STRENGTH STUDIES ONCONCRETE BY PARTIAL REPLACEMENT OF AGGREGATES WITH GRANITE POWDER AND CERAMIC TILES

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Abstract

Due to the day to day innovations and development in construction field, the use of natural aggregates is increased tremendously and at the same time, the production of solid wastes from the demolitions of constructions is also quite high. Because of these reasons the reuse of demolished constructional wastes like ceramic tile and granite powder came into the picture to reduce the solid waste and to reduce the scarcity of natural aggregates for making concrete. The ceramic tile waste is not only occurring from the demolition of structures but also from the manufacturing unit.

Crushed waste ceramic tiles, crushed waste ceramic tile powder and Granite powder are used as a replacement to the coarse aggregates and fine aggregate. The ceramic waste crushed tiles were partially replaced in place of coarse aggregates by 10%, 20%, 30%, 40% and 50%. Granite powder and ceramic tile powder were replaced in place of fine aggregate by 10% along with the ceramic coarse tile. M30 grade of concrete was designed and tested. The mix design for different types of mixes were prepared by replacing the coarse aggregates and fine aggregate at different percentages of crushed tiles and granite powder. Experimental investigations like workability, Compressive strength test, Split tensile strength test for different concrete mixes with different percentages of waste crushed and granite powder after 7and 28 days curing period has done. It has been observed that the workability increases with increase in the percentage of replacement of granite powder and crushed tiles increases. The strength of concrete also increases with the ceramic

coarse tile aggregate up to 30% percentage.

Keywords: Crushed waste ceramic tiles, Granite powder, Workability.

1.Introduction

Concrete with a strength of more than 5000 psi was frequently employed for particular building components. For instance, to maintain small column diameters in high-rise concrete structures, the bottom level columns may be made of concrete with a strength of 12,000 psi or higher. To reduce the number of spans needed, bridges may use long beams of concrete with a strength of 10,000 psi. High strength concrete could occasionally be needed for the other structural requirements. If the structure must be extremely rigid, the very high strength concrete may be specified—far stronger than is necessary to support the service loads. For these commercial purposes, concrete with a 19000-psi strength rating was used.

2. Objectives

a) To use aggregates with granite powder as efficiently as possible

b) To use aggregates with ceramic tiles as efficiently as possible.

c) To assess the concrete's compressive and split tensile strength

3. Materials

The properties of cement are presented in Table 1.

Table 1 Physical properties of cement

S. No.	Property	Cement (53 grade)
1	Specific gravity	3.15
2	Fineness	7.11%

3.1 Ceramic tile aggregate

Broken tiles were gathered from a demolished structure and the solid refuse of a ceramic production facility. By hand and with the use of a crusher, the used tiles were reduced to tiny fragments. To partially replace the natural coarse aggregate, the necessary size of crushed tile aggregate was separated. The waste tile that is smaller than 4.75 mm in size was disregarded. The crushed tile aggregate retained on the 12 mm screen after passing through a 16.5 mm filter is used. Crushed tiles were substituted for coarse aggregate in amounts of 10%, 20%, 30%, 40%, and 50%, respectively, while granite powder was used in place of the fine aggregate.

3.2 Granite powder

The chemical and mineral makeup of granite is comparable to that of cement and natural aggregates since granite powder is produced by crushing granite rocks. It was selected so that concrete behaviour and ceramic tile waste could be tested.

4. EXPERIMENTAL INVESTIGATIONS

4.1 Compressive strength results

The compressive strength conducted in compression testing machine for the cast

and cured specimens and the results are furnished in table 2 .

Table2:Compressive strength of concrete with granite powder and ceramic tiles as partial replacement of cementinconcrete.

Sl. no	MIX DESIGNATION	Aggregate Replacement % (CCA+ GP)	**Compressive strength Results,N/mm^2**	
			7 days	28 days
1	M0	0	28.04	40.12
2	M1	10+10	29.84	42.70
3	M2	20+10	31.60	45.88
4	M3	30+10	37.01	52.51
5	M4	40+10	33.51	48.05
6	M5	50+10	31.12	45.05

Table3:Split Tensile strength of concrete with granite powder and ceramic tiles as partial replacement of cementinconcrete

Sl.no	MIX DESIGNATION	Aggregate Replacement % (CCA+GP)	**Split tensile strength Results,N/mm^2**	
			7 days	28 days
1	M0	0	1.88	2.74
2	M1	10+10	1.99	2.85
3	M2	20+10	2.13	3.11
4	M3	30+10	2.48	3.46
5	M4	40+10	2.21	3.19
6	M5	50+10	2.09	3.04

4.2Split Tensile strength results

At the age of 7 and 28days, the cylindrical specimens (150mm diameter x 300mm height) were tested for evaluating the split tensile strength. The experiment is performed by putting a cylindrical sample horizontally between a compression testing machine loading surface and the load is applied until the cylinder fails along the vertical diameter.

5.Conclusion

In this study the concrete ingredients like fine and coarse aggregates are replaced by granite powder and ceramic tiles. Granite powder replaced with constant percentage of 10% in fine aggregate and ceramic tiles are replaced with different percentages of 10%, 20%, 30%, 40% and 50% in coarse aggregate.

- The compressive strength of normal concrete at the age of 7 and 28 days are 28.04 N/mm^2 & 40.12 N/mm^2.
- The split tensile strength of normal concrete at the age of 7 and 28 days are 1.88 N/mm^2 & 2.74 N/mm^2.

- The compressive strength of 10% ceramic tiles and 10 % of granite powder at the age of 7 and 28 days are 29.84 & 42.70 N/mm^2.
- The split tensile strength of 10% ceramic tiles and 10 % of granite powder at the age of 7 and 28 days are 1.99 & 2.85 N/mm^2
- The compressive strength of 30% ceramic tiles and 10 % of granite powder at the age of 7 and 28 days are 37.01 & 52.51N/mm^2.
- The split tensile strength of 30% ceramic tiles and 10 % of granite powder at the age of 7 and 28 days are 2.48 & 3.46 N/mm^2.

6.References

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