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Experimental study on concrete in partial replacement of fine aggregate with lathe waste

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Abstract— Concrete bring the most important and widely used material is called upon to possess very high strength and sufficient workability properties. Today the construction industry is in need of finding cost efficient material for increasing the strength of concrete structure. Great quantities of steel waste are generated from industries related to lathe. Steel waste is replacement level of 0%, 3%, 6% and 9% the concrete specimen **(cube, cylinder and beam)** produced were cured in water for 7, 28 days. Material study and the Mix proportions are calculated for M25 grade of concrete. The water cement ratio is 0.40.From the experimental studies it has observed that the optimum percentage of lathe waste for high strength concrete.In the present experimental investigation an attempt from the lathe machine is used as a lathe waste in cement concrete for various construction works and to optimize fiber content. The outcome of this project shall be useful for various industries and workshop generating steel scrap from lathe machine

Index Terms— Lathe waste – Tension Zone – M-Sand - Compressive strength – Split tensile strength – Flexural strength.

1 INTRODUCTION

Concrete is the most commonly used building material in the world. It is estimated that this consumption of concrete within the world is of the order of 10 billion tones per annum. Humans consume no material except water in such tremendous quantities.

It is a composite material. Concrete is artificial stone made of Portland cement, coarse aggregates and fine aggregates and water. Aggregates are 65% -80% of the volume of the concrete. Sand, gravel and crushed stone are the first aggregates used. All aggregates must be essentially free of silt or organic matter. The cement and water form a paste that hardens and bonds the aggregates together. Sometime admixtures are added to enhance the properties of the concrete. Concrete may be a versatile material which will easily be mixed to satisfy a spread of special needs and formed to virtually any shape.

Concrete can be cast easily and economically. It is a durable, fire resistant and energy efficient material. Concrete finds applications in foundations and slabs-on-ground, walls, beams, columns, floors, roofs, bridges, dams, swimming pools, homes, streets, patios, basements, balustrades, plain cement tiles, mosaic tiles, pavement blocks, lamp-posts, drain covers, benches pavements and other infrastructure. A larger amount of rainwater ends up falling on impervious surfaces like parking lots, driveways, sidewalks, and streets rather than soaking into the soil. This creates an imbalance in the natural ecosystem and leads to a host of problems including erosion, floods, ground water level depletion and pollution of rivers, lakes and coasel water.

Generally concrete consists of cement, fine aggregate, coarse aggregate, water and Lathe waste. Their proportion within the concrete is predicated on grade of concrete and it determines the strength also. Nowadays use of resources in the construction industry is high. This project is to replace the material in concrete for better improvement of concrete properties .The main aim of for this project is to increase the strength of the concrete. The characteristics of concrete with partial replacement of sand by steel lathe waste to standard M25 grade concrete are investigated in this study. Various other experimental studies conducted on lathe waste concrete showed that there is considerable increase in the compressive strength when compared to conventional cement concrete and also when tested for flexural strength, the lathe waste concrete shows an increase in flexural strength to great extent. In this study, fine aggregate is being replaced with lathe waste at various percentages like 0%, 3%, 6% and 9% and characteristics of concrete like compressive strength, split-tensile strength are to be studied.

1.2 Lathe waste Concrete

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OBJECTIVE

The main objective of this project is to make economical and cost effective.

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2. MATERIALS AND THEIR PROPERTIES

2.1 Cement

Cement isa binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Portland cement is usually used as the main binder for pervious concrete. Cements utilized in construction are usually inorganic; often lime or calcium silicate based, and may be characterized as either hydraulic or non-hydraulic, depending

on the power of the cement to line within the presence of wa-ter. Portland cement is hydraulic cement when mixed in the proper proportions with water, where OPC and PPC common-ly used.

For this study Ordinary Portland cement of 53grade was used for preparation of pervious concrete. The various properties of cement are tabulated in table 1 given below:

Table 1: Properties of cement

S.NO	DESCRIPTION	RESULT
1	Fineness of Cement	8%
2	Standard Consisten-cy	32%
3	Specific gravity	3.15
4	Initial setting time	30 mins
5	Final setting time	10 hrs

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2.2 Fine aggregate (M-sand)

Sand is either round or angular grain and is ofter found mixed in various grading of fineness zones. According to size the fine aggregate could also be described as coarse sand, medium sand and fine sand. IS specification classify the fine aggregate into four types according to its grading as fine aggregate of grading zone-1 grading zone-4.

Depending upon the nature of rock from which it was found and an erosive action to which it has been subjected, many other minerals may be found as constituents mica feldspars, shale are a few of them.

Table 2: Properties of coarse aggregate

S.NO	DESCRIPTION	RESULT
1	Specific Gravity	2.37

2.3 Coarse aggregate

Aggregates are coarse particulate rock like material consisting of a collection of particles ranging in size from 12.5mm to 20mm. It includes gravel and crushed rock. The properties of aggregates depend upon the parent rock which may be igneous, sedimentary or metamorphic. In concrete, aggregate is used to reduce any cracks and to provide strength to the structure. Aggregate accounts for 60% to 75% of the volume of concrete.

