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Experimental Study on Usage of Steel Mill Scrap to Enhance the Mechanical Properties of Concrete

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Abstract: ***in this project, we aim to reduce the landfill due to the high accumulation of steel mill scrap, at various dump yards located at chennai, and at other cities. The accumulation of the lathe scrap also contaminates the land and the groundwater due to the lathe oil in them. The addition of the steel mill scrap to concrete enhances the mechanical properties of concrete. The concrete was casted as four batches, control mix, 10 kg/cu.m addition of the steel mill scrap, 20 kg/cu.m addition and 30kg/cu.m addition. The 30 kg addition of steel scrap showed a higher percentage of increase in the compressive, split tensile and flexural strengths than the other mixes. There was a 35 – 15 % increase in the compressive strength of the 30 kg addition mix to that of control mix, as the concrete sample aged. There was no significant increase in the split tensile strength of the concrete. There was also a slight increase in the flexural strength in the batches of 10 kg addition and 30 kg addition of the steel mill scrap. The 20 kg addition of the steel mill scrap had no changes in the flexural strength from the control mix.***
Keywords – compressive strength, mechanical properties, reducing landfill, steel scrap, strength gain.

I. INTRODUCTION

In the modern world, there is a need to reduce the landfill so that it may be used productively. Many dump yards in and around Major cities, like Chennai, contains a large quantity of Steel scrap dumped as it is. This scrap is fed by lathe machinery which uses Lathe oil for turning operations. The scrap from this operation still contains a trace amount of this oil. When dumped, this oil percolates into the soil form contaminating the Ground water, and also the land. To reduce the landfill, innovative methods have been undergone to reuse this scrap. Concrete is basically weak in Tension but withstands Compression loads. Addition of the Steel scrap might help increasethe Tensile strength of Concrete. In this project this scrap is used as an additive to the Concrete to enhance its mechanical properties, namely Compressive Strength, Split tensile Strength, and Flexural Strength, according to Indian Standards(IS : 516).

The rest of the paper discusses the Mechanical properties of the different Concrete mix, Control mix, 10kg/cu.m, 20kg/cu.m and30kg/cu.m addition of Steel mill scrap. This paper also focuses on the difference in Strength of the Mixes with aging and comparison among the tests.

II. METHODS

Portland Pozzolanic Cement of M30 Grade 53 was used in this project. Water Cement ratio used is 0.5. Coarse aggregate of two types, 20 mm and 12.5 mm were used (60% and 40%). The fine aggregate used in this project is Crushed sand, which is made of Crushed aggregate of size passing through 4.75 mm IS Sieve and retained in 2.36 IS Sieve. The Percentages of Coarse to Fine aggregate used in the project is 55% to 45% respectively. The Steel mill scrap used in this project is of size passing through 4.75 mm IS sieve and retained in 2.36 mm IS sieve. A Chemical admixture namely SUPAFLO SPL was used to increase the workability of Concrete.

Four mix types were casted (control mix, 10 kg, 20 kg, and 30 kg addition) in Cube, Cylinder and Beam Moulds of IS Standards, and they were cured for 3, 7, 28 and 56 days. The cubes were tested for 3, 7, 28 and 56 days, in the Compression Testing machine. The Beams were casted and cured for 7, 28 and 56 days, and tested for their Flexural Strength. The Cylinders were casted and cured for 7, 28 and 56 days and were tested for their Split tensile Strength. The need for curing of the specimens for 56 days is due to the use of Pozzolanic Cement.

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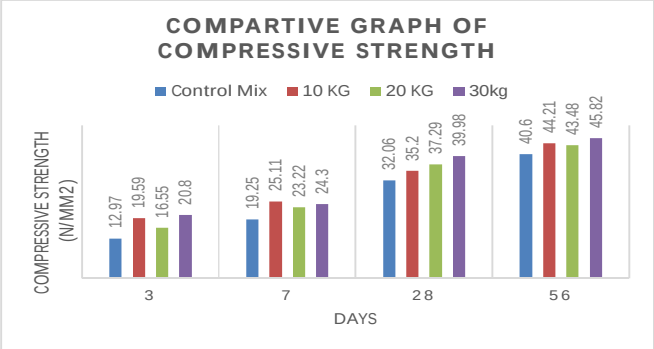
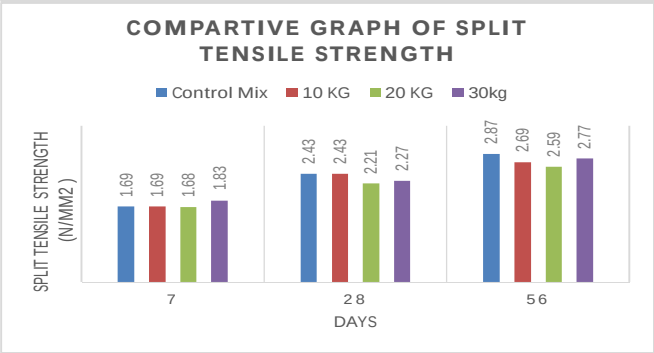
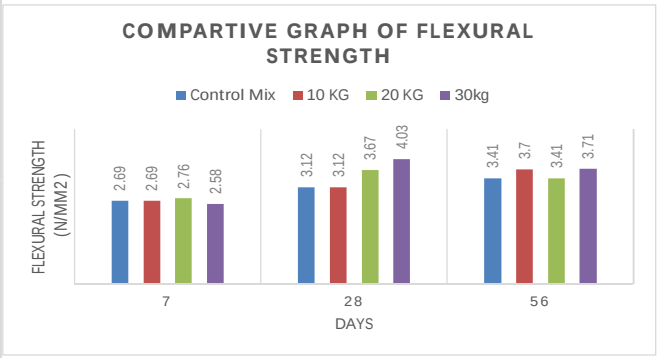
III. RESULTS







