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# A study on addition of scrap in properties of concrete

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**Abstract**
Infrastructure plays an important role for the development of any area. Concrete is a main constituent of the Civil Engineering structures for the infrastructure development. Concrete is one of the widely used construction material in the world after water. Wastes are generated in large quantity from every steel industry. The main objective of this investigation is to study the effect of addition of lathe scrap in concrete. It is expected that the use of lathe scrap in concrete improves strength properties of the concrete. Different strength tests and their related results helped in concluding that lathe scrap can be used as good fiber addition material in concrete.

**Keywords:** Lathe scrap, waste, strength and concrete.

## Introduction
Infrastructure plays an important role for the development of any area. Concrete is a main constituent of the Civil Engineering structures for the infrastructure development. Concrete is one of the widely used construction material in the world afterwater.Concrete has various properties such as ability to be molded into any desired shape, easy availability of the constituent materials used, and many other advantages which make the concrete as a very popular construction material. Other than advantages, concrete have some deficiencies such as low tensile strength and low ductility i.e. concrete is weak in tension. Although the long continuous steel bars are provided in concrete and which are quite effective in providing the tensile strength to the concrete. But these bars fail to stop the development of micro cracks in concrete. In order to overcome the deficiencies, various researches has been carried out by adding the different kind of fibers to concrete to improve the strength properties of concrete and to decrease the development of micro cracks.
Wastes are generated in large quantity from every steel industry. Steel lathe industries generates waste in form of steel scraps obtained from the lathe machines in process of finishing and shaping of different steel parts and products. Dumping of this steel industrial waste is a great problem to the environment and creates a hazardous situation. So it is necessary to take proper steps for the dumping of such waste. For that reason, use of industrial waste as a replacing material to any of the constituent or an addition as a fibre can be done to improve the strength properties of the concrete. When the steel scrap is introduced in the concrete it acquires the term: Fibre Reinforced Concrete (FRC) and using a particular lathe machine waste i.e. lathe scraps in concrete it acquires the name as Lathe Scrap fibre Reinforced Concrete (LSFRC). The main objective of this investigation is to study the effect of addition of lathe scrap in concrete. It is expected that the use of lathe scrap in concrete improves strength properties of the concrete.

## Appraisal
Maximum research in recent past in the field of FRC has been directed towards Steel Fibre Reinforced Concrete (SFRC). Steel fibres have been used widely for long term applications because of their availability at very reasonable cost and safely to be used. Steel fibres used may be either of steel cut or melt extract. The factors affecting the properties of SFRC are fibre content, orientation, fibre shape, and aspect-ratio of the fibre. These fibres are available in different shapes which results in significant improvement in structural properties. The steel fibres are cheaper than glass, carbon and polypropylene fibres and it has been found that SFRC

exhibits better improved properties such as compressive, tensile, shear and flexural strength, higher toughness and ductility as compared with FRC using glass, carbon and polypropylene fibres. SFRC is now well known superior construction material than conventional concrete due to its improved properties. Therefore it has enough potential to be used in earthquake prone areas, industrial floors, highway and airfield pavements etc.

Various studies have shown that lathe scrap can be a good fibre addition material. There are many researches carried out by various researchers in the field of using lathe scrap in concrete and are discussed below:-

Shirulepravinashok, Swami Suntan, Nilesh Chincholkar, (2012) [9] concluded on reuse of steel scrap from lathe machine as reinforced material to enhance properties of concrete. They used M20 grade of concrete and added lathe steel scrap at 0.5%, 1.0%, 1.5%, and 2% by weight of cement. Comparison between plain cement concrete and steel scrap Fiber reinforced concrete was made. It was reported that compressive strength, tensile strength and flexural strength of Fiber reinforced concrete was found maximum at 1.5% of addition of lathe steel scrap.

Irwanliekeng Wong [3] conducted a "Study of utilization of waste lathe scrap on increasing compressive strength and tensile strength of concrete" and In this research, he have mixed the lathe waste in three proportions, i.e. 0.5, 1 and 2%. The results show that the compressive strength increased by 16.4% and tensile strength increased by 25.3% by 2% as compared to plain cement concrete.

"Reuse of steel scrap from lathe machine as reinforce material to enhance properties of concrete" was studied by Pravin, Swami Suman, Nilesh Chincholkar, (2012) [9]. In this study, a comparison has been made between plain cement concrete and steel scrap fibre reinforced concrete (i.e. 0.5%, 1%, 1.5%, 2%) by weight of cement in M30 grade concrete has been taken into account. Compressive strength, tensile strength and flexural strength of SSFRC is found to be maximum for volume fraction of 1.5% steel scrapfibre.

Darji and Borsadiya (2017) evaluated "Analysis of compressive strength of concrete using steel scrap". In this study, concrete cubes using steel scrap are casted of M20 grade concrete at a gap of 0.2%, 0.4%, 0.6%…2% of lathe scrap being used and compressive strength test was performed and found that compressive strength was increased by adding steel scrap up to 1.4%.