Table 3: Properties of coarse aggregate

S.NO	DESCRIPTION	RESULT
1	Specific Gravity	2.62

2.4 Water

Water is one of the important materials for the pervious con-crete Potable water with pH value 6.5-8.5 is used for mixing and curing throughout the experiment.

2.5 Moulds

The size of the cube mould is 150 x 150 x 150 mm.
The size of the cylinder mould is 150 x 300 mm.

The size of the Rectangular Prism mould is 150 x 150 x 500 mm.

2.6 Lathe waste

The utilization of industrial waste produced by process has been the main target of waste reduction research for economic, envi-ronmental and technical reasons. Steel slag is a steel waste product from lathe industry.

Table 4 : Physical Properties of lathe waste

S.NO.	DESIGNATION	PROPERTIES
1	*Colour*	*Light to dark brown*
2	*Shape*	*Highly angular*
3	*Bulk density*	*1911.11 Kg/m^3*
4	*pH (in water)*	*8*
5	*Combustibility*	*Non-combustible*
6	*Surface Texture*	*Rough*
7	*Specific Gravity*	*2.93*

2 MIX PROPORTIONS

The mix proportions are designed as per IS 10262-2009, tabulated in Table 5.

Table 5: Mix Proportion

Water(L)	Cement(**kg/m³**)	Fine aggre-gate(**kg/m³**))	Coarse aggre-gate(**kg/m³**))
197.5	394	625.68	966.24
0.5	1	1.5	2.4

4 CASTING OF SPECIMEN

4.1 Cube

After 24hrs of casting the moulds were removed and the specimens were cured in water for 28days. The size of the cube mould is 150 x 150 x 150 mm.

Fig 4.1 Cube

4.2 Cylinder

After 24hrs of casting the moulds were removed and the specimens were cured in water for 28days. The size of the cylinder mould is 150 x 300 mm.

Fig 4.2 Cylinder

4.2 Rectangular Prism

After 24hrs of casting the moulds were removed and the spec-imens were cured in water for 28days. The size of the Rectan-gular Prism mould is 150 x 150 x 500 mm.

Fig 4.3 Rectangular Prism

5 TESTING PROCEDURE

5.1 Compressive strength

In a compression test a cloth experiences opposing forces that push inward upon the specimen from opposite sides or is oth-erwise compressed, squashed, crushed, or flattened. The test sample is usually placed in between two plates that distribute the applied load across the whole area of two opposite faces of the test sample and then the plates are pushed together by a universal testing machine causing the sample to flatten. A compressed sample is typically shortened with in the direction of the applied forces and expands with in the direction per-pendicular to the force.The compressive strength of specimen after 7 and 28 days was calculated and tabulated in table 6 and table 7.

Table 6: Compressive strength of the concrete after 7 days

percent-age add-ed	Compressive strength after 7 days (N/mm^2)			Mean (N/mm^2)
	S1	S2	S3	
0%	10.67	11.47	10.98	11.04
3%	13.78	14.53	14.27	14.19
6%	15.11	14.53	14.89	14.84
9%	15.47	15.55	15.55	15.52

Table 7: Compressive strength of the concrete after 28 days

percent-age add-ed	Compressive strength after 28 days (N/mm^2)			Mean (N/mm^2)
	S1	S2	S3	
0%	25.24	25.42	24.62	25.09
3%	29.68	30.04	29.86	29.86
6%	30.01	30	30.31	30.11
9%	30.7	30.5	29.9	30.37

5.2 Split Tensile Strength Test

The sample tested in this method is generally cylinder speci-men.The test sample is generally placed in between two plates that distribute the applied load across the entire surface area of two opposite faces of the test sample and then the plates are pushed together by a universal testing machine which causes the sample to flatten. A compressed sample is usually short-ened in the direction of the applied forces and expands in the direction perpendicular to the force.

Table8: Split Tensile strength of the concrete after 28 days

percent-age add-ed	Split tensile strength after 28 days (N/mm2)			Mean (N/mm2)
	S1	S2	S3	
0%	2.77	2.72	2.80	2.76
3%	3.59	3.69	3.64	3.75
6%	3.70	3.74	3.76	3.73
9%	3.84	3.89	3.9	3.87

5.3 Flexural Strength Test

Flexural strength test is to check the power of unreinforced concrete beam to faceup to failure in bending .The results of flexural test on concrete expressed as a modulus of rupture which is denoted in MPa or psi. It evaluates the tensile strength of concrete indirectly. The flexural test on concrete are often conducted using either three point load test (ASTM C78) or center point load test (ASTM C293).The modulus of rupture value obtained by center point load test arrangement is small-er than three point load test. It is observed that low modulus of rupture is achieved when larger size concrete specimen is taken into account. The specimen generally used for this test is rectangular prism.

