Experimental Analysis of Concrete Using Ceramic Tile Powder and Demolition Waste

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Abstract—concrete is far more produced all over the World than any other man made material. The amount and type of waste materials increasing because of increase in population many of the non-decaying materials remains present in environment for hundreds and thousands of years. This waste material cause disposal crisis and thereby contributing to the environmental problems. So the use of waste materials in concrete has been done for safe and economical disposal of waste materials. The use of waste materials not only saves natural resources and dumping spaces but also it maintains a clean environment. Partial replacement of waste material in concrete is done to achieve the desire properties of concrete such as strength, durability and workability. This paper gives idea about waste materials like ceramic tile powder and demolition waste used in concrete and their effects on various properties of concrete.

IndexTerms—Concrete, Ceramic tile powder, Demolition waste, Compressive strength, Eco Friendly

I. INTRODUCTION

At present no construction activity is possible without using concrete. The main reason behind this is because of its high strength, durability and workability. The total world consumption of concrete per year is about one ton for every living human being. Due to privatization and globalization, the construction of important Infrastructure projects like highways, airports, nuclear plants, bridges, dams etc. in India are increasing year after year. Such developmental activities consume large quantity of precious natural resources. This leads not only faster depletion of natural resources but also increase the cost of construction of structures. In view of this, people have started searching for suitable other viable alternative materials which could be used either as an additive or as a partial replacement to the conventional ingredients of concrete so that the existing natural resources could be saved to the possible extent, and could be made available for the future generation. In this process, different industrial waste materials such as fly ash, blast furnace slag, quarry dust, tile waste, brick bats, broken glass waste, waste aggregates from demolition of structures, ceramic tiles, electronic waste of discarded old computers, TVs, refrigerators, radios, waste paper mill pulp, iron filling, waste coconut shell, rice husk ash, marble dust powder, hypo sludge, machine crushed animal bones, chicken feather, eggs shell, granite quarry sludge, palm oil fuel ash, copper dust, human hair etc. have been tried as a viable substitute material to the conventional materials in concrete. In this paper ceramic tile waste powder and demolition waste has been used in place of fine aggregate and coarse aggregate respectively.

II. METHODOLOGY

For this paper M30 grade of concrete has been used. Total 36 samples have been tested with 0%, 20%, 30%, 40%, 50%, 60% replacement of fine aggregate and coarse aggregate with ceramic waste powder and demolition waste. All the above specimens have been tested for 7 days and 28 days compressive strength.

Replacement materials

Following table shows the details of replacement materials with fine aggregate and coarse aggregate.

Table 1 Details of replacement materials

Ingredients of Concrete	Replacement Of Waste Materials
1. Cement - Cement is the binding material, ordinary Portland cement is the Standard cement used for many purpose.	
2. Fine Aggregate - River sand is used as Fine aggregate in construction work.	**2. Ceramic Powder**- Ceramic tiles waste powder obtained from local ceramic tile manufacturing unit will be used as a partial replacement of sand in some % in all mix Composition.
3. Coarse Aggregate - Aggregates are inert Granular particles such as gravel or crushed stone.	**3. Demolition waste –** The waste which is obtained from demolished structure is crushed into required sizes of aggregate as a partial Replacement for coarse aggregates in some % in all mix composition.

Crushed Ceramic

Demolition waste

Comparison of Tests Results

Specific gravity and water absorption tests have been performed on fine aggregate, coarse aggregate and replacement materials. Following table shows results of the same.