Vasudev and Vishnuram [11] studied "Experimental studies of the applications of turn steel scraps as Fibres in concrete– A Rehabilitative Approach". The addition of steel Fibers which is commercially easily available in market increases the cost of the project. But, the steel scraps extracted from the steel lathe shops, improved the tensile properties of concrete by 20 to 35 % in concrete. And authors say it is very much encouraging as the use of such scraps is done effectively in proper way.

James *et al*. (2015) conducted "Experimental study on fiber reinforced concrete using lathe scrap fiber". In this study, the waste steel scrap is used as a steel fiber in M30 grade of concrete at a varying percentage of 0%, 0.5%, 1%, 1.5%, 2% and compressive strength test was performed and concluded that an optimum percentage as 1% of lathe scrap as an addition can be used to improve the strength of concrete.

Haldkar and Salunke, (2016) investigated "Effect of addition of lathe waste scrap on mechanical properties ofconcrete"**.** In this study, all 3 parameters were tested and results were obtained and a comparison has been made between plain cement concrete and steel scrap fibre concrete in ratio of (i.e. 0.5%, 1%, 1.5%, and 2%) in M30 grade. Compressive strength, tensile strength and flexural strength is found to be maximum for volume fraction of 1.5% steel scrapfibre.

Pande et al. conducted an "Experimental study on steel Fibre reinforced concrete for M40 Grade". In this paper, researcher observed that compressive strength, split tensile strength are on higher side for 3% fibre's as compared to that strength attained from 0%, 1% and 2% fibres. It is observed that compressive strength increases from 11 to 24% and split tensile strength increases from 12 to 49% with addition of steel fibres.

Sezhiyan and Rajkumar, (2014) [10] did a "Study on the properties of high strength concrete using glass powder and lathe scrap". They used glass powder as a replacement of cement to assess the pozzolonic activity of fine glass powder in concrete and study the properties of concrete with addition of Lathe scraps are the waste materials which are collected from workshops and other steel industries at very minimum cost in concrete. 30% concentration of glass powder replacement in concrete is found to be the optimum dosage for their project work with use of lathe scrap in concrete.

Meikandaan *et al*. (2012) studied used steel scrap, galvanized iron wire and copper coated waste steel at 0%, 1%. 2%, 3% and 4% by weight of concrete for Mix M20. The aim was to check the compressive strength, splitting tensile strength, flexural strength, modulus of elasticity and impact energy test. For lathe scarp, galvanize iron wire and copper coated wire they found addition of 2%, and 1% respectively optimum percentage.

Mello *et al.* investigated "Improving concrete properties with Fiber addition". In this study researchers studied the concrete properties with the addition of cellulose, steel, carbon and PET fibres and each fibre was added at 4% to the fresh concrete, then tested for compressive, flexural and tensile strength. Results showed that improvement in strength after addition of steel and carbon fibres may justify the extra cost of fibres.

Rajagopalan, (1974) studied the effect of addition of steel fibres on strength of concrete. He used fibres as continuous wires and volume fraction of 1% and 2%. The fibres used were of 25 mm long fibres. The maximum increase was seen when 1% volume fraction of fibres were used as continuous wires distributed uniformly throughout the concrete section.

Sinha studied the strength analysis of steel fibre reinforced concrete. Research was done to find the optimum %age of steel fibre in M30 grade concrete on volume basis. The results obtained were as compressive strength showed maximum increase by 1.25% addition of steel fibre and flexural strength showed maximum strength at 1.50% addition of steel scrap.

Nataraja, (2001) conducted the experiments and concluded that the addition of steel fibre in concrete increases the split tensile strength significantly. He used crimped fibres for the study. Split tensile strength was 0.67 times the flexural strength and 0.09 times the compressive strength for crimped steel fibres.

Balasubramanian, (1996) [2] used tough shaped, crimped shaped and straight shaped fibres. He concluded that even small quantity of fibre was more effective in improving the impact resistance of the concrete. It was found that crimped fibres were found more effective in improving impact strength at 0.5% volume of crimped fibres.

Job Thomas, (2002) used the steel fibres in the ratio of 0.25%, 0.50%, 0.75% and 1% in concrete. He concluded that the maximum strength obtained was at 0.75% fibre content and

suggested that bridging of micro cracks by fibres were effective up to fibre content at 0.75%. Adding more %age of fibre there was seen balling of fibres which ultimately reduced the strength.

**Conclusion**

By the study of the literature review of lathe scrap as addition as a fibre in a concrete, it is found that the lathe scrap being the steel industry waste is a good material as a fibre to be used in the concrete to enhance the strength of the concrete. After going through all the study of the research papers and literature review it has been seen that mainly researchers worked on compressive strength and split tensile strength of concrete on different concrete mix at different proportions of lathe scrap. From the above discussion, it is concluded that the lathe scrap can be used in M25 grade of concrete as a fibre addition at the proportion of 0.4%, 0.8%, 1.2%, 1.6%, and 2.0% by volume of concrete. Compressive strength & Flexural strength tests can be undertaken and comparison & evaluation with the conventional concrete can bedone. It has been concluded that we can add 1.2% of lathe scrap by volume of concrete in concrete mix. Though it not only improves the strength properties of concrete, but it also helps to conserve environment by consuming industrial waste and reducing the quantity of lathe scrap generated from steel industries.

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