Experimental Study of High Strength Concrete Containing Ceramic Waste as a Tile

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ABSTRACT

In this world developing countries are depend on the infrastructure growth but infrastructure is made from the concrete. Concrete is a homogeneous material which is made from cement, fine aggregate, coarse aggregate and water. Pollution in the country is increased with the increase a growth of the country because of the industrialization.in this research fine aggregate and coarse aggregate replaced with ceramic tile. First it replace with coarse aggregate 10%, 20%, 30%, 40% and 50% from them best compressive strength replace with same contain from 10%,20%,30%40% and 50% as a fine aggregate for water cement ratio is 0.35. Now observe fresh property of concrete like slump test and compaction factor test. Also observe a property of the hardened property of concrete like compressive strength, split tensile strength, flexure strength and under water flexure test.

Keyword: - *Ceramic tile, compressive strength, split tensile strength, under water flexure strength*

1. INTRODUCTION

In the next generation concrete will be very useful for civil engineering. Now a day's high-rise building and pre stressed post tensioned bridges are constructed very much. So it can be utilization of the small space in big use. In developing country high rise building are challenged for civil engineering because they make structure cost effective and eco-friendly.

Generally concrete made from the cement, coarse aggregate, fine aggregate, water and super plasticizer. Super plasticizer is used for the purpose of increase workability and strength of concrete. From them cement manufacture in factory. Where fine aggregate and coarse aggregate get naturally. So replace in concrete with the fine aggregate and coarse aggregate for make it economy like marble waste, ceramic waste, tiles etc. this material easily available.

Here in this research ceramic tile is replaced with coarse aggregate and fine aggregate because ceramic tile manufacture 700o boxes per unit and 15 to 30% goes as a waste as a waste which is not recycled which is used for to fill all the dump of land. In that small power of these materials is flow with wind and makes environment pollution so environment become dull which is occurs health problem in human body. So in this research to use of a tile as a coarse aggregate and fine aggregate replaced with tile waste and reduce the pollution from earth and also reduce the use of natural resources.

30% ceramic tile goes as waste because its nature is brittle. Therefore is break down during the time of use and manufacturing. These broken parts are used as coarse aggregate and fine aggregate. It replaced with on behalf coarse aggregate and fine aggregate.

1.1 Objective

- To investigate fresh property of HSC (slump test, compaction factor test) with replacement of ceramic tiles as a coarse aggregate up to 50% for water cement ratio 0.35.
- To investigate a hardened property of concrete (compressive strength, split tensile, flexure test) of concrete to replacement of ceramic tiles as a coarse aggregate and fine aggregate up to 50%.
- To investigate a durability of concrete of HSC (Hcl and Mgso4).
- To investigate a compressive strength of concrete using locally available material.

1.2 Material

Ceramic tiles are broken manually by use of hammer. These parts broken into small pieces and maintain size 120 to 150mm for coarse aggregate for fine aggregate its size is below 4.75mm. The specific gravity of ceramic tiles is 2.51. These tiles are collected from commander ceramic at 8A national highway. In this research ordinary Portland cement is used. Naturally river sand is used by conforming IS 383-1970. Naturally crushed stone are used as a coarse aggregate. Water is most important specially for making a concrete because a bed quality of water is leading to poor quality of concrete. It is reacting with the cement gel to gives strength of concrete. Portable water is used for curing and mixing of concrete. Super plasticizer is most important to improve the workability of concrete and compressive strength for high strength concrete. In this research Conplast sp 430 G8 is used for improvement of the workability of concrete. Water absorption rate of Ceramic aggregate is about 17%. Specific gravity of ceramic aggregate is about 2.51.

2. MIX DESIGN

	Cement(Kg)	Water (Lit.)	Fine agg.(Kg)	Coarse agg.(Kg)	Super plasticizer (%)
By weight	479	168	676	1151	7.18
1bag	50	17.53	70.56	120.14	0.7

Fig-1 Ceramic waste

Fig-2 Under water flexure test

Table-2 Design mix proportion for various concrete

Sr. No	Concrete type	Coarse aggregate replacement
0	M0	0% replacement of CA
1	M1	10% replacement of CA
2	M2	20% replacement of CA
3	M3	30% replacement of CA
4	M4	40% replacement of CA
5	M5	50% replacement of CA
6	M6	20 replacement of CA + 10% replacement of FA
7	M7	20 replacement of CA + 20% replacement of FA
8	M8	20 replacement of CA + 30% replacement of FA
9	M9	20 replacement of CA + 40% replacement of FA
10	M10	20 replacement of CA + 50% replacement of FA

CA- Coarse aggregate

FA- Fine aggregate

2.1 Experimental methodology

Here in this research paper first replace a ceramic waste as a coarse aggregate from 10% to the 50% From the best compressive strength of them to start a replacement of the ceramic waste as a fine aggregate. Observe a compressive strength of concrete after curing of 7 days and 28 days from the date of casting.

