Utilization of Waste Steel Scrap for Increase in Strength of Concrete-Waste Management

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Abstract— Due to rapid growth of population, rapidly increasing in industries which directly increases waste without any management. In this world where some countries are developed and some are developing, the unbelievable demand of steel is on its peak, but it leads toward a dumping ground of industrial waste. For reduction of this dumping of scrap and save the earth from this hazardous problem utilization of steel scrap in concrete is the key step for save the environment and achieving sustainability that will enable the earth to continue to support human life. This paper presents a research to utilization of waste (CNC lathe waste) by partial replacement (5% by weight of natural coarse aggregate) with coarse aggregate. Also for the increment in strength of concrete, wire mesh is used while casting in the form of $10mm^3$ cubes.

Key words: Steel scrap, CNC steel scrap, Concrete, Coarse aggregate

I. INTRODUCTION

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 and Railways. In present days the construction industry is in need of finding cost effective materials for increasing the strength of concrete structures. It is the time to think about sustainable development by reducing the wastes generated or reusing it. Hence an attempt has been made in the present investigations to study the performance of addition of waste materials steel lathe waste fiber (CNC lathe waste) from workshop 5% by weight of coarse aggregate with and without wire mesh. Experimental investigation was done using M20 mix and tests were carried out as per recommended procedures by relevant codes. Total of 9 specimens of scrap concrete and PCC were made. This paper aims to have a comparative study between CNC scrap concrete with and without wire mesh and conventional concrete in M20 concrete. The test parameters include compressive strength, Rebound hammer and UPV test of conventional concrete and steel scrap in concrete with and without wire mesh.

II. OBJECTIVE AND SCOPE OF WORK

India, steel scraps are increasing day by day as a part of industrialization. These scraps are produced mainly due to industrial wastes, constructional waste, steel industry wastes etc. The rapid progress of steel industry has aggravated environmental and waste management problems. This has led to increasing pressure from Government and the public to speed up action plan for effective industrial waste management. The waste management in steel industry is an emerging complex issue and can be implemented after regulating through monitoring, analysis, legalization, addition of infra-structural facilities for enforcement, waste auditing, change of process technology etc. Development of steel industry has brought with it environmental degradation. Environmental conservation has become an increasingly more important aspect of our daily lives. With the rapid and extensive industrialization and urbanization in many parts of India, there is a dawning realization that ultimate prerequisite for man's survival could well be the preservation of environment. We live under horns of dilemma. However, our expectations and our perceptions of what constitutes a minimum standard of living have put increasing pressure on both the public and private industrialists to ensure clean and healthy environment. The present investigation uses waste turn fibers from lathe industry which clearly showed that waste fibres reinforcement significantly improves the behaviour of composite materials and these composite shows more strength with wire mesh.

So idea behind the study is the utilization of steel scrap in improvement in the strength of concrete and use of waste for savior of earth. Wire mesh is also used with concrete for increasing in strength and a very minor increase in cost.

III. MATERIALS USED

MATERIALS	SPECIFICATION
Cement	Ultratech (PPC with Fly Ash)
Fine Aggregate	Natural Sand (M. Sand)
Coarse Aggregate	20mm, 10mm
Water	Portable Water
Steel Scrap: CNC lathe waste	Irregular Size
Wire Mesh	2.5 mm Gauge
Concrete	M20 (1:1.5:3)

IV. EXPERIMENTAL WORKS

Fig. 1: Wire mesh inside cube with Square size

To test the concrete for compression various cubes (150mm x150mmx150mm) were cast respectively. The mix

adopted is M20 (1:1.5:3) and to this CNC lathe waste are added. For 5% percentage of CNC lathe waste in concrete 9 cubes (3 cubes with wire mesh, 3 cubes of without wire mesh and all 6 cubes have replaced 5% by weight of coarse aggregate) are casted. Specimen is tested and strength is obtained by compression test after 28 days in N/mm^2. The rebound hammer and UPV test perform after 7days, 14days and 28 days. The wire mesh inside the cube shown in figure 1 and the CNC lathe waste used for replacement f coarse aggregate shown in figure 2.

