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An Experimental Study on Partial Replacement of Sand by Blue Metal Dust and Iron Scrap in Standard Concrete

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***Abstract*— In this study partial replacement of sand is done by Blue metal Dust and iron scrap in different percentage in concrete.In first category sand has been partially replaced by iron scrap having constant proportion of 5% and Blue metal Dust having 10%, 15% ,20% 25%,30%,35%, 40% partial replacement.**

In second category sand has been partially replaced by Iron scrap proportion of 10%,15%,20%,25%,30%, 35% and Blue Metal dust by 20%, 25%, 30% 35% and 40% replacement, several cubes have been cast for determining the compressive strength and workability split tensile strength.

For this purpose standard concrete of grade M 20 in a design mix proportion was formed and then tested for compressive , tensile and flexure strength and also checked against durability.

***Index Terms*— Blue metal Dust, iron Scrap, strength, Durability etc.**

I. INTRODUCTION

A. Bluemetal Dust

Blue metal Dust is commonly used in construction and as a base for artificial lawns, driveways, parking areas and footpaths. Also known as 'Cracker Dust' or 'Blue metal dust', this product compacts down very well when wet and is typically screened to 3mm.

Blue Metal dust is waste material produced by stone quarries while excavating and finishing stone. A large of waste powder is produced by such quarries only insignificant mass is used rest is dumped in nearby dumping yards. This can be used as a construction material by partially replacing Sand that can reduce overall cost.

II. LITERATUREREVIEW

- **Shankar Meena Rashmi Sakalle Nitin Tiwari(2018);**have found an experimental study of concrete as a partial replacement of sand with query dust and steel powder. In This Study they had used samples casted with 10%, 20%, 30%, 40% & 50% replacement of fine aggregate using stone dust and steel powder tested at a different periods of curing 7 days, 14 days and 28 days . From the test results of this study improvement in flexural strength is increased by 9.23% and 10.38% respectively as compare to conventional concrete mix at 28 days. By results of this study high strength values found at 40% replacement in strength parameters based on results it can be concluded that stone dust and steel powder can be used as concrete ingredients.
- **Anchal Jain, Nitin Thakur ;(2018)** have found in their research a series of experiments performed to compare the use of glass powder and steel powder as partial replacement of sand in different proportions. concrete mixes are modified by 10%, 15% and 20% and 25% of glass powder and steel powder in partial replacement of sand .Several concrete cubes have been prepared by replacing 10%, 15%, 20% and 25%, sand by weight with these waste materials. For preparing mix the cement, sand, and aggregate have been batched as 1:1.5:3 proportions for forming M-20 mix. Cube moulds of 15 x 15 x 15 cm have been used for casting cubes.From the test results of this study, strength was achieved very less on 7th and 14th days but it increases at 28th day. By results of this study high strength values found at 40% replacement in strength parameters.
- **ZainbHashimAbbasAlsalami (2017);** Have found the effect of using pistachio shells as partial replacement of sand on the properties of cement mortar by proportion of pistachio shells were used (10, 20, 30, 40, 50 and 60% by weight of fine aggregate. Furthermore, the effect of density, absorption, and compressive strength of cement mortar were also tested. Ordinary Portland cement were used .Compressive strength values of the mortar cubes were evaluated at 7, 14, 28 days at different percentage replacement levels obtaining a range of valuesof 6.78, 8.92 and 14.1 MPa, respectively at 20% replacement.
- **B. Pujitha N. Swathi Sk. Jain Saheb ;(2017)** have found experimental investigation on concrete to studying the effect of Plastic Waste And Waste Tyre Rubbers in Concrete. They were using the 53 grade Portland cement, graded coarse aggregate, river sand, super plasticizer, pozzollanic material, Plastic waste and waste tyre rubbers and water .In this experiment they were casted a cubes with M30 grade concrete and tested under Compression testing Machine. The replacement of materials 0%, 5%, 10%, 15%, 20% are taken for cubes casting. From test results, strength was achieved very less on 7^{th},14^{th} and 28 days . It show that M30 grade concrete cannot bear good strength at 20% replacement of partial material. As the percentage replacement

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increases the strength decreased continuously. So, it is useful as pavement concrete and the results show that it is non-structural concrete.

