EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF FINE AGGREGATE WITH SAWDUST AND QUARRY DUST

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ABSTRACT *Concrete is a composite material composed of coarse aggregate bonded together with cement which hardens over time. Most concretes used are lime-based concretes such as Portland cement concrete or concretes made with other hydraulic cements. However, asphalt concrete which is very frequently used for road surfaces is also a type of concrete, where the cement material is bitumen, and polymer concretes are sometimes used where the cementing material is a polymer. Quarry dust is a waste obtained during quarrying process. It has very recently gained good attention to be used as an effective filler material instead of fine aggregate. It is defined as residue, tailing or other non-voluble waste material after the extraction and particles less than 4.75mm. This product can be used for asphalt, substitute for sand, and filling around pipes. Quarry dust can be an economic alternative to the river sand.* Here Quarry dust is replaced with fine aggregate and compared with conventional concrete.

Key Words : Concrete, Fine aggregate , Saw dust, Quarry dust.

I INTRODUCTION

Modern structural concrete differs from Roman concrete in two important details. First, its mix consistency is fluid and homogeneous, allowing it to be poured into forms rather than requiring hand-layering together with the placement of aggregate, which, in Roman practice, often consisted of rubble. Second, integral reinforcing steel gives modern concrete assemblies great strength in tension, whereas Roman concrete could depend only upon the strength of the concrete bonding to resist tension. The widespread use of concrete in many Roman structures ensured that many survive to the present day. Sawdust or wood dust is a by-product of cutting, grinding, drilling, sanding, or otherwise pulverizing wood or any other material with a saw or other tool; it is composed of fine particles of wood. It is also the byproduct of certain animals, birds and insects which live in wood, such as the woodpecker and carpenter ant. It can present a hazard in manufacturing industries, especially in terms of its flammability. Sawdust is the main component of particleboard. Quarry dust is a waste obtained during quarrying process. It has very recently gained good attention to be used as an effective filler material instead of fine aggregate,

II LITERATURE REVIEW

M.Shukla et al. (2000) studied environmental hazardous stone dust utilization inbuilding construction. It is found that partial replacement will not affect the strength and also solve the problem of disposal of stone dust. The workability of concrete reduces with the increase in stone dust and this can be improved by adding suitable admixtures.A.K.Sahet at al. (2004) the basic properties of conventional concrete and concrete made using quarry dust have compared. They have studied M20 and M30 concretes. Equivalent mixes are obtained by replacing stone dust partially/fully. Test results indicate effective usage of stone dust with same compressive strength, comparable tensile strength and modulus of rupture. Workability of 40% replacement of stone dust with 2% Superplasticizer is equal to the workability of conventional concrete. Workability is increased by the addition of Superplasticizer. Thaniya Kaosol (2010) has made study on the reuse of concrete waste as crushed stone for hollow concrete masonry units. The main objective was to increase the value of the concrete waste, to make a sustainable and profitable disposal alternative for the concrete waste. Attempts were made to utilize the concrete waste as crushed stones in the concrete mix to make hollow concrete blocks. Various percentages of crusted stones have been tried the amount (i.e. 0%, 10%, 20%, 50% and 100%). from the results they found concrete waste can used to produce hallow concrete block masonry units.

III MATERIAL USED

The materials used in making the concrete are listed below.

1. Cement
2. Water
3. Fly ash
4. Fine aggregates
5. Coarse aggregates
6. Sawdust
7. Quarry dust

MIX PROPORTIONS

1. Cement=201.3 Kg m^3
2. Fly Ash= 136.4 Kg m^3
3. Water= 136.02 litres
4. Fine aggregate= 908.26 Kg m^3
5. Coarse aggregate= 1106.09 Kg m^3
6. Chemical admixture= 1.79 Kg m^3
7. Water-cement ratio (Note 4.1)= 0.4

