Effect of Air Entraining Agent on Properties of Concrete

Rohit Kumar¹, Ritu Rai² and A.K. Srivastava³

^{1,2}PG Scholar, BIET Jhansi ³BIET Jhansi E-mail: ¹rohitsingh2260@gmail.com, ²ritsrai26@gmail.com, ³aks507@rediffmail.com

Abstract—This work emphasizes on the effect of adding air entraining agent on the various characteristics of the concrete. The main work of air entrain agents is to enhance the workability of fresh concrete and durability of hardened concrete along with the compromise in strength of concrete. For this purpose a fatty acid(Oleic Acid) is used as an air entraining agent as it is easily available. The dosage of agent is chosen in the concrete production as 0%, 0.2%, 0.4%, 0.6%, and 0.8% by weight of cement. A number of cubes were casted and tested for various test and which resulted that by adding AEA into the concrete, workability of fresh concrete increases and strength of the concrete is decreased.

1. INTRODUCTION

Entrained air means that air which is intentionally introduced into concrete in the form of uniformly distributed microscopic bubbles. These bubbles on an average are of the order 0.25 mm to 0.025 mm (1/100 in to 1/1000 in.) in appropriate amounts to produce a desired inter bubble spacing and resultant desirable effect. "Entrapped" air is unintentionally included during the batching and mixing operations and if random in amount, size, and shape of the various inclusions usually in amounts to a define percent or so of the volume.

Entrained air produces discrete cavities in the cement paste so that no channels for the passage of water are formed and the permeability of the concrete is not increased. The voids never become filled with the products of hydration of cement as gel can form only in water filled capillaries.

The general effects of air entrainment are freeze-thaw resistance along with increase workability, decrease strength, reduce bleeding and segregation. Air entrained concrete is more resistant to weathering cycles than plain concrete. Air entrainment makes possible a reduction in the sand content of the mix in an amount approximately equal to the volume of the entrained air.

2. MATERIALS AND METHODS

The materials utilized in the work are:

Cement: OPC Vikram Cement of grade 43 was used. The oxide composition is present in table 1 below. Water: portable

water was used both for mixing and curing of the cubes. Air entraining agent: Oleic acid was used. Using a mix design ratio of 1:1.75:2.98 and w/c ratio of 0.45, a total number of 90 concrete cubes of size 150mm x 150mm x 150mm were cast by varying percentage of oleic acid 0%, 0.2%, 0.4%, 0.6% and 0.8% with respect to weight of cement was done. 60 cubes was tested for compressive strength and 30 cubes for sulphate resistance was tested. For compressive strength test the cubes was cured and crushed after 7, 28, 56 and 90 days

Five batches of mixes were prepared as per design mix namely M0, M1, M2, M3, M4 with 0%, 0.2%, 0.4%, 0.6%, and 0.8% of air entraining agent by weight of cement respectively.

The various test conducted were:

For workability slump cone test and compaction factor test was conducted. For compressive strength compression test was done.

3. TEST RESULTS

Table 1 shows the oxide composition, while table2 is the total number of cubes casted. Table 3 is the Properties of Fresh Concrete (Slump Values and Compaction Factor Values) and table 4 is the compressive strength test at 7, 28, 56 and 90 days respectively

4. CONCLUSION AND RECOMMENDATION

Air entrainment can be done up to an extent of compromise with compressive strength of concrete. Although it increases workability, and enhances various properties of concrete up to some extent. Workability can be measured by slump cone test and compaction factor test in which it is observed an increase in workability of concrete as the percentage of air entrain agent is increased.

In the case of compressive strength it is observed a decrease in strength in a non linear manner.

As a result of addition of air entraining agent, the decrease in strength can be recompense by modifying the water cement ratio to the limit of workability need for the work.

Table 1: Oxide Composition.

Oxides	Percent Content		
Cao	60-70		
SiO2	17-25		
Al2O3	3.0-8.0		
Fe2O3	0.5-6.0		
MgO	0.1-4.0		
Alkalies(K2O, Na2O)	0.4-1.3		
SO3	1.3-3.0		

Table 2: Number of Samples Casted.

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Type of mix	For compressive strength
M0	12
M1	12
M2	12
M3	12
M4	12
Total	60

Table 3: Properties of Fresh Concrete (Slump Values and Compaction Factor Values)

S. No.	Mix	W/C	Air entrained agent (% of cement)	Slump value (mm)	Compaction factor value
1.	1:1.75:2.98	0.45	0.0	95	0.83
2.	1:1.75:2.98	0.45	0.2	103	0.86
3.	1:1.75:2.98	0.45	0.4	114	0.88
4.	1:1.75:2.98	0.45	0.6	120	0.91
5.	1:1.75:2.98	0.45	0.8	127	0.94

Table 3: Compressive strength of cubes

			Compressive strength (MPa)			
S. No.	Mix	W/C	7 Days	28 Days	56 Days	90 Days
1.	M0	0.45	37.23	46.39	51.76	52.37
2.	M1	0.45	31.96	34.42	37.79	38.89
3.	M2	0.45	31.03	33.95	37.90	39.40
4.	M3	0.45	30.48	32.30	33.80	35.80
5.	M4	0.45	27.70	29.24	30.10	31.11





Fig. 2: Compaction Factor Value



Fig. 3 Compressive strength at various stages

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