- **Baskaran.P,Karthickkumar.M,Krishnamoorthy.N,Saravanan.P,HematNaveen(2017);** Have found investigation on M25 grade concrete with partial replacement of fine aggregate by GGBS with various percentages of 0%, 5%, 10% and 15%..The specimens were casted for 7days, 14days and 28 days then tested. The maximum flexural strength for partial replacement of fine aggregate with GGBS be achieved by 15% is found to be greater than the conventional concrete .From the test results of this study, strength was achieved very good on 7th and 14th and 28th day. By results high strength values found at 15% replacement of GGBS

III. METHODOLOGY

Experimental work had been conducted on concrete mixes by using a different proportion of Iron scrap and Blue Metal Dust of different percentages of partial replacement of fine aggregates.

Two separate types of concrete mixes were prepared-

- In first category sand has been partially replaced by Iron scrap having constant proportion of 5% and Blue Metal Dusthaving 10%, 15%,20% 25%,30%,35%, 40% partial replacement.
- In second category sand has been partially replaced by Iron scrap proportion of 10%,15%,20%,25%,30%, 35% and Blue metal dust by 20%, 25%, 30% 35% and 40% replacement, several cubes have been cast for determining the compressive strength and workability split tensile strength.

IV. RESULTS

4.1 Slump Test

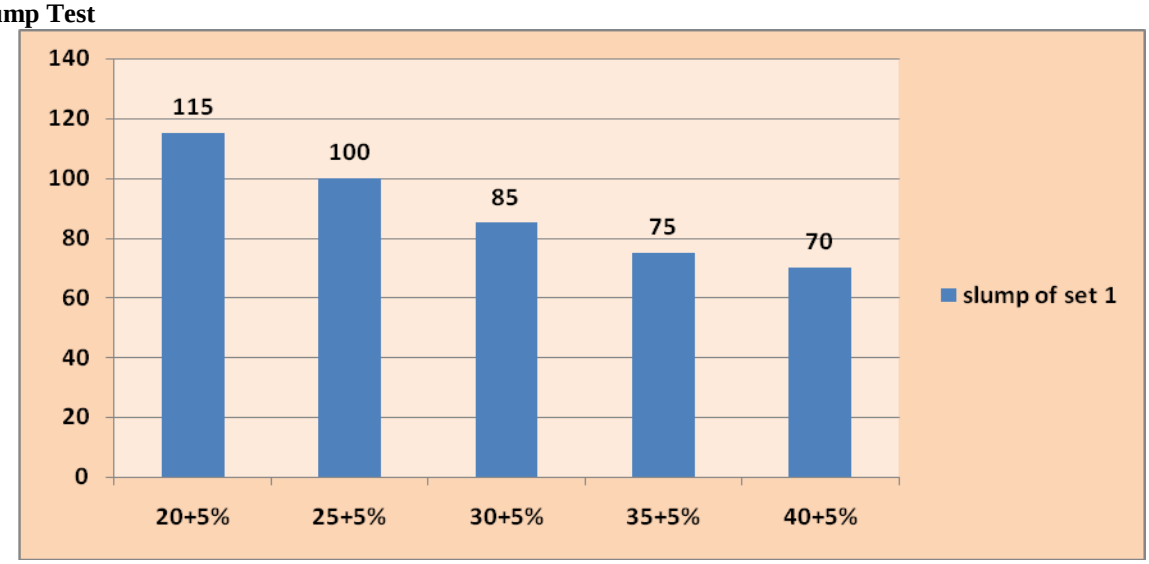

Fig.4.1. Slump variation in Mix 1

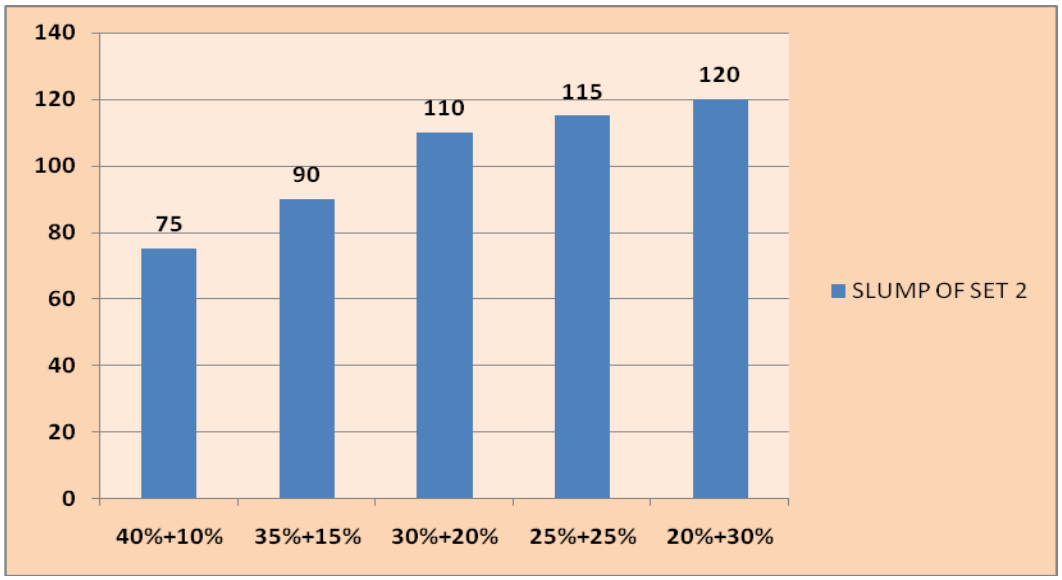

Fig.4.2.Slump variation in Mix 2

4.2 Compressive Strength of Mix 1:

Table 4.1: Compressive Strength of Concrete

F.A%	B.M.D %	I.S%	7DAYS compressive strength	28 DAYS compressive strength
75	20	5	16.2	22.5
70	25	5	17.8	23.5
65	30	5	18.52	24.8
60	35	5	16.78	22.7
55	40	5	15.4	21.9

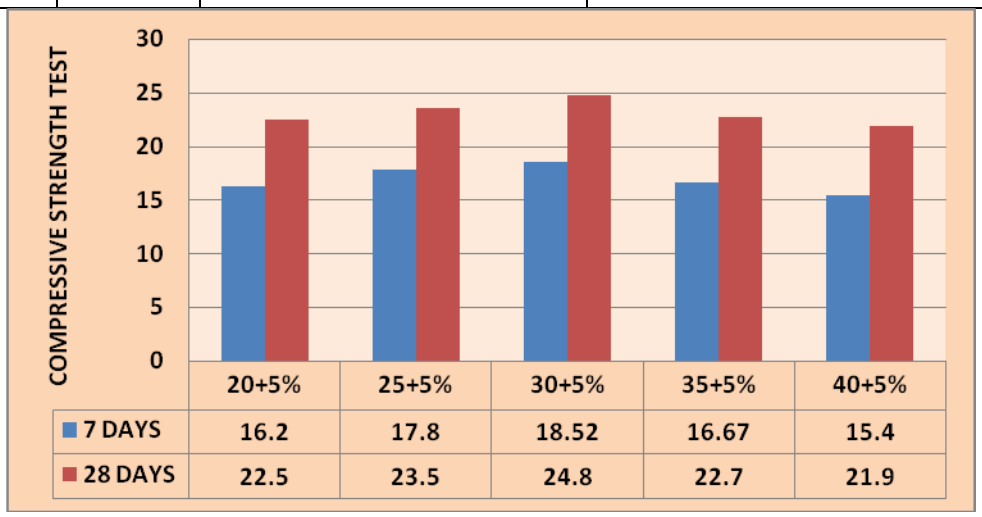

Fig.4.3. Compressive strength of Concrete Cubes in 7 and 28 days

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4.2.1 Compressive Strength of Mix 2

