

Study of Partial Replacement of Coarse Aggregate by Mosaic Tile Chips

Mohd. Fazil Danish¹, Dr Kuldeep Dabhekar², Saurabh R More³, Dr Isha P Khedikar⁴

^{1,3}Research Scholar, Department of Civil Engineering, G.H. Rasoni college of engineering, Maharashtra, India.

^{2,4}Assistant Professor, Department of Civil Engineering, G.H. Rasoni college of engineering, Maharashtra, India.

Abstract- In last decade, construction has increased and replaced the greeneries by concrete mass. As the population is increasing abruptly, we are unable to stop basic housing need of human. Since we have to construct a large amount of concrete mass, we need large amount of coarse aggregate and fine aggregate. This will exhaust naturally available source sand and aggregates which will damage the environment. In futuristic way of construction people preferring cladding material for better architectural appearance. Which is extreme use of tiles, marbles, and granites. The mosaic tile waste isn't just coming from destruction of structure and also from manufacturing factory. This waste material must be reused so as to manage the restricted natural aggregate and to decrease construction wastes. This article is tied in with looking into the ideal level of various material as substitution of coarse aggregate.

Keywords: Waste Crushed tiles, mosaic tile chips workability Compressive strength, Split Tensile strength

1.Introduction:

As the modernization in construction come in context, lots of old structure were dismantled to make new one to give more space or better strength. On that structure there is massive use of different tile mostly ceramic or mosaic tile. Ceramic products play a vital role to make structure look better instantly and also protect that surface. These are generally manufactured by natural material having lots of minerals. In India, around 100 million ton per year of ceramic tiles is manufactured and nearly 15%-30% of it becomes waste while production or while using in situ. And we all know that this type of waste is not perfectly recyclable in other means where as it possesses good resistance to biological chemical or physical degrading force. Therefore, we preferred it as replacement of coarse aggregate to make the waste product useful. These days we are using lots of innovative ways in construction field which increases the use of coarse aggregate and fine aggregates, at the same time, wastes from the dismantling of the structure is also very high. As the standard of living of people become more lavish, they are preferring well-furnished lifestyle.

The tile is first crushed by manual means or by crusher and replace the coarse aggregate in concrete mix proportion. The replacement is done in the percentage of 10%, 20%, 30%, 40% and 50% of coarse aggregate.

Concrete grade of M25 is designed and tested. Various tests are performed like workability, Compressive strength test, split tensile strength test for different concrete mixes in interval of 7, 14- and 28-days curing. The results show that the workability is increases when the percentage of replacement is increases. The strength of concrete also increases with the replacement coarse aggregate. The big advantage of using tile waste, it reduces the construction cost as it is freely available.

2. Methodology

2.1 Work on Materials:

2.1.1 Cement: We used OPC of 53 Grade o Ultra Tech Company.

Sr. No	Description	Tested results
1	Grade used	53
2	Initial setting time	55min
3	Final setting time	255min
4	Specific gravity	3.15
5	Compressive strength	55N/mm ²

2.1.2 Fine Aggregates:

Sr. No	Description Test	Result
1	Sand zone	Zone- III
2	Specific gravity	2.59
3	Water absorption	5%
4	Free Moisture	1%

2.1.3 Coarse Aggregates:

Sr. No	Description	Test Results
1	Nominal size used	20mm down
2	Specific gravity	2.9
3	Water absorption	0.15%

2.1.4 Mosaic Tile Replacement of Coarse Aggregate:

Tile chips are obtained from the manufacturing factory of mosaic tile or from the waste of dismantled structure. We crushed it by manual or mechanical means like crusher or hammer.



Fig -1: Mosaic tile chips

The crushed tile aggregate retaining on 12.5 mm and passing through 16mm sieve are used.

Sr. No	Description	Test Results
1	Specific gravity	2.6
2	Water absorption	0.19%

2.2 Mix design: By replacing coarse aggregate, different mix type is prepared of M25 grade. 6 type of mixes is prepared by replacing 10%, 20%, 30%, 40%, 50% of coarse aggregate. All the concrete mix is done under the IS 10262:2009. Details are as follows.

Final quantities of materials:

- Cement = 384 kg/m³
- Fine aggregates = 646.4 kg/m³
- Coarse aggregates = 1271.30 kg/m³
- Water = 187.5liters/m³

Final Mix Proportions:

C : FA : CA : WATER
 384 : 646.4 : 1271.30 : 187.5
 1 : 1.68 : 3.31 : 0.50

Casting detail:

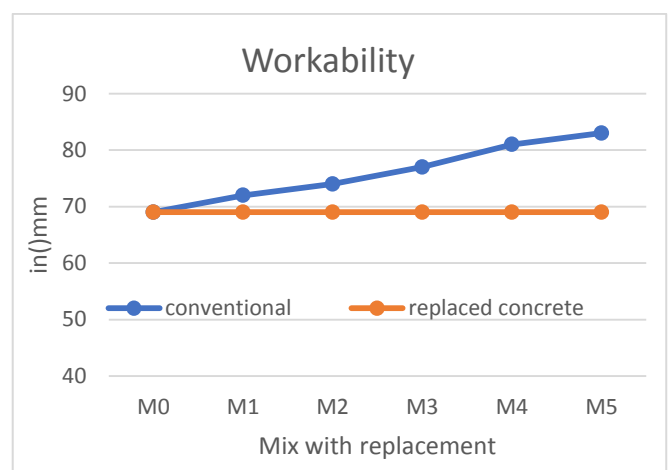
Sr. No.	Concrete	Days	Percentage Replacement	Cube	Cylinder	Beam
1	Conventional concrete	28 days	0%	3	3	3
2	Concrete with replacement	28 days	10%	3	3	3
			20%	3	3	3
			30%	3	3	3
			40%	3	3	3
			50%	3	3	3

3. Test Result:

3.1 Slump Cone Test:

True Slump is obtained in workability pattern. Result from slump cone test are shown in following.

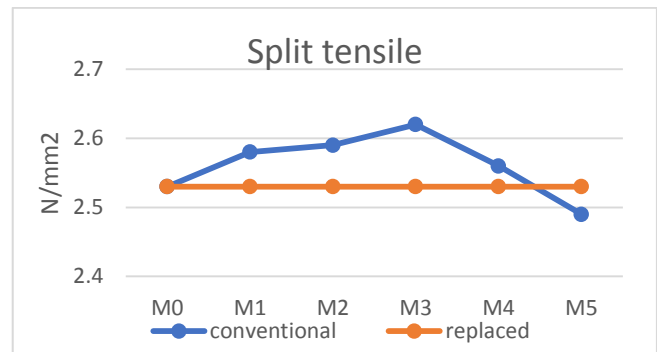
Sr. No	Mix design	Aggregate Replacements % (CCA)	Workability (mm)
			M25
1	M-0	0	69
2	M-1	10	72
3	M-2	20	74
4	M-3	30	77
5	M-4	40	81
6	M-5	50	83



3.2 Compressive strength:

30 cubes -15 x 15 x 15 cm size
 Tested for-7,14,28 days

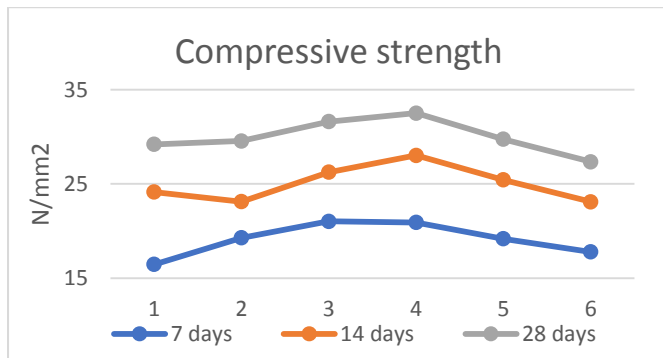
S. No	Mix Design	Aggregate Replacements % (CCA)	Compressive strength (M25 grade N/mm ²)		
			7 days	14 days	28 days
1	M0	0	16.46	24.13	29.2
2	M1	10	19.27	23.11	29.55
3	M2	20	21.02	26.24	31.6
4	M3	30	20.9	28.02	32.51
5	M4	40	19.17	25.42	29.73
6	M5	50	17.78	23.1	27.34



4. Conclusion:

When we were done with all experimental methodology and from the test results lots of variation is observed which are mentioned below.

1. In workability test it is seen that, increase the of tile chips percentage, increases the concrete workability of.
2. Where as in compressive strength test, it is observed that in 7 days, increase in strength to 17.13%, 27.72%, 36.38%, 16.51%, 8.02% of M1, M2, M3, M4, M5 in comparison with conventional concrete.
3. And for the 14 days compressive strength test, the strength of varies as 9.95%, 14.95%, 31.39%, 11.29%, 1.18% for M1, M2, M3, M4, M5 while comparing with convention concrete.
4. Lastly comparing with the conventional concrete compressive strength test for 28 days, the strength increases to 10.5%, 19.20%, 30.4%, 11.80%, 3.05% for M1, M2, M3, M4, M5.
5. After performing split tensile test, observation shows that the tensile strength of concrete mixes varies as 1.94%, 4.89%, 7.2%, 1.15%, -1.62% for M1, M2, M3, M4, M5 in comparison of conventional concrete. But for the 50% replacement shows the downfall of strength in comparison of conventional concrete.
6. After performing all the tests, it is observed that the M3 mix of concrete i.e. 30% replacement of coarse aggregate with tile chips show better results.



3.3 Split Tensile strength:

The cylindrical column of M25 grade of concrete was tested in split tensile machine for various replaced mixes, split tensile strength of 28 days are as folles

S.No	Mix Design	Aggregate Replacements % (CCA)	Split Tensile Strength 28 days (M25 Grade) N/mm ²
1	M-0	0	2.53
2	M-1	10	2.58
3	M-2	20	2.59
4	M-3	30	2.62
5	M-4	40	2.56
6	M-5	50	2.49

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