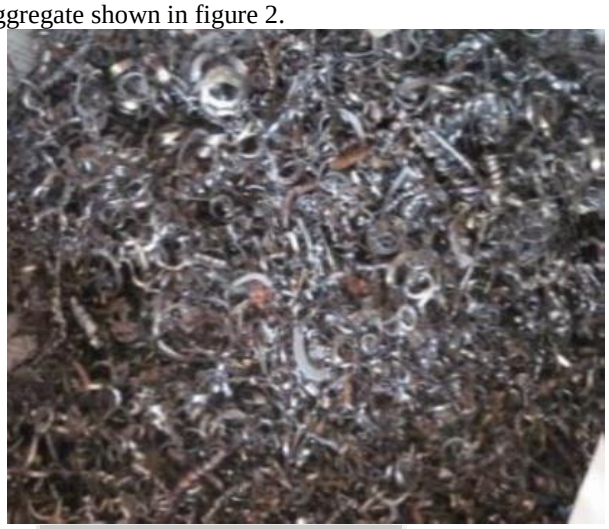

Fig. 2: CNC Lathe Waste

V. Results and Discussion

The results for all the 3 cases i.e.

Case 1- Cubes made by replacing 5 % of normal aggregates with CNC lathe waste without wire mesh
Case 2 -Cubes made by replacing 5 % of normal aggregates with CNC lathe waste with wire mesh

Case 3 -Cube made with normal aggregates.

VI. Rebound Hammer Strength

Rebound hammer strength (MPa) for the three cases after 7, 14, 28 days are given in table 1 it is also shown in Fig 3

Days	Case 1	Case 2	Case 3
7	35.13	30.23	21.446
14	33.40	38.36	23.3
28	34.43	39.72	26.73

Table 1: Rebound Hammer Strength (MPA)

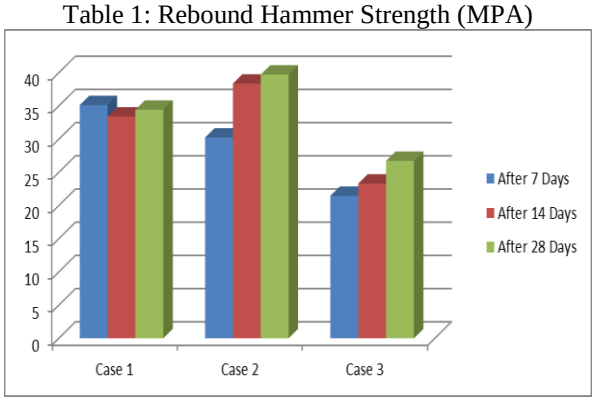

Fig. 3: Average Rebound Hammer Strength (MPa)

After comparing average values of rebound strength at a interval of 7, 14 and 28 days for all the 9 samples it was found that the value comes out to be maximum in the case of "cubes with CNC lathe waste as aggregates and with mesh" at 28 day. Hence it can be concluded wire mesh increase the strength while using with CNC lathe waste as aggregate.

VII. Ultrasonic Pulse Velocity Value

Ultrasonic pulse velocity (m/sec) for the three cases given in Table 2 and shown in Figure 4

Days	Case 1	Case 2	Case 3
7	4166	4311	4103
14	4266	4488	4246
28	4408	4606	4403

Table 2: Ultrasonic Pulse Velocity (m/sec)

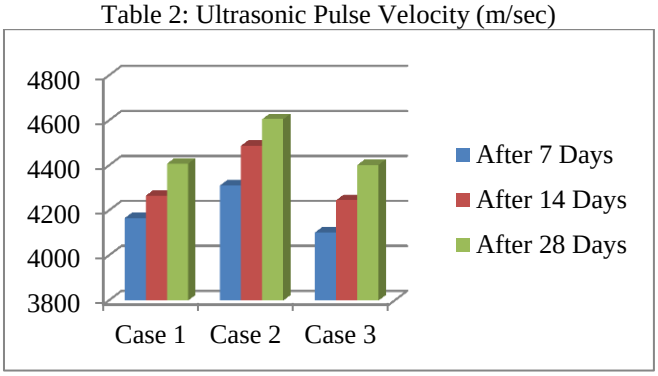

Fig. 4: Average Ultrasonic Pulse Velocity Values

After comparing average values of Ultrasonic Pulse Velocity at a interval of 7, 14 and 28 days for all the 9 samples it was found that the value comes out to be maximum in the case of "Cubes With CNC lathe waste As Aggregates And With Mesh At 28 Days".

Hence it is observed that wire mesh affects the pulse velocity in normal aggregate case is in range of CNC lathe waste without wire mesh and with wire mesh

VIII. Compression Testing Machine Value

Compression testing was carried out using a 2000 KN capacity compression testing machine. The average compression strength (MPa) is given in Table 3 and shown in Figure 5.