Table 2 Comparison of test results

Test conducted on materials	**Test results of normal concrete materials**	**Test conducted on materials**	**Test results of waste materials**
(1)Specific Gravity		**(1)Specific Gravity**	
Fine Aggregate	2.69	Ceramic powder	2.35
Coarse Aggregate	2.84	Demolition waste	2.42
(2)Water Absorption		**(2)Water Absorption**	
Fine Aggregate	3.31	Ceramic powder	1.21
Coarse Aggregate	2.96	Demolition waste	5.94

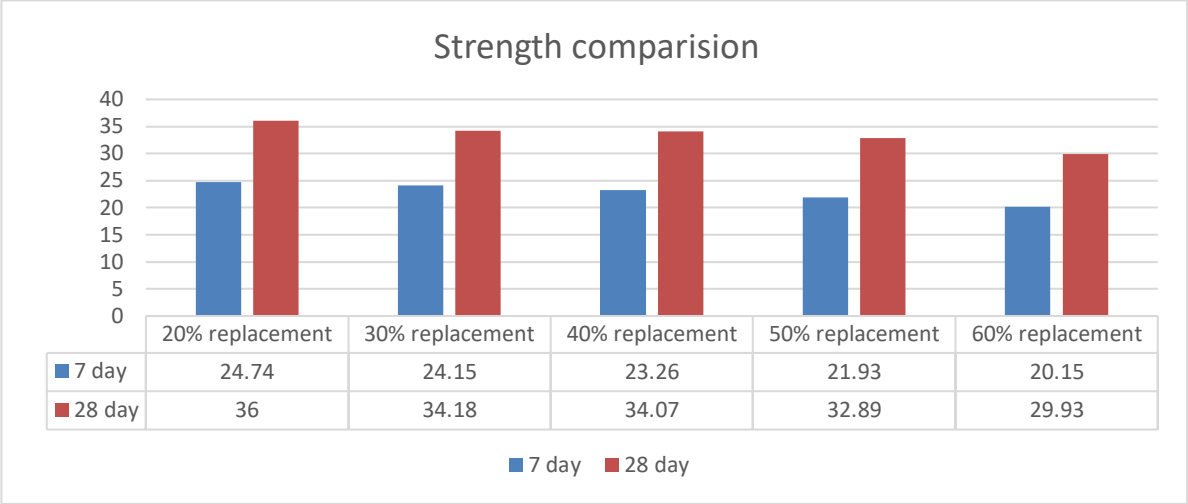
III. RESULTS

For the comparison of compressive strength 5 samples have been taken with increasing percentage of waste materials. Following table shows the comparison of average compressive strength at 28 days.

Table 3 Compressive strength at 28 days

Trials	**Average compressive strength At 28 days (N/mm^2)**
Sample 1 (20% replacement)	36.00
Sample 2 (30% replacement)	35.55
Sample 3 (40% replacement)	34.07
Sample 4 (50% replacement)	32.88
Sample 5 (60% replacement)	29.92

Strength Comparison of 7 days and 28 days



Cost Estimation and Comparison

Following table shows rates of different materials used for the paper

Table 4 Rates of materials

Material	Rate per Brass (Rs)	Rate per m^3(Rs)
River sand	6400	2261.5
Crushed sand	2500	883.4
Crushed stone (CA)	1600	565.4
Ceramic waste	1250	441.7
Demolished waste	1200	424.1

The total cost of fine aggregate and coarse aggregate in $1m^3$ concrete mix = Rs. 1587/-

The total cost of fine aggregate and coarse aggregate with replacement of 50% of ceramic waste and demolished waste respectively = Rs.1063.8/- ~ RS1064/-

Amount saved after replacement of 50% waste = 1587 – 1064

= Rs.523/-

This shows that in $1m^3$ concrete Rs. 523/- saved in 50% replacement of waste with fine aggregate and coarse aggregate without disturbing the required compressive strength of concrete.

IV. CONCLUSION

- In $1m^3$ concrete ₹523/- saved in 50% replacement of waste with fine aggregate and coarse aggregate without disturbing the required compressive strength of concrete.
- Ceramic waste can effectively be used as alternative & supplementary materials in concrete.
- Optimum replacement level of fine aggregate with ceramic waste and coarse aggregate with demolition waste is 50%.
- Demolished aggregate possess relatively lower bulk crushing, density and impact standards and higher waterabsorption as compared to natural aggregate.
- Light weight constructions units can be made by using these wastes.

V. REFERENCES

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