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INVESTIGATION ON PARTIAL REPLACEMENT OF AGGREGATES WITH GRANITE POWDER AND CERAMIC TILES IN CONCRETE

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ABSTRACT

According to studies, 20–30% of the fabric created in tile manufacturing factories winds up as trash. To cope with the finite supply of natural aggregate and to minimize construction waste, this waste product should be required for reuse. In place of the coarse aggregates and fine aggregate, crushed waste ceramic tiles, crushed waste ceramic tile powder, and granite powder are employed. 10%, 20 %, 30% , 40 %, and 50 % of the coarse aggregates were replaced with the crushed ceramic waste tiles. Together with the ceramic coarse tile, 10% of the fine aggregate was swapped out for granite powder and ceramic tile powder. A concrete grade called M30 was developed and tested. By substituting crushed tiles and granite powder at varying ratios for the coarse aggregate and fine aggregate, many varieties of mixtures were created. After a 7,28 days curing period, experimental tests for compressive strength, and split strength were conducted on various concrete mixes including various amounts of crushed trash and granite powder. It's been found that when the replacement rate of smashed tiles and granite powder increases, so does the workability. With the addition of ceramic coarse tile aggregate, the strength of concrete additionally rises by up to 30%.

Keywords*: Ceramic tiles, Granite powder, compressive strength, split tensile strength.*

1. INTRODUCTION

Concrete with a strength of more than 5000 psi was frequently employed for particular building components. For instance, to keep the columns' diameters small, high-rise concrete structures with lower floor columns may employ concrete with a strength of 12,000 psi or higher. To reduce the number of required spans, bridges may use lengthy beams of concrete with a 10,000 psi strength. High strength concrete may occasionally be needed for structural reasons that are the reverse. If the structure must be extremely rigid, the very high strength concrete may also be specified—even much stronger than is necessary to contact the service loads. For these commercial purposes, concrete with a 19000-psi strength rating was used.

2. OBJECTIVES

The objectives of this study are as follows

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	3.149
2	Fineness	7.19%

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. By substituting crushed tiles for coarse aggregate in percentages of 10%, 20%, 30%, 40%, and 50%, respectively, along with substituting granite powder for fine aggregate, crushed tiles were also used in place of coarse 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 .

Table 2: Compressive strength of concrete with granite powder and ceramic tiles as partial replacement ofcement in concrete

Sl.no	MIX DESIGNATION	Aggregate Replacement % (CCA+GP)	7 days (N/mm^2)	28 days (N/mm^2)
1	M0	0	34.61	49.52
2	M1	10+10	36.83	52.71
3	M2	20+10	39.01	56.64
4	M3	30+10	45.68	64.81
5	M4	40+10	41.36	59.31
6	M5	50+10	37.70	55.61

4.2 Split Tensile strength results

The cylindrical specimens (150 mm diameter x 300 mm height) were tested for determining the split tensile strength at ages 7 and 28 days. A cylindrical sample is placed horizontally between the loading surface of a compression testing machine.

Table 3: Split Tensile strength of concrete with granite powder and ceramic tiles as partial replacement ofcement in concrete

Sl.no	MIX DESIGNATION	Aggregate Replacement % (CCA+GP)	7 days (N/mm^2)	28 days (N/mm^2)
1	M0	0	3.39	4.86
2	M1	10+10	3.64	5.21
3	M2	20+10	3.78	5.49
4	M3	30+10	4.61	6.67
5	M4	40+10	4.04	5.80
6	M5	50+10	3.72	5.49

5. CONCLUSION

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.

1. The compressive strength of normal concrete at the age of 7 days and 28days are 34.61N/mm^2 &49.52 N/mm^2.
2. The compressive strength of 10% ceramic tiles and 10 % of granite powder at the age of 7 days and 28days are 36.83 N/mm^2 & 52.71 N/mm^2 .
3. The compressive strength of 20% ceramic tiles and 10 % of granite powder at the age of 7 days and 28days are 39.01 N/mm^2 & 56.64 N/mm^2 .
4. The compressive strength of 30% ceramic tiles and 10 % of granite powder at the age of 7 days and 28days are 45.68 N/mm^2 & 64.81 N/mm^2 .
5. The compressive strength of 40% ceramic tiles and 10 % of granite powder at the age of 7 days and 28days are 41.36 N/mm^2 & 59.31 N/mm^2 .
6. The compressive strength of 50% ceramic tiles and 10 % of granite powder at the age of 7 days and 28days are 37.70N/mm^2 55.61 N/mm^2
7. 7.The Split tensile strength of normal concrete at the age of 7 days and 28days are 3.39N/mm^2 & 4.86 N/mm^2.
8. The Split Tensile strength of 10% ceramic tiles and 10 % of granite powder at the age of 7 days and 28days are 3.64 N/mm^2 & 5.21 N/mm^2
9. The Split tensile strength of 20% ceramic tiles and 10 % of granite powder at the age of 7 days and 28days are 3.78 N/mm^2 & 5.49 N/mm^2 .
10. 10.The Split tensile strength of 30% ceramic tiles and 10 % of granite powder at the age of 7 days and 28days are 4.61 N/mm^2 & 6.67 N/mm^2 .
11. 11. The Split Tensile strength of 40% ceramic tiles and 10 % of granite powder at the age of 7 days and 28days are 4.04 N/mm^2 & 5.80 N/mm^2 .
12. 12. The Split Tensile strength of 50% ceramic tiles and 10 % of granite powder at the age of 7 days and 28days are 3.72 N/mm^2 & 5.49 N/mm^2 .

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