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APPRAISAL OF SUBSTITUTION OF HYPO-SLUDGE & ADDITION OF LATHE WASTE ON M-50 GRADE OF CONCRETE

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***Abstract*—Hypo sludge is a material procured from the chemical recovery process of paper production & waste steel scrap available from the lathe is used. In the present appraisal, the effects of Hypo-sludge as a limited renewal of 5%, 10%, 15% & 20% to the cement for M50 grade concrete with 0.4 as w/c and uniformly maintaining the addition of 1% lathe waste by weight of cement. Further, in this appraisal, properties of fresh concrete was assessed and prominently found to be workable in nature. Some of the mechanical properties were carried out for different ages (3, 7, & 28 days). Additions of lathe waste have some advantage effect on strength properties up to Mix- 3. From the results, Mix-3 was found to be an optimal replacement in which there is an enhancement in values of Compressive & Split- tensile strength, but Mix-2 showed enhancement in values in flexural strength. An additional durability test was studied by performing water absorption test & observed that increase in the variation of Hypo-sludge has more water absorption.**

Keyword: Hypo sludge, Lathe waste, Mechanical Properties, Durability Test,.

I.INTRODUCTION

1.1 General

Concrete is a material which is broadly used in the Construction ground to build a structurally strong and stable building. The main constituent of concrete is cement, Fine- Aggregate, Coarse-Aggregate & water mixing of these ingredients with a proper proportion to become a good concrete. [1] Manufacture of Cement is taken a lot of energy and raw material to production for good quality cement, its emits carbon to the ecosystem, the environment will be more polluted due to the production of cement. Many experiment and researches are going on nowadays to invent the alternate Cementious material to reduce the uses of cement. Already some materials are successfully used alternatively to the cement such as Fly Ash, ggbs, Micro Silica, Rice Husk Ash, Metakaolin etc. in this experimental project is used as an alternate Cementious material to cement to reduce the environmental pollution and landfilling problems from the Hypo Sludge [2]

1.2 Hypo Sludge

Hypo-Sludge is a discarded substantial wasted obtained from the paper manufacturing unit. It is classified as industrial waste it is dangerous and harmful to the Environment, and also influences the human health. Paper manufacturing process having many stages to produce the good quality of paper, in this process various chemical recovery process undergoes and cleaning process like deinking of recycled paper, separation of wood waste like bamboo and, paper fibers are recycled many times to become a weak and short layer of a good quality paper. In this process lot of waste is produced, this paper waste is known as paper industry waste or hypo-sludge. [2] This waste is produced million tonnes in the all over world from the paper manufacture industry. In India, every ton of paper produced can produce more than 250 kg of waste paper, and this has become a difficult to handle and transport, the hypo- sludge contains the some Cementious ingredients like Lime, Silica, Magnesium, Alumina and Calcium sulphate, all these ingredients are also present in Cement so we conclude that hyposludge as used an additional Cementious material in the concrete. [16] In this project, hyposludgeis used as a partial additional for cement with various proportional mix & adding fibers to study the strong performance of concrete using hypo sludge in cement. It is helpful to the sustainable concrete, proper utilization of hypo sludge waste in the concrete to avoid the little bit environment pollution and waste management of hypo sludge. [2]

1.3 Waste Lathe Scrap

Steel and Iron Industries produce a lot of lathe waste during the production of different shapes and size of metals, these waste material don't have any particular size and shape, these waste is harmful to the environment and creates the landfilling problem as well as its harmful to the animals. This waste material can be used as fibers in concrete for getting good strength and avoid the landfilling, reduces the environmental pollution. In this project we collect the waste lathe scrap from the industrial area Kalaburagi, it's available at the cost of 15Rs per kg. [3]

1.4Objectives of Study

I. To study the feasibility of utilization of supplementary cementitious material like Hypo-Sludge.
II. To find out the effect of Lathe waste as a addition to Hypo-Sludge based concrete and its influence on strength parameter.

II.MATERIALS

2.1 Cement

Ultra-Tech OPC 53 Grade cements which confirming IS: 12269-1987 is used for the present project investigation work. The properties of cement were tested in the laboratory its specific gravity is 3.1, fineness 2.5%.

2.2 Hypo -Sludge

In the present investigation work Hypo- sludge was collected from the West Coast Paper Mill, Dandeli (Uttar Kannada). Properties of Hypo- Sludge are as follows Specific gravity 2.9, Moisture content 2.97% and fineness 1.8%.