Table 9: Flexural strength of the concrete after 28 days

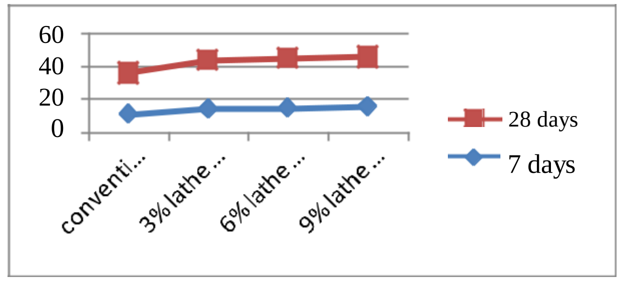
percent-age add-ed	Flexural strength after 28 days (N/mm2)			Mean (N/mm2)
	S1	S2	S3	
0%	6.5	6.5	7	6.67
3%	12.5	10	12	11.5
6%	12	13.5	11	12.16
9%	13	14.5	12	13.16

6 Result And Discussion

6.1 Compressive Strength Test

From the Table 6.1 and 6.2, it is observed that the compressive strength is in increasing order when admixtures are used. It is also observed that the compressive strength of concrete with lathe waste concrete is greater than that of con-vention concrete. The variation in compressive strength is presented in fig.6.1.

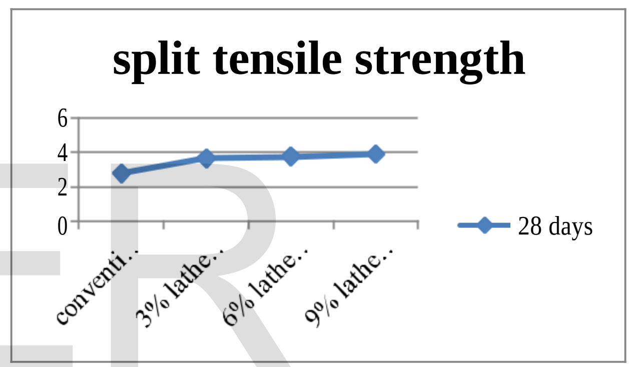
Fig 6.1 Compressive strength of Concrete in 7 daysand 28 days



6.2 Split Tensile Strength Test

From the Table 5, it is observed that the split tensile strength is in increasing order when admixtures are used. It is also observed that the split tensile strength of concrete with lathe waste concrete is greater than that of convention con-crete.. The variation in split tensile strength is presented in fig.6.2.

Fig 6.2 Split tensile strength of concrete in 28 days



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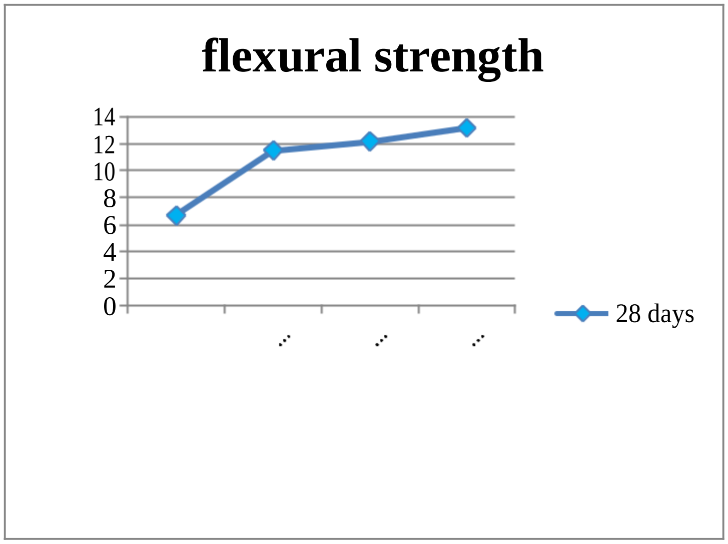
6.3 Flexural Strength Test

From the Table 6, it is observed that the flexural strength is in increasing order when admixtures are used. It is also observed that the flexural strength of concrete with lathe waste concrete is greater than that of convention concrete. The variation in flexural strength is presented in fig.6.3.

Fig 6.3 Flexural strength of concrete in 28 days



7 CONCLUSION

From the test results, the subsequent conclusions were made

1 Compressive strength of the concrete attained at an age of 7 days is about 50-70% of the compressive strength of the concrete attained at an age of 28 days.

2 The compressive strength of lathe waste concrete is increased when compared to convention concrete concrete, when the lathe waste is added to the con-crete at a percentage of 3%, 6% and 9% of the weight of fine aggregate.

3 And in rectangular prism the lathe waste is filled in the tension zone. The flexural strength of prism is compared to the convention concrete. The flexural strength is gradually increased.

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