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WASTE PLASTIC USED IN MODERN CONCRETE CONSTRUCTION

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Abstract - *The use of plastics is increasing day by day through there are steps taken to reduce it. The most suitable plastics for use as coarse aggregate in concrete and the details by which they are selected are discussed. Few tests were conducted on the properties of the ne aggregate such as density, specific gravity, crushing value. The suitability of volumetric substitution and grade substitution is adopted. Certain percentage of volumetric gave higher strength and this was used for determining other properties like cylindrical tensile strength, flexural strength and R.C strength.*

1. INTRODUCTION

Concrete is the most widely used man made construction material in the world and its second only to water as the most utilized substance in the planet. It is obtained by mixing cementitious material. Water aggregate and admixtures in the required proportions. This mixture when placed in forms allowed to cure hardens into rock like mass known as concrete. The largest portion of the concrete is taken by the coarse aggregates in concrete. This investigation aims at production of an aggregate which is better than the conventional stone aggregates.

2. METHODOLOGY

Since a complete substitution of the conventional aggregate with the plastic aggregate is not feasible due to lack availability, a partial substitution is checked. The partial the best percentage substitution of yield the best compressive strength was determined (0%, 20%,

40%, 60% 80% and 100% plastic with stone aggregates.)

With the percentage substitutions the following were determined.

Construction material in the world and its second only to water as the most utilized substance in the planet. It is obtained by mixing cementitious material, water aggregate and admixtures in the required proportions. This mixture when placed in forms allowed to cure hardens into rock like mass known as concrete. The hardening is caused by chemical reactions between water and cement substitution is checked. The partial the best percentage substitution of yield the best compressive strength was determined (0%, 20%, 40%, 60% 80% and 100% plastic with stone aggregates.)

With the percentage substitutions the following were determined.

1) Cylindrical compressive strength

2) Splitting tensile strength

3) Modulus of elasticity

4) Flexural strength

5) R.C.C Strength

6) Temperature sensitivity.

7) Grade substitutions were checked20mm grades with plastic aggregates rest with stone aggregate

8) Suitability of admixture CS-ST to increase strength was also checked

2.1 Plastic Aggregate

Plastics are becoming an environmental problem even through steps are taken to reduce usage. Plastics are one of the best materials that man has ever found and hence it will be difficult to minimize use of multi- purpose material. There are many recycling plan across the world which recycles plastics, but the strength of plastics cannot be maintain. All the plastics recycled are down cycled, I e, there lose their strength with the number of recycling so these plastics end up as earth fill when sufficient strength is not achieved. Until a method of properly dismantling the composition of plastics thus making its biodegradable. The possible advantages of using plastic aggregate concrete are

- Lighter weight aggregate
- Higher crushing strength
- A way to discard non – usable plastics.
- Specific gravity .9
- Density 2
- Crushing value .81

3. EXPERIMENTAL INVESTIGATION AND RESULT DISCUSSION

The section includes the detailed of material used, method of casting used, various tests conducted on those materials and their results. The effect of using plastic aggregates in cement concrete has been embodied here. Concert mix of grade M20 was chosen and the specimen was casted with plastic aggregates in mixes with weighing percentage by volume. An attempt was also made to study the suitability of grade substitution for the plastic aggregates. A number of specimens were casted and trusted to determine to the suitability of plastics as coarse aggregates. In the present investigation, an attempt has

been made to study in detail the behaviour of conventional concrete and plastic aggregate concrete. M20 mix was loosed for workability tests, compression test; cylinder split tensile test, flexural tensile strength tests and modules of elasticity tests. The result of tests conducted and the discussion on the tests are presented in this chapter. The parameters such as compressive strength, split tensile strength, flexural strength and modules of elasticity has been considered for the analyses of the result.

Table 3.1: Workability values

Specification	Slump in	Compaction
Stone aggregate concrete	33	.93
20%plastic aggregate concrete	36	.95

Table 3.2: Volumetric substitution

Specification	Label	Load (T)	Stress (N/mm^2)	Average Stress (N/mm 2)
0% plastic	001	55.65	24.7	
	002	55.2	24.5	24.2
	003	52.65	23.4	30.83
	201	70.95	31.5	
20% plastic	202	66	29.3	
	203	71.28	31.7	28.1
40%plastic	401	68.64	30.51	
	402	56.43	25.3	
	403	64.35	28.6	
60% plastic	601	49.17	21.9	
	602	54.78	24.35	21.2
	603	45.87	20.39	
80% plastic	801	50.82	22.6	20.9
	802	43.23	19.21	
	803	47.19	20.9	
100 % plastic	1001	44.72	19.8	17.7
	1002	35.31	15.7	
	1003	39.6	17.6	