2.3 Fine Aggregate (Sand)

For this present investigation, Fine aggregates are obtained from the Shahabad, Kalaburagi dist.is used for the project work. The Laboratory test results on natural fine aggregates are as follows Fineness modulus 3.87% confirming Zone II, Specific gravity is 2.61, and water absorption is about 1.4%.

2.4 Coarse Aggregate

In this present investigation, 20mm downsized coarse aggregates are used; the aggregate is obtained from the Lahoti crushers at Kalaburagi. The properties of coarse aggregates are Fineness modulus 6.42%, Specific gravity 2.65, water absorption 1% and Impact Value 12.

2.5 Lathe Waste

The lathe waste is collecting from the kalaburagi industrial area, at the rate of 15Rs/kg. Lathe waste doesn't have any particular shapes and size. Properties of lathe waste Length 25-50mm, Aspect Ratio 25-100 and density 7850 kg/m^3.

2.6 Water

Potable water was used

2.7 Concrete Mix

TABLEI: 2.7 Mix Proportion

Sl. No	Designated Mix	Cement (in kg)	Hypo Sludge (in kg)	Fine Aggregate (in kg)	Coarse Aggregate (in kg)	Water	Lathe Waste (in kg)
1.	Mix1	492	00	597	1082	216	00
2.	Mix2	467.4	24.6	597	1082	216	4.67
3.	Mix3	442.8	49.2	597	1082	216	4.42
4.	Mix4	418.2	73.8	597	1082	216	4.18
5.	Mix5	393.6	98.4	597	1082	216	3.93

III. EXPERIMENTAL PROCEDURES

For Present investigation following total no of samples were casted, for compressive strength 45 no's of cubes, for conventional concrete 12 no's of cubes, 30 no's of beams for flexural test and 30 no's cylinder for the split tensile test, these specimen was cured in fully immersed water for 3 days 7 days & 28 days. For durability of concrete water absorption test 15, no's of cube was casted and cured. [24]

Table No: 3 Shows The Various Tests Assessed For Present Investigation.

Fresh Concrete	*Hardened Concrete*	*Durability Test*
a) Slump Cone **b)** Compaction Factor	**a)** Compressive-Strength **b)** Split Tensile-Strength **c)** Flexural Strength	**a)** Water Absorption

3.1 Compression Test

A specimen of 150 X 150 X 150 (mm) size was casted and cured for different ages (3, 7&28 days). After curing with respected ages specimen were tested in a UTM (universal testing machine) to find the compression strength as per IS 516-1959 codal recommendation by using below Equation (1)[25]

$$fc' = \frac{P}{A}$$

Where fc' = Compressive-Strength of cube N/mm^2

P = Specimen failure load

A = cross section mm^2

3.2 Split Tensile Test

Split-Tensile Strength test for various mix was found at 7 and 28 days in accordance with IS 5816-1970 the test specimen tested on the UTM (universal testing machine). [25]The split tensile strength can be obtained using the below equation

$$\sigma = \frac{2P}{\pi DL}$$

σ is the split tensile strength N/mm2

P = load (N)

L = Specimen Height (mm)

D = Specimen Dia (mm)

3.3 Flexural Strength

Flexural strength test for different mix at different curing period of 7days and 28 days was carried out of prism size 100 X 100 X 500 (mm)[25]. The test results was obtained using the below Eqn.

$$Fcr = \frac{PL}{BXD^2}$$

Fcr = Flexural Strength (N/mm2) P = Load (N)

L = Length (mm)

B = Width (mm)

D = Depth (mm)

3.4 Water Absorption Test

A durability test was conducted for water absorption of concrete. The water absorption test is carried to find out the voids in concrete. In this experimental investigation we find out the water absorption of Hypo-Sludge concrete of various mix and compared with the normal concrete. [15]

The calculation of water absorption test is given below

$$\% \text{ of Water Absorption} = \frac{W2 - W1}{W1} X\ 100$$

Water absorption is measured in percentage

W1 = Oven dried weight of specimen.

W2 = wet weight specimen after immersion in water.

