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A Study on Partial Replacement of Coarse Aggregate by Ceramic Tile Aggregate and Fine Aggregate by Marble Dustto Improve Concrete Strengths

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ABSTRACT

In day by day innovations and development in construction field, the use of natural aggregates is very high and at the same time production of solid wastes from the demolitions of constructions is also very high. In this study we introduce the ceramic tile aggregate as coarse aggregate replacement and marble dust as fine aggregate replacement in order to reduce the environmental pollution due to this waste and also reduce the natural aggregates. We assessed that approximately 30 percent of the daily production is discarded as of ceramic waste, Hence for the sustainable development of concrete technology as well as safe environment it has replaceable. The marble dust is a byproduct of marble processing industries. All these wastes are thrown away in the areas near the factories and cause severe environmental problems. These marbles are widely used in construction work. A large amount of waste is generated during sawing, grinding and polishing process. Therefore the marble dust is used as a fine aggregate and ceramic tile aggregate as coarse aggregate replacement to reduce environmental pollution. The maximum percentage of ceramic tile aggregate used is about 30% of the mass of coarse aggregate. The percentages in which the ceramic tile aggregate was replaced were 0%, 5%, 10%, 15%, 20%, 25%, and 30%. This compressive strengths are compared with conventional concrete i.e. concrete prepared without ceramic tile aggregate & marble dust and with ceramic tile aggregate & marble dust aggregate. This study will result in bulk utilization of ceramic tile aggregate and marble dust that indirectly control the environmental pollution and preserve the natural resources.

INTRODUCTION

Concrete is a composite material consist of mainly water, aggregate, and cement. The physical properties desired for the finished material can be attained by adding additives and reinforcements to the concrete mixture. A solid mass that can be easily moulded into desired shape can be formed by mixing these ingredients in certain proportions. Concrete is a composite material consist of mainly water, aggregate, and cement. The physical properties desired for the finished material can be attained by adding additives and reinforcements to the concrete mixture. A solid mass that can be easily moulded into desired shape can be formed by mixing these ingredients in certain proportions. When aggregate is mixed together with dry Portland cement and water, the mixture forms fluid slurry that is easily poured and moulded into

shape. Most concrete is poured with reinforcing materials embedded to provide tensile strength, yielding reinforced concrete. Concrete is used to make architectural structures, foundations, pavements, motorways, bridges, multi-story parking, walls, footings etc. Its biggest advantage is that it bonds together bricks and stones better than any other method known to mankind. Concrete is strong in compression but weak in tension. For some purposes it needs to be reinforced with steel rods and these rods can be galvanized to prevent rusting and corrosion.

Concrete was widely used in the Roman Empire. Concrete is as old as 5600 BC. It was not invented by Romans, but much used by them. But, after the fall of Roman Empire, use of concrete became very less. In the mid-18th century, concrete was re-pioneered. Today, the most widely used man-made material is concrete, measured in tonnage. Although high strength concrete is considered as relatively a new material, its development has been gradually increasing over years. In 1950s, USA considered the concrete with a compressive strength of 34mpa as high strength. In 1960's, the concrete with compressive strength 41mpa to 52mpa was used commercially. In the early 1970's, 62mpa concrete was been made. Within the world state of affairs, however, within the last fifteen years, concrete of terribly high strength entered into the construction sector of high-rise buildings and long span bridges. The compressive strength 2 over 110mpa has been thought-about by IS 456-2000 for the applications in pre-stressed concrete members and cast-in-place buildings. It is estimated that the present consumption of concrete in the world is of the order of 12 billion tons every year.

In this paper the ceramic waste is used to replace the coarse aggregates and Ceramic waste is locally available at the ceramic manufactures in Vijayawada. The marble dust is used to replace the fine aggregate and marble dust is collecting from Vijayawada surroundings at marble manufacturers.

Figure 1: Ceramic Waste and Marble waste

N. Sivachandiran, A. Magesh (2018): This research focuses on ceramic tile waste as partial coarse aggregates replacement for concrete production, prevention of environmental pollution with considering the elements of sustainable and cost-saving construction projects, especially material usage. Percentages used for the replacement level in this study were 10%, 20%, 30%, 40% and 50% of ceramic as partial replacement of coarse aggregates. The concrete cube were tested as destructive test at last which is compression test that to find out compressive strength of specimens of hardened concrete at 3 days, 7 days and 28 days. From the results of the study, samples of concrete with 20% & 30% ceramic coarse aggregate replacement has reached optimum strength. In this study M20 grade concrete were used. Prof. Shruthi. H. G, Prof. Gowtham Prasad. M. E, Samreen Taj, Syed Ruman Pasha (2016): The reuse of ceramic waste as a substitute for coarse aggregate in concrete has been investigated. In the present study, Ceramic tile waste were used in concrete as a replacement for natural coarse aggregate with 0%, 10%, 20% and 30% of the substitution and M20 grade concrete were used. The concrete moulds were casted and tested for Compressive Strength and Split Tensile Strength after a curing period of 3, 7 & 28 days. The results indicate that, the maximum compressive strength is obtained for the 30% replacement of ceramic tile aggregate with natural coarse aggregate. Prof. Lakshmi H. S (2017): Our aim is to study the suitability alternative to depletion of natural aggregates. Demolished building wastes are used to partial replacement of the coarse aggregate and marble powder is used to partial replacement of the fine aggregate. M20of concrete mix has been taken and casted into cubes and conducted a strength tests. Natural aggregates according to gradation with the percentages of 0%, 10%, 20%, 30% replacement was used, and casted moulds. The water cement ratio is 0.50. From the results found the optimum percentage of demolished waste aggregate keeping that as constant. Up to 20% replacement of fine aggregate and coarse aggregate with waste marble powder and demolished waste there is an increase in all mechanical properties. More than 20% fine and coarse aggregate cannot be replace with marble powder and demolished waste thus it decreases the compressive strength.