Table 4.2 Value of compressive strength set 2

F.A%	B.M.D %	I.S%	7 DAYS Compressive Strength	28DAYS Compressive Strength
50	40	10	19.75	38.33
50	35	15	25.25	40.12
50	30	20	33.52	45.12
50	25	25	40.02	49.02
50	20	30	44.04	54.12

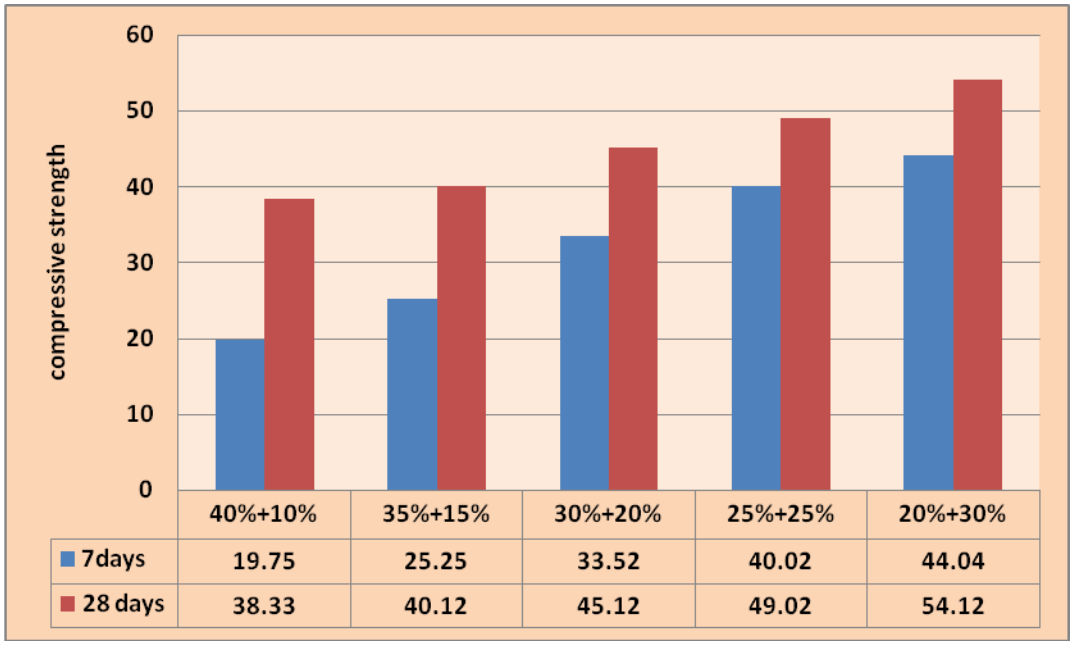

Fig.4.4. Variation in compressive strength in 7 and 28 days in set 2

4.3 SPLIT TENSILE STRENGTH TEST

Table 4.3 Split tensile strength in 7 and 28 days in Mix 1

F.A %	B.M.D %	I.S%	7 DAYS SPLIT TEST	28 DAYS SPLIT TEST
75	20	5	2.1	3.25
70	25	5	2.3	3.357
65	30	5	2.8	3.89
60	35	5	1.98	3.15
55	40	5	1.96	3.1