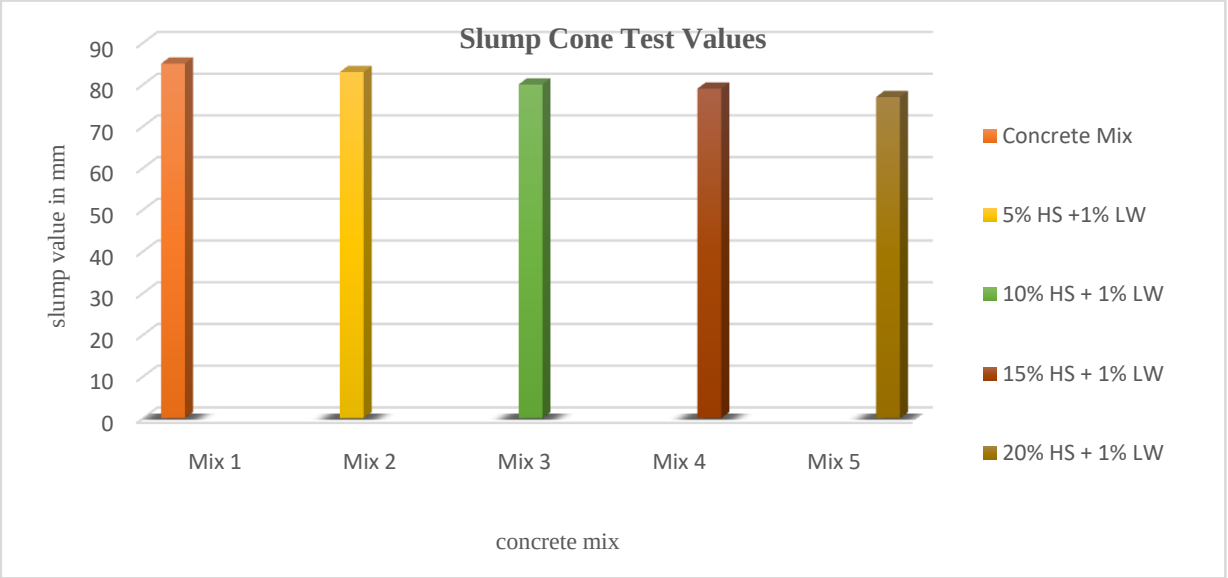
IV.RESULT AND DISCUSSION

4.1 Workability Test

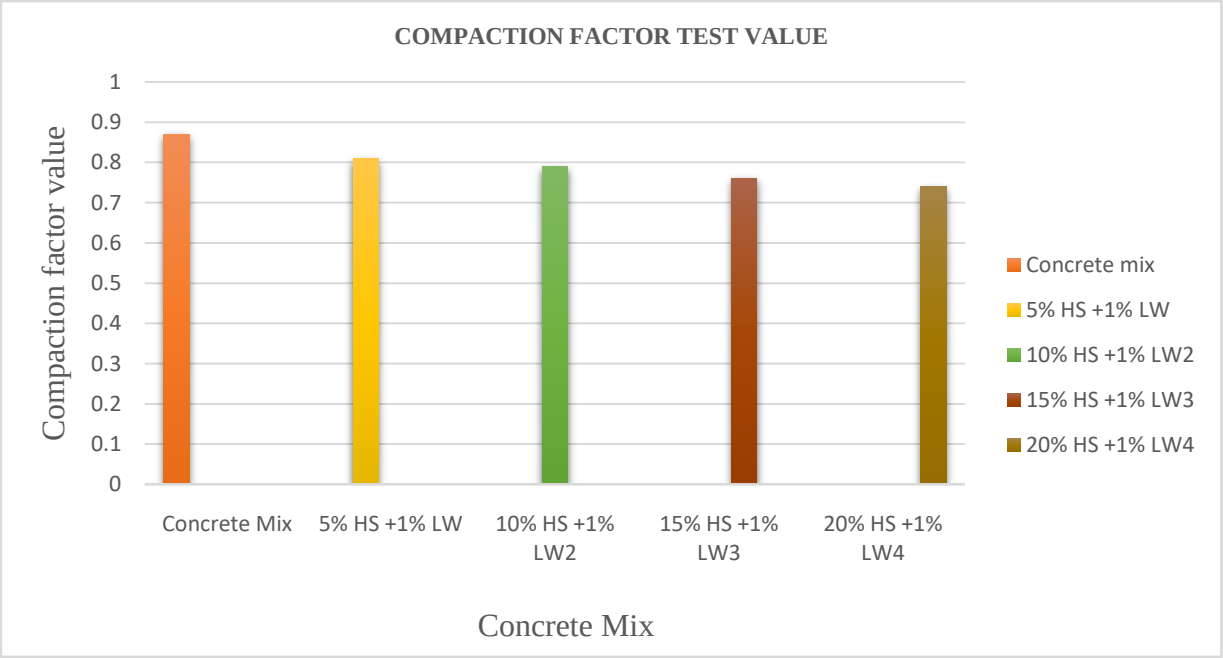
Slump Cone and Compaction Factor test is carried for good workable concrete in this test we get the slum cone value given below 4.1

