# Experimental Investigation on Concrete By Partial Replacement of Coarse Aggregate With Industrial Lathe Scrap

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***Abstract-*** *Concrete is a widely acceptable material for making structural components in building construction and it arrived from natural substance mixtures of cement, fine aggregate, coarse aggregate and water content. Due to urbanization and industrial revolution the utility of concrete is used broadly and in excess to the scarcity of raw materials. For the Sustainability approach, the natural substances preservation is important. A lathe scrap is an industrial waste material, which is habitually available in lathe industries in addition to dumping of these waste materials into the barren dirt also contaminates the soil and ground water, which generates an unhealthy. The lathe scrap material is used in modern construction and likewise in pavement construction. The coarse aggregated are partially replaced with lathe scrap and its mechanical strength parameters has to be determined experimentally. As per Indian Standard 10262, M20 mix proportions were stipulated with 5%, 8% and 10% of replacement of lathe scrap in concrete with the water-cement ratio being kept as 0.45. The compressive and split tensile strength of concrete was determined by using digital compression testing machine. The result shows that the compressive strength of concrete is increased to 5% and 8% replacement of lathe scrap.*

***Keywords***- Concrete, Lathe scraps and Compressive strength

## I. INTRODUCTION

Concrete is most universal material in many civil engineering construction projects for strengthening of structural members day by day and the great significant to reduce the usages of concrete ingredients towards the sustainability concern. In recent research focused on the better improvement of concrete performance by adding various alternate materials. Lathe scraps are waste materials which produced in iron and steel fabrication industries. According to ICI, 1200 million tones of lathe scrap were generated and India is the one of the largest producer of crude steel [1]. In addition of lathe scrap material to cement concrete increase the mechanical properties of concrete at great extent and therefore utilization of fiber strengthened of concrete is increases day to day life in industrial growth [2]. By using large amount of lathe scrap waste helps to produce large quantity of eco friendly concrete and reduce impact land pollution. Generally the lathe scrap length range between 20 – 40 mm, width 2 mm and thickness is 0.3 to0.6 mm aspect ratio may be range vary from 50 -70 [3]. In general, the mechanical properties of the concrete are improved by increasing the proportion of the lathe scrap up to 1.5% and significantly improved the resistance to impact and greater ductility of failure in compression, flexure and torsion and can be effectively used in pavement [4].

## II. MATERIAL USED

Cement is used as a binding material and setting of concrete to attain strength. The Portland Pozzolana Cement (PPC) is used in a grade of 53 as per IS 12269:1987. The coarse aggregate which was used for the concrete is angular in shape and the size is 20 mm. The fine aggregate is a sand material obtains from sand dunes. The fine aggregate should pass through 4.75mm as per IS sieve which was used in the concrete. The pycnometer test was conducted to find out the specific gravity of fine aggregate. The specific gravity of fine aggregate is 2.76. The water used for the experimental study should not morethan the pH level of 6. The Lathe scraps obtain from lathe workshop Laboratory andit also produced from lathe industries also. Thedensity of lathe scrap is 7850 kg/m3 the properties of materials are determined in Laboratory for Mix design development. The properties of the materials are mentioned in Table 1.

Fig. 1 Waste Lathe Scrap

Table 1: Physical Properties of the Lathe scrap, Cement and Aggregates.

| Properties | Lathe Scrap | Cement | FA | CA |
|---|---|---|---|---|
| Density in Kg/m³ | 7850 | 1400 | 1620 | 2550 |
| Specific Gravity | 5.37 | 3.2 | 2.76 | 2.9 |
| Consistency | | 29% | | |

## III. MIX DESIGN

The M20 mix design was made confirming with IS 10262: 2019 and the mix proportion of concrete were 1:1.59:3.10 (Cement: Fine Aggregate: Coarse Aggregate). The water cement ratio should be maintained in 0.45. The lathe scrap in the order of 5%, 8 % and 10% is used in concrete with the mix ratio of M20. After the mix design, the 150 mm x 150 mm x 150 mm size cubes and 150mm x 300mm size cylinders are casted in specified dimension as per IS guidelines. The compressive and split tensile strength of the casted cubes is determined after 7 days and 14 days of curing in water.

Fig.2 Cube and Cylinder Specimens after curing

## IV. RESULTS AND DISCUSSION

### Compressive strength

The compressive strength of concrete is most important harden property and the compressive strength of a material is that value of uniaxial compressive stress reached when the material fails entirely. The compressive strength is usually obtained experimentally by means of compressive test by using compressive testing machine. A uniaxialcompressive load is applied on testing material to extract the strength of the specimen. Three cubes are casted in each mix proportion and cured in 14 days and 28 days. The test specimens are tested in compression Testing machine. The test results have been tabulated in Table 2 and Table 3.

