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Effect of Corrosion Inhibitor on Compressive Strength and Corrosion Resisting Properties of Blended Concrete

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Abstract : *Use of blended concrete in the construction industry increased to reduce the cost and environmental effect. Present these paper presents Compressive Strength & corrosion resistance of blended concrete with partial replacement of cement by different percentages of marble powder & Fly-ash i.e., (5%MP+5%FA), (7.5%MP+7.5%FA) & (10%MP+10%FA). The strength increased at (7.5%MP+7.5%FA). Corrosion inhibitor (calcium nitrate) 1%, 2% and 3% added to normal concrete and (7.5%MP+7.5%FA) there is small decrease of strength but corrosion resistance shows better results at 2% of corrosion inhibitor added. The corrosion resistance is evaluated based on the performance of concrete from weight loss measurement test.*

Keywords - *Blended Concrete, marble powder, fly ash, calcium nitrate, corrosion resistance & Compressive strength*

I. INTRODUCTION

Day by day the development and use of blended concrete is growing rapidly in the construction mostly due to considering cost saving, energy saving, protecting environment and protection of resources. Fly ash material obtained from different thermal power stations (V. Saraswathy et al (2002). In this investigation various activation techniques used such as physical, thermal and chemical were adopted. From above methods they proved corrosion resistance and strength of blended concrete by replacement of cement with 10%, 20%, 30% and 40%.among all the results confirmed up to 20% replacement is sufficient. (GauravNagalia et al) based up on this paper higher amount of CaO contains fly ash gives the more strength and NaOH improves the kinetics, long curing times gives significant results. (Sukhrash jerath, P.E, M. ASCE) here they said that the concrete mixtures having dense graded aggregates required more content of fly ash with low water content provides more strength when compared to gap graded aggregates. The study shows durability of concrete can be increased 40% of fly ash for replacement with OPC. Marble powder is collected from marble factories. The use of marble powder and fly ash in mortar and concrete, as partial replacement of ordinary Portland cement has resulted in significant saving in the cost of production of concrete. It was found that in order to get good properties. Rajasthan marble factories release 4500 tons annually. Recycling marble waste powder in substation of cement also indirectly can reduce environmental problems related with cement production. The highest marble powder and fly ash for replacement of cement obtained through PH test. (J. Dabg) the ph value can measured through electrochemical method for geopolymer concrete in first time. The test is repeated after 6 weeks the 0.4 ph reduced at corners. Carbonation test also conducted in same concrete for comparing the results. Corrosion is main problem in the construction point of view. (Mohammed Maslehuddin, Rasheeduzzafar, and Abdul-Aziz Ibrahim Al-Mana, Member, ASCE) in this research work 32% of water is reduced with help of superplasticiser. The compressive strength is high in super plasticizer concrete when compared to non superplasticiser based concrete. The corrosion also low in superlpasticiser concrete because low water content. (S. S. AI-Saadoun, 1 Rasheeduzzafarfl and A. S. AI-GahtanP) from this investigation fly ash based blended concrete shows good corrosion resisting properties because fly ash is pozzolanic material. The cement is replaced up to 30% gives good results. (Haussmann, D. A. (1968)) on the basis of this investigation concluded that cathodic method is correct for corrosion control can use for bridge decks. (Tarek Uddin Mohammed; Nobuaki Otsuki; and Hidenori Hamada) explained the corrosion in cracked based concrete in marine structures. Cracked regions can reduce the chloride concentration when compared to uncracked region. So, that corrosion control can occur because most cases corrosion can form presences of chlorides from the above phenomena cracked concrete is better.

II. EXPERIMENTAL PROGRAM

A. Materials and mix proportions

III.

A eleven mix of concrete was prepared. The nomenclature, mix proportions and the details of concrete are provided in Table 1.Three specimens of all concrete mixes have been prepared to determine the average

cube compressive strength, corrosion resistance. Ordinary Portland cement 53 grade, conforming to IS: 12269-1987,having the specific gravity of 3.12, Marble powder collected from deposits of marble factories near Bethamcherla having the specific gravity of 2.56, The fly ash collected from thermal power plant near kadapa having specific gravity of 2.27, Locally available sand conforming Zone-II according to IS: 383-1970. Specific gravity of fine aggregate is 2.69.Locally available coarse aggregates used having specific gravity of 2.74.Calcium nitrate is an organic chemical compound obtained from the reaction between calcium hydroxide and ammonium nitrate,& superplastisizer was used for maintained workability.