Table 4.1 Shows The Result of Slump Cone & Compaction factor Value

SL No.	Concrete Type	Obtained Slump Value (mm)	Compaction factor Value
1.	Mix 1	85	0.87
2.	Mix 2	83	0.81
3.	Mix 3	80	0.79
4.	Mix 4	79	0.76
5.	Mix 5	77	0.74



Graph 4.1 Shows The Slump Cone Values

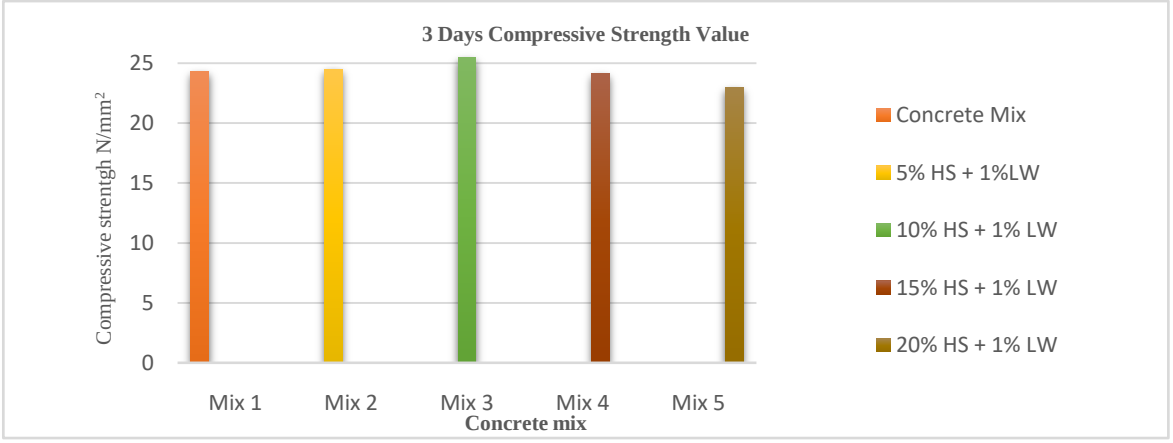


Graph 4.1a Shows The Compaction Factor Value

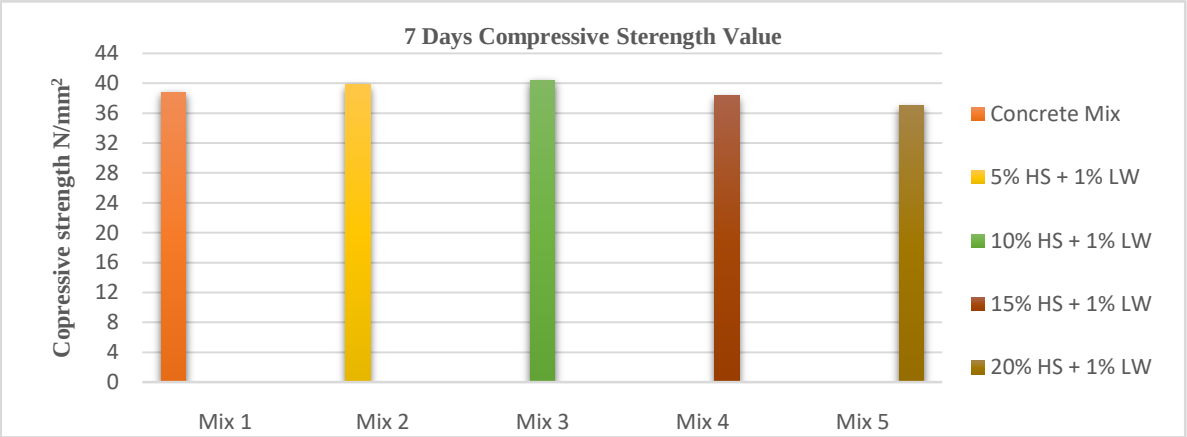