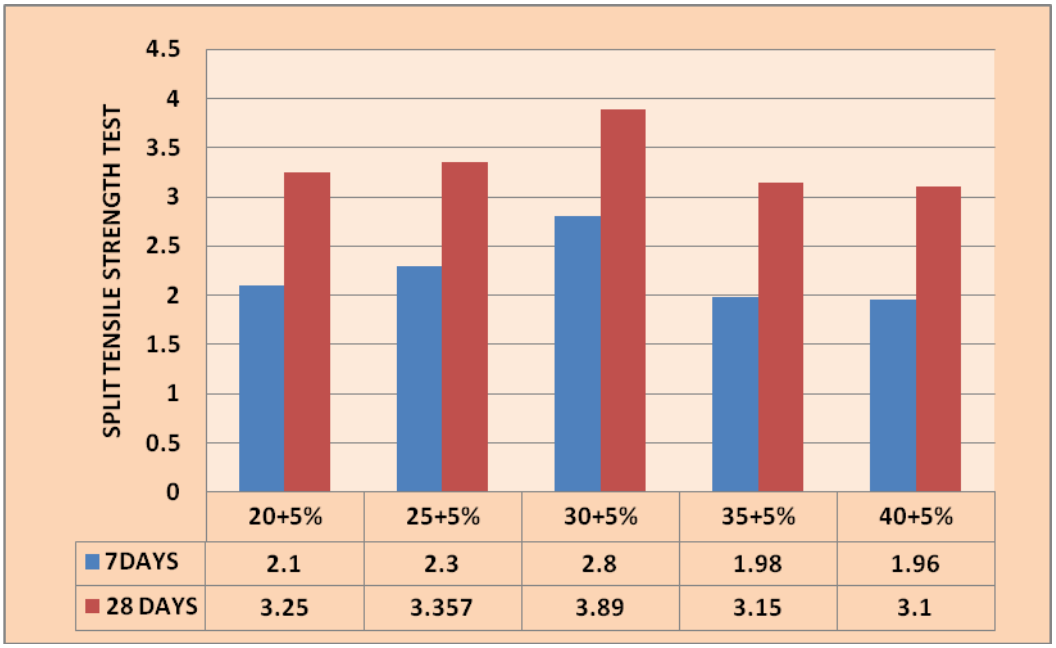

Fig.4.5. Variation in split tensile strength in 7 and 28 days in set 1

4.3.1 Split Tensile Strength Test Mix 2:

Table 4.4Value of split tensile strength in 7 and 28 days in set 2

F.A%	B.M.D %	I.S%	7 DAYS SPLIT TEST	28 DAYS SPLIT TEST
50	40	10	1.8	2.42
50	35	15	1.9	2.68
50	30	20	2.75	2.72
50	25	25	2.01	2.75
50	20	30	2.08	2.85