MIX PROPORTIONS	
1	100% Cement + 100 % Ca + 100 % Fa
2	100% Cement + 100 % Ca + 10 % Qd +10 % Sd + 80 % Fa
3	100% Cement + 100 % Ca + 20 % Qd +15 % Sd + 65 % Fa
4	100% Cement + 100 % Ca + 30 % Qd +20 % Sd + 50 % Fa
5	100% Cement + 100 % Ca + 40 % Qd +25 % Sd + 35 % Fa

Table 1Mix.Proportions

IV TEST RESULTS

4.1 Initial Test

1.Specific Gravity of Cement = **3.15**
2. Fineness of cement =**3%**
3.Consistency of cement = **33%**
4. Fineness modulus of fine aggregate = **2.97**
5. Specific gravity of fine aggregate =**2.74**
6. Water Absorption =**1%**
7.Specific gravity coarse aggregate= **2.74**
8.Fineness modulus of coarse aggregate = **3.1**
9.Moisture content of coarse aggregate = **0.5**

4.2 Compressive Test Results

Mix	**7th day N/mm2**	**28th day N/mm2**
Mix 1	24.52	31.42
Mix 2	24.94	32.14
Mix 3	25.26	32.45
Mix 4	25.82	33.05
Mix 5	24.98	32.79

Table 2. Compressive test results of mix proportions

4.3 Flexural Test Result

Mix	**7^{th} day N/mm^2**	**28^{th} day N/mm^2**
Mix 1	4.56	5.23
Mix 2	4.76	5.75
Mix 3	5.23	6.12
Mix 4	5.77	6.87
Mix 5	4.97	6.05

4.4 Split Tensile Test

Mix	7th day N/mm2	28th day N/mm2
Mix 1	2.56	3.45
Mix 2	2.62	3.74
Mix 3	2.84	3.94
Mix 4	3.02	4.35

V RESULTS AND DISCUSSION

EXPERIMENTAL WORK

Size of beam(Over All)	-	100 x 150 x 1500mm
No. of beams	-	3
Type of Beam	-	Singly Reinforced beam
Support conditions	-	Simply Supported
Loading Condition	-	Two point load at one third distance
Materials	-	Quarry Dust and Saw Dust
Method of Curing	-	Water Curing
Test of beams	-	Under the Loading capacity 1000 KN with jack load capacity 500KN

FIG1. TEST SET UP OF BEAM IN LOAD

FIG 2. CRACK PATTERN OF BEAM FRAME

DEFLECTION VALUES FOR BEAM OF CONCRETE WITH QUARRY DUST AND SAW DUST

Load	Deflection
0	0
10	0.45
20	0.82
35	1.69
50	2.18
90	3..42

TABLE 5.DEFLECTION VALUES FOR BEAM OF CONCRETE WITH QUARRY DUST AND SAW DUST

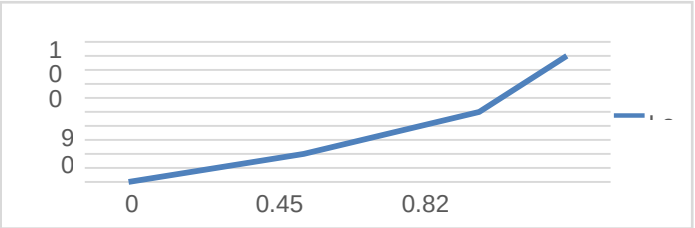

FIG 3. LOAD - DEFLECTION GRAPH

VI CONCLUSION

The concrete mix planned for this study with partial replacement of sawdust and quarry dust found possible and economical based on previous studied. In this study sand is partially replaced by industrial by-product sawdust and quarry dust. The following points are arrived from the present study.

- From the past studies it has been proved using sawdust and quarry dust doesn't affect the properties of concrete majorly.
- Sawdust and quarry dust as partial replacement of fine aggregate is economical.
- Due to its high fines of quarry dust it provided to be very effective in assuring very good cohesiveness of concrete.
- The properties exhibited by the concrete made with Quarry dust as fine aggregate matches with the conventional concrete.
- With regards to costs, the price of sawdust per sack in comparison with sand was also lesser than usual since sawdust already is waste.

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