4.2 Compression Test

Table 4.2 Shows the Compressive-Strength of Specimen

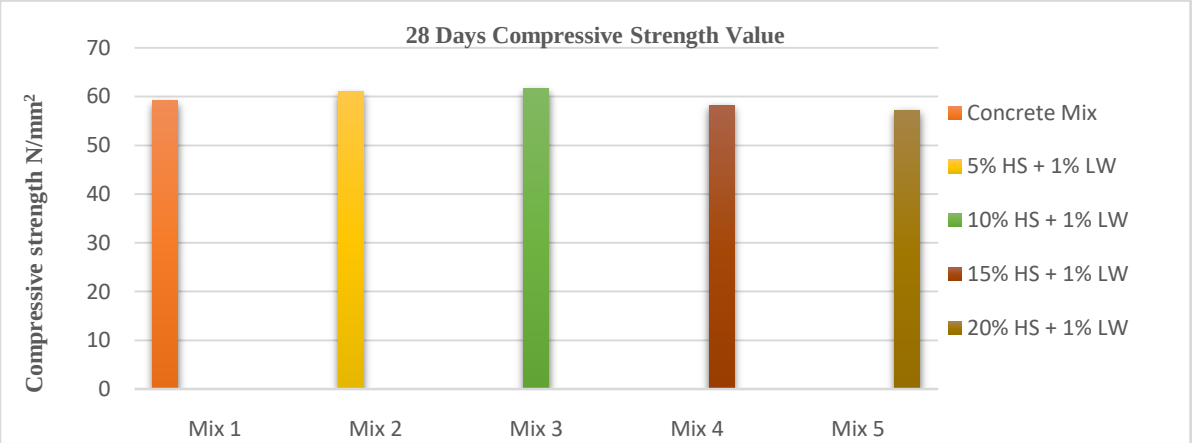
SL No.	Designation of Specimen	Avg Compressive-Strength of Specimen in N/mm^2 at Curing in Days		
		3days	7days	28days
1.	Mix 1	24.29	38.81	59.11
2.	Mix 2	25.03	39.85	61.03
3.	Mix 3	25.47	40.44	61.62
4.	Mix 4	24.14	38.36	58.21
5.	Mix 5	22.96	37.01	57.18