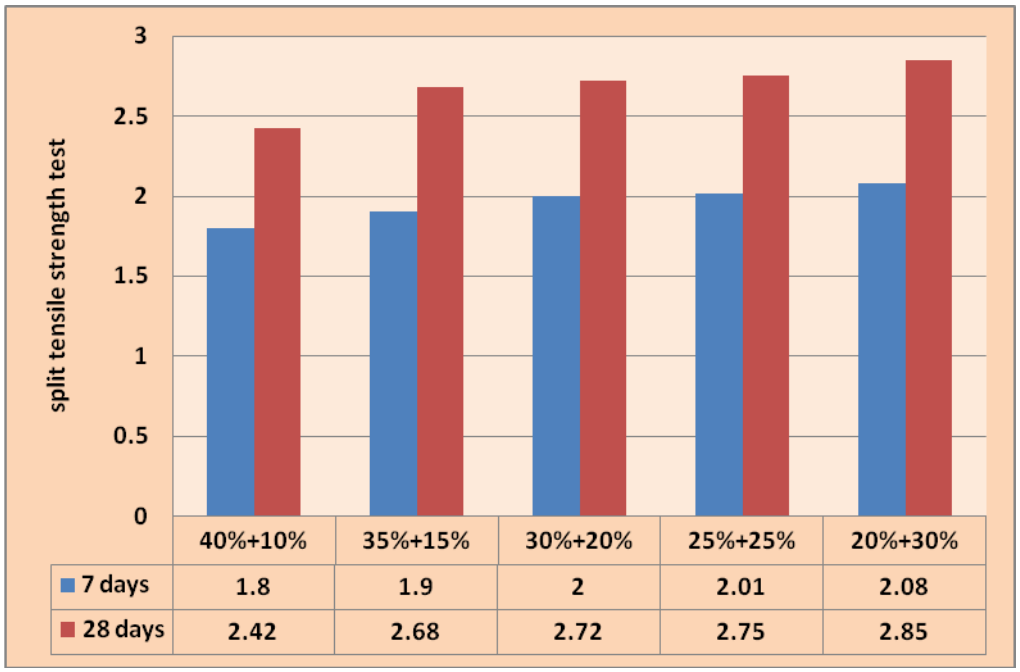

Fig.4.6.Variation in split tensile strength in 7 and 28 days in set 2

V. CONCLUSION

Conclusion for Mix 1

After analyzing the results for all tests including Slump test, Compressive Strength test, Splitting Tensile Strength test ,Following conclusions have been drawn in set 1 having 5 mixes (mix1,mix2,mix3,mix4,mix5) in which blue metal dust and fine aggregate having different proportion and mild steel scrape having 5% (constant)proportion .

- Mix ratio of M20 (cement: aggregate: sand+ blue metal dust +Iron scrap) give the optimum strength in this study.
- As the percentage of blue metal dust+ scrap gradually increases, the Compressive strength of concrete will also increase with condition that percentage of blue metal dust(30%)+mild steel scrap (5%) should not exceed (30+5) % and the strength is 18.52 N/mm2 for 7 days and23.8N/mm2 in 28 days. After this proportion a slight decrement was observed which is shown in table 5.5 and 5.6.
- The compressive strength of concrete increase with the increase of age of maturity.
- The split tensile strength of set 1 also tend to increase upto 30% after that a decrement is observed in strength of concrete.
- According to the value of compressive strength collected, the value is high and it show that blue metal dust +mild steel scrap suitable to use as sand replacementupto(30+5)%. All the value of compressive strength surpasses the minimum value of compressive strength for normal concrete So, crusher dust +mild steel scrape can apply as sand replacement in concrete mix for construction industry .
- The workability of concrete is decreased by adding % of blue metal dust. But it is compensate by adding metallic dust, because it increase workability.

Conclusion of Mix 2

The strength characteristic and split tensile strength of concrete work have been analyze .In This thesis work ,replacement of sand by blue metal dust and mild steel scrape of proportion (40+10),(35+15),(30+20),(25+25),(20+30) percentage replaced in sand .After analyzing the results for all tests including Slump test, Compressive Strength test, Splitting Tensile Strength test ,Following conclusions have been drawn in set 2 having 5 mixes (mix1,mix2,mix3,mix4,mix5) in which blue metal dust and mild steel scrape having different proportion and sand having 50% (constant) proportion.

- The compressive strength is gradually increased as the %of blue metal dust (20% decrease) and mild steel scrap (30% increased) is increased and the

value of compressive strength is 44.04 N/mm2 for 7 days and 54.12N/mm2 in 28 days.

- The split tensile strength is also increased at increase percentage of mild steel scrap and decrease % of blue metal dust is 2.08N/mm2 for7 days and 2.18N/mm2 in 28 days.
- The early age strength gains higher as compare to normal mix.
- The split tensile strength of set 2 tend to increase upto (20+30)%
- This study has brought out positive results that compressive strength and split tensile strength is increased as the blue metal dust and mild steel scrape increased.
- The workability of concrete is decreased by adding % of blue metal dust. But it is compensate by adding metallic dust, because it increase workability.

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