B. Mixing and Testing

Slump test was conducted and to maintain the good workability super plasticizer was used. The ph test is conducted on different proportions of marble powder and fly ash. Finally the ph value is increased up to 7.5%MP+7.5%FA then after decreased. So, that proportion the strength is increased. A specimen of 150x150x150mm size of cube were casted and conducted compressive strength of average of three cubes for each mix of 7days,28days & 56days curing. Test was conducted on compression testing machine of 3000KN capacity.

Corrosion resistance was conducted by using Weight loss measurement test. Cubes specimens of size 150x150x150 mm were cast using OPC and OPC content is replaced with marble powder and fly ash with 1%, 2% & 3% of calcium nitrate Every specimen three rods with 10 mm diameter and 110mm long placed in the cube. After 91 days the prepared moulds are broken with carefully without any damage and placed on oven at 50 degrees for 5 hours. Then after clean the rust over the rods. Thus the corrosion can be calculated by

% of loss of weight=$\frac{W2}{W1}$ x100

W1=weight of rod before inserting in mould (kg)

W2=weight of rod after kept in oven.

Fig.1 steel rods are inserted in concrete cubes

Porosity test conducted on 70.6X70.6X70.6mm cube specimens according to principle related to the weight of saturated in air and water and dry weight. The porosity was calculated by this equation.

$$P = \frac{(\text{Wsat} - \text{Wdry})}{(\text{Wsat} - \text{Wwater})} \text{X100} \qquad (1)$$

After determined the porosity, these specimens are also used for sorptivity value. The specimens are placed in oven at 40- 50 degrees and cooled at room temperature. Test was conducted on pan. The water level in the water pan maintained at about 3cm. frequently time also recorded. The amount of water absorbed by specimen at various times such 0, 10, 20, 30, 60 min etc. The sorptivity coefficient was obtained by using the following equation

$$Q\backslash A = K\sqrt{t} \qquad (2)$$

Q= the amount of water absorbed *in* (cm^3)

A= the cross section of specimen was contact with water (cm^2)

K=sorptivity coefficient

t =time (s)

III. FIGURES AND TABLES

Table 1.Mix Design for Experimental Program and Mix Proportion

Mix	Description	Cement (Kg/m^3)	Fly-ash (Kg/m^3)	Marble powder (Kg/m^3)	Fine aggregate (Kg/m^3)	Coarse aggregate (Kg/m^3)	W/c	Calcium nitrate (Kg/m^3)	SP (Kg/m^3)
P	Conventional concrete (100% cement)	425	-	-	746.4	1013.6	0.4	-	2.1765
P1	Conventional concrete with 1% calcium nitrate	425	-	-	746	1013	0.4	4.25	2.1765
P2	Conventional concrete with 2% calcium nitrate	425	-	-	746	1013	0.4	8.5	2.251
P3	Conventional concrete with 3% calcium nitrate	425	-	-	744.56	1011.2	0.4	12.75	2.30
Q	5%MP+5%FA+90% cement	382.5	21.25	21.25	677.50	1193.23	0.4	-	2.295
R	7.5%MP+7.5%FA+85 % cement	361.25	31.825	31.825	675.72	1189.71	0.4	-	2.6375
R1	7.5%MP+7.5%FA+85 % Cement with 1% calcium nitrate	361.25	31.825	31.825	675.72	1189.71	0.4	3.6125	2.705
R2	7.5%MP+7.5%FA+85 % Cement with 2% calcium nitrate	361.25	31.825	31.825	675.72	1189.71	0.4	7.225	2.806
R3	7.5%MP+7.5%FA+85 % Cement with 3% calcium nitrate	361.25	31.825	31.825	675.72	1189.71	0.4	10.837	2.879
S	10%MP+10%FA+80% C	340	42.5	42.5	673.85	1186.49	0.4	-	3.034

IV. RESULT AND DISSCUSION

From Fig 2 the PH values initial increased up to 7.5%MP+7.5%FA then after decreased. So, that optimum PH value gives highest strength. The compressive strength vs. curing time for ordinary Portland cement and replaced with marble powder and fly ash at different proportions shown in Fig 3. From fig shows when the curing time increases the strength also increases at the ages of 7, 28 and 56 days. 7.5%MP+7.5%FA for cement replacement attain highest compressive strength when compared to remaining proportions. Fig 4 shows the reduction of corrosion by addition of corrosion inhibitor up to 2% and further addition indicates slightly increases. Porosity and Sorptivity also reduced in cement replaced with marble powder and fly ash with different proportions are noticed at fig 5 and fig 6.