Graph 4.2 Shows the Compression Test Values for 3Days



Graph 4.2a Shows the 7 Days Compressive Strength

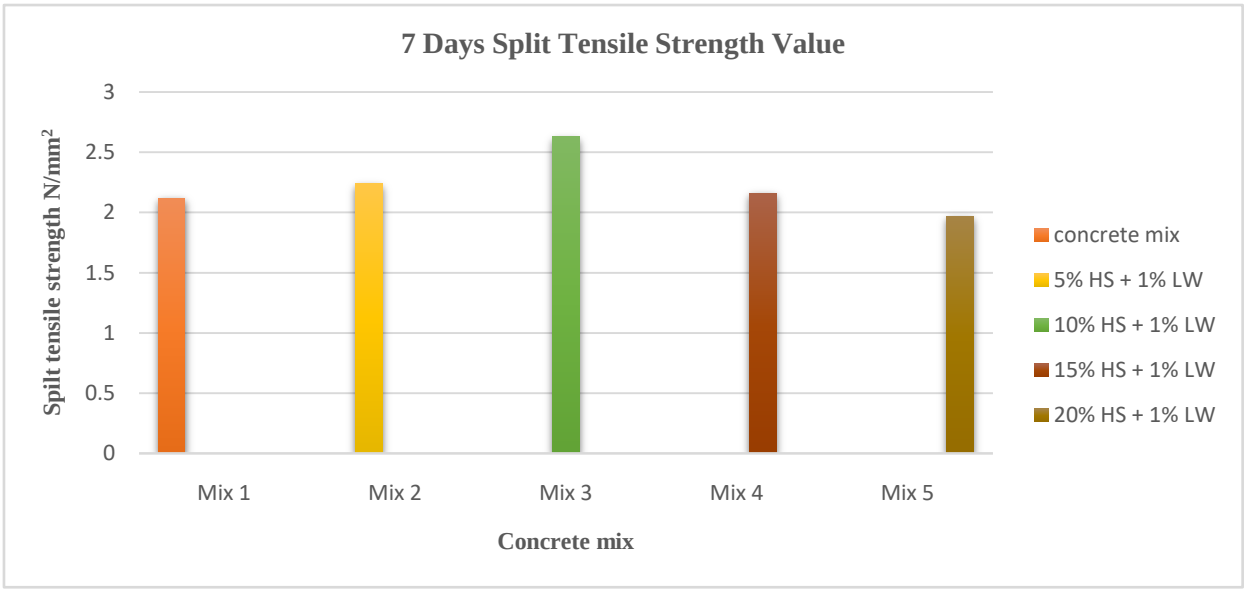


Graph 4.2b Shows the 28 Days Compressive Strength

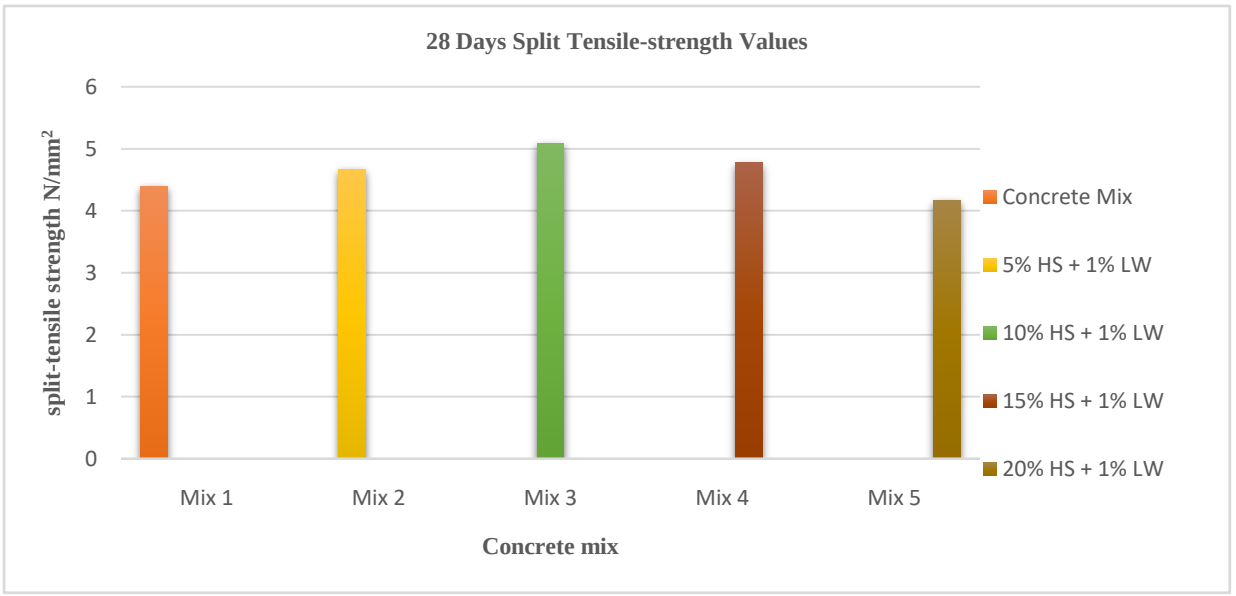
4.3 Split Tensile Test

Table 4.3 Shows the Split-Tensile Strength of Concrete

SL No.	*Designation Specimen*	*Avg Split Tensile Strength of Specimen in N/mm^2 at Curing Period in Days*	
		7days	*28days*
1.	Mix 1	2.12	4.40
2.	Mix 2	2.4	4.67
3.	Mix 3	2.63	5.09
4.	Mix 4	2.16	4.78
5.	Mix 5	1.97	4.14