IV. DISCUSSIONS

According to the test results, the Concrete mixes achieved their Target compressive strength of 38.25 KN/mm^2, by their 56 day Curing. Although, the 30 kg addition of Steel mill scrap achieved the target strength by 28 days. There exists a gradual increase in the compressive Strength of the mixes as they age. The Strength of the 30 kg addition is also high compared to the other mixes. Considering the Split tensile strength of the Concrete, there is no significant change in it. The values all lie in the range of ± 2-5%. The Flexural Strength of Concrete has slightly increased in the 30 kg addition of Steel mill scrap. (8.8%).

When comparing across the Strengths of the Mixes, the percentage increase between Compression and Split tensile Strength, at the 56 day period, ranges between 92% - 94% for all the mixes. The percentage difference between Compressive Strength and Flexural Strength ranges between 90% - 92.5%.

V. SUMMARY AND CONCLUSIONS

From these values, it can be said that the 30 kg addition of the Steel mill scrap gave positive results for all the tests. Also, the Strength of 10 kg addition of Steel is, in some cases, higher than the 20 kg addition. The Compressive Strength of the Concrete increases with increase in Steel Content.

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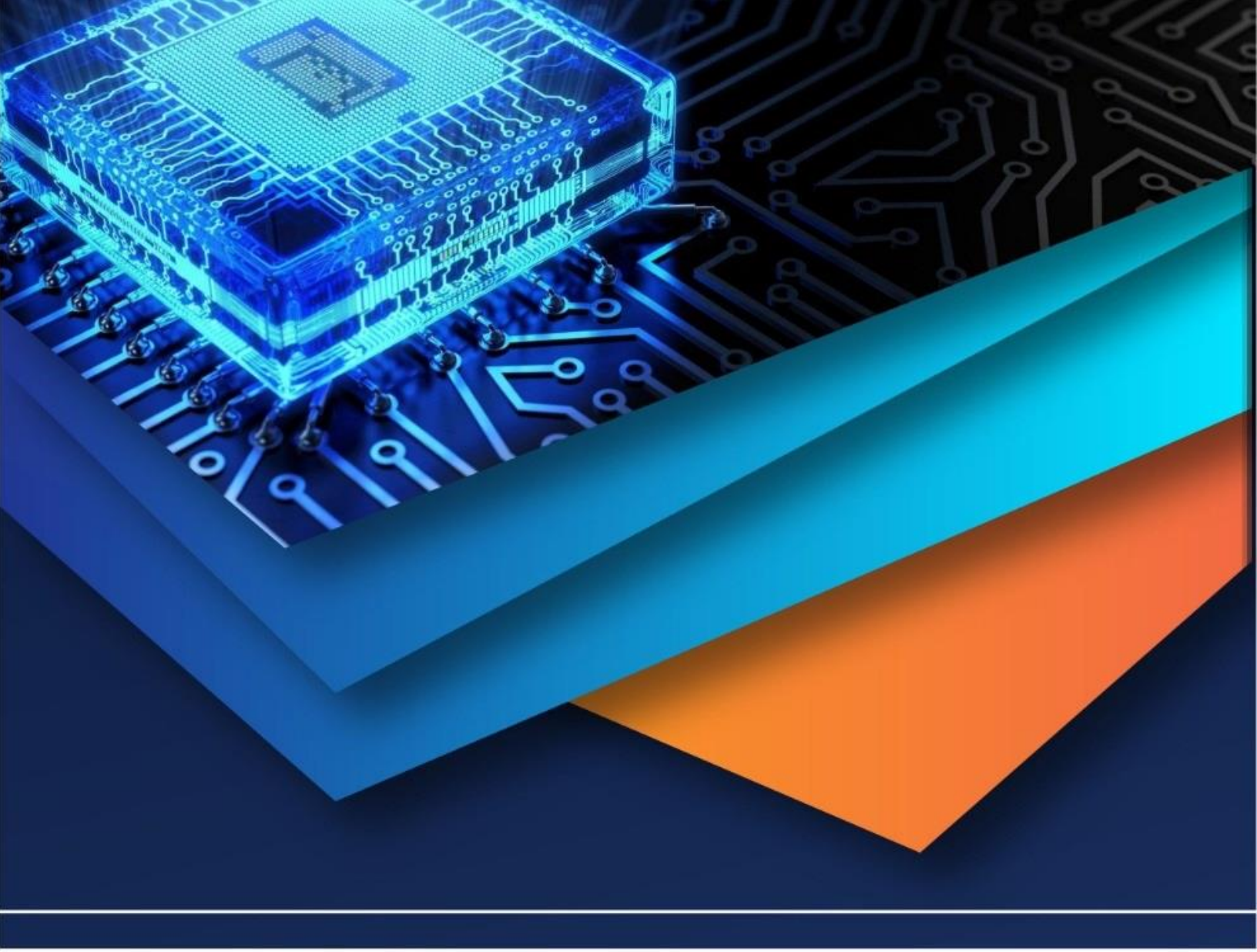

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