concrete (SWFRC) provide improvements in the tensile strength, toughness, ductility, post cracking resistance, fatigue characteristics, durability, shrinkage characteristics, impact, cavitations, erosion resistance and serviceability of concrete. Due to these benefits, the use of SWFRC has increased during last two decades. In each lathe industries wastes are available in form of steel scraps are yield by the lathe machines in process of finishing of different machines parts and dumping of these wastes in the barren soil contaminating the soil and ground water that builds an unhealthy environment. Now a day’s these steel scraps as a waste products used by innovative construction industry and also in transportation and highway industry. In addition to get sustainable progress and environmental remuneration, lathe scrap as worn-recycle fibers with concrete are likely to be used. When the steel scrap reinforced in concrete it acquire a term, fiber reinforced concrete. Concrete in general is weak in tensile strength and strong in compressive strength. The main aim of researchers or concrete technologists is to improve the tensile strength of concrete. To overcome this serious defect, partial incorporation of fibers is practiced. Great quantities of steel waste fibers are generated from industries related to lathes, empty beverage metal cans and soft drink bottle caps. This is an environmental issue as steel waste fibers are difficult to biodegrade and involves processes either to recycle or reuse. Fiber reinforced concrete is an interesting topic discussed by numerous researchers in the last two decade. Concrete has an extensive role to play in the construction and improvement of our civil Engineering and infrastructure development. Its great strength, durability and veracity are the properties that are utilized in construction of Roads, Bridges, Airports, Railways, and Tunnels, Port, Harbours, and many other infrastructural projects. Use of admixtures to concrete has long been practised since 1900. In the early 1900s, asbestos fibres were used in concrete. There was a need to find replacement for the asbestos used in concrete. By the 1960s, steel, glass (GFRC) and synthetic fibres such as polypropylene fibres were used in concrete. Great quantities of steel waste fibers are generated from industries related to lathes, empty beverage metal cans and soft drink bottle caps. This is an environmental issue as steel waste fibres are difficult to biodegrade and involves processes either to recycle or reuse. The resulting compressive strength, split tensile strength and flexural strength of the mixture depends on the type of cement, size and type of aggregate, period and type of curing adopted. Admixtures is defined as a material, other than Cement, water and aggregate, that is used as an Ingredient of concrete and is added to the batch immediately before or during mixing. Chemical admixture and Mineral admixture. In this investigation mineral admixture are the metallic waste obtained from varies sources such as mild steel lathe waste, empty beverage tins, soft drink bottle caps are deformed into the rectangular from with an approximate size of 10mm to 15mm as in the form of fibers. These fibers are added in the concrete with 0.4%, 0.8%, 1.2%and 1.6% by weight of concrete. Ordinary Portland Cement (OPC) 43 grade and fine aggregate with less amount of clay and silt with sand size is passing through 1.19mm sieve and retained on 900micron sieve. The coarse aggregate used in 20mm & 10mm size. It is well graded and potable water, free from impurities such as oil, alkalies, acids; salts, sugar, and organic materials were used.

(a)

(b)

(c)

(d)

EXPERIMENTAL PROGRAMME

The main objectives of the experimental programme are experimental investigation on cement concrete by using different steel waste as a fiber to strengthen the concrete and study the physical and chemical properties of cement by adding the steel waste and to study the effects of using steel waste as a fiber on the performance of concrete. To achieve these objectives, two major experiments were designed.

The first experiment (experiment 1) was done to determine the effects of replacing part of ordinary Portland cement with marble waste powder on various properties of cement such as water requirement or normal consistency, setting time, soundness, compressive strength and flexural strength.

In order to achieve the objective of present study, an experimental programme was planned to investigate the effect of steel waste on the strength characteristics of concrete. The main parameters investigated in this study were compressive strength, split tensile strength and flexural strength.

Table 1 Characteristics Properties of Cement

Sr. No.	Characteristics	Experimental value	Specified value as per IS:8112-1989
1	Consistency of cement (%)	34%	---
2	Specific gravity	2.99	3.15
3	Initial setting time (minutes)	35	>30 As Per IS 4031-1968
4	Final setting time (minutes)	282	<600 As per IS 4031-1968
5	Compressive strength (N/mm^2) (i) 3days (ii) 7 days (iii)28days	25.88 40.24 47.70	>23 >33 >43
6	Soundness (mm)	1.00	10
7	Fineness of Cement	5%	10% As Per IS 269-1976.