Graph 4.3 Shows The Split-Tensile Strength at 7 Days

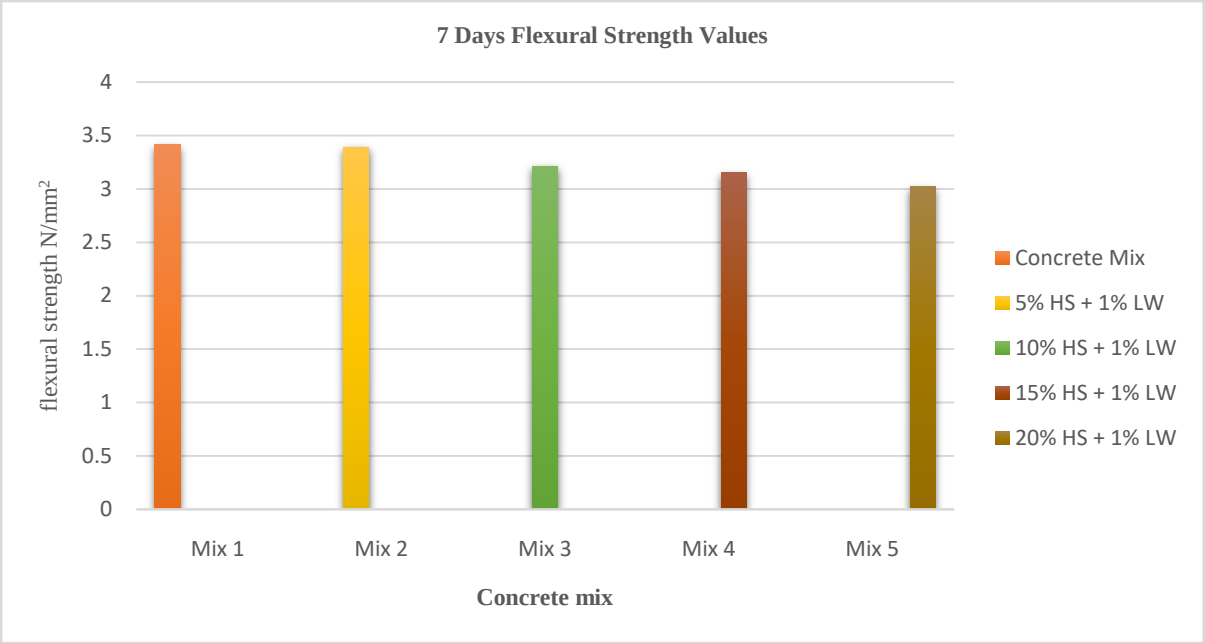


Graph 4.3a Shows The Split-Tensile Strength at 28 Days

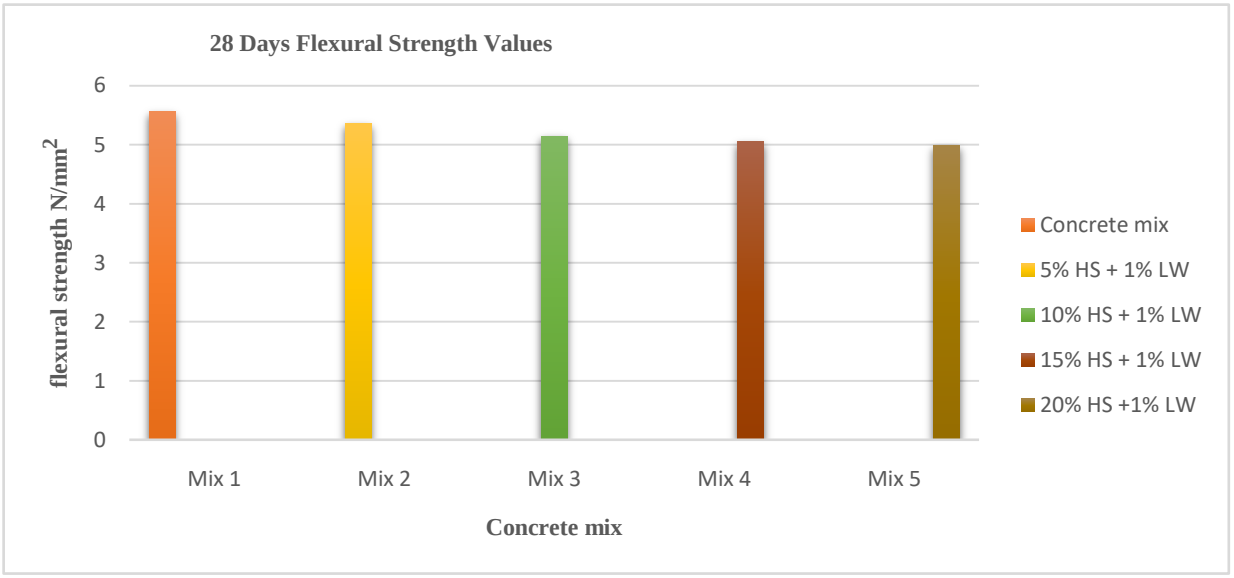
4.4 Flexural Strength

Table 4.4 Shows The Flexural Strength of Concrete

SN	Designation Specimen	Avg Flexural Strength of Specimen in N/mm^2 at Curing Period in Days	
		7days	28days
1.	Mix 1	3.41	5.56
2.	Mix 2	3.32	5.35
3.	Mix 3	3.21	5.14
4.	Mix 4	3.1	5.05
5.	Mix 5	3.02	4.98