MATERIAL AND PROPERTIES

This paper will execute in three stages, initially we are going to study the engineering properties of every material. Then we followed to the Mix Design for M30 with partial replacement of Ceramic tile aggregate and marble dust. Later we go for methods of testing of each specimen and comparison with the replaced materials. Thus we conclude the values based on the above procedure executed and evaluated. The materials used in this project are ceramic tile aggregate is being used as a partial replacement for coarse aggregate. The maximum percentage of ceramic tile aggregate used is about 30% of the mass of coarse aggregate. The percentages in which the ceramic tile aggregate was replaced were 5%, 10%, 15%, 20%, 25%, and 30%. The increase in the percentage of ceramic tile aggregate as a partial replacement for coarse aggregate gives the moderate strength properties of concrete. In order to increase the strength, 10 % of marble dust is added to the concrete as a partial replacement of fine aggregate to achieve better results

MATERIALS

The materials which are using in this study are as follows:

1. Cement
2. Fine Aggregate
3. Coarse Aggregate
4. Water
5. Ceramic Tile Aggregate
6. Marble Dus

DESIGN MIX OF CONCRETE

Cement concrete mix design means, determination of the proportion of the concrete ingredients i.e. cement, water, fine aggregate, Coarse aggregate which would produce concrete processing specified properties such as workability, strength and durability with maximum overall economy. From technical point of view the rich mixes may lead to high shrinkage and cracking in the structural concrete, and to evolution of high heat of hydration in mass concrete which may cause cracking.

MANUFACTURING OF CONCRETE

The various stages of manufacture of concrete are:

- Batching
- Mixing
- Transporting
- Placing
- Compacting
- Curing
- Finishing

MIXING OF CONCRETE:

1. Thorough mixing of the materials is essential for the production of uniform concrete.
2. The mixing should ensure that the mass becomes homogeneous, uniform in color and consistency. There are two methods adopted for mixing concrete:

Figure 2: Mixing of concrete in Pan Mixer

METHODS OF CONVENTIONAL CURING:

Methods of curing concrete fall broadly into the following categories:

a) Ponding method
b) Covering concrete surfaces with hessian or gunny bags
c) Sprinkling of water
d) Membrane Curing
e) Steam curing

RESULT AND DISCUSSION:

a. **Tests on Fresh Concrete**

The property of fresh concrete which is indicated by the amount of useful internal work required to fully compact the concrete without bleeding or segregation in the finished product. Workability is one of the physical parameters of concrete which affects the strength and durability as well as the cost of labour and appearance of the finished product. Concrete is said to be workable when it is easily placed and compacted homogeneously i.e., without bleeding or Segregation. Unworkable concrete needs more work or effort to be compacted in place, also honeycombs & or pockets may also be visible in finished concrete. The main purpose of testing hardened concrete is to check and confirm that the concrete has attained the target strength. The tests conducted were compaction factor test for workability, density, compressive strength, split tensile strength and flexural strength.

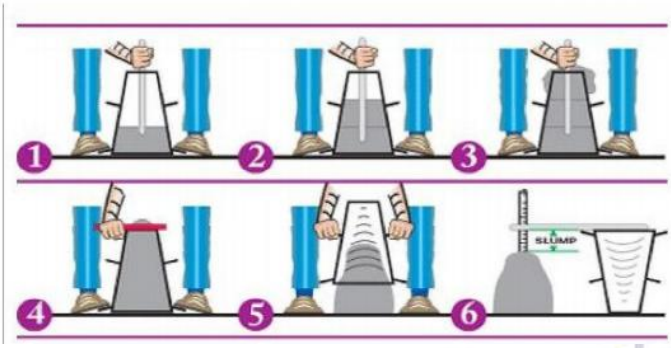

Figure 3: Concrete Slump Test Procedure

Figure 4: Compaction Factor Apparatus

Figure 5: Cube Placed in mould and Compressive Testing Machine

Figure 6: Casted Cylinders

Figure 7: Testing of Specimen

Table 1: Compressive Strength of CTA concrete at 7, 14 &28 days

COMPRESSIVE STRENGTH OF CTA CONCRETE (N/mm^2)				
MIX	REPLACEMENT %	7 DAYS	14 DAYS	28 DAYS
M1	M30	18.62	25.15	29.97
M2	M30+5%CTA	25.10	28.23	36.38
M3	M30+10%CTA	25.94	29.89	37.12
M4	M30+15%CTA	26.20	29.65	39.54
M5	M30+20%CTA	26.89	30.34	40.99
M6	M30+25%CTA	26.47	29.44	39.30
M7	M30+30%CTA	25.96	28.93	38.78