Table 3.3: Volumetric substitution- Strength weight ratio

Specification	Label	Weight (kg)	Stress (Nmm^2)	Stress/weight	Average stress/weight
0%plastic	001	8.174	24.7	3.32	2.96
	002	8.233	24.5	2.98	
	003	8.108	23.4	2.88	
20%plastic	201	7.565	31.5	4.17	4.07
	202	7.610	29.3	3.85	
	203	7.587	31.7	4.18	
40%plastic	401	7.191	30.51	4.23	3.93
	402	6.941	25.1	3.62	
	403	7.272	28.6	3.93	

60%plastic	601	6.402	21.9	3.42	3.42
	602	6.625	24.35	3.68	
	603	6.473	20.39	3.15	
80%plastic	801	6.081	22.6	3.72	3.44
	802	5.878	19.21	3.16	
	803	6.083	20.9	3.44	
100% plastic	1001	5.728	19.8	3.46	
	1002	5.691	15.7	2.76	3.12
	1003	5.589	17.6	3.15	

Table 3.4: Grade substitution

Specifications	Label	Weight (kg)	Stress (N/mm^2	Stress/weight	Average stress /weight
0% plastic	001	8.174	24.7	3.02	2.96
	002	8.233	24.5	2.98	
	003	8.108	23.4	2.88	
20%plastic	201	7.565	31.5	4.17	4.07
	202	7.610	29.3	3.85	
	203	7.587	31.7	4.18	
Grade substitution 20 mm plastics	CA1	7.642	17.48	2.28	2.41
	CA2	7.899	20.6	2.61	
	CA3	7.774	18.14	2.33	

Table 3.5: Cube compressive strength

Specification	Label	Load (T)	Stress (N/mm^2)	Average Stress (N/mm^2)
Stone aggregate concrete	001	55.65	24.7	24.2
	002	55.2	24.5	
	003	52.65	2.4	
20%plastic Aggregate concrete	201	70.95	31.5	
	202	66	29.3	30.83
	203	71.29	31.7	

Table 3.6 Cylinder compressive strength

Specification	Label	Max in T	Compressive strength in N/mm^2	Avg.compressive strength
Stone aggregative concrete	013	20	11.10	11.80
	014	22.5	12.49	
	015	21.3	11.82	
22%plastic	2211	28.4	15.77	

aggregate concrete	2212	30.2	16.76	16.27
	2213	29.3	16.27	

Table 3.7 Split tensile test

Specification	Label	Mix load in T	Splitting tensile strength N/mm^2	Avg.splitting Tensile Strength(fct)
Metal aggregate concrete	016	18	2.5	2.45
	017	17.6	2.44	
	018	17.3	2.4	
22 %plastic aggregate concrete	2214	14.2	1.97	1.91
	2215	13.3	1.84	
	2216	13.7	1.9	

Table: 3.7 Ratio of modulus of rupture to splitting tensile strength

Specifications	Avg.modulus of rupture, fcr N/mm^2	Avg. splitting tensile strength (Fct)	Ratio of fcr/fct
Metal aggregate concrete	4.69	2.45	1.91
22 % plastic aggregate	4.49	1.91	2.36

Table: 3.8: Modulus of elasticity values

Specification	Label	Young's modulus in elasticity MPa 28th day	Average Young's modulus in MPA a on 28th day	Theoretical value E_c=5000 f_{ck}
Stone aggregate concrete	015	15417	16290	22361
	016	17164		
22 % plastic aggregate concrete	2212	12222	12686	

This study was conducted to determine the suitability of plastic coarse aggregate. The replacement of 22% plastics coarse aggregate in an concrete gives higher compressive strength than conventional type concrete. One the main problem arising is the bond strength between plastic aggregate and cement, can be over comes by use use of admixture manufactured by Piditite. Plastics coarse aggregate needs more attention against reduction of split tensile strength and elastic modulus.

4. CONCLUSION AND SCOPE FOR FUTURE WORK

Based on the present study the following conclusion can is drawn Poly propylene is the best plastic aggregate for temperature polypropylene has a melting point of 1300 c compared to lower values of the other varieties of plastics. The bond strength of plastics with cement is generally weak.

Plastic aggregate satisfy the criteria of light weight concrete. The use of 100% plastic substituted concrete gave a density of 16kNm3 which falls in the category of weight

aggregate (3kN/m3 to 19kN/m3). Higher strength compared to light weight concrete was also achieved 22% substitution with use stone aggregate was the substitution percentage which gave the best results Better workable concrete was obtained.

Better results of compressive strength for cube cylinder compression was achieved in the investigation with 22% plastic along with the stone aggregate. Lower density concrete compared to the stone aggregate concrete. Was achieved in the investigations. The 22% plastic aggregate concrete has a density of 21lN/m2 compared 24 kN/m2 given by the stone aggregate concrete.

The tensile strength obtained for the tensile is lesser compared with the stone aggregate concrete.

The behavior of plastic in Reinforced concrete beams was better. The strength of the Reinforced concrete beam increased with the use of 22% plastic aggregate along with the stone aggregate.

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