For each mix concrete six cube is casted (3 tested at 7 days and 3 tested at 28days) of a size 150mm*150mm*150mm. 3 cylinder is tested at 28days from the date of casted of a size 150mm diameter and 300mm length. 3 beams are tested at 28 days and from the date of casting. 3 beams is tested at 56 days (28 days normal curing after 28 days 3% of Nacl added into water than under water tested at 56 days) and tested at under water by made of a plasti glass box with a 4mm thickness of base made by cast iron.

Compressive strength, Split tensile strength, Flexure strength and under water flexure strength of concrete is given at below table.

Table-3 Data of hardened property of concrete

Design Mix	Compressive strength		Split tensile strength	Flexure strength of concrete	Under water flexure strength of concrete
	7 Days	28 Days			
M0	42.46	63.25	3.27	5.55	7.56
M1	39.22	56.41	3.45	5.67	7.68
M2	39.86	56.60	3.49	5.87	7.74
M3	38.25	55.21	3.62	5.98	7.52
M4	39.91	55.47	3.22	5.51	7.49
M5	38.31	55.25	3.19	5.48	7.42
M6	39.86	58.65	3.61	5.93	7.98
M7	39.66	55.15	3.68	5.97	7.95
M8	39.28	55.77	3.23	5.51	7.49
M9	40.11	55.66	3.21	5.48	7.47
M10	39.82	58.32	3.19	5.46	7.41