Graph 4.4 Shows The Flexural. Strength 7 Days



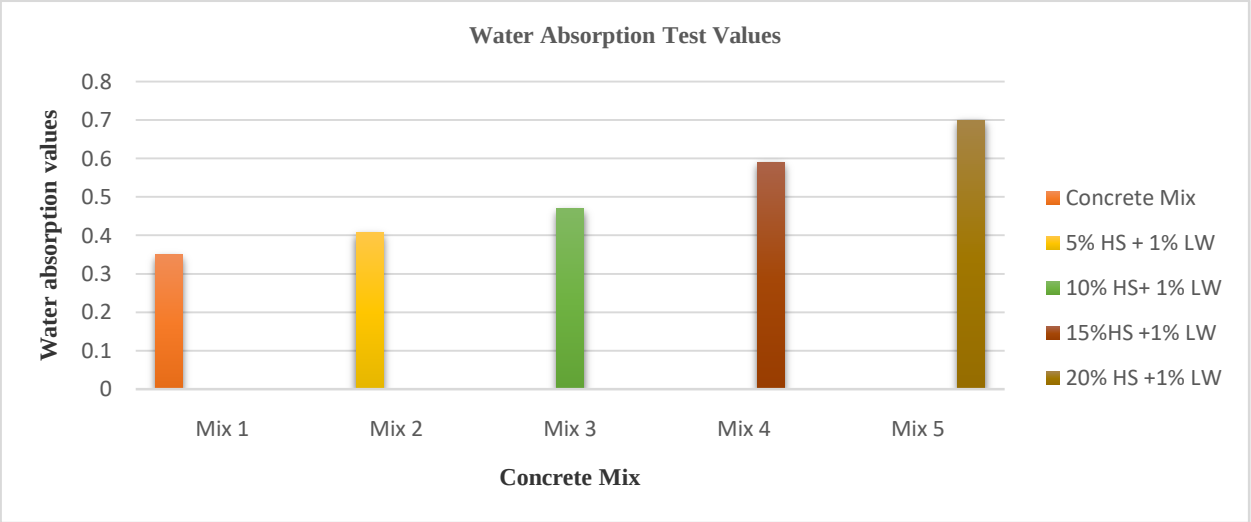
Graph 4.4a Shows The Flexural Strength At 28 Days

4.5 Water Absorption Test

Water absorption of concrete was tested in Laboratory the results are given in table no 4.5

Table no 4.5 Shows The Water Absorption Results of Concrete

SL.No	Type of Concrete	Dry weight in grams (W_1)	Wet weight in grams (W_2)	% age of Water Absorption
1	Mix 1	8490	8520	0.35
2	Mix 2	8590	8625	0.407
3	Mix 3	8484	8524	0.47
4	Mix 4	8460	8510	0.59
5	Mix 5	8466	8526	0.7



Graph 4.5 Shows the water Absorption Test Value

V CONCLUSIONS

In this experimental work following tests were carried out such as workability of concrete, Compressive-Strength, flexural-strength and Split Tensile Strength on M-50 grade concrete mix with partial replacement for cement with Hypo Sludge i.e, 5% 10% 15% and 20% and addition of Lathe waste (constant 1%) was considered.

Following are the conclusions obtained from this experiment.

1) Here the slump cone value decreases with the increase of Hypo sludge and getting medium workable slump value to the easy workability of concrete.
2) The density of concrete decreases with the increase of hypo sludge by increasing 10 % 15% and 20% because of the hypo sludge density is lighter than cement and it is useful for low-density concrete.
3) The compression strength increases with the replacement of hypo sludge by cement 5% and 10% and gradually decrease the strength replacement of 15% and 20% the optimum strength getting at 10% replacement of hypo sludge with respect normal concrete.
4) Split tensile strength increases with the replacement of 5% and 10% with the addition of Lathe waste and decreases strength when increases of hypo sludge 15% and 20% compared with normal concrete, normal concrete gives good strength compared to the replacement of hypo sludge.
5) Flexural strength decreases the strength with an increase of hypo sludge by 5 % it decreases the strength compared with the Normal concrete. Here the addition of 1% lathe waste is not given the strength to the flexural strength of beam because of lathe waste sizes are uneven and it does not maintain the proper aspect ratio of fiber.
6) Finally, we conclude that the replacement of hypo sludge for M-50 grade concrete 10% of hypo sludge gives the good strength for Non- structural concrete work and it is helpful for roads works and pavers.
7) In this experiment gives the utilization of hypo sludge up to 10% is no problem but increase the in hypo sludge decreases the strength of the concrete.
8) Water absorption is increased with increase in Hypo-Sludge at 5% 10% 15% &20%.
9) Replacement will be helpful to the decreases the cement usage by 10% and solve the bit environmental disposal of hypo sludge.

VI further scope of the study

1) Use of plasticizers or additives for study the strength performance of hypo sludge concrete with various proportions of mixing.
2) To study the details durability properties of hypo sludge concrete like acid attack, sulfate attack
3) To know the detailed structural actions of hypo sludge concrete.
4) Add different types of fibers to study the strength characteristic of hypo sludge concrete
5) Study the strength parameters by adding the silicate material to the hypo sludge because of silica content is low in Hypo sludge.

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