Days	CASE -1	CASE -2	CASE -3
After 28 days	30.31	38.36	28.80

Table 3: Compressive Strength of Concrete Cube Sample after 28 days

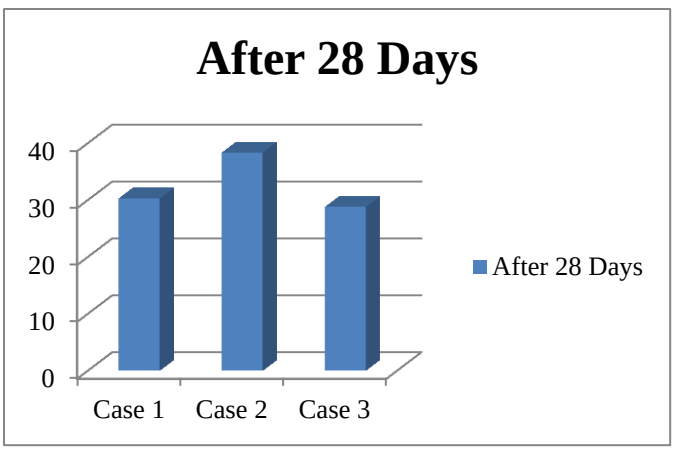

Fig. 5: Average Compressive Strength (MPa)

IX. CONCLUSION

Following are the salient conclusions of the study-

A. Rebound Hammer Strength

1. Rebound hammer reading for cubes with 5% replacement of aggregates with CNC lathe waste as aggregate and with wire mesh are higher than other cubes for M20 grade of concrete after 28 days.

2. Maximum value is recorded for cubes with 5% replacement of aggregates with CNC lathe waste as aggregate and with wire mesh.

3. Rebound strength is more affected by wire mesh.

B. Ultrasonic Pulse Velocity

1. Ultrasonic Pulse velocity reading for cubes with 5% replacement of aggregates with CNC lathe waste as aggregate and with wire mesh are higher than other cubes for M20 grade of concrete after 28 days.

2. Maximum value is recorded for Cubes with 5% Replacement of Aggregates with CNC lathe waste as aggregate and with wire mesh are higher than other cubes for M20 grade of concrete after 28 days.

3. Pulse velocity is almost equally affected by wire mesh.

C. Universal Testing Machine

1. Highest value of compressive strength is obtained for cubes with 5% replacement of aggregates with CNC lathe waste as aggregate and with wire mesh.

REFERENCES

[1] Abbas Hadi Abbas, (2011), "Management of steel solid waste generated from lathes as fibre reinforced concrete", European Journal of Scientific Research, Vol-No. 50, pp 481-485.
[2] Ashish Kumar Parashar and Rinku Parashar (2012), "Utility of wastage material as steel fibre in concrete M-20" ISSN: 0976-4860, International journal of advancements in research & technology.
[3] 3.C.M.Vivek Vardhan et.al (2012), "Experimental investigation on fibre reinforced concrete using waste material" ISSN: 2248-9622, International journal of engineering research & applications.
[4] 4.Kumutha R., Vijai K. (2010), "Strength of concrete incorporating aggregates recycled from demolition waste", ARPN Journal of Engineering and Applied Sciences, Vol-No. 5, pp 64-71.
[5] Mohamed Bencheikh and Mohammed Seddik Meddah (2009) "Properties of concrete reinforced with different kinds of industrial waste fiber materials", Construction and Building materials 23 (2009) 3196-3205.
[6] Nilesh Chincholkar et.al (2012), "Reuse of steel scrap from lathe machine as reinforced material to enhance properties of concrete" Pp 164-167, Global journal of engineering & applied sciences.
[7] Parashar Ashish Kumar and Parashar Rinku (2012), "The effect of size of fibres on compressive strength of M20 concrete mix", International journal of Engineering Research and Applications, Vol-No. 2, pp 1232-1236.
[8] Prasad M.L.V. and Rathish P. Kumar (2007), "Strength Studies On Glass Fibre Reinforced Recycled Aggregate Concrete", Asian Journal Of Civil Engineering of Building And Housing, Vol-No. 8, pp 6677-690
[9] Yaprak Hasbi, Aruntas Huseyin Yılmaz, Demir Ilhami, Simsek Osman and Gokhan Durmus (2011), "Effects of the fine recycled concrete aggregates on the concrete properties", International Journal of the Physical Sciences, Vol-No.6, pp 2455-2461.