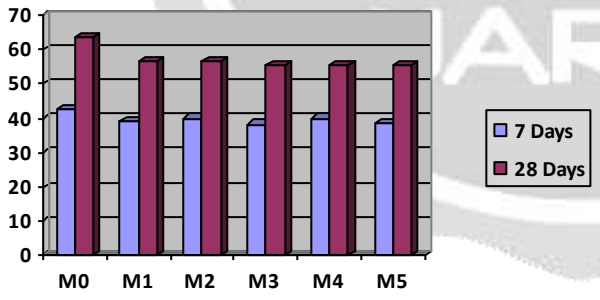

Fig-3 Compressive strength

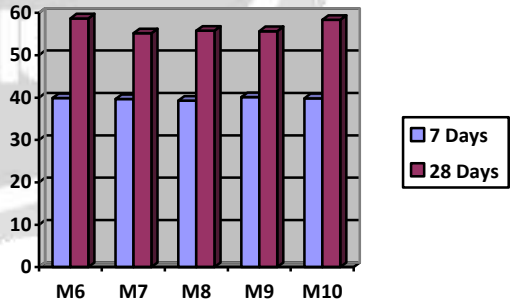

Fig-4 Compressive strength

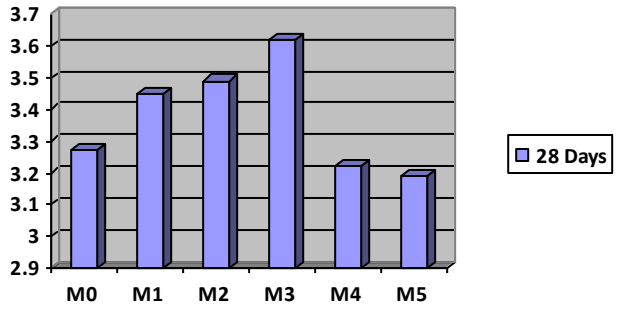

Fig-5 Split tensile strength

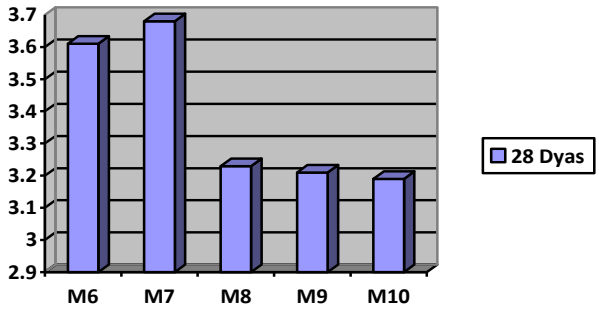

Fig-6 Split tensile strength

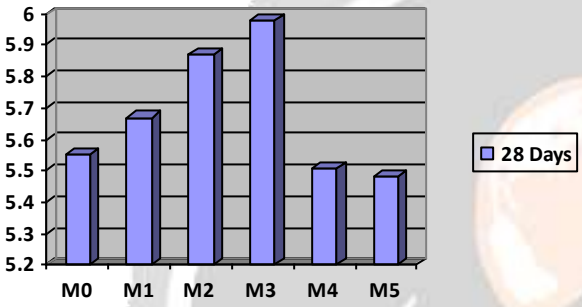

Fig-7 Flexure strength

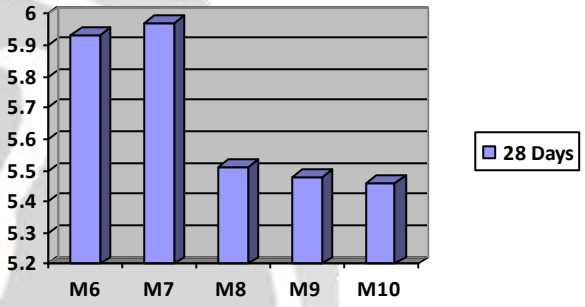

Fig-8 Flexure strength

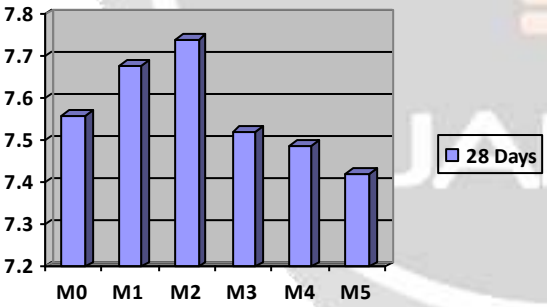

Fig-9 Under water Flexure strength

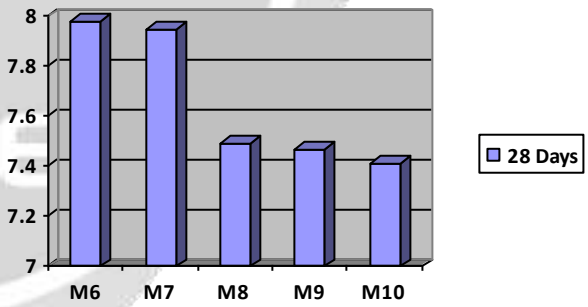

Fig-10 Under water Flexure strength

2.2 Result and Discussion

Here Show the result of the compressive strength with the increase the quantity of the ceramic tile here compressive strength of concrete is decreased than the conventional concrete. Compressive strength of concrete gives a higher result at a 20% replacement of the ceramic aggregate. Replacement of the natural fine aggregate with the various percentage of the ceramic fine aggregate compressive strength of concrete is decreased with the increased of the ceramic fine aggregate. It gives a higher value at the 30% replacement of the ceramic fine aggregate. When the quantity of ceramic tile is increase so compressive strength of concrete because of the very small thickness of the ceramic tile and also some pores is stay between the cement pastes and ceramic tile aggregate.

Here in the split tensile strength and flexure strength of concrete is increased up to 30% replacement of the ceramic waste tile. When ceramic tile is increased as a coarse aggregate more than the 30% replacement of the concrete than the flexure strength and split tensile strength of concrete is decreased with the increased percentage of the ceramic tile.

In underwater flexure test is perform in the box which made by the plasti glass (periphery) and base made by the iron plate. Underwater flexure strength of concrete is gives a higher value of the flexure test of concrete due to the uplift pressure of the water. So underwater flexure test of concrete is gives a higher value at the 20% replacement of the ceramic tile waste as a coarse aggregate. Underwater flexure test gives a higher value at the replacement of the 10% as a fine aggregate.

3. CONCLUSION

- Slump value of the concrete is decrease with the increase a replacement of the ceramic waste as a coarse aggregate and also reduces with the replacement of the ceramic fine aggregate because a higher water absorption rate of the ceramic tile so water reduce compare to the conventional concrete so workability of concrete reduce.
- Weight of the concrete is reducing compare to the conventional concrete so it is gives a light weight concrete.
- Compressive strength of concrete is reduced than the conventional concrete because of the larger water absorption rate of ceramic tile is reducing the hydration of the cement paste.
- When replacement of the ceramic tile as a coarse aggregate a compressive strength of concrete give a batter result with the 20% replacement of the ceramic tile.
- At a 20% replacement of the ceramic tile as a coarse aggregate with replacement of the ceramic tile as a fine aggregate a compressive strength of concrete gives a better result in the 30% replacement of the ceramic tile.
- Split tensile strength and flexure strength of concrete is gives a maximum result at the 30% replacement of the ceramic tile as a coarse aggregate. Split tensile strength of concrete and flexure strength gives a maximum result at a replacement of the 20% as a coarse aggregate and 30% replacement of the fine aggregate.
- Under water flexure test gives a better result with the 20% replacement of the ceramic tile as a coarse aggregate and gives a better result with the 20% replacement of the ceramic tile as a coarse aggregate and 20% replacement of the fine aggregate.

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