Fig. 3 Concrete Cubes tested in Compression Testing Machine

Table 2: Average Compressive strength of concrete cubes after curing

| S.No. | % of lathe scrap | Compressive strength in N/mm² | |
|---|---|---|---|
| | | 14 days | 28 days |
| 1. | 0 | 21.50 | 26.45 |
| 2. | 5 | 26.47 | 31.47 |
| 3. | 8 | 28.29 | 33.61 |
| 4. | 10 | 19.20 | 22.04 |

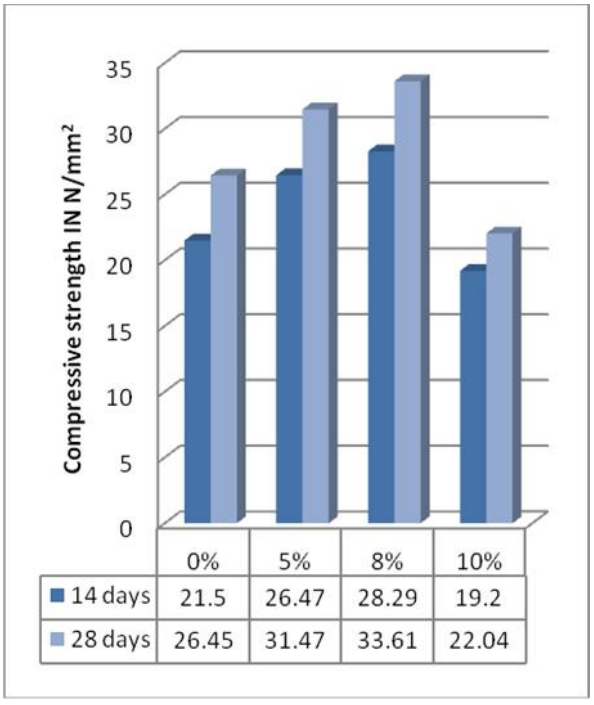


Fig. 4 Compressive strength test result after 14 and 28 days

### Split tensile strength

For split tensile strength, the cylinders of 150 mm x 300mm were casting using M20 grade concrete. After curing the specimens are tested in compressive strength using a calibrated compression testing machine by placing the concrete cylinder in its longitudinal axis and thereby providing indirect tension to the specimen. The variations in their testing results are noted and a graph is plotted.

**Table 3: Average Split Tensile strength of concrete cylinder**

| S. No. | % of lathe scrap | Split tensile strength in N/mm² | |
|---|---|---|---|
| | | 14 days | 28 days |
| 1. | 0 | 2.15 | 2.92 |
| 2. | 5 | 2.68 | 3.28 |
| 3. | 8 | 2.89 | 3.63 |
| 4. | 10 | 2.64 | 3.47 |

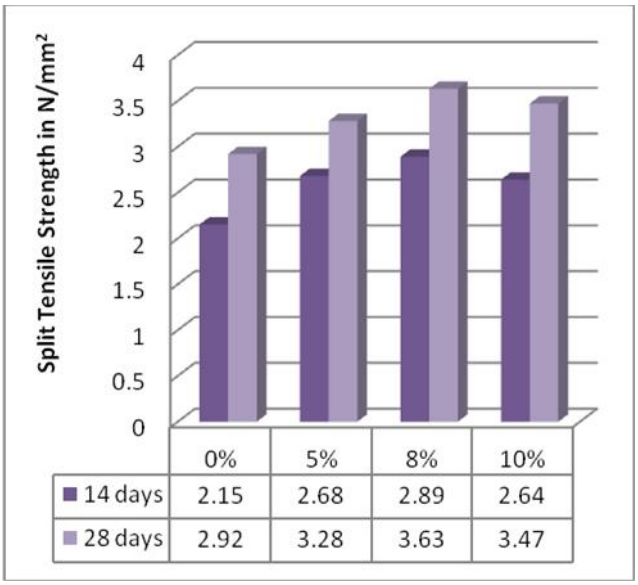


Fig. 5 Split tensile strength test result after 14 and 28 days

## V. CONCLUSION

From the test conducted on lathe scrap replaced coarse aggregate in concrete shows that utilization of percentage of replacement of lathe scrap can be used up to some extend only. Further increase of lathe scarps in concrete decrease the both compressive and tensile strength. The compressive strength of concrete is gradually increase from 5 to 8 % beyond that strength is suddenly decreased. Similarly, split tensile strength also deceases in 10% of lathe scrap replaced coarse aggregate concrete mix. But the split tensile strength of 8 % replacement of concrete gives better value compared to conventional concrete.

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