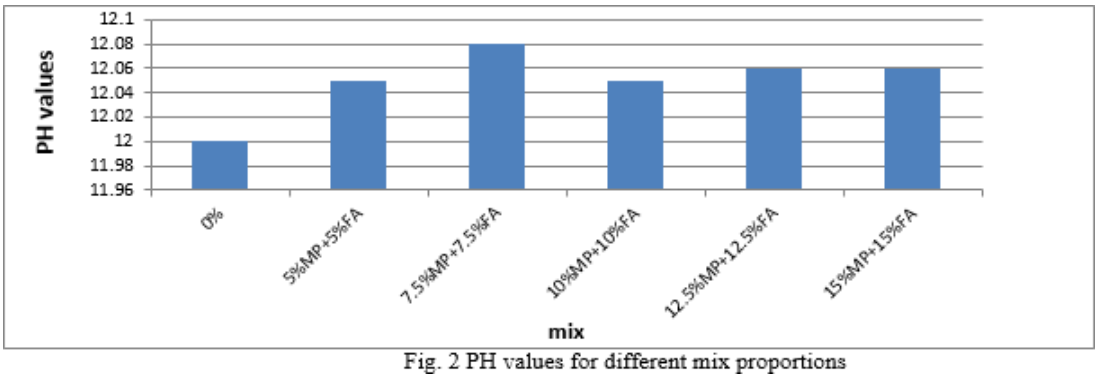

Fig. 2 PH values for different mix proportions

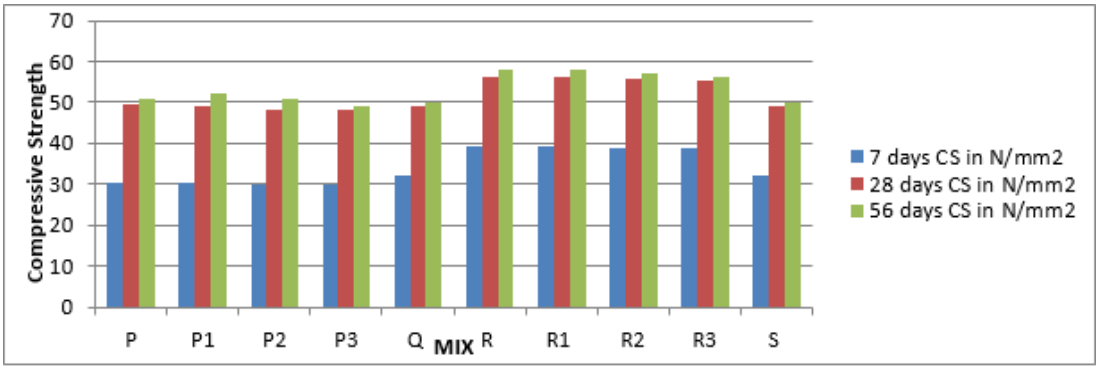

Fig 3: compressive strength values for different concrete mixes at 7, 28 and 56 days curing.