Table 2 Physical Properties of Aggregates

Sr.No.	Specific Gravity of Fine Aggregates	2.65
1	Specific Gravity of Coarse Aggregates	2.87
2	Free Moisture Content	2%
3	Water Absorption	1.82%

Compressive strength test

Split tensile strength test

Table -3: compressive Strength by adding waste steel fibre

Sr. No.	%of waste steel	Compressive Strength at 7 days	Compressive Strength at 28 days
1	0	30.50	48.29
2	0.4	31	49.02
3	0.8	31.89	49.64
4	1.2	32.69	50.32
5	1.6	32.48	51.23

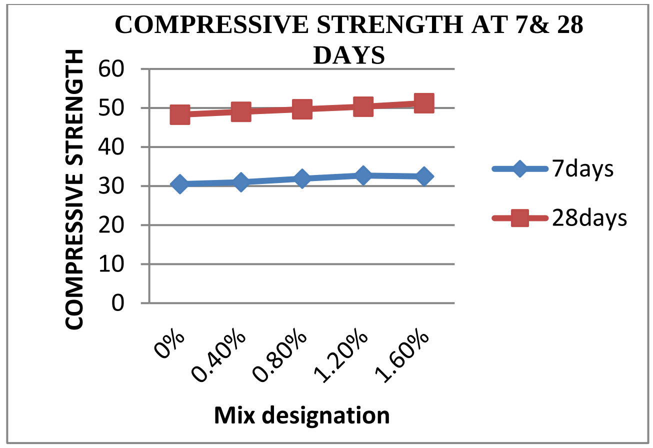

Figure No. 5: Graph comparing compressive Strength for 7 and 28 days

Table -4: Split Tensile Strength by adding waste steel fibre

Sr.No.	%of waste steel	Split Tensile Strength at 7 days	Split Tensile Strength at 28 days
1	0	1.86	3.15
2	0.4	2.09	3.36
3	0.8	2.28	3.62
4	1.2	2.47	3.81
5	1.6	2.41	3.76

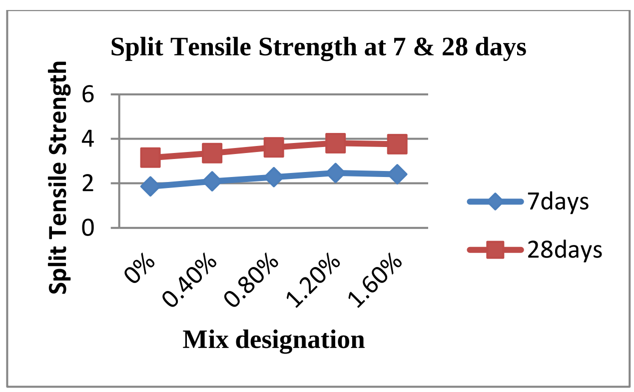

Figure No 6: Graph comparing Split Tensile Strength for 7 and 28 days

Table -5: Flexural Strength by adding waste steel fibre

Sr. No.	% of waste steel	Flexural Strength at 7 days	Flexural Strength at 28 days
1	0	3.81	5.99
2	0.4	4.06	6.23
3	0.8	4.32	6.49
4	1.2	4.48	6.69
5	1.6	4.42	6.59

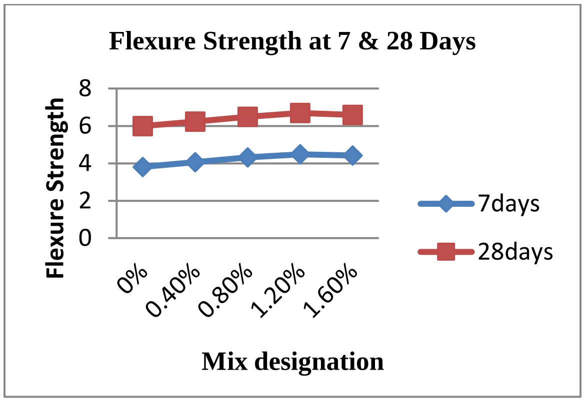

Figure No. 7 : Graph comparing Split Tensile Strength for 7 and 28 days

CONCLUSIONS

Based on the results obtained in the present investigation, the following conclusion can be drawn.

1] The results obtained in the present study indicates that it is feasible to add the steel waste as a fibre for improving the strength characteristics of concrete up to 1.2% after this decreasing at 1.6%. thus the WSF can be used as an additive material for the production of concrete to address the waste disposal problems and to maximize the strength of concrete with usages of WSF which is most cheaply available.

2] With the addition of the waste steel fibre

3] Addition of waste steel fibres helps in increasing ductility of concrete.

4] Addition of waste steel fibres in high strength concrete adds more advantage compared to its addition in normal strength concrete. High strength concrete has a compact structure, low water cement ratio. As the temperature increases more internal stresses are induced causing bursting or explosive spelling. Waste steel fibres helps in decreasing the internal pressures and also helps in improved flexural and split strengths.

5] The geometry of waste steel fibres helps in better bonding of concrete, it also helps the fibres to act more efficiently as abridge in reducing the fracture of concrete. It also helps using attaining fibre free surface.

6] Fiber addition improves ductility of concrete & its post-cracking load carrying capacity.

7] Increases the cube compressive strength of concrete in 7 days to an extent of + i7.01%

8] The increase in the various mechanical properties of the concrete mixes with polythene fiber is not in same league as that of the steel fiber.

9] Increases the cube compressive strength of concrete in 28 days to an extent of 4.21% at the dosage of 1.2% of addition of waste steel fibre.

10] Increases the split tensile strength of concrete in 28 days up to 21.25 % at the 1.2% of fibre addition. It is much higher strength increment at last specimen in our study .it shows that as per our objective we can gain better tensile strength.

11] In this the flexural strength of concrete at 1.6% of waste steel fibre addition in concrete at 28 days at a percentage of 11.78%.

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