57_Effect of GGBS on Durability Properties of Concrete

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Effect of GGBS on Durability Properties Of Concrete

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Abstract— **For high rise buildings and design of important structures the high strength and high-performance concrete is widely used universally. Many researchers largely focuses on only strength factor and less focus for durability and serviceability of structure while designing. Normally design life of reinforced concrete structure is around 70 to 100 years but many times it may not be achieved due to various factors, and one of them is material properties. The properties of materials used for design of high-performance concrete need to check according to Indian Standard to fulfill strength criteria. But by using conventional materials may not fulfill durability criteria, for that need to use some cementitious materials to increase strength and durability property of concrete. Many researchers used different cementitious materials such as Micro Silica (MS), GGBS, Colloidal silica, Fly ash, etc. in concrete and studied durability property of concrete by various tests as RCPT, Water absorption, water permeability, effect of temperature on concrete properties. Now a days due to urbanization the skyscrapers constructed in metro cities. fire is one of the major factor to damage the concrete when concrete comes in to contact of fire. So, to observe properties of concrete during and after fire we need to focus on durability of concrete after fire. This paper focused on to study various durability properties of concrete for different percentages of GGBS.**

Keywords - Strength, Durability, Fire, Concrete.

I. INTRODUCTION

Concrete is being used extensively in the construction sector each year, and it is projected that demand will rise soon[1]. Cement is the main ingredient in concrete, which is one of the most often used building materials. Concrete is more and more in demand as a building material. The output of cement is projected to just have jumped of around 1.5 billion metric tons in 1995 to 3.2 billion metric tons in 2016[2].

Regrettably, employing cement causes environmental harm and depletes the supply of raw materials (limestone). Worldwide, Portland cement manufacturing is rising 9% yearly. Currently, the production of Portland cement accounts for around 1.5 million tonnes of annual greenhouse gas emissions, or 7% of all greenhouse gas emissions to the the environment's atmosphere[2].

Generally speaking, ground slag has been utilised as a cementitious ingredient in concrete since the turn of the century[3]. In instance, ground granulated blast slag seems to be the basis of a study from several studies on various partial cement replacement materials (GGBS).

II. APPLICATION OF GGBS

In the United States and Europe, correspondingly, blast furnace residue (BFS) and steel ash and blast furnace (SFS) have a strong tradition of usefulness as industrial by products going back at least almost 100 years and 150 years, including both. For many years, concrete has used ground granulation blast furnace slag (GGBS) as a cementitious element and in composite cements. The fabrication of bricks from unground, granulate blast furnace slag was the first industrial, commercial employment (about 1859). Only after GBS's initial cementitious properties had been established in the second half of the century, around the turn of the nineteenth century, had the first cements containing GGBS been produced.GGBS has been used more frequently as an individually ground product put to the mixer together with Portland cement since the late 1950s. A common term for pure GGBS in several nations is "slag cement"[8].

GGBS is being utilised as a weight-for-weight equivalent alternative for Portland cement. It is combined with regular Portland cement and/or similar pozzolanic ingredients to create sturdy concrete constructions. Because to its greater concrete durability, which increases a building's lifespan from fifty to one hundred years, GGBS is extensively utilised in Europe, and is being used more and more in the Americas and Asia (especially in China, India, Japan, and Singapore). In China, GGBS is primarily used as a clinker substitute in the manufacturing of blended slag and regular cement as well as a supplemental cementitious material in the production of primed and site-batched concrete[9].

Benefits from cost reduction are now the primary and primary factor behind the implementation of GGBS. GGBS is used to make high-quality, enhanced slag cements, such as Portland Electric Arc furnaces Cement (Friendlier) and High Slag Coal Combustion Cement (HSBFC), with GGBS contents that generally range from 30 to 70%. They are also used to make durable ready-mixed or site-batched concrete. GGBS has stronger resistance to chloride intrusion, which lowers the danger of reinforcing corrosion, and offers high resistant to assaults by sulphate and other chemicals[10]. It also lessens the risk of damages brought on by the alkali-silica reaction (ASR).

Unground GGBS is acceptable as a standard weight concrete aggregate in addition to the features listed above. In the building of roads, it is also utilised as a foundation layer material. BFS aggregates are no longer utilised for surface layers, only for pavement surface bases and sub-bases due of their poor porosity. This slow rate of cementation is one of the main advantages of employing slag material in a stabilised pavement. Depending mostly on binder, the road material can be worked again for a period of two days or above after the initial mixing without losing any final strength. The degree of material fineness, which in turn influences the efficacy of both Gbm and GGBS in stabilizing Economics plays a role in turn. A compromise must be struck between the cost of creating a finer degree of both GBS and GGBS and the lesser amount of slag stabilising binder required to achieve an equal level of strength[8].