Strength of Concrete with Ternary Blend Pozzolonic Material

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Abstract- For a constructional company to meet the demand of structure to be economical the PPC was used which is mixture of OPC and some pozzolonic material, the most commonly used admixtures were SF and FA, which were mix with different w/b ration and in different proportion of SF and FA to achieve the maximum strength as compared to OPC. The results demonstrate that the strength in comparison to the control stir increases to a certain point and then decreases when the general substitution level of OPC is significantly employing an OPC + FA + SF ternary mixture. In order to achieve the 28 days strength many portion of OPC was replaced by SF and FA, if the concrete composition of mixed blend is maintained at every w/b percentage. Thus the split tensile strength of concrete is greater than OPC for a given compression level.

Keywords- OPC (Ordinary Portland Cement), PPC (Pozzolonic Portland cement), SF (Silica Fume), FA (Fly Ash), w/b ration (water binder ration).

INTRODUCTION

At present time every construction company face a problem to build a cost-effective structure without effecting the strength and durability of the structure. As a solution we used different material which have same properties as previous material used in construction like as PPC in place of OPC. The strength of PPC is nearly same as OPC after 28 days curing, while it is cheaper than OPC and pozzolonic material used in it are ecofriendly and by-products of coal fired power industry. Which make the structure more cost effectives and also ecofriendly.

OBJECTIVE OF STUDY

1. To investigate the strength of OPC mixing with SF and FA at their different proportion such as FA at 20%,30%,40% and half by weight, SF at 7% and 10% and at different w/b ration of 0.3,0.4 and 0.45 after 7, 28 and 56 days.
2. To analysis the spilt tensile strength of mixed blend concrete.

METHODOLOGY

1. Make a concrete sample of OPC+FA+SF at their different proportion discuss above in study at different w/b ration.
2. Mix all of them and add75% water then dried for 60 sec then compacting with temping rod to filled out the voids properly.
3. Make 3 specimens each for compressive strength and split tensile strength.
4. Compressive strength was calculated at 7, 28, 56 days.
5. Stiffness was calculated at 7 and 28 days.

DATA ANALYSIS

It demonstrates when the OPC was replaced with FA (20% by weight) then at different w/b ration of 0.3,0.4 and 0.45 the strength reduced to 9.71, 11.76, and 12.88 %, but at higher value of FA(50% by weight) it shows higher strength value of is 27.22, 43.66, and 51.64 %. Which shows that Fly debris contribution to strength was greater in blends ready with lower w/b ratios than in blends prepared with the higher w/b proportions. This is likely to filler out the effect of fine particles for fly debris, densifying a framework and working on the interfacial connection between the glue substrate total. On mixing ternary blend cement i.e OPC with SF and FA the compressive strength of mix blend will increase firstly and then decrease at all w/b ration. As the w/b proportion decreases, a greater amount of OPC will be replaced by minerals admixture to provide strength comparable to the control blend. The addition of the SF to the cement frame increases the initial strength of the cement and fundamentally increases the strength of considerable blends formed with a matched combination of OPC and FA. As a result, ternary OPC + SF + FA blends neutralize for the strength reduction

of twofold OPC + FA blends. This is because of SF's expanded effectiveness as a pozzolana.

Chemical Reaction

The reaction of FA to OPC occurs in two stages. $Ca(OH)_2$ has a large response in the initial phase, during early restoration; however, the speed of reaction is related to the alleviating temperature. The slower $Ca(OH)_2$ initiation rate at room temperature slows the reaction rate.

Variation in FA synthesis and the reactivity effect cement starting phase characteristics and rheology. It is taught to find the sufficiency of FA via initial blends by consideration of the usefulness, strength enhancement, and sturdiness. The pozzolanic reaction could be addressed as follows:

Calcium hydroxide + silica = tricalcium silicate + water

$$3Ca(OH)_2 + SiO_2 = 3CaO.SiO_2 + 3\ H_2O$$

The lime minimized by a time and response effect the drawn out increase of solidity concrete made with FA when compared with OPC.

Typically, sulfates and antacids function as activators, causing the GGBS to respond artificially. These activators disrupt the polished structure and respond by raising the pH of the framework to basic. Unlike FA, GGBS just requires a pH of less than 12 and activators are produced in concrete as a result of hydration and behaves as an activator. SF, as a pozzolan, interacts with $Ca(OH)_2$, and at 28 days, approximately 25% of the SF can absorb the majority of the $Ca(OH)_2$. This is critical since $Ca(OH)_2$ valuable stones are relatively weak, delicate, and non-cementitious, and cracks can surely spread over $Ca(OH)_2$ gems-rich areas, or at the very least, the complete concrete glue framework surface. A calcination interaction “dehydroxylation” of the kaolin results in a transition from translucent to nebulous. The amount and type of shapeless stage have an effect on the action of the added chemicals.

CONCLUSION

1. Due to environmentally logical and lower cost ternary mix blend of OPC + FA + SF are preferred to parallel concrete framework of OPC.
2. Mixing proportion of ternary blend shows higher strength at lower w/b ration.
3. From all mixing ration of FA and SF maximum initial strength achived by replacing OPC by 20% (10% each of SF and FA).
4. The split suppleness of cement prepared with a ternary blend concrete framework was larger than that of a control blend due to the filler affect and pozzolanic response.

REFERENCE

1. IS 12269:1987, Indian standard specification for 53 grade ordinary Portland cement, Reaffirmed 1999.
2. IS 15388:2OO3, Indian Standard specification for silicafume.
3. IS 383:197O, Indian standard specification for coarse and fine aggregates from natural sources for concrete, second revision, Reaffirmed 1997.
4. IS 91O3:1999, Indian standard concrete admixtures-specifications, first revision.
5. IS 5816:1999, Indian standard splitting tensile strength of concrete-method of the test, first revision.
6. Almeida, N., & de Brito, J. (2O17). Influence of binary, ternary, and quaternary cement blends on the durability of concrete. Construction and Building Materials, 152, 42O-433.
7. Hanif, A., Akhtar, S., & Siddiqui, N. A. (2O19). Effect of ternary blended cement containing fly ash and silica fume on the mechanical properties of concrete. Construction and Building Materials, 2O6, 15O-159
8. S. M., Hussin, K., & Azhar, S. (2O18). Performance of high-strength concrete containing ternary blended cement under elevated temperature. Construction and Building Materials, 191, 553-564.