CONCLUSION

The main objective of this paper is to prepare a concrete much more stable and durable than the conventional concrete by replacing both coarse and fine aggregates by minimizing the water cement ratio. Usage of ceramic tile aggregate and marble dust reduces the costs for construction. Based on this work it has been concluded that the coarse aggregate was replaced by ceramic tile aggregate in the percentages of 0%, 5%, 10%, 15%, 20%, 25% and 30% and 10% fine aggregate replacement with marble dust achieved increment of strengths up to 20% ceramic tile aggregate and 10% marble dust replacement and later decreased in strengths. The compressive strength of ordinary concrete is 29.97 N/mm2 and the increased strength in replaced concrete at 20% was 40.99 N/mm2 at 28 days of curing. The compressive strength of CTA concrete is 40.99 N/mm2 and adding 10% marble dust the increased strength in replaced concrete at 20% was 42.96 N/mm2 at 28 days of curing. 6. The maximum compression strength is obtained when 20% of ceramic tile aggregate was replaced with coarse aggregate and later decreased in strengths.

REFERENCES

[1] N. Sivachandiran, A. Magesh (2018). An Experimental Analysis of Partial Replacement of Coarse Aggregate by Waste Ceramic Tile in Concrete. International Journal of Pure and Applied Mathematics (IJPAM), Vol. 119, Special Issue, ISSN (Print): 1311-8080, ISSN (Online): 1314-3395.

[2] Prof. Shruthi. H. G, Prof. Gowtham Prasad. M. E, Samreen Taj, Syed Ruman Pasha (2016). Reuse of Ceramic Waste as Aggregate in Concrete. International Research Journal of

Engineering and Technology (IRJET), Vol. 3, Issue 7 e-ISSN: 2395 -0056, p-ISSN: 2395- 0072.

[3] Batriti Monhun R. Marwein, M. Sneha, I. Bharathidasan (2016). A Review Paper on Utilisation of Ceramic Waste in Concrete. International Journal of Scientific & Engineering Research (IJSER), Vol. 7, Issue 4, ISSN 2229-5518.

[4] Prof. Lakshmi H. S (2017). Partial Replacement of Fine and Coarse Aggregate By Using Marble Powder and Demolished Waste. International Journal of Advance Research in Science & Engineering (IJARSE), Vol. 6, Issue 7, ISSN (P): 2319 -8346, ISSN (O): 2319- 8354.

[5] S. Khaviya (2017). Experimental Study on Partial Replacement of Waste Ceramic Tiles used as an Alternative Coarse Aggregate in Concrete. International Journal of Modern Trends in Engineering and Research (IJMTER), Vol. 4, Issue 8, ISSN (Online): 2349-9745, ISSN (Print):2393-8161.

[6] E. E. Ikponmwosa, S. O. Ehikhuenmen (2017). The Effect of Ceramic Waste as Coarse Aggregate on Strength Properties of Concrete. Nigerian Journal of Technology (NIJOTECH), Vol. 36, Issue 3, pp.691-696, ISSN (Print): 0331-8443, ISSN (Electronic): 2467-8821.

[7] Hemanth Kumar Ch, Ananda Ramakrishna K, Sateesh Babu K, Guravaiah T, Naveen N, Jani Sk (2015). Effect of Waste Ceramic Tiles in Partial Replacement of Coarse and Fine Aggregate of Concrete. International Advanced Research Journal in Science, Engineering and Technology (IARJSE), Vol. 2, Issue 6, ISSN (Online): 2393-8021, ISSN (Print): 2394- 1588.

[8] Sunny B. Vachhani, Y.V. Akbari, Sharad Kondhiya (2017). Experimental Study of High Strength Concrete Containing Ceramic Waste as a Tile. IJARIIE, Vol. 3, Issue 2, ISSN (O): 2395-4396.

[9] Tamanna, Puneet Sharma (2018). An Experimental Work on Crushed Ceramic Waste Tiles by Coarse Aggregate in Concrete Mix. International Research Journal of Engineering and Technology (IRJET), Vol-5, Issue-02, e-ISSN: 2395-0056, p-ISSN: 2395-0072.

[10] Vivek Singh and Rizvi M.U (2018). Experimental Study for the Use of Ceramic Waste as Partial Replacement of Coarse Aggregate in Concrete. International Journal of Recent Scientific Research (IJRSR) Vol. 9, Issue 7, pp. 27970-27973, ISSN: 0976-3031.