Chloride Transport Rate in Blended Concrete Depending on Different Test Methods

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ABSTRACT

Concretes with binary blends of Portland cement, silica fume, fly ash and ground granulated blast furnace slag were produce to investigate their effects on compressive strength and chloride transport in rapid chloride permeability. Ten different mix of concrete with 0.45 water/binder were produced. Portland cement was replacedby: (i) 10%, 20%, 30% Fly ash (ii) 3%, 5%, 10% Silica Fume (iii) 20%, 40%, 60% GGBS. Compressive strength of concrete with the pozzolans is higher compared to that of the Portland cement concrete. The test results indicate the fly ash, silica fume, and ground granulated furnace slag greatly reduce the rapid chloride permeability of concrete. It was concluded that pozzolans are more effective to reduce chloride permeability of concrete.

1. INTRODUCTION

Cement production is an energy intensive process which also has an important effect on the environment. Producing one ton of Portland cement releases about one ton of CO2 green house gas into atmosphere and as a result of this production 1.6 billion tons of CO2 is released every year which is estimated at about 7% of the CO2 production worldwide [1].

There are two major reasons to use these by-products in concrete: decreasing cement consumption by replacing part of cement with these pozzolanic materials and improving fresh and hardened concrete properties. In recent years, the reduction of water/cement ratio by using super plasticizers and usage of ultrafine mineral admixtures lead to high performance concrete. Beside the advantages, pozzolanic materials have certain drawbacks

2. Experiments and materials

Ordinary Portland cement, silica fume, fly ash, ground blast furnace slag were used in the concretes with 0.45 water cement ration. The 7 day compressive strength and rapid chloride permeability test were conducted.

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The rapid chloride ion permeability of the concrete was obtained according to ASTM C 1202. Three concrete disc specimens of 100mm in diameter and 50mm thick were used for the test. The same size of specimens used for compressive strength as well

3. RESULTS AND DISCUSSION

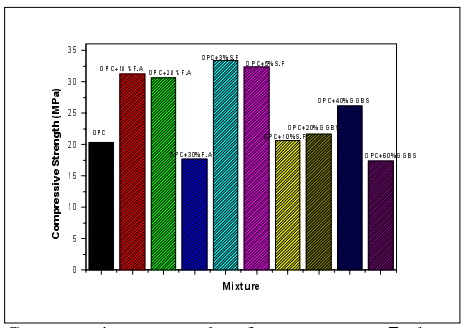

Fig.1Compressive strength of concrete at 7 days

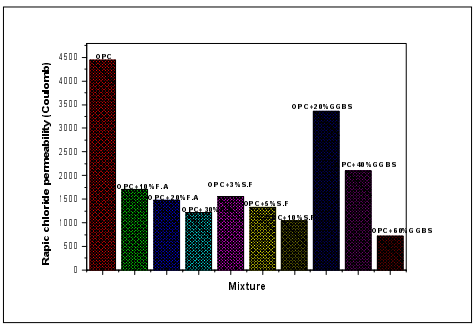

Fig.2 Rapid chloride permeability test results for 7 days

Compressive strength results are shown in Fig.1 the compressive strength of concrete with 60% slag replacement is slightly lower than Portland cement. However, 3%, 5% silica fume replacement is showing higher compressive strength. Fly ash and silica fume replacement concrete can be classified as a high strength concrete. Rapid chloride ion penetration test results are given in Fig.2. As seen in the figure, pozzolan replacement caused great reduction in the repaid chloride permeability of concretes. Fly ash, slag, silica fume replacement, greater reduction in chloride permeability compare than Portland cement.

4. CONCLUSIONS

1.The compressive strength of concrete is reduced with the use of pozzolans and the lowest strength was obtained 60%GGBS.

2.The chloride permeability of the concrete is reduced substantially with use of pozzolans. And it's more effective.

REFERENCES

1. Buenfeld, N. R., and Okundi, E. (1998). "Effect of cement content on transport in concrete." *Mag. Concrete Res.*, 50(4), 339-351.