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A Review on Strength Properties of Concrete with Partial Replacement of Cement by GGBS

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ABTRACTS:- Concrete is probably the most extensively material to used construction material in the world with about six billion tones being produced every year. Countries like India and China are facing problem of pollution due to large construction works in recent times. Ordinary Portland cement which is used in Concrete releases plethora of carbon dioxide (CO2) in atmosphere during manufacturing. This leads to increase of level of greenhouse gases and hence contributes in global warming. Material like Geo polymer concrete is best alternative for this problem.. Many researchers works **for** the reduction of cement consumption by partial replacement of cement by supplementary materials. I was found that Compressive strength and Flexural strength of GGBS concrete increased at 40 % of GGBS and further addition of GGBS, concrete showed marginal decrease in compressive Split and flexural strength.

Key word - Concrete, Durability, GGBS, Pozzalonas, Wastes, Silica fume, Sulphuric acid

I INTRODUCTION

1.1 General

Ground Granulated Blast Furnace Slag Ground Granulated Blast furnace Slag is a by-product of iron manufacturing industry. Iron ore, coke and limestone are fed into the furnace, and the resulting molten slag floats above the molten iron at a temperature of about 1500oC to 1600oC. The molten slag has a composition of 30% to 40% Silicon Dioxide (SiO2) and approximately 40% Calcium Oxide (CaO), which is close to the chemical composition of portland cement. After the molten iron is tapped off, the remaining molten slag, which mainly consists of siliceous and aluminous residues, is then rapidly water- quenched, resulting in the formation of a glassy granulate.

GGBS

II LITERATURES REVIEW

2.1 LITERATURE REVIEWED

This chapter is all about the previous work done by so many researchers across the world. Substantial amount of works on this aspect have been carried out by great number of researchers in India and abroad. Some notable contributions in this direction in recent past have been made by scholars are presenting

Venu Malagavelli et al. **[1]** studied on high performance concrete with GGBS and robo sand nd concluded that the percentage increase of compressive strength of concrete is 11.06 and 17.6% at the age of 7 and 28 days by replacing 50% of cement with GGBS and 25% of sand with ROBO sand.

Luo et al. [2] experimentally studied the chloride diffusion coefficient and the chloride binding capacity of Portland cement or blended cement made of Portland cement and 70 % GGBS replacement with or without 5 % sulphate. They found that (i) chloride diffusion coefficient decreased; (ii) chloride ion binding capacity improved in samples of blended cement.

Clear [3] concluded that higher the proportion of GGBS, the slower the early age strength development.

Oner and Akyuz[4] studied on optimum level of GGBS on compressive strength of concreteand concluded that the optimum level of GGBS content for maximizing strength is at about 55–59% of the total binder content.

Qian Jueshi and Shi Caijun**[**5] studied on high performance cementing materials from industrial slag and reviewed the recent progresses in the activation of latent cementitious properties of different slag. They opined that Alkali-activated slag, such as blast furnace slag, steel slag, copper slag and phosphorus slag should be a prime topic for construction materials researchers.

Ganesh Babu and SreeRama Kumar [6] studied on efficiency of GGBS in Concrete. Wainwright [7] conducted Bleed tests in accordance with ASTM C232-92 on concretes in which up to 85% of thecement was replaced with ground granulated blastfurnaceslag (GGBS) obtained from different sources. They observed that delaying the start of the bleed test from 30 to 120 min reduced the bleed capacity of the OPC mix by more than 55% compared with 32% for the slag mixes. The reduction in bleed rate was similar for all mixes at about 45%.

Soutsos et al. [8] studied on fast track construction with high-strength concrete mixes containing Ground Granulated Blast Furnace Slag. They showed that the existing maturity functions like the Nurse-Saul and the Arrhenius equation may not be suitable for GGBS concretes.

Pavia and Condren[9] studied the durability of OPC versus GGBS Concrete on Exposure to Silage Effluent. This research concluded that PC composites incorporating GGBS are more durable than those made with PC alone in aggressive environments under the action of acids and salts such as those produced by silage.

Ashish kumar dash et al. [10] researched on different materials like rice husk ash, GGBS, silica fume to obtain the desired needs.

Higgins [11] discussed on the effect of addition of a small percentage of calcium carbonate or calcium sulfate on the sulfate resistance of concrete containing GGBS. Pazhani and Jeyaraj[12] conducted experimental investigation to assess the durability parameters of high performance concrete with the industrial wastes.

ShariqPrasad et al. [13] studied the effect of curing procedure on the compressive strength development of cement mortar and concrete incorporating ground granulated blast furnace slag is studied. The compressive strength of OPC concrete shows higher strength as compare to the GGBFS based concrete for all percent replacement and at all ages. Incorporating 40% GGBFS is highly significant to increase the compressive strength of concrete after 56 days than the 20 and 60% replacement. Among GGBFS based concrete 40% replacement is found to be optimum.

Stanley [14] studied onthe use of iron blast-furnace slag as a constituent of concrete, either as an aggregate or as a cementing material.

HanifiBinici et al. [15] studied on blended cements containing corncob ash (CA) and GGBS. They concluded that The CA and GGBFS containing cements, immersed in sulfate solution showed 15% lower average compressive strength than that of the control cement specimens at the end of 24 months. Greater resistances of blended cements against sodium sulfate were achieved with higher percentage of additives.

Puertas et al. [16] analyzed the behaviour of water glass- or NaOH-activated slag mortars after carbonation. The results obtained indicate that alkali-activated slag mortars were more intensely and deeply carbonated than Portland cement mortars.

Barnett et al. [17] studied on the strength development of mortars containing GGBS and Portland cement. They concluded that the early age strength development of mixtures containing GGBS is highly dependent on temperature.

Wang Ling et al. [18] studied the application of GGBS in China.

An Cheng, Ran Huang et al.[19] investigated on the durability of GGBS concretes and the corrosion behavior of reinforced concrete beams under various loading ratios.

Olorunsogo et al. [20] investigated the influence of particle size distribution (PSD) of GGBS on the bleeding characteristics of slag cement mortars. The results showed that for the slag samples with similar size range distribution (i.e., having a constant slope, n), the bleeding capacity increased with increases in xo, except the 30% slag mixes, which were made to 0.35 w/c.

Huiwen Wan et. al. [21] investigated the geometric characteristics of different GGBS, including particle size distribution (PSD), shape and their influences on cement properties. All the above results are based on the properties of ingredients used. The optimum % replacement may vary based on the properties of GGBS and ingredients used. The main objective of this paper is to study the strength and durability characteristics of GGBS concrete with locally available fine and course aggregate.

Tamilarasan et al. [22] studied on Chloride diffusion of concrete on using GGBS as a partial replacement material for cement and without and with Superplasticiser. The study results showed that, with the increase in percentage of GGBS, the Chloride diffusion of concrete decreases. Also it is found that the Chloride diffusion in the M25 concrete is less than M20 concrete.

III CONCLUSIONS

From the experimental investigation carried out for present dissertation work, following salient conclusion can be drawn

- From the experiment it was found that GGBS is replace by cement and improve the strength of concrete.
- From the previous paper study it was found that GGBS used with other waste material like silica fume and increase the strength of concrete

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