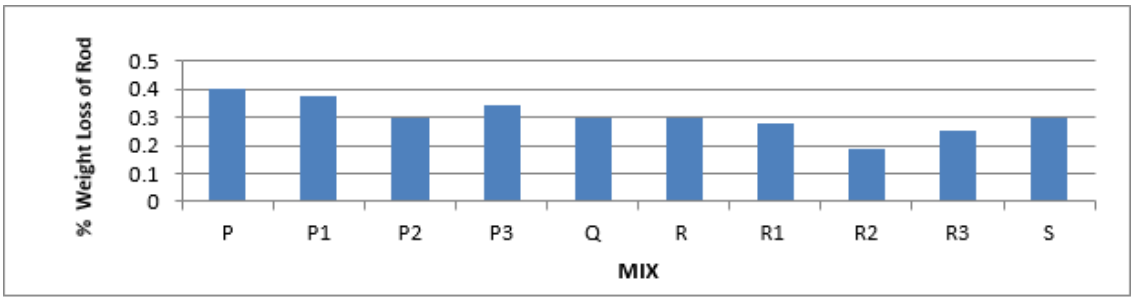

Fig 4: Percentage of Corrosion with Addition of Inhibitor

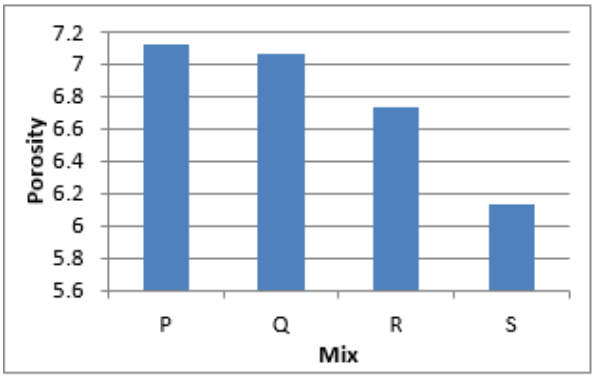

Fig 5: Porosity values for different mixes

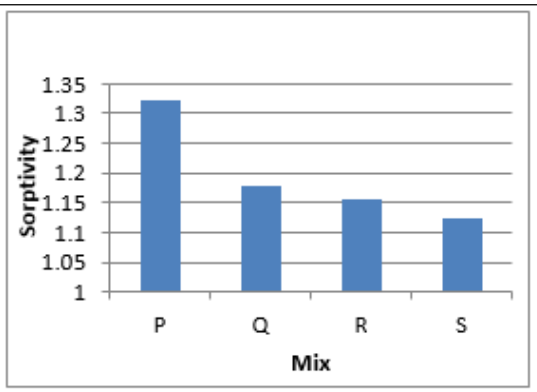

Fig 6: Sorptivity values for different mix proportions

V. CONCLUSION

The compressive strength increased up to 7.5%MP+7.5%FA later the strength property decreased. So, that 15% of cement replaced with marble powder and fly ash.Addition 2% corrosion inhibitor to the conventional concrete and blended concrete (7.5%MP+7.5%FA) shows good corrosion resistant in reinforced concrete Porosity and Sorptivity also reduced when the cement Partial replaced with marble powder and fly ash at Various mix proportions

REFERENCES

1. V. Saraswathy, S. muralidharan et al. „"*Influence of activated fly ash on corrosion resistance and strength of concrete''*. Cement and concrete composites 25 (2003) 673-680.
2. GauravNagalia;YeonhoPark,Ph.D.,M.ASCE."*Compressive Strength and Microstructural Properties of Fly Ash–Based Geopolymer Concrete''*.American SocietyofCivilEngineers(2016).DOI:10.1061/(ASCE)MT.1943-5533.0001656.
3. Sukhvarsh Jerath, P.E., M.ASCE *"Effect of Fly Ash Content and Aggregate Gradation on the Durability of Concrete''* **DOI:** 10.1061/_ASCE_0899-1561_2007_19:5_367
4. J. Dang et al. "*Monitoring Apparent pH Value in Geopolymer Concrete Using Glass Electrode''*. 33rd International Symposium on Automation and Robotics in Construction (ISARC 2016).
5. Mohammed Maslehuddin,1 Rasheeduzzafar,2 and Abdulaziz Ibrahim Al-Mana,3 Member, ASCE. "*Strength and corrosion resistance of superlpasticiser concretes''*. J. Mater. Civ. Eng., 1992, 4(1): 108-113.
6. S. S. AI-Saadoun, Rasheeduzzafar."*Corrosion of reinforcing steel in fly ash blended cement concrete''*. J. Mater. Civ. Eng., 1993, 5(3): 356-371.
7. . Tarek Uddin Mohammed et al*. "Corrosion of Steel Bars in Cracked Concrete under Marine Environment's*. **DOI:** 10.1061/~ASCE (0899-156