Experimental Study on Concrete by Partial Replacement Sand as Marble Dust and of Cement by Fly Ash

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***Abstract*—: This paper covered major aspect of concrete mix design as the quality control measure of concrete production, as per the Indian Standard Code IS: 10262-1982. It is aimed at highlighting the important of designed concrete as compared to an ordinary ratio analyzed concrete in concrete production for any civil/structural concrete work. It equally include the whole laboratory test analysis, to determine the physical and geotechnical properties of the materials needed for the mix design in order to attain the required data for the design procedure, in accordance to the parent material types and location, and the specific density of the designed concrete, that will be suitable, adoptable, durable, economical, workable and generally safe for the structural design objective of the weather condition in any specified locality.**

I. INTRODUCTION

In Civil Engineering 'Cement' plays the important role as it is impossible to produce any sustainable infrastructure without use of cement. We can say everything is incomplete without 'Cement' as construction is the factor which rapidly growing with new innovations and ideas. Various types of Pozzolanic materials that improve cement properties have been used in the cement industry for a long time or artificial (silica fume, fly ash, blast furnace slag and so on) in origin. The use of additional cementitious materials due to economic, technical and environmental considerations has become very common in modern concrete construction.

1.1 Cement:

Cement used in construction is characterized as hydraulic or non-hydraulic. Hydraulic cements (e.g., Portland cement) harden because of hydration, chemical reactions that occur independently of the mixture's water content; they can harden even underwater or when constantly exposed to wet weather. The chemical reaction that results when the anhydrous cement powder is mixed with water produces hydrates that are not water-soluble. Non-hydraulic cements (e.g. gypsum plaster) must be kept dry in order to retain their strength.

1.2 Pozzolans:

A "Pozzolan" is defined as "a siliceous or siliceous and aluminous material, which in itself possesses little or no cementing property, but will in a finely divided form - and in the presence of moisture - chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties."

II. MATERIAL PROPERTIES

A. Fly Ash:

Component	Bituminous	Sub-bituminous	Lignite
SiO2 (%)	20-60	40-60	15-45
Al2O3 (%)	5-35	20-30	20-25
Fe2O3 (%)	10-40	4-10	4-15
CaO (%)	1-12	5-30	15-40
LOI (%)	0-15	0-3	0-5

B. Marble Dust :

Physical Properties:

Hardness	3 to 4 on Mohr's Scale
Density	2.55 to 2.7 Kg/cm^3
Compressive Strength	70 to 140 N/mm^2
Modulus of Rupture	12 to 18 N/mm^2
Water Absorption	Less than 0.5% (except Rainforest Green/Brown with 2-3%)
Porosity	Quite low
Weather Impact	Resistant

Chemical Properties

Lime (CaO)	28-32%
Silica (SiO2)	3-30% (varies with variety)
MgO	20 to 25%
FeO + Fe2O3	1-3%
Loss On Ignition (LOI)	20-45%

III.MIX PROPORTION

Determine the mean target strength ft. from the specified characteristic compressive strength at 28- day fck and the level of quality control.

ft = fck + 1.65 S

Where S is the standard deviation obtained from the Table of approximate contents given after the design mix. Obtain the water cement ratio for the desired mean target using the empirical relationship between compressive strength and water cement ratio so chosen is checked against the limiting water cement ratio. The water cement ratio so chosen is checked against the limiting water cement ratio for the requirements of durability given in table and adopts the lower of the two values.

Estimate the amount of entrapped air for maximum nominal size of the aggregate from the table.Select the water

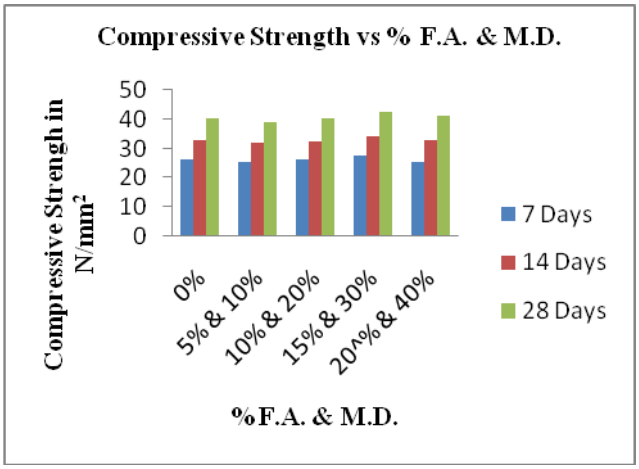
content, for the required workability and maximum size of aggregates (for aggregates in saturated surface dry condition) from table. Determine the percentage of fine aggregate in total aggregate by absolute volume from table for the concrete using crushed coarse aggregate.Adjust the values of water content and percentage of sand as provided in the table for any difference in workability, water cement ratio, grading of fine aggregate and for rounded aggregate the values are given in table. Calculate the cement content form the water-cement ratio and the final water content as arrived after adjustment. Check the cement against the minimum cement content from the requirements of the durability, and greater of the two values is adopted.

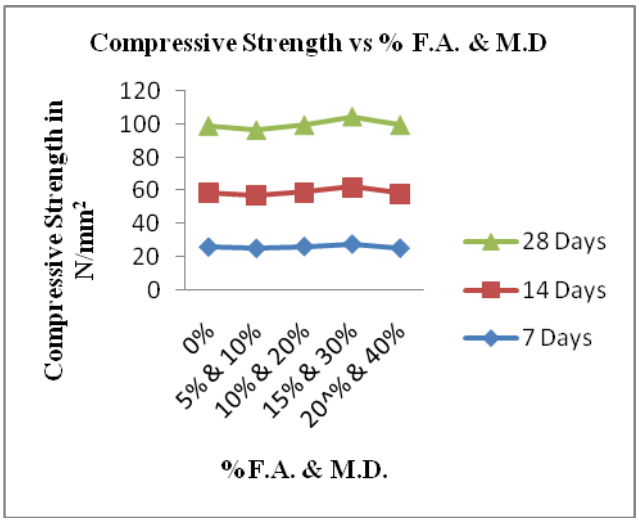
From the quantities of water and cement per unit volume of concrete and the percentage of sand already determined in steps 6 and 7 above, calculate the content of coarse and fine aggregates per unit volume of concrete from the following relations:

$$V = \left[W + \frac{C}{S_c} + \frac{1}{p}\frac{f_a}{S_{fa}}\right] \times \frac{1}{1000}$$

$$V = \left[W + \frac{C}{S_c} + \frac{1}{1-p}\frac{C_a}{S_{ca}}\right] \times \frac{1}{1000}$$

IV.RESULTS AND DISCUSSION





V.CONCLUSION

Marble dust & fly ash leads to improvement of both mechanical properties and durability of partial replaced concrete. The employment of 15% of fly ash and 30% of marble dust in cement concrete to improvement of compressive strength. The reason could be the inclusion of marble dust and fly ash to the concrete actually forms denser matrices thereby improving resistance of the matrices against water ingress which is one of the most important reasons that increases the deterioration of concrete.

FUTURE SCOPE

Taking into consideration above results it is observed that there is huge scope of development of use of fly ash and marble dust by partial replacement in concrete. Furthermore fly ash can be widely used to reduce environmental pollution and is effectively used as replacement of cement.

REFERENCES

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